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(54) **A LOCK WITH WIRELESS COMMUNICATION MODULE AND A SYSTEM OF CACHES FOR STORING AND RETRIEVING OBJECTS**

(57) The subject of the invention is a lock with a wireless communication module comprising:
• a housing (10, 11) with a slot,
• a lock striker (12) adapted to be inserted into the slot in the housing, comprising a magnet (15) placed on the part of the lock striker (12), which, in the closed position of the lock, is located inside the slot of the housing (11),
• a mechanism for moving the locking element (2), placed in the housing (10,11) nearby the slot, in such a way that in one of its positions the locking element blocks the lock striker (12) when it is located inside the slot,
• a controller (7) for controlling the mechanism (2) equipped with a Wi-Fi communication module,
wherein the walls of the housing (11) nearby the slot and the lock striker (12) are equipped with reinforcing metal plates (14).

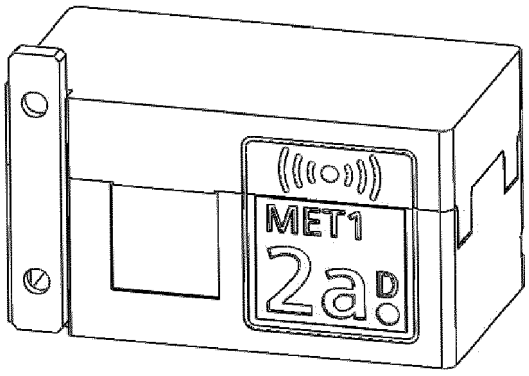

Fig. 1

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Description

Field of the Invention

[0001] The subject of the invention is a lock with a wireless communication module.

[0002] The subject of the invention is also a system of caches for storing and retrieving objects in different locations having a central management system. The system can function as a store managed from the application level, an internal warehouse system integrated with the company IT system or a mailbox system.

Prior art

[0003] Drum magazines which consist of a drum magazine with caches and a management unit are known. Such solutions are widely spread and used, but the device requires a lot of space, it is not scalable (additional shelves cannot be added at any time) and, most importantly, it can be operated only in one place in which it is located.

[0004] Cache magazines which are also delivered in the form of a single device having a system of caches and a management module, and thus the same limitations as in case of a drum solution, are known.

[0005] Tower warehouses which ensure storage of large amounts of materials and good use of the storage space are known, however, systems of this type are very expensive, materials may be retrieved in one place and the entire large system has to be purchased at the beginning of the investment.

Object of the invention

[0006] The object of the present invention is to provide a solution enabling the storage and retrieval of products and standardized production materials from internal and external spaces of institutions, warehouses and shops.

[0007] The object of the invention is also to provide a lock with a wireless communication module enabling implementation of such a system.

Summary of the invention

[0008] The subject of the invention is a lock with a wireless communication module which comprises:

- a housing with a slot,
- a lock striker adapted to be inserted into the slot in the housing, comprising a magnet placed on the part of the lock striker which, in the closed position of the lock, is located inside the slot of the housing,
- a mechanism for moving the locking element, placed in the housing nearby the slot, in such a way that in one of the positions the locking element blocks the lock striker when it is located inside the slot,
- a controller for controlling the mechanism equipped with a Wi-Fi communication module,

wherein the walls of the housing nearby the slot and the lock striker are equipped with reinforcing metal plates.

[0009] Preferably, the housing and the lock striker are made using 3D printing technology.

[0010] Preferably, the reinforcing metal plates are made using laser cutting technology.

[0011] Preferably, the controller is connected to an RFID reader.

[0012] Preferably, the lock comprises a Hall sensor for detecting the position of the lock striker, preferably attached to the lower housing nearby the slot of the lock.

[0013] Preferably, the lock comprises a weight module for reading the weight inside the cache.

[0014] The invention also relates to a system of caches for storing and retrieving objects, which comprises caches equipped with a lock with a wireless communication module of the present invention and a server for managing caches, configured to communicate with the Wi-Fi modules of the locks.

Technical effect of the invention

[0015] The solution according to the invention allows to obtain a durable housing, reduces the costs associated with the production of complex metal latches while ensuring high durability, isolates the metal printed in the housing from external factors which eliminates the costs associated with further processing and coating of the metal.

[0016] Additionally, the use of a magnet in the striker facilitates closing of the lock thanks to the action of the magnet on the reinforcing plates 14 in the lower casing and tightening of the striker thanks to the magnetic force.

Brief description of figures of the drawing

[0017] The embodiments of the invention will now be illustrated with reference to the figures of the drawing which present:

Fig. 1 - complex electronic lock

Fig. 2 - exploded view of the electronic lock

Fig. 3 - lower housing of the electronic lock

Fig. 4 - cross-section of the lower housing of the electronic lock

Fig. 5 - lock striker

Example - Lock

[0018] The electronic lock is presented in Fig. 1 and it consists of the elements presented in Fig. 2.

[0019] According to Fig. 2, the electronic lock consists

of:

- lower 11 and upper 10 housing,
- lock striker 12,
- controller 7 for controlling the operation of a lock with Wi-Fi module,
- servo 2 with a stainless steel locking element made using laser cutting technology,
- weight module 3 for reading the weight inside the cache,
- RFID reader 5, through which employee cards are read,
- plates 8 with an individual QR code of the cache, thanks to which the cache can be opened from the mobile application level,
- plates 4 with cache description illuminated by LED 6,
- Hall sensor 1 for detecting the position of the lock striker 12,
- screw for connecting the upper and lower part of the housing 9

[0020] The lower housing 11 is made using 3D printing technology. However, it was extended with wall reinforcements shown on Figures 3 and 4.

[0021] The lower housing 11 of the electronic lock is equipped with reinforcing metal plates 14 shown on Fig. 3 and Fig. 4 made using laser cutting technology, which during the 3D printing process were placed in the center of the housing 11 and then printed on.

[0022] The lock striker 12 is shown on Fig. 5. The striker is made using 3D printing technology. Due to the fact that this is the component most prone to damage, it has been reinforced with a reinforcing metal plate 14, similarly as the lower housing. The reinforcing metal plate is made of laser-cut steel having a thickness of 1.5 mm.

[0023] The striker was additionally equipped with a magnet 15 which has two functions. The first function is to provide better closing thanks to its action on the reinforcing plates 14 in the lower housing and to tighten the striker thanks to the magnetic force. The second function is to act on the Hall sensor and to signal that the lock is closed. The Hall sensor 1 is attached to the lower housing, nearby the slot of the lock.

[0024] In the closed position, the lock striker 12 is inserted into the slot of the lower housing and the locking element placed on the servo 2 is in the lower position, in which it cooperates with recess of the striker, preventing the striker from sliding out of the slot. The servo 2 is controlled by the controller 7 with a Wi-Fi module, and therefore the signal to open/close the lock can be transmitted to the controller remotely.

[0025] Electronic lock is an autonomous module that manages the status of closed caches. It can operate independently thanks to the Wi-Fi module built in the lock controller. It only needs a 5V DC power supply to operate.

Example - Distributed warehouse of products and standardized materials

[0026] The main problem in production plants is a central parts warehouse, imposing the constant supply of production parts to the production cells.

[0027] The distributed warehouse system is based on a network of smart shelves and managing terminals, communicating with the central system via Wi-Fi network (Fig. 6).

[0028] The system is based on smart caches presented on Fig. 7, equipped with a wireless electronic lock as described in the Example - "Lock".

[0029] Each cache is equipped with a separate electronic lock which also functions as a module managing the state of the shelf. Thanks to this, each cache works independently and can be located in a convenient place within the range of the Wi-Fi network. It only requires a 5V DC power supply.

[0030] The electronic lock module is equipped with an RFID card reader 5 thanks to which the caches can be accessed using employee cards or after touching in and out the employee card at the cache lock the shelf requests the system for access rights to the cache, on the basis of which the cache is opened or not. Thanks to this, it is known who used the cache at a given time. Alternatively, one can use the QR code placed on the cache, which is scanned by a smartphone into a mobile application, which then transmits the data to the system and the system gives an order to open the cache.

[0031] Another way to access the cache is through a terminal within a specific slot (as shown on Fig. 6). The terminal then sends a request to the management system to open the cache and the system - directly to the shelf.

[0032] The electronic lock can be equipped with LEDs 6 indicating that the cache is closed (red LED), that the cache is opened (green LED) and other functions (yellow LED). The controller is also equipped with a buzzer informing about granted access by two short beeps and about denied access by three short beeps.

[0033] Each shelf can be equipped with a weight module 3, managed via the electronic lock of the cache. This enables a real-time warehouse control. This module also allows for the archiving of data regarding the amount of materials retrieved by employees, alerts about low inventory, provides information about the consumption of materials which enables to plan production.

[0034] The system has its own database and software, but it can be integrated with an ERP system in the company or integrated with the store or warehouse application.

[0035] The software allows reporting the status of materials and the history of retrievals by employees, customers and other users for a specified period of time.

[0036] The system allows to compose the number and size of caches according to customer's requirements, which makes the system easily scalable.

[0037] The system can be expanded during the invest-

ment according to needs.

Example - Mailbox system

[0038] The cache uses the same smart lock module with a Wi-Fi module and the same architecture system as the distributed products warehouse , but differs from the warehouse system in the way it sends the signal to open the cache.

[0039] The warehouse system uses an encoded RFID card - assigned to each employee with an appropriate list of permissions. In the mailbox system, on the other hand, opening of the appropriate cache is executed by the application. The user (courier) scans QR code of the cache, which is sent the application. The application communicates with the server, which transmits a cache opening signal to the Wi-Fi module of the lock's controller - either by additional user approval or automatically, leaving an electronic trace of who delivered or retrieved the parcel.

Claims

1. A lock with a wireless communication module, **characterized in that** it comprises:

   • a housing (10, 11) with a slot,
   • a lock striker (12) adapted to be inserted into the slot in the housing, comprising a magnet (15) placed on the part of the lock striker (12) which, in the closed position of the lock, is located inside slot of the housing (11),
   • a mechanism for moving the locking element (2), placed in the housing (10, 11) nearby the slot in such a way that in one of its positions the locking element blocks the lock striker (12) when it is located inside the slot,
   • a controller (7) for controlling the mechanism (2) equipped with a Wi-Fi communication module,

   wherein the walls of the housing (11) nearby the slot and the lock striker (12) are equipped with reinforcing metal plates (14).

2. The lock according to claim 1, **characterized in that the** housing (11) and the lock striker (12) are made using 3D printing technology.

3. The lock according to claim 1 or 2, **characterized in that** the reinforcing metal plates (14) are made using laser cutting technology.

4. The lock according to claim 1 or 2 or 3, **characterized in that** the controller is connected to an RFID reader (5).

5. The lock according to any one of claims 1 to 4, **characterized in that** it comprises a Hall sensor (1) for detecting the position of the lock striker (12), preferably attached to the lower housing (11) nearby the slot of the lock.

6. The lock according to claims 1 to 5, **characterized in that** it comprises a weight module (3) for reading the weight inside the cache.

7. A system of caches for storing and retrieving objects, **characterized in that** it comprises caches equipped with a lock with a wireless communication module according to any one of the preceding claims, and a server for managing caches, configured to communicate with the Wi-Fi modules of the locks.

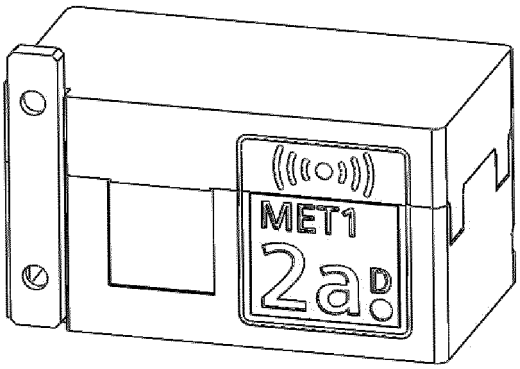

Fig. 1

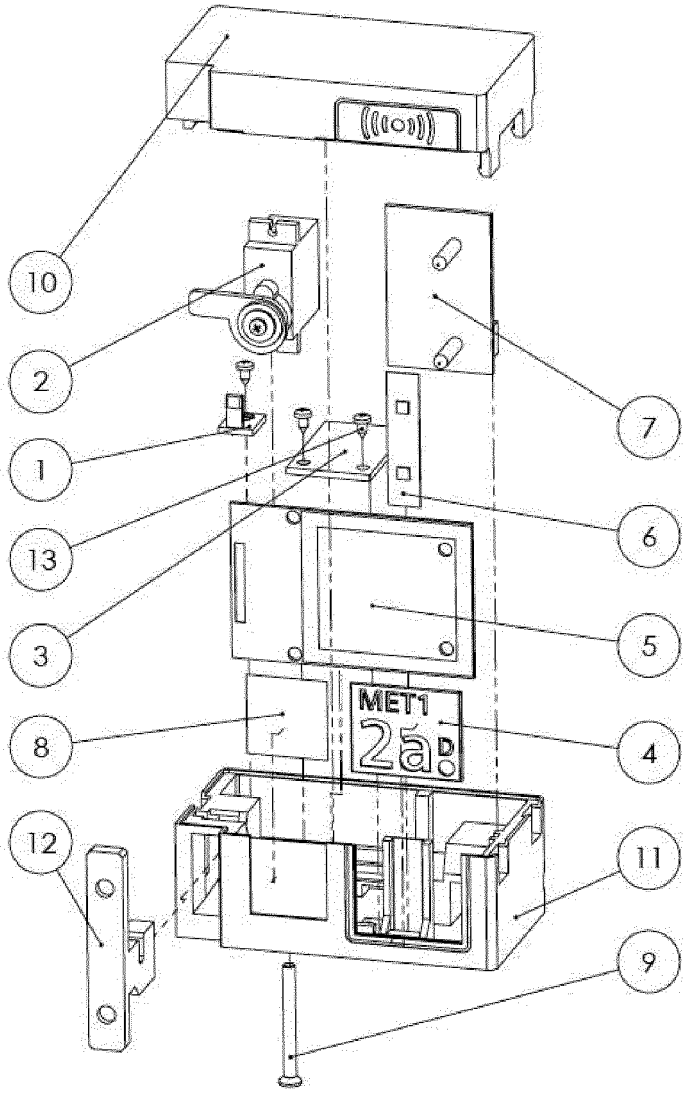

Fig. 2

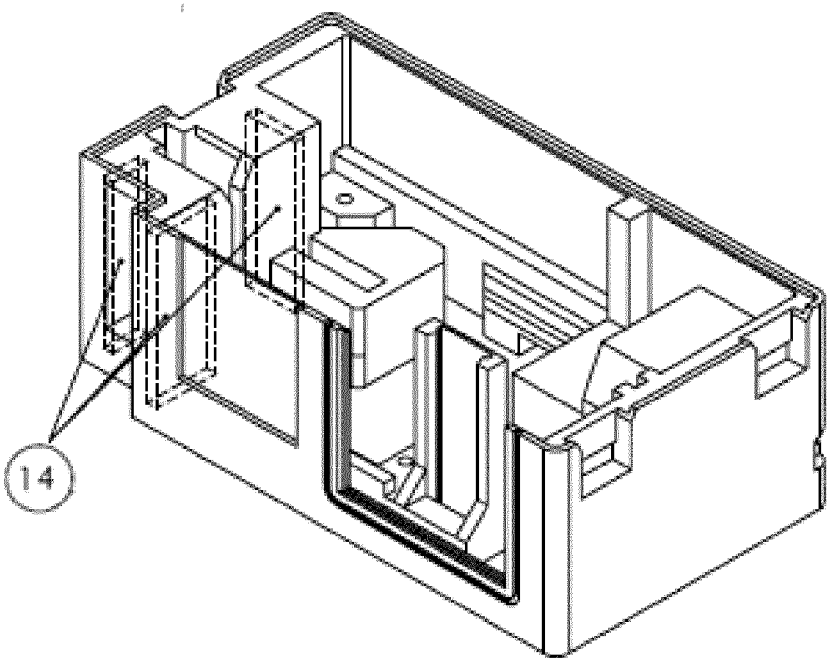

Fig. 3

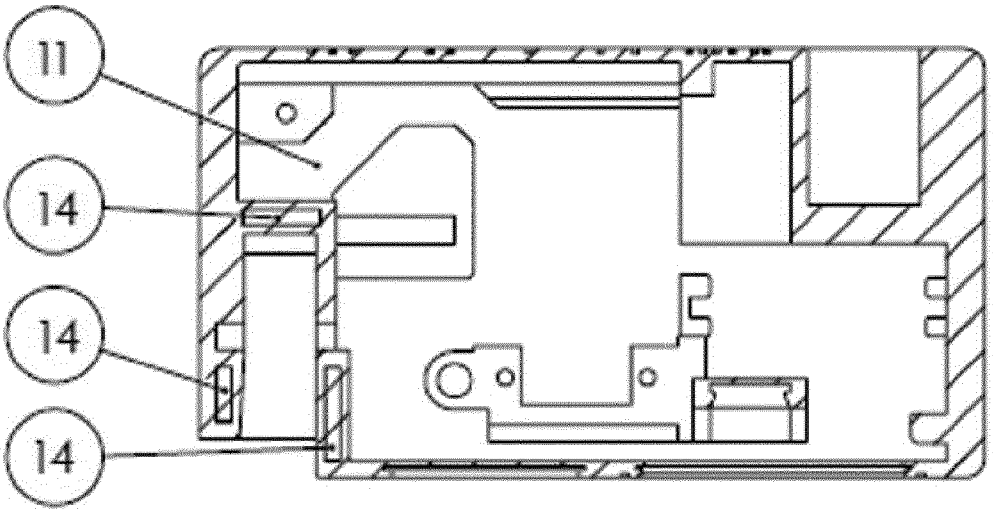

Fig. 4

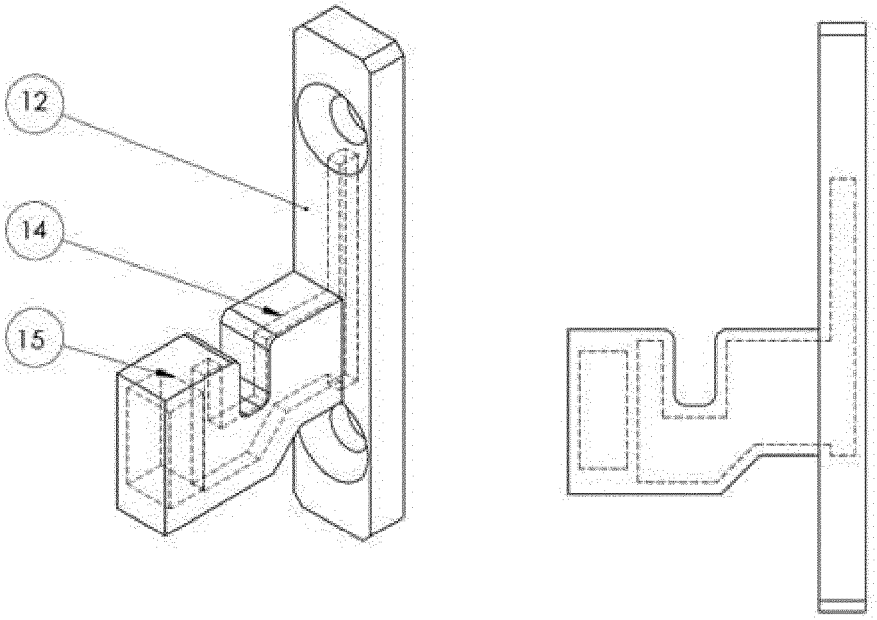
12
14
15

Fig. 5

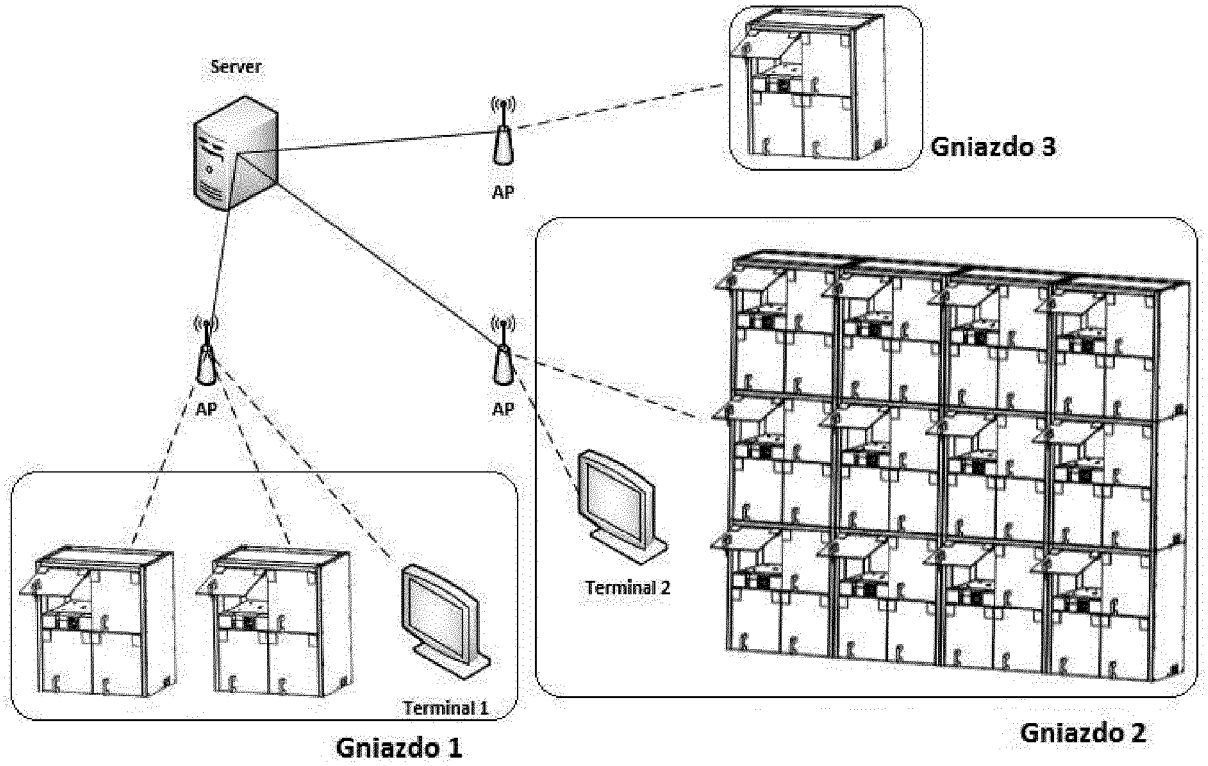
Server
AP
AP
AP
Gniazdo 3
Terminal 2
Terminal 1
Gniazdo 1
Gniazdo 2

Fig. 6

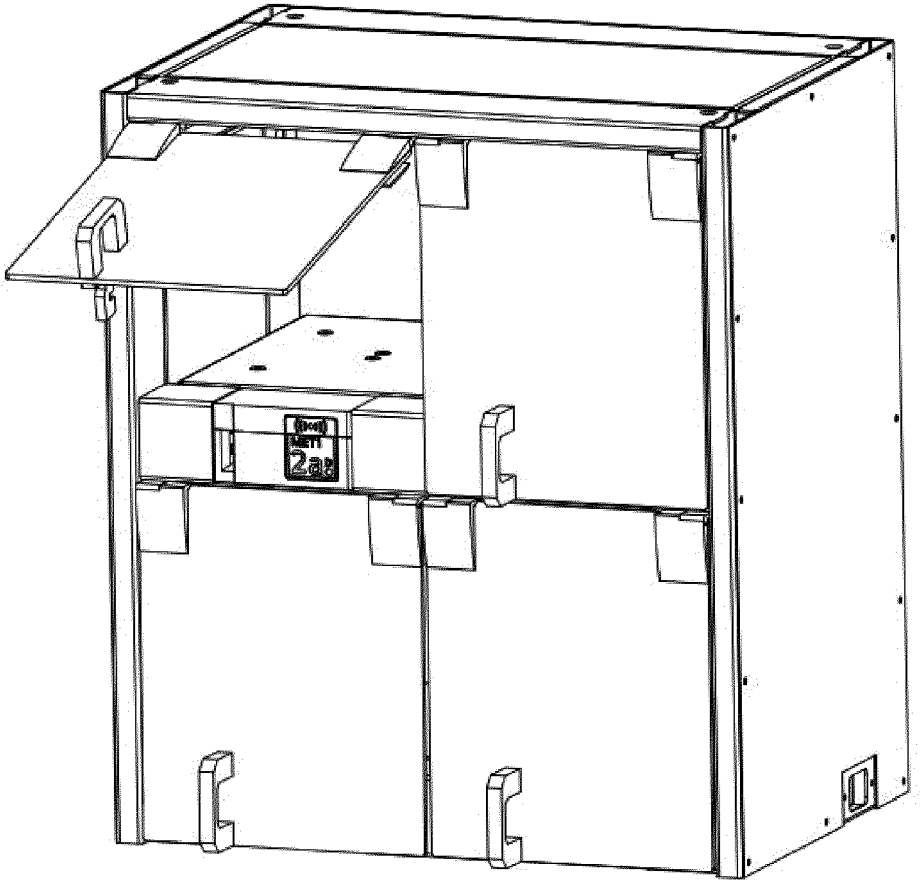

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 21 15 7000

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

E05B
A47G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	8 July 2021	Ansel, Yannick

CATEGORY OF CITED DOCUMENTS

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