

PATENT SPECIFICATION (11)

1 455 857

1 455 857

- (21) Application No. 52947/73 (22) Filed 14 Nov. 1973 (19)
 (31) Convention Application No. 391 781 (32) Filed 27 Aug. 1973 in
 (33) United States of America (US)
 (44) Complete Specification published 17 Nov. 1976
 (51) INT. CL.^a G04C 21/18
 (52) Index at acceptance
 G3T AI
 (72) Inventor ROBERT LEE BOYLES



(54) ALARM CLOCK

(71) We, GENERAL ELECTRIC COMPANY, a corporation organized and existing under the laws of the State of New York, United States of America, of 1 River Road, Schenectady 12305, State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to alarm clocks and more particularly, but not exclusively, to digital clocks provided with an alarm control mechanism.

In the construction of clocks of this type it has been common practice to provide hours, tens of minutes and minutes numerals on drums or wheels which are rotated by an electric motor to bring successive numerals into position behind a viewing window. Thus, the time indicating numerals are generally centrally positioned on the clock timer and the mechanism for driving and indexing the rotatable drums or wheels from one numeral position to a next succeeding numeral position is located at the sides of the numerals.

In our co-pending U.K. Patent Application No. 9063/74 (Serial No. 1,455,859), there is disclosed a digital clock wherein minutes, tens of minutes, and hours display indicators are rotated by a motor in order to bring successive numerals into position behind a viewing window. Geneva gears 113 and 115 are grouped at the left of the numerals for driving an hours drum 56 and a tens of minutes numeral drum 58. Geneva driver cams 114 and 116 are also positioned at the left of the numerals and include driving projections 122 and 130 for movement into and out of the cusps of the geneva wheels for indexing the tens of minutes and hours geneva wheels. The numeral drums are supported with respect to each other so they may be driven by a motor 8 which is located at the right of the numerals. With this construction, coaxial shafts extend

through the numeral drums for not only driving the drums and their geneva gears and geneva drivers, but also a 12 hour alarm mechanism 160, which is located at the left of the numerals.

In our aforesaid co-pending U.K. patent application the 12 hour alarm cam mechanism includes two coaxially mounted gears 162 and 168 which are provided with interacting cams for causing relative coaxial movement of the gears at a preset alarm time. As shown, the cam gear 162 may be formed with two leftwardly extending projections 163 and 165 for co-operating with slots 164 and 166 which may be formed in a manually adjustable alarm set cam 168.

This invention seeks to provide a relatively simple alarm vibrator control mechanism, and preferably also a temporary repeat alarm shutoff control mechanism which may be inexpensively manufactured and readily incorporated in a digital clock of the type disclosed in our aforesaid co-pending U.K. patent application; however, it is to be understood that the unique control mechanism may also be utilized in other clock timer mechanisms.

The invention provides an alarm clock comprising:

- (a) an alarm vibrator;
- (b) a clock timing mechanism;
- (c) a member actuated by said timing mechanism and movable at a preset alarm time;
- (d) a stationary supporting structure including a supporting plate;
- (e) a vibrator shutoff lever having an alarm on position for releasing said vibrator and an alarm off position for holding said vibrator, said vibrator shutoff lever including two pivot arms pivotally mounting said shutoff lever on said supporting plate and an elongated groove located between said pivot arms;
- (f) an elongated axially movable rod hav-

- ing two ends mounted on said supporting structure, one end of said rod being arranged for longitudinal slidable movement within the groove formed in said vibrator shutoff lever;
- (g) said pivot arms having contact surfaces located on one side of said vibrator shutoff lever, and said elongated groove being located on the other side of said vibrator shutoff lever, so that the vibrator shutoff lever is sandwiched and held on the supporting structure between the elongated axially movable rod and the supporting plate; and
- (h) means positioned between said member and the other end of said rod for permitting said rod to move longitudinally within said groove at the preset alarm time to thereby release said vibrator at a preset alarm time.

With this construction, the alarm vibrator may be compactly located between the supporting plate and the field laminations of a synchronous motor for the clock, and moreover, the vibrator shutoff lever may be readily formed of low cost plastics material and may be readily connected to a clock structure by simply placing the pivot arms of the shutoff lever on an edge of the supporting plate and locating the longitudinally movable rod within the longitudinal groove that is formed in the vibrator shutoff lever. Thus, the vibrator shutoff lever is conveniently sandwiched between an end of the longitudinally movable rod and an edge portion of the supporting plate without the use of any separate connecting mechanism.

In addition, with this construction, the supporting plate may include an outwardly extending portion positioned between the arms of the vibrator shutoff lever for providing additional guide surfaces for the lever. Thus the vibrator shutoff lever is held and positioned on the alarm clock so that it may be readily and reliably actuated at an alarm time to release the audible alarm vibrator.

Moreover, with this construction a temporary repeat alarm shutoff control mechanism may be readily incorporated with the elongated axially movable rod. An interval lever is mounted adjacent to, the axially movable rod for cooperating with an abutment collar that is fixed on the rod to hold the rod and the vibrator shutoff lever in the alarm OFF position. A cam on a tens of minutes geneva driver wheel may be utilized for moving the interval lever.

Further, a mechanism may be provided for automatically shutting off the alarm. This may be accomplished by the addition of a single lever between the axially movable rod and a reset lug which is provided on a cam for driving the units display indicator of the digital clock disclosed in our aforesaid co-

pending Patent Application No. 9063/74 (Serial No. 1,455,859).

With this construction, relatively few parts are required for adding an alarm mechanism, a repeat alarm mechanism and an automatic repeat alarm mechanism to the digital clock mechanism disclosed in our co-pending Patent Application No. 9063/74 (Serial No. 1,455,859). A vibrator shutoff lever including two integrally formed pivot arms is readily attached to the mechanism between an end of the axially movable rod and an edge portion of the supporting plate. The addition of a single lever is all that is required as the principal component of a temporary repeat alarm mechanism, and the addition of another lever is the principal element that is required for the addition of an automatic repeat alarm mechanism. Thus, an exceedingly simple yet effective and reliable alarm mechanism, repeat alarm mechanism and automatic repeat alarm mechanism for a clock timer has been achieved.

In order that the invention may be clearly understood, a preferred embodiment thereof will now be described by way of example only with reference to the accompanying drawings, in which:

Fig. 1 is a front perspective view of a digital alarm clock constructed in accordance with the invention;

Fig. 2 is a front top perspective view generally similar to Fig. 1 with the outer casing removed for purposes of illustration;

Fig. 3 is a bottom front perspective view generally similar to Fig. 2 showing the vibrator shutoff member and the longitudinally movable control rod that extends from one side of the clock to the other side of the clock;

Fig. 4 is a fragmentary exploded bottom perspective view of the alarm clock illustrated in Fig. 3;

Fig. 5 is a cross-sectional view of the clock taken substantially on the plane of 5-5 of Fig. 2;

Fig. 6 is a fragmentary left end elevational view of a minutes drum driving mechanism of the clock shown in Fig. 1;

Fig. 7 is a fragmentary exploded perspective view showing the details of construction of an alarm time cam and an alarm set cam of the clock shown in Fig. 1;

Fig. 8 is a fragmentary bottom plan view of the alarm clock shown in Fig. 3 with the parts in the alarm sounding position;

Fig. 9 is a fragmentary bottom plan view similar to Fig. 5 with the parts held in the alarm set position by the 12 hour alarm cam mechanism;

Fig. 10 is a fragmentary bottom plan view similar to Fig. 5 with the parts held in the temporary alarm shutoff position by the interval lever mechanism;

Fig. 11 is a fragmentary cross-sectional

view of the clock taken substantially on the plane of 11—11 of Fig. 2 showing the interval lever being released from the longitudinal rod by the tens of minutes geneva driver; and

Fig. 12 is a fragmentary exploded perspective view showing the details of construction of the alarm selector mechanism of the digital alarm clock shown in Fig. 1.

Referring now to the drawings and first particularly to Figs. 1, 2 and 3, there is shown a digital clock which includes an alarm vibrator control mechanism. The clock includes three numeral display indicators 2, 4, and 6, which indicate minutes, tens of minutes and hours respectively. With reference to Fig. 5, portions of a geneva cam mechanism for driving the tens of minutes and hours display indicators are shown generally by reference numeral 8 at the left side of the digital clock, and portions of a mechanism for indexing the units display indicator 2 are shown at the right side of the clock and are indicated generally by reference numeral 10.

The digital clock may be driven by a conventional self-starting synchronous motor 12 having a magnetic core 14 and energizing coil 16. As shown in Fig. 2, the motor may be readily attached to an end plate 17 of the clock by means of screws 18 or other suitable securing means.

As shown more particularly in Fig. 5, the display mechanism includes a minutes drum 22 which is fixed to a centrally positioned shaft 24, a tens of minutes drum 26 which is fixed to a coaxial shaft 28, and an hours drum 30 which is coaxially mounted on shaft 28. As shown, the minutes shaft 24 extends a considerable distance to the left of the drum and is supported for rotation within the concentric hollow shaft 28 of the tens of minutes drum. The right end portion 32 of the shaft 24 is rotatably supported within a bearing 34 which is integrally formed with a supporting plate 35.

The minutes drum 2 is indexed from one numeral position to a next succeeding numeral position by a ratchet wheel mechanism as shown more particularly in Fig. 6 (reference should also be made to Fig. 4). As shown, the ratchet wheel 36 is integrally formed with the minutes drum 22 for incrementally moving the drum. A drive finger 38 is eccentrically mounted for rotation with respect to the ratchet wheel 36 to engage and move one tooth of the ratchet wheel for each revolution of the drive finger 38. The drive finger 38 is integrally formed on a reduction gear unit 40 which is positioned between an output shaft 42 of the electric motor 12 and the ratchet wheel 36. With this construction, the output pinion 42 of the motor drives a gear 44 of the integrally formed reduction gear unit 40 to move the

drive finger 38 at one revolution per minute.

The details of the mechanism for driving the units drum 2 do not form a part of this invention and are described and claimed in greater detail in our co-pending U.K. Patent Application No. 9062/74 (Serial No. 1,455,858). However, the same reduction gear unit 40 which is utilized for driving the minutes drum 2 is also utilized for actuating the automatic alarm shutoff mechanism, and thus, it should be appreciated that the reduction gear 40 is rotated at one revolution per minute.

The minutes, tens of minutes and hours drums are supported for rotation between the previously mentioned supporting plate 35 and a supporting plate 50 which is arranged generally parallel thereto. Both of the supporting plates 35 and 50 are preferably formed of a suitable plastics material to include a plurality of outwardly extending spacer posts 52, 54, 56, 58, 60, 62 for supporting the motor mounting plate 17 at the right side of the clock and a mounting plate 64 at the left side of the clock. As shown more particularly in Figs. 2, 3 and 5, a plurality of spacer posts 66, 68, 70 and 72 are positioned between the supporting plates 35 and 50 for securely connecting the plates to each other and for providing a convenient means for mounting other components to the clock mechanism.

The geneva mechanism 8 for driving the hours and tens of minutes drums 30 and 26 is positioned between the supporting plates 50 and 64. As shown, the mechanism includes a pair of geneva driver cams 74 and 76 which are arranged coaxially with each other and are supported on a common shaft 78 for driving the hours and tens of minutes geneva gears 80 and 82, respectively.

With particular reference to Fig. 5, it can be seen that a gear 84 is fixed to the minutes shaft 24 for driving the geneva mechanism 8 to advance the hours drum 30 one increment every hour and to advance the tens of minutes drum 26 one increment every ten minutes. Gear 84 is arranged in mesh with a gear 90 of the tens of minutes driver cam 76 and with one driving finger 92 on the geneva driver cam 76, the gearing ratio between the gears 84 and 90 will enable the timing motor 12, to rotate the tens of minutes geneva driver cam 76 once every ten minutes. Thus, once every ten minutes the geneva drive finger 92 will be moved into one of the cusps of the geneva wheel 82 to rotate the tens of minutes geneva wheel one increment every ten minutes.

The details of the geneva mechanism for driving the tens of minutes and hours indicator drums do not form a part of this invention and are described and claimed in our co-pending Patent Application No. 9063/74 (Serial No. 1,455,859). However,

the drive finger 92 on the tens of minutes geneva driver is utilized for actuating a repeat alarm mechanism lever, and accordingly, it should be recognized that the geneva driver cam 76 is rotated at one revolution every ten minutes.

In accordance with the illustrated embodiment of the invention, the geneva mechanism 8 is utilized for driving the alarm mechanism. With particular reference to Fig. 5, the hours geneva driver cam 74 is driven at six revolutions every 12 hours, and thus, it is utilized for driving a 12 hours cam gear 94 of a 12 hour alarm mechanism. To achieve this, the hours geneva driver cam 74 is fixed to an elongated shaft 96 which extends through the tens of minutes geneva driver cam 76 and a conventional gear 98 is integrally formed on the left end portion of the shaft 96. As shown in Fig. 5, the gear 98 is arranged in mesh with the 12 hour cam gear 94 to drive the cam gear 94 at one revolution every 12 hours.

Conventional 12 hour alarm cam mechanisms include two coaxially mounted gears which are provided with interacting cams for causing relative axial movement of the gears at a preset alarm time for actuating a switch or other alarm mechanism. Thus, as shown in Figs. 5 and 7, the cam gear 94 is formed with two leftwardly extending projections 100 and 102 for cooperating with slots 104 and 106 which are formed in a manually adjustable alarm set cam 108.

ALARM CONTROL MECHANISM

There is combined with the afore-described digital clock elements a shutoff lever mechanism generally indicated by reference numeral 110 which is arranged between a longitudinally movable rod 112 and an alarm vibrator 114. As shown more particularly in the bottom exploded perspective view of Fig. 4, a resilient magnetic vibrator vibrator 114 is positioned between the vibrator shutoff lever mechanism 110 and field laminations 118 of the electric motor 12. The vibrator is operated by leakage flux from the motor and is arranged to have its free end portion 116 vibrate against the stator lamination 118 and produce an audible alarm at all times when the motor is energized unless the vibrator is prevented from vibrating by our vibrator shutoff lever mechanism 110.

As shown in Figs. 2 and 4, the vibrator 114 is formed of a single piece of sheet metal and connected to the upper portion of the motor supporting plate 17 by means of rivets 120 and 122. The vibrator is generally L-shaped and includes a transverse arm 124 for receiving the rivets 120 and 122 and a downwardly extending arm 126 which is positioned between the motor coil 16 and the motor gear reduction unit 130. As

shown more particularly in Fig. 4, the downwardly extending arm 126 of the vibrator is formed to include a transversely extending projection 132 for cooperation with shutoff lever mechanism 110.

The longitudinally movable rod 112 for translating movement from the alarm time cam gear 94 and a lever 136 at one side of the clock to the vibrator shutoff lever mechanism 110 at the other side of the clock is mounted for slidable movement within apertures 138 and 140 that are provided within downwardly extending projections 142 and 144 which are integrally formed with the supporting plates 50 and 35, respectively. As shown, a collar 146 is fixed to the longitudinally movable rod 112 at the right side of the clock and a spring 148 is positioned between the collar 146 and the outwardly extending portion 144 of the mounting plate 35 for urging the rod 112 to the left as shown in Fig. 4 into engagement with a lower arm portion 150 of lever 136.

As shown, the lever 136 is generally T-shaped and includes a generally transverse upper arm portion 152 which is provided with pivot apertures 154 and 156 for pivotally mounting the lever on rightwardly extending projections 158 and 160, respectively, which may be integrally formed with a left end supporting plate 64. A rightwardly extending collar 161 is integrally formed with the alarm time gear 94 for cooperating with a left surface of the lever 136 in the vicinity of its notched out portion 164. Thus it can be appreciated that spring 148 will urge collar 146 and rod 112 to the left against the downwardly extending arm 150 of lever 136 to urge left surface of the lever 136 into engagement with the collar 161 of the alarm time gear 94. Accordingly, at the alarm time when the projections 100 and 102 line up with the slots 104 and 106 that are formed in the manually adjustable alarm set cam 108, the spring 148 will urge the longitudinal rod 112, lever 136, and alarm time gear 94 to the left to release the alarm vibrator 114 unless the longitudinally movable rod 112 or the lever 136 are prevented from such movement by mechanisms to be described in more detail hereinafter.

The vibrator shutoff lever mechanism 110 which is positioned between the right end portion of the longitudinally movable rod 112 and the vibrator 114 will now be more particularly described. As shown in Fig. 4, the vibrator shutoff lever 110 is designed so that it may be formed of a low cost plastics material and readily connected to the clock mechanism previously described. It includes two integrally formed pivot arms 170 and 172 having notched out portions 174 and 176 (not visible in the drawings) for receiving an edge portion of the supporting

plate 35. As shown in Fig. 3, the pivot arms are positioned to straddle the outwardly extending portion 144 of the plate 35 with the notches 174 and 176 being positioned over edge portions of the mounting plate 35 on opposite sides of the outwardly extending portion 144.

The lever 110 also includes an elongated longitudinal cam groove 180 positioned between pivot arms 170 and 172 on the other side of the lever from the notches or contact surfaces and extending rightwardly therefrom for receiving the right end of the longitudinally movable rod 112. As shown more particularly in Fig. 4, the cam groove 180 includes a generally downwardly extending cam surface 181 for cooperating with the end portion of rod 112 so that the lever 110 may be readily pushed upwardly when the rod 112 is moved to the right. The shutoff lever 110 also includes an upwardly extending finger portion 182 which is integrally formed at its right end for engagement with tab 132 of the vibrator 114 to hold the vibrator from sounding against the field laminations 118 when the rod 112 is pushed to the right.

With this construction, the vibrator shutoff lever may be readily and quickly mounted on the supporting plate 35 by simply locating the pivot arms 170 and 172 on the plate and rotating the lever downwardly about its pivot arms until the groove 180 is positioned over the right end portion of rod 112. Thus, with this arrangement of parts the alarm vibrator 114 may be located between the motor supporting plate 17 and the field laminations 118 of the motor, and moreover, the vibrator shutoff member 110 is readily and conveniently sandwiched between the end of the longitudinally movable rod 112 and the edge portion of the supporting plate 35 without the use of any separate connecting mechanisms. In addition, the outwardly extending portion 144 of the supporting plate 35, groove 180 and rod 112 provide guide surfaces for the vibrator shutoff member 110. Thus, the vibrator shutoff member 110 is held and positioned on the alarm clock so that it may readily and reliably release the audible alarm vibrator 114 at an alarm time.

REPEAT ALARM MECHANISM

A repeat alarm mechanism may be readily added to the alarm clock timer with the addition of relatively few parts. With such a mechanism, the vibrator may be shut off and then a timing mechanism may be automatically operated to resound the alarm a short time after the original sounding, just to make sure that the user has not fallen asleep.

As shown more particularly in Fig. 4, the principal component of the repeat alarm mechanism is an integrally formed interval

lever 200 which is positioned between a collar 202 that is fixed to the longitudinally movable rod 112 and a driving finger 92 of the tens of minutes geneva driver cam 76. The repeat alarm interval lever 200 is formed to include a collar portion 204 having a centrally located circular aperture 206 for mounting the lever on the lower rear spacer post 72. The lever also includes a forwardly extending arm 208 for cooperating with the collar 202 on the longitudinal rod 112 and an upwardly and leftwardly extending arm 210 for slidable engagement with the tens of minutes geneva driver cam 76.

The repeat alarm lever 200 also includes a rightwardly extending arm 212 for receiving one end of a spring 214 for biasing the lever in a counterclockwise direction about the spacer post 72 into engagement with the longitudinally movable rod 112 and its collar 202. As shown more particularly in Fig. 11, the other end of the spring 214 is anchored to a tab 216 which may be integrally formed with the plate 50.

With the construction thus far described, it can be appreciated that at the alarm time when projections 100 and 102 become aligned with the slots 104 and 106 of the alarm set cam, spring 148 will move alarm time cam 94 to the left, arm 150 of lever 136 to the left, and the longitudinally slidable rod 112 to the left to the position illustrated in Fig. 10. Then the tens of minutes geneva driver cam 76 will move interval lever 200 to release it from collar 202 to allow spring 148 to move rod 112 to the left to the position illustrated in Fig. 8.

In this position, the right end portion of the longitudinally slidable rod 112 will have been moved far enough to the left within cam groove 180 of the alarm shutoff lever 110 to permit the alarm shutoff lever to pivot downwardly by gravity about its pivot arms 170 and 172 to thereby release the end portion 182 of the vibrator shutoff lever from the vibrator to permit the vibrator to sound.

In order to shut off the vibrator for a short time interval, it is merely necessary to move the longitudinally slidable rod 112 to the right from the position illustrated in Fig. 8 to the position illustrated in Fig. 10. In moving to the position illustrated in Fig. 10 it may be appreciated that the collar 202 of the rod 112 will slide on the forwardly extending arm 208 of the repeat alarm lever 200 and that as soon as the collar 202 is moved far enough to the right, spring 214 will move the forwardly extending arm 208 behind the collar to hold the longitudinal rod 112 in the alarm OFF position illustrated in Fig. 10.

A relatively simple mechanism is provided for moving the longitudinal rod 112

to the right to permit arm 208 to engage the left surface of the collar 202. To achieve this, the lever 136 is simply formed with a leftwardly extending tab 220 for engagement with a downwardly extending portion of a repeat alarm pushbutton 222 (see Figs. 1 and 2). Thus, upon depression of the manually operable pushbutton 222, tab 220 will be pivoted downwardly about its pivots 154 and 156 to move the lower portion of lever 136 and rod 112 to the right to permit the interval lever 200 to hold the longitudinal rod 112 in the temporary alarm shut-off position. As the units numeral 6 comes into view, the lug 92 on the tens of minutes geneva driver 76 will have moved through the position illustrated in Fig. 11, and as illustrated in Fig. 11, it will have rotated the interval lever 200 clockwise far enough to release the push rod 112 and its collar 202 to thereby permit the rod 112 to move far enough to the left under the force of spring 148 to resound the alarm. With this construction, since the geneva driver cam 76 rotates once every ten minutes, the repeat alarm cycle can be repeated every ten minutes until the projections 100 and 102 of the alarm time cam 94 are driven out of the slots 104 and 106 of the alarm set cam 108.

It can be appreciated that when a clock is provided with the repeat alarm mechanism 200 the first sounding of the alarm at the alarm time will not occur at the instant that the hour gear 94 moves toward the alarm set cam 108 but when the tens of minutes geneva driver releases interval lever 200 from the side surface of collar 202.

AUTOMATIC ALARM SHUTOFF MECHANISM

An automatic alarm shutoff mechanism may be added to the alarm clock timer in order to automatically shut off the alarm a short time interval after it has been sounded. The automatic shutoff alarm mechanism accomplishes the same function as the tab 220 which is formed on the lever 136. That is, it moves the longitudinal rod 112 to the right from the position illustrated in Fig. 8, to the position illustrated in Fig. 10 to permit the interval lever 200 to hold the longitudinal rod 112 in the alarm shutoff position for a short time interval. As previously indicated this mechanism can be readily actuated by the same reduction gear unit 40 which is utilized for actuating the minutes display indicator 2.

The principal component of the automatic alarm shutoff mechanism is a single lever 300 which may be readily formed from a piece of sheet metal. As shown more particularly in Fig. 4, the lever extends between the spacer post 72 and the longitudinally movable rod 112, and it also includes a rightwardly extending arm portion 302 which is arranged

for engagement with a rightwardly extending lug 304 which may be integrally formed on the reduction gear unit 40. As shown, the lever includes a lower saddle-shaped portion for pivotal engagement within a groove 306 which is formed in the spacer post 72. The upper portion of the lever is provided with a curved slot 308 for receiving rod 112 and the left surface of collar 146, and the rightwardly extending arm 302 is passed through a slot 310 in supporting plate 35, as shown in Fig. 6. Thus the automatic shutoff alarm lever 300 is designed so that it may be readily held on to the clock structure without the use of separate connecting hardware, and moreover, it is positioned so that an automatic shutoff alarm feature can be provided by the addition of the single automatic shutoff alarm lever 300. Naturally, it is to be expected that the outwardly extending lug 304 of the reduction gear unit 40 which is preferably formed of plastics, may be readily formed on the reduction gear unit at the same time that the teeth and other portions of the reduction gear unit are being formed.

With the automatic shutoff alarm mechanism, after the drive finger 38 of the units driver has moved the units drum 2 and the units gear 84 has moved the geneva drivers 76 and 74 to move the alarm time gear 94 to sound the alarm at the time which has been preset by alarm set cam 108, the gear reduction unit 40 will continue to be rotated by the drive pinion 42 of the electric motor and before the drive finger 38 of the reduction gear unit causes the units drum 2 to be moved an additional increment, the reset lug 304 on the reduction gear unit 40 will move into contact with arm 302 of the shutoff alarm lever 300 to pivot the lever in a clockwise direction about its pivot groove 306 to move the longitudinally movable rod 112 against the force of spring 148 far enough to the right to permit the interval lever arm 208 to engage the collar 202 to hold the longitudinally movable rod 112 in the temporary alarm shutoff position. With this construction, it can be appreciated that the positioning of the reset lug 304 with respect to the drive finger 38 on the reduction gear unit will determine the length of time that the vibrator 114 is allowed to sound before the automatic shut off occurs.

The automatic alarm shutoff mechanism is also described and claimed in our co-pending Patent Application No. 24533/76 (Serial No. 1,455,860), which is divided out of the present Application.

ALARM SET MECHANISM

A relatively simple alarm control mechanism may be provided for setting the desired operation of the alarm. In order to achieve this, a tab 404 is provided on the lower front portion of lever 136 for operation by a

manually movable cam 402. As shown more particularly in Fig. 4, the cam 402 may be integrally formed of plastics along with a lever 400 that extends through an enlarged aperture 408 in the front face of the clock casing. As shown in Fig. 12, the lever 400 and its integrally formed cam 402 may be readily pivoted to the clock by means of a pivot shaft 410 supported on plate 50. It can be appreciated that when the lever 400 is rotated upwardly to the alarm OFF position, its cam 402 will be rotated against the tab 404 to move the tab 404 and the lever 136 to the right to thereby move rod 112 to the right against the force of spring 148. During this movement the right end portion of rod 112 will also be moved to the right within the longitudinal cam groove 180 of the vibrator shutoff lever 110 to shut off the alarm and hold it in its shutoff position. In order to set the alarm for automatic operation by the 12 hour alarm time gear 94, the lever 400 is moved downwardly to the position illustrated in Fig. 4. In this position the cam 402 is removed from the tab 404 of lever 136, and the left side surface of lever 136 will ride on the collar 161 of the alarm time cam 94 to thereby follow any leftward movement of the alarm time cam 94 at the alarm time, and thus allow the rod 112 to be moved to the left to sound the alarm.

OPERATION

If, for example, it is desired to have the alarm ring at 7 o'clock in the morning, the operator rotates the alarm cam 108 to the appropriate 7 AM position, as indicated in Fig. 1. Then the selector lever 400 is moved down to the alarm position to move cam 402 to allow pivotal movement of lever 136, as illustrated in Fig. 9. Thus, the cam surfaces 100 and 102 of the incrementally rotated gear 94 will ride on the inside surface of the time set cam 108 as the gear 94 is rotated by the hours geneva driver cam 74 of the digital clock.

At 7 o'clock in the morning the abrupt cam surfaces 100 and 102 become aligned with the abrupt cam slots 104 and 106 of the alarm set cam 108 and the spring 148 acting through collar 146 of the longitudinally movable rod 112 and the lever 136 rapidly moves the incrementally rotated gear 94 toward the alarm set cam 108 from the position illustrated in Fig. 9 to that of Fig. 10 to move the left side surface of collar 202 against a side surface of arm 208 of interval lever 200 to continue to hold the rod 112 and lever 110 in the alarm off position. Six minutes later the lug 92 on the geneva driver passes through the position shown in Fig. 11 and rotates the interval lever 200 far enough to release the collar 202 of push rod 112 to allow spring 148 to move rod 112 to the left to the position illustrated in Fig. 8 to sound

the alarm vibrator 114. During this movement, it can be appreciated that the vibrator shutoff lever 110 will be allowed to pivot downwardly to release the vibrator 114 as the right end of the movable rod 112 is moved to the left within the groove 180 of the vibrator shutoff lever.

When the alarm has sounded the operator may permanently shut off the alarm by actuating the lever 400 to the alarm off position. To achieve this, the selector lever 400 is moved upwardly from the position illustrated in Fig. 1 to thereby cause rearwardly extending cam 402 to engage the tab 404 of lever 136 to move the lever 136 and rod 112 to the right to thereby slide the end of rod 112 within the groove 180 of the vibrator shutoff lever to move the vibrator shutoff lever 110 to the alarm off position illustrated in Fig. 12.

If, for example, it is desired to temporarily shut off the alarm for a short interval of time as soon as the operator hears the alarm sound, the operator may manually depress pushbutton 222 to thereby press tab 220 downwardly to pivot lever 136 to the right to enable the interval lever 208 to move behind collar 202 to hold the alarm in the temporary alarm shutoff position illustrated in Fig. 10. A short time interval thereafter, the lug 92 on the geneva driver cam 76 will move to the position illustrated in Fig. 11 to pivot the repeat alarm interval lever in a clockwise direction to release the interval lever arm 208 from the collar 202 to resound the alarm.

If the digital alarm clock is provided with the automatic shutoff alarm lever 300, after the alarm has sounded and if the operator does not wish to immediately shut off the alarm, the alarm will continue to sound until it is shut off by the automatic shut off lever 300. It can be appreciated that the reset lug 304 on the gear 40 will engage the lever 300 to pivot the lever 300 in a clockwise direction about its pivot groove 306 and thereby move the lever 300 against the collar 146 against the force of the spring 148 to position the collar 202 to the right of the forwardly extending arm 208 of the interval lever to temporarily shut off the alarm. Biasing spring 214 will then move arm 208 behind the collar 202 as shown in Fig. 10 to hold the alarm in the off position for about ten minutes until the interval lever 200 will again be rotated by lug 92 to release rod 112. This sequence will be repeated until the alarm is either permanently shut off by selector lever 400 or the projections 100 and 102 of the alarm time gear are driven out of the slots in the alarm set gear 108.

From the foregoing description it will be appreciated that the alarm control mechanism is achieved with the use of relatively few parts which may be readily incorporated with a digital clock of the type described

and claimed in our co-pending Patent Application No. 9063/74 (Serial No. 1,455,859). The principal component of the alarm vibrator control mechanism is a shutoff lever 110 which may be formed of a low cost plastics material and readily attached to the supporting plate 35 in order to reliably control the alarm vibrator 114. In order to achieve a repeat alarm function with this mechanism, a readily formed repeat alarm lever 200 is simply positioned over a spacer post 72 and located between the longitudinally movable rod 112 and a lug 92 on a tens of minutes geneva driver mechanism 76. The automatic shutoff alarm function is also achieved with the use of a single lever 300 which is positioned on the same spacer post 72 and arranged between the longitudinally movable rod 112 and a reset lug 304 which is formed on the reduction gear unit 40. Thus, an exceedingly simple and reliable alarm control mechanism is achieved with the use of relatively few parts which may be readily connected to each other.

WHAT WE CLAIM IS:—

1. An alarm clock comprising:
 - (a) an alarm vibrator;
 - (b) a clock timing mechanism;
 - (c) a member actuated by said timing mechanism and movable at a preset alarm time;
 - (d) a stationary supporting structure including a supporting plate;
 - (e) a vibrator shutoff lever having an alarm on position for releasing said vibrator and an alarm off position for holding said vibrator, said vibrator shutoff lever including two pivot arms pivotally mounting said shutoff lever on said supporting plate and an elongated groove located between said pivot arms;
 - (f) an elongated axially movable rod having two ends mounted on said supporting structure, one end of said rod being arranged for longitudinal slidable movement within the groove formed in said vibrator shutoff lever;
 - (g) said pivot arms having contact surfaces located on one side of said vibrator shutoff lever, and said elongated groove being located on the other side of said vibrator shutoff lever, so that the vibrator shutoff lever is sandwiched and held on the supporting structure between the elongated axially movable rod and the supporting plate; and
 - (h) means positioned between said member and the other end of said rod for permitting said rod to move longitudinally within said groove at the preset alarm time to thereby release said vibrator at a preset alarm time.

2. An alarm clock as claimed in Claim 1,

wherein said supporting plate includes an outwardly extending portion and said pivot arms are positioned with their contact surfaces on an edge surface of said supporting plate with the outwardly extending portion of said supporting plate being positioned between the pivot arms of said vibrator shutoff lever whereby said vibrator shutoff lever may be readily and quickly mounted on said supporting plate and is accurately and positively guided for movement on said supporting plate in order to positively control operation of the alarm vibrator.

3. An alarm clock as claimed in Claim 1 or Claim 2, wherein said supporting structure includes two supporting plates which are arranged generally parallel to each other and are held spaced apart from each other by a plurality of spacer posts and both of said supporting plates include integrally formed outwardly extending portions having apertures formed therein receiving end portions of said elongated axially movable rod in order to accurately guide said rod within the longitudinal groove formed in said vibrator shutoff lever.

4. An alarm clock as claimed in any one of Claims 1 to 3, wherein said vibrator is arranged generally perpendicular to said vibrator shutoff lever, said vibrator shutoff lever includes an outwardly extending portion for engaging and holding said vibrator in its off position, and a spring is positioned between said longitudinal rod and a supporting plate for resiliently urging said rod and said vibrator shutoff lever to the alarm sounding position.

5. An alarm clock as claimed in any one of Claims 1 to 3, and comprising:
 - a spring positioned between said elongated rod and said supporting structure for urging said rod and said vibrator shutoff lever to the alarm sounding position;

said member actuated by said timing mechanism comprising a rotatably mounted alarm time cam mounted to be axially movable at the preset alarm time; and

said means between said member and the other end of the rod being a control lever pivotally mounted on said clock between said rod and said alarm time cam for normally holding said rod against the force of said spring and for permitting said spring to slide said elongated rod axially to thereby release the alarm vibrator to sound the alarm at a preset time when said alarm time cam has been moved axially.

6. An alarm clock as claimed in Claim 5 and further comprising:

- (a) an interval lever resiliently urged into engagement with said elongated rod;
- (b) an abutment collar fixed on said elongated rod for cooperating with said interval lever to hold the rod and the vibrator shutoff lever in the alarm off position;

and claimed in our co-pending Patent Application No. 9063/74 (Serial No. 1,455,859). The principal component of the alarm vibrator control mechanism is a shutoff lever 110 which may be formed of a low cost plastics material and readily attached to the supporting plate 35 in order to reliably control the alarm vibrator 114. In order to achieve a repeat alarm function with this mechanism, a readily formed repeat alarm lever 200 is simply positioned over a spacer post 72 and located between the longitudinally movable rod 112 and a lug 92 on a tens of minutes geneva driver mechanism 76. The automatic shutoff alarm function is also achieved with the use of a single lever 300 which is positioned on the same spacer post 72 and arranged between the longitudinally movable rod 112 and a reset lug 304 which is formed on the reduction gear unit 40. Thus, an exceedingly simple and reliable alarm control mechanism is achieved with the use of relatively few parts which may be readily connected to each other.

WHAT WE CLAIM IS:—

1. An alarm clock comprising:
 - (a) an alarm vibrator;
 - (b) a clock timing mechanism;
 - (c) a member actuated by said timing mechanism and movable at a preset alarm time;
 - (d) a stationary supporting structure including a supporting plate;
 - (e) a vibrator shutoff lever having an alarm on position for releasing said vibrator and an alarm off position for holding said vibrator, said vibrator shutoff lever including two pivot arms pivotally mounting said shutoff lever on said supporting plate and an elongated groove located between said pivot arms;
 - (f) an elongated axially movable rod having two ends mounted on said supporting structure, one end of said rod being arranged for longitudinal slidable movement within the groove formed in said vibrator shutoff lever;
 - (g) said pivot arms having contact surfaces located on one side of said vibrator shutoff lever, and said elongated groove being located on the other side of said vibrator shutoff lever, so that the vibrator shutoff lever is sandwiched and held on the supporting structure between the elongated axially movable rod and the supporting plate; and
 - (h) means positioned between said member and the other end of said rod for permitting said rod to move longitudinally within said groove at the preset alarm time to thereby release said vibrator at a preset alarm time.
2. An alarm clock as claimed in Claim 1,

wherein said supporting plate includes an outwardly extending portion and said pivot arms are positioned with their contact surfaces on an edge surface of said supporting plate with the outwardly extending portion of said supporting plate being positioned between the pivot arms of said vibrator shutoff lever whereby said vibrator shutoff lever may be readily and quickly mounted on said supporting plate and is accurately and positively guided for movement on said supporting plate in order to positively control operation of the alarm vibrator.

3. An alarm clock as claimed in Claim 1 or Claim 2, wherein said supporting structure includes two supporting plates which are arranged generally parallel to each other and are held spaced apart from each other by a plurality of spacer posts and both of said supporting plates include integrally formed outwardly extending portions having apertures formed therein receiving end portions of said elongated axially movable rod in order to accurately guide said rod within the longitudinal groove formed in said vibrator shutoff lever.

4. An alarm clock as claimed in any one of Claims 1 to 3, wherein said vibrator is arranged generally perpendicular to said vibrator shutoff lever, said vibrator shutoff lever includes an outwardly extending portion for engaging and holding said vibrator in its off position, and a spring is positioned between said longitudinal rod and a supporting plate for resiliently urging said rod and said vibrator shutoff lever to the alarm sounding position.

5. An alarm clock as claimed in any one of Claims 1 to 3, and comprising: a spring positioned between said elongated rod and said supporting structure for urging said rod and said vibrator shutoff lever to the alarm sounding position;

said member actuated by said timing mechanism comprising a rotatably mounted alarm time cam mounted to be axially movable at the preset alarm time; and

said means between said member and the other end of the rod being a control lever pivotally mounted on said clock between said rod and said alarm time cam for normally holding said rod against the force of said spring and for permitting said spring to slide said elongated rod axially to thereby release the alarm vibrator to sound the alarm at a preset time when said alarm time cam has been moved axially.

6. An alarm clock as claimed in Claim 5 and further comprising:

- (a) an interval lever resiliently urged into engagement with said elongated rod;
- (b) an abutment collar fixed on said elongated rod for cooperating with said interval lever to hold the rod and the vibrator shutoff lever in the alarm off position;



- (c) manually operable means movable into engagement with said control lever for moving said control lever and said rod to the alarm off position; and
- 5 (d) timing means for moving said interval lever against the force of its resilient bias after a short time interval to release it from the abutment collar formed on the elongated rod to thereby release the vibrator after a short time interval.
- 10 7. An alarm clock as claimed in Claim 6 wherein the timing means is a tens of minutes geneva driver cam arranged to move said interval lever to release the interval lever from the abutment collar to release the vibrator at the alarm time.
- 15 8. An alarm clock as claimed in any one of Claims 5 to 7, wherein an automatic alarm shutoff lever is positioned between the elongated rod and a reset lug which is rotated as a function of time by said alarm clock for moving said automatic shutoff lever and the elongated rod a short time after the alarm
- has sounded in order to automatically shut off the alarm.
- 25 9. An alarm clock as claimed in Claim 8, wherein said automatic alarm shutoff lever is pivotally mounted on a spacer post of the alarm clock and is positioned within a slot that is formed in a supporting plate of the alarm clock in order to support the automatic alarm shutoff lever without the use of additional supporting components.
- 30 10. An alarm clock as claimed in Claim 6 or Claim 7, when dependent upon Claim 3, wherein the plurality of spacer posts are located between the plates for securely connecting the supporting plates to each other and wherein the interval lever includes a bearing aperture pivotally mounting the interval lever on one of the spacer posts.
- 35 11. An alarm clock substantially as hereinbefore described with reference to and as shown in the accompanying drawings.
- 40 JOHN A. BLEACH,
Agent for the Applicants.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1976.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY
from which copies may be obtained.



* C L M S *