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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 mechanism, and more particularly, to an improved sleep switch movement for a clock timer which may be readily and reliably operated to close a switch for a predetermined time interval.

It is found highly desirable in the manufacture of clock timers to provide a mechanism for manually turning on a radio at bed time and then automatically turning off the radio a short time thereafter while the user goes to sleep. Previously proposed sleep switch timers of this type use a rotatable sector gear which is moved into engagement with a constantly rotating clock gear through the use of a friction clutch assembly. The sector gear rotates with the clock gear until the sector gear is driven out of mesh with the clock gear to thereby shut off the radio by opening a switch which is actuated by the sector gear.

The invention is concerned with such a sleep switch movement, and more particularly, to a pawl and ratchet drive mechanism for a sleep gear which does not require the use of a friction clutch mechanism for connecting the sleep gear to a continuously rotated timing gear.

In accordance with this invention, an alarm clock timer includes a switch having an open and closed position and a timing motor, a sleep cam is operably connected to the switch for closing the switch for a predetermined time interval, and a knob

or other manually operable means is formed integrally with or connected to the sleep cam for manually moving the sleep cam to open or close the switch; ratchet teeth are formed on the sleep cam for permitting the sleep cam to be moved from a switch closed position to a switch open position by the timing motor, to achieve this, a pawl lever having a pawl is positioned in the alarm clock timer mechanism and means is provided for moving the pawl lever to move the pawl into engagement with the ratchet teeth when it is desired to move the sleep cam in a direction for opening the switch; and a drive mechanism is operably connected to the timing motor for moving the pawl lever and the pawl back and forth to incrementally move the sleep cam as a function of time in order to open the switch at the end of the time interval.

With this construction, the sleep cam is not continuously rotated by the timing motor when it is being operated by the timing motor, but is only incrementally moved on one of the strokes of the pawl lever. Thus, it only places a load on the timing motor on one of the strokes of the pawl lever, and accordingly, during the return stroke of the pawl lever the motor will have available torque to drive other mechanisms. In addition, there is no need for a friction clutch assembly.

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 from perspective view of a portion of the switch operating and sleep cam mechanism of the digital clock shown in FIG. 1;

FIG. 3 is a fragmentary front perspective

[Price 33p]

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 our sleep switch movement being shown in a position wherein the parts are under the control of an alarm shut-off cam which overrides a sleep cam to move the switch to an open position to shut off the alarm;

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

15 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 our sleep cam movement 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 our sleep drive pawl lever on a smooth portion of the sleep cam;

FIG. 8 is a fragmentary front elevational view of a portion of the digital alarm clock timer shown in FIG. 1, the parts being shown in a position wherein our sleep drive pawl lever is in engagement with the ratchet teeth on a sleep cam for moving the sleep cam to a switch open position; and

40 FIG. 9 is a fragmentary front elevational view generally similar to FIG. 8 showing the pawl lever held out of mesh with the sleep cam for permitting the sleep cam to be indexed only twice for each revolution of a units cam.

Referring now to the drawing and first particularly to FIGS. 1 and 2, there is shown a digital clock which includes our sleep cam 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 200.

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 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 62 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 pinion 110 of a synchronous electric motor 111. 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. 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. It can also be appreciated that with this mechanism the units cam 52 will be driven at one revolution every ten minutes in order to display numerals from 0 thru 9 and the tens cam 54 will be driven at one revolution each hour. Further details of the display indicators 2, 4, 6, 8 and of the mechanism for indexing and driving the cams therefor are more fully described and claimed in our copending patent applications Nos. 1162/72 and 49846/72. (Serial Nos. 1 371 401 and 1 408 416).

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 described 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.

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.

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.

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 preset time for actuating the switch 206 and 208.

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 70 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. The shaft 242 extends rearwardly through an aperture which is formed in the mounting plate 100 and as shown in FIG. 2 the shaft 230 extends forwardly through an aperture 246 80 which is formed in a front plate 248 for supporting the alarm time cam and the alarm set cam on the digital clock.

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 95 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 219 as the finger 222 moves into the cam notch 226 at the alarm time, as shown in FIG. 5. Naturally, during this 105 movement the switch blade 202 will also move forwardly to close switch contacts 206, 208.

This alarm mechanism is described and claimed in our copending patent application No. 16400/73 (Serial No. 1 416 031).

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 finger 222 on the front surface of cam 220. As shown more particularly in FIG. 3, 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.

After the switch 206, 208 has been moved to its closed position as shown in FIG. 5, 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.

A manually settable SLEEP-ON-OFF cam mechanism 215 is arranged to control lever 268 and switch actuating lever 212. 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, the lever 212 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 266 of the switch actuating lever 212 is formed with a forwardly extending shaft portion 270 (i.e. portion 272 is rigid with the rest of lever 212) which is received by an aperture 272 formed in the plural position lever 268 so that there is limited pivotal movement at tabs 290. The lever 212 is described in more detail and claimed in our copending patent application No. 16402/73 (Serial No. 1416 033). 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.

The ON-OFF-SLEEP cam 215 may be rotated at any time to close 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.

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.

5 In the embodiment illustrated in FIG. 6, 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
10 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
15 of the preselected time interval the gear 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
20 end of shaft 242 to open the switch, as shown in FIG. 3.

A pawl and ratchet mechanism is provided for driving the sleep switch cam 215. With this mechanism, whenever the ratchet
25 toothed portion 298 of the sleep cam is rotated to the position illustrated in FIG. 8 the pawl lever 300 will rotate the sleep cam one incremental movement every five minutes.

30 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 func-
35 tions. In the preferred embodiment, the entire cam 215 including the ratchet toothed portion 298, a shaft portion 304, an OFF notch 294, a raised ON notch 301, and SLEEP surface 302 are all integrally
40 formed on a single molded part.

Should an operator grasp shaft knob 304 and 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
45 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-
50 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
55 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
60 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 gear portion 298 of the sleep cam will be placed in a posi-
65 tion 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
70 shown in FIG. 3.

The pawl and ratchet mechanism 300, 298 is designed and combined with units cam 52 is provided with two flat surfaces
75 clock for indexing the sleep switch cam 215 one increment every five minutes when the cam 215 is rotated to any one of its "SLEEP" positions illustrated in FIG. 1. To achieve this, the sleep pawl lever 300 is pivotally mounted on the drive lever 86
80 and is counterweighted at 303 for urging a pawl 305 upwardly into contact with the sleep cam 215. With reference to FIG. 2, it can be appreciated that the drive lever 86 is provided with cam surfaces for co-
85 operating with an eccentric drive roller 106 to move the drive lever 86 and a units cam pawl lever 84 one incremental movement every minute. Moreover, it can be seen that the actuating movement for the units
90 cam 52 occurs when the drive lever 86 is moved to the right as shown in FIG. 2. The sleep cam actuating movement through pawl lever 300 occurs when the lever 86 is moved to the left as shown in FIG. 2. Thus, with
95 the parts in the position illustrated in FIG. 8, movement of the drive lever 86 counter-clockwise to the left about pivot 88 will move the entire pawl lever 300 to the left to move the sleep cam 215 one increment
100 in a clockwise direction. With this construction, the actuating movement for the sleep cam 215 does not occur at the same instant as the actuating movement for the minutes cam 52, and thus, the motor load at any particular instant is minimized. With
105 particular reference to FIG. 2, it can also be appreciated that the sleep ratchet drive pawl 300 is mounted on a pivot pin 307 which is positioned closer to the drive lever pivot 88 than pawl lever 84 because only
110 a short stroke is required for moving the sleep cam one increment.

The pawl drive lever 300 is also combined with the previously described digital clock structure for indexing the sleep cam 215
115 any number of increments during a ten minute period. In the preferred embodiment illustrated in FIG. 8, a shaft 322 which extends rearwardly from the units cam 52 is provided with two flat surfaces
120 324 and 326 for permitting the pawl 305 to move into engagement with the teeth on the sleep cam 215 only twice for each revolution of the units cam 52 or once every five minutes. It can be readily understood
125 that the units cam 52 is rotated at one revolution every ten minutes for displaying numerals from 0 to 9. Thus, two flat surfaces will provide an incremental movement every five minutes, and the number of flat
130

surfaces on the cam shaft 322 could be selected for achieving any desired number of incremental movements of the sleep cam 215.

5 As shown in FIG. 8 an upper surface of the pawl lever 300 is arranged generally parallel to the flat surface 326 of the shaft 322 and therefore, the counterweights 303 of the pawl 300 is effective to move the
10 pawl 305 into engagement with the teeth of the sleep cam 215. It can be seen that when the shaft 322 is moved approximately 36° from the FIG. 8 to the FIG 9 position during a next succeeding incremental move-
15 ment of the units cam 52, the shaft 322 will hold the pawl in its lower position as shown in FIG. 9 to thereby hold the pawl 305 away from the ratchet teeth of the sleep cam during the next succeeding movements
20 of the drive lever 86.

With particular reference to FIGS. 2 8 and 9, it can be appreciated that the units cam may be readily molded from a piece of plastic to provide all of the cam and tooth
25 surfaces illustrated, and naturally, the surfaces 324 and 326 on shaft 322 may be also provided during the molding operation of the units cam 52.

If at bed time it is desired to have the
30 switch for operating apparatus such as a radio receiver closed to turn the radio on for a short time interval before falling asleep, the sleep cam knob 304 is rotated in a clockwise direction to position the tab
35 276 on the smooth cam surface 302 of the sleep cam. As shown in FIG. 1, any desired sleep time interval up to three hours may be selected..

The mechanism can now operate to drive
40 the tab 276 along the smooth surface 296 of the sleep cam for the desired sleep time interval at which time the tab 276 will snap into the off notch 294 to thereby lift switch actuating lever 212 from the position
45 illustrated in FIG. 6 to the position illustrated in FIG. 3.

From the foregoing discussion it can be appreciated that our sleep cam indexing mechanism may be readily formed and
50 added to any suitable alarm clock timer. Relatively few additional parts are required. It is merely necessary to pivot a pawl lever 300 on the drive lever 86 which is also used for indexing and driving the units and tens
55 display indicators of the digital clock. Moreover, the pawl lever 300 is pivoted to the drive lever at such a location that it drives the ratchet of the sleep cam on the return stroke of the drive lever to thereby mini-
60 mize motor load. Thus, when the motor is being utilized for driving the units and tens display indicators it is not rotating the sleep cam 215, and conversely, when the drive lever 86 is being utilized for driving
65 pawl 300 to rotate sleep cam 215 the dis-

play indicators are not being indexed.

WHAT WE CLAIM IS:—

1. An alarm clock mechanism comprising a switch having an open and a closed position, a timing motor, a sleep cam oper- 70
ably connected to said switch for closing said switch for a predetermined time interval, manual means connected to said sleep cam for moving said sleep cam to open or close said switch, ratchet teeth 75
formed on said sleep cam for permitting said sleep cam to be moved from a switch closed position to a switch open position by said timing motor, a pawl lever having a pawl positioned in said alarm clock mech- 80
anism, means for moving said pawl lever to move said pawl into engagement with said ratchet teeth, and a drive mechanism oper-
ably connected to said timing motor for moving said pawl lever and said pawl back 85
and forth to incrementally move said sleep cam as a function of time to thereby open said switch at the end of said time interval.
2. An alarm clock mechanism as claimed in Claim 1 wherein the sleep cam is rotat- 90
ably mounted in the alarm clock and includes a peripheral cam surface for operating the switch and a peripheral ratchet
tooth surface positioned axially adjacent the cam surface for cooperating with the pawl 95
lever to rotate the sleep cam as a function of time to open the switch.
3. An alarm clock mechanism as claimed in Claim 1 or Claim 2, wherein said ratchet teeth extend through a sector of the sleep 100
cam, an adjoining sector of the sleep cam having a smooth curved surface so that should said pawl lever be positioned on said smooth surface no actuating movement of the sleep cam will occur. 105
4. An alarm clock mechanism as claimed in any one of Claims 1 to 3, wherein:
 - a) a plural position lever having two arms pivotally mounted on said clock mechanism; 110
 - b) a switch actuating lever is connected to one of the arms of the plural position lever;
 - c) said sleep cam being positioned adjacent to the other arm of the plural 115
position lever; and
 - d) said manually rotatable sleep cam includes a lower cam surface for moving said plural position lever to open the switch, a raised notched surface for 120
holding the plural position lever in one position to hold the switch open and a raised curved generally smooth cam surface for locating the plural position lever to hold the switch in a closed 125
position for a predetermined sleep time interval.
5. An alarm clock mechanism as claimed in any one of the preceding claims wherein a clock cam having a flat surface is rotated 130



surfaces on the cam shaft 322 could be selected for achieving any desired number of incremental movements of the sleep cam 215.

5 As shown in FIG. 8 an upper surface of the pawl lever 300 is arranged generally parallel to the flat surface 326 of the shaft 322 and therefore, the counterweights 303 of the pawl 300 is effective to move the
10 pawl 305 into engagement with the teeth of the sleep cam 215. It can be seen that when the shaft 322 is moved approximately 36° from the FIG. 8 to the FIG. 9 position during a next succeeding incremental move-
15 ment of the units cam 52, the shaft 322 will hold the pawl in its lower position as shown in FIG. 9 to thereby hold the pawl 305 away from the ratchet teeth of the sleep cam during the next succeeding movements
20 of the drive lever 86.

With particular reference to FIGS. 2, 8 and 9, it can be appreciated that the units cam may be readily molded from a piece of plastic to provide all of the cam and tooth
25 surfaces illustrated, and naturally, the surfaces 324 and 326 on shaft 322 may be also provided during the molding operation of the units cam 52.

If at bed time it is desired to have the
30 switch for operating apparatus such as a radio receiver closed to turn the radio on for a short time interval before falling asleep, the sleep cam knob 304 is rotated in a clockwise direction to position the tab
35 276 on the smooth cam surface 302 of the sleep cam. As shown in FIG. 1, any desired sleep time interval up to three hours may be selected.

The mechanism can now operate to drive
40 the tab 276 along the smooth surface 296 of the sleep cam for the desired sleep time interval at which time the tab 276 will snap into the off notch 294 to thereby lift switch actuating lever 212 from the position
45 illustrated in FIG. 6 to the position illustrated in FIG. 3.

From the foregoing discussion it can be appreciated that our sleep cam indexing mechanism may be readily formed and
50 added to any suitable alarm clock timer. Relatively few additional parts are required. It is merely necessary to pivot a pawl lever 300 on the drive lever 86 which is also used for indexing and driving the units and tens
55 display indicators of the digital clock. Moreover, the pawl lever 300 is pivoted to the drive lever at such a location that it drives the ratchet of the sleep cam on the return stroke of the drive lever to thereby mini-
60 mize motor load. Thus, when the motor is being utilized for driving the units and tens display indicators it is not rotating the sleep cam 215, and conversely, when the drive lever 86 is being utilized for driving
65 pawl 300 to rotate sleep cam 215 the dis-

play indicators are not being indexed.

WHAT WE CLAIM IS:—

1. An alarm clock mechanism comprising a switch having an open and a closed position, a timing motor, a sleep cam oper- 70
ably connected to said switch for closing said switch for a predetermined time interval, manual means connected to said sleep cam for moving said sleep cam to open or close said switch, ratchet teeth 75
formed on said sleep cam for permitting said sleep cam to be moved from a switch closed position to a switch open position by
said timing motor, a pawl lever having a pawl positioned in said alarm clock mech- 80
anism, means for moving said pawl lever to move said pawl into engagement with said ratchet teeth, and a drive mechanism oper-
ably connected to said timing motor for moving said pawl lever and said pawl back 85
and forth to incrementally move said sleep cam as a function of time to thereby open said switch at the end of said time interval.

2. An alarm clock mechanism as claimed in Claim 1 wherein the sleep cam is rotat- 90
ably mounted in the alarm clock and includes a peripheral cam surface for operating the switch and a peripheral ratchet tooth surface positioned axially adjacent the
cam surface for cooperating with the pawl 95
lever to rotate the sleep cam as a function of time to open the switch.

3. An alarm clock mechanism as claimed in Claim 1 or Claim 2, wherein said ratchet teeth extend through a sector of the sleep 100
cam, an adjoining sector of the sleep cam having a smooth curved surface so that should said pawl lever be positioned on said smooth surface no actuating movement of the sleep cam will occur. 105

4. An alarm clock mechanism as claimed in any one of Claims 1 to 3, wherein:

- a) a plural position lever having two arms pivotally mounted on said clock mechanism; 110
- b) a switch actuating lever is connected to one of the arms of the plural position lever;
- c) said sleep cam being positioned adjacent to the other arm of the plural 115
position lever; and
- d) said manually rotatable sleep cam includes a lower cam surface for moving said plural position lever to open the switch, a raised notched surface for 120
holding the plural position lever in one position to hold the switch open and a raised curved generally smooth cam surface for locating the plural position lever to hold the switch in a closed 125
position for a predetermined sleep time interval.

5. An alarm clock mechanism as claimed in any one of the preceding claims wherein a clock cam having a flat surface is rotated 130



adjacent to the pawl lever for intermittently holding the pawl lever substantially out of engagement with the ratchet teeth of the sleep cam, said flat surface permitting the pawl to engage said ratchet teeth and thereby drive the sleep cam only once during a number of consecutive to and fro movements of the pawl lever.

6. An alarm clock mechanism as claimed

in any one of the preceding claims, wherein the pawl lever is counterweighted for urging the pawl toward said ratchet teeth.

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

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