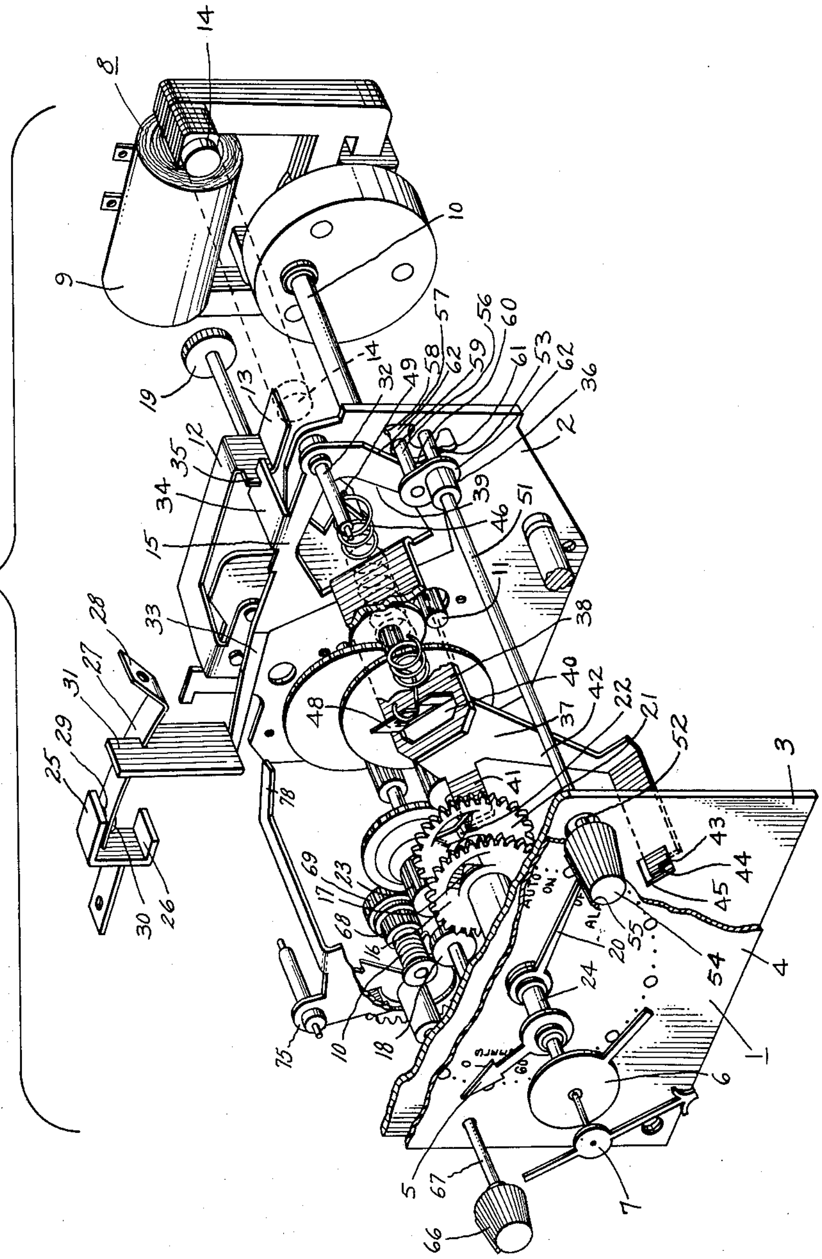
May 8, 1962 R. L. BOYLES 3,033,948

TIME SWITCH AND ALARM

Filed Aug. 20, 1956 4 Sheets-Sheet 1

Fig. 1.



Inventor:
Robert L. Boyles
by Armand Cifelli
His Attorney

TIME SWITCH AND ALARM

Filed Aug. 20, 1956

4 Sheets-Sheet 2

Fig. 2.

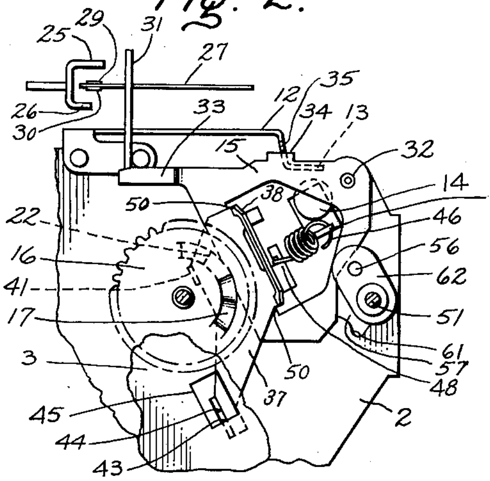


Fig. 3.

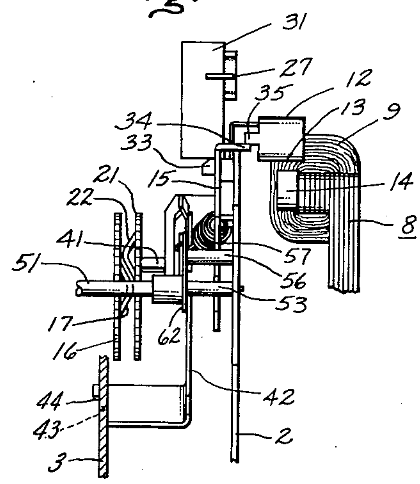


Fig. 4.

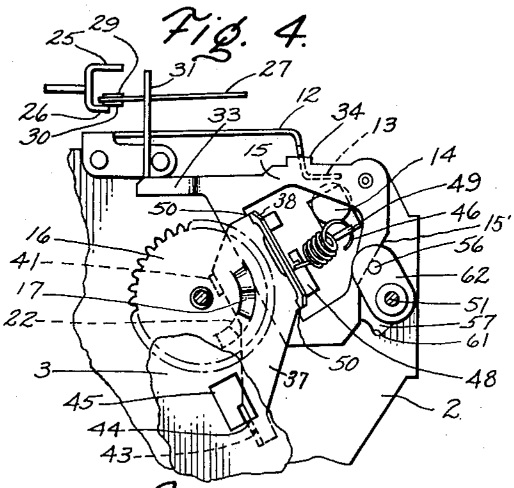


Fig. 5.

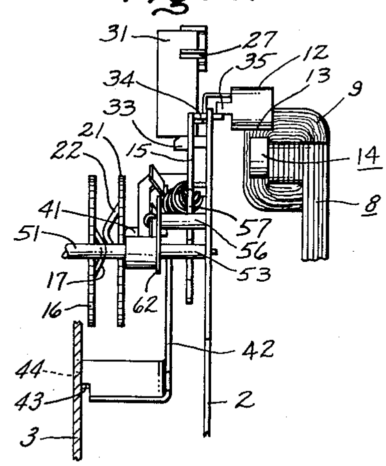
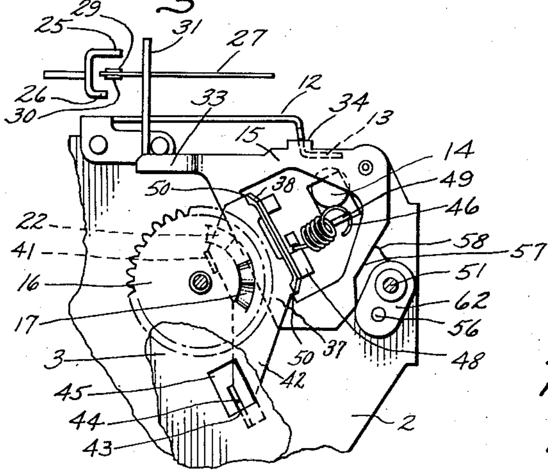


Fig. 6.



Inventor:
Robert L. Boyles
by Armand Cifelli
His Attorney

TIME SWITCH AND ALARM

Filed Aug. 20, 1956 4 Sheets-Sheet 3

Fig. 7.

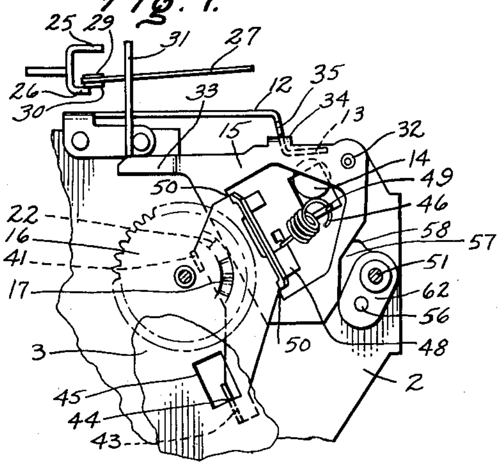


Fig. 8.

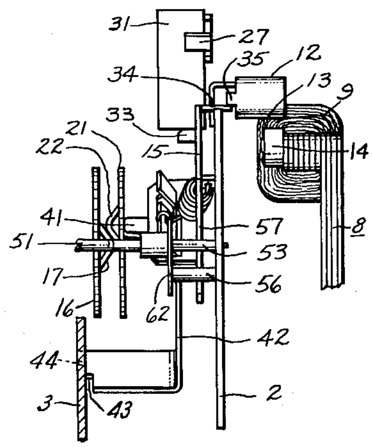


Fig. 9.

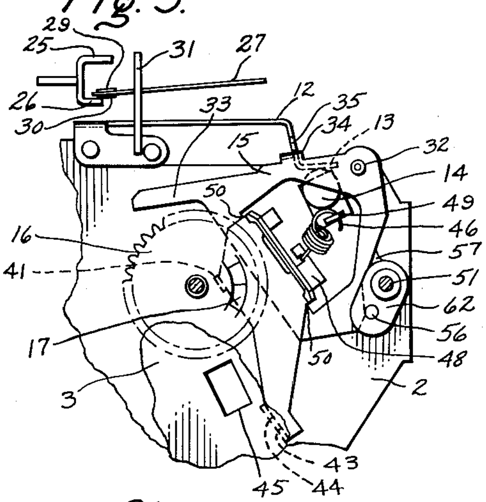


Fig. 10.

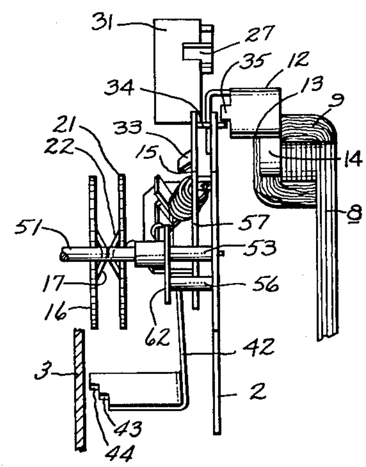
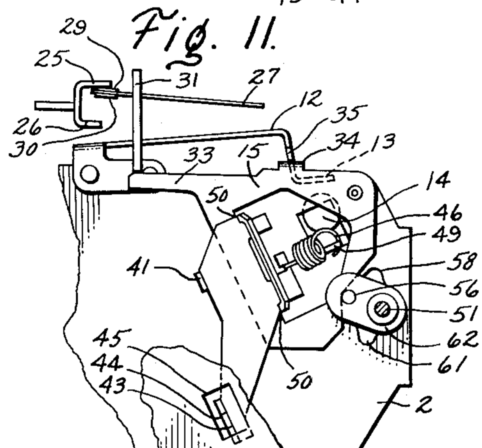


Fig. 11.



Inventor:
Robert L. Boyles
by Armand Cifelli
His Attorney

May 8, 1962 R. L. BOYLES 3,033,948

TIME SWITCH AND ALARM

Filed Aug. 20, 1956 4 Sheets-Sheet 4

Fig. 12.

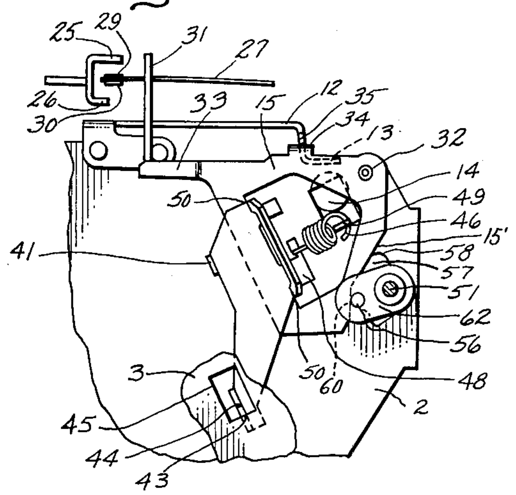


Fig. 13.

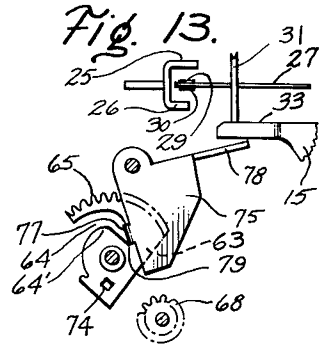


Fig. 14.

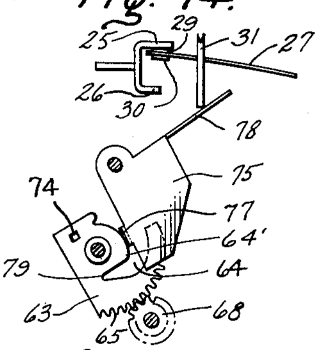


Fig. 15.

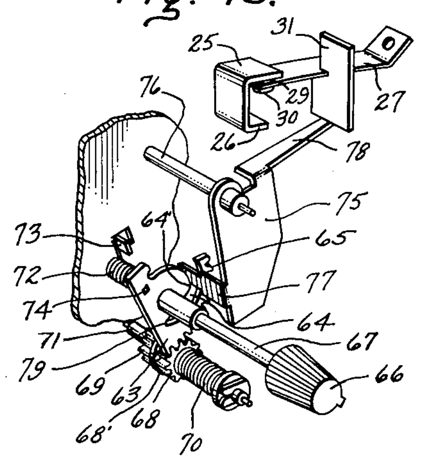
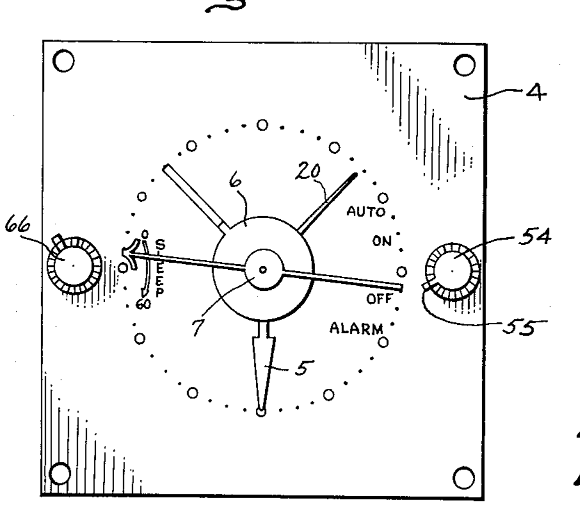


Fig. 16.



Inventor:
Robert L. Boyles
by Armand Cifelli
His Attorney

United States Patent Office

3,033,948

Patented May 8, 1962

1

2

3,033,948

TIME SWITCH AND ALARM

Robert L. Boyles, Wayland, Mass., assignor to General Electric Company, a corporation of New York

Filed Aug. 20, 1956, Ser. No. 605,032

12 Claims. (Cl. 200—38)

This invention relates to time controlled devices, and more particularly to switch and alarm means actuated as a function of time.

For example, it is found highly desirable to control apparatus such as a radio receiver and an audible alarm vibrator so that operation of the radio receiver will be automatically commenced at a particular preset time, and after the lapse of a predetermined time interval, operation of the audible alarm vibrator will be commenced. In this manner, sounding of the audible alarm is designed to awaken an individual in the event that the radio fails to accomplish such awakening. An alarm and time switch for operating a radio receiving set is also particularly useful where the switch may be turned on automatically at any predetermined time without the subsequent sounding of the audible alarm, to be turned off manually when desired; to be turned on manually, to be left on until turned off manually; or to be turned on manually, to be turned off automatically at an adjustable time interval thereafter, or manually before it would otherwise be turned off automatically should that become desirable.

It is highly desirable that time switches in combination with audible alarm means be provided with simplified control devices so that an operator may easily and readily set the time switch and alarm mechanism to perform any one of the plurality of control functions mentioned above without becoming involved in a series of complicated setting operations to arrive at a particular setting he desires. My invention is concerned with such a time switch and audible alarm combination.

Accordingly, it is a primary object of this invention to provide an improved time switch and audible alarm in which a single control knob may be used to select the desired operation of the switch and the audible alarm.

It is another object of the present invention to provide an improved combination of means for manually closing a switch and automatically opening the switch, and means for manually setting the switch for automatic closure at a preset time.

In accordance with one aspect of this invention, a timing device comprises an audible alarm vibrator and a switch. A lever is provided for actuating the switch and for obstructing operation of the audible alarm vibrator. The lever may be moved in one direction to a plurality of different positions by means driven by the timing device. When the lever is moved automatically in the above-mentioned direction to one position, the switch is closed and when the lever is moved further in said direction to a different position, operation of the audible alarm is permitted. Thus, the lever is utilized to sequentially close the switch at a preset time and after the lapse of a predetermined time interval permit operation of the audible alarm vibrator. A manually adjustable control mechanism is positioned adjacent to the lever for selectively limiting motion of the lever in the above-mentioned direction and may be set to prevent the lever from moving far enough to permit operation of the alarm. By this arrangement, a simple manually adjustable control mechanism may be set in any one of a plurality of positions to control the desired operation of the audible alarm and switch.

Further objects and advantages of my invention as well as other modifications and uses thereof will become apparent as the description proceeds. My invention will be better understood by reference to the accompanying drawings in which:

FIG. 1 is an exploded perspective view of the operating mechanism of the time switch and audible alarm showing the switch in the manual "ON" position;

FIG. 2 is a partial front elevational view of the time switch and alarm with the control mechanism set to close the switch automatically at a preset time but to prevent operation of the alarm vibrator;

FIG. 3 is a partial side elevational view of the time switch and alarm mechanism shown in FIG. 2;

FIG. 4 is a partial front elevational view of the time switch and alarm with the control mechanism set in the position shown in FIG. 2 after the switch has been closed automatically at the preset time;

FIG. 5 is a partial side elevational view of the time switch and alarm mechanism shown in FIG. 4;

FIG. 6 is a partial front elevational view of a time switch and alarm mechanism with the control mechanism set to automatically close the switch at a preset time and after the lapse of a short time interval, permit operation of the audible alarm;

FIG. 7 is a partial front elevational view of the time switch and alarm set in the position shown in FIG. 6 after the switch has been closed automatically at the preset time but before the alarm is released;

FIG. 8 is a partial side elevational view of the switch and alarm shown in FIG. 7;

FIG. 9 is a partial front elevational view of the time switch and alarm mechanism set in the position shown in FIG. 6 after the switch has been closed automatically and the alarm has been released;

FIG. 10 is a side elevational view of the switch and alarm mechanism shown in FIG. 9;

FIG. 11 is a partial front elevational view of the time switch and alarm mechanism showing the switch in the manual "ON" position;

FIG. 12 is a partial front elevational view of the time switch and alarm mechanism showing the switch in the manual "Off" position;

FIG. 13 is a partial front elevational view showing the improved control mechanism for manually closing the switch and automatically maintaining the switch in a closed position for a preselected adjustable time interval showing the switch in an open position;

FIG. 14 is a partial front elevational view of the mechanism shown in FIG. 13 with the switch in a closed position;

FIG. 15 is an exploded perspective view of the control mechanism for manually closing the switch and automatically maintaining the switch in a closed position for a preselected adjustable time interval; and

FIG. 16 is a front elevational view of my improved time switch and alarm mechanism.

Referring now to the drawing and first, particularly to FIG. 1, the time control device of this invention is shown as comprising a generally square casing **1** suitable for mounting in any desired manner in an apparatus such as a radio receiver (not shown). This mechanism comprises a supporting structure including a rear plate **2**, and a front plate **3** upon which is mounted a dial plate **4** having the usual clock indicia painted or otherwise generally centrally placed thereon. The clock is provided with hour, minute, and second hands, **5**, **6**, and **7**, respectively, mounted for movement over the dial and driven by a conventional timing device gear train.

The timing device may include any suitable form of timer motor here shown as a self-starting synchronous motor **8**, a field coil **9** of which is connected to a source of regulated frequency alternating current. A terminal shaft **10** including a gear **11** fixed thereto extends through rear plate 2 for driving the hands of the clock and my improved time switch and alarm mechanism. A resilient magnetic vibrator 12 operated by leakage flux from the motor is arranged to have its free end portion 13 vibrate against a stator nut 14 and produce an audible alarm at all times when the motor is energized unless the vibrator is prevented from vibrating by a lever 15 in a manner to be more fully described hereinafter.

A time set cam gear 16 having a projecting cam portion 17 located thereon is rotatably mounted on the supporting structure. The angular position of cam gear 16 is manually adjustable by means of a gear 18 which is connected for rotation by a knob 19 which extends through the rear of the casing in a conventional manner. A hand 20 is connected to cam gear 16 for rotation therewith in order to indicate the time setting of cam gear 16. A second rotatable cam gear 21 having a cam surface 22 is also rotatably mounted on the supporting structure as shown, and is axially movable to actuate the time switch and alarm in a manner to be hereinafter more fully described. Cam gear 21 is driven by motor 8 at one revolution every twelve hours through a suitable gearing arrangement including a gear 23 in a manner known in the art. Hour hand 5 and cam gear 21 may both be fixed to a common shaft 24 so that cam gear 21 may rotate the hour hand 5 at one revolution in every twelve hours. In a manner known in the art, at the time set by cam gear 16, cam surfaces 17 and 22 co-operate with each other to move gear 21 axially away from cam gear 16.

A three position switch which may be utilized to control an apparatus such as a radio receiver, is provided for actuation by the timing device. In the arrangement illustrated in FIG. 1, the switch comprises two fixed upper and lower switch contacts 25 and 26 spaced from each other. Fixed switch contacts 25 and 26 are electrically connected to each other and may be formed from a single U-shaped piece of conducting material. A movable switch blade 27, fixed at one end 28 thereof, is provided with two oppositely disposed contacts 29 and 30 formed on the other end thereof for co-operation with fixed switch contacts 25 and 26, respectively. Switch blade 27 is normally self-biased downwardly to one closed position with the lower movable contact 30 in abutting relation with the lower fixed switch contact 26. An insulated plate 31 is provided for moving resilient blade 27 upwardly for positioning contacts 29 and 30 between switch contacts 25 and 26 to open the switch, and for further moving resilient switch blade 27 upwardly to another closed position with switch contact 29 in abutting relation with switch contact 25. Lever 15 is provided for co-operating with insulated plate 31 to actuate the switch in a manner to be more fully described hereinafter.

A uniquely designed, manually adjustable means continuously operated by the timing device is provided for manually moving switch blade 27 so that contacts 29 and 30 are spaced from contacts 25 and 26, respectively, to open the switch, for manually moving switch blade 27 upwardly so that contact 29 abuts contact 25 to close the switch, for automatically moving switch blade 27 to a closed position with contact 30 in abutting relation with contact 26, and for automatically releasing alarm vibrator 12, 13. This manually adjustable means includes the above-mentioned lever 15 for actuating the switch and for releasing the alarm. Lever 15 is pivoted to the supporting structure at 32 and may be moved in a clockwise or counterclockwise direction in a manner to be more particularly described hereinafter. As shown in FIG. 1, lever 15 is generally triangular-shaped and is provided with an outwardly extending arm 33 or co-operating with insulated plate 31 to actuate the switch. An upper portion of lever 15 is provided with a rearwardly extending lug 34 for co-operating with a forwardly extending lug 35 which may be formed on vibrator 12 in order to obstruct operation of the vibrator 12. Lug 34 may be easily formed on lever 15 by bending an upwardly extending portion of lever 15 rearwardly in the manner shown in FIG. 1. Thus, a simple lever which may be easily manuactured is utilized to actuate and control both the switch 25, 26, 29, 30, and audible vibrator 12.

As shown in FIG. 1, the means for manually operating the switch, or automatically closing the switch, and for releasing the alarm vibrator 12, 13 also includes a manually adjustable control cam mechanism generally indicated by reference numeral 36. This mechanism is positioned adjacent to lever 15 for selectively limiting pivotal motion of lever 15 in one direction and for moving lever 15 in an opposite direction. This mechanism will be more fully described hereinafter, and for the purposes of this discussion it may be assumed that the control cam mechanism 36 is rotated to the extreme counterclockwise position (Alarm), shown in FIG. 6, so that the mechanism cannot stop the lever 15 from pivoting in a counterclockwise direction.

My improved means for manually opening the switch and automatically closing the same also includes a uniquely designed latch mechanism which co-operates with the continuously operated axially movable twelve-hour cam gear 21 for automatically moving lever 15 in one direction to sequentially close the switch at a preset time, and after a lapse of a predetermined time interval, permit operation of alarm vibrator 15. In the arrangement illustrated in FIG. 1, the mechanism comprises a generally Y-shaped latch 37 which is pivotally mounted on lever 15. To achieve this, a forwardly extending lug 38 is bent from lever 15 so as to form an enlarged opening 39 in lever 15, and an aperture 40 is formed at the end of lug 38 for receiving the base of the Y-shaped latch 37. In the preferred embodiment shown in FIG. 1, one of the arms 41 of Y-shaped latch 37 is considerably shorter than the other arm 42 of latch 37, and is provided for contacting a side portion of the axially movable twelve-hour cam gear 21. The other arm 42 of Y-shaped latch 37 may be provided with a forwardly extending end portion having a plurality of steps 43, 44 formed thereon for co-operating with a generally rectangular hole 45 which may be cut in front plate 3. In the position shown in FIG. 2, it can be seen that step 43 co-operates with an edge of hole 45 to prevent counterclockwise rotation of lever 15 about pivot 32.

A tension spring 46 is provided for urging the two arms 41 and 42 of the Y-shaped latch 37 forwardly as viewed in FIG. 1, for biasing lever 15 in a counterclockwise direction as viewed in FIG. 1, and for pivotally securing latch 37 to lever 15. Spring 46 may be passed through the enlarged opening 39 formed in lever 15 with one end thereof conected to a lug 48 formed at the end of the base of Y-shaped latch 37 and the other end thereof connected to an upstanding lug 49 formed in rear plate 2. Referring now to FIG. 2, it can be seen that since the point of connection of spring 46 to lug 49 is to the right of an imaginary line connecting lug 48 and pivot 32, spring 46 will urge lever 15 in a counterclockwise direction as viewed in FIG. 2. The end portion of the base of Y-shaped latch 37 may be reduced in width so as to form shoulders 50. Thus, the end portion of Y-shaped latch 37 is formed with a complemental portion for insertion in aperture 40 and for restricting inward movement of Y-shaped latch 37 in aperture 40. It can be seen that spring 46 urges shoulders 50 of latch 37 into contact with a side surface of lug 38 to pivotally secure latch 37 to lever 15.

Accordingly, with the parts in the positions shown in FIG. 6, spring 46 urges lever 15 and latch 37 which is pivoted thereto counterclockwise so that step 43 formed on arm 42 of latch 37 contacts an edge of hole 45 to hold the switch in the open position shownin FIG. 6. As the time preset by cam gear 16 is approached, cam surface 22 will engage cam surface 17 to slide gear 21 rearwardly, thereby pivoting latch 37 about lug 38 to allow spring 46 to move latch 37 from step 43 to step 44 so that step 44 contacts an edge portion of aperture **45**, as shown in FIG. 7. At the same time, spring **46** pivots lever **15** an increment in a counterclockwise direction so that insulated switch actuator **31** is moved downwardly by the spring bias of switch blade **27** until contact **30** abuts contact **26** to close the switch; however, such slight pivotal movement of lever **15** does not move lug **34** down far enough to enable end portion **13** of vibrator **12** to contact field nut **14** to sound the alarm. As shown in FIG. 10, continued rotation of cam gear **21** will cause cam surface **22** to move further up on cam surface **17** in order to slide gear **21** still further rearwardly. Thus, as shown in FIG. 9, latch **37** is moved far enough rearwardly so that step **44** will become disengaged from an edge portion of hole **45**. This completely disengages latch **37** from hole **45** and therefore, spring **46** pivots lever **15** further in a counterclockwise direction to lower lug **34** sufficiently far enough so that vibrator **13** may contact field nut **14** to thereby sound the audible alarm.

My improved manually adjustable plural position control mechanism for selectively limiting motion of lever **15** in one direction and for moving the lever in another direction in order to select the desired operation of my improved time switch and alarm mechanism, will now be more particularly described. As shown more particularly in FIG. 1, the control mechanism comprises a shaft **51** which is mounted for rotation at **52** and **53** on the front and rear supporting plates **3** and **2**, respectively. As shown more particularly in FIG. 16, a knob **54** having a suitable pointer **55** formed thereon may be fixed to one end of shaft **51** for manually adjusting the position of the control mechanism to one of the four positions shown in FIG. 16, namely, "Auto," "On," "Off," and "Alarm." A cam lug **56** is fixed to the other end of shaft **51** for limiting counterclockwise rotation of lever **15** about pivot **32** and for moving lever **15** in a clockwise direction. A generally annular aperture **57** having four pronounced depressions **58**, **59**, **60**, **61** formed in the radially outer edge thereof may be cut in rear plate **2**. A flat spring member **62** resiliently connects cam lug **56** to shaft **51** so that cam lug **56** may be moved radially inwardly against the biasing force of spring **62** when the cam lug is rotated from one depression to another depression. Depressions **58**, **59**, **60** and **61** correspond with the "Auto," "On," "Off," and "Alarm" positions, respectively, of the control cam mechanism shown in FIG. 16. The particular location of the edge of "Auto" depression **58** as viewed in FIG. 4, is designed so that when cam lug **56** is positioned within depression **58** with an edge portion **15'** of lever **15** in contact with lug **56**, lever **15** is in a position so that switch blade **27** may move downwardly to allow contact **30** to abut contact **26** to close the switch, but in this position lug **34** on lever **15** is not down far enough to allow the end portion **13** of vibrator **12** to contact field nut **14**.

Referring now to FIG. 11, when cam lug **56** is moved to the "On" position with cam lug **56** in depression **59**, cam lug **56** moves lever **15** clockwise against the force of spring **46** to the position shown in FIG. 11. In this position, the end portion **33** of lever **15** pushes switch actuator plate **31** upwardly against the force of switch blade **27** to move contact **29** into abutting relation with respect to contact **25** to thereby close the switch. In this position, lug **34** is held high enough to prevent the alarm from sounding. As shown in FIG. 12, when cam lug **56** is located in "Off" depression **60**, spring **46** forces edge portion **62** of lever **15** into contact with lug **56**. In this position of lever **15**, switch blade **27** is held by lever **15**, acting through switch actuator plate **31**, so that contacts **29** and **30** are positioned between contacts **25** and **26** to open the switch. Referring now to FIG. 9, when cam lug **56** is positioned in the "Alarm" depression **61**, the lever **15** may be moved counterclockwise to the position shown in FIG. 9 by the timing mechanism to allow blade **27** to move downwardly so that contact **30** abuts contact **26** to close the switch and to move lug **34** downwardly so that vibrator **12** can contact field nut **14**. Thus, it can be seen that a simple mechanism **36** having a single control knob **54** may be merely rotated to any one of a plurality of positions to control the desired operation of the audible alarm and the switch.

Sleep Switch

A manually presettable means is provided for manually moving the switch to a closed position and for automatically maintaining the switch in said 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 for such use it may be termed a "sleep switch." The sleep switch mechanism is uniquely combined with the mechanism for automatically closing the switch when open, described above, and operates on the same insulated plate **31** and switch blade **27** to manually move the switch to its upper closed position with contact **29** in abutting relation with the fixed contact **25**. The sleep switch mechanism does not interfere with any of the previously described mechanism for manually operating the switch or automatically closing the switch except to the extent that operation of such additional means temporarily takes over control of the switch.

As shown in FIG. 15, the sleep switch mechanism includes a uniquely designed combination cam gear sector **63** having gear teeth **65** and a cam slot **64** formed therein. Gear teeth **65** and cam slot **64** may be formed in a single stamping operation. Thus, a simple flat piece of metal may function as a gear and a cam. A manual setting knob **66** may be connected to cam gear **63** for rotating same through shaft **67** to which both the knob **66** and cam gear **63** are rigidly fixed. The cam gear **63** may be connected to the timing mechanism **8** through a pinion **68**. A pinion **69** is arranged coaxially with pinion **68** and is connected thereto through a slip friction clutch which may include a washer **68'** disposed between pinions **68** and **69**. Pinion **69** is meshed with the timing mechanism gear train and rotates continuously therewith. The necessary friction for clutch purposes between pinions **68** and **69** may be supplied by a compression spring **70** on the shaft **71**, on which pinion **68** and washer **68'** may rotate and on which pinion **69** is fixed. Shaft **67** passes through the center axis of cam gear **63**. A spring **72** coiled about shaft **67** with one end secured to a lug **73** which may be formed in rear plate **2** and the other end engaging a lug **74** formed in cam gear **63** serves to bias cam gear **63** out of meshing engagement with pinion **68**.

A cam follower lever **75** is pivoted to the supporting structure at **76** and operatively connects cam gear **63** to insulated switch actuator plate **31**. One end of the lever **75** is provided with a rearwardly extending finger **77** for co-operating with the cam slot **64** and the other end of lever **75** is provided with a radially extending arm **78** for co-operating with switch actuator plate **31**.

As illustrated in FIG. 16, suitable indicia such as "sleep" and a time scale consisting of an arc-shaped arrow extending between numerals zero and sixty, sixty referring to sixty minutes, may be positioned adjacent to set knob **66**. When not in use, the sleep switch knob **66** will be in the position shown in FIG. 16 and cam gear **63** will be in the demeshed position shown in FIG. 13, with gear **63** out of mesh with pinion **68**.

If it is desired to manually close the switch and have the switch remain closed for a preselected time interval, knob **66** is rotated clockwise in the direction of the arrow to the desired time between zero and sixty. As shown in FIG. 14, this simultaneously rotates cam gear **63** into mesh with pinion **68** and allows a hump **64'** on the radial inner edge of cam slot **64** to pivot lever **74** counterclockwise to thereby move insulated plate **31** and switch blade **27** upwardly until contact **29** is in abutting relation with respect to switch contact **25** to close the switch. During such rotation of gear sector **63** into mesh with pinion 68, the friction clutch between pinions 68 and 69 slips. The above-mentioned operation may occur if the manually adjustable control knob 54 is positioned in the "Off" position or in the "Auto" or "Alarm" positions before the preset time; however, should the control knob 54 be positioned in the "On" position, lever 15 will have already moved insulated plate 31 upwardly to cause contact 29 to abut contact 25 to close the switch and in this event, the sleep switch mechanism will be overridden by the manual switch closing mechanism and will be ineffective to open the switch after a predetermined adjustable time interval.

Assuming the manually adjustable control knob 54 to be in the manual "Off" position or in the "Auto" or "Alarm" positions before the preset time, operation of the sleep switch mechanism may continue as follows: After the above-mentioned setting operation, the parts will be in some intermediate position as illustrated in FIG. 15. As the timing device 8 rotates pinions 69 and 68, gear sector 63 will be rotated counterclockwise as shown in FIG. 15 and at a rate which will require the time set by knob 66 for its disengagement from pinion 68, at which time it is moved by spring 72 to the position represented by FIG. 13. As shown in FIG. 13, arm 77 moves off of the hump 64' of the radially inner edge of cam slot 64 to allow lever 75 to pivot clockwise away from insulated switch actuator plate 31. This permits switch blade 27 to move slider 31 downwardly so that the lower edge of slider 31 abuts arm 33 of lever 15 to hold the switch open. During the operation of the sleep mechanism, the time may be extended or reduced or eliminated entirely by turning control knob 66 in the proper direction. Any such adjustment simply slips the friction clutch between pinions 68 and 69 and changes the time setting accordingly. As shown in FIG. 13, a closed end 79 of slot 64 acts as a stop for co-operation with arm 77 to prevent rotation of gear sector 63 out of mesh beyond a predetermined position. Thus, an easily manufactured simple flat member 63 functions as a gear, a cam, and a stop mechanism.

Operation

If it is desired to have the switch for operating apparatus such as a radio receiver closed at some time in the future, say, three o'clock, and after the lapse of a short time interval sound the alarm vibrator, knob 19 at the rear of the timing mechanism is rotated to set hand 20 to the three o'clock position illustrated in FIG. 1 in a conventional manner to thereby set the angular position of cam gear 16, and control knob 54 is set in the "Alarm" position shown in FIG. 6; either knob may be set first. In rotating knob 54 through the "Off" position to the "Alarm" position, cam lug 56 is removed from the edge portion 15' of lever 15 and thus, no longer stops counterclockwise rotation of lever 15 by spring 46. However, as knob 54 is moved to the "Alarm" position, spring 46 urges step 43 on latch 42 into intimate contact with an edge of hole 45, and thus, latch 37 prevents any significant rotation of lever 15 when knob 54 is moved from the "Off" position to the "Alarm" position.

The mechanism can now operate to trip latch 37 and lever 15 to the position shown in FIG. 7 to close the switch at three o'clock. The timing device rotates the clock hands toward three o'clock and at the same time, the timing mechanism rotates cam gear 21 clockwise. As the preset time is approached, the cam portions on gears 16 and 21 come into contact with each other and cam portion 22 rises on cam portion 17, thereby pivoting latch 37 about lug 38 formed on lever 15. At three o'clock, latch 37 is moved far enough rearwardly to allow step 43 to become disengaged from the edge of hole 45, as shown in FIGS. 7 and 8. Thus, spring 46 moves lever 15 and latch 37 in a counterclockwise direction until step 44 on latch 37 engages an edge of hole 45. This slight counterclockwise movement of lever 15 allows blade 27 to move contact 30 into abutting relation with respect to fixed contact 26 to close the switch. As the timing mechanism continues to rotate gear 21, cam surfaces 22 and 17 on gears 16 and 21, respectively, move further into alignment with each other to thereby move gear 22 further rearwardly to approximately the position shown in FIG. 10. In this position, step 44 of latch 37 is disengaged from an edge of hole 45. This allows spring 46 to move lever 15 and latch 37 counterclockwise to the position shown in FIG. 9. Vibrator 12 snaps down on field nut 14 and starts buzzing. The time relation between the automatic closing of switch contacts 26 and 30 and the automatic release of audible alarm vibrator 12 may be determined by the relative dimensioning and positioning of the parts, and is easily subject to variation. For example, the height of step 44 on latch 37 may be varied to change the length of the time interval between the closing of the switch and the sounding of the audible alarm vibrator. In a preferred embodiment, the dimensions of the parts are adjusted so that the audible alarm will be caused to sound approximately ten minutes after the switch is closed. The buzzing will continue and the switch will remain closed until knob 54 is rotated clockwise to the "Off" position so that lug 56 engages edge portion 15' of lever 15 and moves lever 15 clockwise to the position shown in FIG. 12. In this position, arm 33 of lever 15 holds the switch open and lug 34 formed on lever 15 engages lug 35 formed on vibrator 12 to prevent the vibrator from sounding.

If it is desired to have the switch for operating apparatus such as a radio receiver closed at some time in the future without the subsequent sounding of the audible alarm vibrator, knob 19 at the rear of the timing mechanism is rotated to set hand 20 in the manner described above, and control knob 64 is set in the "Auto" position, as shown in FIG. 2. As shown in FIGS. 4 and 5, the mechanism can now operate to trip latch 37 and lever 15 to thereby move contact 30 into abutting relation with contact 26 to close the switch at the preset time in the manner described above. However, when gear 22 moves far enough rearwardly to disengage step 44 from an edge of hole 45, edge portion 15' of lever 15 engages lug 56 to thereby prevent further counter clockwise rotation of lever 15. In this position of lever 15, the switch is closed but lug 34 formed on lever 15 is held high enough to obstruct operation of the audible alarm.

While there has been shown and described a particular embodiment of this invention, it will be obvious to those skilled in the art that various other changes and modifications can be made therein without departing from the invention, and therefore, it is aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a timing device, an audible alarm vibrator, a switch, a plural position lever for actuating said switch and for obstructing operation of said alarm vibrator, means driven by said timing device for automatically moving said lever in one direction to sequentially close said switch at a preset time and after the lapse of a predetermined time interval permit operation of said alarm vibrator, and a manually adjustable plural position control mechanism positioned adjacent to said lever for selectively limiting motion of said lever in said one direction such that when said control mechanism is in one position said lever is moved to close the switch but the control mechanism stops further movement of said lever to thereby prevent operation of the alarm vibrator.

2. In a timing device, an audible alarm vibrator, a switch, a plural position lever for actuating said switch and for obstructing operation of said alarm vibrator, means driven by said timing device for automatically moving said lever in one direction to sequentially close said switch at a preset time and after the lapse of a predetermined time interval permit operation of said alarm vibrator, a plural position control cam mechanism for

selectively moving said lever in an opposite direction and for limiting motion of said lever in said one direction, such that when said control cam mechanism is in a first position said lever is stopped to prevent automatic operation of said switch and vibrator, when said control cam mechanism is in a second position the means driven by the timing mechanism automatically moves said lever to close the switch but the cam mechanism stops further movement of said lever to thereby prevent operation of the alarm, when said cam mechanism is in a third position the timing mechanism automatically moves said lever to sequentially close said switch and permit operation of said alarm vibrator, and when said cam mechanism is in a fourth position the lever manually closes the switch and prevents operation of the alarm vibrator.

3. In a timing device, an audible alarm vibrator, a switch, a plural position lever for actuating said switch and for obstructing operation of said alarm vibrator, means driven by said timing device for automatically moving said lever in one direction to sequentially close said switch at a preset time and after the lapse of a predetermined time interval permit operation of said alarm vibrator, a rotatable four position control cam mechanism located adjacent to said lever for selectively limiting motion of said lever in said one direction and for moving said lever in an opposite direction such that in a first angular position of said control cam mechanism said lever is stopped to prevent operation of said switch and vibrator, in a second angular position of said control cam mechanism the means driven by the timing device automatically moves the lever to close the switch but the cam mechanism stops further movement of said lever to thereby prevent operation of the alarm, in a third angular position of said control cam mechanism the timing mechanism automatically moves said lever to sequentially close said switch and permit operation of said alarm vibrator, and in a fourth angular position said control cam mechanism manually closes the switch and prevents operation of the alarm vibrator.

4. In a timing device, an audible alarm vibrator, a switch, a plural position lever for actuating said switch and for obstructing operation of said alarm vibrator, means driven by said timing device for automatically moving said lever in one direction to sequentially close said switch at a preset time and after the lapse of a predetermined time interval permit operation of said alarm vibrator, a supporting plate, and a manually adjustable plural position control mechanism positioned adjacent to said lever for selectively limiting motion of said lever in said one direction comprising a rotatable shaft, a flat spring fixed to said shaft, an annular aperture having a plurality of depressions formed in said plate, and a cam lug fixed to said leaf spring and positioned in said annular aperture for selectively abutting said lever.

5. In a timing device, an audible alarm vibrator, a switch, a lever for actuating said switch and for obstructing operation of said alarm vibrator, plural position latch means pivoted to said lever, and means driven by said timing mechanism for successively disengaging said latch means to thereby move said lever to sequentially operate said switch and said alarm vibrator, whereby when said latch means is in one position said lever holds said switch open and obstructs operation of said alarm vibrator, when said latch is in another one of said positions said lever allows the switch to be closed but obstructs operation of said alarm vibrator, and when said latch is in a third position said lever releases the alarm vibrator and allows the switch to be closed.

6. In a timing device, an audible alarm vibrator, a switch, a lever for actuating said switch and for obstructing operation of said alarm vibrator, plural position latch means pivoted to said lever, spring means connected to said latch means for urging said latch means and lever in one direction, and means driven by said timing mechanism for successively disengaging said latch means to thereby allow said spring means to sequentially operate said switch and said alarm vibrator, whereby when said latch means is in one position said lever holds said switch open and obstructs operation of said alarm vibrator, when said latch is in another one of said positions said lever allows the switch to be closed but obstructs operation of said alarm vibrator, and when said latch is in a third position said lever releases the alarm vibrator and allows the switch to be closed.

7. In a timing device, an audible alarm, a switch, lever means for operating said switch and said audible alarm, latch means pivoted to said lever means for locking said lever means in one position to hold said switch open and to prevent operation of said alarm, a plurality of steps formed on said latch means, and means driven by said timing mechanism for pivoting said latch means on said lever means for disengaging one step of said latch means to thereby allow said lever means to move to a second position to close said switch at a preset time, said means driven by said timing mechanism being operable to further pivot said latch means on said lever means for disengaging a second step of said latch means to allow said lever means to move to a third position to thereby maintain said switch closed and permit operation of said audible alarm.

8. In a timing device, a switch having first, second and third operating positions, two of said positions being closed positions and one of said positions being an open position, a manually adjustable means continuously operated by said timing device for manually moving said switch to said open position and automatically moving said switch to one of said closed positions, and a manually presettable means for manually moving said switch to the other one of said closed positions and for automatically maintaining said switch in the other one of said closed positions for a preselected adjustable time interval.

9. In a timing device, a switch therein having first, second and third operating positions, two of said positions being closed positions and one of said positions being an open position, said switch being self-biased to one of said closed positions, a first manually presettable means continuously operated by said timing device for manually moving said switch to said open position and for automatically moving said switch to one of said closed positions, and a second manually presettable means for manually moving said switch to the other one of said closed positions and for maintaining said switch in the other one of said closed positions for a preselected adjustable time interval.

10. In a timing device, two fixed switch contacts spaced from each other and electrically connected to each other, a movable switch blade positioned between said fixed contacts, two oppositely disposed contacts on said movable switch blade for co-operation with said fixed contacts, a first manually presettable means continuously operated by said timing device for manually moving said switch blade to position said contacts on said movable switch blade between said fixed contacts to open said switch and for automatically positioning said switch blade so that one of said contacts on said switch blade abuts one of said fixed contacts to close the switch at a preset time, and a second manually presettable means for manually positioning said switch blade so that the other one of said contacts on said switch blade abuts the other fixed contact to thereby close the switch and for maintaining said switch in said closed position for a preselected adjustable time interval.

11. In a timing device, a switch and means for manually closing said switch when open and maintaining it closed for a predetermined adjustable time and opening the same automatically at the end of such time, comprising a first gear continuously rotated by said timing device, a second gear connected in driving relation with said first gear through a friction clutch, a gear sector manually rotatable from a demeshed position into and out of mesh

with said second gear, a cam slot cut in said second gear sector, a cam follower lever co-operating with said cam slot and in operative relation with said switch such that when the gear sector is rotated into and out of mesh with the second gear said switch is closed and opened, respectively, by said cam slot and lever, the direction of rotation of said continuously rotating first gear being in such a direction as to rotate the gear sector out of mesh to open said switch, said clutch being adjusted to slip only during the manual rotation of said second gear by said gear sector.

12. In a timing device, a switch and means for manually closing said switch when open and maintaining it closed for a predetermined adjustable time and opening the same automatically at the end of such time, comprising a first gear continuously rotated by said timing device, a second gear connected in driving relation with the said first gear through a friction clutch, a gear sector manually rotatable from a demeshed position into and out of mesh with said second gear, spring means for biasing said gear sector to a demeshed position, a cam slot cut in said gear sector, a cam follower lever co-operating with said cam slot and in operative relation with said switch such that when the gear sector is rotated into and out of mesh with said second gear the switch is closed and opened respectively by the cam slot and lever, the direction of rotation of said continuously rotating first gear being in such a direction as to rotate said gear sector out of mesh to open said switch, said clutch being adjusted to slip only during the manual rotation of said second gear by said gear sector.

References Cited in the file of this patent

UNITED STATES PATENTS

2,424,116	Puerner	July 15, 1947
2,444,748	Parissi	July 6, 1948
2,505,573	Prophet	Apr. 25, 1950
2,512,775	Parissi	June 27, 1950
2,626,660	Seeler et al.	Jan. 27, 1953
2,721,441	Boyles	Oct. 25, 1955
2,773,548	Thompson et al.	Dec. 11, 1956
2,782,274	Powers et al.	Feb. 19, 1957
2,876,344	Miller	Mar. 3, 1959