

April 30, 1935.

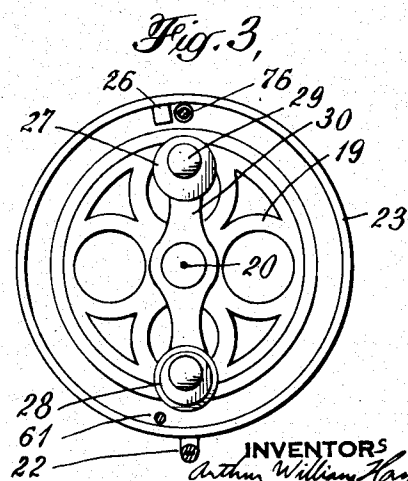
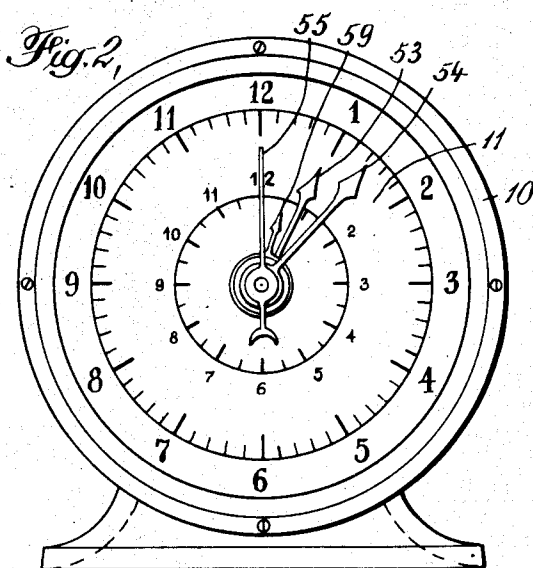
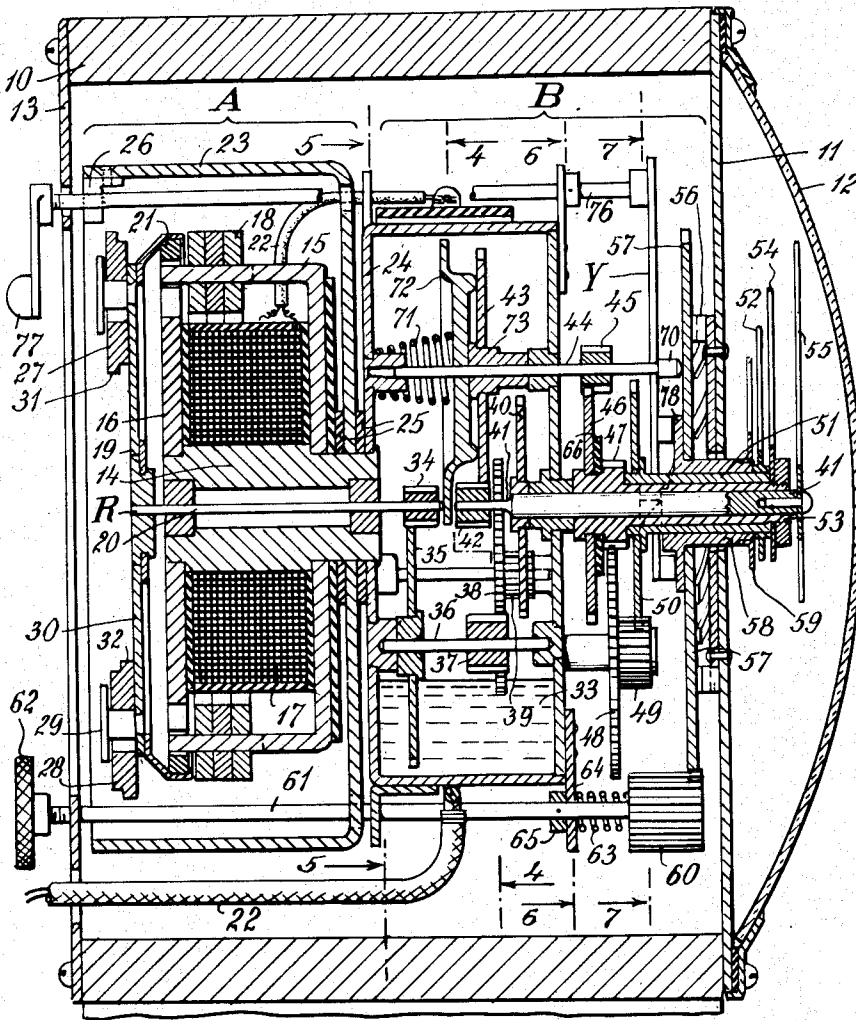
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1,999,692

ELECTRIC CLOCK

Filed June 1, 1934

3 Sheets-Sheet 1



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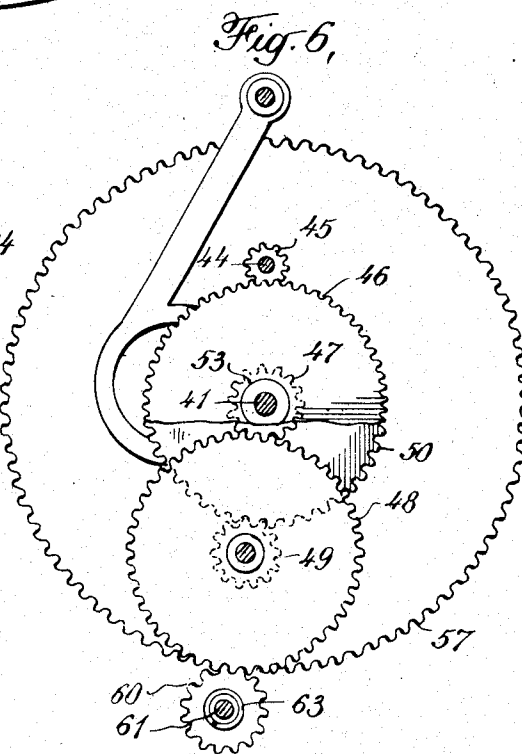
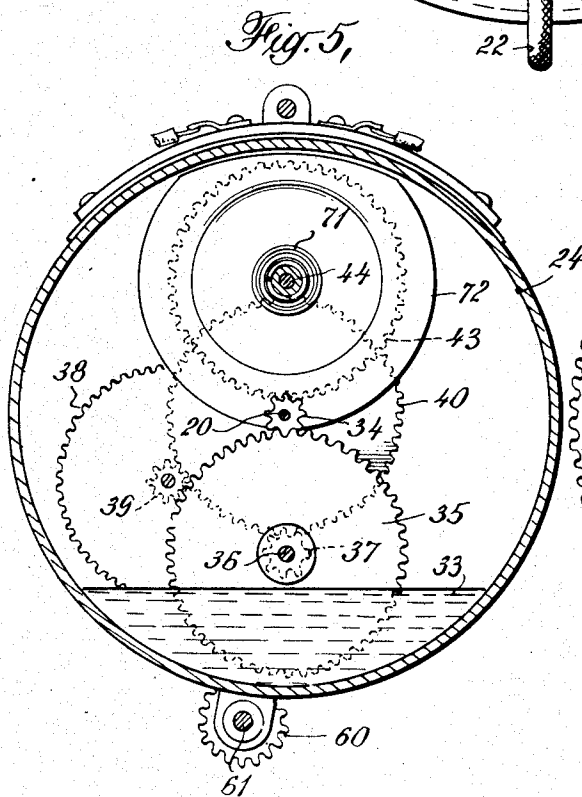
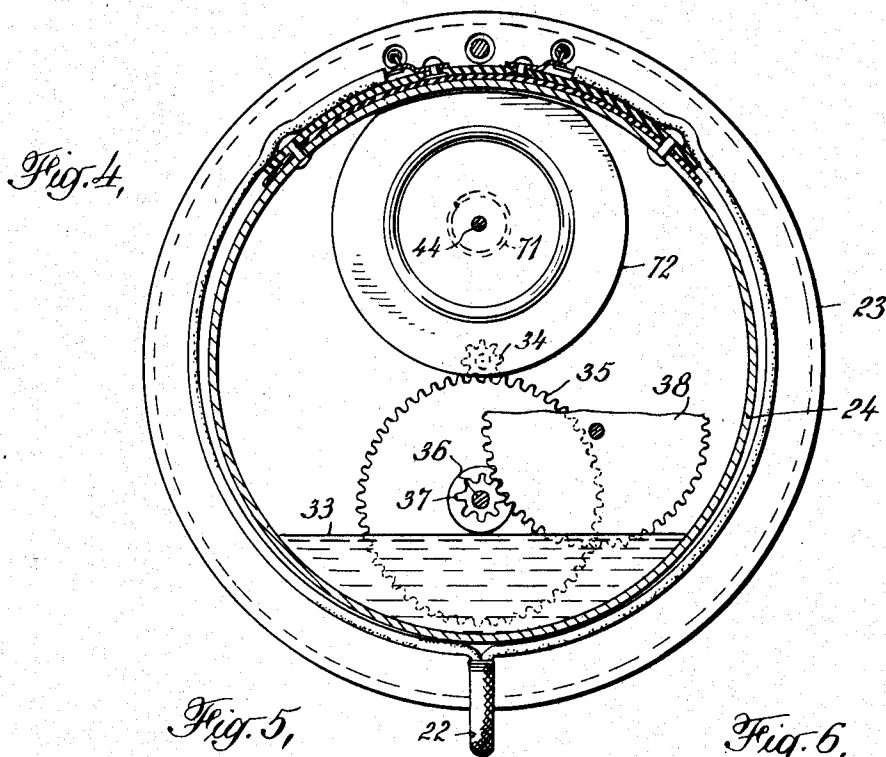
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ELECTRIC CLOCK

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3 Sheets-Sheet 2



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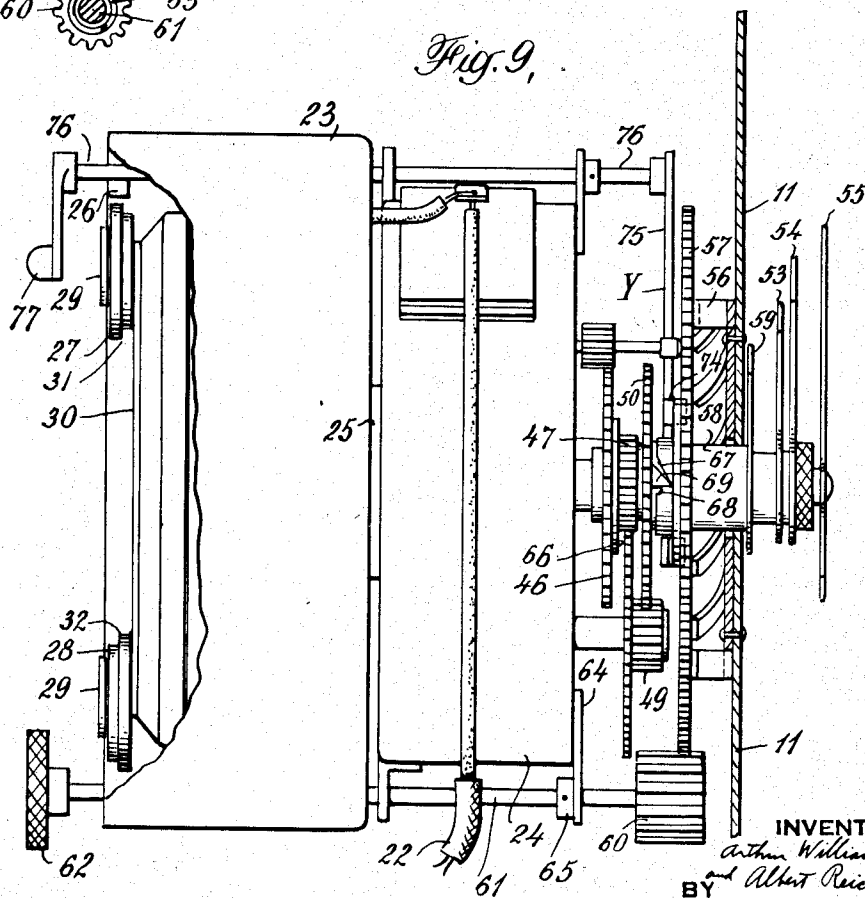
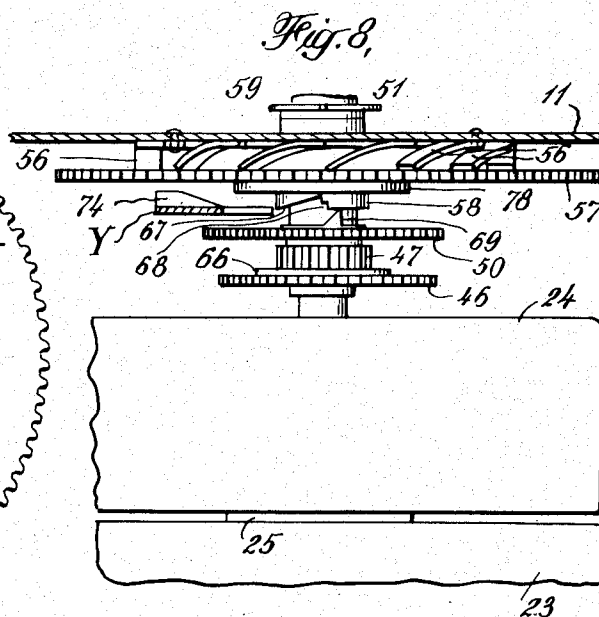
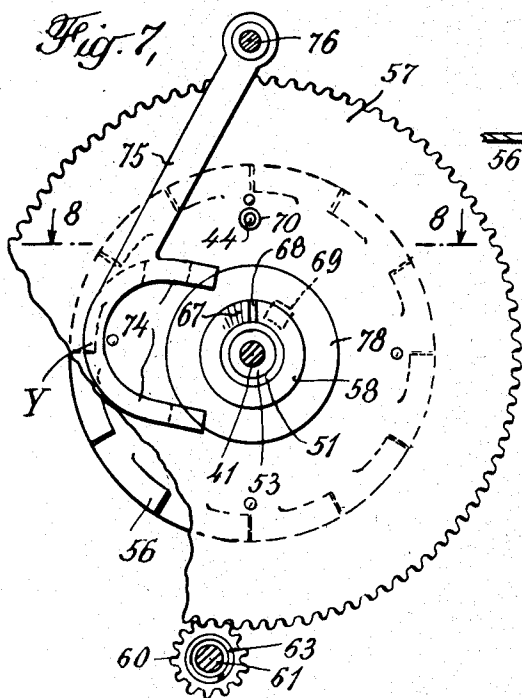
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ELECTRIC CLOCK

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

1,999,692

ELECTRIC CLOCK

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Application June 1, 1934, Serial No. 728,501

20 Claims. (Cl. 58—38)

This invention relates to improvements in alarm operating and control mechanisms for clocks and includes an improved alarm clock in which both the time mechanism and the alarm mechanism are operated by a single source of motive power.

Known forms of mechanical alarm clocks customarily include separate sources of motive power for the timing and alarm sounding mechanisms with complicated gear trains for each such source and mechanism. The driving means and gear trains of previously known electric alarm clocks are also complex, but these clocks also employ separate sources of motive power for time and alarm sounding purposes and the alarm control apparatus is generally of a very complicated nature.

It is the object of the present invention to provide an improved and simplified alarm operating and control mechanism for clocks. It is a further object of the invention to provide an improved alarm clock in which a single source of motive power or driving device acts to operate both the time and the alarm sounding mechanisms and in which the alarm sounding mechanism is highly simplified. Various other specific objects, advantages and characteristic features of the invention will be pointed out or will become apparent as the description progresses.

In general, the objects of the invention are carried out by providing a rotating element carrying at least one alarm actuator or clapper thereon and mounted in close proximity to an alarm device or bell, and by employing time mechanism for controlling the movement of the rotating element into and out of positions where the alarm actuator strikes the alarm device. We prefer to employ the rotor of an electric motor as the rotating element of the alarm operating means, and to drive the time mechanism of the clock by this same motor, which is preferably of the synchronous type. The rotary motion of the motor rotor is continuous whereby the time mechanism is driven at the proper speed without interruption, and the sounding of the alarm is preferably initiated and interrupted by the axial movement of the rotor relative to the alarm device or bell under the control of the time mechanism and manual control means. The rotor may be normally held in a non-alarm sounding position by the magnetic pull exerted thereon by the stator structure of the motor.

In a preferred embodiment of my invention, the alarm actuating means comprises one or more clapper elements loosely mounted on the

rotor eccentrically of the axis thereof whereby as the rotor turns, these elements move outwardly by centrifugal force to positions where they may strike the alarm device. With this arrangement, the amount of power consumed in sounding the alarm is small and the operating speed of the motor and hence the accuracy of the time mechanism driven thereby is not varied when the alarm is sounded. We may use two or more alarm actuator elements or clappers so designed and mounted that different numbers of these clappers engage the alarm device or bell at different axial positions of the motor rotor. In this manner, the frequency with which the alarm bell is struck may be varied by the time mechanism, and alarms of periodically increasing magnitude may be produced.

The invention will be best understood by reference to the accompanying drawings in which an embodiment thereof has been illustrated. In the drawings:

Figure 1 is a sectional side elevation of a clock embodying the present invention;

Figure 2 is a front elevation on a smaller scale of the clock of Figure 1;

Figure 3 is a rear elevation of the alarm device and alarm actuating means of the clock;

Figures 4, 5, 6 and 7 are respectively views, taken along the lines 4—4, 5—5, 6—6 and 7—7 of Figure 1, and viewed in the direction of the arrows;

Figure 8 is a plan view, taken along the line 8—8 of Figure 7, and viewed in the direction of the arrows; and

Figure 9 is a side elevation of the clock mechanism showing the alarm control means in the operated position.

Referring to the drawings, the clock disclosed as embodying the invention is mounted in a substantially cylindrical case 10 provided with the usual dial 11, crystal 12 and rear plate 13. The clock mechanism proper comprises generally a motor and alarm device assembly A together with a gear train and control mechanism indicated at B.

The motor may be of any suitable type but preferably comprises a synchronous motor of the type disclosed and claimed in Patent No. 1,935,208, issued to Arthur William Haydon, November 14, 1933, or in Patent No. 1,977,184 issued to Arthur William Haydon, October 16, 1934. As shown, this motor includes a stator comprising a central core 14 carrying a cup-shaped field element 15 and a disc-shaped field element 16 adjacent the opposite ends thereof, with an energizing coil 17

mounted about the core and within the cup-shaped element 15, as shown. The cylindrical portion of the field element 15 is sub-divided into pole pieces at its rearward edge and radial pole pieces on the disc-shaped element 16 are disposed in interleaving relationship with the cup-shaped element pole pieces. Shading coils 18 are preferably disposed on some of the pole pieces of the cup-shaped element 15 whereby the motor has self-starting characteristics. The motor rotor R comprises a spider or disc 19 carried by a shaft 20 which is journaled in a central opening through the core 14, as shown. The spider 19 carries a ring armature 21 preferably formed of hardened steel or other high hysteresis coefficient material, which armature surrounds and lies adjacent to the ends of the pole pieces on the stator field elements 15 and 16. The rotor shaft 20 is movable axially in its journals to a limited extent, and the magnetic pull exerted by the stator field elements on the armature 21 tends to maintain the rotor and its shaft in the position shown in Fig. 1 when the motor is energized.

The coil 17 of the motor may be connected to a suitable source of alternating current through the wires 22. The motor operates on the hysteresis principle as fully explained in the above noted patents, and since the manner of operation of the motor forms no part of the present invention, it will not be described herein. It is sufficient to note that the motor operates synchronously, that is, in definitely timed relation to the frequency of the alternating current supplied thereto, and that the motor is capable of operating in this manner even though its rotor armature 21 is moved axially to a position where its inner face is substantially aligned with the outer face of the stator structure.

The alarm device or bell 23 preferably comprises a cup-shaped element of suitable metal mounted on the central core 14 of the motor stator. As shown in the drawings, the core 14 passes through a central opening in the alarm device 23 and this device is spaced from the stator element 15 and from the adjacent gear train housing 24 by the washers 25. The cylindrical wall of the alarm device surrounds the motor and terminates at a point somewhat beyond the rearward end of the motor as shown. A striking extension or lug 26 is fixed to or formed integral with the alarm device 23 adjacent its rearward edge, and this lug extends inwardly adjacent the motor rotor as shown.

As explained above, we prefer to employ alarm actuators or clappers loosely mounted on the motor rotor, and in the disclosed embodiment, these actuators take the form of disc-shaped elements 27 and 28 located at diametrically opposite points adjacent the periphery of the rotor. The actuators or clappers 27 and 28 are attached to the rotor by flat headed pins 29 riveted or otherwise secured to a frame 30 which is fixed to the rotor spider 19. The pins 29 loosely engage the central openings in the clappers 27 and 28, and these openings are considerably larger than the pins passing therethrough whereby the clappers may move radially with respect to the rotor. The arrangement is such that the clappers 27 and 28 may freely move to and from positions in which their outer edges will strike the lug 26 when the motor rotor is in a position to align the clappers with the lug. In the embodiment shown, the clappers are so constructed that as the revolving rotor R moves axially rearwardly of the clock,

first one and then both of the clappers 27 and 28 strike the bell lug 26, and the frequency and intensity of the alarm is thus different at different axial positions of the rotor. This result is accomplished by providing an outwardly extending lug striking flange 31 at the rearward edge of the clapper 27 and the similar outwardly extending lug striking flange 32 at the forward edge of the clapper 28.

The shaft 20 of the motor is connected through a suitable train of gears to the hands of the clock. In the particular clock construction chosen to illustrate the invention, the more rapidly moving gears of the train are enclosed in a housing 24 carrying a quantity of lubricant 33. The housing 24 is preferably provided with a central opening in its rearward face through which the forward end of the central motor core 14 passes, and the housing 24 and alarm device 23 may be fixed to the motor stator by riveting over the end of the core 14 within the housing 24, as shown. The driving sequence through the gear train includes in succession the motor shaft pinion 34, gear 35, shaft 36, pinion 37, gear 38, pinion 39, gear 40, shaft 41, pinion 42, gear 43, shaft 44, pinion 45, gear 46, pinion 47, gear 48, pinion 49, and gear 50. The last gear 50 is connected through a sleeve 51 to the hour hand 52 of the clock. The gear 46 is connected through a sleeve 53 to the minute hand 54 of the clock and the gear 40 is connected through the central shaft 41 to the sweep second hand 55.

The gear 46 is connected to the pinion 47 through a friction clutch represented by the washer 56, whereby the clock hands may be manually set by turning the pinion 47 independently of the gear 46 and the preceding gear train. The mechanism for thus setting the clock hands will be hereinafter described.

The alarm operation is initiated by the time means which governs suitable mechanism for moving the motor rotor R axially in a direction rearwardly of the clock in two steps, whereby first one and then both of the alarm actuators or clappers 27 and 28 are brought into striking alignment with the lug 26 on the alarm device or bell 23. Axial movement is imparted to the rotor R through the motor shaft 20 by a circular series of springs 56, which are riveted to the clock dial 11 and compressed between the inner surface of the clock dial 11 and an alarm disc 57 fixed to a sleeve 58 surrounding and movable on the hour hand sleeve 51. An alarm setting indicator hand 59 is fixed to the sleeve 58 on the outer face of the dial 11, as shown. The disc 57 is provided with gear teeth about its peripheral edge, and these teeth are normally engaged by a pinion 60 carried on a shaft 61 which extends to the rear of the clock case and terminates in a setting knob 62. The shaft 61 is normally held in a position to engage the pinion 60 with the disc 57 by a spring 63 compressed between the pinion and the journal bracket 64, and a collar 65, fixed on the shaft 61, limits the forward movement thereof. By drawing the shaft 61 rearwardly against the opposition of the springs 63, the pinion 60 may be engaged with the gear 48 and thereupon rotation of the knob 62 will turn the clock hands 52 and 54 through the gear 48, the pinion 47 (which is connected to the minute hand 54), the pinion 49 and the gear 50 (which is connected to the hour hand 52).

As best shown in Figs. 8 and 9, the rearward end of the sleeve 58 is provided with a cam surface 67 terminating in a stepped notch 68. The

forward face of the hour hand gear 50 carries a pointed lug 60 disposed to bear upon the rear end of the sleeve 58. With the clock in a non-alarm sounding position, the lug 60 engages the face of the sleeve 58 and holds this sleeve and the disc 57 in a forward position, compressing the springs 56, as shown in Figure 8. When the hour hand gear 50 has turned to the position for which the alarm is set, the lug 60 passes over the edge of the stepped notch 68 and the sleeve 58 and disc 57 are moved rearwardly of the clock by the springs 56 to a position limited by the depth of the step in the notch 68, the sleeve 58 coming to rest with this step engaging the end of the lug 60. This rearward movement of the disc 57 is transmitted to the motor shaft 20 through the gear train shaft 44.

As shown in Figure 1, the forward end of the shaft 44 carries a rounded knob 70 which bears against the alarm disc 57, and the shaft 44 is held in its forward position by a spring 71 compressed between the rear wall of the housing 24 and a disc 72 which engages a collar 73 fixed to the shaft 44. The shaft 44 is free to turn in the disc 72, and the rearward axial movement of the shaft 44 is transmitted to the disc 72 by the collar 73. The rim of the disc 72 engages the forward end of the motor shaft 20 as shown. The pinion 45 on the shaft 44 and the pinion 42 engaged by the gear 43 on this shaft are of sufficient width so that the axial movement of the shaft 44 does not disengage the gear train. Similarly, the width of the pinion 34 is sufficient to prevent its disengagement from the gear 35 when the motor shaft moves rearwardly.

With the construction described, the above explained initial rearward movement of the collar 58 and alarm disc 57 moves the motor shaft 20 and rotor R axially toward the rear of the clock to a point where the striking flange 31 of the alarm actuator or clapper 27 is aligned with the striking lug 26 of the bell 23, and the bell is struck once in each revolution of the motor rotor R. This initial axial movement of the motor rotor R due to the movement of the sleeve 58 to a point where the lug 60 engages the step of the notch 68 is not sufficient to bring the flange 32 of the clapper 28 into striking alignment with the lug 26.

If the alarm is not manually turned off within a predetermined time after it starts to sound, the continued movement of the hour hand gear 50 moves the lug 60 off the step in the notch 68 and the sleeve 58 is again moved rearwardly by the springs 56 to a point where the lug 60 rests in the bottom of the notch 68, as shown in Figure 9. This additional movement is transmitted to the motor shaft 20 through the alarm disc 57, the shaft 44 and the disc 72, and the axial movement thus imparted to the motor rotor R is sufficient to bring the striking flange 32 of the second clapper 28 into striking alignment with the lug 26 on the bell. Thus the bell is now struck twice in each revolution of the motor rotor and the intensity or frequency of the alarm is doubled.

It will be understood that the alarm initiating mechanism can be set to act at any desired time by rotating the alarm disc 57 and sleeve 58 to the desired point by means of the setting knob 62. The time setting of the mechanism is indicated by the hand 59 on the clock dial. Once set, the disc 57 and connected sleeve 58 remain stationary in spite of the clock operation since the drag of the hour hand sleeve 51 and lug 60 on the alarm sleeve 58 is insufficient to overcome the opposi-

tion to rotation offered by the frictional engagement of the springs 56 on the disc 57.

Suitable manually operable means is provided for turning off the alarm actuating mechanism. In the disclosed embodiment, this means takes the form of a yoke Y, the fingers 74 of which bear cam surfaces, as shown in Figure 8. The yoke Y is carried by an arm 75 fixed to a suitably journaled shaft 76 which extends rearwardly and terminates in a manually operated crank or lever 77 outside of the rear plate 13 of the clock case. The yoke Y is so disposed that as the arm 75 is moved to a vertical position, as viewed in Figure 7, the fingers 74 embrace the sleeve 58 and the cam surfaces on these fingers engage a washer 78 on the rearward face of the alarm disc 57, moving this disc and the sleeve 58 forward against the opposition of the springs 56. This forward movement of the disc 57 releases the shaft 44 which is then moved forward by the spring 71 and the disc 72 thus moves away from the end of the motor shaft 20. The magnetic pull exerted by the motor stator structure on the motor armature 21 immediately moves the rotor R axially forward and the alarm actuators or clappers 27 and 28 are thus drawn out of striking alignment with the lug 26. The mechanism can be again placed in operating condition by moving the lever 77 and withdrawing the cam fingers 74 from engagement with the washer 78, whereupon the alarm disc 57 is again free to move rearwardly under the control of the time mechanism, as described above.

The clock work mechanism may be supported within the clock case 10 by any suitable brackets or other means, not shown.

The alarm clock construction of the invention incorporates many advantageous features. The use of a single driving device or source of motive power for operating both the time mechanism and the alarm sounding mechanism eliminates the cost and complication of two separate driving devices, and the arrangement of the alarm actuators directly on the motor rotor avoids the necessity of providing a separate gear train for the alarm actuating means. The use of alarm actuators or clappers loosely mounted on the rotor permits the operation of the alarm with a minimum of power and without interrupting or disturbing the accurate operation of the time mechanism. The actuation and change in intensity of the alarm by axial movement of the rotor results in a very simple, compact and inexpensive construction to which the driving motor is readily adaptable without essential change.

We claim:

1. An alarm mechanism comprising a rotatable element, means for rotating said element continuously at a constant speed, an alarm actuator carried by said element and movable radially thereof, an alarm device mounted adjacent said element, time mechanism and means actuated by said time mechanism for causing sufficient relative movement between said element and said alarm device to bring such parts to a position where said actuator engages said alarm device.

2. An alarm mechanism comprising a rotatable element, means for continuously rotating said element, an alarm actuator carried in an eccentric position on said element and movable radially of said element, an alarm device mounted adjacent said element, time mechanism and means actuated by said time mechanism for at times causing sufficient relative movement, other than the rotative movement of said element,

between said rotating element and said alarm device to bring such parts to a position in which said actuator engages said alarm device.

3. An alarm mechanism comprising a rotatable element, means for rotating said element, an alarm actuator on said element and movable radially with respect thereto, an alarm device adjacent but spaced axially from said element, and time mechanism for moving said element axially into a position where said alarm actuator engages said alarm device during the rotation of said element.

4. An alarm mechanism comprising a rotatable element, means for rotating said element, an alarm actuator loosely mounted on said element and movable radially with respect thereto, an alarm device comprising a cup-shaped member embracing said rotatable element and having a striking extension thereon adjacent but spaced axially from said element, time mechanism and means actuated by said time mechanism for moving said element axially into a position where said alarm actuator engages the striking extension of said alarm device during the rotation of said element.

5. An alarm mechanism comprising a rotatable element, means for rotating said element, an alarm actuator loosely mounted eccentrically on said element, an alarm device mounted adjacent said element, time mechanism and means actuated by said time mechanism for moving said element and said actuator into operative relation to said alarm device to actuate the same at a relatively slow rate and for thereafter moving said element and actuator into a second operative relation to actuate the alarm device at a more rapid rate.

6. An alarm mechanism comprising a rotating element, at least two alarm actuators loosely mounted on said element and movable radially with respect thereto, said actuators having striking surfaces spaced axially of said element, an alarm device mounted adjacent said element but spaced axially therefrom, time mechanism and means actuated by said time mechanism for successively moving said element axially to a position in which one of said actuators engages said alarm device and to a position where both of said actuators engage said alarm device.

7. In an alarm mechanism, in combination, an electric motor having a rotating member, a time mechanism driven by said motor, an alarm device, means directly connected to the rotating member of said motor for at times striking said alarm device and means controlled by said time mechanism for initiating the striking of said alarm device by said means on said rotating member.

8. The combination of a time mechanism, an electric motor having a rotor for driving the same, an alarm device axially adjacent said rotor, an alarm actuator mounted on said motor rotor and means controlled by the said time mechanism for moving said rotor axially to actuate said alarm device.

9. The combination of a time mechanism, an electric motor having a rotor for driving the same, an alarm device axially adjacent said rotor, an alarm actuator loosely mounted on said rotor to move radially with respect thereto and means controlled by said time mechanism for moving said rotor axially into a position in which said actuator engages said alarm device.

10. The combination of a time mechanism, an electric motor having a rotor for driving the same, an alarm device axially adjacent said rotor, an

alarm actuator loosely mounted in an eccentric position on said rotor and movable radially with respect thereto, and means controlled by said time mechanism for moving said rotor axially into a position in which said actuator engages said alarm device.

11. The combination of a time mechanism, an electric motor for driving the same, said motor having a stator and an axially movable rotor normally held in close proximity to the stator by magnetic attraction, an alarm actuator mounted on said rotor, an alarm device having a portion thereof spaced axially of said rotor from said actuator and means controlled by said time mechanism for moving said rotor axially away from the stator to cause the actuation of said alarm device by said actuator.

12. The combination of a time mechanism, a synchronous motor for driving the same, said motor having a rotor cooperating with a stator to operate at synchronous speed in a plurality of axially spaced positions, an alarm actuator carried by said rotor, an alarm device having a portion thereof spaced axially of said rotor from said actuator and means controlled by said time mechanism for moving said rotor axially from one of said spaced positions to another to bring said actuator into engagement with said alarm device.

13. In combination with a time gear train, an electric motor for driving the same, said motor having a stator and an axially movable rotor, an alarm actuator carried by said rotor, an alarm device having a portion thereof spaced axially of said rotor from said actuator and means including a portion of said gear train for moving said rotor axially to actuate said alarm device by said actuator.

14. An alarm mechanism comprising the combination of a time gear train having a portion thereof constructed and arranged to be shiftable axially while in operation, an electric motor for driving said gear train, said motor including a stator and an axially movable rotor, an alarm actuator carried by said rotor, an alarm device having a portion thereof spaced axially of said rotor from said actuator and means including said axially shiftable portion of said time gear train for shifting said rotor and the actuator carried thereby into a position to actuate said alarm device.

15. A motor driven alarm mechanism comprising an electric motor having a rotor and a stator, an alarm device mounted on said stator, an alarm actuator mounted on said rotor, means for shifting said rotor axially while the motor is operating and means for operating said alarm device by said alarm actuator when said rotor is so shifted.

16. A motor driven alarm mechanism comprising a synchronous electric motor having a rotor and a stator, an alarm device mounted on said stator, an alarm actuator mounted on said rotor, means for shifting said rotor axially while the motor continues to operate synchronously and means for causing the operation of said alarm device by said alarm actuator when the rotor is so shifted.

17. A motor driven alarm mechanism comprising an electric motor having a rotor and a stator, an alarm device mounted on said stator, an alarm actuator mounted eccentrically on said rotor, means for shifting said rotor axially while the motor is in operation and means for causing operation of said alarm device by said alarm actuator when said rotor is so shifted.

18. A motor driven alarm mechanism comprising an electric motor having a rotor and a stator, a pair of alarm actuators mounted at diametrically opposite eccentric positions on said rotor, an alarm device mounted on said stator and having a portion thereof spaced axially of said rotor from said actuators and means for shifting said rotor axially to a position where said actuators engage said portion of said alarm device while the motor is operating.

19. A motor driven alarm mechanism comprising an electric motor having a rotor and a stator, two alarm actuators mounted eccentrically on said rotor and relatively spaced axially and circumferentially of said rotor, an alarm device having a portion thereof adjacent but spaced axially

of said rotor from said actuators and means for axially shifting said rotor to successive positions in which first one and then both of said actuators engage said alarm device while the motor continues to operate.

20. A motor driven alarm mechanism comprising an electric motor having a rotor and a stator, a cup-shaped alarm device mounted on said stator and surrounding said stator and said rotor, an alarm actuator mounted eccentrically on said rotor, means for shifting said rotor axially while the motor is operating and means on said alarm device for engagement with said actuator when said rotor is so shifted.

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