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(54) ALARM CLOCK MECHANISM

(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, 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 clock mechanisms, and more particularly, to a mechanism for providing automatic operation of a switch at a preset time and manual operation of the switch at any time.

Radio alarm clock timers are now well-known in the horological art. Such radio alarms are generally designed to close a switch at a preselected time which has been manually set by a user of the radio alarm clock. Thus, the radio may be automatically turned on so that one may wake up to music.

In addition to the usual alarm clock function of a radio alarm clock, clock radios are usually provided with a readily accessible knob or button for allowing the user to manually turn the radio on or off at any time. It has also been suggested to provide radio alarm clock timers with SLEEP switch mechanisms. With such a mechanism a person may close the switch to turn the radio on for a predetermined short time interval while he falls asleep to the sound of the radio. After the short interval of time the radio alarm clock will automatically open the switch to turn off the radio.

The invention provides an alarm clock mechanism comprising a switch having an open and a closed position, an elongated switch actuating lever for opening and closing said switch, said elongated lever having two end portions and an intermediate

portion and said lever being guided for longitudinal and transverse movement, one end portion of said elongated switch actuating lever being in engagement with said switch for opening or closing the switch upon said transverse movement, an alarm time cam mounted adjacent to the intermediate portion of said switch actuating lever for effecting said transverse movement of the elongated lever at an alarm time for closing said switch, and a manually operable member connected to the other end portion of said switch actuating lever for moving said switch actuating lever in a longitudinal direction with consequent transverse movement to close the switch at any time whereby said switch may be closed at a preset time by said alarm time cam and said switch may also be closed at any time by said manually operable member.

By this arrangement, when the manually operable member has placed the switch actuating lever in an appropriate longitudinal position with respect to the alarm time cam, the alarm time cam may move the switch actuating lever in a transverse direction at the alarm time to close the switch. However, the switch actuating lever is not positively connected to the alarm time cam, and thus, the manually operable member may move the switch actuating lever longitudinally at any time to close the switch or set the lever for automatic operation by the alarm time cam without disturbing the position of the alarm time cam.

With this construction, relatively few parts are required for transmitting motion from the alarm time cam to the switch, and likewise, few parts are required for transmitting motion from the manually operable member to the switch and the alarm time cam. A suitably formed elongated switch actuating lever is all that is required to

[Price 33p]

Price 75p

translate motion from the alarm cam and the manually operable member to the switch. The elongated switch actuating lever is moved transversely by the alarm time cam to close the switch at the appropriate alarm times and the elongated switch actuating lever may be moved longitudinally by the manually operable member to close the switch at any time. Thus, a very simple yet effective and reliable switch actuating 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 elevational view of a digital alarm clock incorporating mechanism in accordance with our invention;

FIG. 2 is a fragmentary exploded front perspective view of a portion of the switch operating and alarm mechanism which is incorporated in the digital clock shown in FIG. 1;

FIG. 3 is a fragmentary front perspective view generally similar to FIG. 2 with many of the parts of the display mechanism of the clock removed for purposes of illustration, the parts of the alarm and switch actuating mechanism being shown in a position wherein the parts are under the control of an alarm shut-off cam which overrides an alarm cam and a sleep cam to move the switch to an open position to shut off the alarm;

FIG. 4 is a fragmentary front perspective view similar to FIG. 3 showing the parts under the control of the alarm cam with the alarm cam in a position to hold a switch actuating lever and the switch in an open position;

FIG. 5 is a fragmentary front perspective view generally similar to FIG. 4 showing the parts under the control of an alarm time cam wherein the alarm time cam has functioned to close the switch at the alarm time;

FIG. 6 is a fragmentary front perspective view generally similar to FIG. 5 with the parts under the control of the sleep cam, the elongated alarm shut-off lever being shown in its longitudinally down position for closing the switch for a predetermined short time interval;

FIG. 7 is a fragmentary front perspective view generally similar to part of FIG. 6 showing a plural position lever in an ON notch on the sleep cam and showing a sleep cam drive lever on a smooth portion of the sleep cam;

FIG. 8 is a detail side elevational view of the alarm time cam, alarm set cam, switch actuating lever, and switch in the position illustrated in FIG. 4;

FIG. 9 is a detail side elevational view of the alarm time cam, alarm set cam, switch actuating lever, and switch in the position illustrated in FIG. 5;

FIG. 10 is a fragmentary front elevational view of the alarm time cam and a finger portion of the alarm set cam, the cam finger of the alarm set cam being shown in three different operative positions on the alarm time cam; and

FIG. 11 is a fragmentary front perspective view generally similar to FIG. 6 showing the parts under the control of the sleep cam and the alarm time cam wherein the switch has been closed by the sleep cam and the device has been set to open the switch contacts after a short interval of time and then close the switch at an alarm set time; a WAKE-NO WAKE cam being in the WAKE position.

Referring now to the drawing and first particularly to FIGS. 1 and 2, there is shown a digital clock which includes our alarm mechanism. The clock includes four numeral display indicators 2, 4, 6 and 8 which indicate minutes, tens of minutes, hours and tens of hours, respectively. As shown in FIG. 2, portions of the display indicators are identified by reference numerals 30, 32, 34, 46, 48 and 50, portions of the cams and other mechanism for driving the display indicators are shown by reference numerals 52, 54, 56, 74 and 72, and our improved alarm mechanism is generally identified by reference numeral 100.

The details of the digital display indicators 2, 4, 6 and 8 and the details of the mechanism for indexing and driving the minutes, tens of minutes, and hours cams do not form a part of this invention but are more fully described and claimed in our copending patent applications Nos. 1162/72 and 49846/72. (Serial Nos 1371401 and 1408416)

As shown in FIG. 1, the display indicators 2, 4 and 6 include a common front plate 24 which may be formed of a sheet of plastic that may be readily slotted or blocked out to reveal three clear numeral 8's, one for each of the display indicators 2, 4 and 6. With particular reference to FIG. 2, each of the display indicators 2, 4 and 6 includes a vertically movable shutter 30, 32 and 34, respectively, for selectively blocking out one or more of the horizontal indicator bars 10, 12 and 14. It can be appreciated that all of the horizontal bars should be blocked out for displaying a numeral 1 while only the central bar 12 should be blocked out for displaying the numeral 0. To achieve this, a plurality of opaque shutter bars 36, 38 and 40 may be painted or otherwise formed on the vertically movable shutter members 30, 32

and 34 for blocking out the appropriate horizontal indicator bars.

With particular reference to FIG. 2, horizontally slidable shutters 46 and 48 and 50 are positioned behind the vertically slidable shutters for selectively obstructing the vertical bars 16, 18, 20 and 22 of the slotted figure 8 numerals of the display indicators 2, 4 and 6. It can be appreciated that the upper left vertical bar 18 should be blocked out to display numerals 1, 2 and 3 while it would be unobstructed to display the numerals 6, 8 and 9, for example.

It can be readily appreciated that in order to display a particular numeral the vertical shutter has to be moved to one position while the horizontally movable shutter is required to be moved to a different position. For example, in order to display the numeral 2 as shown in FIG. 1, the vertically movable shutter has to be moved to leave all of the horizontal bars 10, 12 and 14 unobstructed. In a similar manner, the horizontally movable shutter has to be moved to block out only the lower right and upper left vertical indicator bars 20 and 18, respectively.

With reference to FIG. 2, two-faced rotatable cams 52, 54 and 56 are provided for moving the vertical shutters 30, 32 and 34, respectively, and the horizontal shutters 46, 48 and 50, respectively. The front faces of each of the cams include a cam groove 60 for receiving a cam follower pin 62 on lever 64 in order to appropriately position the vertically movable shutters 30, 32 and 34. A cam groove (not shown) is also formed in the rear face of the rotatable cams 52, 54 and 56 for moving the horizontal shutters 46, 48 and 50 back and forth behind the vertical shutters 30, 32 and 34. With this construction, when the cams 52, 54 and 56 are rotated in a clockwise direction as illustrated in FIG. 2, the front cam groove and cam follower causes the vertical sliders to move upwardly and downwardly with respect to the slotted numeral 8 members, and the rear cam track causes the horizontal shutters 46, 48 and 50 to be moved to the right and left behind the vertical shutters and the slotted numeral 8.

A mechanism is positioned between the minutes and tens cams 52 and 54 for indexing the minutes cam once every minute and for simultaneously indexing the tens cam one increment at the instant that the minutes cam is being indexed a tenth increment, so that the minutes cam and the tens cam are simultaneously indexed to the next succeeding numbers when the units cam is being moved to its tenth increment. To achieve this, special cam teeth 80 and 82 are integrally formed on the outer periphery of the cams 52 and 54

for cooperating with a pawl lever 84 which is positioned between the cams. As shown more particularly in FIG. 2, the indexing mechanism includes a drive lever 86 which is pivotally mounted on the digital clock between the units and tens cams 52 and 54.

An arrangement for oscillating the drive lever 86 to provide a rapid clockwise advance stroke of about five seconds duration and a slower return stroke once per minute is shown in FIG. 2. To accomplish this, the drive lever 86 is provided with cam surfaces for cooperating with an eccentric drive roller 106 mounted on a gear 108 that is rotated at one revolution per minute by a synchronous electric motor pinion 110. The gear 108 and its eccentric roller 106 are rotated in a clockwise direction and the roller 106 abuts a cam surface to pivot the upper portion of the drive lever 86 to the right about its lower pivot 88 to move a units pawl 112 of the pawl lever 84 to the right. With reference to FIG. 2, the pawl 112 moves against a tooth of the units cam 52 to move the units cam 52 one increment to thereby actuate the units display indicator 2 to display a next succeeding numeral. Continued rotation of the eccentric roller 106 moves the roller into contact with a return stroke cam surface to move the drive lever 86 and the pawl lever 84 to the left as shown in FIG. 2.

The pawl lever 84 is shaped, weighted and pivoted so that the relatively small pawl lever 84 may reliably index both the units cam 52 and the tens cam 54. The pawl lever 84 includes a central portion 116 which is loosely pivoted to the drive lever 86 by a pivot pin 118, a right side portion having a units pawl 112 formed thereon for indexing the units cam and a left side portion having a pawl 120 formed thereon for indexing the tens cam 54. As shown more particularly in FIG. 2, the pawl 84 is weighted by a counterweighted portion 113 in the vicinity of the units pawl 112 so that the pawl 112 gently rests on the units cam 52. In this position, it can be appreciated that the tens pawl 120 is located above the teeth 82 on the tens cam 54. Thus, during nine of the ten incremental movements of the pawl lever 84, the tens pawl 120 clears the teeth 82 on the tens cam 54, and consequently, the tens cam 54 remains stationary.

During the tenth incremental movement of the drive lever 86 the mechanism indexes both the units cam 52 and the tens cam 54 simultaneously so that the succeeding numerals will simultaneously appear at the display indicators 2 and 4. To accomplish this the tenth tooth on the units cam is made much higher than the other nine

teeth of the units cam which correspond to numerals 1 thru 9. This causes the left tens pawl 120 to be moved downwardly to engage one of the teeth 82 on the tens cam.

5 Accordingly, the units pawl 112 is in engagement with the high tooth on the units cam, and tens pawl 120 is in engagement with one of the teeth on the tens cam 54, and further rotation of the eccentric roller 106 against the drive lever 86 will cause the drive lever and the pawl lever 84 to be moved to the right to index both the units cam 52 and the tens cam 54 one increment. It can be appreciated that this movement of both cams occurs simultaneously, and thus, a person viewing the digital clock will observe a simultaneous change in both the units and the tens numerals which appear on display indicators 2 and 4, respectively.

20 With the mechanism thus far described, it can be appreciated that the units display indicator 2 is rapidly indexed one incremental movement each minute by the eccentric roller 106 when it is moved against the lever 86 and that the units and tens display indicators 2 and 4 are simultaneously rapidly indexed to their next succeeding positions once every ten minutes. A mechanism is also provided for rapidly indexing the hours digital display indicator 6 once every hour. The mechanism for achieving this is driven from the tens cam 54, and thus, the mechanism is arranged to simultaneously index the hours display indicator 6 on every sixth indexing movement of the tens cam. As shown in FIG. 2, a six slotted geneva gear 124 and a two lug geneva driver 126 are positioned between the tens cam 54 and an hours cam 56. The geneva driver 126 is positioned on the same axis as the tens cam gear 54 and may be directly keyed thereto by means of a radial lug 128 which is integrally formed with the tens cam gear 54. In like manner, an hour gear 130 may be positioned on the same axis as the hour cam 56 and keyed to the hour cam by means of a lug 132. The geneva gear 124 may be formed of plastic to include an integrally formed toothed gear 134 which is arranged in mesh with the hour gear 130.

55 With particular reference to FIG. 2, it can be appreciated that the geneva gear 124 and its integrally formed toothed gear 134 are positioned between the geneva driver 126 and the hour gear 130. The tens of minutes cam 54 is provided with twelve teeth and the geneva driver 126 is formed to include two lugs 136 and 138 for driving the geneva gear 124. Thus, with this arrangement on every sixth incremental movement of the tens of minutes cam 54 one of the drive lugs 136 or 138 is brought into engagement with one of the six notches

of the geneva gear to move the geneva gear one incremental movement to thereby advance the hour digital display indicator 6 to the next succeeding number.

A switch and alarm mechanism is incorporated with the digital clock thus far described so that the clock may be utilized as a radio alarm timer for automatically turning a radio on at a preset time. The alarm mechanism is generally designated by reference numeral 200 in FIG. 2, and with particular reference to FIGS. 3, 4 and 6, it can be seen that a switch for the alarm mechanism is positioned rearwardly of mounting plate 100.

80 The switch includes a pair of switch blades 202 and 204 having a pair of switch contacts 206 and 208 mounted at their free end portions. Rear switch blade 202 is somewhat longer than the front switch blade 204 and is formed of spring material for normally biasing the rear switch blade forwardly to hold the switch contacts in a closed position. The switch blades may be mounted on a conventional switch block member 210 which may be connected to the rear plate 100 of the digital clock by any suitable securing means. As shown, the switch is mounted so that the switch blades 202 and 204 are arranged in planes which are generally parallel to the base plate 100. With this arrangement, rearward or transverse movement of the free end portion of the switch blade 202 will open the switch contacts.

100 An elongated switch actuating lever 212 is positioned between the rear switch blade 202 and the base plate 100 for opening or closing the switch in response to movement of an alarm time cam mechanism 214, a SLEEP, ON or OFF cam mechanism 215 or an alarm shut-off cam mechanism 216. It can be appreciated that rearward transverse movement of the elongated switch actuating lever 212 will cause the lower end portion 217 of the lever to abut the front surface of switch blade 202 and further rearward movement of the lever will cause the switch blade 202 to be moved far enough rearwardly to open the switch contacts 206 and 208, as shown more particularly in FIG. 3.

115 The alarm cam mechanism for allowing the elongated switch actuating lever 212 to be moved transversely forwardly at a preset alarm time to close the switch contacts 206 and 208 to thereby turn on a radio or other alarm at a preset time will now be more particularly described. Basically, the alarm cam mechanism includes two coaxially mounted gears 218 and 219 which are provided with interacting cams 220 and 222, respectively, for causing relative axial movement of the gears at a present time for actuating the switch 206 and 208.

The cam gears 218 and 219 are combined with the digital clock mechanism thus far described. As shown more particularly in FIGS. 2 and 3, cam gear 218 functions as an alarm time cam and is driven at one revolution every twelve hours by a pinion gear 224 which may be integrally formed with the tens of minutes cam gear 54. Thus, the alarm time cam gear 218 is provided with a sufficient number of teeth on its outer periphery to achieve a suitable gear reduction from the tens of minutes pinion 224 so that the alarm time cam gear 218 will be driven at one revolution every twelve hours.

The alarm cam 220 is fixed to its gear 218 and their common shaft 242 in any suitable manner. As shown in FIG. 3 the cam 220 is generally circular in shape with a cutout or notch 226 which forms the operable portion.

As shown more particularly in FIG. 3, the alarm set cam gear 219 is fixed to a shaft 230 which extends forwardly and rearwardly therefrom, and a knob 232 may be fixed to forward end of shaft 230 for manually rotating the alarm set cam 222 to any desired alarm time.

The alarm time cam 218, 220 and the alarm set cam 219, 222 are supported in coaxial relationship with respect to each other on the digital alarm clock by providing shaft 242 of the alarm time cam with a relatively small diameter so that it extends into a hollow end portion of shaft 230 of the alarm set cam. As shown more particularly in FIGS. 8 and 9, the shaft 242 extends rearwardly through an aperture 244 which is formed in the mounting plate 100 and as shown in FIG. 2 the shaft 230 extends forwardly through an aperture 246 which is formed in a front plate 248 for supporting the alarm time cam and the alarm set cam on the digital clock.

A relatively simple and reliable alarm time indicator is incorporated with the alarm set cam for indicating the desired alarm time. As shown in FIG. 3, the principal component of the indicating mechanism is a disk 234 which may be readily snapped on an outer portion of the shaft 230 for cooperation with a suitable slot 238 which may be formed in the front casing of the digital clock for viewing the hour numerals which are formed on the indicating disk 234. Accordingly, with this construction a user of the digital clock may readily set a desired alarm time by simply rotating the manual knob 232, and such rotation will cause corresponding movement of the alarm set cam gear 219, cam finger 222 and the disk 234.

In a preferred embodiment of our invention a reliable mechanism is provided for holding the alarm set gear 219 in any one

of its set positions. As shown more particularly in FIG. 2, this is achieved by the use of a gear 236 and a detent leaf spring 238. The gear 236 is arranged in mesh with gear 219 and a tongue 240 is formed on leaf spring 238 for clicking between the teeth of gear 236. With this arrangement, the gear 219 may be conveniently held in its set position, and it is prevented from moving backward. In addition, the alarm may be "click" set in ten minute increments by the manual knob 232. This is accomplished in the preferred embodiment since there are 72 teeth on the alarm set gear 219 and the alarm time cam 218 is rotated in ten minute increments by the tens cam 56.

With the low cost alarm cam mechanism 218, 220, 219 and 222, it can be appreciated that relatively few parts are required for actuating the switch 206, 208 at a preset alarm time. The inherent resiliency of the switch blade 202 is all that is necessary for constantly urging the switch actuating lever 212 forwardly which in turn urges the shaft 242, and hence, the alarm time cam 218 forwardly into contact with the alarm set cam 219.

In operation, if it is desired to have the alarm ring at 6 o'clock in the morning, the operator rotates knob 232, the alarm time indicating disk 234, and hence, the alarm set cam 219 to the appropriate 6 o'clock position as indicated in FIG. 1. The spring force of the switch blade 202 urges the front face of cam 220 into contact with the cam finger 222 on the alarm set cam 219, and thus, the forward cam surface of cam finger 222 will ride on the forward face of cam 220 as the cam 220 is continuously rotated by the gear 218 and pinion 224 of the tens of minutes cam.

At 6 o'clock in the morning the cam finger 222 will become aligned with the cam notch 226 which is formed in cam 220 and the switch blade 202 will rapidly force the continuously rotated gear 218 axially toward the gear 222 as the finger 228 moves into the cam notch 226 at the alarm time, as shown in FIGS. 5, 9 and 10. Naturally, during this movement the switch blade 202 will also move forwardly to close switch contacts 206, 208.

In order to keep the torque requirements of the motor as low as possible it is preferred that a manual reset arrangement be utilized with the switch actuating components disclosed in the instant case. A cam finger 222 is not fixed to the alarm set cam gear 219, but is resiliently mounted within a slot which is provided in the gear. A leaf spring 252 is fixed to the front surface of the cam gear 219 for normally holding the finger 222 on the front surface of cam 220 as shown more particu-

larly in FIGS. 6 and 8. This is also illustrated by the upper dotted line position of finger 222 in FIG. 10. Upon relative axial movement of the alarm time gear 218 toward the alarm set gear 219 as shown in FIG. 5, the finger 222 merely slides on the outer periphery of the cam 220 as the alarm time cam is rotated by pinion 224 at one revolution every twelve hours. This is illustrated by the lower dotted line position of finger 222 in FIG. 10. This alarm mechanism is described and claimed in our copending Patent Application No. 16400/73 (Serial No. 1416031).

15 A WAKE-NO WAKE alarm shut-off cam lever mechanism 216, 254 is provided for moving the alarm time cam gear 218, 220 rearwardly to position the finger 222 on the front surface of cam 220. As shown more particularly in FIGS. 3 and 6, the mechanism includes a bifurcated lever 254 which is pivoted by tabs 256 and 258 to the mounting plate 100 of our digital clock.

One downwardly extending arm 260 of the lever includes a U-shaped slot 261 for receiving an annular groove 262 which is formed on the shaft portion 242 of the alarm time cam. With this construction, the lever 254 is loosely held to the alarm time cam gear 218. The other left arm 264 of the lever 254 extends downwardly into a position to be actuated by the WAKE-NO WAKE cam 216.

With the use of the manual reset cam system disclosed in our above-mentioned co-pending Patent Application, after the switch 206, 208 has been moved to its closed position as shown in FIGS. 5, 9 and 10, at 6 o'clock in the morning in the above-mentioned example, and it is desired to turn off the radio or alarm, the radio or alarm switch 206, 208 may be readily moved to the open position illustrated in FIG. 3 by rotating the WAKE-NO WAKE cam 216 clockwise from the position illustrated in FIG. 5 to the position illustrated in FIG. 3. During this movement, the cam 216 moves arm 264 toward the base plate 100 to thereby simultaneously move arm 260 and the alarm time cam 218 including its shaft 242 rearwardly to open switch contacts 206, 208. This movement for opening the switch also simultaneously manually resets the cam finger 222 on top of the front surface of cam 220. It can be appreciated that as the cam 220 is moved rearwardly the finger 222 slides forwardly on the outer periphery of the cam surface 220 until it reaches the front surface of the cam and at that instant the leaf spring 252 flips the finger 222 from the position illustrated in FIG. 9 to the position illustrated in FIG. 8.

A very significant element of our switch and alarm actuating mechanism is the elongated switch actuating lever 212 which is

positioned between switch blade 202, shaft 242 of the alarm time cam 218, and a manually operable SLEEP-ON-OFF cam mechanism 215. From the preceding description of the alarm cam mechanism 218 and 219, it can be appreciated that the elongated switch actuating lever 212 serves as an intermediary between the end of shaft 242 and switch blade 202; i.e., when the end of shaft 242 is moved forwardly the lower portion of lever 212 and switch blade 202 is moved forwardly, and when the shaft 242 is moved rearwardly actuator 212 and the switch blade 202 are moved rearwardly.

The switch actuating lever 212 is shaped and positioned so that it may be manually pushed downwardly at any time to close the switch without disturbing the position of shaft 242. To achieve this, an upper end portion 266 is pivoted to a plural position lever 268 which in turn is arranged to be actuated by the ON-OFF-SLEEP cam 215. As illustrated in FIG. 5, the upper end of the switch actuating lever 212 is formed with a forwardly extending shaft portion 270 which is received by an aperture 272 which is formed in the plural position lever 268. A conventional pivot 274 is provided for generally centrally supporting the plural position lever 268, and the right portion of the plural position lever is provided with a forwardly extending tab 276 for riding on the surface of the ON-OFF-SLEEP cam 215.

In order to insure continuous following contact of the tab 276 with the surface of the cam 215, a spring 278 is stretched between a tab 280 which is formed on the plural position lever and a tab or other projection 282 which is struck from the lower portion of the mounting plate 100. With this arrangement, the spring 278 will constantly urge the right portion of the plural position lever 268 downwardly as viewed in FIG. 5.

With further reference to FIG. 5, it can also be appreciated that upon rotational movement of the sleep cam 215 to lift the tab 276, the right portion of the lever 268 will be moved upwardly and the left portion of the lever 268 will be moved downwardly to change the position of switch actuating lever 212 with respect to the switch blade 202 and also to the end of shaft 242.

With this construction, the ON-OFF-SLEEP cam 215 may be rotated at any time to close the switch or open the switch without disturbing the position of the alarm time cam shaft 242. For example, should it be desired to close the switch 206, 208 after the WAKE-NO WAKE alarm shut-off cam 216 has moved the switch to the position illustrated in FIG. 3, it is merely necessary to rotate the SLEEP-ON-OFF cam to

move the switch actuating lever 212 longitudinally downwardly from the position illustrated in FIG. 3 to the position illustrated in FIG. 6. During this movement, the end of the alarm time cam shaft 242 will slide from an intermediate forward surface 221 of the switch actuating lever to a more rearward intermediate surface 284 of the switch actuating lever thereby pivoting the lever 212 forwardly to move blade 202 forwardly to close switch contacts 206, 208. In addition, during this same movement the forward portion of the switch blade 202 will have merely slid somewhat upwardly on the lower end portion 217 of the switch actuating lever 212, but not high enough to move to the rearward intermediate portion 284. Thus, during such downward movement of the switch actuating lever 212 by the ON-OFF-SLEEP cam, the switch will be moved from its opened position illustrated in FIG. 3 to its closed position illustrated in FIG. 6 and the switch actuating lever 212 will have been effectively removed from the rear surface of shaft 242 to permit the resilient switch blade 202 to pivot the lever 212 forwardly to close the switch. Accordingly, the switch will remain closed and a radio or whatever alarm may be controlled by the switch will remain on while the shaft 242 may be moved forwardly and rearwardly by the alarm time cam 218.

From the foregoing description, it can be generally appreciated that our elongated switch actuating lever 212 includes a lower end portion 217 for remaining in constant contact with switch blade 202, an intermediate cam portion 221, 223 for selective contact with the end of shaft 242, and an upper portion 266 for pivotal engagement with the plural position lever 268.

It is required that the lever 212 be formed and shaped to achieve the previously described pivot 266, forward and rearward intermediate surfaces 221 and 223, respectively, and other surfaces; and yet, the lever is designed so that it is subjected to very low forces. Thus, the lever 212 may be readily formed of plastics or other low cost material.

Assembly of the lever 212 to the other parts of our invention may be readily achieved. As shown more particularly in FIG. 5, the lower end portion 217 of the lever may be guided for longitudinal and transverse movement by a slot 286 which may be conveniently provided in a switch casing 288.

In order to positively hold the lever 212 on the plural position lever 268, a bayonet type tab and slot are provided at the pivot portion 266 of the lever. Tabs 290 are integrally formed with the elongated lever 212 for insertion within complementary slots

292 which may be integrally formed in the plural position lever 268. With particular reference to FIG. 6, it can be appreciated that after the tabs 290 are inserted within the slots 292 the lever 212 is simply rotated so that its main body portion hangs downwardly, and then the lower portion of the lever is inserted within the slot 286 which is formed in the switch casing 288.

The sleep cam portion 298, 302 of our ON-OFF-SLEEP cam 215 also operates the plural position lever 268 and the elongated switch actuating lever 212. This sleep mechanism is provided for manually moving the switch 206, 208 to a closed position and automatically maintaining the switch in the closed position for a preselected adjustable time interval. Such a mechanism is particularly useful for turning off a radio receiver in the evening after a person has gone to sleep, and thus, mechanisms that accomplish this function have been called a SLEEP switch.

The SLEEP portion of cam 215 includes a generally smooth raised cam surface 302 for cooperating with tab 276 for holding the switch 206, 208 in a closed or radio on position for a preselected time interval. Ratchet teeth 298 are formed on the cam 215 for incrementally driving the gear and the sleep cam surface 302 in a clockwise direction as a function of time. At the end of the preselected time interval the sleep cam 215 will have been rotated to a position wherein tab 276 is moved from the smooth raised sleep surface 302 into an off notch 294 to pivot lever 268 to lift lever 212 to abut the end of shaft 242 to open the switch as shown in FIG. 3.

While various mechanisms have been provided for driving sleep sector gears as a function of time, it is preferred that the pawl and ratchet mechanism as described and claimed in our copending Patent Application No. 16401/73 (Serial No. 1416032) be utilized with the ON-OFF-SLEEP cam 215. With this mechanism, whenever the ratchet portion 298 of the sleep cam is placed in the vicinity of the end of pawl lever 300, the pawl lever 300 will rotate the sleep cam one incremental movement every five minutes. As shown more particularly in FIG. 2, the pawl 300 is pivoted to the oscillating drive lever 86, and as indicated generally, above the drive lever 86 which indexes the minutes and tens cams 52 and 54 of the digital alarm clock also indexes the sleep cam drive lever 300.

The overall shape of the SLEEP-ON-OFF cam may be readily observed in FIGS. 5, 6 and the other FIGURES, and in view of the foregoing description it can be appreciated that it performs a plurality of functions. In the preferred embodiment, the entire cam 215 including the ratchet por-

tion 298, a shaft portion 304, an OFF notch 294, a raised ON notch 301, and SLEEP surface 302 are all integrally formed on a single molded part.

Should an operator rotate the cam 215 clockwise from its off position to its ON position the tab 276 will be lifted from the OFF notch 294 and placed within the ON notch 301 on the upper surface of the cam.

In this position, the switch will be closed as shown in FIG. 6. However, the sleep drive lever 300 will be placed in the vicinity of a smooth non-toothed portion 306 of the sleep cam 215, and thus, movement of the sleep drive lever will have no effect on the sleep cam and the switch will remain in its closed position until the cam 215 is manually rotated to position the tab 276 on the sleep surface 302 or in the OFF notch 294.

Should the ON-OFF-SLEEP cam be moved in a clockwise direction from its off position illustrated in FIG. 4 to place the tab 276 on the generally smooth peripheral surface 302 of the sleep cam, the switch will be placed in its closed position illustrated in FIG. 6, and the toothed portion 298 of the sleep cam will be placed in a position to be actuated by the sleep drive lever 300. In this position, the sleep drive lever will incrementally move the sleep cam to eventually move the tab 276 to the off notch at the end of the preset sleep interval, as shown in FIG. 3.

If at bed time it is desired to have the switch for operating apparatus, such as a radio receiver closed to turn the radio on for a short time interval before falling asleep, and if it is also desired to have the switch for operating such a radio closed at some time in the future, say 6 o'clock in the morning, the sleep cam knob 304 is rotated in a clockwise direction to position the tab 276 on the smooth cam surface 302 of the sleep cam, the alarm set knob 232 is rotated to the 6 o'clock position illustrated in FIG. 1, and the WAKE-NO WAKE cam 216 is rotated counterclockwise to the WAKE position illustrated in FIG. 11.

The mechanism can now operate to drive the tab 276 along the smooth surface 302 of the sleep cam for up to three hours at which time the tab 276 will snap into the off notch 294 to thereby lift switch actuating lever 212 from the position illustrated in FIG. 11 to the position illustrated in FIG. 4. In this position it can be appreciated that the shaft end 242 of the alarm cam will have moved from the rear intermediate surface 223 of the switch actuating lever 212 to a forward intermediate surface 221 of the elongated lever 212 to open switch contacts 206, 208 as shown in FIG. 4.

Throughout the night the switch contacts 65 will remain in the open position illustrated

in FIG. 4 as the finger 222 of the alarm set cam 219 slides on the forward surface of the continuously rotatable alarm time cam 220. At 6 o'clock in the morning the finger 222 will have moved to the notch in the alarm time cam 220 and the resilient switch blade 202 will move the lower portion of lever 212 forwardly to move shaft 242 and the alarm time cam 220 to the position illustrated in FIG. 5. Naturally, during this movement the switch 206, 208 will be moved to its closed position illustrated in FIG. 5.

After the switch has been closed to operate apparatus, such as radio receiver for a short time interval, it may be desired to open the switch to turn the radio off. To achieve this, it is merely necessary for the operator to rotate the WAKE-NO WAKE cam 216 from the WAKE position illustrated in FIG. 5 to the NO WAKE position illustrated in FIG. 3. During this movement, the lower arms 264 and 260 of the lever 254 will be moved rearwardly to move shaft 242 rearwardly to open the switch. Moreover, this movement will also reset the movable cam finger 222 from the outer periphery of the cam illustrated in FIG. 9 to the upper surface of the cam as shown in FIG. 8.

At some time during the day, it may be desired to close the switch contacts 206, 208 to operate a radio receiver or some other apparatus which may utilize our improved digital alarm clock timer. With particular reference to FIGS. 3 and 6, to accomplish this, it is merely necessary to rotate the ON-OFF-SLEEP knob 304 from the off position illustrated in FIG. 3 to an on position wherein the tab 276 of the plural position lever will be placed within the on notch 301 on the upper surface of the ON-OFF-SLEEP cam. During this movement the plural position lever 268 will be rotated in a counterclockwise direction to lower the switch actuating lever 212 from the position illustrated in FIG. 3 to the position illustrated in FIG. 6. Thus, the end of shaft 242 will be moved from the forward intermediate surface 221 of lever 212 to the rearward intermediate surface 223 of the lever 212 to close the switch as illustrated in FIG. 6.

From the foregoing discussion, it will be appreciated that our improved switch actuating and control mechanism for an alarm clock timer may be readily formed with relatively few parts. Perhaps the principal component is the specially shaped switch actuating lever 212 which may be readily formed of inexpensive plastics material. With the shape of the lever, the manner in which it is connected to the plural position lever 268, and its relative position to the end of an alarm time cam

shaft 242, this lever 212 may be moved transversely and longitudinally upwardly or downwardly to open or close the switch contacts 206, 208 to perform many of the functions of an alarm clock timer. The lever 212 can be moved to automatically close the switch at an alarm time, to manually open or close the switch at any time, and to manually close the switch for a predetermined interval of SLEEP time.

With our improved switch actuating mechanisms it can also be appreciated that the mechanism may be readily added to a suitable digital clock. The plural position lever 268 is connected to the same base plate 100 which is provided for rotatably supporting the display mechanisms for the digital clock, and the relatively few parts which are required for the switch actuating and alarm control mechanism are sandwiched between the other components of the digital clock. Thus, an exceedingly simple and reliable mechanism is achieved with relatively few parts which may be readily connected to each other.

WHAT WE CLAIM IS:—

1. An alarm clock mechanism comprising a switch having an open and a closed position, an elongated switch actuating lever for opening and closing said switch, said elongated lever having two end portions and an intermediate portion and said lever being guided for longitudinal and transverse movement, one end portion of said elongated switch actuating lever being in engagement with said switch for opening or closing the switch upon said transverse movement, an alarm time cam mounted adjacent to the intermediate portion of said switch actuating lever for effecting said transverse movement of the elongated lever at an alarm time for closing said switch, and a manually operable member connected to the other end portion of said switch actuating lever for moving said switch actuating lever in a longitudinal direction with consequent transverse movement to close the switch at any time whereby said switch may be closed at a preset time by said alarm time cam and said switch may also be closed at any time by said manually operable member.

2. An alarm clock mechanism as claimed in Claim 1, wherein the alarm time cam includes a shaft end which is placed in engagement with the switch actuating lever for moving the switch actuating lever in a transverse direction at an alarm time to move the switch to its closed position.

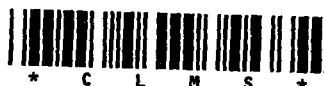
3. An alarm clock mechanism as claimed in Claim 1 or Claim 2, wherein an alarm time set cam is rotatably mounted in co-axial relationship with said alarm time cam, said alarm time set cam is manually adjustable to set the alarm time, said alarm time cam is arranged to be continuously rotated by the alarm clock timer, and said alarm time cam and said alarm time set cam further include: a transversely extending cam projection positioned on said alarm set cam extending toward said alarm time cam and arranged for slidable movement on said alarm time cam as said alarm time cam is continuously rotated by the alarm clock timer; and said alarm time cam including a cam notch for receiving the cam projection of the alarm time set cam to permit the alarm time cam to move axially toward the alarm time set cam to thereby close the switch at the alarm time.

4. An alarm clock timer mechanism as claimed in any one of Claims 1 to 3, wherein said switch is mounted within a switch casing and said switch casing is provided with a transversely extending slot for guiding the elongated switch actuating lever for longitudinal movement into and out of said slot and transverse movement within said slot.

5. A digital alarm clock mechanism as claimed in any one of the preceding claims, including two display indicators for visually displaying numerals from 0 thru 9 to indicate minutes and tens of minutes, a rotatable units cam for progressively actuating the minutes display indicator to display numerals from 0 thru 9 to indicate minutes, a rotatable tens cam spaced from the units cam for progressively actuating the tens of minutes display indicator for displaying numerals to the left of the units numerals in order to display tens of minutes, a supporting means for rotatably supporting said units and tens cams on axes generally parallel to each other and spaced from each other, said rotatable alarm time cam being positioned rearwardly from said tens cam, and a pinion gear integrally formed with said rotatable tens cam positioned in engagement with said alarm time cam for driving said alarm time cam at one revolution every twelve hours.

6. An alarm clock mechanism substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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shaft 242, this lever 212 may be moved transversely and longitudinally upwardly or downwardly to open or close the switch contacts 206, 208 to perform many of the functions of an alarm clock timer. The lever 212 can be moved to automatically close the switch at an alarm time, to manually open or close the switch at any time, and to manually close the switch for a predetermined interval of SLEEP time.

With our improved switch actuating mechanisms it can also be appreciated that the mechanism may be readily added to a suitable digital clock. The plural position lever 268 is connected to the same base plate 100 which is provided for rotatably supporting the display mechanisms for the digital clock, and the relatively few parts which are required for the switch actuating and alarm control mechanism are sandwiched between the other components of the digital clock. Thus, an exceedingly simple and reliable mechanism is achieved with relatively few parts which may be readily connected to each other.

WHAT WE CLAIM IS:—

1. An alarm clock mechanism comprising a switch having an open and a closed position, an elongated switch actuating lever for opening and closing said switch, said elongated lever having two end portions and an intermediate portion and said lever being guided for longitudinal and transverse movement, one end portion of said elongated switch actuating lever being in engagement with said switch for opening or closing the switch upon said transverse movement, an alarm time cam mounted adjacent to the intermediate portion of said switch actuating lever for effecting said transverse movement of the elongated lever at an alarm time for closing said switch, and a manually operable member connected to the other end portion of said switch actuating lever for moving said switch actuating lever in a longitudinal direction with consequent transverse movement to close the switch at any time whereby said switch may be closed at a preset time by said alarm time cam and said switch may also be closed at any time by said manually operable member.

2. An alarm clock mechanism as claimed in Claim 1, wherein the alarm time cam includes a shaft end which is placed in engagement with the switch actuating lever for moving the switch actuating lever in a transverse direction at an alarm time to move the switch to its closed position.

3. An alarm clock mechanism as claimed in Claim 1 or Claim 2, wherein an alarm time set cam is rotatably mounted in co-axial relationship with said alarm time cam, said alarm time set cam is manually adjustable to set the alarm time, said alarm time cam is arranged to be continuously rotated by the alarm clock timer, and said alarm time cam and said alarm time set cam further include: a transversely extending cam projection positioned on said alarm time cam extending toward said alarm time cam and arranged for slidable movement on said alarm time cam as said alarm time cam is continuously rotated by the alarm clock timer; and said alarm time cam including a cam notch for receiving the cam projection of the alarm time set cam to permit the alarm time cam to move axially toward the alarm time set cam to thereby close the switch at the alarm time.

4. An alarm clock timer mechanism as claimed in any one of Claims 1 to 3, wherein said switch is mounted within a switch casing and said switch casing is provided with a transversely extending slot for guiding the elongated switch actuating lever for longitudinal movement into and out of said slot and transverse movement within said slot.

5. A digital alarm clock mechanism as claimed in any one of the preceding claims, including two display indicators for visually displaying numerals from 0 thru 9 to indicate minutes and tens of minutes, a rotatable units cam for progressively actuating the minutes display indicator to display numerals from 0 thru 9 to indicate minutes, a rotatable tens cam spaced from the units cam for progressively actuating the tens of minutes display indicator for displaying numerals to the left of the units numerals in order to display tens of minutes, a supporting means for rotatably supporting said units and tens cams on axes generally parallel to each other and spaced from each other, said rotatable alarm time cam being positioned rearwardly from said tens cam, and a pinion gear integrally formed with said rotatable tens cam positioned in engagement with said alarm time cam for driving said alarm time cam at one revolution every twelve hours.

6. An alarm clock mechanism substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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