

June 21, 1966

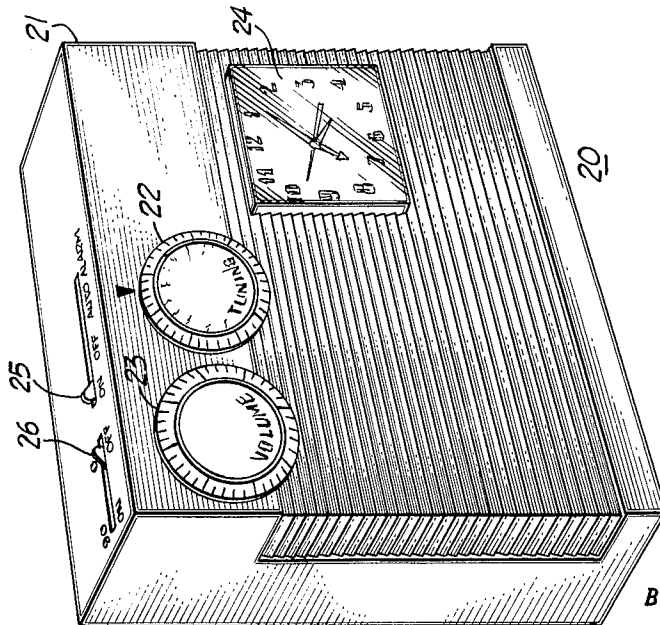
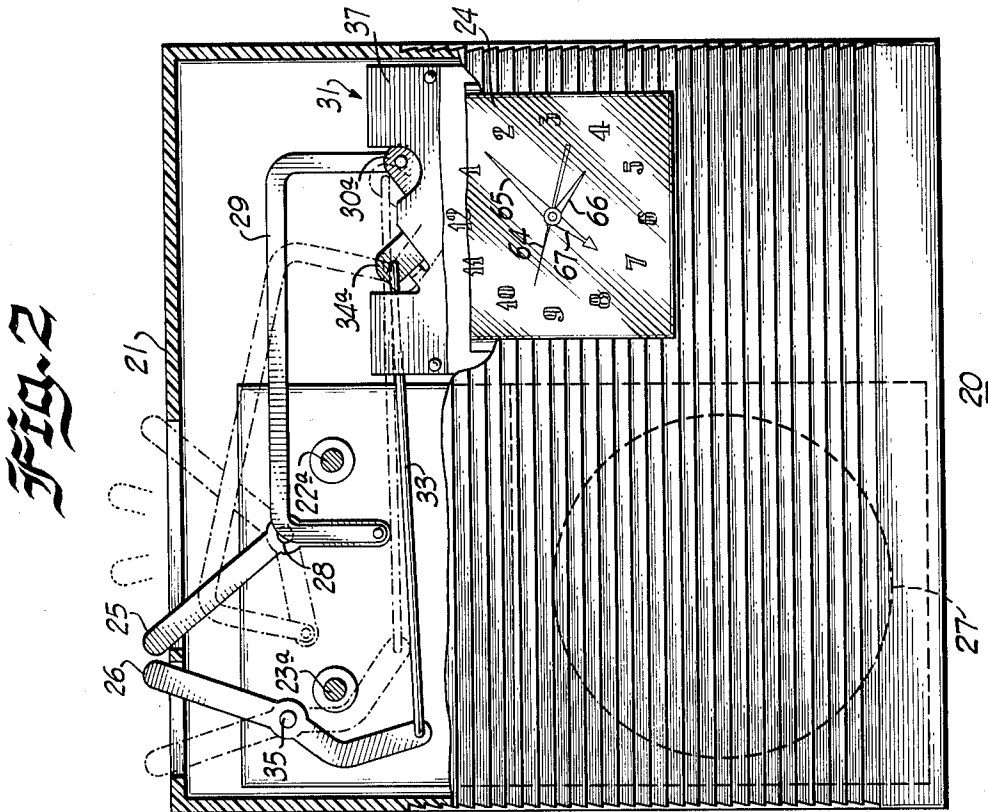
I. TREPANIER ETAL

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RADIO CLOCK TIMER

Filed Jan. 7, 1960

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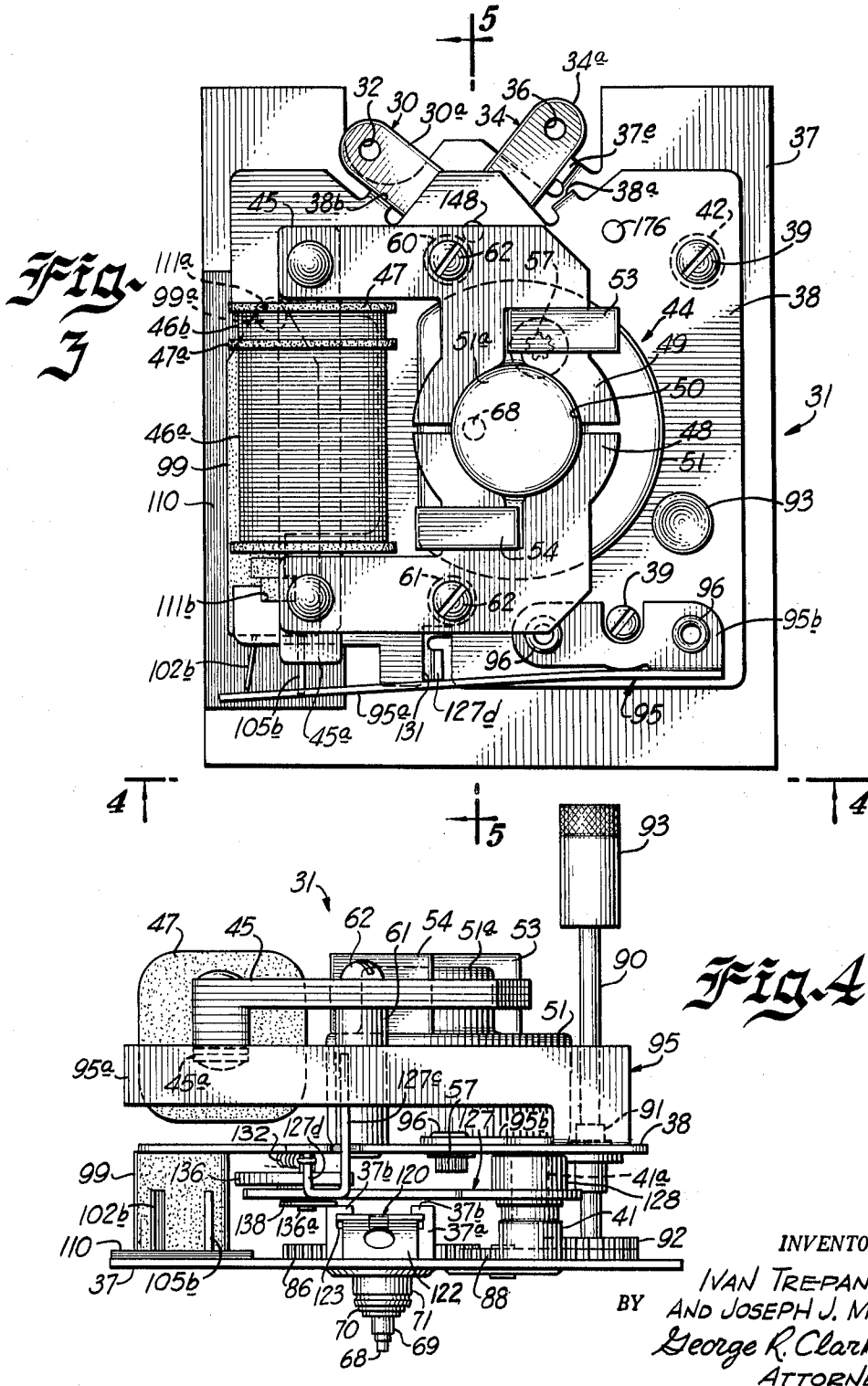
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RADIO CLOCK TIMER

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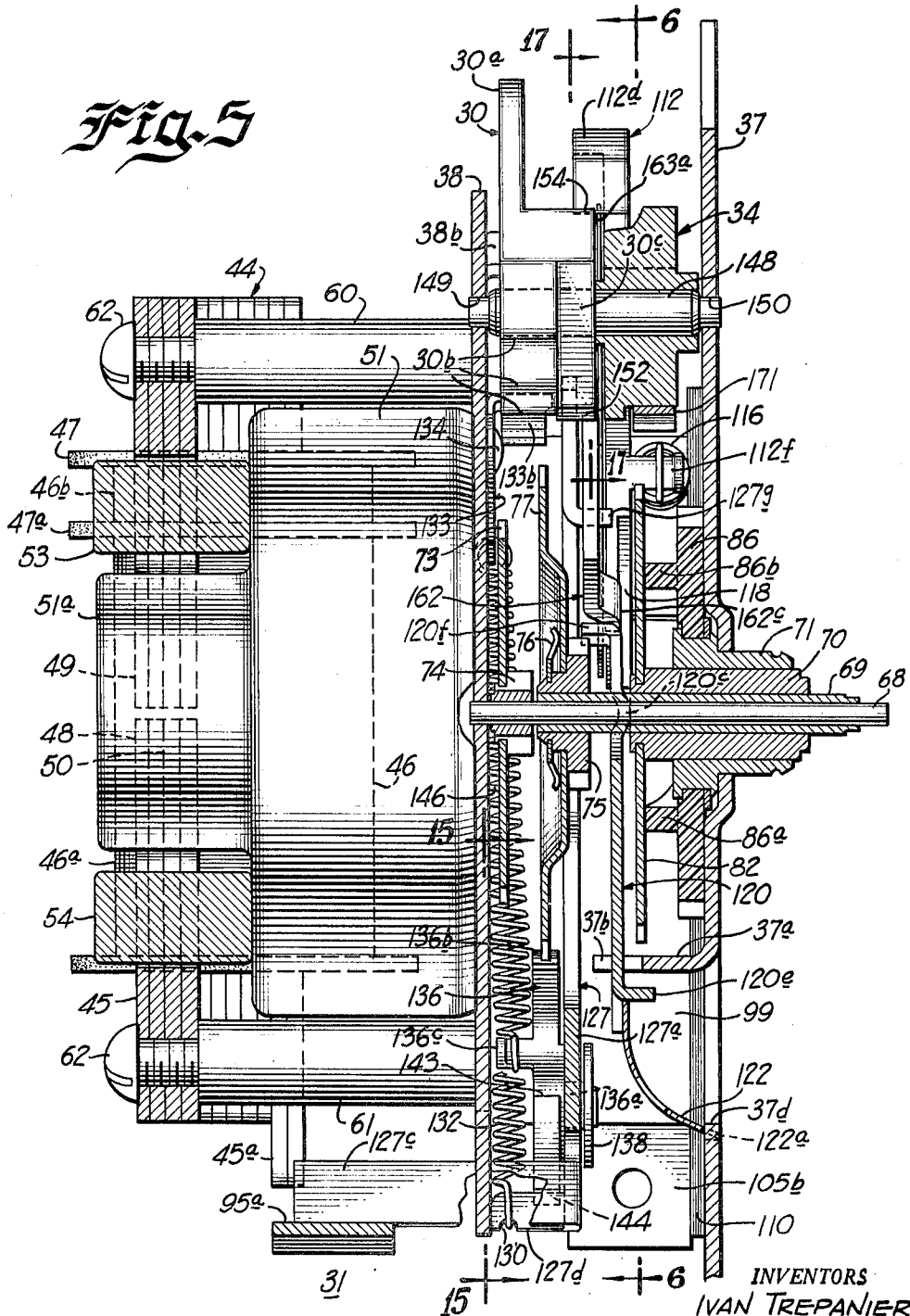
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Fig. 5



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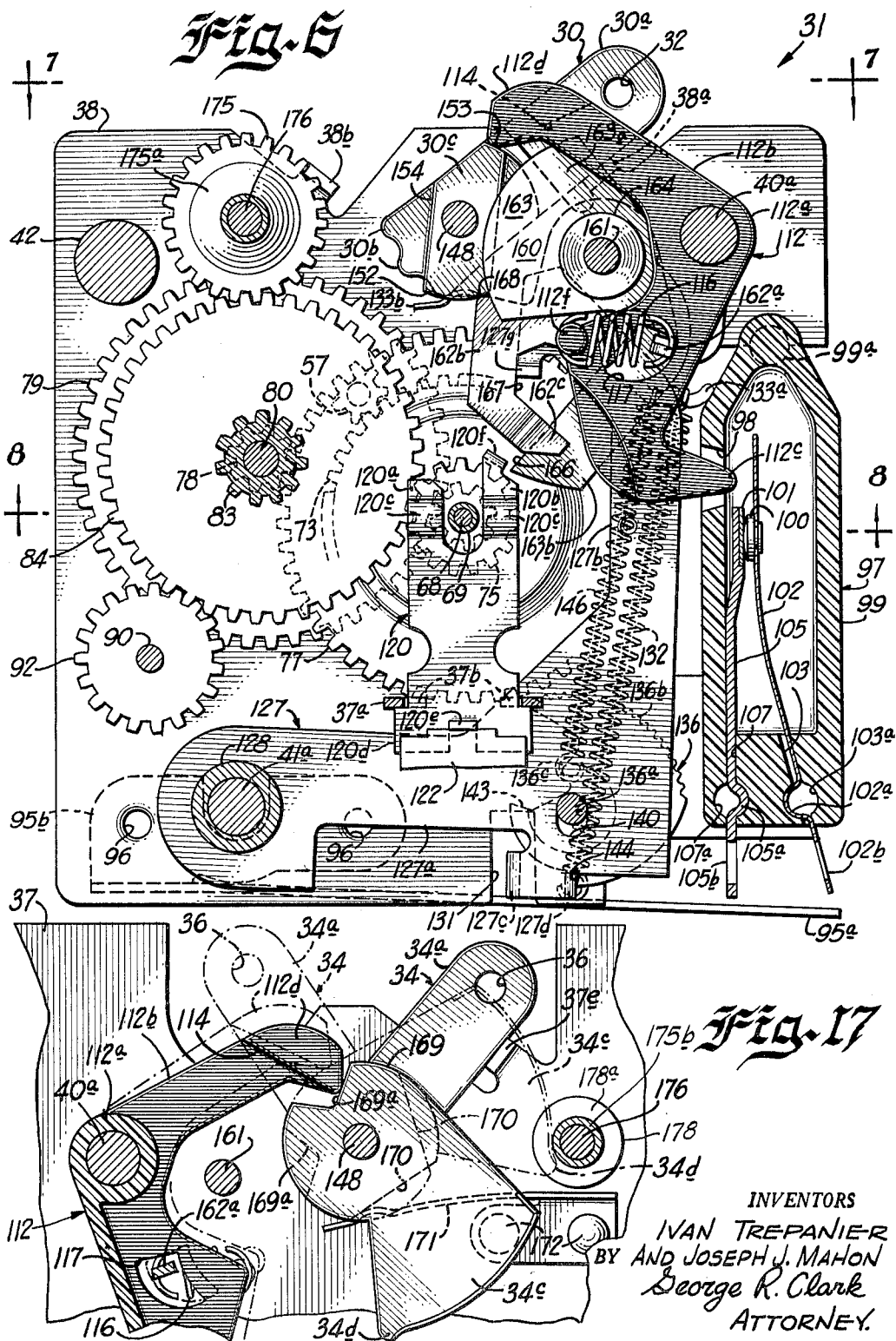
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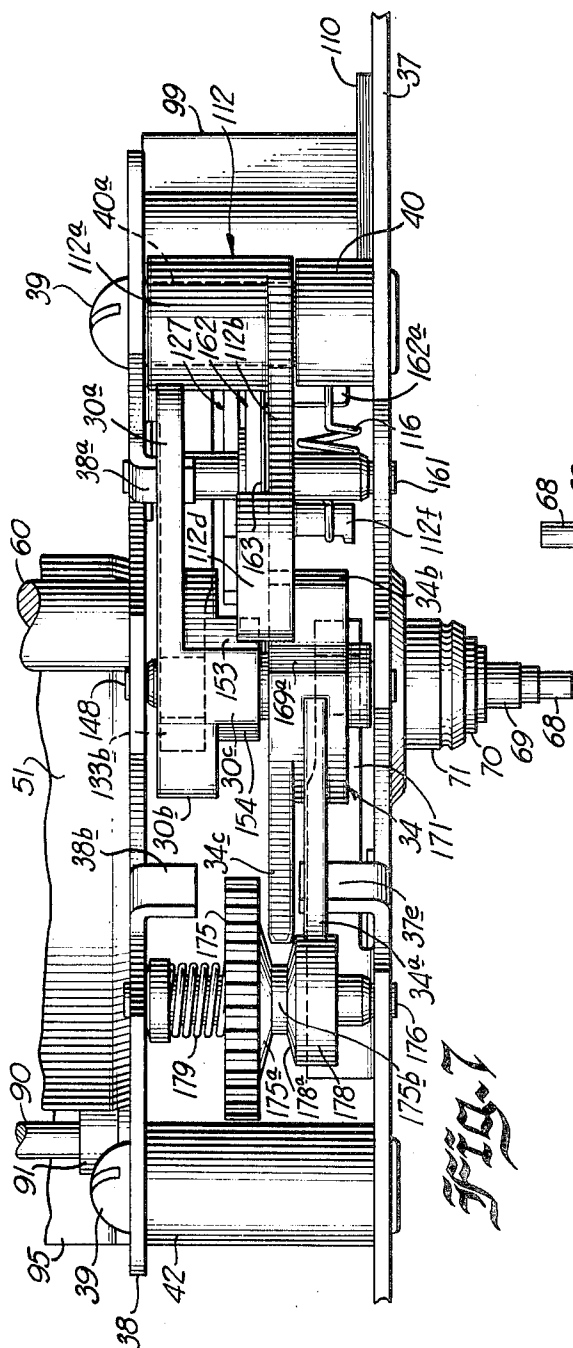


Fig. 7

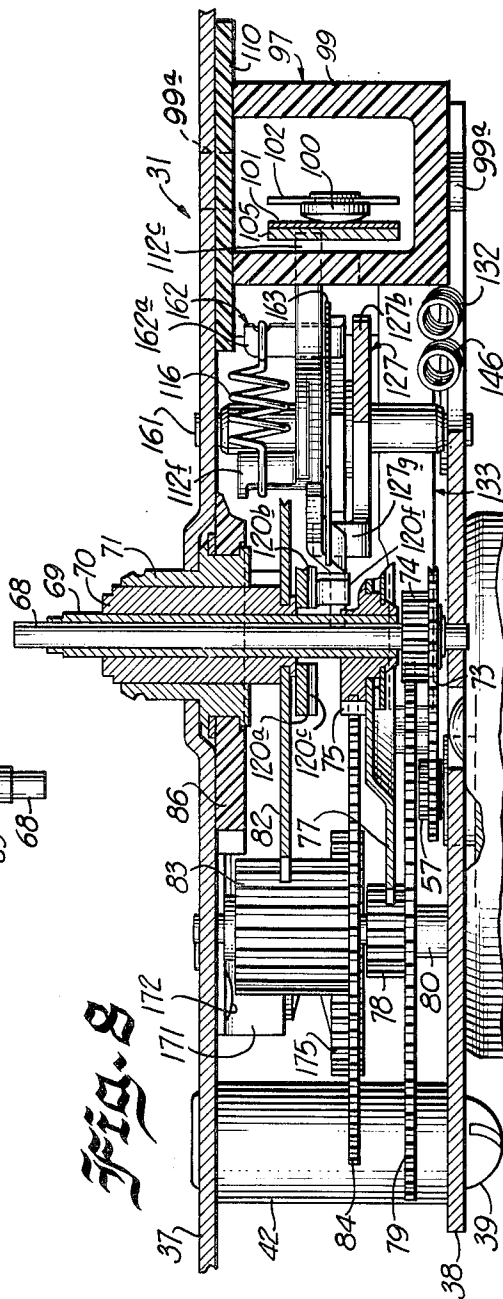


Fig. 8

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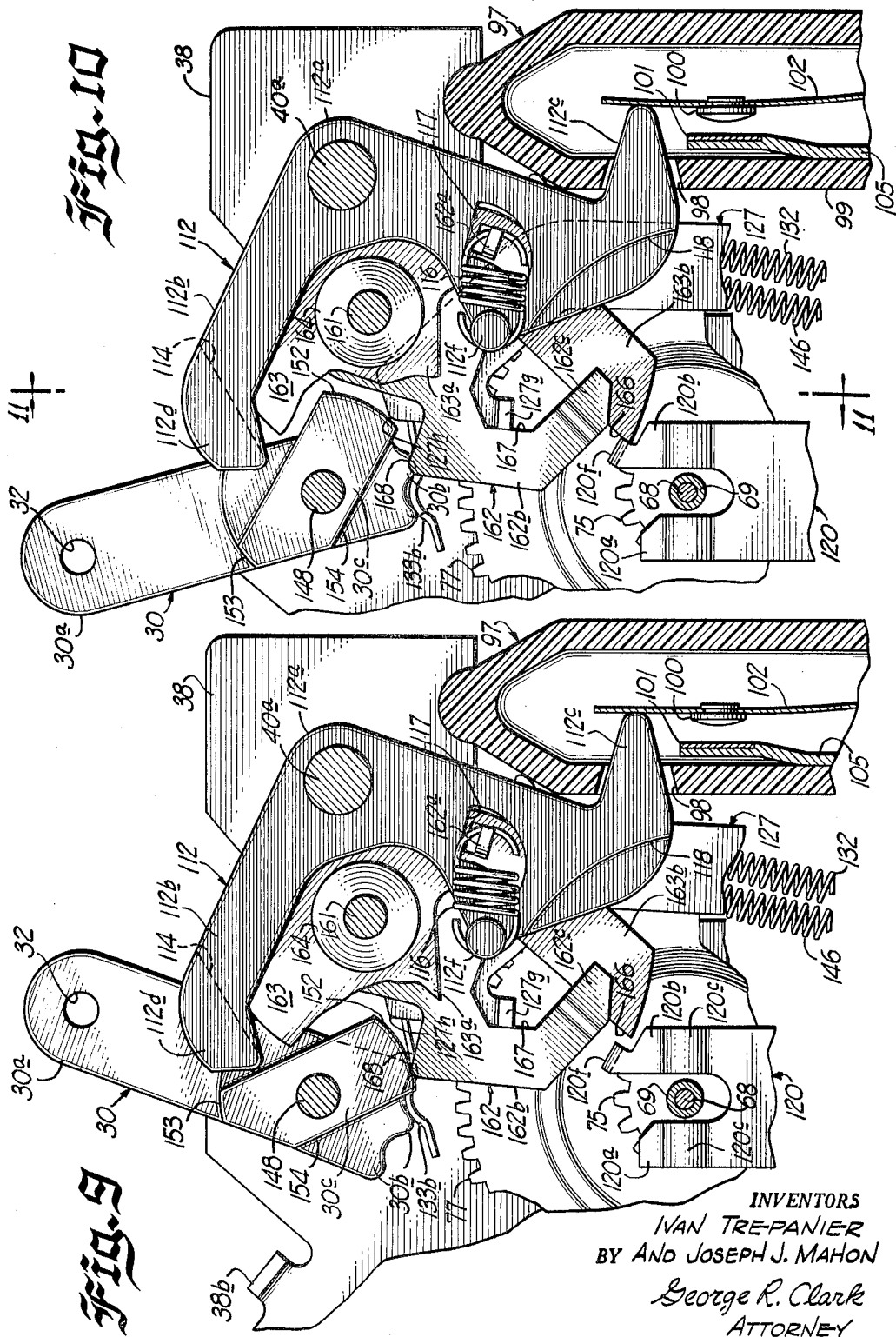
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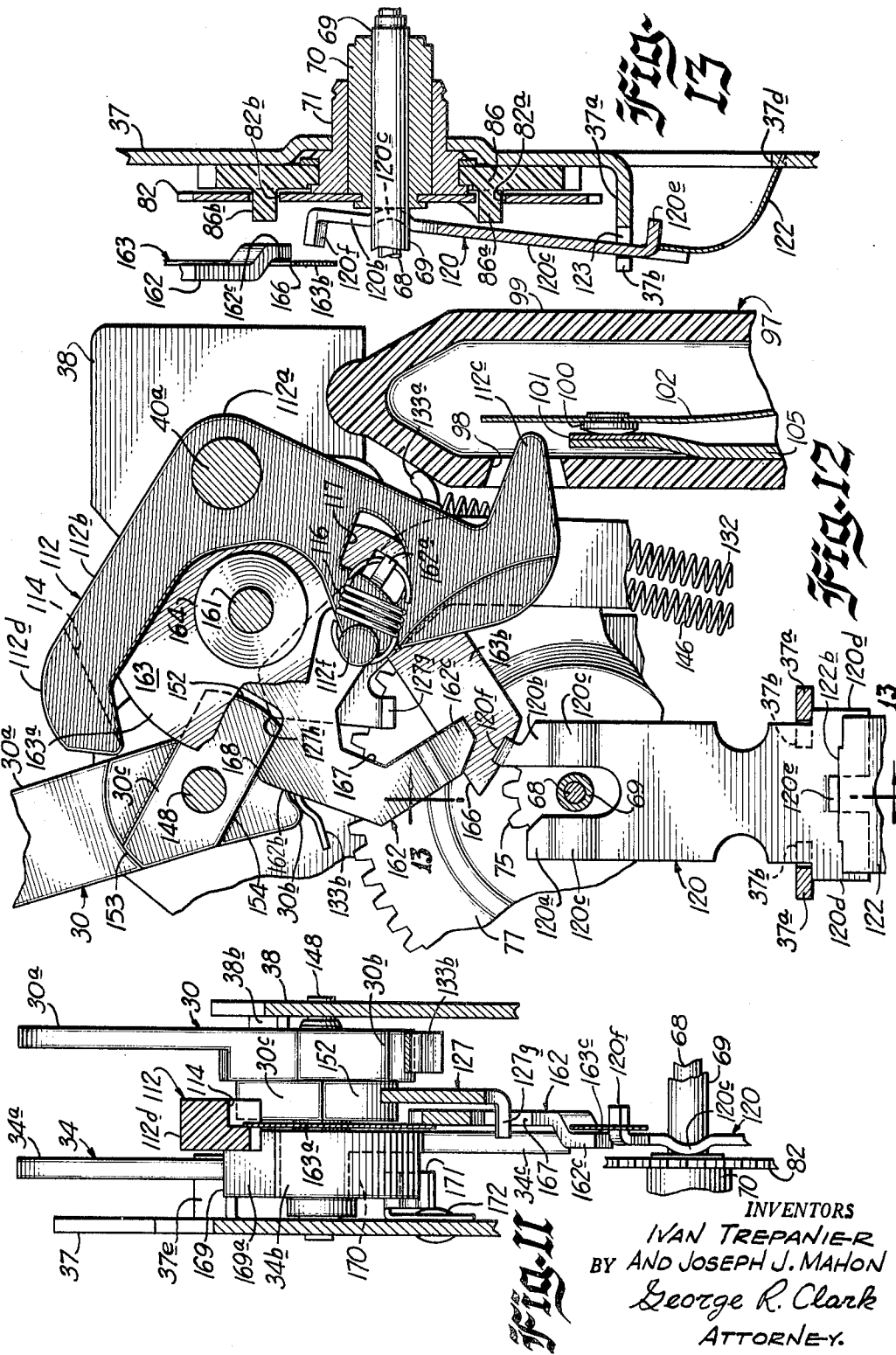
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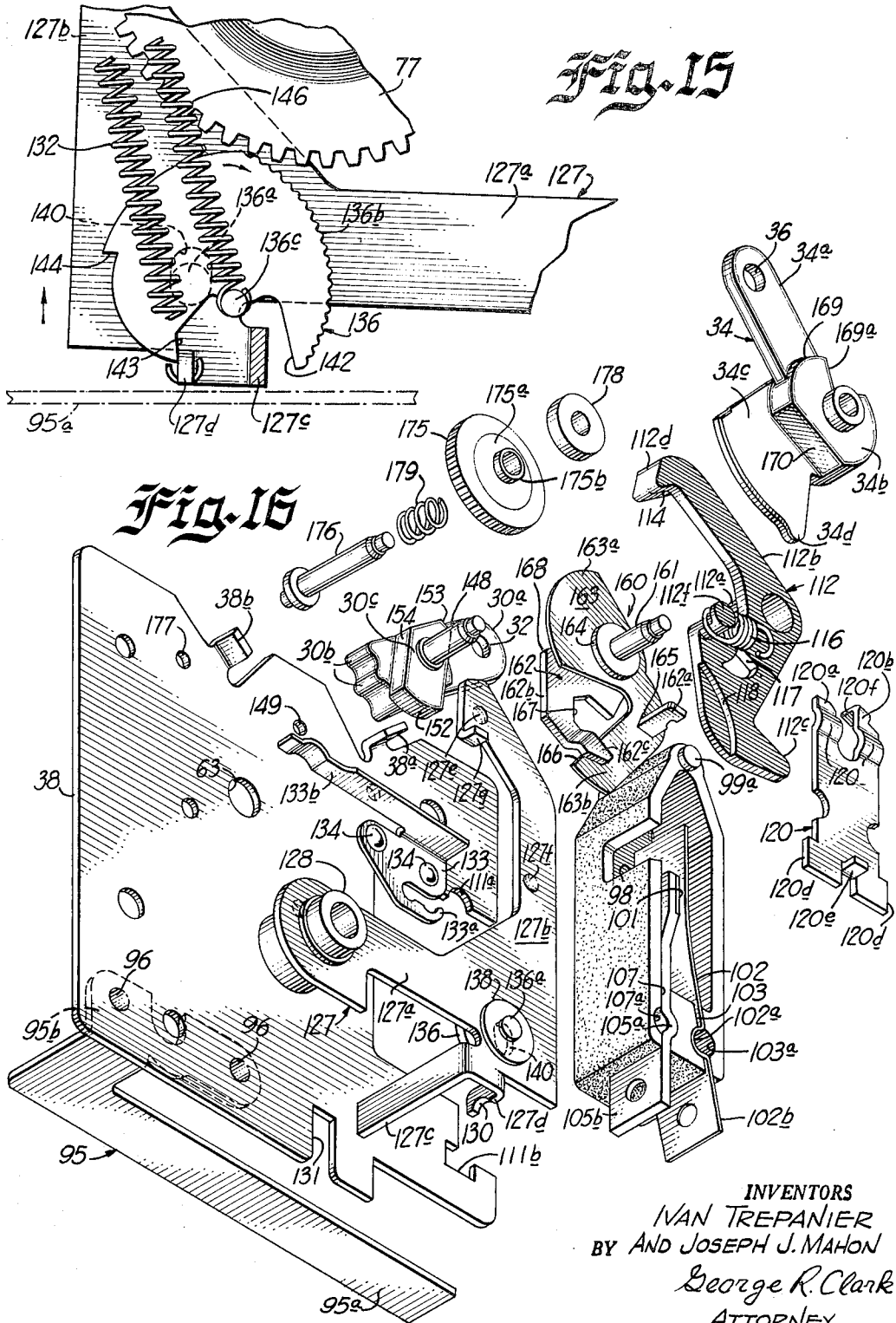
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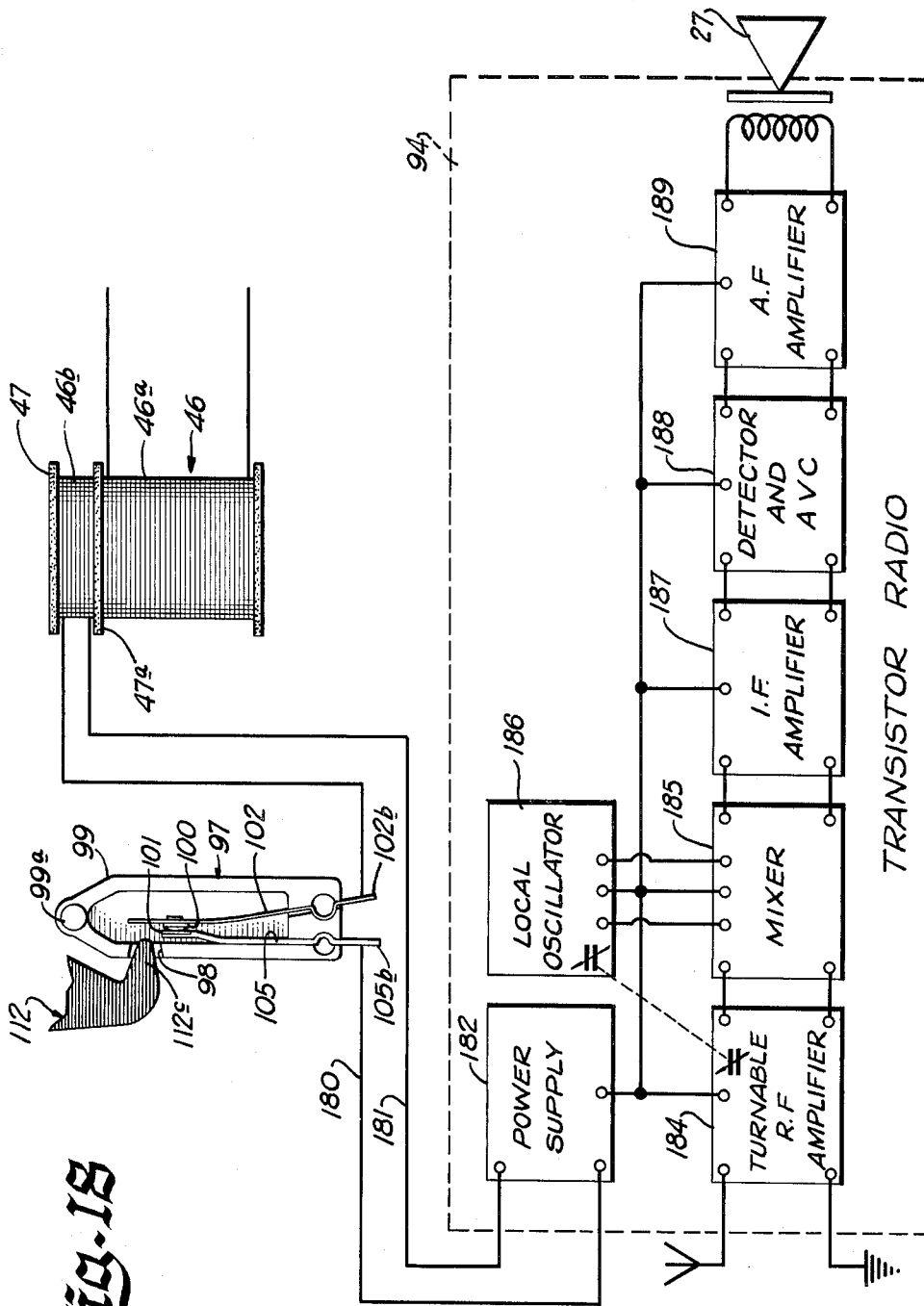


Fig. 18

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RADIO CLOCK TIMER

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25 Claims. (Cl. 325—396)

The present invention relates to a radio clock timer and, more particularly, to a clock mechanism including means for readily adapting the same to control an associated radio.

In recent years the so-called clock radio has come into very extensive use. Such clock radios combine the function of a radio and an alarm clock into a single unit and at the same time provide certain additional desirable features, for example, such a device may have a so-called "sleep switch" which permits the user to have the radio on at the time of going to bed knowing that within a predetermined time thereafter the radio will be shut off automatically. Also, such clock radios are designed so that the clock automatically turns on the radio at a pre-selected time, thereby functioning as an alarm to awaken the user. Furthermore, if desired, an audible alarm will come on a predetermined time after the radio comes on to further insure awakening of the user.

Clock radios are of many forms, shapes and sizes and every year the manufacturers come out with a redesigned unit at least from an appearance standpoint. Heretofore, the design and styling of clock radios has been limited by the fact that the clocks for controlling the same had certain design limitations which prevented the freedom or latitude of design that was desired. It would be desirable, therefore, to provide a clock timer which permits more latitude in the design or the styling of the radio than have similar clock timers heretofore available. In addition to the desirability of such a radio timer to be readily adaptable with many different types and styles of radios and designs of the radio cabinets with a minimum of expense, it is also desirable for such radio timers to be simple and compact in construction and foolproof in operation. Moreover, in recent years the transistor radio has come into extensive use. It would be desirable to provide simple means for energizing both the radio and the clock timer. Obviously, a source of power is necessary to energize the clock timer and it would be desirable by simple means to utilize this source of power and by means of the clock timer convert it to a lower voltage capable of use to energize a transistor radio forming a part of a so-called clock radio.

Accordingly, it is an object of the present invention to provide a new and improved clock timer for a radio.

It is another object of the present invention to provide a clock timer which is simple and compact, foolproof in operation, and which will give many years of satisfactory service.

It is another object of the present invention to provide an improved clock timer for use with a radio in which the timer motor serves as a transformer to step down the voltage supplied to the radio.

Still another object of the present invention resides in an improved clock timer in which the operating portions thereof may be connected by suitable longitudinally movable links to control mechanisms whereby the timer is readily adaptable for installation in any type of apparatus.

Still another object of the present invention resides in an improved clock timer for use with a radio in which simple and compact mechanism is employed to provide the desired radio operation at predetermined times and also alarm operations when desired and wherein a sleep switch mechanism is included to shut off the radio after a predetermined time has elapsed.

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 the specification.

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

FIG. 1 is a perspective view of a clock radio showing one application of the timer clock of the present invention;

FIG. 2 is an enlarged front elevational view of FIG. 1 with certain portions thereof cut away more clearly to illustrate an application of the present invention, various positions of the controls being shown in solid and dashed lines;

FIG. 3 is an enlarged rear elevational view of the timer mechanism of the clock timer shown in FIGS. 1 and 2 of the drawings with the sleep cam set in the "off" position and the clock timer set for the radio "on" position;

FIG. 4 is a view looking in the direction of the arrows 4—4 of FIG. 3 with certain parts omitted for the purpose of simplifying the drawings;

FIG. 5 is a somewhat enlarged sectional view taken on line 5—5 of FIG. 3 with the clock timer mechanism set for the radio "on" position;

FIG. 6 is a sectional view taken on line 6—6 of FIG. 5 assuming that FIG. 5 shows the complete structure and again showing the timer mechanism set for the radio "on" position;

FIG. 7 is a view taken in the direction of the arrows 7—7 of FIG. 6 assuming that FIG. 6 shows the complete structure;

FIG. 8 is a sectional view taken substantially along line 8—8 of FIG. 6 assuming that FIG. 6 shows the complete structure;

FIG. 9 is an enlarged fragmentary view of a portion of FIG. 6 but showing the parts of the clock timer mechanism set for the radio "off" position;

FIG. 10 is a view similar to FIG. 9 with the clock timer mechanism set for the "automatic" position and with the parts shown in the position immediately preceding the automatic turning on of the radio;

FIG. 11 is a fragmentary sectional view taken on line 11—11 of FIG. 10 assuming that FIG. 10 shows the complete structure;

FIG. 12 is a fragmentary view similar to FIG. 9 but with the clock timer mechanism set for the "automatic" position and the parts in the position assumed immediately subsequent to the position of these parts is shown in FIG. 10 wherein the hour gear and alarm gears are in the relative position they must assume before the radio or alarm may be turned on during automatic operation;

FIG. 13 is a fragmentary sectional view taken on line 13—13 of FIG. 12 assuming that FIG. 12 shows the complete structure;

FIG. 14 is a view somewhat similar to FIG. 6 but with the clock timer set for the "alarm" position and with the other parts substantially in the position shown in FIG. 12 of the drawings;

FIG. 15 is a fragmentary sectional view taken on line 15—15 of FIG. 5 assuming that FIG. 5 shows the complete structure but with the parts in the position assumed a short time subsequent to the position of the parts shown in FIG. 14;

FIG. 16 is an exploded perspective view of the sleep cam and clock timer mechanisms of the present invention;

FIG. 17 is a fragmentary sectional view taken on line 17—17 of FIG. 5 assuming that FIG. 5 shows the complete structure and showing the sleep cam mechanism in both of the extreme positions which it may assume; and

FIG. 18 is a schematic circuit diagram showing the

power supply for the clock radio obtained from the clock timer of the present invention.

Briefly, the present invention is concerned with a clock timer in which, by simple punched parts and the like, there is provided a mechanism which will control a radio so as automatically to turn the radio on at a predetermined time and, if desired, to provide a suitable alarm in the event that the turning on of the radio fails to awaken the user following a short delay. Additionally, a mechanism known as the sleep cam is provided which will permit the radio to remain on for a predetermined time after the user goes to bed, for example, and which mechanism will, following the expiration of a preselected time, automatically turn off the radio. This is accomplished with a very simple mechanism and the operating parts are such as to permit connection by simple longitudinally movable links with any type of radio control so that the timer may be adapted for use with any type of radio cabinet. Additionally, the device is particularly adapted for use with a transistor radio wherein the power for energizing the transistor radio is obtained from a supplementary winding on the motor energization coil of the timer whereby the transformer action of the two windings is utilized to step down the voltage to the proper magnitude for the transistor radio.

Referring now to the drawings and particularly to FIGS. 1 and 2 thereof, there is illustrated a time clock radio generally indicated at 20 which is illustrated as comprising a casing or housing 21 with the conventional control knobs 22 and 23 for tuning the radio receiver and controlling the volume thereof, respectively. The casing 21 also includes the clock face 24 forming a part of the clock timer of the present invention described hereinafter. The clock radio 20 is illustrated as comprising additional control means including levers 25 and 26, respectively. The lever 25 comprises a four position clock timer control for the radio which positions are specifically designated as the "on" position, the "off" position, the "automatic" position and the "alarm" position. The lever 26, on the other hand, controls the so-called sleep cam having conventional "on" and "off" positions. The casing 21 is illustrated as having a suitable means to permit sound to emanate therefrom from a suitable speaker 27 shown in dashed lines in FIG. 2 of the drawings and schematically designated in FIG. 18 of the drawings.

An important feature of the present invention is clearly illustrated in FIG. 2 of the drawings where the control lever 25 is illustrated as comprising a bell crank pivotally supported at 28 within the casing 21 and connected by a suitable somewhat U-shaped link 29 with a control lever portion 30a of an alarm set cam 30, described hereinafter and forming a part of the clock timer of the present invention, which clock timer is generally designated by the reference numeral 31 and which clock timer includes the clock face 24 described above. The lever portion 30a is provided with a link connecting opening 32 therein.

The sleep cam lever 26 in FIG. 2 may also comprise a bell crank connected by a suitable link 33 with a lever portion 34a forming part of a sleep cam 34 described in detail hereinafter, the bell crank 26 being pivoted at 35 as clearly indicated in FIG. 2 of the drawings. The shanks 22a and 23a of the control knobs 22 and 23 are readily visible in FIG. 2 of the drawings and the extreme positions on the control levers 25 and 26 are also indicated. The lever portion 34a is provided with a link connecting opening 36 similar to the opening 32 in the lever portion 30a. With this arrangement it will be apparent that the lever portions 30a and 34a of the clock timer 31 can readily be connected by simple longitudinally movable links to control means on the clock radio which can be disposed in many different positions and comprise a wide variety of arrangements. Thus, the clock timer 31 will permit a great deal of latitude in design for anyone building a clock radio using this timer 31 since the controls therefor affixed to the radio housing can be of many dif-

ferent forms and disposed in various places while still readily permitting operative connection with the lever portions 30a and 34a of the clock timer 31.

The particular electric clock mechanism with which the timer of the present invention is associated may comprise any suitable available clock mechanism. In order to illustrate the present invention, however, the clock mechanism is substantially that disclosed and claimed in copending Chartier and Wickenburg application Serial No. 688,467, filed October 7, 1957, now Patent No. 3,004,179, and assigned to the same assignee as the instant application. The alarm clock of the above mentioned Chartier et al. application has been modified to include the necessary elements to provide the four position radio clock timer control of the present invention including a sleep cam mechanism.

As illustrated, the clock timer 31 of the present invention comprises a front plate 37 and a back plate 38 which are disposed in spaced parallel relationship by means of suitable spacing studs or pivot pillars which may be riveted or otherwise secured to the front plate 37. Suitable screws such as 39 (FIGS. 3 and 8) then may secure the back plate 38 to the studs or pillars thereby permitting ready removal of the back plate and affording access to the clock mechanism disposed between these plates. Three of these studs or pillars are provided which are effectively disposed at three corners of the plates 37 and 38. As illustrated, the three studs are designated as 40, 41 and 42, respectively, (FIG. 6). The element 42 serves only as a stud (FIGS. 6, 7 and 8) but the elements 40 and 41 also serve as pivot pillars as will become apparent from the ensuing description and, hence, each includes a portion of reduced cross section designated as 40a and 41a, respectively.

For the purpose of supplying the driving force for the clock timer 31 of the present invention there is provided an electric motor 44 which preferably comprises a rectangular shaped magnetic core 45 formed of suitable laminations having a single phase energizing winding 46a wound on a suitable spool 47 or insulating bobbin 47 which surrounds one leg of the rectangular core 45. In accordance with the present invention, the bobbin 47 is divided into two sections by an intermediate spacer member 47a which is much closer to one end of the bobbin than to the other. A secondary winding 46b is disposed in the small winding section of bobbin 47 while the motor winding 46a connected to a suitable alternating current power source is disposed in the larger section, as clearly shown in the schematic diagram of FIG. 18 of the drawings. The magnetic core 45 on the leg thereof opposite that encompassed by the winding 46 and the bobbin 47 terminates in a pair of pole faces 48 and 49, each of which is divided or split into two sections. The pole faces 48 and 49 are of curved configuration so as to define a circular opening 50 for receiving therein a suitable rotor or motor armature which is housed within a sealed casing 51 having a portion 51a of reduced cross section snugly received within the opening 50. Shading coils 53 and 54 are provided so as effectively to define a two shaded pole synchronous motor which will operate at a speed of 3600 r.p.m. from a 60-cycle source. The motor 44 described herein may be identical with that disclosed and claimed in the above mentioned copending Chartier et al. application. Preferably the sealed housing 51 contains a suitable gear train to reduce the speed of rotation of the motor armature a substantial amount, and, as disclosed in the above mentioned Chartier application, the motor 44 has an output gear or pinion 57 (FIGS. 3, 4, 6 and 8) which rotates at a speed of six r.p.m.

In order to support the motor 44 from the back plate 38 of the clock timer 31 there is provided a pair of spacer studs 60 and 61 (FIGS. 4, 5 and 7). These spacer studs preferably have one end thereof secured to the back plate 38 in any suitable manner such as by riveting or the like. The other ends of the spacer studs 60 and 61 preferably

include tapped openings for receiving suitable fastening means 62 (FIGS. 3 and 4) which fastening means pass through suitable openings defined in the magnetic structure 45. Thus, the spacer studs 60 and 61 support the motor in position with the output gear 57 thereof extending through an opening 63 in the back plate 38 so as to be disposed in the space between the front and back plates 37 and 38, as clearly shown in FIGS. 4 and 8 of the drawings.

The particular clock face 24 indicated in FIGS. 1 and 2 of the drawings is illustrated as being provided with a sweep second hand 64, a minute hand 65, an hour hand 66, and an alarm indicator 67, all of these elements 64, 65, 66 and 67 being rotatable about a common axis and supported on an arrangement of concentric shafts preferably identical with the arrangement disclosed in the above mentioned Chartier et al. application. To support these various hands there is provided, as best shown in FIGS. 4, 5, 7 and 8, a sweep second hand shaft 68 which is the innermost of a series of concentric shafts and protrudes through the front plate 37. The sweep second hand 64 is, of course, secured to the end of the sweep second shaft 68. For the purpose of supporting the minute hand 65, there is provided a tubular minute hand shaft 69 which immediately surrounds the second hand shaft 68 and also protrudes through the front plate 37 so as to support on the end thereof the minute hand 65. In a similar manner and in order to control the hour hand 66, there is provided a tubular hour shaft 70 which, as is clearly shown in FIGS. 5 and 8 of the drawings, immediately surrounds the tubular minute shaft 69 and it likewise protrudes through the front plate 37 so as to support thereon the hour hand 66. In order to support the alarm indicator 67 there is provided the outermost of the four concentric shafts comprising the tubular alarm shaft 71 which also projects through the front plate 37 and supports on the end thereof the alarm indicator 67. Preferably, the various concentric shafts 68, 69, 70 and 71 are frictionally secured to their respective hands so that when the hands are pressed into position they will so remain.

For proper operation of the clock portion of the present invention it is obvious that the shaft 68 must rotate at one r.p.m., the shaft 69 must rotate at one revolution per hour, and the shaft 70 must rotate two revolutions during each twenty-four hour period or one revolution during each twelve hour period. The alarm indicator shaft 71, on the other hand, does not rotate at any prescribed speed but is settable by the operator to some preselected time position at which it is desired for the alarm to be actuated.

For the purpose of rotating the sweep second hand shaft 68 at one r.p.m., the output gear 57 of the electric motor 44 drivingly engages a gear and pinion assembly comprising gear 73 and pinion 74 which are suitably secured to the end of sweep second hand shaft 68 remote from the sweep second hand 64 (FIGS. 5 and 8). The gear ratio between the gears 57 and 73 is such that the sweep second hand shaft 68 rotates at one r.p.m. In the Chartier et al. application the gear 57 which rotated at six r.p.m. had eight teeth and the gear 73 had forty-eight teeth which obviously results in a rotation of the sweep second hand 68 at one r.p.m.

For the purpose of driving the tubular minute hand shaft 69 at one revolution per hour there is secured to the minute hand shaft 69 a minute pinion 75. It will be appreciated that it is necessary to be able to set the hands of an electric clock when it is first connected to a source of electric power and occasionally at other times. However, it is not usually desirable to reset the sweep second hand which is directly driven from the output of motor 44. Consequently, some clutch arrangement is provided to permit resetting of the minute and hour hands without actuating the entire mechanism including the sweep second hand. As is fully disclosed in the above mentioned

Chartier application, the minute pinion 75 is provided with a spring friction member 76 suitably secured to the pinion 75, and this spring friction member is adapted to press against the face of a gear 77 of somewhat dished construction, with the spring member 76 disposed within the depression of the gear 77. Normally the gear 77 will rotate with the pinion 75 but if the pinion 75 is prevented from rotating as by driving engagement with the motor output gear 57 it is still possible manually to rotate the minute sleeve 69 by virtue of the slippage between the gear 77 and the friction spring 76. As illustrated, the gear 77 is adapted to be driven from the sweep second hand shaft 68 through a gear and pinion assembly comprising a pinion 78 and a gear 79 rotatably mounted on an intermediate shaft 80 (FIGS. 6 and 8) suitably supported between the front plate 37 and the back plate 38. The gear 77 is adapted to mesh with the pinion 78 and the gear 79 is adapted to mesh with the pinion 74. Thus, by choosing the proper gear ratios between the pinion 74 and the gear 79 and between the pinion 78 and the gear 77, the tubular minute shaft 69 will be caused to rotate at one revolution per hour.

In order to actuate the tubular hour shaft 70 at one revolution during each twelve hour period there is secured to the tubular shaft 70 at the end thereof remote from the hour hand 66 an hour gear 82 (FIGS. 5, 8 and 13), which hour gear performs a dual function serving both as an hour gear and an alarm cam as is fully disclosed in the above mentioned Chartier et al. application. Considering first its function for driving the hour sleeve or shaft 70 at one revolution during each twelve hour period the hour gear 82 is adapted drivingly to engage a pinion 83 (FIGS. 6 and 8) and connected gear 84 secured to the intermediate shaft 80 and rotatable therewith or, in any event, rotatable as a unit about the axis of the shaft 80. The gear 84 is driven by the pinion 75 secured to the minute sleeve 69 while the pinion 83 engages the hour gear 82. The gear ratios between the gear 84 and pinion 75 and between the gear 82 and pinion 83 are such that the hour hand sleeve or shaft 70 rotates at one revolution during each twelve hour period.

To perform an alarm controlling function the hour gear 82 and its associated tubular shaft or sleeve 70 are axially movable to a limited extent between the two extreme positions, shown in FIGS. 8 and 13 of the drawings, and for this reason the pinion 83 is somewhat elongated to insure a constant driving engagement between it and the hour gear 82 at all times. The hour gear is provided with a pair of diametrically opposed openings 82a and 82b (FIG 13), the function of which is described hereinafter.

For the purpose of setting the alarm indicator 67 and the associated alarm sleeve 71 there is secured to the shaft 71 at the end thereof remote from the alarm indicator 67 an alarm gear 86. Preferably the alarm gear 86 is a molded nylon gear and is suitably secured to the sleeve 71. The face of the alarm gear 86 adjacent the hour gear 82 is provided with a pair of laterally projecting cam members 86a and 86b (FIGS. 5 and 13) which are molded integrally with the nylon gear 86 and are intended to cooperate with the openings 82a and 82b in hour gear 82. These cam members are positioned diametrically opposite each other but to insure operation thereof only once during each twelve hour period the distance from the common axis of the concentric shafts 68, 69, 70 and 71 is greater for the projection 86b than for the projection 86a. The same spacing applies to the openings 82a and 82b, respectively. The projections 86a and 86b extend for a short distance in a circumferential direction with respect to the gear 86 and are adapted to cooperate with the openings 82a and 82b. If the cam members 86a and 86b are aligned with the openings 82a and 82b, respectively, as shown in FIG. 13 of the drawings, the tubular hour shaft 70 and the associated gear 82 are moved toward the gear 86 by means described hereinafter so that the parts assume the position shown in FIG. 13 and the change in the

axial position of gear 82 may be utilized to actuate an alarm or perform some other control function.

In order that the alarm gear 86, its associated tubular shaft 71, and the alarm indicator 67 remain in a predetermined selected position unless positively moved to a different position there is provided an alarm friction gear 88 (FIG. 4) which is journaled on a suitable stud secured to the front plate 37. This friction gear is drivingly engaged with the alarm gear 86 at all times. A suitable spring member (not shown) interposed between the front plate 37 and the friction gear 88 provides the necessary friction on the gear 88 so that it will remain at whatever setting it is placed and since it is in driving engagement with the alarm gear 86 this, of course, means that the alarm gear 86 remains positioned in whatever position it is originally placed.

For the purpose of readily adjusting and selectively setting the alarm gear 86 and associated cams 86a and 86b for any particular setting of the alarm there is provided a combined time and alarm setting shaft 90 (FIGS. 3, 4 and 7) which is mounted in an elongated bearing 91 suitably supported by the back plate 38. This shaft, as in the above mentioned Chartier et al. application, serves as a time setting shaft as well as an alarm setting shaft and it is both rotatably and axially movable in the elongated bearing 91. The end of the shaft 90 which is disposed between the front and back plates 37 and 38, respectively, is secured to a suitable gear 92. In the position shown in FIG. 4 of the drawings, the gear 92 is drivingly engaged with the friction gear 88. The end of the shaft 90 remote from the gear 92 is preferably provided with an adjusting knob 93. It will be apparent that the adjustment of the knob 93 with the gear 92 in the position shown in FIG. 4 of the drawings will set the alarm gear 86 and the associated alarm indicator 67 to any desired position.

When it is desired to set the hour and minute hands of the clock to some predetermined selected time, the knob 93 is pulled away from the back plate 38, as viewed in FIG. 4 of the drawings, until the gear 92 meshes with the gear 84, as shown in FIG. 6 of the drawings. Thus, by rotating knob 93 and, hence, gear 84 the mechanism comprising the minute and hour hands can be adjusted to any selected position. By virtue of the slip clutch described above, such setting of the hour and minute hands does not effect the sweep second hand.

In order to provide an audible alarm, any suitable mechanism may be provided. As illustrated in the drawings, the magnetic field already available by virtue of the magnetic structure 45 of the motor 44 and its energizing winding 46a is employed as the actuating source of such a buzzer or audible signal device. To this end, there is provided a vibrator generally designated as 95, best shown in FIGS. 3, 4, 5, 6 and 16 of the drawings, which comprises a thin sheet metal vibrator arm 95a having at one end a lateral somewhat L-shaped supporting member 95b which is riveted or otherwise suitably secured as indicated at 96 to one corner of the back plate 38. Thus, the vibrator arm 95a effectively comprises a spring arm which extends parallel with the back plate 38, as clearly illustrated in FIGS. 3 and 4 of the drawings. The free end of the vibrator arm extends over and is in fairly close proximity to one end of the leg of the magnetic structure 45 upon which the winding 46a is wound. Preferably this leg of the magnetic structure 45 is provided with an extension 45a (FIGS. 3 and 4) comprising several slightly longer laminations which are disposed immediately adjacent the free end of the vibrator arm 95. It will be appreciated that with the free end of the vibrator arm 95a disposed relatively close to the ends of the lamination extensions 45a and with the winding 46a energized, it will be caused to vibrate under the electrical impulses of the flux produced by the winding 46. Thus, the free end of the vibrator arm 95a will vibrate back and forth striking the lamination extensions 45a to produce an audible signal.

In accordance with the present invention, the electric clock mechanism described heretofore is modified to provide automatic means for controlling a clock radio. To this end, there is suitably mounted between the front plate 37 and back plate 38 switch means generally designated at 97 which switch means are suitably operated by the timer mechanism of the present invention for controlling the radio portion 94 (designated as a transistor radio in FIG. 18 of the drawings) of the time clock radio 20. This switch means 97 is both manually and automatically operable as described in detail hereinafter. As illustrated, the switch means 97 comprises a molded insulating boxlike housing 99 open on one side and having a switch actuating opening 98 defined in one wall thereof. This housing 99 is preferably formed of phenolic resin or the like and defines a housing for a pair of relatively movable switch contacts 100 and 101. As illustrated in the drawings, the contact 100 is mounted on a flexible spring arm 102 at an intermediate point along such arm. The end of the arm 102 comprising the free end thereof extends over the opening 98 so as to be engageable by suitable switch actuating means described hereinafter. The other end of the contact arm 102 is effectively a fixed end provided with a deformed portion 102a which is receivable within an enlargement 103a of a slot 103 defined in an end wall of the housing 99. The slot 103 extends to the open side of housing 99 whereby the flexible arm 102 can readily be inserted in the slot 103 with the portion 102a in the enlargement 103a. A portion of the flexible arm 102 designated as 102b extends outside the housing 99 whereby electrical connection can readily be made thereto as indicated in FIG. 18 of the drawings.

The other contact 101 of the switch means 97 is suitably mounted on a relatively rigid conducting blade 105 which includes a deformed portion 105a receivable in an enlargement 107a of a slot 107 substantially like slot 103 and closely adjacent thereto. The conducting support or blade 105 may readily be inserted into the slot 107 whereby its associated contact 101 is disposed within the housing 99 in operative relationship with contact 100. The blade 105 has a portion 105b extending outside the housing whereby electrical connections can readily be made thereto, as shown in FIG. 18 of the drawings. By virtue of the inherent resilience of the contact support 102 the switch means 97 is normally biased toward the closed position as indicated in FIGS. 6, 12, 14 and 18 of the drawings.

For the purpose of closing the open side of the housing 99 there is provided a suitable insulating switch cover 110 (FIGS. 4 and 5). Preferably the housing 99 is provided with integrally molded projections such as 99a (FIG. 8) which are receivable within cooperating notches or openings in the front and back plates 37 and 38, respectively, such as the notches 111a and 111b in back plate 38 (FIG. 16). Moreover, the housing 99 is of such size that with the cover 110 in place, it is just snugly receivable between the front and back plates 37 and 38, as clearly shown in FIG. 4 of the drawings. Thus, the cover 110 must be provided with one or more suitable openings to permit the projections such as 99a to extend therethrough (FIG. 8), which arrangement holds the cover 110 in position relative to housing 99. It will be understood that the switch means 97 can readily be mounted between the front plate 37 and back plate 38 to one side of the regular clock mechanism described above without interfering in any way with the operation thereof.

For the purpose of actuating the switch means 97 there is provided an insulated switch actuating lever 112 preferably molded from a suitable insulating material such as from a phenolformaldehyde resin. Effectively the lever 112 is a sort of bell crank having an integrally molded hub portion 112a (FIG. 7) pivotally mounted about the portion 40a of the pivot pillar 40. The insulated switch actuating lever 112 includes a pair of arms 112b and 112c, one disposed on either side of hub portion 112a. The

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arm 112c might be designated as the switch engaging arm in that it comprises a projection receivable with the opening 98 in the switch housing 99 and movable between the position shown in FIGS. 6, 12 and 14 of the drawings where the switch means 97 is in the closed position to the position shown in other figures of the drawings such as FIGS. 9 and 10 where the insulating switch actuating lever 112 has moved the switch means 97 to the open position. The end of the arm 112b of insulating switch actuating lever 112 includes an integral lateral projection 112d defined by a portion of the arm which is somewhat thicker than the remainder of the arm, as best shown in FIGS. 7 and 16 of the drawings. The thickened portion of the arm is defined on one side by the surface 114. For a purpose which will become apparent as the following description ensues, the insulated switch lever 112 is provided with a projecting pin 112f for securing thereto one end of a suitable tension spring 116 which might generally be designated as the switch lever spring. Additionally, the insulated switch lever 112 is provided with a somewhat triangular shaped opening 117 with two sides of the triangle defined by somewhat arcuate shaped sides, one of which defines a cam surface described hereinafter. In order that the switch actuating lever 112 may be mounted closely adjacent axially movable hour gear 82, the arm 112c is notched out, as indicated at 118 as best shown in FIGS. 8 and 18, whereby no interference between these parts occurs.

To control the alarm and, hence, to control the vibrator arm 95a in the above mentioned Chartier et al. application, there was provided an alarm lever actuated by axial movement of the hour gear 82 along the longitudinal axis of the concentric shafts 68, 69, 70 and 71. However, in the clock timer of the present invention, it is desirable that the so-called alarm lever be actuated not only to control the alarm but also to control the switching means 97 and, hence, to control the operation of radio 94. It is intended that when automatic operation of the radio 94 is desired under the control of the clock timer 31 of the present invention, the radio 94 will automatically be turned on at the preselected setting of the alarm gear 86. If, however, the controls are set to the alarm position the radio will first be turned on at the preselected setting and a predetermined time. After the radio has been turned on the audible alarm will be actuated. To this end, there is provided an alarm lever 120 pivoted at one end and which has the other end thereof biased against the axially movable assembly comprising hour gear 82 and associated hour shaft 70 by a spring member 122. With this arrangement, spring 122 constantly urges gear 82 to the position shown in FIG. 13 of the drawings. However, cam members 86a and 86b prevent this unless the hour gear 82 is in a preselected position determined by the setting of alarm gear 86. As illustrated, the free end of alarm lever 120 is provided with a pair of bifurcations 120a and 120b designed to receive in the space therebetween the concentric sweep second hand shaft 68 and the minute shaft 69, as clearly shown in FIGS. 5, 6, 8 and 9 of the drawings. To reduce the frictional contact between the bifurcations 120a and 120b of the alarm lever 120 and the assembly comprising gear 82 and hour shaft 70, these bifurcations include arcuate deformations 120c which engage a minimum area of the end of the tubular shaft 70 which extends through the gear 82 and is peened over to integrally relate the gear 82 and tubular shaft 70. For the purpose of pivotally supporting the end of alarm lever 120 remote from the bifurcations 120a and 120b, the front plate 37 includes an integral projection 37a (FIGS. 4, 5, 6 and 13 of the drawings) bifurcated at the end remote from front plate 37. This projection has a recess 123 defined between the bifurcations and beneath a pair of overhanging ears 37b for receiving the pivotal end of alarm lever 120. Alarm lever 120 at the pivotal end thereof is provided with laterally extending ears 120d bearing against the bifurcations of projection 37a, as best

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shown in FIG. 12 of the drawings, when disposed within recess 123.

In order that the spring 122 will hold alarm lever 120 in its pivotal support 37a and will bias gear 82 toward alarm cam 86, spring 122 is longitudinally stressed between front plate 37 and the pivoted end of alarm lever 120. To this end, one end of spring 122 is notched as indicated at 122a to receive therein a tongue 37d defined at the edge of the opening in front plate 37 from which the integral projection 37a (FIG. 5) was obtained. The other end of the spring 122 is provided with a tongue 122b (FIGS. 6 and 12) which engages a projecting lug 120e on alarm lever 120. Moreover, the spring 122 engages one side of the lever 120 in order to pivot it about pivotal support 37a in a clockwise direction, as viewed in FIGS. 5 and 13 of the drawings. For performing a control function, the purpose of which will be apparent as the ensuing description proceeds, the alarm lever 120 includes a projection 120f at the end of the bifurcation 120b which extends in the direction opposite from the projection 120e, already described.

From the above description it will be apparent that whenever the clock winding 46a is energized the alarm vibrator arm 95a will vibrate unless means are provided physically to hold the same and prevent it from vibrating. To this end, there is provided an L-shaped vibration control lever 127 comprising arms 127a and 127b. The end of the arm 127a remote from the arm 127b is secured to a bushing 128 for pivotally supporting the lever 127 about the portion 41a of the pivot pillar 41. The arm 127a is also provided with a pair of laterally projecting lugs 127c and 127d which are cut out of the plane of the arm 127a and are bent at right angles to project toward the back plate 38, as clearly shown in FIGS. 4, 5, 6, 14 and 16 of the drawings. The projection 127d is a spring supporting lug and is indicated as being notched, as indicated at 130, to readily secure thereto a suitable tension spring described hereinafter. The projection 127c, on the other hand, is adapted to be received within a notch 131 cut in the back plate 38, as best shown in FIG. 16 of the drawings. The projection 127c then extends into the path of movement of the vibrator arm 95a and when moved against the arm 95a prevents vibration thereof. Hence, the lever 127 is referred to as the vibration control lever.

For the purpose of normally biasing the vibration control lever 127 in a counterclockwise direction about the pivotal axis of the bushing 128 and, hence, the axis of pivot post 41, as viewed in FIGS. 6 and 16 of the drawings, there is provided a tension spring 132 having one end thereof connected to the lug 127b which is provided with the notch 130, and the other end thereof engages a hooked shaped portion 133a of a combined support and detent member 133 suitably riveted to the back plate 38, as by rivets 134 (FIG. 16). This spring 132 will tend to pivot the vibration control lever 127 in a direction to cause the lug 127c to move into the notch 131 or, in other words, in a direction to release the vibrator arm 95a.

Since the lever 127, and particularly the arm 127b thereof, moves closely adjacent other parts of the apparatus including gear 77, dimples 127e and 127f are provided on the arm 127b to define bearing points of limited area, the dimple 127e projecting on the same side of lever 127 as lug 127c while the dimple 127f projects from the opposite side. Thus, dimple 127f will engage gear 77 and dimple 127e will engage a movable part of the timer described hereinafter. These dimples aid in insuring proper operation of lever 127. In order to hold the vibration control lever 127 in the position shown in FIGS. 5 and 6 of the drawings against the force of spring 132 to prevent vibration of arm 95a, the free end of the arm 127b is provided with a lug 127g which is engageable with certain control members, also described hereinafter. The projection or lug 127g extends in a direction from the lever 127 opposite to that of dimple 127f and the projec-

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tions 127c and 127d and in the same direction as dimple 127e. The purpose of lug 127g will become apparent from the ensuing description.

It will be understood that when lever 127 is free to pivot under the influence of spring 132 the vibrator arm 95a will be released to produce an audible alarm. In accordance with the present invention, means are provided to release lug 127g of lever 127 to permit a limited pivotal movement of lever 127 to render effective a time delay mechanism which will permit freeing vibration arm 95a after a predetermined delay. To secure this delay, there is provided a vibrator delay cam 136 (FIGS. 4, 5, 6, 14 and 15) which is pivotally mounted to the vibration control lever 127 at the junction between the arms 127a and 127b as by a suitable pivot shaft 136a which may be integral with cam 136. Preferably the cam 136 is mounted on the same side of the lever 127 as the projection 127c and a suitable washer 138 is mounted at the other side so that the shaft 136a may be peened over to hold the vibrator delay cam 136 in position. In accordance with the present invention and to permit limited initial movement of vibration control lever 127 about its pivotal axis, the opening in the vibration control lever 127 through which the vibrator delay cam shaft 136a extends is an elongated opening designated at 140 and is best shown in FIGS. 6, 14, 15 and 16 of the drawings.

The vibrator delay cam 136 is provided with a segmental portion including a plurality of teeth 136b which are disposed in the plane of the gear 77 drivingly related to the tubular minute shaft 69 so that under predetermined conditions, such as shown in FIG. 14 of the drawings, the segmental gear teeth 136b may be driven from the gear 77 to cause the vibrator delay cam 136 to pivot about its shaft 136a in the direction of the arrows indicated in FIG. 14 of the drawings. When the clock timer 31 is not set for alarm operation, however, then the parts are in the position of FIG. 6 where the teeth 136b of the vibrator delay cam 136 are out of driving engagement with gear 77. As specifically disclosed in FIGS. 6, 14 and 15 of the drawings, the vibrator delay cam is provided with a notched out portion defined by shoulders 142 and 143 at either side of the notch. A portion of the periphery of the vibrator delay cam 136 on the side thereof opposite the teeth 136b is cut away to define a shoulder 144 which is normally engageable with the lug 127d as shown in FIGS. 6 and 14 of the drawings. For the purpose of holding shoulder 144 in engagement with lug 127d and also under certain conditions to cause resetting of the vibrator delay cam 136, there is provided a vibrator delay cam reset spring 146 which is a tension spring having one end thereof connected to a pin 136c integrally secured to one face of the vibrator delay cam 136 adjacent the edge of the cut out portion between the shoulders 142 and 143. The other end of the vibrator delay cam reset spring is connected to the arm 133a of the combined support and detent 133 which is clearly shown in FIGS. 6, 14 and 16 of the drawings. As illustrated best in FIG. 16 of the drawings, the support 133a is provided with a pair of spaced recesses respectively to receive the corresponding ends of both tension springs 132 and 146 which extend generally parallel to each other. As will become apparent from the ensuing description, the vibrator delay cam will normally have its shaft 136a at one end of the elongated opening 140, as indicated in FIGS. 6 and 14 of the drawings, but under certain operating conditions, such as indicated in FIG. 15 of the drawings, the shaft 136a may be at the opposite end of elongated opening 140 as described hereinafter. The normal condition occurs by virtue of the fact that the shaft 136a is moved to the position at the end of the elongated slot 140, shown in FIGS. 6 and 14 of the drawings, by the lug 127d engaging the cam periphery. Under these conditions the shoulder 144 of the vibrator delay cam 136 engages the lug 127d and prevents clockwise rotation of the cam 136 about

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the axis of its shaft 136a, as viewed in FIG. 6 of the drawings. Counterclockwise rotation of cam 136 is prevented by tension spring 146. As shown in the drawings the cam 136 between the shoulders 143 and 144 has a constant radius. This results in a sudden release of the lever 127 and similarly a sudden starting of the audible alarm at full volume. If desired the radius of cam 136 referred to above may vary slightly so that the alarm may start earlier with a very quiet hum gradually increasing to full volume as the shoulder 143 reaches lug 127d.

Considering now the details of the alarm set cam 30 and the sleep cam 34 and their relationship to the remainder of the apparatus, each comprises a casting having a predetermined configuration pivotally mounted about a common shaft 148, the ends of which shaft may extend into suitable openings such as the opening 149 defined in the back plate 38 and the opening 150 in front plate 37 (FIG. 5). The alarm set cam 30 includes at the end remote from the lever portion 30a a plurality of spaced projections 30b for engaging with the alarm set cam detent spring 133b integrally formed with the element 133 already described heretofore. With this arrangement, the four positions of the alarm set cam 30 can readily be obtained. Preferably, the back plate 38 is provided with a pair of projections 38a and 38b, both of which extend into the path of the lever 30a. The projection 38a defines the stop for the lever 30a indicating the "on" position of the radio control (FIG. 6) while the projection 38b limits the other extreme position of the lever 30a and defines the "alarm" position of the lever (FIG. 14). The two spaces between the projections 30b of the alarm set cam 30 engaging the detent 133b then define the two intermediate positions, namely, the "off" position (FIG. 9) and the "automatic" position (FIGS. 10 and 12). The spring detent will hold the alarm set cam in whichever of the four positions it is set.

To perform certain control functions the alarm set cam 30, on the side thereof adjacent the sleep cam 34, includes an integral projection 30c which provides camming surfaces for engaging other parts of the timer including the insulated switch lever 112. As illustrated, the projection 30c includes an arcuate cam surface 152 and a switch lever engaging surface 153. It also includes a surface 154 for engaging various other parts of the apparatus such as vibrator control arm 127 and the like described more in detail hereinafter.

For the purpose of relating the alarm set cam, the insulated switch lever 112, and the vibrator control cam 127 as well as other parts of the mechanism, there is provided an automatic set lever mechanism generally designated at 160 in FIG. 16 of the drawings, which mechanism comprises a shaft 161 to which are secured a relatively rigid automatic set lever 162 and an automatic set lever spring 163. These three elements 161, 162 and 163 comprising the automatic set lever mechanism are effectively a unit pivotal about the longitudinal axis of shaft 161. A suitable washer 164 is illustrated as being included in the assembly to aid in holding the parts together. The ends of the shaft 161 are provided with portions of reduced cross section to be receivable within suitable cooperating openings defined in the front plate 37 and back plate 38, as is clearly shown in FIG. 7 of the drawings. The set lever spring 163 comprises a thin flat spring member including a segmental portion 163a which is adapted at all times to extend between alarm set cam 30 and sleep cam 34, as best shown in FIGS. 5, 6, 7 and 11 of the drawings, thereby accurately to guide the pivotal movement of the automatic set lever assembly 160 about the axis of shaft 161. Additionally, the spring 163 includes a narrow curved extension 163b having an opening 165 therein through which a rigid lug 162a of the automatic set lever extends. The end of one edge of extension 163b defines a shoulder 166 for engagement with lug 120f of alarm lever 120 under

certain conditions. The automatic set lever 162 is essentially a rigid plate having a portion thereof lying in face to face engagement with the segmental portions 163a of spring 163 through which shaft 161 extends and from which portion the lateral projection 162a extends. In addition, automatic set lever 162 includes a somewhat U-shaped extension 162b including an end portion 162c which is raised out of the plane of the main portion of lever 162 and, in fact, extends over the side of spring 163 opposite the side with which a portion thereof is in face to face engagement, as clearly shown in FIG. 16 of the drawings. The inside edge of the U-shaped extension 162b defines a stop or shoulder 167 engageable with lug 127g of vibration control lever 127 under various conditions. The outside edge of the U-shaped portion 162b defines a shoulder 168 engageable under certain conditions with cam surfaces 152 and 154 of alarm set cam 30.

The assembly of the automatic set lever mechanism 160 with the rest of the apparatus described thus far is such that the projection 162a of the automatic set lever 162 extends through the opening 117 in the insulated switch lever 112, and under certain conditions engages one of the arcuate cam surfaces defining opening 117. Moreover, the spring 116, which is a tension spring and which has one end thereof as described above engaging the projection 112f on the insulated switch lever 112, has the other end thereof secured to the lug or projection 162a of the automatic set lever 162. The parts are furthermore so interrelated, as described above, that the segment 163a of the mechanism 160 is guided during pivotal movement between cams 30 and 34. Moreover, upon assembly of the parts projection 127g of the vibrator control lever 127 is adapted to be disposed in the same plane as is the shoulder 167. Additionally, the lug 120f, as described above, of the alarm lever 120 is under certain conditions engageable with the automatic set lever mechanism 160. From the above description it will be apparent that the spring 116, assuming that the insulated switch lever 112 is held stationary, will tend to bias the automatic set lever mechanism 160 in a clockwise direction about the axis of shaft 161, as viewed in FIGS. 6, 9, 10 and 14 of the drawings, or in the event the automatic set lever mechanism 160 is assumed to be stationary, spring 116 will tend to rotate the insulated switch lever 112 in a counterclockwise direction about the axis of portion 40a of the pivot pillar 40.

Before considering the operation of the clock timer 31 with respect to the four positions of the alarm set cam 30 and its effect on switch means 97 and the radio 94 controlled thereby, consideration will first be given to the details of the sleep cam 34, already described. The purpose of the sleep cam is to permit the operator effectively to turn off the radio but, by virtue of the sleep cam, the radio will continue to operate for a predetermined period which might be as long as an hour and then automatically shut itself off at the end of that time. Consequently, this mechanism must prevent the radio from turning off until the preselected time delay after initially setting the sleep cam. Preferably, this time delay should be variable depending upon the desires of the user. As was described above, the sleep cam 34 is pivotally mounted upon the shaft 148 that supports the alarm set cam 30 and this cam has the "on" and "off" positions described in connection with FIGS. 1 and 2. In FIGS. 2 and 11 of the drawings, the "off" position of the sleep cam 34 is shown in which position the lever portion 34a engages a suitable stop 37e which is deformed from the front plate 37 and extends into the path of movement of lever portion 34a. As illustrated, the sleep cam 34 includes an integral raised portion 34b defining on one side a V-shaped notch 169a cut in an arcuate shoulder 169 and on the other a shoulder 170 (FIGS. 11, 16 and 17). The shoulder 170 is engageable with a detent spring 171 suitably secured as by rivets 172 to the front plate 37.

As illustrated, the detent spring 171 may be identical with the detent spring 133b and the associated parts of the element 133, thereby to reduce the number of different parts necessary. The shoulder 170 and the detent spring 171 are so arranged that as the sleep cam lever 34a almost reaches the off position determined by the stop 37e that it is caused to move to this position by sort of a snap action. The shoulder 169 and V-shaped notch 169a therein are disposed to engage the end of the arm 112b of the insulated switch lever 112, as clearly shown in FIG. 17 of the drawings, and this shoulder is what determines the position of lever 112 as viewed in FIGS. 9 and 10 of the drawings as well as both the solid line and dashed line position in FIG. 17. It will be apparent that it is desired for the sleep cam 34 to open the switch means 97 when moved to the off position shown in solid lines in FIG. 17 of the drawings and the V-shaped notch 169a in the shoulder 169 cooperating with the switch lever 112 will permit this to occur as will become apparent from the ensuing description.

It will be apparent that sleep cam 34, if it is to provide a predetermined time delay in moving from a position somewhere between the dashed line position and solid line position of FIG. 17 to the solid line position, must be driven by the timing mechanism of the clock timer during such movement. To this end, the sleep cam includes an integral segmental cam portion 34c which, at one end of the cam, terminates in a stop projection 34d which engages suitable stop means described hereinafter. In the dashed line position of FIG. 17 of the drawings the stop projection 34a is shown in the maximum "on" position.

For the purpose of drivingly engaging the segmental cam portion 34c of sleep cam 34 and moving it in response to operation of the time clock 31, there is provided a sleep pinion 175 suitably mounted upon a sleep pinion shaft 176 which shaft preferably has reduced end portions to be receivable in suitable openings in the front and rear plates 37 and 38, respectively. One of these openings, namely the opening 177 in back plate 38, is visible in FIG. 16 of the drawings. In accordance with the present invention, there is also mounted on the sleep pinion shaft 176 a sleep pinion flange 178 and a sleep pinion spring 179, the latter being a compression spring which biases the sleep pinion 175 toward the sleep pinion flange 178. The adjacent surfaces of the sleep pinion 175 and the sleep pinion flange 178 are provided with conical or beveled surfaces specifically designated as 175a and 178a (FIG. 7), respectively, thereby providing a somewhat V-shaped driving arrangement for receiving therebetween the segmental cam portion 34c of the sleep cam 34, as described above. Actually, the sleep pinion 175 is provided with a tubular extension 175b which engages the flange 178 and also defines the stop engageable by the stop projection 34d (FIG. 17). The sleep pinion 175 with its conical driving surface 175a is clearly shown in FIGS. 6 and 7 of the drawings and this pinion is shown in FIG. 6 as drivingly engaging the gear 84, which gear 84 is driven from the pinion 75 secured to the tubular minute shaft 69. Consequently, the sleep pinion 175 may be rotated in some predetermined relationship to the minute shaft 69 so that the sleep cam 34 may be actuated from some preset position to the "off" position in a period of time which may comprise thirty minutes, one hour, or even an hour and one-half, if that is desired. This means that the operator could set the time that the radio would operate after going to bed and for any period not exceeding the maximum provided. In a device built in accordance with the present invention the maximum time provided by the sleep cam 34 was one hour. Obviously, it could be more or less, depending upon the gear ratio between the gear 84 and the sleep pinion 75 and upon the extent of the segmental frictional driving portion 34c of the sleep cam 34.

In accordance with the present invention the power

supply for the radio portion of the clock radio 20 is obtained directly from the clock timer 31. As best shown in FIG. 18 of the drawings, the motor winding 46a and the secondary winding 46b are both wound on the bobbin 47 separated by the spacer 47a. In an embodiment built in accordance with the present invention the space between spacer 47a and the end of the coil remote from winding 46a was approximately one-quarter of an inch. By winding the secondary winding 46b directly on the core of the bobbin 47 rather than over the motor energizing winding 46a, the efficiency of the secondary winding is increased since it is more closely wound to the field structure 45. In an embodiment built in accordance with the present invention, the secondary winding 46b provided an output of nine volts and approximately three-thousandths of an ampere which is sufficient for operating the transistor radio 94.

In FIG. 18 the circuitry of the power supply for the transistor radio 94 is clearly indicated as is also the switch means 97 connected in this circuit. It is observed that the output of the winding 46b is supplied through conductors 180 and 181 to the power supply unit 182 of the transistor radio 94. The switch means 97 is connected in the conductor 180 and, hence, controls the supply of power to the transistor radio 94. The particular construction of the transistor radio forms no part of the present invention but it has been illustrated as including a tunable RF radio amplifier stage 184, a mixer stage 185, a conventional local oscillator 186, an intermediate frequency amplifier stage 187, a detector stage 188, and an audio frequency amplifier stage 189 to which the speaker 27 is connected.

OPERATION

In view of the detailed description set forth above, the operation of the clock timer 31 of the present invention will readily be understood. It will be appreciated that the operation of the timer in all four positions of the alarm set cam 30 can be considered without reference to the sleep cam 34 and it will be assumed in the ensuing description of the timer operation at different positions of the alarm set cam 30 that the sleep cam 34 is in the "off" position. Starting with the "on" position of the alarm set cam, reference should first be had to FIG. 6 of the drawings where the alarm set cam 30 is shown in the "on" position. In this position the thickened portion 112d on the insulated switch lever 112 engages the cam surfaces 153 of the alarm set cam 30 thus causing a slight pivotal movement of the insulated switch arm 112 in a clockwise direction about the axis of pivot pillar 40, as viewed in FIG. 6. Such pivotal movement of insulated switch lever 112 moves the arm 112c away from the flexible spring arm 102 and permits the switch means 97 to close the circuit at contacts 100 and 101. In this "on" position of alarm set cam 30, the lever portion 30a is against the stop 38a and the detent 133b holds it in this position. Moreover, in the "on" position of the alarm set cam 30 the cam surface 152 engages the shoulder 168 of the alarm set lever 162 thus limiting the maximum clockwise rotation of the alarm set lever 162 and associated parts defining assembly 160 about the axis of shaft 161, as viewed in FIG. 6. Counterclockwise rotation of the automatic set lever assembly 160 from the position shown in FIG. 6, where the shoulder 168 engages the cam surface 152, is prevented by the lug 127g of the vibration control lever 127 which, under the influence of tension spring 132, tends to rotate vibration control lever 127 in a counterclockwise direction about the axis of portion 41a of pivot pillar 41. Under these conditions, it will be apparent that the automatic set lever mechanism 160 is rigidly held in the position shown in FIG. 6 between the cam 152 and the lug 127g, and in this position the lug 127c of the vibrator control lever 127 holds the vibrator arm 95a in a position so that it cannot vibrate to produce an audible signal. The remaining parts of the apparatus are all held in the

position shown in FIG. 6 of the drawings. Pivotal movement of the alarm lever 120 between the positions shown in FIGS. 5 and 13 will have no effect on the mechanism since the shoulder 166 on the alarm set lever mechanism 160 is prevented from engaging the lug 120f on the alarm lever 120. Since automatic set lever 162 is held in fixed position, it will be appreciated that the spring 116 tends to move insulated switch lever 112 in a counterclockwise direction about its pivotal axis, as viewed in FIG. 6, but this is prevented by the shoulder 153 on the alarm set cam 30 which engages the thickened portion 112d best shown in FIGS. 6 and 11 of the drawings.

When the alarm set cam 30 is moved to the "off" position shown in FIG. 9 of the drawings it is moved away from the stop 38a in a counterclockwise direction (as viewed in FIGS. 6 and 9) about the pivotal axis of shaft 148 and the detent 133 again holds the alarm set cam in such "off" position. By moving the alarm set cam 30 to the "off" position shown in FIG. 9, no change in the position of the automatic set lever 162 occurs since the arcuate cam surface 152 continues to engage the shoulder 168, a different portion of this arcuate cam surface 152 merely engaging the shoulder. However, in this "off" position, the shoulder 153 defined on the alarm set cam 30 is moved free of the overhanging shoulder 114 defined on the insulated switch lever 112 and the spring 116 thereby pivots the insulated switch lever 112 in a counterclockwise direction about its pivotal axis until the free end of the arm 112b engages the notch 169a of the shoulder 169, best shown in FIG. 17 of the drawings. This position of the insulated switch lever 112 results in the switch means 97 being moved to the open position as clearly indicated in FIG. 9 of the drawings. In this position as in the position shown in FIG. 6, the parts of the timer mechanism perform their normal functions.

From the above discussion it can readily be observed that in either the "on" or the "off" position of the alarm set cam 30 the automatic set lever 160 is effectively in a fixed position and holds the vibrator control lever 127 in a position to prevent vibration of the arm 95a.

When the alarm set cam 30 is moved to the "automatic" position shown in FIGS. 10 and 12 of the drawings, a somewhat different situation ensues. In the first place, in this position the arcuate cam surface 152 no longer engages the shoulder 168 and, hence, the automatic set lever mechanism 160 is free to move in a clockwise direction about the axis of shaft 161 as viewed in these figures. The insulated switch lever 112 remains, however, in the same position shown in FIG. 9 of the drawings with the free end of the arm 112b in engagement with the notch 169a of the shoulder 169 defined on the sleep cam 34. This means that the insulated switch lever 112 cannot pivot about its pivotal axis in a counterclockwise direction and the tension spring 116 will therefore rotate the automatic set lever 162 and associated spring 163 in a clockwise direction, as viewed in FIG. 10, until the shoulder 166 engages the lug 120f of the alarm lever 120. By comparing FIGS. 9 and 10 it will be observed that this pivotal movement of the automatic set lever mechanism 160 is rather a limited movement. Such movement also moves the shoulder 167 and, consequently, the vibration control lever 127 pivots in a counterclockwise direction as viewed in FIG. 6 of the drawings under the influence of tension spring 132 so that the lug 127g remains in engagement with the shoulder 167. Such slight movement of the vibration control lever 127 does not release the vibrating arm 95a, however. When the timer mechanism, however, reaches the time at which the alarm indicator 67 and, hence, the alarm cam 86 are set, the alarm lever 120 pivots from the position shown in FIG. 5 of the drawings to the position shown in FIG. 13 of the drawings. Such movement of the alarm lever 120 moves the lug 120f clear of the shoulder 166 defined on portion 163b of spring 163 and, at this

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instant, the automatic set lever mechanism 160 comprising elements 162 and 163 is free to pivot an additional amount about shaft 161 in a clockwise direction from the position shown in FIG. 10 of the drawings to the position shown in FIG. 12 of the drawings until the shoulder 168 thereon engages the shoulder 154 on the alarm set cam 30. Such movement of the automatic set lever mechanism 160 moves the shoulder 167 and, hence, frees vibration control lever 127. However, cam surface 152 is in such a position as to engage a shoulder 127h at the free end of the vibration control lever 127 thus preventing further counterclockwise pivotal movement of the vibration control lever, as viewed in FIG. 6 of the drawings, just as effectively as if the lug 127g were still in engagement with the shoulder 167 as in FIGS. 6, 9 and 10 of the drawings. Consequently, the vibrating arm 95a is still prevented from vibrating by the lug 127c and no alarm action takes place.

The pivotal movement (slight clockwise rotation as viewed in FIGS. 10 and 12) of the automatic set lever 162 that occurs between the position shown in FIG. 10 and the position shown in FIG. 12 causes lateral projection 162a to engage the cam surface defined by one of the arcuate edges of the opening 117 and thus forces insulated switch lever 112 to pivot in a clockwise direction about the pivot pin 40a from the position shown in FIG. 10 to the position shown in FIG. 12. The design of the cam surface engaged by the lateral projection 162a determines the relative positions of the insulated switch lever 112 and automatic set lever 162. This cam surface is so positioned that in the position of FIG. 12 of the drawings the switch comprising contacts 100 and 101 is closed. In other words, the pivotal movement of the automatic set lever 162 that occurred between the position shown in FIG. 10 and the position shown in FIG. 12 is such as to cause insulated switch lever 112 to pivot sufficiently in a clockwise direction about its pivotal axis automatically to actuate the switch means 97 to the closed position shown in FIG. 12 and, hence, automatically to turn on the transistor radio 94 shown in FIG. 18 of the drawings. As the timer mechanism continues to operate it will be apparent that the cam members 86a and 86b of the alarm cam 86 will force the hour gear 82 from the position shown in FIG. 13 of the drawings to the position shown in FIG. 5 with the result that the lug 120f of the alarm cam will move into engagement with the set lever spring 163. By virtue of the flexibility of the extension 163b of this spring 163 it will merely be deflected away from the portion 162c of the automatic set lever 162 without damage to the mechanism. Furthermore, if the alarm set cam 30 is moved from the "automatic" position to either the "off" or the "on" position, described heretofore, the automatic set lever mechanism 160 will be restored to the positions shown in FIGS. 6 and 9 and the shoulder 166 will again be free to engage the lug 127 on subsequent operations. Thus, the purpose of the flexible extension 163b becomes readily apparent.

When the alarm set cam 30 is moved to the "alarm" position which is the fourth of the four possible positions, clearly shown in FIG. 14 of the drawings, the parts are in essentially the same positions as in FIG. 12 of the drawings with two major exceptions. In the first place, the arcuate cam surface 152 has been moved sufficiently so that it does not engage the shoulder or stop 127h defined at the end of the vibration control lever 127 and, hence, this vibration control lever is free to pivot in a counterclockwise direction about its pivotal axis as viewed in FIG. 14 of the drawings without such movement being limited either by the lug 127g or the shoulder 127h as was the case in the positions described heretofore. However, in FIG. 14 the counterclockwise rotation of the vibration control lever 127 is limited by the fact that the teeth 136b of the vibrator delay cam 136 are moved into engagement with the gear 77 under the influence of

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the tension spring 132. Hence, the limited pivotal movement of the arm 127a that is permitted is that required to move delay cam 136 from the position shown in FIG. 6 to the position shown in FIG. 14 of the drawings. Furthermore, shaft 136a of the vibrator delay cam is maintained at the upper end of elongated opening 140 as viewed in FIG. 14 of the drawings by virtue of lug 127d engaging the periphery of delay cam 136. The portion of the insulated switch lever 112, as in all of the previous positions of the alarm set cam 30 except the "off" position, is determined by the notch 169a in the shoulder 169 of the sleep cam 34. Under the conditions indicated in FIG. 14 of the drawings, clockwise rotation of the gear 77 in the direction of the arrow there indicated will cause counterclockwise rotation of the vibrator delay cam 136 to provide a predetermined delay which, in an embodiment built in accordance with the present invention, was of the order of seven minutes. When a predetermined rotation of the vibrator delay cam 136 has occurred by virtue of the driving engagement with gear 77, the lug 127d is permitted to move into the notch in the vibrator delay cam defined between the shoulders 142 and 143 as shown in FIG. 15 of the drawings. Moreover, the tension spring 132 will cause the vibration control lever 127 to pivot in a counterclockwise direction as viewed in FIG. 14 of the drawings until stopped by the shaft 136a of the vibrator delay cam engaging the opposite end of the elongated opening 140 to assume the position shown in FIG. 15 of the drawings. In this position, as clearly shown in FIG. 15, the vibrator arm 95a is free to vibrate and an audible signal results. The switch means 97 is actuated in the position shown in FIG. 14 in exactly the same manner that it was actuated in connection with FIG. 12. The audible alarm will continue to operate until the operator actuates the lever portion 30a to any one of the other three positions of the alarm set cam 30 whereupon the shoulder cam surface 152 will move vibration control lever 127 to the FIG. 12 position and, hence, to a position preventing vibration of vibrator arm 95a. Such movement of vibrator control lever 127 will also move vibrator delay cam 136 away from gear 77, as viewed in FIG. 15, with the result that reset spring 146 is free to quickly reset cam 136 to the position shown in FIG. 6 of the drawings.

From the above description it will be understood that the alarm set cam may be moved to any one of four positions with the resultant desired operation. Furthermore, the apparatus forming a part of the clock timer 31 is simple and compact and may be embodied in a very small space such as in the existing clock mechanism.

The operation of the sleep switch 34 will also be readily understood in view of the detailed description set forth above. It will be appreciated that whenever the sleep cam 34 is moved away from the "off" position which is the position against the stop 37d, the cam segment 34c moves into driving engagement with the conical surfaces 175a and 178a of the sleep pinion 175 and sleep pinion flange 178, respectively, which results in a gradual return of the cam 34 to the solid line position shown in FIG. 17 of the drawings.

Referring now to FIG. 17 of the drawings, it will be apparent that when the sleep cam 34 is moved away from the stop 37a the end of the insulated switch lever 112 moves out of the notch 169a and is caused to rotate in a counterclockwise direction, as viewed in FIG. 17 of the drawings, about its pivotal axis which means that the insulated switch lever is moved to its switch closing position represented by FIG. 6 of the drawings just as effectively as if the alarm set cam 30 was moved to the "on" position shown in FIG. 6 except that in this case the insulated switch lever is controlled by the sleep cam 34. It will be understood that the insulated sleep cam 34 will be actuated to the "on" position only when the alarm set cam 30 is in other than its "on" position for if the alarm set cam 30 is in its "on" position the sleep cam 34 is in-

effective. Assuming, therefore, that the alarm set cam 30 is in other than its "on" position the sleep cam 34 when moved to any position away from the stop 37d will close switch means 97 and, hence, energize the radio 94. The particular pivotal movement of the sleep cam 34 away from the stop 37d will determine the time that it takes for the sleep cam 34 to return to the solid line position against stop 37d. The maximum initial setting of sleep cam 34 is, of course, limited by the engagement of stop 34d with tubular flange 175b, as clearly shown by dashed lines in FIG. 17 of the drawings. The operator may move the sleep cam 34 to any position between these extremes and the radio will remain energized for whatever preselected time is chosen until alarm cam 34 is restored automatically to its "off" position. As it approaches this "off" position the detent 171 engaging cam surface 170 will cause rather high speed final movement thereof to cause opening of switch means 97 with sort of snap action.

While there has been illustrated and described a particular embodiment of the clock timer of the present invention it will be understood that various changes and modifications may occur to those skilled in the art. It is intended in the appended claims to cover all those changes and modifications which fall within the true spirit and scope of the present invention.

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

1. A clock timer for controlling a signal device comprising a timer motor means, control means, time-driven means driven by said timer motor means for actuating said control means at a preselected time, means for selectively adjusting said preselected time, switch means movable between an open and a closed position, pivotally mounted lever means for actuating said switch means, alarm set means comprising a pivotally mounted lever including cam means for selecting various modes of operation of said switch means, means responsive to a first position of said alarm set means for directly actuating said lever means to permit said switch means to move to said closed position and responsive to a second position of said alarm set means for directly actuating said lever means to move said switch means to said open position and responsive to a third position of said alarm set means out of engagement with said lever means whereby said control means permits said switch means to be actuated to said closed position at said preselected time.

2. A clock timer as defined in claim 1 above and including additional means manually settable to actuate said switch to said open position at a preselected time after setting thereof when said alarm set means is in any but the first of its positions.

3. A clock timer for controlling a signal device comprising a timer motor means, control means, time-driven means driven by said timer motor means for actuating said control means at a preselected time, means for selectively adjusting said preselected time, switch means movable between an open and a closed position, pivotally mounted lever means for actuating said switch means, audible alarm means, alarm set means comprising a pivotally mounted lever including cam means for selecting various modes of operation of said switch means and alarm means, means responsive to a first position of said alarm set means for directly actuating said lever means to permit said switch means to move to a closed position and responsive to a second position of said alarm set means for directly actuating said lever means to move said switch means to an open position and responsive to a third position of said alarm set means out of engagement with said lever means whereby said control means permits said switch means to be actuated to a closed position at said preselected time and responsive to a fourth position of said alarm set means and to said control means for actuating said switch means to a closed position at said preselected time and for turning on said alarm means at a fixed time thereafter.

4. A clock timer as defined in claim 3 above and including additional means manually settable to actuate said switch to said open position at a preselected time after setting thereof when said alarm set means is in any but the first of its positions.

5. A clock radio comprising a timer motor means, control means, time-driven means driven by said timer motor means for actuating said control means at a preselected time, means for selectively adjusting said preselected time, a radio receiver, circuit means for supplying electrical energy to said receiver, switch means in said circuit means movable to a first position to open said circuit and movable to a second position to close said circuit, pivotally mounted lever means for actuating said switch means, alarm set means comprising a pivotally mounted lever including cam means for selecting various modes of operation of said switch means, means responsive to a first position of said alarm set means for directly actuating said lever means to permit said switch means to turn on said receiver and responsive to a second position of said alarm set means for directly actuating said lever means to cause said switch means to turn off said receiver and responsive to a third position of said alarm set means out of engagement with said lever means whereby said control means permit said switch at said preselected time to turn on said receiver.

6. A clock radio as defined in claim 5 above and including means manually settable to actuate said switch to an open position at a preselected time after setting thereof when said alarm set means is in any but its first position.

7. A clock radio comprising a timer motor means, control means, time-driven means driven by said timer motor means for actuating said control means at a preselected time, means for selectively adjusting said preselected time, a radio receiver, circuit means for supplying electrical energy to said receiver, switch means in said circuit means movable to a first position to open said circuit and movable to a second position to close said circuit, pivotally mounted lever means for actuating said switch means, audible alarm means, alarm set means comprising a pivotally mounted lever including cam means for selecting various modes of operation of said switch means and alarm means, means responsive to a first position of said alarm set means for directly actuating said lever means to permit said switch means to turn on said receiver and responsive to a second position of said alarm set means for directly actuating said lever means to cause said switch means to turn off said receiver and responsive to a third position of said alarm set means out of engagement with said lever means whereby said control means permits said switch means to turn on said receiver at said preselected time and responsive to a fourth position of said alarm set means and to said control means for permitting said switch means to move to a closed position at said preselected time to turn on said receiver and for turning on said alarm means at a fixed time thereafter.

8. A clock radio as defined in claim 7 above and including additional means manually settable to actuate said switch to an open position at a preselected time after setting thereof when said alarm set means is in any but its first position.

9. A clock radio comprising a timer motor means including an energizing winding, control means, time-driven means driven by said timer motor means for actuating said control means at a preselected time, means for selectively adjusting said preselected time, a radio receiver, a secondary winding inductively coupled to said energizing winding connected to supply energy to said receiver, switch means connected to said secondary winding and movable to an open position to turn said receiver on and to a closed position to turn said receiver off, pivotally mounted lever means for actuating said switch means, audible alarm means, alarm set means comprising a pivotally mounted lever including cam means for selecting

various modes of operation of said switch means and alarm means, means responsive to a first position of said alarm set means for directly actuating said lever means to permit said switch means to turn on said receiver and responsive to a second position of said alarm set means for directly actuating said lever means to cause said switch means to turn off said receiver and responsive to a third position of said alarm set means out of engagement with said lever means whereby said control means permits said switch means at said preselected time to turn on said receiver and responsive to a fourth position of said alarm set means and to said control means for permitting closing of said switch means at said preselected time to turn on said receiver and for turning on said alarm means at a fixed time thereafter, and means manually settable to actuate said switch means to an open position in a preselected time after setting thereof when said alarm set means is in any but its first position.

10. A clock radio as defined in claim 9 above wherein said receiver is a transistor type requiring a lower voltage than is supplied to said timer motor means and said secondary winding acts as a voltage step-down transformer to reduce the voltage thereof supplied to said receiver.

11. A clock radio comprising a transistor type radio receiver, a synchronous electric motor including a rectangularly shaped magnetic core having a pair of pole faces forming an opening, a pair of independent axially spaced windings on said core including a single phase energizing winding for said motor, a rotor housed within a sealed casing having a portion of reduced cross section received in said opening, the other of said windings comprising a secondary winding in inductive relation to said energizing winding forming with said energized winding and said core a voltage step-down transformer connected to furnish electrical energy to said receiver, and time indicating means driven by said rotor.

12. A clock timer for controlling a signal device comprising a timer motor means, control means, time-driven means driven by said timer motor means for actuating said control means at a preselected time, means for selectively adjusting said preselected time, switch means movable between an open and a closed position, a longitudinally movable link member, manually settable alarm set means connected to said link member for selecting various modes of operation of said switch means, means responsive to a first position of said alarm set means for actuating said switch means to said closed position and responsive to a second position of said alarm set means for actuating said switch means to said open position and responsive to a third position of said alarm set means and to said control means for actuating said switch means to said closed position at said preselected time.

13. A clock timer as set forth in claim 12 above and additionally including an audible alarm, and wherein means responsive to a fourth position of said alarm set means and to said control means is provided for closing said switch at said predetermined time and for sounding said audible alarm at a fixed time thereafter.

14. A clock timer for controlling a signal device comprising a timer motor means, control means, time-driven means driven by said timer motor means for actuating said control means at a preselected time, means for selectively adjusting said preselected time, switch means movable between an open and a closed position, a longitudinally movable link member, manually settable alarm set means connected to said link member for selecting various modes of operation of said switch means, means responsive to a first position of said alarm set means for actuating said switch means to said closed position and responsive to a second position of said alarm set means for actuating said switch means to said open position and responsive to a third position of said alarm set means and to said control means for actuating said switch means to said closed position at said preselected time, a second longitudinally movable link member, and manually set-

table means operable by said second link member for actuating said switch means to said open position in a preselected time after setting thereof when said alarm set means is in any but the first of its positions.

15. A clock timer for controlling a signal device comprising a timer motor means, control means, time-driven means driven by said timer motor means for actuating said control means at a preselected time, means for selectively adjusting said preselected time, switch means movable between an open and a closed position, a manually settable alarm set cam for selecting various modes of operation of said switch means, a longitudinally movable link connected to actuate said cam, means responsive to a first position of said cam for actuating said switch means to said closed position and responsive to a second position of said cam for actuating said switch means to said open position and responsive to a third position of said cam and to said control means for actuating said switch means to said closed position at said selected time, a manually settable sleep cam for opening said switch means in a preselected time after setting thereof when said alarm set cam is in any but its first position, and a longitudinally movable link connected to actuate said sleep cam.

16. A clock timer for controlling an electric switch comprising supporting structure, timing means carried by said supporting structure and including an hour gear rotating at one revolution every twelve hours, a combined cam and alarm gear coaxial with the hour gear, means for selectively adjusting said alarm gear, control means biasing at least one of said gears to a first axial position, cooperating cam means for said hour gear to produce axial separation of said gears, switch means, actuating means for said switch means, alarm set cam means for selecting various modes of operation of said switch means, and means responsive to the position of said alarm set cam means and to the axial position of said gears for causing performance of the selected mode of operation of said switch means.

17. A clock timer as set forth in claim 16 above and additionally including an audible alarm means and wherein one of said modes of operation selectable by said alarm set cam means includes means for sounding said audible alarm means.

18. A clock timer as set forth in claim 17 above and additionally including sleep cam means for selecting a further mode of operation of said switch means.

19. A clock timer for controlling an electric switch comprising supporting structure, electric timing means carried by said supporting structure and including an electric motor, an hour gear rotating at one revolution every twelve hours, a combined cam and alarm gear coaxial with the hour gear, means for selectively adjusting said alarm gear, control means biasing one of said gears to a first axial position toward the other gear, cooperating cam means on said hour gear to produce axial separation of said gears, a switch, an alarm set cam movable to a plurality of positions for selecting various modes of operation of said switch, a switch actuating lever connected to actuate said switch between an open and a closed position, said switch actuating lever responsive to a first position of said alarm set cam to actuate said switch to one of its positions and responsive to a second position of said alarm set cam to actuate said switch to the other of its positions, and an automatic set lever mechanism connected to actuate said switch actuating lever at said predetermined time when said alarm set cam is in a third position and rendered ineffective to actuate said switch actuating lever when said alarm set cam is in said first and second positions.

20. A clock timer as set forth in claim 19 above and additionally including a vibrating alarm, a vibration control lever normally preventing vibration of said alarm, a time-driven gear, and a vibration delay cam cooperable with said time-driven gear for releasing said vibration

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control lever to permit vibration of said alarm after a fixed time after engagement of said delay cam and time-driven gear, said vibration control lever restrained from permitting vibration of said alarm when said alarm set cam is in its three above-mentioned positions but releasable for movement under the control of the delay cam at said preselected time when said alarm set cam is in a fourth position.

21. A clock timer is set forth in claim 19 above and additionally including a sleep cam movable to a plurality of positions and controlling said switch actuating lever to move said switch to one of its positions when said sleep cam is moved into a first position whenever said alarm set cam is in any one but one of its positions, and a time-driven gear cooperable with said sleep cam to drive said cam into its said first position when said sleep cam is moved out of its said first position.

22. A clock timer as set forth in claim 20 above and additionally including a sleep cam movable to a plurality of positions and controlling said switch actuating lever to move said switch to one of its positions when said sleep cam is moved into a first position whenever said alarm set cam is in any but one of its positions, and another time-driven gear cooperable with said sleep cam to drive said cam into its said first position whenever said sleep cam is moved out of its said first position.

23. In a timing device, an audible alarm vibrator, a switch, a plural position two-part lever means for actuating said switch, and for obstructing operation of said alarm vibrator, means driven by said timing device for automatically moving said lever means 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 manual means for moving one of said lever parts in said one direction at any time to close said switch.

24. In a timing device, an audible alarm vibrator, a switch, a plural position two-part lever means for actuating said switch and for obstructing operation of said alarm vibrator, spring means for yieldingly holding the parts of said lever means in engagement with each other,

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means driven by said timing device for automatically moving said lever means as a unit 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 manual means for moving one of said lever parts in said one direction in opposition to the force of said spring means at any time to close said switch.

25. In a timing device, an audible alarm vibrator, a switch, a plural position two-part lever means for actuating said switch, and for obstructing operation of said alarm vibrator, means driven by said timing device for automatically moving said lever means 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 manual means for simultaneously moving one of said lever parts in said one direction at any time to close said switch and for moving the other one of said lever parts in an opposite direction to set said lever means for automatic operation.

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