(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 394 746 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
03.07.2024 Bulletin 2024/27

(21) Application number: **23208749.4**

(22) Date of filing: **09.11.2023**

(51) International Patent Classification (IPC):
G09F 3/02 *(2006.01)* ***G09F 3/20*** *(2006.01)*
G09F 9/37 *(2006.01)* ***G09F 27/00*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
G09F 3/208; G09F 3/204; G09F 9/372; G09F 27/007

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **30.12.2022 CN 202223562761 U**

(71) Applicant: **Suzhou Etag-Technology Co., Ltd.**
215001 Suzhou Jiangsu (CN)

(72) Inventors:
- **HU, Xiande**
  Suzhou, 215001 (CN)
- **LI, Bailiang**
  Suzhou, 215001 (CN)
- **HUANG, Haipeng**
  Suzhou, 215001 (CN)
- **XIA, Xinglong**
  Suzhou, 215001 (CN)

(74) Representative: **dompatent von Kreisler Selting Werner -**
Partnerschaft von Patent- und Rechtsanwälten mbB
Deichmannhaus am Dom
Bahnhofsvorplatz 1
50667 Köln (DE)

(54) **ENVIRONMENTAL ENERGY COLLECTION ELECTRONIC PRICE TAG**

(57) This application discloses an environmental energy collection electronic price tag, which includes a solar panel (1), an electronic paper display screen (2), a printed circuit board (3) and a super-capacitor (5). The printed circuit board (3) is provided thereon with a signal transceiver antenna and a radio frequency collection antenna. The signal transceiver antenna is configured to send and receive a wireless radio frequency signal, and the radio frequency collection antenna is configured to collect radio frequency signal energy sent by another electronic price tag in environment. An operation frequency of the signal transceiver antenna and an operation frequency of the radio frequency transceiver antenna are same. The super-capacitor (5) is configured to store electric energy converted by the solar panel (1) and the radio frequency collection antenna and provide the electric energy to the printed circuit board (3) and the electronic paper display screen (2). With this application, energies (such as daylight, radio frequency signals, etc.) contained in the surrounding environment can be converted into electrical energy to power the electronic price tag, which meets application requirements of the electronic price tag in a variety of scenes, reduces maintenance frequency of the electronic price tag, and reduces pollution to the environment.

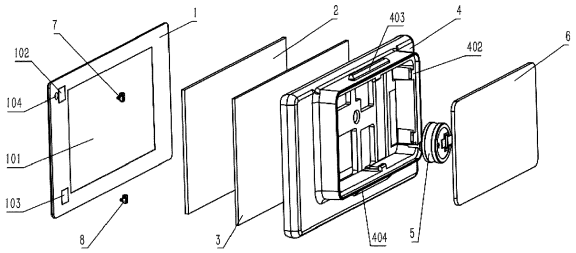

FIG.1

EP 4 394 746 A1

Description

FIELD OF THE INVENTION

[0001] This application relates to the technical field of electronic devices, in particular to an electronic price tag capable of collecting environmental energy.

BACKGROUND OF THE INVENTION

[0002] At present, electronic price tags on the market are mostly powered through disposable batteries or wired power supplies.

[0003] For power supply via the disposable batteries, the electronic price tag cannot be used permanently due to capacity and service life limit of the battery, besides, the battery is needed to be replaced for the electronic price tag at certain time, resulting in human waste and environmental pollution. For the wired power supply, a variety of accessories are required, the direct current is supplied to the electronic price tag through a wire, resulting in resource consumption, cost increasement and inflexible usage.

SUMMARY OF THE INVENTION

[0004] In view of the shortcomings of the prior art, it is provided according to the present application an environmental energy collection electronic price tag, which can convert energies contained in the surrounding environment (such as daylight, radio frequency signals, etc.) into electrical energy, to power the electronic price tag, which meets application requirements of the electronic price tag in a variety of scenes, reduces maintenance frequency of the electronic price tag, and reduces pollution to the environment.

[0005] For the above purposes, this application provides the following technical solutions.

[0006] An environmental energy collection electronic price tag includes a solar panel, an electronic paper display screen, a printed circuit board and a super-capacitor;

the solar panel is formed by assembling a plurality of solar cells, a middle portion of the solar panel is provided with a transparent display area, and the electronic paper display screen is installed in the transparent display area and is fixed on the printed circuit board;

the printed circuit board is provided thereon with a control circuit for the electronic paper display screen, a signal transceiver antenna and a radio frequency collection antenna, the signal transceiver antenna is configured to send and receive a wireless radio frequency signal, the radio frequency collection antenna is configured to collect radio frequency signal energy sent by another electronic price tag in environment; an operation frequency of the signal transceiver antenna and an operation frequency of the radio frequency transceiver antenna are same; and

the super-capacitor is fixed on a front side of the printed circuit board away from the electronic paper display screen, an input end of the super-capacitor is connected with the solar panel and the radio frequency collection antenna, and an output end of the super-capacitor is connected with the control circuit and the electronic paper display screen, the super-capacitor is configured to store electric energy converted by the solar panel and the radio frequency collection antenna and to provide the electric energy to the printed circuit board and the electronic paper display screen.

[0007] To optimize the above technical solution, specific implementations including the followings are provided.

[0008] Further, the electronic paper display screen is fixed on a back side of the printed circuit board by means of adhesive.

[0009] Further, an LED light is provided on the printed circuit board, and the solar panel is provided with an orifice, light of the LED light can pass through the orifice to a surface of the solar panel, and the LED light is connected with the control circuit.

[0010] Further, a positive contact spring leaf and a negative contact spring leaf are disposed on a back side of the printed circuit board, and the positive contact spring leaf and the negative contact spring leaf are connected to a positive terminal and a negative terminal of the super-capacitor, respectively; and

a positive contact and a negative contact are disposed on a back side of the solar panel; and the printed circuit board is connected with the positive contact of the solar panel through the positive contact spring leaf, and is connected with the negative contact of the solar panel through the negative contact spring leaf.

[0011] Further, the environmental energy collection electronic price tag includes a shell and a back cover;

the shell has a rectangular-shaped frame structure, a front side of the shell is provided with a solar panel dispensing groove, and a back side of the shell is provided with a back cover dispensing groove; a size of the solar panel is matched with a size of the solar panel dispensing groove, and the solar panel is fixed in the solar panel dispensing groove through a dispensing process, and thus the electronic paper display screen is sandwiched between the solar panel and the shell; a size of the back cover is matched with a size of the back cover dispensing groove, and the back cover is fixed in the back cover dispensing groove through the dispensing process.

[0012] Further, an upper engaging block is disposed on and protruded from a top surface of the shell, and a lower engaging block is disposed on and protruded from a bottom surface of the shell, and the shell is fastened onto a guide rail through the upper engaging block and the lower engaging block.

[0013] Further, the guide rail includes a guide rail body,

an upper engaging groove, a lower engaging groove, a first protrusion, a snap member and a second protrusion, wherein

the upper engaging groove, the lower engaging groove and the first protrusion are arranged on an inner side of the guide rail body, and the snap member and the second protrusion are arranged on an outer side of the guide rail body; the upper engaging groove is configured such that the upper engaging block can be snap fitted therein, and the lower engaging groove is configured such that the lower engaging block can be snap fitted therein;

the snap member has an L shape, and a short side of the snap member away from an end of a long side of the snap member is fixed at a position adjacent to the upper engaging groove; and the second protrusion is has a T shape and is fixed on a lower half of the guide rail body; and

the first protrusion part is positioned between the snap member and the second protrusion part, closing to the snap member.

[0014] Further, an end of the upper engaging groove away from the guide rail body is provided with a hook portion, and an end of the lower engaging groove away from the guide rail body is provided with a hook portion.

[0015] Further, the snap member is fixed at an installation position through adhesive or screws.

[0016] This application has the following advantageous effects:

First, the environmental energy collection electronic price tag provided by the present application can convert energies contained in the surrounding environment (such as daylight, radio frequency signals, etc.) into electrical energy, to power the electronic price tag, which meets application requirements of the electronic price tag in a variety of scenes, reduces maintenance frequency of the electronic price tag, and reduces pollution to the environment.

Second, the environmental energy collection electronic price tag according to the present application provides a novel guide rail structure, which reduces installation difficulty of the electronic price tag, improves heat dissipation performance of the electronic price tag, and reduces damage to the guide rail in the assembly/disassembly process by setting reasonable distances between the structural members.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG. 1 is a schematic structural diagram of an environmental energy collection electronic price tag according to an embodiment of the present application.

FIG. 2 is a schematic diagram of position relationships of components of an environmental energy collection electronic price tag according to an embodiment of the present application.

FIG. 3 is a schematic structural diagram of a guide rail according to an embodiment of the present application.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0018] The present application is described in detail in combination with the drawings.

[0019] It is to be noted that the terms referred to in this application such as "upper", "lower", "left", "right", "front", "back", etc., are only for convenience of description, but not to limit the scope of this application, and the change or adjustment of the relative relationships shall also be regarded as falling within the scope of this application without substantial change to the technical solution.

[0020] Besides, as used herein, the "super capacitor" may also be called ultracapacitor, which is also known as Electrical Double-Layer Capacitor, it is an electrochemical element that stores energy by polarizing electrolytes. Different from the traditional chemical power supply, it is a kind of power supply with special performance, which is between the traditional capacitor and the battery. It mainly relies on the double electrical layers and the redox "pseudocapacitance" charge to store electric energy. However, there is no chemical reaction in the process of its energy storage, and this energy storage process is reversible. Accordingly, the super capacitor can be repeatedly charged and discharged hundreds of thousands of times. Its basic principle, like other kinds of electrical double-layer capacitors, is to use the electrical double-layer structure of activated carbon porous electrode and electrolyte to obtain super-large capacity. The electronic paper display (EPD) screen employs the technology of electronic paper. Electronic paper generally refers to a kind of display that coats electronic ink on a layer of plastic film, which can be attached to a thin film transistor (made of TFT/PET/FPC, and the like.) circuit, and can be controlled by a driving integrated circuit (IC) to form a pixel pattern. Electronic paper display screen is based on the electronic ink technology. Its principle is that many tiny "microcapsules" are attached to the surface of the screen, which encapsulate negatively charged black particles and positively charged white particles. By changing the charge, the particles of different colors are arranged in order, thus presenting a clear visual effect of black and white.

[0021] FIG. 1 is a schematic structural diagram of an environmental energy collection electronic price tag according to an embodiment of this application. As shown in FIG. 1, the environmental energy collection electronic price tag includes a solar panel 1, an electronic paper display screen 2, a printed circuit board 3 and a supercapacitor 5.

[0022] The solar panel 1 is formed by assembling a plurality of solar cells. A middle portion of the solar panel

1 is provided with a transparent display area, and the electronic paper display screen 2 is installed in the transparent display area and is fixed onto the printed circuit board.

[0023] The printed circuit board may be a silkscreen printed circuit board. The printed circuit board 3 is provided thereon with a control circuit for the electronic paper display screen 2, a signal transceiver antenna and a radio frequency collection antenna. The signal transceiver antenna is configured to send and receive a wireless radio frequency signal. The radio frequency collection antenna is configured to collect radio frequency signal energy sent by another electronic price tag in environment. An operation frequency of the signal transceiver antenna and an operation frequency of the radio frequency transceiver antenna are the same.

[0024] The super-capacitor 5 is fixed onto a front side of the printed circuit board 3 away from the electronic paper display screen 2. An input end of the super-capacitor is connected with the solar panel 1 and the radio frequency collection antenna, and an output end of the super-capacitor is connected with the control circuit and the electronic paper display screen 2. The super-capacitor 5 is configured to store electric energy converted by the solar panel and the radio frequency collection antenna and provide the electric energy to the printed circuit board 3 and the electronic paper display screen 2.

[0025] Specifically, as shown in FIG. 1 and FIG. 2, the environmental energy collection electronic price tag includes the solar panel 1, the electronic paper display screen 2, the printed circuit board 3, a shell 4, the super-capacitor 5, a back cover 6, a positive contact spring leaf 7 and a negative contact spring leaf 8.

[0026] The solar panel 1 is formed by assembling a plurality of solar cells. A transparent display area 101 is provided in a middle portion of the solar panel 1, and through the transparent display area, images displayed by the electronic paper display screen 2 below the solar panel 1 can be seen.

[0027] The printed circuit board 3 is fixed on the shell 4 by means of adhesive. The positive contact spring leaf 7 and the negative contact spring leaf 8 are fixed on the back side of printed circuit board 3. When the solar panel 1 is fixed onto the shell 4, the positive contact 102 on the back side of the solar panel 1 is in contact with the positive contact spring leaf 7, and the negative contact 103 on the back side of the solar panel 1 is in contact with the negative contact spring leaf 8, which then are connected to the positive terminal and the negative terminal of the super-capacitor 5 through the printed circuit board 3.

[0028] The printed circuit board 3 is provided with a signal transceiver antenna to send and receive a wireless radio frequency signal and a radio frequency collection antenna to collect radio frequency energy generated by the signal transceiver antenna of the printed circuit board itself. An operation frequency of the signal transceiver antenna and an operation frequency of the radio frequency transceiver antenna are same, which can be used to collect radio frequency signal energy of other environmental energy collection electronic price tag in the environment.

[0029] The super-capacitor 5 is fixed on a front side of the printed circuit board 3, and is configured to store electric energy converted from the solar energy and the radio frequency energy, to supply power to a control chip and the electronic paper display screen 2.

[0030] The display screen is arranged between the solar panel 1 and the printed circuit board 3. The display screen is fixed on the back side of the printed circuit board 3 by means of adhesive. The printed circuit board 3 is connected with the display screen, and can drive the display screen and control the display content of the display screen.

[0031] An LED light 301 is provided on the printed circuit board 3. The control chip controls the LED light 301 to be turned on and off. An orifice 104 is provided in the solar panel 1, and the light of the LED light 301 can pass through the orifice 104.

[0032] A front side of the shell 4 is provided with a solar panel dispensing groove 401, and a back side thereof is provided with a back cover dispensing groove 402. Through a dispensing process, the solar panel 1 is fixed onto the front side of the shell 4, and the back cover 6 is fixed on the back side of the shell 4.

[0033] Considering the application scenario of the electronic price tag, a guide rail structure is provided according to an embodiment, which considers assembly/disassembly requirements, stable requirements, free movement requirements and heat dissipation requirements of the electronic price tag, as well as assembly/disassembly and service life of the guide rail.

[0034] As shown in FIG. 3, the guide rail 9 includes a guide rail body, an upper engaging groove 901, a lower engaging groove 902, a first protrusion, a snap member 903 and a second protrusion.

[0035] The upper engaging groove 901, the lower engaging groove 902 and the first protrusion are arranged on an inner side of the guide rail body. The snap member 903 and the second protrusion are arranged on an outer side of the guide rail body. The upper engaging groove 901 is configured such that an upper engaging block 403 can be snap-fitted therein, and the lower engaging groove 902 is configured such that a lower engaging block 404 can be snap-fitted therein.

[0036] The snap member 903 has a L shape, and a short side of the snap member away from an end of a long side of the snap member is fixed at a position adjacent to the upper engaging groove 901. The second protrusion has a T shape and is fixed on a lower half of the guide rail body.

[0037] The first protrusion part is positioned between the snap member 903 and the second protrusion, closing to the snap member 903.

[0038] An end of the upper engaging groove 901 away from the guide rail body is provided with a hook portion, and an end of the lower engaging groove 902 away from

the guide rail body is provided with a hook portion, so as to ensure the electronic price tag to be stably installed in the guide rail.

[0039] During the installation, since the shell 4 of the environmental energy collection electronic price tag is provided with the upper engaging block 403 and the lower engaging block 404, and the guide rail 9 is provided with the upper engaging groove 901 and the lower engaging groove 902, the environmental energy collection electronic price tag can be fastened onto the guide rail 9 with the upper engaging block 403 of the shell 4 being snap fitted into the upper engaging groove 901 of guide rail 9 and the lower engaging block 404 of the shell 4 being snap fitted into the lower engaging groove 902 of guide rail 9. The snap member 903 of guide rail 9 can be fixed at an installation position through adhesive or screws, or be connected at the installation position in a snap-fit manner. The fixing manner of the electronic price tag is not limited to the guide rail 9.

[0040] The above are only preferred embodiments of the present application, and the protection scope of this application is not limited to the above embodiments. All technical solutions complying with the concept of this application fall within the protection scope of the present application. It should be noted that for those skilled in the art, various improvements and modifications without departing from the principle of this application shall be regarded as falling within the protection scope of this application.

Claims

1. An environmental energy collection electronic price tag, **characterized by** comprising a solar panel, an electronic paper display screen, a printed circuit board and a super-capacitor;

   the solar panel is formed by assembling a plurality of solar cells, a middle portion of the solar panel is provided with a transparent display area, and the electronic paper display screen is installed in the transparent display area and is fixed on the printed circuit board;
   the printed circuit board is provided thereon with a control circuit for the electronic paper display screen, a signal transceiver antenna and a radio frequency collection antenna, the signal transceiver antenna is configured to send and receive a wireless radio frequency signal, the radio frequency collection antenna is configured to collect radio frequency signal energy sent by another electronic price tag in environment, and an operation frequency of the signal transceiver antenna and an operation frequency of the radio frequency transceiver antenna are same; and
   the super-capacitor is fixed on a front side of the printed circuit board away from the electronic paper display screen, an input end of the super-capacitor is connected with the solar panel and the radio frequency collection antenna and an output end of the super-capacitor is connected with the control circuit and the electronic paper display screen, the super-capacitor is configured to store electric energy converted by the solar panel and the radio frequency collection antenna and provide the electric energy to the printed circuit board and the electronic paper display screen.

2. The environmental energy collection electronic price tag according to claim 1, **characterized in that** the electronic paper display screen is fixed on a back side of the printed circuit board by means of adhesive.

3. The environmental energy collection electronic price tag according to claim 1 or 2, **characterized in that** an LED light is disposed on the printed circuit board, and the solar panel is provided with an orifice, light of the LED light can pass through the orifice to a surface of the solar panel, and the LED light is connected with the control circuit.

4. The environmental energy collection electronic price tag according to any one of claims 1 to 3, **characterized in that** a positive contact spring leaf and a negative contact spring leaf are disposed on a back side of the printed circuit board, and the positive contact spring leaf and the negative contact spring leaf are respectively connected to a positive terminal and a negative terminal of the super-capacitor;
   a positive contact and a negative contact are disposed on a back side of the solar panel, and the printed circuit board is connected with the positive contact of the solar panel through the positive contact spring leaf, and is connected with the negative contact of the solar panel through the negative contact spring leaf.

5. The environmental energy collection electronic price tag according to any one of claims 1 to 4, **characterized in that** the environmental energy collection electronic price tag comprises a shell and a back cover;
   the shell is in a rectangular frame structure, a front side of the shell is provided with a solar panel dispensing groove, and a back side of the shell is provided with a back cover dispensing groove; a size of the solar panel is matched with a size of the solar panel dispensing groove, and the solar panel is fixed in the solar panel dispensing groove through a dispensing process, and thus the electronic paper display screen is sandwiched between the solar panel and the shell; a size of the back cover is matched with a size of the back cover dispensing groove, and

the back cover is fixed in the back cover dispensing groove through the dispensing process.

6. The environmental energy collection electronic price tag according to claim 5, **characterized in that** an upper engaging block is disposed on and protruded from a top surface of the shell, and a lower engaging block is disposed on and protruded from a bottom surface of the shell, and the shell is fastened onto a guide rail through the upper engaging block and the lower engaging block.

7. The environmental energy collection electronic price tag according to claim 6, **characterized in that** the guide rail comprises a guide rail body, an upper engaging groove, a lower engaging groove, a first protrusion, a snap member and a second protrusion;

the upper engaging groove, the lower engaging groove and the first protrusion are arranged on an inner side of the guide rail body, and the snap member and the second protrusion are arranged on an outer side of the guide rail body;
the upper engaging groove is configured such that the upper engaging block can be snap fitted therein, and the lower engaging groove is configured such that the lower engaging block can be snap fitted therein;
the snap member is in an L shape, and a short side of the snap member away from an end of a long side of the snap member is fixed at a position adjacent to the upper engaging groove;
and the second protrusion is in a T shape and is fixed on a lower half of the guide rail body; and
the first protrusion part is positioned between the snap member and the second protrusion part, closing to the snap member.

8. The environmental energy collection electronic price tag according to claim 7, **characterized in that** an end of the upper engaging groove away from the guide rail body comprises a hook portion, and an end of the lower engaging groove away from the guide rail body comprises a hook portion.

9. The environmental energy collection electronic price tag according to claim 7 or 8, **characterized in that** the snap member is fixed at an installation position through adhesive or screws.

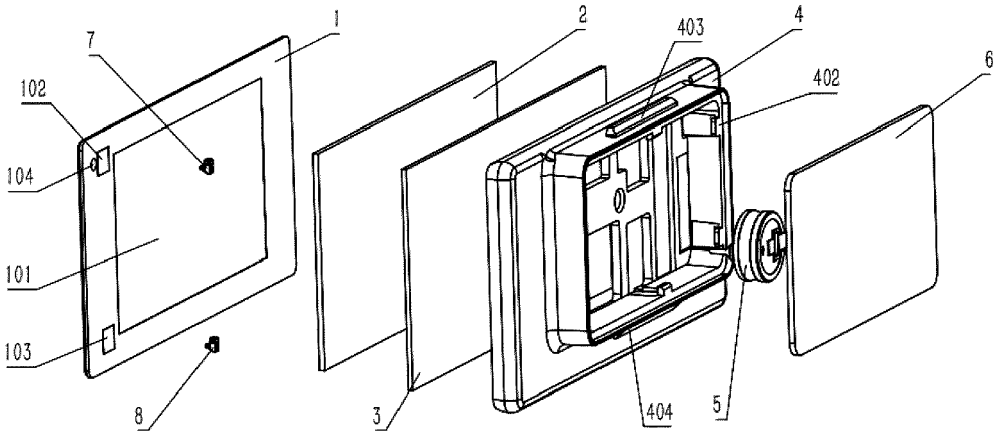
1
2
403
4
6
7
102
402
104
101
103
8
3
404
5

FIG.1

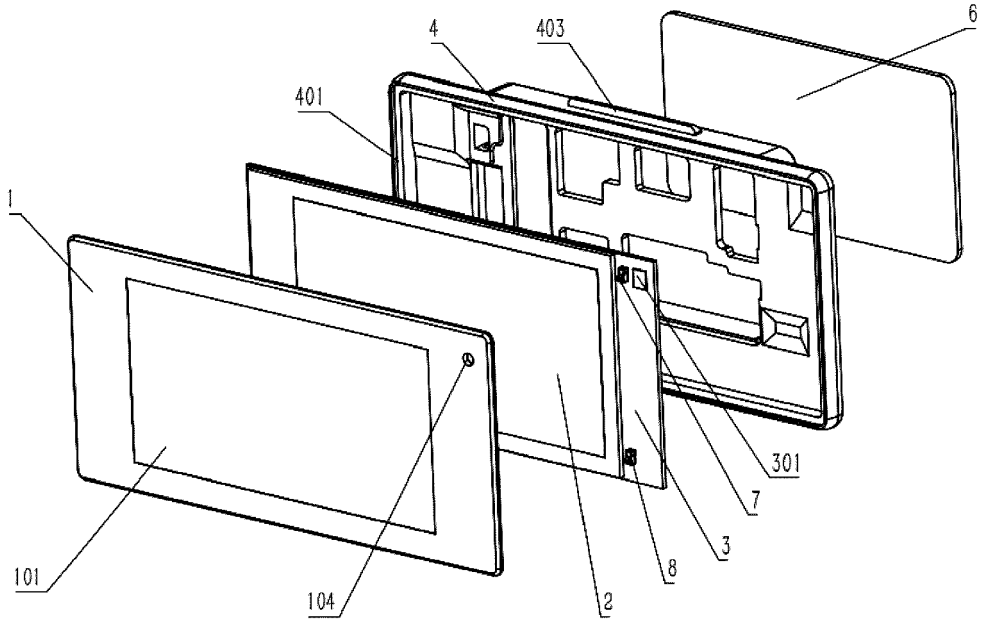
4
403
6
401
1
301
7
3
101
8
104
2

FIG.2

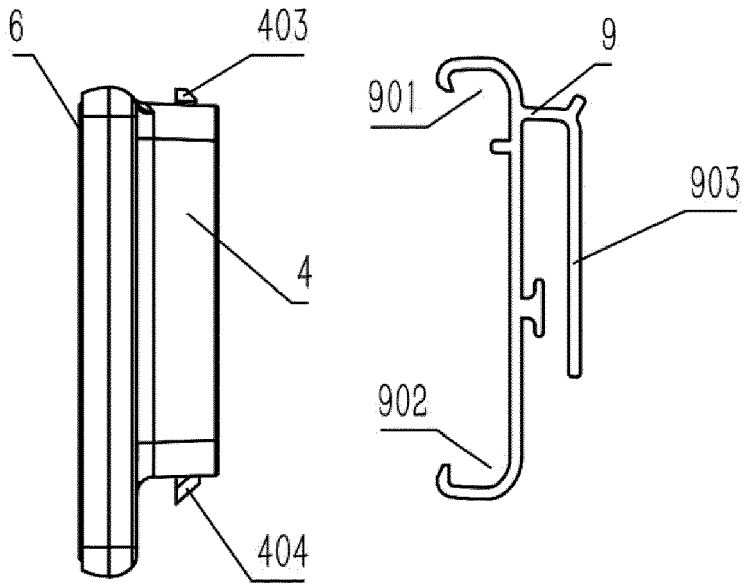

FIG.3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 20 8749

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2019/057626 A1 (LEE YU-MING [TW] ET AL) 21 February 2019 (2019-02-21) * paragraphs [0037], [0039] - [0042], [0044], [0046] - [0051], [0059] * * figures 1,3,4 *	1-9	INV. G09F3/02 G09F3/20 G09F9/37 G09F27/00
Y	WO 2015/136146 A1 (MARIELLA LABELS OY [FI]) 17 September 2015 (2015-09-17)	1,3,4	
A	* page 6, line 22 - page 8, line 34 * * figures 1,2 *	2,5-9	
Y	EP 2 876 628 A2 (PRICER AB [SE]) 27 May 2015 (2015-05-27)	2	
A	* paragraphs [0012], [0025] - [0029], [0033], [0041], [0042] * * claim 6 * * figures 1,5 *	1,3-9	
Y	CN 115 202 125 A (HKC CO LTD) 18 October 2022 (2022-10-18)	5	
A	* abstract * * figures 1-5 *	1-4,6-9	TECHNICAL FIELDS SEARCHED (IPC)
Y	WO 2022/218513 A1 (SES IMAGOTAG GMBH [AT]) 20 October 2022 (2022-10-20)	6-9	G09F
A	* page 1, lines 10-15 * * page 4, line 17 - page 5, line 7 * * page 26, line 32 - page 29, line 16 * * figures 9-12 *	1-5	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18 April 2024	Lechanteux, Alice

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 20 8749

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

18-04-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2019057626 A1	21-02-2019	US 2019057626 A1	21-02-2019
		US 2020312200 A1	01-10-2020
WO 2015136146 A1	17-09-2015	NONE	
EP 2876628 A2	27-05-2015	EP 2876628 A2	27-05-2015
		US 2016260163 A1	08-09-2016
CN 115202125 A	18-10-2022	CN 115202125 A	18-10-2022
		WO 2024007554 A1	11-01-2024
WO 2022218513 A1	20-10-2022	CN 117223043 A	12-12-2023
		EP 4323985 A1	21-02-2024
		WO 2022218513 A1	20-10-2022

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82