March 3, 1970 C. A. McLEOD ET AL 3,498,047

ALARM TERMINATING MEANS

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Fig. 1.

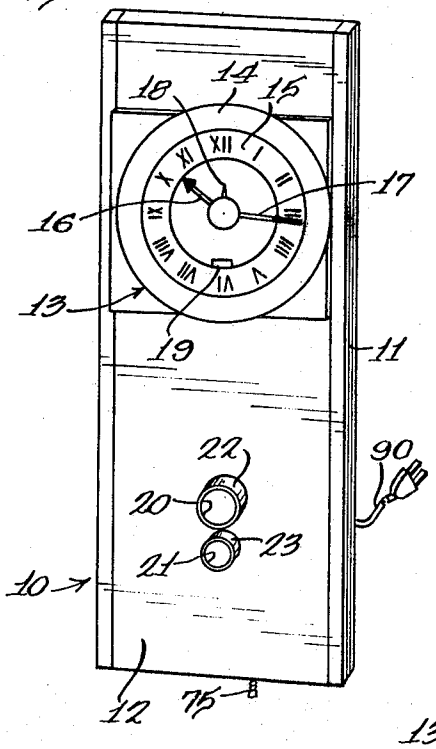


Fig. 3.

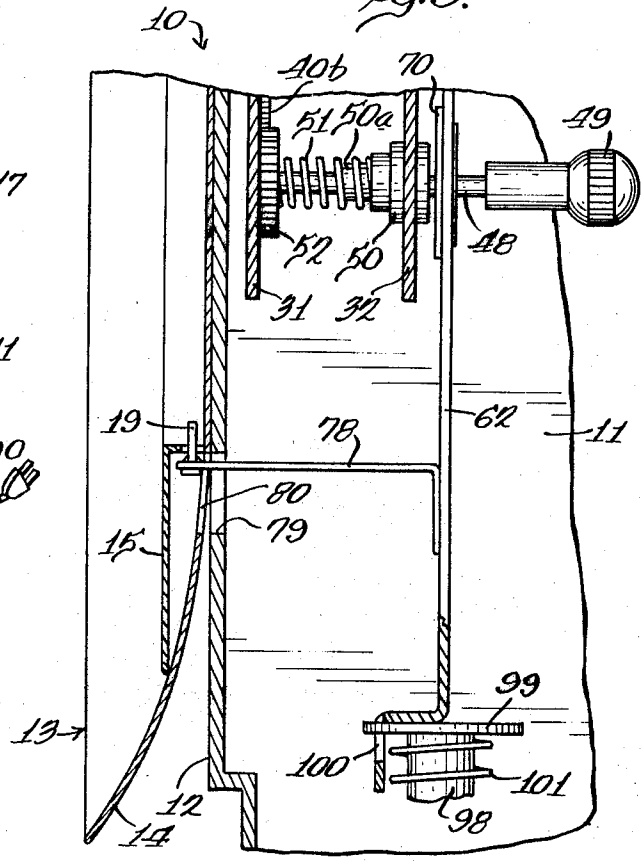
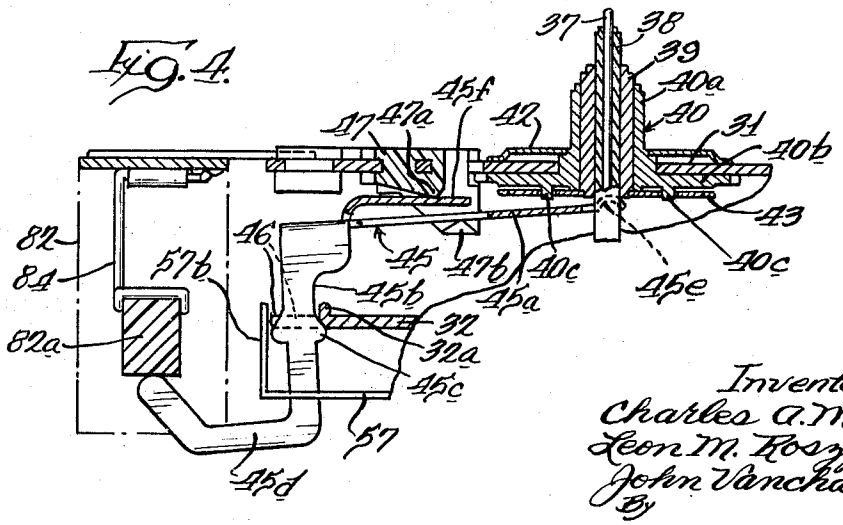


Fig. 4.



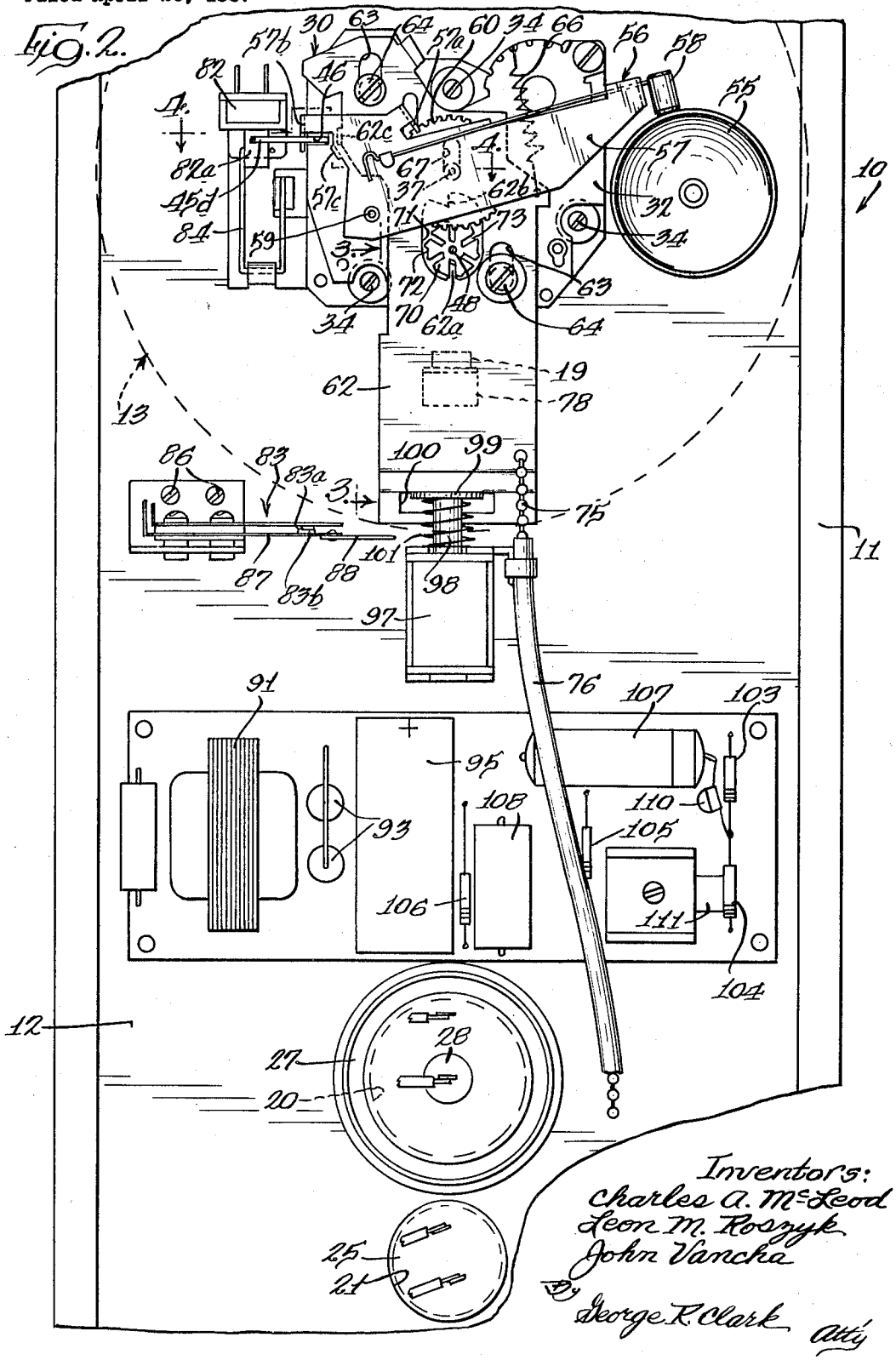
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ALARM TERMINATING MEANS

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Fig. 2.



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ALARM TERMINATING MEANS

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Fig. 5.

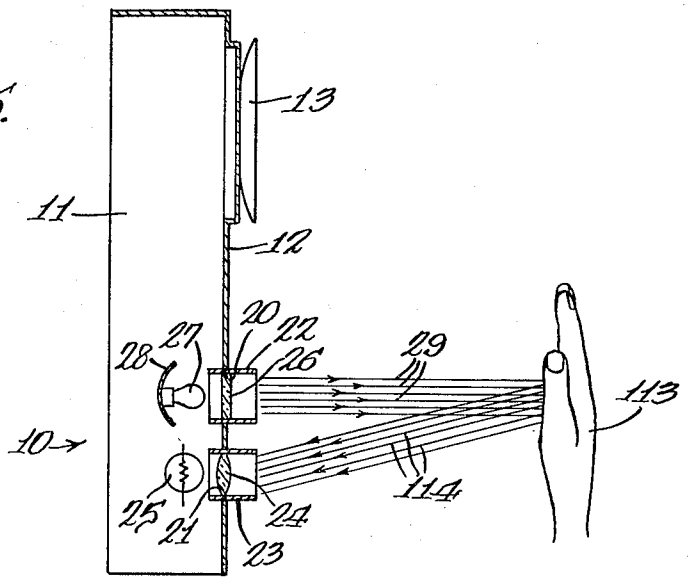
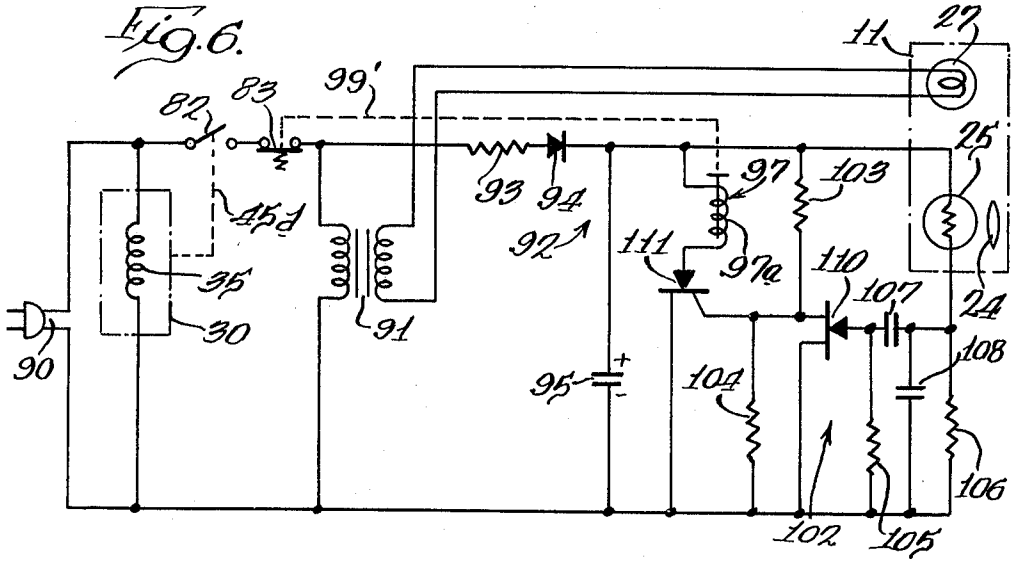


Fig. 6.



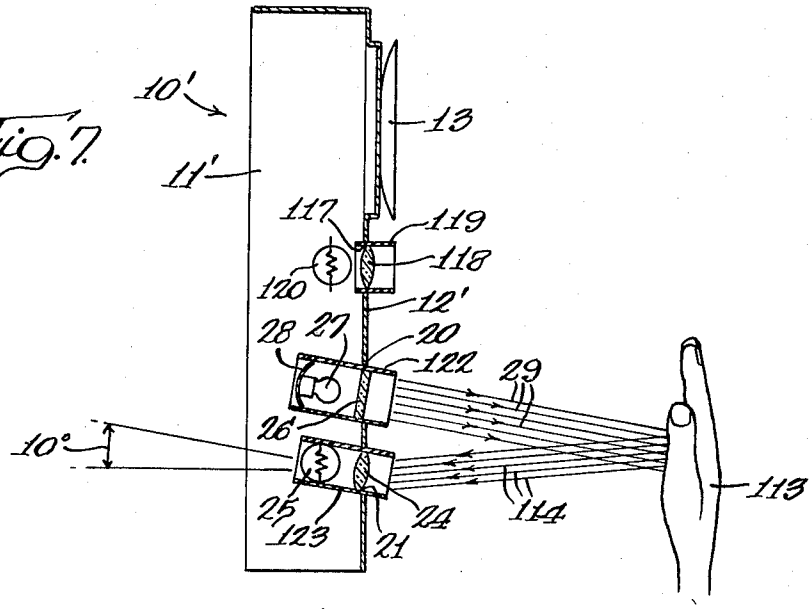
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ALARM TERMINATING MEANS

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Fig. 7.



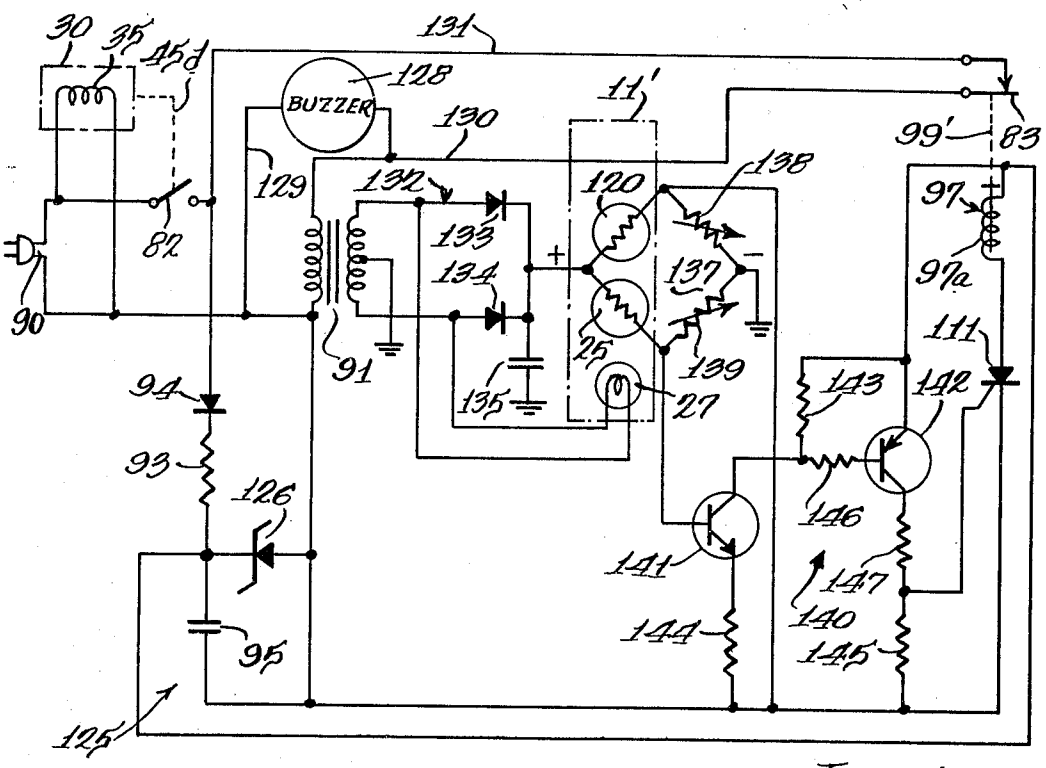


Fig. 8.

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United States Patent Office 3,498,047
Patented Mar. 3, 1970

3,498,047

ALARM TERMINATING MEANS

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Filed Apr. 26, 1967, Ser. No. 633,746
Int. Cl. G04b 13/00
U.S. Cl. 58—21.15 11 Claims

ABSTRACT OF THE DISCLOSURE

An electric alarm clock is provided in which the alarm may be shut off by the user without touching the clock or any part thereof. The electric alarm clock is provided with a light and a photoelectric control means, whereby, when the alarm comes on, a light beam is directed over the bed of the user. Then the user, by merely moving an arm or the like, will cause at least some of the light from the beam to reflect back to the photoelectric control means in the clock with the result that the alarm is shut off.

The present invention relates to an electric alarm clock and more particularly to improved means for terminating the alarm without the necessity of even touching the clock or any part thereof.

Electric alarm clocks are employed extensively to produce an audible signal at a predetermined time, generally to awake the user. The most common means of terminating the alarm of an electric alarm clock, once it is actuated, is to move the manual alarm "On" and "Off" button or means to the "Off" position. This requires the user to physically engage this button or means on the clock. Means are also available whereby the user may terminate the alarm merely by touching a portion of the clock without specifically finding and actuating the "On-Off" button. With either of these arrangements, however, it is necessary to have the clock close to the user's bed (if it is desired to terminate alarm operation while the user remains in bed) so that the user may readily touch the clock for terminating the alarm or specifically actuate a manual alarm "On" and "Off" button to the "Off" position. It would be desirable to permit the alarm clock to be disposed remote from the bed of the user while still permitting the user to terminate the alarm in a simple manner without getting out of bed or going near the clock to touch a portion thereof.

Accordingly, it is an object of the present invention to provide an improved alarm control mechanism for an electric alarm clock.

It is a further object of the present invention to provide an improved alarm terminating control means whereby the alarm may be terminated without touching any part of the alarm clock even though the clock is remote from the user.

It is another object of the present invention to provide an improved alarm terminating means wherein the user may merely move some part of his body into a predetermined position quite remote from the alarm clock to terminate operation of the alarm.

Still a further object of the present invention resides in an improved electric alarm terminating means wherein a light is energized concurrently with the alarm and this light is directed toward the user whereby the user merely needs to intercept momentarily the beam from this light to terminate the alarm.

It is another object of the present invention to provide an improved alarm control mechanism which is low in cost, easy to operate, has relatively few parts, is readily adaptable to existing clocks and which is simple and foolproof in operation.

Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this application.

For a better understanding of the present invention reference may be had to the accompanying drawings in which:

FIG. 1 is a front perspective view of an electric clock embodying the alarm terminating mechanism of the present invention with the parts in the alarm "On" position set to start the alarm at approximately 12:00 o'clock;

FIG. 2 is a greatly enlarged fragmentary rear plan view of the electric alarm clock of FIG. 1 more clearly to illustrate the parts of the clock and alarm mechanism and the alarm terminating mechanism with certain portions cut away;

FIG. 3 is an enlarged fragmentary sectional view taken on line 3—3 of FIG. 2 assuming that FIG. 2 shows the complete structure and with certain portions broken away to aid in illustrating the invention;

FIG. 4 is a greatly enlarged fragmentary sectional view taken on line 4—4 of FIG. 2 assuming that FIG. 2 shows the complete structure and again with certain portions shown in full to aid in illustrating the invention and also with other parts broken away to simplify the disclosure;

FIG. 5 is a somewhat schematic side elevational view of the electric alarm clock of FIG. 1 to illustrate the operation of the remote alarm terminating feature thereof;

FIG. 6 is a schematic circuit diagram of the electric control system of the alarm clock of FIG. 1;

FIG. 7 is a somewhat schematic view similar to FIG. 5 of a modification of the electric alarm clock terminating means of the present invention; and

FIG. 8 is a schematic circuit diagram similar to FIG. 6 illustrating the electrical circuit of the modified arrangement of FIG. 7.

Briefly, the present invention is concerned with an electric alarm clock in which upon actuation of the audible alarm an electric light is energized to direct a beam of light over the bed of the user. A photoelectric cell is incorporated in the clock so that, if the user interposes his hand into the light beam directed over the user's bed, light reflected from the hand of the user will reach the photoelectric cell and through a suitable control circuit actuate a relay or other means effectively to shut off or terminate the audible alarm. In one modification the conventional alarm arrangement already associated with the clock is used and the photoelectric control incapacitates this alarm. In another embodiment a separate buzzer or alarm is provided and the solenoid interrupts the electrical circuit of this buzzer and thus terminates the alarm.

Referring now to the drawings and specifically to FIGS. 1 to 6 thereof, there is illustrated an electric clock generally indicated at **10**. The particular construction of the clock or casing forms no part of the present invention but is included merely to illustrate the present invention. As illustrated the clock **10** is what is commonly termed a wall clock in that it is hung from the wall so the front thereof is pointed in the direction of the bed of the user. Obviously, a clock adapted to rest on a dresser or the like could equally well be employed, the specific disclosure being by way example only. The clock **10** comprises a hollow rectangular casing or housing **11** comprising a front wall **12** on which is mounted any suitable clock face generally designated as **13**. As best shown in FIGS. 1 and 3 of the drawings, the clock face **13** comprises a circular saucer-shaped member **14** secured to the casing **11** with the concave side thereof defining part of the front of the clock face. Superimposed

over member **14** and secured thereto is an annular disk **15** upon which the clock figures are positioned in the conventional manner. A suitable hour hand **16**, a minute hand **17** and an alarm set indicating hand **18** are provided in the conventional manner. Although not shown in the drawings, obviously a sweep second hand may also be employed suitably associated with the clock face **13**.

In order that the operator can readily see whether the alarm is set, a suitable indicator such as a flag **19** is provided in addition to the alarm set hand **18**. Thus, the user can readily observe whether the alarm is on and the time when it will be actuated.

In accordance with the present invention, a pair of openings **20** and **21**, each surrounded by suitable, annular forwardly projecting shielding hoods **22** and **23**, respectively, are provided in the front wall **12** of housing **11** (FIGS. 1 and 5). The opening **21** is preferably closed by a suitable convex lens **24** schematically illustrated in FIGS. 5 and 6 of the drawings. Also, in accordance with the present invention, a suitable photoelectric cell **25** (FIGS. 2, 5 and 6) is disposed within the clock casing **11** immediately behind the lens **24**. The opening **20** is preferably closed by a suitable window **26** which may also comprise a lens of some sort, and a suitable electric lamp **27** and a reflector **28** (FIGS. 5 and 6) are provided so that when the lamp **27** is energized the reflector **28** causes light rays to be directed forwardly, as indicated at **29** (FIG. 5), from the front **12** of the clock **10**. The elements **20**, **21**, **22**, **23**, **24**, **25**, **26**, **27** and **28** may be mounted as a unit on a separate moveable panel suitably supported by the wall **12**, whereby this unit may be swiveled and selectively positioned at slightly different angles so the light rays, such as **29**, may be directed as desired.

Although any suitable clock motor and movement may be employed to drive hands **16** and **17**, there has been illustrated in the drawings the electric clock motor and movement disclosed and claimed in Jepson et al. Patent No. 3,248,867, granted May 3, 1966, and assigned to the same assignee as the instant application. It should be understood, however, that the present invention is not restricted for use with the specific clock motor and movement of the aforesaid Jepson et al. patent, the latter construction being disclosed merely by way of example. In view of the full disclosure of the clock motor and movement in the above mentioned Jepson et al. patent, only those parts which are clearly necessary to an understanding of the present invention will be mentioned or described herein. However, for the complete details of the clock motor and movement reference may be had to Patent No. 3,248,867 which is incorporated in this application by reference.

The electric clock motor and movement designated generally as **30** is shown in FIG. 2 of the drawings and some parts thereof are shown in FIGS. 3 and 4 of the drawings. It is also schematically indicated in FIG. 6 of the drawings. As fully disclosed in Patent No. 3,248,867, it comprises a front support plate **31** (FIGS. 3 and 4) and a rear support plate **32** (FIGS. 2, 3 and 4). These front and rear support plates **31** and **32** form a frame when assembled in spaced relation by means of suitable frame support posts, as is described in the above mentioned Jepson et al. patent, and all the parts of the clock motor and movement are carried by these plates. It will be understood that the clock motor and movement **30** is suitably secured as by screws **34** within clock housing **11** to drive the clock hands **16** and **17**. The front and rear support plates **31** and **32** are formed of a ferrous or magnetic material and serve as the field members for the motor portion of the integrated clock motor and movement **30** as well as serving as support members for the various shafts, levers, etc., included in the mechanism **30**. The clock motor includes a motor field coil which is not visible in any of the structural views of the drawings, but is schematically illustrated as **35** in the circuit diagram of FIG. 6 of the drawings. When the field coil **35** is energized by conventional **60** cycles per second alternating current, a suitable rotor (not shown) is rotated at the rate of 200 revolutions per minute in one embodiment built in accordance with the present invention. By a suitable gear mechanism, including certain gears and pinions mounted on suitable shafts journaled in bearings supported by the plates **31** and **32**, means are provided to drive a sweep second shaft **37** (FIGS. 2 and 4) which extends through the front plate **31**, as shown in FIG. 4 of the drawings. Although a sweep second hand has not been illustrated in FIG. 1 of the drawings, it could obviously be applied to the forward end of the shaft **37**. Concentrically mounted relative to the sweep second shaft **37**, as best shown in FIG. 4 of the drawings, are a series of concentrically arranged tubular shafts including the minute shaft **38**, the hour shaft **39** and a tubular shaft portion **40***a* of a combined alarm gear, cam and shaft member **40** preferably integrally formed as a unit, as clearly shown in FIG. 4 of the drawings. It will readily be understood that the minute hand **17** is associated with the outer end of the minute shaft **38**, the hour hand **16** is associated with the outer end of the hour shaft **39** and the alarm set indicator hand **18** is associated with the outer end of the tubular shaft portion **40***a* of the combined alarm gear, cam and shaft member **40**.

As illustrated, the combined alarm gear, cam and tubular shaft member **40** includes an alarm gear portion **40***b* (FIGS. 3 and 4) having a pair of diametrically opposed cam portions **40***c* projecting from the side thereof opposite the side from which the tubular shaft portion **40***a* projects. The face of the alarm gear **40***a* remote from the cams **40***c* engages with the inside face of the front support plate **31** and is held assembled thereto by a suitable spring disk **42** (FIG. 4). The disk **42** is preferably staked to the tubular portion **40***a* of the combined alarm gear, cam and shaft member **40** and thus holds the alarm gear in assembled relationship to the front plate **31**. The outer periphery of the spring disk **42** is flanged rearwardly and engages the front side of support plate **31**. The frictional engagement between the spring disk **42** and the front plate **31** permits rotation of the alarm gear **40***b* when desired, but retains it in the position selected even against the tendency of the hour shaft **39** disposed therein to cause rotation thereof.

As is best shown in the above mentioned Jepson et al. patent, a suitable hour gear **43** is provided which is staked or otherwise suitably secured to the tubular hour gear shaft **39** at the inside end thereof. This hour gear **43** is provided with suitable openings to receive the cams or projections **40***c* of the alarm gear **40***b* for a selected short period of time during the rotation of the hour gear **43** with respect to the alarm gear **40***b*. When the projections **40***c* are received in the openings in the hour gear **43**, then the hour gear assumes the position shown in FIG, 4 of the drawings closely adjacent the alarm gear **40***b*. However, for the majority of the time, the hour gear rotates so the projections **40***c* are moved out of the openings in the hour gear and the hour gear is axially moved away from the alarm gear to the position shown in FIG. 10 of the drawings of Jepson et al. Patent No. 3,248,867. It should be noted that FIG. 4 of the instant application is quite similar to FIG. 11 of the aforesaid Jepson et al. patent.

As fully disclosed in the aforesaid Jepson et al. patent, the axial movement of the hour gear **40***b* is utilized to perform an alarm actuating function. To this end there is provided an alarm lever generally indicated at **45** (FIG. 4) which is of somewhat Z-shaped configuration including one arm **45***a* disposed generally parallel to the front plate **31** of the clock motor and movement **30**. The lever **45** also includes an arm **45***b*, including an enlargement **45***c*, which is disposed within a slot **46** (FIG. 2) in the rear support plate **32**. Support plate **32** is provided with an integral projection **32***a* at the inner edge of slot **46** defining a stop for the enlargement **45***c*. Additionally,

the alarm lever **45**, in accordance with the present invention, includes a switch actuating projection **45***d* (FIGS. 2, 4 and 6) the function of which will be described in greater detail hereinafter. Also, as in the above mentioned Jepson et al. patent, the enlargement **45***c* functions as an alarm control member.

The arm **45***a* of the alarm lever **45** includes at one end a bifurcated portion for receiving between the bifurcations the tubular minute shaft **38** (FIG. 4). The bifurcations actually include the deformed portions **45***e* which engage and ride against the hour gear **43** effectively biasing the hour gear to the position shown in FIG. 4 of the drawings. The portion **45***a* of the alarm lever **45** is pivoted intermediate its ends by means of a plastic bearing block **47**, which is molded to the front plate **31**. The center portion of the leg **45***a* of the alarm lever **45** includes a sheared out portion **45***f* which actually functions as a biasing spring for the alarm lever **45**, but which for purposes of simplification is an integral part of the alarm lever. The end of the biasing spring portion **45***f* of the alarm lever engages the body portion **47***a* of the bearing block **47**, urging the portion **45***a* of the alarm lever against the fulcrum portions **47***b* of the plastic bearing block **47**. Because of the relative positions of the application of the biasing force with respect to the fulcrum portions **47***b*, the alarm lever **45** is caused to rotate counterclockwise around the fulcrum portions **47***b* as viewed in FIG. 4 of the drawings to cause a biasing force to be exerted on the hour gear **43** moving it toward alarm gear portion **40***b*. It will be apparent from an examination of FIG. 4 that the enlargement **45***c* of the alarm lever **45** will move from the position shown in FIG. 4 of the drawings to a position somewhat to the left, so as to perform an alarm shutoff or immobilization function as described hereinafter when cams **40***c* cause axial movement of hour gear **43** away from alarm gear **40***b*.

In order to permit setting of the hands **16** and **17** of the clock **10**, as well as for setting of the alarm set indicator hand **18**, there is provided an axially moveable shaft **48** (FIGS. 2 and 3) which carries on its outer end a plastic knob **49** (cut away in FIG. 2 of the drawings) suitable for manual actuation. The shaft **48** is supported for rotation and axial movement in elongated bearing **50** (FIG. 3) which is molded to the rear supporting plate **32**. The bearing **50** includes a forwardly extending tubular guiding portion **50***a* of reduced diameter which serves to support on its inner diameter the shaft **48** and receives on its outer diameter a helical spring **51**. Secured to the front end of shaft **48** is a set gear **52** which preferably includes a guiding boss (not shown) receivable in a suitable opening in the front support plate **31**. The helical spring **51** biases the set gear **52** to the position shown in FIG. 3 of the drawings in meshing engagement with the alarm gear **40***b*. It will be understood that the set shaft **48** may be axially withdrawn to the limit of it movement permitted by the elongated plastic bearing **50** whereby the set gear **52** is in driving engagement with a suitable gear (not shown) secured to the minute shaft **38**. Thus, in the retracted position, rotation of the shaft **48** causes rotation of the minute shaft **38** and setting of the clock hands **16** and **17**.

Although in the Jepson et al. Patent No. 3,248,867 referred to above an alarm vibrator member is employed which is vibrated by virtue of the alternating magnetic field produced by the motor, the present invention is illustrated with a somewhat different alarm arrangement, such as disclosed in a copending application of James W. Richmond, Ser No. 565,041, filed July 5, 1966, and also assigned to the same assignee as the instant application. It should be understood, however, that, if desired, the vibrator alarm of the Jepson et al. patent may be used with the present invention.

In the Richmond application, there is illustrated an imroved alarm control mechanism associated with the same slonk motor and movement of the above mentioned Jepson et al. patent. Moreover, in the Richmond application, the alarm control mechanism is one that can be successively turned on and off by a successive and simple light touching movement, very similar to tapping the spacer bar on a typewriter.

The alarm mechanism illustrated in the drawing is essentially identical with that disclosed in the above mentioned Richmond application. It comprises a bell **55** (FIG. 2 of the drawings) suitably mounted within clock casing **11** adjacent the clock motor and movement **30**. This bell is positioned to be struck intermittently by a hammer mechanism, indicated generally by the reference numeral **56**. The hammer mechanism **56** comprises a pivoted lever **57** having mounted at one end thereof a slug of metal or hammer head **58**. The lever **57** is pivotally mounted about a pivot pin **59** suitably supported on the mechanism **30**.

In order to cause the lever **57** to move up and down slightly to cause the hammer head **58** to strike the bell **55**, there is provided a toothed wheel **60**, which is secured to the sweep second hand shaft **37** so as to make one revolution per minute. This toothed wheel **60**, which rotates constantly with the sweep second hand shaft **37**, causes the head **58** to move up and down pivoting about pivot pin **59** by virtue of a tab portion or projection **57***a* integrally formed with the lever **57** capable of engaging successive teeth of the toothed wheel **60**. The lever **57** includes, in addition to the tab **57***a*, downwardly directed alarm control tabs **57***b* (FIGS. 2 and 4) and **57***c* (FIG. 2) identical with corresponding parts in the Richmond copending application, the functions of which are more fully described hereinafter.

Considering now the alarm control mechanism for manually turning the alarm on and off, which is very similar to that disclosed in the above mentioned Richmond application, it comprises a slidable plate **62** (FIGS. 2 and 3) disposed in spaced parallel relationship with the rear support plate **32**. This plate is provided with a pair of elongated openings **63** for receiving suitable fastening means **64** to secure the slidable plate to the rear plate **32** in a manner to permit limited relative movement between these plates. Suitable support members (not shown) maintain the plate **62** in spaced relationship from the rear plate **32** and the slots **63** permit the limited movement of plate **62** in an up and down direction (as viewed in FIG. 2 of the drawings) relative to the clock motor and movement **30**. A suitable tension spring **66** having one end secured to the rear support plate **32** and the other end secured to the slidable plate **62** biases the slidable plate to its uppermost position, as shown in FIG. 2 of the drawings. Plate **62** is provided with an elongated slot **67** to clear the sweep second shaft **37** to which the toothed wheel **60** is attached, the toothed wheel being disposed to the rear of the slidable plate **62**.

For the purpose of successively positioning the plate **62** in the upper position, shown in FIG. 2 of the drawings, and in an intermediate position, sort of halfway between this upper position and the lowermost position permitted by virtue of the slots **63**, there is provided a toothed wheel **70** rotatable about the axially movable alarm shaft **48**. The toothed wheel **70** is in the plane of the slidable plate **62** and, to accommodate the same, this plate **62** is provided with a clearance opening **71** of a particular configuration to provide an elongated upwardly extending lug **62***a* at the bottom edge of the clearance opening **71** and a downward extending tooth **62***b* at the upper edge of the clearance opening and more or less diametrically opposed to the projection **62***a*. These projections are preferably integrally formed with the slidable plate **62**. The plate **62** also includes an upwardly extending tab **62***c* (FIG. 2) adapted to cooperate with the downwardly depending tab **57***c* of the hammer supporting lever **57**. The teeth of toothed wheel **70** are so shaped as to define alternate shallow notches or recesses **72** and deep recesses or notches **73**. When the slideable plate **62** is moved down-

wardly, as viewed in FIG. 2 of the drawings, the lower lug **62***a* is moved out of whatever notch it happened to be engaged with and the upper lug **62***b* is moved into engagement with one of the teeth. Due to the shape of the lug **62***b* and the teeth on the toothed wheel **70**, such movement causes slight counterclockwise rotation of the toothed wheel **70**, whereby successive actuations of the plate **62** will rotate the wheel in a counterclockwise direction to cause the lower lug **62***a* to successively move into either a deep notch or slot **73** or a shallow slot or notch **72**. When the lug **62***a* is in a deep slot **73**, the plate **62** moves to its uppermost position under the influence of biasing spring **66**, as shown in FIG. 2 of the drawings. When the lug **62***a* is in a shallow recess, then the plate **62** is moved downwardly to an intermediate position. In this intermediate position, the tab **62***c* engages the tab **57***c* to move tab **57***a* out of engagement of toothed wheel **60**, thereby rendering the alarm ineffective. This is the alarm "Off" position of slidable plate **62**. It will be apparent then that the slideable plate **62** by successive downward movements first moves the alarm mechanism to the "On" position and then to the "Off" position, it being shown in FIG. 2 in the "On" position with the lug **62***a* in a deep slot **73**.

For the purpose of manually actuating the alarm to the "On" position, a suitable flexible chain **75** (FIGS. 1 and 2) is provided, connected to the lower end of slidable plate **62**. A suitable conduit **76** mounted within the clock housing **11** guides the flexible conduit, so it doesn't interfere with any of the mechanism within the housing. The lower end of the flexible chain **75**, as shown in FIG. 1 of the drawings, depends from the clock housing **11** so as to be readily accessible to the user. By pulling on the chain, the alarm is manually successively turned on and off. It should be obvious that other manual means for actuating slideable plate **62** may readily be employed.

In order that the user may know whether the alarm is in the "On" or "Off" position, a suitable indicator comprising the flag **19**, described heretofore, is provided. The flag **19** is connected by suitable arm **78** to the slideable plate **62**, as best shown in FIG. 3 of the drawings. This arm extends through openings **79** and **80** in front of the wall **12** and saucer shaped member **14**, respectively. Thus, the flag **19** will indicate when the alarm is in the "On" position and, of course, hand **18** will indicate the time when the alarm will go off. When the alarm is not in the "On" position, the flag will not be visible, it being shown in the "On" position in FIGS. 1 and 2 of the drawings.

It will be apparent from the above description that, when the parts are in the positions shown in FIG. 4 of the drawings where the cams **40***c* of the alarm gear are in the openings of the hour gear **43** and when the slidable plate **62** is in the position shown in FIG. 2 of the drawings, the lever **57** is free to pivot about its axis **59** and successively strike the bell **55** as the tab **57***a* moves into engagement with successive teeth of the the toothed wheel **60**. If the user now pulls on chain **75**, the plate **62** will move downwardly and then move back to an intermediate position which is the alarm "Off" position. In this position, the tab **62***c* engages tab **57***c* and pivots lever **57** slightly in a counterclockwise direction, as viewed in FIG. 2 of the drawings, whereby tab **57***a* no longer engages the teeth of toothed wheel **60**. Thus, the alarm mechanism is immobilized, even if the alarm lever **45** were in the position shown in FIG. 4 of the drawings. After an elapse of a predetermined time, the cams **40***c* on the alarm gear **40***b* will move out of the openings in the hour gear **43** due to rotation of the latter, and the alarm lever **45** will move the enlargement **45***c* in slot **46** slightly to the left, as viewed in FIG. 4 of the drawings, into engagement with the tab **57***b* on the alarm lever **57**, thereby further immobilizing the alarm mechanism even if tab **62***c* did not engage tab **57***c*.

In view of the detailed description included above, it will be obvious that there is provided an alarm clock including a simple mechanism for turning the alarm "On" and "Off" manually by merely actuating the slideable plate **62**. In order that the alarm may be shut "Off" by the user while remote from the clock **10** or any portion thereof, there are provided within the housing **11** (FIG. 2), and as schematically indicated in FIG. 6 of the drawings, a pair of switches generally designated as **82** and **83**, respectively. As best shown in the schematic drawing of FIG. 6 of the drawings, switch **82** is a normally open switch which is actuated to the closed position by the extension **45***d* on the alarm lever **45** when the hour gear **43** reaches a certain position relative to the alarm gear **40***b* to cause the alarm to be actuated if slideable plate **62** is in its upper or "Alarm On" position. In FIG. 6 the extension **45***d* is schematically indicated as interconnecting the switch **82** and the clock motor and movement mechanism **30**. A suitable U-shaped spring member **84** is illustrated in FIG. 4 of the drawings for biasing the switch **82** and specifically the switch actuating knob **82***a* to the open position. Switch **82** is moved to the closed position against the bias of spring **84** by the extension **45***d* of the alarm lever **45**.

Switch **83** is illustrated as a normally closed switch suitably mounted within the clock casing **11** as by fastening means **86**. As best shown in FIG. 2, switch **83** comprises a stationary contact **83***a* and a movable contact **83***b*, the latter being mounted on a resilient switch arm **87**. A switch actuating extension **88** secured to the end of the resilient switch arm **87** is disposed in the path of the slideable plate **62**. When slideable plate **62** is in the uppermost position, shown in FIG. 2 of the drawings, the switch **83** is closed. However, when the slideable plate **62** is moved to its intermediate or lowermost position as limited by the slots **63**, then the switch **83** is moved to the open position.

To permit the photoelectric cell **25** described above to terminate the operation of the alarm in response to some interference with rays of light produced by the lamp **27**, there is provided an electrical control means, best shown in FIG. 6 of the drawings, and also to some extent shown in FIG. 2. In FIG. 6 of the drawings, the clock casing or housing **11** is shown schematically with the lamp **27** and the photoelectric cell **25** disposed therein. The lens **24** is also schematically illustrated. The clock motor and movement **30** is schematically illustrated as physically separate from the housing **11** in order to simplify the drawings. As shown in FIG. 6, a conventional power cord **90** adapted to be plugged into the ordinary household circuit is connected to the clock motor coil **35**, so that whenever the power cord **90** is plugged into a source of power, the electric motor of the clock motor and movement **30** is energized.

For the purpose of energizing the lamp **27** and also to render effective an electrical control circuit for the photoelectric cell **25** only when the switches **82** and **83** are both closed, these two switches are connected in series. As illustrated, when both switches **82** and **83** are closed a transformer **91** and a power supply network, generally designated as **92**, are energized. The power supply network comprises resistor **93**, diode or rectifier **94** and capacitor **95**. The transformer **91** is a step-down transformer for energizing the lamp **27** upon actuation of the alarm and the closing of switch **82**. Also, when switch **82** is closed, by virtue of diode **94**, a half wave rectified direct current charge appears across capacitor **95**, the resistor **93** functioning as a current limiting resistor.

In accordance with the present invention, there is provided a solenoid **97** (FIGS. 2 and 6) which, when energized, is capable of moving the switch **83** to the open position. The solenoid **97** is shown in FIG. 2 of the drawings as comprising a plunger **98** having a plunger head **99** receivable in a slot **100** in slideable plate **62**. A suitable biasing spring **101** biases the plunger head **99** to the uppermost position. Upon energization of the solenoid winding designated as **97***a* in FIG. 6 of the drawings, the

plunger **98** and plunger head **99** are moved downwardly as viewed in FIG. 2 of the drawings against the bias of spring **101** with the result that the slidable plate **62** is moved downwardly to its lower limit to engage projection **88** and momentarily open switch **83**. The connection between solenoid **97** and switch **83** is schematically indicated in FIG. 6 of the drawings by the reference numeral **99'**.

To energize the solenoid **97** in response to a sudden change of light effecting the photocell **25** and to prevent operation of solenoid **97** in response to gradual light changes, such as would occur when it becomes daylight or when the sun comes up and the light thereof enters the room, there is provided a photocell controlled network generally designated as **102**, the time constant of which network determines the speed of light change necessary to effect photocell **25** in a manner to energize solenoid **97**. As illustrated, this network comprises resistors **103**, **104**, **105** and **106**, capacitors **107** and **108**, an N-channel field effect transistor (F.E.T.) **110** and a silicon controlled rectifier (S.C.R.) **111**. The photocell control circuit **102** functions to cause the capacitor **95** to discharge through the winding **97***a* of the solenoid **97** when a sudden change of light occurs, such as when the hand of the user designated as **113** in FIG. 5 of the drawings intercepts the light rays **29** and causes them to reflect as light rays **114** toward the photocell **25**.

In view of the detailed description included above, the operation of the photocell control circuit will be readily understood. In the normal condition of the control circuit shown in FIG. 6 of the drawings where the alarm is set to go off at approximately 12:00 o'clock, due to the fact that switch **82** is open, only the winding **35** of the clock is energized from the power cord **90**. When the alarm is actuated, switch **82** is closed to complete a circuit through the diode or rectifier **94** to charge the capacitor **95** to a positive potential which is applied across the control network **102**. The positive potential provided across the capacitor **95** biases the transistor **110** which is connected as a common source amplifier or switch into a saturation region so that the gate of the rectifier **111** is shunted to the cathode electrode.

Closure of the switch **82** also energizes the transformer **91** so that the lamp **27** is illuminated. The illumination of the lamp **27** does not affect the control circuit **102**, even though it may serve to increase ambient lighting levels. When, however, the alarm is to be disabled and an object is moved to a position intercepting the light from the lamp **27** so that a portion thereof is briefly applied to and removed from the photocell **25** through the lens **24**, the momentary greatly increased illumination of the cell **25** produces a momentary and substantial reduction in its resistance. This abrupt change in the resistance of the cell **25** produces a pulse that controls the network **102** to place the silicon controlled rectifier **111** in conduction, to operate the solenoid **97**, and terminate operation of the alarm. Alternatively, if the level of illumination applied to the cell **25** varies gradually even though the change in illumination is such as to decrease the resistance of the cell **25**, the network **102** does not place the rectifier **111** in conduction.

More specifically, the photoelectric cell **25** forms one arm of a voltage dividing network including the resistance element **106** and the capacitor **108**. The latter is shunted across the element **106** and is normally charged to the potential drop across the element **106**. When the resistance of the cell **25** is abruptly decreased and increased, a positive-going pulse is developed which is differentiated in the network including the capacitor **107** and the resistance element **105** to provide a signal for reducing the conductivity of the field effect transistor **110**. If, on the other hand, a change in the level of illumination applied to the cell **25** is gradual, the time constant of the network including the resistance element **106** and the capacitor **108** is such that the capacitor **108** recharges to a new level determined by the changed resistance of the cell **25**, and the amplitude of the pulse applied to the differentiating network is not adequate to substantially change the level of conduction through the transistor **110**.

Assuming that an abrupt change in the level of illumination of the cell **25** has occurred, the differentiated signal applied to the gate of the transistor **110** produces a current flow in the drain-source circuit, and a positive-going signal appears across the resistance **104** sufficient to supply a threshold gate current for the rectifier **111**. This momentarily places the rectifier **111** in conduction so that the capacitor **95** discharges through the winding **97***a* of the solenoid **97**. The energization of the winding **97***a* of the solenoid **97** moves the slideable plate **62** to open the switch **83**. Such movement of slideable plate **62** causes lug **62***a* to be engaged with a shallow notch or recess **72** to disable the alarms by virtue of tabs **57***c* and **62***c*. Also, switch **83** is held in the open position until plate **62** is reset to the alarm "On" position. When the switch **83** is opened, the illumination of the lamp **27** is terminated, and power is removed from the circuits **92** and **102**, respectively. After a predetermined delay switch **82** is reopened by lever **45***d*.

Although the control circuit shown in FIG. 6 can be fabricated with components of many different values and types, in accordance with the desired circuit application, one control circuit, which was successfully built and tested, used the following components:

Resistor **93**	ohms	2,200
Capacitor **95**	μfd	100
Resistors:		
103	ohms	150,000
104	do	22,000
105	do	10,000,000
106	do	100,000
Capacitors:		
107	μfd	0.1
108	μfd	4
Lens **26**		Double convex
Focal length	mm	22
Diameter	mm	23.5

Referring now to FIGS. 7 and 8 of the drawings, there is illustrated a modification of the present invention in which the corresponding parts are designated by the same reference numerals as in the first described embodiment. In FIG. 7 there is schematically illustrated an electric alarm clock **10'** having a casing **11'** with a front wall **12'** which may be substantially identical with the clock **10** described above, except for the modification described hereinafter. The front wall **12'** contains the same openings **20** and **21** for accommodating the double convex lens **24** and the window **26**. A similar photocell **25** is associated with the opening **21** and the lens **24**. An identical lamp **27** and reflector **28** is associated with the opening **20** and the window **26**. In addition, the front wall **12'** is provided with another opening **117** remote from the openings **20** and **21** within which is mounted a double convex lens **118**. A suitable hood **119** surrounds the lens **118** and opening **117**. In addition, a second photoelectric cell **120**, which might be designated as an ambient light responsive photoelectric cell, is provided. The remote mounting of cell **120** from lamp **27** helps to insure that cell **118** is affected only by ambient light.

In order to further insure that the ambient light responsive photoelectric cell **120** will not be affected by the reflected rays **114** from the hand **113**, as shown in FIG. 7 of the drawings, the window **26**, the lamp **27** and the reflector **28** are preferably mounted in a tubular member **122** and similarly the lens **24** and photocell **25** are mounted in a tubular member **123**, which project from the front **12'** of the housing **11'** to function as protecting hoods for light rays emanating from lamp **27** and from reflected light rays received by the photocell **25**, respec-

tively. Moreover, the longitudinal axes of the tubular members **122** and **123** are disposed at an angle of the order of 10° to a perpendicular to the front of casing **12'** in a direction away from photocell **120**. Thus, with this angular relationship and with the relatively large spacing between opening **117** and openings **20** and **21**, light reflected from the hand of the user, for example, at distances of five feet or more from the clock will not influence the photocell **120**.

In FIG. 8 of the drawings, the power cord **90**, the clock motor and movement **30**, the clock motor winding **35**, the switch **82** actuated by the movement actuated element **45***d*, the photocell **25**, the lamp **27**, the solenoid **97** and its winding **97***a*, the switch **83** which is actuated through the element **99'** by the solenoid **97**, the silicon controlled rectifier **111**, the resistor **93**, the rectifier **94**, the capacitor **95** and the transformer **91** energizing the lamp **27** are illustrated as essentially the same as in the previously described embodiment. Also, as in the previous embodiment, the rectifier **94**, resistor **93** and the capacitor **95** provide a direct current power supply circuit, generally designated as **125**, for the solenoid **97** controlled by the silicon controlled rectifier **111**. The power network **125** also includes a Zener diode **126** which functions as a voltage regulator to attempt to maintain a predetermined charge on the capacitor **95** following closure of the switch **82**.

Instead of utilizing the alarm mechanism of the clock motor and movement **30**, in FIG. 8 of the drawings a separate audible signal means **128** is illustrated, which is energized from the power cord **90** when the serially ar ranged switches **82** and **83** are both closed. This is ac complished through a circuit comprising conductor **129**, audible electric signal **128**, conductor **130**, switch **83**, conductor **131** and switch **82**. Opening of either of the switches **82** or **83** will deenergize audible alarm signal means **128**.

As shown in FIG. 8 of the drawings, the transformer **91**, in addition to energizing lamp **27**, has its secondary winding connected in a full wave rectifier circuit, generally indicated at **132**, comprising a pair of rectifiers **133** and **134** and a smoothing capacitor **135**. The direct current output of this rectifier circuit **132** is applied to a Wheatstone bridge arrangement **137** wherein photocells **25** and **120** each comprise one arm of the bridge and the other two bridge arms are each comprised of adjustable resistances **138** and **139**, respectively. With this Wheatstone bridge arrangement **137**, a self-compensating circuit is provided which compensates for relatively wide changes in room illumination.

For the purpose of actuating the solenoid **97** in response to sudden light changes due to interfering with the rays from lamp **27**, the output of the Wheatstone bridge arrangement **137** is connected to a suitable SCR network, generally designated at **140** which comprises an NPN transistor **141**, a PNP transistor **142** and resistors **143**, **144**, **145**, **146** and **147**, as well as the silicon controlled rectifier **111**. Rapid light changes affecting the photocell **25**, such as reflection from the hand **113**, as indicated in FIG. 7 of the drawings, will cause opening of switch **83**. Gradual changes of light, which simultaneously affect photocells **25** and **120**, will not cause operation of switch **83**.

The operation of the modification of FIGS. 7 and 8 of the drawings will readily be understood. When the switch **82** is closed, assuming switch **83** is closed, the audible signal produced by the signal producing means **128** is actuated and power is supplied to energize the lamp **27** as well as the power network **125**, the Wheatstone bridge arrangement **137** and the SCR network **140**. When light from the beam produced by the lamp **27** is reflected back to the photocell **25**, it reduces the resistance of the latter and increases the positive voltage at the base of the transistor **141**. This signal is amplified by the transistor **142** and, if of sufficient magnitude, will render the silicon controlled rectifier **111** conductive, thus permitting the charge on capacitor **95** to discharge through the winding **97***a* of the solenoid **97** which in turn opens the switch **83** terminating the alarm. The slideable plate **62** then maintains the switch **83** open until the alarm is reset as described above. The silicon controlled rectifier **111** continues to conduct, thereby also maintaining the solenoid **97** energized until the clock motor and movement causes hour gear **43** through lever **45** and particularly extension **45***d* to open switch **83** thus deenergizing the entire circuit except for motor winding **35** until switch **83** is again moved to the closed position so as to be reset for the next operation, and switch **82** is closed.

It will be understood that the photocell **120**, in addition to providing compensation for changes in ambient light level, allows the circuit to operate in a "shadowing mode" when the room is brightly illuminated. In other words, if the user shadows photocell **120** with his hand, the signal at the base of transistor **141** becomes more positive and the circuit operates again as described above. This latter feature is not likely to be used to shut off the alarm.

While there have been illustrated and described several embodiments of the present invention, it will be apparent to those skilled in the art that numerous changes and modifications will occur.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. An electric alarm clock comprising, a clock motor and movement, alarm means for producing an audible signal, means associated with said clock motor and movement for rendering said alarm means effective at a selected time, an electric lamp associated with said clock, means for energizing said lamp substantially simultaneously with the rendering effective of said alarm means, light responsive means associated with said clock, and alarm terminating means actuated by said light responsive means for terminating the audible signal produced by said alarm means in response to changes in the amount of light from said lamp reflected back to said light responsive means.

2. The apparatus of claim **1** wherein said light responsive means comprises a photocell controlled network the time constant of which determines the speed of light change necessary to terminate the audible signal produced by said alarm means.

3. The clock of claim **1** wherein said means for energizing said lamp includes an electrical circuit including a first switch and a second switch connected in series, said first switch being normally open and closed at said selected time, said second switch being normally closed but opened by said alarm terminating means whereby said lamp is energized at said selected time.

4. The apparatus of claim **3** wherein said lamp is deenergized upon opening of said second switch.

5. The electric alarm clock of claim **1** wherein said alarm terminating means comprises a capacitor, a silicon controlled rectifier, a solenoid winding and a photocell, and wherein a rapid change in light reaching said photocell causes said silicon controlled rectifier to permit the charge on said capacitor to discharge through said solenoid winding.

6. Alarm terminating means for an electric alarm clock comprising, a casing, a clock motor and movement mounted in said casing, alarm means for producing an audible signal mounted in said casing, means in said casing interrelating said clock motor and movement with said alarm means to render said alarm means effective at a selected predetermined time, an electric lamp mounted on one wall of said casing so that light rays therefrom are directed from said wall away from said casing, means for energizing said lamp substantially simultaneously with the rendering effective of said alarm means, a photocell mounted in said wall adjacent said lamp, and circuit means connected to said photocell for terminating the audible signal produced by said alarm means in response

to changes in the amount of light from said lamp reaching said photocell.

7. An electric alarm clock comprising, a casing, a clock motor and movement mounted in said casing, alarm means for producing an audible signal mounted in said casing, means in said casing interrelating said clock motor and movement with said alarm means to render said alarm means effective at a selected predetermined time, an electric lamp mounted adjacent the front wall of said casing so that light rays therefrom are directed from said front wall away from said casing and over the bed of the user of said alarm clock, means for energizing said lamp substantially simultaneously with the rendering effective of said alarm means, a photocell mounted adjacent said front wall closely adjacent said lamp, a lens for causing light rays directed toward said front wall to reach said photocell, and circuit means connected to said photocell for rendering said alarm means ineffective following actuation thereof in response to change in the interception of light rays from said lamp reflected in the direction of said photocell.

8. The alarm clock of claim 7 wherein said circuit means includes two photocells both of which are disposed adjacent said front wall but the second one is remote from said lamp and the first photocell.

9. An electric alarm clock comprising, a casing, a clock motor and movement mounted in said casing, alarm means for producing an audible signal mounted in said casing, means in said casing interrelating said clock motor and movement with said alarm means to render said alarm means effective at a selected predetermined time, an electric lamp mounted adjacent the front wall of said casing so that light rays therefrom are directed from said front wall away from said casing and over the bed of the user of said alarm clock, means for energizing said lamp substantially simultaneously with the rendering effective of said alarm means, a photocell mounted adjacent said front wall closely adjacent said lamp, a lens for causing light rays directed toward said front wall to reach said photocell, and circuit means connected to said photocell including at least one transistor and a silicon controlled rectifier for rendering said alarm means ineffective following actuation thereof in response to rapid interception of light rays from said lamp by a moving portion of the body of the user to change the amount of light reflected from rays in the direction of said photocell.

10. The alarm clock of claim 9 wherein said circuit means includes a second photocell, and said photocells each comprise one arm of a balanced bridge arrangement.

11. An electric alarm clock comprising, a casing, a clock motor and movement mounted in said casing, alarm means for producing an audible signal mounted in said casing, alarm actuating means in said casing interrelating said clock motor and movement with said alarm means to render said alarm means effective at a selected predetermined time, an electric lamp mounted adjacent the front wall of said casing, a reflector for directing light rays from said lamp in a direction away from said front wall of said casing and over the bed of the user of said alarm clock, a photocell mounted adjacent said front wall closely adjacent said lamp, said photocell being incapable of receiving said rays unless reflected in a direction substantially opposite said predetermined direction, a source of electric power, circuit means including two serially connected switches for energizing said lamp from said source, one of said switches being normally open and the other of said switches being normally closed, means for closing said normally open switch to energize said lamp from said source when said alarm actuating means actuates said alarm, a control circuit including a rectifier and a capacitor connected to said source through said switches whereby said capacitor is charged from said source when both of said switches are closed, a solenoid including a winding, means for opening said normally closed switch in response to actuating of said solenoid, a silicon controlled rectifier interconnecting said winding and said capacitor, and means responsive to a predetermined change in light reaching said photocell for causing the charge on said capacitor to discharge through said winding and actuate said solenoid.

References Cited

UNITED STATES PATENTS

2,512,775	6/1950	Parissi	58—19 X
3,273,752	9/1966	Horeczky	250—210 X
3,328,592	6/1967	Shaw	250—221

FOREIGN PATENTS

383,287	11/1932	Great Britain.

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U.S. Cl. X.R.

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