United States Patent [19]

Coe

[11] **3,775,574**

[45] **Nov. 27, 1973**

[54] **WEEKLY CYCLE TIMING MECHANISM WITH SHAFT SECURING MEANS FOR PREDETERMINED ADJUSTABLE PROGRAMMING CAM ASSEMBLY**

[76] Inventor: **Robert L. Coe,** St. Louis, Mo.

[22] Filed: **Jan. 26, 1973**

[21] Appl. No.: **327,617**

Related U.S. Application Data

[63] Continuation of Ser. No. 200,428, Nov. 19, 1971, abandoned.

[52] **U.S. Cl.** ..... **200/38 BA,** 200/38 D
[51] **Int. Cl.** **H01h 43/18**
[58] **Field of Search** ..... 200/18, 33 B, 35 R, 200/37 A, 38 R, 38 B, 38 BA, 38 D, 38 DA, 200/38 DB; 74/568 R, 568 T, 352, 354

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[57] **ABSTRACT**

Security timing apparatus for simulating occupancy in a building by turning on and off certain electrical lights and/or minor appliances such as a radio to deter a burglar from breaking into the building. This apparatus has a set of disk cams carried on a shaft which is driven at a rate of one revolution per week by a synchronous clock motor. Each of the cams in the cam set has a plurality of cam formations on its periphery for opening and closing a respective switch which turns on and off one or more of the above-mentioned lights or appliances. The cam formations on each cam differ in pattern and position from those on the periphery of each of the other cams in the set. Each of the cams of the cam set is secured to the shaft in any one of seven preselected fixed positions to provide many different sequences of operation of the lights and appliances each day and on each different day of the week.

5 Claims, 5 Drawing Figures

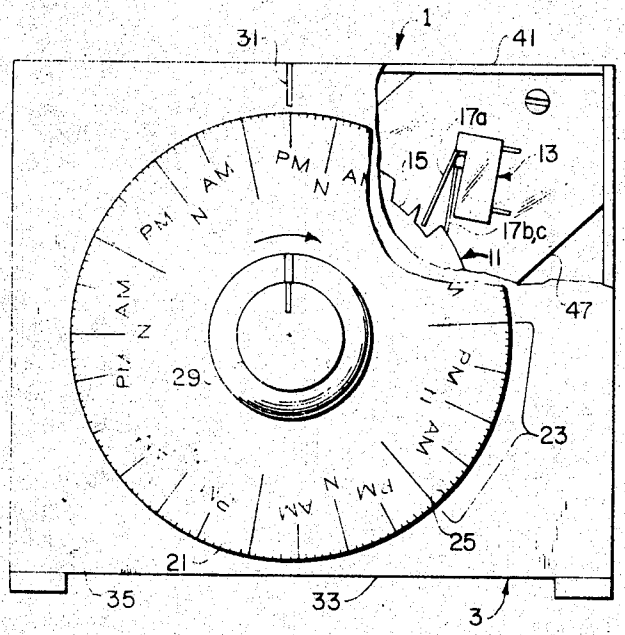

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FIG. 1

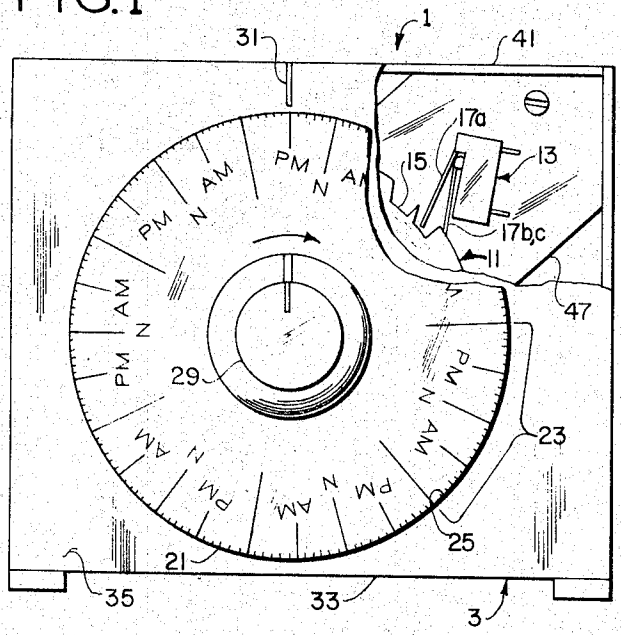


FIG. 2

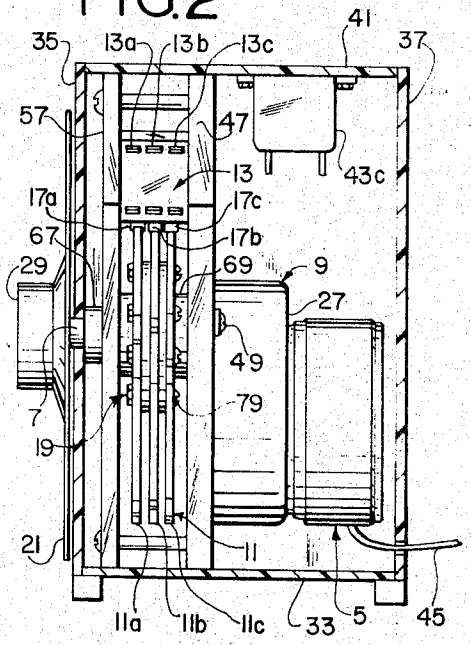


FIG. 3

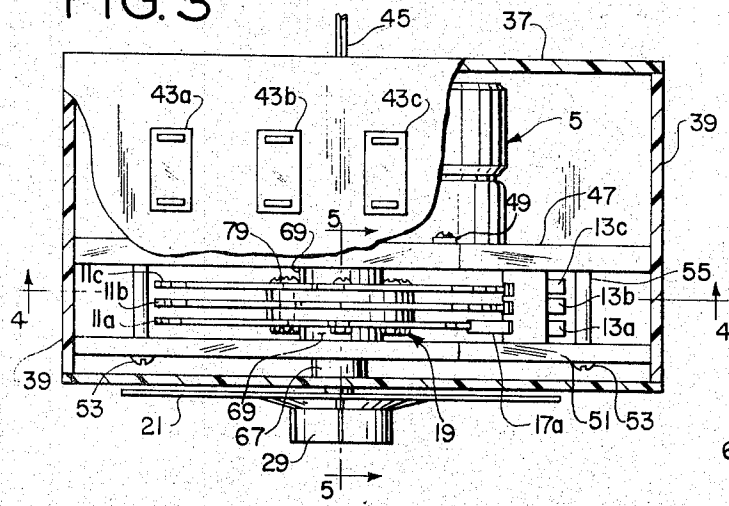


FIG. 4

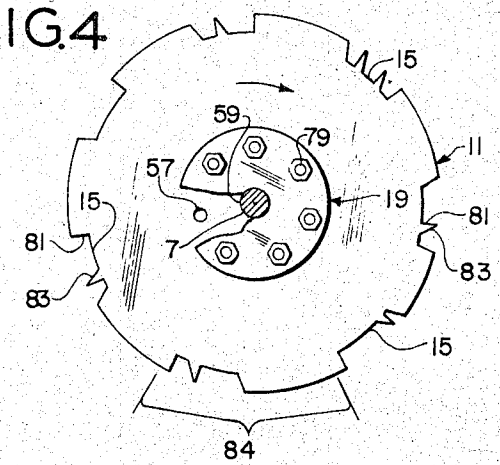
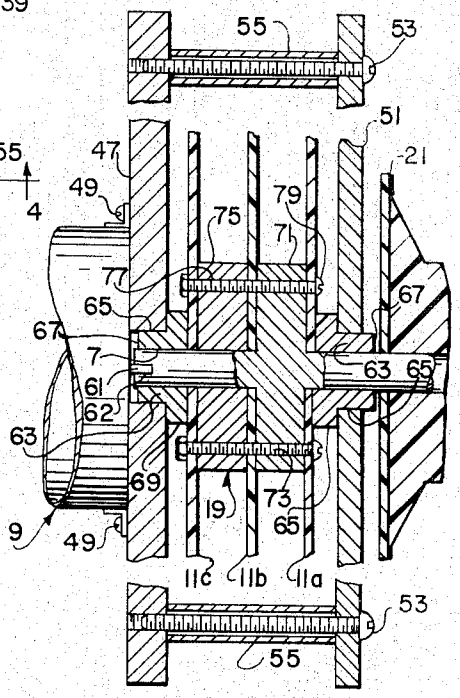


FIG. 5



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WEEKLY CYCLE TIMING MECHANISM WITH SHAFT SECURING MEANS FOR PREDETERMINED ADJUSTABLE PROGRAMMING CAM ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of my copending application Ser. No. 200,428, filed Nov. 19, 1971, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to a security timing apparatus and particularly to such apparatus which simulates occupany in a building and lessens the risk of burglary by intermittently energizing and deenergizing one or more electrical circuits for predetermined time intervals thereby to turn on and off certain selected lights and/or electrical appliances (e.g., a radio or television set).

Timers have been used to simulate occupancy but such units have controlled electrical circuits or lamps to turn them on and off at the same times each day. Such a simple repetitive pattern is not likely to deceive an observer as to the occupancy of the building. Timing devices which provide a different period of energization each day and other devices which control more than one circuit are also known. However, these have not been used in the field of security apparatus and none provided multiple circuit control in which there is a different pattern of circuitry energization every day for each circuit.

U.S. Pat. Nos. 2,688,366, 2,712,763 and 3,170,330 illustrate typical timers.

In addition to turning electrical circuits on and off to simulate occupancy, it is important that security timing apparatus in wide use in one area (i.e., a subdivision or an apartment complex) have different sequences of operation to prevent a burglar from detecting a standard or single sequence of operation of several such apparatus used in the area and thereby ascertaining that occupancy is merely simulated.

SUMMARY OF THE INVENTION

Among the many objects of this invention may be noted the provision of security timing apparatus for energizing and deenergizing selected electrical circuits for realistically simulating occupancy of a building; the provision of such security apparatus which has an extremely large number of possible sequences or patterns of operation; and the provision of such apparatus which is of economical construction and reliable operation.

In general,security timing apparatus of this invention comprises a case, a synchronous electric motor mounted within the case, an output shaft rotatably driven by the motor at a rate of one revolution per week, and a set of disk cams carried on the shaft for rotation therewith. Each cam has seven different peripheral zones corresponding to the days of the week, and a plurality of cam formations are provided on the periphery of each cam with the cam formations on each cam in the cam set differing in pattern and position from those on the periphery of each of the other cams in the set. Each switch has a switch arm which engages the periphery of a respective cam and which is moved in response to rotation of its respective cam to open and close each respective switch thereby intermittently energizing and deenergizing these electrical circuits. The shaft includes means for securing the set of cams

thereon with each cam being positioned in any one of seven fixed positions relative to the shaft whereby many different sequences of operation of the switches are provided. A dial is affixed to the shaft for rotation therewith and is divided into seven equal arcuate sections, each section corresponding to one day of the week and being divided into intervals denoting the time of the day. A one-way clutch for the motor is provided to permit the shaft to be manually rotated in the direction of rotation of the shaft for setting the sequencing of the switch in relation to the actual time of the day.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front elevation of security timing apparatus of this invention with parts broken away;

FIG. **2** is a side elevation of this apparatus with its right side wall removed;

FIG. **3** is a plan view of this apparatus with portions of its top wall broken away;

FIG. **4** is a vertical section on line **4—4** of FIG. **3** with parts removed for clarity; and

FIG. **5** is an enlarged vertical section on line **5—5** of FIG. **3.**

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, security timing apparatus of this invention, indicated in its entirety at **1,** for energizing and deenergizing selected electrical circuits in a building (e.g., electric lamps and small electrical appliances such as a radio or television set) to simulate occupancy of the building is shown to comprise a case **3** having a synchronous electric clock motor **5** mounted therein. This motor drives a shaft **7** via a reduction gear assembly generally indicated at **9** at a rate of one revolution per week (i.e., 1/168 revolution per hour). As shown in FIGS. **2** and **3,** shaft **7** carries a set of disk cams generally indicated at **11** for rotation with the shaft, the cams in this set being individually indicated at **11***a*, **11***b* and **11***c*. A switch assembly generally indicated at **13** having switches **13***a*, **13***b* and **13***c* therein is mounted within the case. These switches are operable in response to rotation of the cam set for turning on and off the lights and appliances connected thereto. A plurality of cam formations or notches **15** (see FIG. **4**) is provided on the periphery of each cam of cam set **11.** The cam formations on each cam differ in pattern and position from those on the periphery of each of the other cams in cam set **11** for purposes as will appear. Each switch of the switch assembly has a switch arm as respectively indicated at **17***a*, **17***b* and **17***c* which engages the periphery of a respective cam and which moves in response to the slowly rotating cams between an open position (the position of switch arm **17***b* and **17***c* as shown in FIG. **1**) in which its respective switch is open and a closed position (the position of switch arm **17***a*) in which its respective switch is closed. Each switch arm is spring biased for movement into the notches of its respective cam thereby to close its switch and is held in a switch-open position when the outer end of the switch arm is not aligned with a notch but is in engagement with the unnotched periphery of its respective cam.

As shown in FIGS. 2-5, means generally indicated at 19 carried by shaft 7 are provided for securing the cams of cam set 11 on the shaft with each cam independently being positioned in any one of seven preselected fixed positions relative to the shaft, these seven fixed positions corresponding to the days of the week. Means 19 permit each one of the cams 11*a*, 11*b* or 11*c* to be selectively positioned on shaft 7 in any one of seven fixed positions thereby to change the angular relation of the cams in the set relative to one another and thus change the sequencing of the switches 13*a*, 13*b* and 13*c* relative to one another so that many different sequences of operation of the switches on different days of the week may be attained.

A dial 21 affixed to the outer end of shaft 7 rotates with the shaft. This dial is divided into seven equal arcuate sections 23, each section corresponding to a day of the week and being divided into intervals as indicated at 25 denoting the time of the day. Motor 5 is provided with a one-way clutch 27 for permitting output shaft 7 to be manually rotated in the direction of rotation of the shaft (i.e., clockwise as shown by the arrows in FIG. 1) for setting the sequencing of cam set 11 in relation to the actual time of the day. A knob 29 is affixed to the outer end of shaft 7 to facilitate turning of the shaft, and an index mark 31 is provided on case 3 as a reference mark for the markings 25 on the dial.

More particularly, case 3 is a box-like structure having a bottom wall 33, a front wall 35, a back wall 37, side walls 39, and a top wall 41. Shaft 7 extends out beyond front wall 35 having dial 21 and knob 29 mounted thereon adjacent its outer end. As shown in FIG. 3, top wall 41 carries outlet receptacles 43*a*, 43*b* and 43*c*, these receptacles being respectively connected to switches 13*a*, 13*b* and 13*c* by wires (not shown) so that power is selectively supplied to these outlets when the respective switches are in their closed positions. An electrical power cable 45 passes through back wall 37 for supplying power from a conventional 120 vac wall outlet to motor 5 and to the switch assembly for energizing receptacles 43*a*, 43*b* and 43*c* when their respective switches are closed.

A mounting member 47 extends diagonally within case 3 from one upper corner of the case (its upper right corner as shown in FIG. 1) to the opposite lower corner (its lower left corner). Reduction gear assembly 9 along with motor 5 is secured to the back face of the mounting member by screws 49. A diagonal support member 51 spaced apart from mounting member 47 is secured to the mounting member by screws 53 with spacers 55 surrounding the screws between the mounting member and support member for maintaining the spaced-apart relation therebetween. Switch assembly 13 is mounted between the mounting member and the support member so that switch arms 13*a*, 13*b* and 13*c* are in engagement with the peripheral edges of their respective cams in cam set 11 as heretofore described.

As shown in FIG. 4, each cam 11*a*, 11*b* and 11*c* has seven equidistantly spaced holes 57 surrounding a hole 59 at its center through which shaft 7 extends. As shown in FIG. 5, output shaft 7 is secured to a drive shaft 61 extending outwardly from reduction gear assembly 9. This drive shaft has a flat, rectangular cross section and the rear end of the output shaft has a corresponding slot 62 therewithin which receives shaft 61 for connecting the output shaft to the drive shaft. Shaft 7 is journalled in bushings 63 which are received in holes 65 in mounting member 47 and in mounting member 51. Each bushing includes a shank portion 67 and a head 69 with the shank portions of the bushings being received by holes 65 and with the heads positioning shaft 7 and cam set 11 between the mounting member and the support member.

Means 19 for securing cam set 11 to shaft 7 for rotation therewith includes a flange 71 integrally formed with shaft 7. This flange has seven equidistantly spaced holes 73 (see FIG. 5) therein arranged for alignment with holes 57 in disk cams 11*a*, 11*b* and 11*c*. As shown in FIG. 5, cam 11*a* is positioned against the front face of flange 71 with cam 11*b* against its back face. A spacer 75 having seven equidistantly spaced holes 77 corresponding to holes 57 in the cams and to holes 73 in the flange is positioned between cam 11*b* and 11*c*. Screws 79 which constitute indexing members extend through holes 57 in the cams and through the corresponding holes 73 and 77 in the flange and in the spacer to fix the cams relative to the flange for rotation with shaft 7. Each cam is independently positioned on shaft 7 relative to the other cams in any one of the seven preselected positions provided by the seven equally spaced holes 57 in each cam. It will be understood that other means may be utilized to secure the cams on the shaft, e.g., by providing seven splines on the shaft which engage corresponding notches in an opening at the center of each of the cams, or by adhering the cams to one another by means of a mastic or adhesive material.

Each cam 11*a*, 11*b*, 11*c* has notches 15 provided on its periphery for opening and closing a respective switch 13*a*, 13*b* or 13*c*. As shown by the arrow in FIG. 4, cam set 11 rotates clockwise and each notch has a leading edge 81 for permitting a respective switch arm 17*a*, 17*b* or 17*c* to suddenly snap into the notch thus closing corresponding switch 13*a*, 13*b* or 13*c* to energize its respective receptacle 43*a*, 43*b* or 43*c*, and a trailing edge 83 at the rear of the notch for moving the switch arm to open the switch and deenergize the respective receptacle. The length of this notch (i.e., the distance between the top of the leading edge and the top of the trailing edge) corresponds to a predetermined time interval during which the switch is in its closed position. Each cam has seven different peripheral zones, as shown in FIG. 4 and as indicated at 84, corresponding to the days of the week. The sequence of operation of a switch during a one-week period is determined by the placement and length of the notches in the zones 84 of its respective cam. Two or more of the notches may be positioned close together within one of the zones 84 so that the respective switch may be turned on and off two or more times in relatively rapid succession during a one-day period to simulate intermittent occupancy of a room by turning the lights or electrical appliances in the room on and off two or more times during the course of the day.

Trailing edges 83 preferably are inclined away from the direction of rotation of cam set 11 to facilitate movement of the switch arm to its open position. By inclining the trailing edges successive notches may be placed quite closely together so that a switch arm may be moved to its fully opened position by the trailing edge of the first notch and then be permitted to move to its closed position by the leading edge of a second notch in as short a time as possible. With inclined trailing edges the structural strength of the marginal por-

tion of the disk cams is great enough so that little or none of the circular peripheral edge of the cam need be included between the upper portion of the trailing edge of the first notch and the leading edge of the second notch.

Notches **15** are positioned in the seven different zones **84** of cams **11***a*, **11***b*, **11***c* at predetermined positions so that the leading and trailing edges **81** and **83**, respectively, engage their respective switch arms **17***a*, **17***b*, **17***c* to open and close their respective switches at predetermined times of the day. Thus, the location of leading edge **81** and the length of the notches in each of the zones of a cam, determine the time of the day at which the switch controlled by each cam turns on its respective light and/or appliance and the length of time during which the light and/or appliance remains turned on. Furthermore, with the position and length of the notches **15** in each zone **84** of each cam of cam set **11** being different from those in zones of the other cams, many different sequences of operation of switches **13***a*, **13***b* and **13***c* on different days of the week are attained by assembling the cams of the cam set on shaft **7** in different positions relative to one another. Thus, with a cam set as shown in the drawings having three cams and with each cam having seven fixed positions, a total of 343 (i.e., $7 \times 7 \times 7$) sequences of operation of the switches may be attained. This large number of possible sequences of operation insures that if the three different cams are placed on shaft **7** and secured in their fixed positions in accordance with a schedule of assembly during manufacture of the timer, the sequence of operation of various timing apparatus of this invention is likely to be different from one another.

In operation, the security timing apparatus **1** of this invention may be readily connected to various electrical lamps and/or appliances to simulate occupancy in a building for deterring burglars from breaking into the building. The timer is placed in a building in which occupancy is to be simulated and by means of their own cords or extension cables selected lamps and appliances in different areas of the building are plugged into receptacles **43***a*, **43***b* and **43***c* (the switches of the lamps and appliances should be closed so that they may be controlled by the timer). Power cable **45** is plugged into a wall outlet for supplying power to apparatus **1** for driving motor **5** and for supplying power to switches **13***a*, **13***b* and **13***c* for energizing the lamps and appliances when the switches are closed. Knob **29** is manually twisted to turn dial **21** affixed on shaft **7** clockwise until the index mark **31** is in approximate alignment relative to the proper interval **25** so as to indicate the actual time of the day (e.g., 6:15 PM) in any one of the seven arcuate sections **23**. The timer is now set for operation and the switches **13***a*, **13***b* and **13***c* will open and close as cam set **11** rotates with shaft **7** to turn on and off the lights and appliances at different times during the week corresponding to the location of notches **15** in the cams. The random setting of dial **21** further reduces the possibility of simultaneous operation by 7×343 (2,401). Further, since the hour intervals **25** on dial **21** are very small, the probability of identical setting of two separate timers becomes almost infinite.

It is to be understood that a security apparatus of this invention may be built into a house in a central location (e.g., the kitchen) and connected via permanent wiring to special electrical outlets in various rooms of the building or to certain outdoor lights. If, for example, security timing apparatus of this invention were included in every apartment of a large apartment building, the 2,401 (i.e., 7×343) different possible sequences of operation of the various lights and/or appliances controlled by the timer effectively prevent a burglar from observing the apartments and determining in which of the apartments the lights are controlled by a timer in accordance with an observable sequence of operation and thus determining which apartments are not occupied. Moreover, the dimensional tolerances in the placement of the notches in the cams of cam set **11**, the improbability of identical setting of days of the week, and the unlikelihood that users of two timers could each adjust the dials of their respective timers to operate the switches at precisely the same time, make it even more difficult for a burglar to detect in which of the apartments the lights therein are controlled by a timer of this invention.

It is particularly advantageous that the switches **13***a*, **13***b* and **13***c* be so positioned relative to the disk cams **11***a*, **11***b* and **11***c*, and be of such a type that the internal contacts thereof are held open while the switch arms are in engagement with the unnotched peripheries of the respective cams, and that the switch arms are biased to move into notches **15** thereby to close these contacts. This is because the electrical loads to be intermittently energized by the security timing apparatus of this invention are generally incandescent lamp loads and because these switches **13***a–c* are small (preferably of the microswitch type) and must reliably continue to close and reopen these circuits over the extended life of such apparatus. Incandescent lamp loads have the characteristic of initially drawing current at a level which is about **14** times greater than the normal operating current drawn. This high inrush current, due to the initial low resistance of incandescent lamp filaments, poses a serious circuit closing burden on the contacts of the small switches which are particularly useful as components in the apparatus of this invention. By insuring the maximum speed of contact closing as the switch arm drops into a notch, the life of these switches is greatly increased. If this arrangement were not utilized and contact closing were effected by the switch arm being raised by the trailing edges **83**, the very slow movement of a disk cam and the possible instability of the switch contacts as the arm is slowly lifted to a contact closing position, would result in damage to the contacts by such high inrush current.

It is to be understood that rotation of output shaft **7** at a rate which is a multiple of one revolution per 7 days (e.g., one revolution every fourteen days) and the use of peripheral zones **84** on cams **11** in multiples of seven (e.g., 14 zones) are within the scope of this invention.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A security timing apparatus for energizing and deenergizing selected electrical circuits for simulating occupancy in a building comprising:

a case;

a synchronous electric motor mounted within said case;

an output shaft rotatably driven by the motor at a rate of one revolution per week;

a set of disk cams carried on said shaft for rotation therewith, each said cam having seven different peripheral zones corresponding to the days of the week;

a plurality of cam formations provided on the periphery of each said cam, said cam formations on each cam of said set differing in pattern and position from those on the periphery of each of the other cams in said set;

a plurality of switches each of which has a switch arm which engages the periphery of a respective cam and which is moved in response to its respective slowly rotating cam to open and close each respective switch thereby intermittently energizing and deenergizing said electrical circuits;

means carried by said shaft for securing said set of cams thereon with each cam being positioned in a different predetermined one of seven preselected fixed positions relative to the shaft whereby many different sequences of operation of the switches are attained;

a dial affixed to said shaft for rotation therewith, said dial being divided into seven equal arcuate sections corresponding to the days of the week, each section corresponding to a day of the week and being divided into intervals denoting the time of the days; and,

a one-way clutch for said motor to permit said shaft to be manually rotated in the direction of rotation of said shaft for setting the sequencing of said switches in relation to the actual time of the day.

2. Apparatus as set forth in claim **1** wherein said cam formations are notches provided in the periphery of each said cam, and wherein each said switch arm is biased for movement into the notches of its respective cam thereby to close its switch and is held in a switch-open position when it is not aligned with such notches but is in engagement with the unnotched periphery of its respective cam.

3. Apparatus as set forth in claim **1** wherein each said cam has seven equidistantly spaced holes arranged in a circle around its center, said holes corresponding to said seven fixed positions, and wherein said cam-securing means includes a flange on said shaft and at least one indexing member extending from said flange through one of said seven holes in each cam for positioning each cam in the cam set relative to the others on said shaft in a different predetermined one of said seven fixed positions.

4. Apparatus as set forth in claim **1** wherein two or more of said cam formations are provided in at least one of said peripheral zones of one of said cams for opening and closing a respective switch two or more times in a one-day period.

5. A security timing apparatus for energizing and deenergizing selected electrical circuits for simulating occupancy in a building comprising:

a case;

a synchronous electric motor mounted within said case;

an output shaft rotatably driven by the motor at a rate of one revolution per week;

a set of disks carried on said shaft for rotation therewith, each said disk having seven different zones corresponding to the days of the week;

a plurality of switch operating means provided within each of the seven zones of each said disk, said switch operating means within each zone of each disk differing in pattern and position from those within each other zone of the same and other disks in said set;

a plurality of switch means each of which is responsive to the slowly rotating switch operating means on a respective disk to open and close each respective switch means thereby intermittently energizing and deenergizing said electrical circuits;

means carried by said shaft for securing said set of disks thereon with each disk being positioned in a different predetermined one of seven preselected fixed positions relative to the shaft whereby many different sequences of operation of the switch means are attained;

a dial affixed to said shaft for rotation therewith, said dial being divided into seven equal arcuate sections corresponding to the days of the week, each section corresponding to a day of the week and being divided into intervals denoting the time of the days; and,

a clutch for said motor to permit said shaft to be manually rotated for setting the sequencing of said switch means in relation to the actual time of the day.

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