(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
01 August 2019 (01.08.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/147352 A1

(51) International Patent Classification:
G07C 9/00 (2006.01) *E05B 47/06* (2006.01)
E05B 47/02 (2006.01)

(21) International Application Number:
PCT/US2018/065104

(22) International Filing Date:
12 December 2018 (12.12.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
15/598,777 12 January 2018 (12.01.2018) US

(72) Inventor; and
(71) Applicant: **RAIS ELLIOT** [US/US]; 60 Sutton Place South, New York, NY 10022 (US).

(74) Agent: **NISSENBAUM, Israel**; 1038 56th Street, Brooklyn, NY 11219 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*

(54) Title: BATTERY FREE SMART LOCK

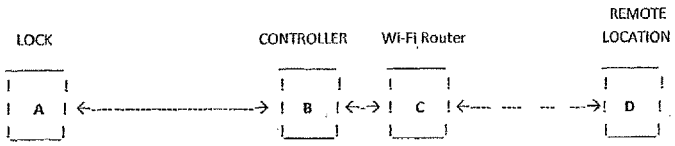

FIG. 1

(57) Abstract: A smart lock system and method having a smart lock element, a data entry interface element; a mechanically operated power generator such as a dynamo as the sole power source; and an electronic control element. A separate controller is in communication with the smart lock element, only when the dynamo provides power to the smart lock. The controller element constantly receives and store updated key code information from a remote location source. With the providing of the operating energy to the smart lock the electronic control element receives and stores updated key code information from the controller, if any, prior to any unlocking activation of the locking mechanism. The electronic control element compares stored key code information with entered key codes and the locking mechanism is unlocked thereafter with entry of a valid key code corresponding to a key code stored in the electronic control element.

WO 2019/147352 A1

BATTERY FREE SMART LOCK

Field of the Invention

This invention relates to smart locks with update code communication and particularly to smart locks without batteries subject to degradation and depletion.

BACKGROUND

Smart locks are known devices which are affixed to doors or other entrances, with the smart lock having an integrated interface, most commonly a key pad, for the entry of key codes for opening of the door to which it is affixed. Other types of interfaces include magnetic key cards for insertion into the lock or RF controlled cards for proximate placement to the lock.

For ease of installation and lower cost for the lock and installation, the smart lock is provided with a battery power source rather than being hard wired into electrical supply systems. In addition, the battery, with a constant-on and powering mode, enables the smart lock to be in constant communication, usually via local wi-fi internet connection, to a central computer which periodically transmits periodically updated key codes for enhanced security. In view of this constantly required connection a full time power source is required and batteries are the full time power source of preference. If only lock activation is required, on-demand electrical power may be provided such as via mechanically operated dynamos. Such dynamos are described, for example, in US Patent No. 8354914 issued to Duane Buckingham and in US Patent Publication 2005/0099262 by Robert Childress, for use in powering door lock operations. However, for actual communication with a central computer, Childress requires a separate cell phone connected to the lock with an audio signal and Buckingham relies on a separate controller distanced from the lock. The parent of this application also discloses the use of a dynamo for powering a smart lock as an emergency source of power for opening a door with depletion of primary battery power for the smart lock

Smart locks, as they are known, have thus not been able to be fully operable without a battery or a hard wired connection.

SUMMARY OF THE INVENTION

It is accordingly an object of the present invention to provide a smart lock system which is not powered by a battery, detrimentally subject to depletion and failure, yet which is able to function with all of the battery powered smart lock functions including the ability to program key codes and other functions remotely, via a typical wi-fi connection.

Generally, the invention comprises a smart lock system and method of smart lock operation which does not require battery power. The smart lock system herein is comprised of a smart lock which is powered only with a failure resistant dynamo, such as shown in the parent application, but without the need for batteries for full smart lock operation including lock operational updating.

The smart lock system comprises:

a) an electrically operable smart lock element configured to be affixed to a door and having a locking mechanism configured for locking/unlocking the door;

b) a data entry interface element directly associated with the smart lock element configured for the entry of a valid key code for opening of the locking mechanism and the door;

c) a mechanically operated power generator directly associated with the smart lock for providing operating energy for powering the smart lock element, without battery power, for the data entry interface for operative entry of the key code for unlocking the locking mechanism;

d) a separate controller element configured to be in communication with the smart lock element, via a communication connection, when the mechanically operated power generator provides operating energy to the smart lock element, and wherein the controller element is configured to constantly receive and store updated key code information from a remote location source;

e) a communication router to which the smart lock element is electronically connected, when provided with the operating energy;

f) an electronic control element within the smart lock element configured to synchronize with the controller element, with the providing of the operating energy and activation of the electronic control element with an activation element to receive and store updated key code information, if any, prior to any unlocking activation of the locking mechanism, and with the electronic control element

configured to compare stored key code information with entered key codes via the data entry interface;

wherein the locking mechanism is configured to be unlocked thereafter with entry of a valid key code corresponding to a key code stored in the electronic control element.

The operations of opening or closing of the lock is effected by mechanical winding of the dynamo which supplies power for a very limited period of time just sufficient to power the interface such as a key pad for opening the electrically controlled lock. The dynamo winding mechanism, in one embodiment, is integrated with a latch handle of the smart lock.

For the additional smart lock operations of the system, a separate controller is provided with wi-fi or direct route internet or other communication access and the smart lock is similarly provided with immediate access to wi-fi or direct route internet or other communication access upon being powered. The controller is constantly on and programmed to communicate with the lock at any time when the lock is powered by the dynamo. A remote station is in contact such as with an internet connection with the controller at all times.

In order to provide programming of key codes, the smart lock system comprises the communication connected controller which is configured to communicate with the lock with the following protocol and lock configuration and operation:

Opening of the lock is effected by lifting the latch lever of the lock in an upward direction to spring load the dynamo with this movement and then the lever is returned to the neutral normal position. Upward lever movement initiates a program in which:

a) The lock contains an electronic control element which is caused to synchronize with the controller to receive stored latest key codes and which, in turn, notifies the controller of the initial operation of the lock, then

b) The electronic control element of the lock compares digits entered on the key pad with its internally stored and updated code list and determines a proper response (valid and opening of the lock, invalid and no opening).

Key codes are remotely programmed from the remote station with the adding or deleting of key codes at any time via the communication connection between the remote station, at which the key codes are generated or removed, and the controller. The commands with key codes are stored only in the controller, without necessity for the lock to be powered. The lock is configured to synchronize with the controller, as described above, at the initiation step before lock opening action is effected with the stored transmission of required current

key code data for lock operation. As a result, there is always full smart lock function even without the presence of a battery or any constant source of power.

The method of operation of the smart lock for opening a door comprises the steps of:

a) providing a smart lock on a door, with the smart lock having a data entry interface for entry of a valid key code and an electronic control element, with only a mechanically operated dynamo as a power source for the smart lock;

b) providing a controller element separate from the smart lock and configured to be in data transmission communication with the smart lock only upon powering of the smart lock with the dynamo, wherein the controller element is configured to receive updated key code information and to transmit the updated key code information to the smart lock for operational storage in the electronic control element;

c) configuring the mechanically operated dynamo to open communication with the controller upon initial activation to effect transmission of updated key code information; and

d) completion of powering the smart lock with the dynamo and entry of a key code via the data entry interface; and

e) comparison by the electronic control element of an entered key code with a stored key code for the validation thereof and the opening of the door.

Though the lock system by Buckingham, as described in US Patent No. 8354914, includes a controller it is not provided with any key code update function or synchronization with the smart lock, except for functions such as remote powering of the lock.

The above objective and other features and advantages of the invention will become more evident from the following drawings in which:

SHORT DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic view of the components of the system of the invention,

Figure 2 is a schematic flow chart of the system operation,

Figures 3, 4 and 5 are applicant's prior versions of hybrid powering lock systems with both battery power and back-up mechanical power generation, with the latter being the sole power source in the present application.

DETAILED DESCRIPTION

At initial step 1, at the start of a smart lock A in Figure 1 as shown in Figure 2, a lock lever of smart lock A is lifted (not shown) to activate a powering dynamo contained within the lock and the lever is returned to its initial position. The lock A is activated to initiate the program at step 2 to inquire whether the controller B is active with an updated key code or not. If controller B is not active then the system moves to step 4 with the key pad lighting up to accept an entered key code as previously programmed. If the controller B is active then at step 3 the lock synchronizes with the controller to receive updated codes and the system moves to step 4 for entry of the code. At step 5 the lock system checks whether the entered code matches any key code in a key code storage table. If there is a match, then the door is unlocked at step 6. If there is an invalid code then the system moves to step 7 to see if the invalid code has been entered more than 3 times and, if so, the lock is disabled for 15 minutes (or other pre-selected time period). If an invalid code has been entered less than 3 times, the system moves in a loop, as shown, for entry of a new code.

Lock A, Figure 1 is shown in more detail in Figures 3, 4 and 5, as applicant's related art embodiments. Lock 45 includes an electrically operable key pad 11b for entry of requisite key codes. Dynamo 40, with operating gears 24 and 25, and flywheel 41, with circuit 42, serve to mechanically generate sufficient electrical power to operate the keypad 11b and also to power the smart lock or electronic control element 46 for operation, as depicted in Figure 2, without the battery used in the prior art. Up and down movement of door lock lever 12b of typical prior art locks, is modified in accordance with the operational logic of Figure 2 to effect key code updating (with initial up movement of the lever), without battery power normally constantly on, as in the prior and related art, but which is not available, except on demand, in the present invention. Battery related element 43 of Figure 5 is neither required nor present in the lock A of the present invention.

It is understood that the above description and details are exemplary of the invention and that changes in the process and details may be made without departing from the scope of the invention as defined in the following claims.

What is claimed is:

1. A smart lock system comprising:

i. an electrically operable smart lock element configured to be affixed to a door and having a locking mechanism configured for locking/unlocking the door, the smart lock element comprising:

a. an electrically powered key pad configured for the entry of a currently valid key code for opening of the locking mechanism and the door;

b. an externally manually operatively accessible mechanically operated power generator directly electrically connected to the smart lock element for solely providing operating energy, for powering the smart lock element, without any other power source, and for powering the electrically powered key pad for operative entry of the currently valid key code for unlocking the locking mechanism; and

c. an electronic control element;

ii. a remote, separate controller element configured to be in communication with the smart lock element, via a communication connection, only when the mechanically operated power generator provides operating energy to the smart lock element, and wherein the controller element is configured to constantly receive and store updated constantly changing currently valid key code information from a location source remote from the controller element and to transmit the currently valid key code information to the smart lock element when in communication therewith; the remote location source generating and communicating constantly changing currently valid key code information to the controller element;

iii. a communication router to which the smart lock element is electronically connected for the communication connection, when the smart lock element is provided with the operating energy;

wherein the electronic control element within the smart lock element is configured to synchronize with the controller element, only upon the providing of the operating energy and activation of the electronic control element with an activation element to receive and store the changing and currently valid updated key code information prior to any unlocking activation of the locking mechanism, and with the electronic control element configured to compare

received and stored currently valid key code information with entered key codes via the electrically powered key pad ; and

wherein the locking mechanism is configured to be unlocked thereafter by an operator of the electrically powered key pad with direct entry of a currently valid key code, separately known to the operator of the electrically powered key pad, corresponding to the currently valid key code currently stored in the electronic control element.

2.) The smart lock system of claim 1, wherein the smart lock element comprises a lever element configured to mechanically operate the power generator with a movement in one direction away from a rest position for generation of the operating energy and simultaneously therewith to effect the synchronization of the electronic control element and the controller element for transmission of any updated currently valid key code information.

3. The smart lock system of claim 1, wherein the communication is via an internet connection and wherein the communication router is a Wi-Fi router.

4. A method of operation of a smart lock system, with remotely generated constantly changing key codes, for closing and opening a door locked with the smart lock system, by an operator of the lock, comprising the steps of:

a) providing a smart lock on a door, with the smart lock having an electrically powered key pad for direct entry by the operator of a currently valid key code separately known by the operator, an electronic control element, and a manually operationally accessible mechanically operated dynamo as a sole power source for the smart lock;

b) providing a controller element separate and remote from the smart lock and configured to be in data transmission communication with the smart lock only upon powering of the smart lock with the dynamo, wherein the controller element is configured to receive constantly changing updated currently valid key code information from a source remote thereto and to transmit the updated currently valid key code information to the smart lock for operational storage in the electronic control element;

c) configuring the mechanically operated dynamo to open communication with the controller upon initial activation of the dynamo to provide power, and prior to

entry of the currently valid key code, to effect transmission of updated currently valid key code information; and

d) completion of powering the smart lock with the dynamo for direct electrically powered entry of a currently valid key code via the electrically powered key pad; and

e) electrically powered comparison, by the electronic control element, of the directly entered key code by the operator with the electrically powered key pad, with a stored current key code for the validation thereof and the opening of the door.

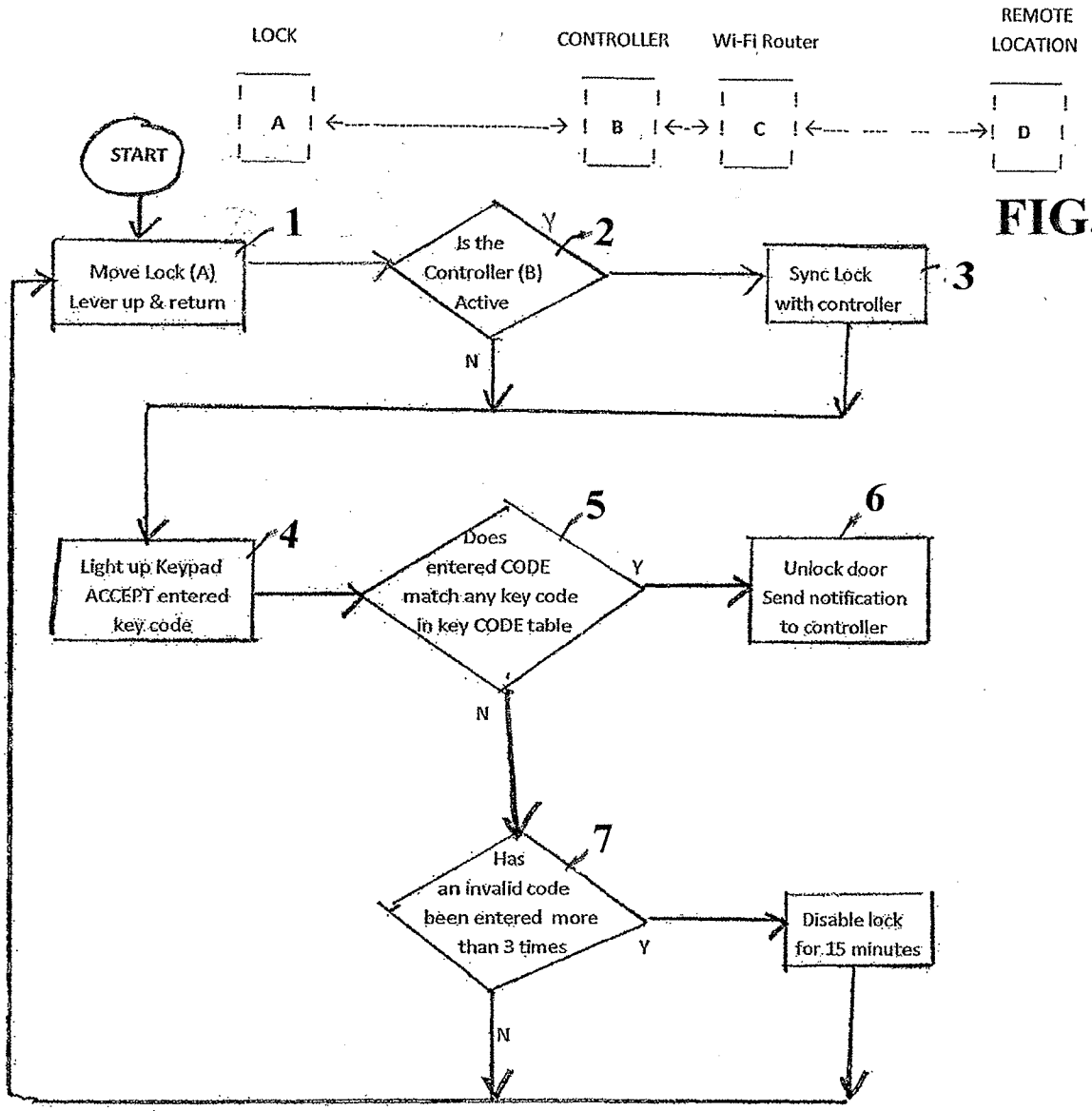
LOCK
CONTROLLER
Wi-Fi Router
REMOTE LOCATION
A
B
C
D
START
1
Move Lock (A) Lever up & return
2
Is the Controller (B) Active
Y
N
3
Sync Lock with controller
4
Light up Keypad ACCEPT entered key code
5
Does entered CODE match any key code in key CODE table
Y
N
6
Unlock door Send notification to controller
7
Has an invalid code been entered more than 3 times
Y
N
Disable lock for 15 minutes

FIG. 1

FIG. 2

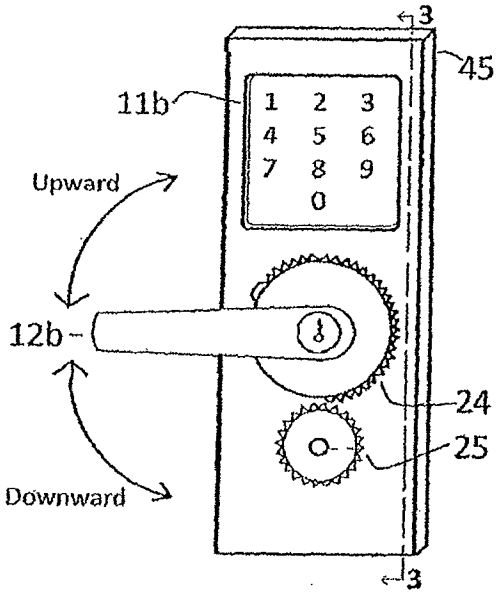

FIG. 3

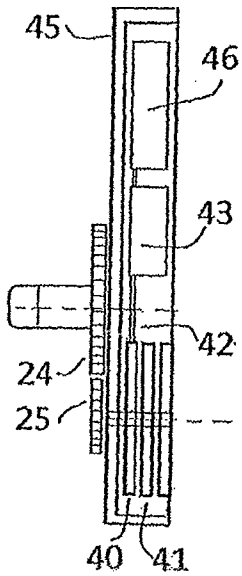

FIG. 4

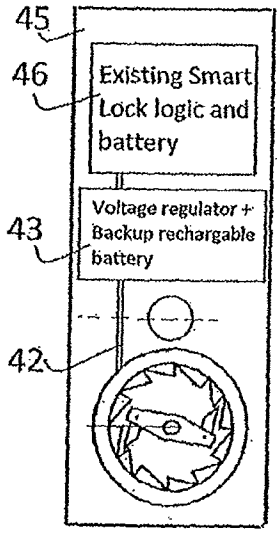

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 18/65104

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G07C 9/00; E05B 47/02; E05B 47/06 (2019.01)
CPC - G07C 9/00309; E05B 47/0676; E05B 2047/0058; E05B 47/026; G07C 9/00015; E05B 47/06; E05B 2047/0062

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History Document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
See Search History Document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2013/0000366 A1 (Martel et al.) 03 January 2013 (03.01.2013) entire document, especially: para [0002], [0017]-[0019]	1-4
A	US 2002/0178385 A1 (Dent et al.) 28 November 2002 (28.11.2002) entire document, especially: fig 1, para [0004], [0012], [0013], [0017], [0020]	1-4
A	US 8,037,511 B1 (Lundy et al.) 11 October 2011 (11.10.2011) entire document	1-4
A	US 2010/0180649 A1 (Harvey) 22 July 2010 (22.07.2010) entire document	1-4
A	US 2016/0189453 A1 (August Home Inc.) 30 June 2016 (30.06.2016) entire document	1-4

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 February 2019	25 MAR 2019
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774