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Programmable Automatic Pill Despenser

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Abstract

This paper deals with, A device that can be loaded with appropriate pills and programmed to automatically dispense the proper amount(s) and proper type(s) of pill(s) as per the requirement of the consumer. The device includes a system to take the input from the consumer, analyze the data and conclude to a disease by comparing it to the stored data, dispensing the correct type and amount of pill(s) as required, alerting the pill taker that pills have been dispensed, a system for providing voice messages to coach the pill taker to use the device and consume the pills. Major components of the device include a programmable timer, a screen, a pill-storage wheel, a cabinet, a compartment for storing bottles of pills , a push button to stop the alarm and release the pills, a pill-release gate, a compartment indicator template , an index gear, a battery, a pill-storage wheel actuation circuit , a pill alert LED and buzzer driver circuit. The device can contact the nearest hospital by its own, if needed.

Introduction

1.1 Problem Statement

This invention relates to automatic pill dispensers, particularly to methods and devices which may be programmed to diagnose the patient and to automatically dispense predetermined quantities and preselected types of pills at preset times.

1.2 Objectives

The usage of pills to regain and maintain health has increased with the advancement of medical science. Many rural parts of the country don't have a good medical upgrade. Some of them are too distant from the nearest medical facility for the villagers to consult a doctor for acute diseases. This actuates the acute disease to turn into a fatal one. Sometimes, death occurs due to absence of first aid. These are some factors which decline the percentage of disease-free people living in a particular locality and thus, quality of living is decreased resulting in migration and population concentration in cities. This opposes the overall development of a nation. This invention will support the medical chain of the country and also its effective range.

1.3 Methodology

The present invention provides a system for automatically dispensing proper amount(s) of proper type(s) of pill(s) at proper time(s) each day and alerting a pill taker to consume the pills by: 1. Presetting a computer for various inputs and respective pills that need to be dispensed; 2. Loading the compartments of a motorized pill storage-wheel with proper amount(s) and type(s) of pill(s) to be dispensed; 3. Moving the proper loaded compartment of the pill-storage wheel to align with a pill discharge outlet only when the timer arrives at each preset time; 4. Discharging the loaded pill(s) by gravity into a pill receptacle; and 5. Issuing a visual and audible alarm to alert the pill taker to take the pill(s) in the pill receptacle.

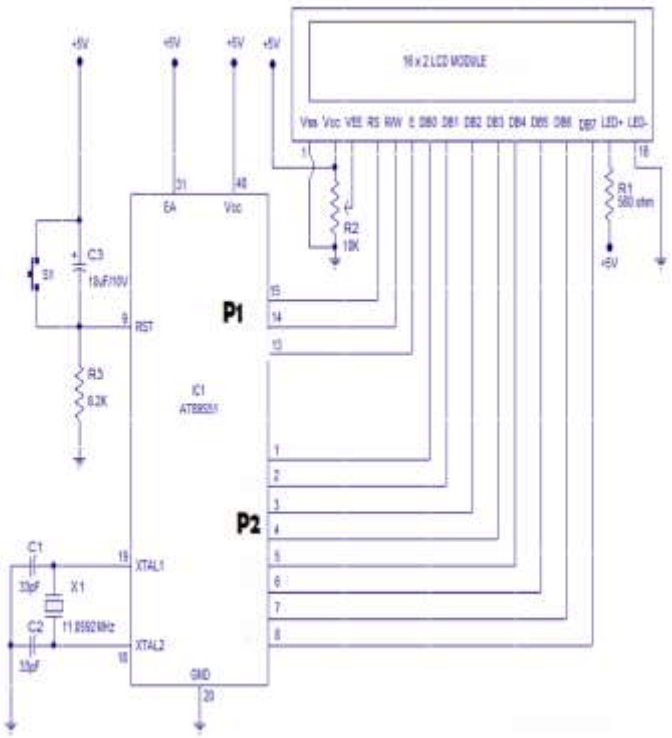
The system also includes a lockable and built-in storage compartment for storing supply containers with pills that need to be dispensed, and a simple means to control the movement of the pill-storage wheel. The system may also include a system for providing voice messages to coach the pill taker on consuming the pills, a system for alerting an off-site caregiver when the pill taker has not responded as required or when there is a problem with the operation of the dispenser, and a system for alerting the need to reload the pill-storage wheel and the need to replace or recharge the battery.

Tentative Model

DESCRIPTION OF ELECTRONIC CIRCUITRY

The construction of the required circuits for the preferred embodiment is not described in detail because there are numerous ways a circuit may be designed to achieve a particular function or objective. A person proficient in the art should not have any difficulty in designing the required circuits. Only the functions, objectives, and interactions of the required circuits will be described herein. Looking at FIG. 10, a battery supplies power to all of the circuits. The voltage of battery is monitored by a low battery detection circuit and a low battery condition is indicated by a LED. A low battery condition also activates an automatic telephone dialer system comprising of a wireless transmitter that turns on a nearby detached automatic telephone dialer with a voice message record and playback circuit. A pill refill indicator circuit contains circuitry which drives a blinking LED and activates automatic telephone dialer system after the circuitry has detected and counted a preset number of times motor has been actuated. At programmed preset times, timer activates a pill-storage wheel actuation circuit to drive motor via motor interrupt switch; the circuit preferably uses a silicon-controlled rectifier (SCR) to control electrical current to the motor. Circuit also has a manually operated switch for manually advancing the pill-storage wheel when needed. Timer also turns on a blinking LED and buzzer driver circuit and an adjustable alert duration timing circuit. Circuit drives a blinking LED and a buzzer. Circuit keeps circuit on unless it is interrupted by stop alarm switch. Circuit provides for adjustment in the length of time that the pill alert system remains turned on, and if circuit is timed out, circuit will activate automatic telephone dialer system. If the momentary stop alarm switch is actuated to turn off alert system circuit, it will also turn on a voice message record and playback system to play a voice message #**1** and activate a voice message #**1** timing circuit. System has capability to record a personal voice message and to playback the recorded message repeatedly in a loop fashion. If personal or customized voice messages are not needed, a simpler playback only system having standardized recordings of voice messages installed at the factory may be used instead. If timing circuit is not interrupted

by pill receptacle switch and circuit is timed out, it will activate the automatic telephone dialer system. When switch is actuated, it will also turn on a voice message #**2** circuit and a timing circuit. The voice message #**2** circuit has recording and loop playback capabilities similar to the circuit of system. Circuits of and preferably use integrated circuits with electrically erasable programmable read-only memory (EEPROM) to store the voice message data in digitized form. If timing circuit is not interrupted by switch and is timed out, it will activate the automatic telephone dialer system. All of the above circuitry may be implemented with printed circuit boards located on the backside of cabinet, and the associated manual adjustment controls of the circuits may also be located at the back of the cabinet.



Electronics circuit diagram

OPERATION OF THE PREFERRED EMBODIMENT To initially use the preferred embodiment, the user needs to recharge or replace the battery if needed. Then the user programs timer and loads pill-storage wheel with the pills to be dispensed. This is done by laying the dispenser on its back and opening door to gain access to the timer and the pill-storage wheel. Timer is adjusted to the current time of day by manipulating push buttons; in addition, the preset times when pills are to be dispensed are programmed into timer also by manipulating the push buttons. The appropriate indicator template is installed to identify each compartment of the pill storage-wheel with an indicium. Assume that three preset times for dispensing pills have been programmed into timer. In this case, a template with a repeating series of three different identifying indicia such as illustrated by reference numeral should be installed. In sequential order, each idicium in the series of three different indicia will be used to represent each preset time in the series of the three sequentially ordered preset times in this case. Since the needed pills to be dispensed at each preset time are known, the needed pills are loaded into each compartment of the pill-storage wheel identified by the indicium associated with that preset time. Accordingly, all of the compartments are loaded with the proper pills. The method described in U.S. Pat. No. 5,915,589 (Lim, 1999) may be used to facilitate the accurate

loading of pills into the pill-storage wheel. When the pill loading is completed, the bulk supply containers of pills are stored in compartment so that they will be readily available for the next reloading of pills; door is closed and locked, and the automatic pill dispenser is returned to an upright position. Then the pill-storage wheel is synchronized as needed by manually operating the control switch of circuit so that a loaded compartment which is identified with the indicium associated with the next impending preset time is moved to the position indicated by reference numeral. The automatic pill dispenser is now ready for use and is located in area that is convenient for the pill taker. When the real time clock of timer reaches a programmed preset time, the timer sends an electrical signal to activate pill-storage wheel actuation circuit to deliver electrical current to motor. The timer signal also turns on circuit which drives blinking LED and buzzer. Motor rotates the pill-storage wheel in a clockwise direction until motor interrupt switch is actuated by index gear to stop the current to motor. Since the index gear has 24 equally spaced teeth, the motor will rotate the pill storage wheel {fraction (1/24)} of a revolution. This means that pill-storage compartment in the position indicated by reference numeral will advance to the position of reference numeral. When motor is not in operation, the arrested worm gear will keep the pill-storage wheel from freely turning. After the pill alert driver circuit is activated by the signal from timer, the pill alert LED and buzzer will remain activated for a set length of time controlled by timing circuit unless the pill taker operates push button to actuate switch to interrupt timing circuit and turn off pill alert circuit. Timing circuit may be adjusted to preset the pill alert duration in accordance with the wishes of the user and the constraints of the pill administration schedule. If pill alert circuit and timer circuit are not deactivated by the pill taker operating push button, circuit will activate an automatic telephone dialer system when circuit is timed out. The automatic telephone dialer is programmed with telephone numbers of some off-site caregivers who have been warned that they may receive a call from the automatic telephone dialer. The automatic telephone dialer is programmed with a recorded voice message stating that the pill taker has not responded to the automatic pill dispenser as required or there is a problem with the operation of the dispenser, and assistance to investigate the problem is needed. When activated, the automatic telephone dialer will dial the programmed telephone numbers until somebody answers at a dialed number and the automatic telephone dialer plays the recorded voice message. If the pill taker does not respond to the pill alert and does not push button, the pill(s) will not fall into the pill receptacle and will remain in the pill-storage wheel as a safeguard against overdose from too many pills accumulating in the pill receptacle. In addition, the caregiver or user will be able to see the pills that have not been dispensed by looking at the pill-storage wheel through the transparent door. Thus, data on non-compliance with the pill administration schedule will be available. If the user does respond to the pill alert issued by the dispenser and pushes push button to stop the blinking LED and buzzer, the downward movement of push button operates rack and pinion to open gate. The opening of gate allows pills in the pill-storage compartment that is registered with the gate to fall by gravity into pill receptacle. The downward movement of push button actuates switch to also activate the voice message record and playback circuit to play a previously recorded voice message #**1** stored in circuit. The message may be used to remind the pill taker of special instructions in taking the dispensed pills, or to encourage a pill taker who is not interested in taking pills to take the dispensed pills. A different voice message may be provided at each preset time with additional circuitry. The following is an example of a voice message #**1** made by a caregiver in her personal voice for her mother: “Mom, we love you and want you to stay healthy. Please take the pill cup from the machine and take your pills now with plenty of water and food.” The voice message #**1** will repeatedly emanate from acoustical outlet grille of cabinet. Timing circuit will loop play voice message #**1** for a preset duration, say 10 minutes, unless it is interrupted by switch that is actuated by the removal of pill

receptacle from the dispenser. If the pill receptacle is not removed and timing circuit is timed out, circuit will activate the automatic telephone dialer system to call an off-site caregiver to investigate the problem. The removal of the pill box to actuate switch will also turn on voice message #**2** circuit. Circuit is capable of recording and playing back a voice message to remind the pill taker to replace the pill receptacle into the machine. For example, voice message #**2** may say "Please take your pills and put the pill cup back in the machine so this message will stop." Timing circuit will keep the voice message #**2** loop playing until circuit is timed out or is interrupted by switch which is actuated when the pill receptacle is replaced into the cabinet. If circuit is timed out, it will activate the automatic telephone dialer system to call an off-site caregiver to investigate the problem. The dispenser will continue to operate in the manner described above for each successive preset time until the last filled compartment of the pill-storage wheel has advanced to register with gate. Circuit counts each time the pill storage wheel advances, and after a predetermined count, it will turn on the pill refill indicator LED and activate the automatic telephone dialer to alert the need for refilling the pill-storage wheel. The pill dispenser will continue to automatically dispense the needed pills to the pill taker as long as it is kept filled with pills and the dispenser's battery is maintained. When the voltage of battery deteriorates to a level that will no longer meet the power requirements of the programmable automatic pill dispenser, low battery detection circuit will turn on low battery indicator LED, and activate the automatic telephone dialer system to alert the need for battery maintenance.

OBJECTS AND ADVANTAGES

Accordingly, the object of the present invention is to provide an improved programmable automatic pill dispenser without the deficiencies and disadvantages of the above mentioned devices; specifically, to provide a simple and reliable programmable automatic pill dispenser that has a pill-storage wheel which moves only at preset time(s), and has a built-in lockable storage compartment for bottles containing pills which are to be loaded into the pill-storage wheel. The device will be able to diagnose the patient and prescribe correct type and amount of pill. The device will also provide first aid as and when needed. Still further objects and advantages are: a) to provide a programmable automatic pill dispenser that reduces the possibility of the pill taker taking an improper accumulation of dispensed pills which may result in overdosing; b) to provide a programmable automatic pill dispenser that has a system to record personal voice messages and to play these messages to coach the pill taker into properly taking the dispensed pills; c) to provide a programmable automatic pill dispenser that has a system to alert an off-site caregiver when the pill taker has not taken the dispensed pill(s), or when there is a problem with the operation of the programmable automatic pill dispenser; and d) to provide a programmable automatic pill dispenser that is compact, and battery operated. Additional objects and advantages will become apparent in studying the ensuing drawings and description.

CONCLUSIONS

As seen from the preceding description, the dispenser involves a simple electromechanical system that can be programmed and loaded with appropriate pills so that the proper pill(s) in the proper amount(s) will be automatically dispensed with an alert signal for the pill taker at the proper time(s) each day. The dispenser also provides a system for providing personal voice messages to coach and assist the pill taker into properly taking the dispensed pills, and a system for alerting an off-site caregiver when dispensed pills are not taken by the pill taker or there is a problem in the operation of the dispenser. Some other advantages of the dispenser include: a) the pill-storage wheel rotates only at preset time(s) for dispensing of pill(s); b) it has a

mechanism for preventing an accumulation of dispensed pills to minimize the possibility of over-dosing; and c) it has an indicator that signifies when the pill-storage wheel needs refilling. The possible variations and ramifications of the present invention are numerous. For example, a programmable analog mechanical type timer instead of the digital solid-state timer shown in the preferred embodiment may be used. In another variation, the removable pill receptacle can be omitted. In this case, the dispenser is designed so that the user may place a hand under the pill release gate in the vicinity of a fixed pill receptacle to catch the pills as the user opens the gate, or manually scoop out the pills from the fixed receptacle after they are discharged into the fixed receptacle. A variation for detecting the removal of a dispensed pill from the dispenser is the use of an electronic motion or proximity detector, or a light beam interruption device to sense the fingers of a user in retrieving the dispensed pill from the dispenser. Also, these alternate sensors or detection devices combined with an index wheel designed to interact with the selected sensor may be used in lieu of the motor interrupt switch and index gear shown in the preferred embodiment; for example, the index wheel may be disk with a series of concentric holes and the sensor may be a light beam on one side of the disk and a light detector on the other side of the disk.

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