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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 actuating a control mechanism such as an alarm vibrator or a switch at a preset time to sound an alarm or turn on a radio.

The invention provides an alarm clock mechanism comprising a timing mechanism, a supporting structure, a first cam member rotatably mounted on said supporting structure, a second cam member rotatably mounted on said supporting structure in co-axial relationship with said first cam member and axially movable with respect thereto, one of said cam members being caused to rotate by said timing mechanism, means for manually adjusting the relative angular position of said cam members, an on-off control mechanism having a resilient member exerting a spring force urging said second cam member axially toward said first cam member, said second cam member being disposed to move axially under the influence of said spring force to permit said control mechanism to be moved to its on position upon relative rotation of said cam members through a predetermined relative angular position, one of said cam members supporting a cam follower which is rotatable with said one of said cam members for cooperating with axially raised and lower cam surfaces of the other cam member to permit said resilient member to move said second cam member toward said first cam member

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to permit the control mechanism to be moved to its on position, and said cam follower being mounted for movement with respect to the cam member on which it is supported for permitting said cam follower to remain on the said lower cam surface of said other cam member so that said timing mechanism is not required to restore said cam follower from said lower cam surface on said other cam member to said raised cam surface of said other cam member against the force of said resilient member.

When the cam follower drops to the lower cam surface of the other cam member, it remains on the lower cam surface, and the timing mechanism simply rotates the cam members with respect to each other under substantially the same torque load that prevailed while the cam follower was positioned on the upper surface of the other cam member. Since the timing mechanism is not required to reset the cam follower by moving it from a lower surface of the other cam member to a higher cam surface of the other cam member against the force of the resilient member, our alarm clock mechanism may be readily operated with a relatively low torque motor.

In order to reset the alarm mechanism, a manually operable control shut-off mechanism may be provided for moving the second cam member axially away from the first cam member. During this movement, the control mechanism is moved to its off position against the spring force of the resilient member, and in addition, the cam follower is moved from a lower cam surface of the other cam member to a higher cam surface of the other cam member to reset the cams.

With this construction, a twelve hour alarm mechanism may be readily added to a digital clock timer without substantially increasing the torque requirements of the motor. Moreover, relatively few additional

parts are required to achieve this low torque alarm mechanism. Principally, it is merely necessary to provide a movable rather than a fixed cam follower on one of the twelve hour cam gears. A slot in the cam gear and a flexible leaf spring is all that is required for holding the cam follower on the gear.

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 front perspective view of a portion of the alarm clock of FIG. 1 illustrating the time and alarm set cam mechanism and other portions of the clock, the parts being shown in a position wherein an alarm shut-off cam has moved a switch to an OPEN position to shut-off the alarm;

FIG. 3 is a fragmentary exploded front perspective view of the digital alarm clock mechanism; portions of the display indicators for the clock are also shown in this figure;

FIG. 4 is a fragmentary front perspective view generally similar to FIG. 2 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. 5 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. 2;

FIG. 6 is a detail side elevational view of the alarm time cam, alarm set cam, switch actuating lever, and switch, the parts being shown in their positions after the switch has been closed and the timing motor has rotated the alarm time cam without resetting the cam finger on top of the alarm time cam;

FIG. 7 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;

FIG. 8 is a fragmentary front perspective view similar to FIG. 2 showing the parts under the control of the alarm time cam with the alarm cam and cam finger in a position to hold the switch in an OPEN position;

FIG. 9 is a fragmentary exploded front perspective view of a portion of the alarm set cam;

FIG. 10 is a fragmentary cross-sectional view thereof; and

FIG. 11 is a fragmentary perspective view thereof with portions cut away to show de-

tails of construction.

Referring now to the drawing and first particularly to FIGS. 1 and 3, 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 described and claimed in our copending Application No. 1162/72 (Serial No. 1371401). As shown in FIG. 3, 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 a switch actuating and control mechanism for the clock is generally identified by reference numeral 200.

With reference to FIG. 2, the overall construction of the switch and alarm mechanism for the digital clock includes a switch 201, switch actuating levers 212 and 268, and an alarm time cam mechanism 214.

The switch 201 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 a 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 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 our 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. 2.

The operation of the SLEEP, ON or OFF cam mechanism 215 is more fully described and claimed in our copending application No. 16401/72 (1416632), while the function of lever 212 is more fully described and

claimed in our copending application No. 16402/73 (1416033).

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 alarm 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 FIG. 2 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 a 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.

An alarm cam 220 is fixed to its gear 218 and their common shaft 242 in any suitable manner. As shown for example in Figs. 3 and 7, the cam 220 is generally circular in shape with a cutout or notch 226 which forms the alarm time operable portion. 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 the forward end of shaft 230 for manually rotating the alarm set cam 222 to any desired alarm time.

As shown more particularly in FIGS. 4, 5 and 6, 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 FIG. 6, the shaft 242 extends rearwardly through an aperture 244 which is formed on the mounting plate 100, and as shown in FIGS. 1 and 3 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 FIGS. 1 and 2, 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.

With our 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, and, hence, the alarm time indicating disk 234 and 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 follower 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 incrementally 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 222 moves into the cam notch 226 at the alarm time, as shown in FIGS. 4 and 7. 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, we have provided cam gear 219 with a movable cam follower 222 which may remain on a lower cam surface of cam 218 after the cam gear 218 has been moved axially toward gear 219 at the alarm time. As shown more particularly in FIGS. 9 and 10, the cam follower 222 may be formed from a piece of sheet metal. The follower includes an enlarged finger portion 308 which is arranged in slidable engagement with the surfaces of the alarm time cam 220, and a reduced holding portion 310 for retaining the follower 222 on its alarm set gear 219. As shown, the retaining portion 310 is arranged at an angle of about 120° to the finger 308 and it is inserted within a slot 312 which is

formed in the gear 219.

An extremely simple and reliable mechanism is provided for resiliently holding the cam follower 222 on gear 219. As shown more particularly in FIG. 9, a flexible leaf spring 252 is held to a forward surface of the cam gear 219 by being sandwiched between a flange portion 316 of shaft 230 and the forward surface of gear 219. With particular reference to FIG. 11, it can be appreciated that the end of shaft 230 may be readily peened over at 318 to hold the gear 219 and the flexible leaf spring to the shaft 230. In order to connect the cam follower 222 to its gear 219 it is merely necessary to insert its holding finger 310 within slot 312 as shown in FIG. 10 and then release the finger. With particular reference to FIG. 11 it can be appreciated that the resilient force of leaf spring 252 will hold finger 310 against the front surface of gear 219 and the cam follower 308 will be positioned at a somewhat less than a 90° angle with respect to the rear surface of gear 219. With this construction it can be readily understood that as gear 218 is rotated by the timing motor the rear most surface of cam follower 308 will ride on the surface of cam 220.

In the position illustrated in FIGS. 8 and 5, the parts are under the control of the alarm time and alarm set cams 218 and 219, respectively, with the alarm set cam 219 and its follower 222 in a position to hold the switch 206, 208 in its OPEN position. In this position, the cam follower finger 308 is located on the upper forward surface of cam 220 and its slides on the forward surface as the cam 220 is incrementally rotated by the timing motor. This position of the cam finger 308 is also illustrated in dotted lines at the upper portion of FIG. 7.

With particular reference to FIGS. 4 and 7, it can be appreciated that the cam finger 308 drops into the notch 226 of the alarm time cam at the alarm time to permit cam 220 and gear 218 to move axially forward toward gear 219. This movement is caused by the resilient force of switch blade 202, and naturally, it can be appreciated that the switch contacts 206, 208 will be closed during this forward movement of cam 220. After the switch actuating movement takes place and the gear 218 continues to be rotated by the timing motor the rear surface of cam finger 308 slides on the inner or lower surface of the cam gear 218, 220, as shown in FIG. 4 and the solid line and lower dotted line positions of finger 308 in FIG. 7.

Our cam follower finger 308 is arranged so that the timing motor is not required to reset the finger 308 from the lower surface of cam 220 to the upper surface of cam 220. Accordingly, as the cam 220 is rotated by the timing motor the finger 308 merely slides on the peripheral surface of

the cam 220 from its solid line position illustrated in FIG. 7 to its dotted line position illustrated in the lower portion of FIG. 7. With particular reference to FIGS. 6 and 7, it can be appreciated that during this movement the end portion of the cam finger 308 is moved radially outwardly from its solid line to its lower dotted line position illustrated in FIG. 7. During this movement a very slight force is exerted on the leaf spring 252 and the finger 308 is positioned almost perpendicular to the surface of gear 219, as shown in FIG. 6.

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. 2 and 4, 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 (Fig. 5) 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 mechanism 216, 254 after the switch 206, 208 has been moved to its closed position as shown in FIG. 4, 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. 2 by rotating the WAKE-NO WAKE cam 216 clockwise from the position illustrated in FIG. 4 to the position illustrated in FIG. 2. 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 308 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 308 from its lower dotted line position illustrated in FIG. 7 to its radially inner dotted line position illustrated at the upper portion of FIG. 7 and in FIG. 5.

From the foregoing description, it can be appreciated that the manually operable control shut-off mechanism 216, 254 is provided

for moving the cam member 220 away from the cam member 219, 222 in order to manually move the cam follower 308 from a lower surface of cam 220 illustrated in FIG. 4 to an upper surface of cam 220 as illustrated in FIGS. 2 and 5. Thus, after the timing motor has moved the cam parts to the radio ON alarm sounding position illustrated in FIG. 4 the timing motor is not required to reset the cam finger 308 on top of cam 220 and the finger merely slides on the lower surface of the cam. Naturally, since the timing motor is not required to reset the cam follower, our cam mechanism does not appreciably add to the torque requirements of the motor.

A very significant advantage is achieved with the use of the movably mounted cam follower 222 and the manually operated WAKE-NO WAKE alarm shut-off cam lever mechanism 216 when the alarm mechanism is utilized for actuating a switch. If a cam gear arrangement in which the gears are driven apart were used for operating a low cost switch such as the switch 206, 208 illustrated in FIG. 2., the contacts would be opened very slowly as the cam gears were being separated by the timing motor. This action would probably draw an arc for an appreciable period of time and would erode or perhaps weld the contacts to each other. In addition, such an arrangement could cause electrical interference. With this arrangement, the contacts are opened manually by using the manually operable WAKE-NO WAKE cam 216. This opening occurs reasonably rapidly and thus, the arcing problem is minimized. The initial closure of the switch occurs rapidly when the cam finger 222 drops into notch 226. Thus, the speed of closure is no problem. Without our movably mounted cam follower 222 and the manually operated WAKE-NO WAKE shut-off mechanism 216 a more expensive snap action switch would probably be utilized thereby increasing the number of parts.

From the foregoing discussion it will also be appreciated that our cam mechanism may be readily formed and added to an alarm clock timer with relatively few additional parts. It is merely necessary to provide a movable rather than a fixed cam follower one of the twelve hour cam gears, and a slot in the cam gear and a flexible leaf spring is all that is required for holding the cam follower 222 on the gear.

WHAT WE CLAIM IS:—

1. An alarm clock mechanism comprising:
a timing mechanism,
a supporting structure,
a first cam member rotatably mounted on said supporting structure,
a second cam member rotatably

mounted on said supporting structure in coaxial relationship with said first cam member and axially movable with respect thereto,
one of said cam members being caused to rotate by said timing mechanism,
means for manually adjusting the relative angular position of said cam members,
an on-off control mechanism having a resilient member exerting a spring force urging said second cam member axially toward said first cam member, said second cam member being disposed to move axially under the influence of said spring force to permit said control mechanism to be moved to its on position upon relative rotation of said cam members through a predetermined relative angular position,
one of said cam member supporting a cam follower which is rotatable with said one of said cam members for cooperating with axially raised and lower cam surfaces of the other cam member to permit said resilient member to move said second cam member toward said first cam member to permit the control mechanism to be moved to its on position, and said cam follower being mounted for movement with respect to the cam member on which it is supported for permitting said cam follower to remain on the said lower cam surface of said other cam member so that said timing mechanism is not required to restore said cam follower from said lower cam surface on said other cam member to said raised cam surface of said other cam member against the force of said resilient member.

2. An alarm clock mechanism as claimed in claim 1 wherein a manually operable control shut-off mechanism is provided for moving the second cam member axially away from the first cam member to move the control mechanism to its off position and to permit said cam follower to be moved from said lower cam surface of the other cam member to said higher cam surface of the other cam member.

3. An alarm clock mechanism as claimed in claim 1 or claim 2, wherein said cam follower includes a cam finger which is inserted within a slot formed in the cam member on which it is mounted and is arranged for pivotal movement within the slot.

4. An alarm clock mechanism as claimed in claim 3 wherein a leaf spring is fixed to the cam member for resiliently holding the cam finger.

5. An alarm clock mechanism as claimed in claim 2 and claim 4 wherein the manually operable control shut-off mechanism pro-



for moving the cam member 220 away from the cam member 219, 222 in order to manually move the cam follower 308 from a lower surface of cam 220 illustrated in FIG. 4 to an upper surface of cam 220 as illustrated in FIGS. 2 and 5. Thus, after the timing motor has moved the cam parts to the radio ON alarm sounding position illustrated in FIG. 4 the timing motor is not required to reset the cam finger 308 on top of cam 220 and the finger merely slides on the lower surface of the cam. Naturally, since the timing motor is not required to reset the cam follower, our cam mechanism does not appreciably add to the torque requirements of the motor.

A very significant advantage is achieved with the use of the movably mounted cam follower 222 and the manually operated WAKE-NO WAKE alarm shut-off cam lever mechanism 216 when the alarm mechanism is utilized for actuating a switch. If a cam gear arrangement in which the gears are driven apart were used for operating a low cost switch such as the switch 206, 208 illustrated in FIG. 2., the contacts would be opened very slowly as the cam gears were being separated by the timing motor. This action would probably draw an arc for an appreciable period of time and would erode or perhaps weld the contacts to each other. In addition, such an arrangement could cause electrical interference. With this arrangement, the contacts are opened manually by using the manually operable WAKE-NO WAKE cam 216. This opening occurs reasonably rapidly and thus, the arcing problem is minimized. The initial closure of the switch occurs rapidly when the cam finger 222 drops into notch 226. Thus, the speed of closure is no problem. Without our movably mounted cam follower 222 and the manually operated WAKE-NO WAKE shut-off mechanism 216 a more expensive snap action switch would probably be utilized thereby increasing the number of parts.

From the foregoing discussion it will also be appreciated that our cam mechanism may be readily formed and added to an alarm clock timer with relatively few additional parts. It is merely necessary to provide a movable rather than a fixed cam follower one of the twelve hour cam gears, and a slot in the cam gear and a flexible leaf spring is all that is required for holding the cam follower 222 on the gear.

WHAT WE CLAIM IS:—

1. An alarm clock mechanism comprising:
 - a timing mechanism,
 - a supporting structure,
 - a first cam member rotatably mounted on said supporting structure,
 - a second cam member rotatably

mounted on said supporting structure in coaxial relationship with said first cam member and axially movable with respect thereto, one of said cam members being caused to rotate by said timing mechanism, means for manually adjusting the relative angular position of said cam members,

an on-off control mechanism having a resilient member exerting a spring force urging said second cam member axially toward said first cam member, said second cam member being disposed to move axially under the influence of said spring force to permit said control mechanism to be moved to its on position upon relative rotation of said cam members through a predetermined relative angular position,

one of said cam member supporting a cam follower which is rotatable with said one of said cam members for co-operating with axially raised and lower cam surfaces of the other cam member to permit said resilient member to move said second cam member toward said first cam member to permit the control mechanism to be moved to its on position, and said cam follower being mounted for movement with respect to the cam member on which it is supported for permitting said cam follower to remain on the said lower cam surface of said other cam member so that said timing mechanism is not required to restore said cam follower from said lower cam surface on said other cam member to said raised cam surface of said other cam member against the force of said resilient member.

2. An alarm clock mechanism as claimed in claim 1 wherein a manually operable control shut-off mechanism is provided for moving the second cam member axially away from the first cam member to move the control mechanism to its off position and to permit said cam follower to be moved from said lower cam surface of the other cam member to said higher cam surface of the other cam member.

3. An alarm clock mechanism as claimed in claim 1 or claim 2, wherein said cam follower includes a cam finger which is inserted within a slot formed in the cam member on which it is mounted and is arranged for pivotal movement within the slot.

4. An alarm clock mechanism as claimed in claim 3 wherein a leaf spring is fixed to the cam member for resiliently holding the cam finger.

5. An alarm clock mechanism as claimed in claim 2 and claim 4 wherein the manually operable control shut-off mechanism pro-



vided for moving the second cam member axially away from the first cam member permits said cam follower to be moved from said lower cam surface of the other cam member to said higher cam surface of the other cam member under the resilient force of said leaf spring.

6. An alarm clock mechanism as claimed in claim 2 or any one of claims 3 to 5 when dependent upon claim 2, wherein the resilient member of said on-off control mechanism is a resilient switch blade having a contact formed thereon which is normally biased toward a fixed switch contact, and

said manually operable control shut-off mechanism is adapted to rapidly move said switch blade and its contact away from the fixed contact when the cam members are moved axially away from each other thereby minimizing arcing between the switch contacts.

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

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