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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 May 2017 (11.05.2017)

WIPO | PCT

(10) International Publication Number
WO 2017/077087 A1

(51) International Patent Classification:
B05B 12/00 (2006.01)

(21) International Application Number:
PCT/EP2016/076749

(22) International Filing Date:
4 November 2016 (04.11.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/250,538 4 November 2015 (04.11.2015) US
62/331,299 3 May 2016 (03.05.2016) US

(71) Applicant: **SPRAYPRINTER OÜ** [EE/EE]; Narva maantee 3, 51013 Tartu (EE).

(72) Inventor: **JOALA, Mihkel**; Narva maantee 3, 51013 Tartu (EE).

(74) Agent: **SARAP, Margus**; Sarap and Putk Patent Agency, Kompanii 1C, 51004 Tartu (EE).

(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, JP, KE, KG, 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).

Declarations under Rule 4.17:

— *as to the identity of the inventor (Rule 4.17(i))*

Published:

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

(54) Title: A WIRELESS APPLICATION BASED SPRAY PRINTER DEVICE AND SYSTEM FOR SURFACE PAINTING

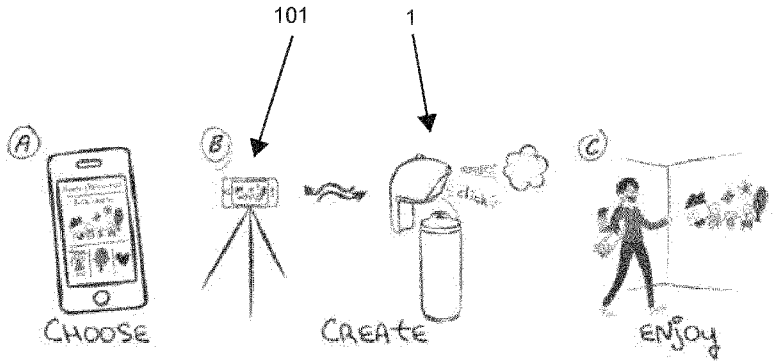


FIG 1

(57) Abstract: The present invention relates to a wireless application based spray printer device for surface painting comprising a camera module and a printing module. Said spray printer device comprises a housing where is attached an aerosol spray paint reservoir. A spray activation device attached to the upper portion of the housing is provided with an extension for pushing down an aerosol spray paint reservoir valve and for directing aerosol spray paint into a printing head. A printing head comprises a printing valve, a spray channel attached to the printing valve and followed by a spray nozzle for forming a printed pixel to the painted surface. The device comprises electronics for receiving signals from camera module and means for controlling printing valve.

WO 2017/077087 A1

A wireless application based spray printer device and system for surface painting

Technical field

The present invention relates to a field of printing techniques, in particular, in the field of printers used to cover a surfaces with a painted picture etc., where for printing are used pressurized paint in an aerosol spray paint reservoir which is placed into a printer housing comprising printer head and the present invention relates to a method which comprises use of sensors for controlling and identification orientation of a printer on the surface and transmission image files and commands to the printer for controlling the printing process.

Technical background

From the art is known spray painters who may cover large surfaces with the spray paint from spray can. All paintings are done by hand and therefore creating the wall paintings depends from the skills of the artist. For large scale painting the orientation of the spray can is challenging and the artist must have very good focus to the concept of the picture.

The overall objective of the present invention is to improve and commercialize a new do-it-yourself surface painting solution which enables to transfer or paint pictures and designs directly from a computer or smartphone to any surface (walls, cakes, cars, surfboards etc.). For this, the applicant team has developed an innovative wireless printer device (SprayPrinter) which communicates in preferred embodiments with smartphone's sensors (camera) through an app that controls the painting process. However invention is not limited to be implemented as an app on a smartphone.

To the printer device itself is attached preferably an aerosol spray can in order to complete the desired paint work on surface using spray paint. With said SprayPrinter device, the whole process of planning and completing a personalized surface design (for example wall design) can thus be done by everyone.

As such, the printer device converts digital designs such as photos, pictures, ornaments etc. into surface design such as wall, ceiling, floor etc. design, wirelessly and all the user needs to do is to download the app, choose the suitable image from a large gallery made up of custom art and images for example by an international community of artists and designers, attach a spray can to the printing device and print

the picture on the desired surface such as wall, ceiling, canvas, 3D objects etc. Basically with said printer device any surface can be painted.

As a tool that any home decorator or interior designer can easily use without intermediaries, the SprayPrinter device according to present invention has remarkable potential in the decorative arts market. The main competitive solutions are either very expensive (custom wall paintings), not easy to use (stencils) or cannot be customized (stickers, posters), whereas the SprayPrinter device will offer superior functionality, personalization, ease-of-use and competitive pricing. What is more, the current Do-It-Yourself trends and the emerging maker culture will further support the fast market uptake of the printer device.

Disclosure of the Invention

The SprayPrinter solution is the most innovative spray printing device to be on the market in near future. It is designed for wireless printing of graphic designs (images) on surfaces from a smartphone (see FIG 2). The SprayPrinter solution is made up of two basic modules: a printing module and a camera module.

A printing module of a wireless application based spray printer device for surface painting comprises a housing and an aerosol spray paint reservoir attached to said housing, a spray activation device attached to the upper portion of the housing for directing aerosol spray paint into a printing head comprising a printing valve, a spray channel is attached to the printing valve and followed by a spray nozzle for forming a printed pixel to the painted surface. The printing process is controlled by an electronics comprising radio transceiver for receiving and transmitting signals from camera module to printing module and from printing module to camera module.

To the printing module is attached the aerosol spray paint reservoir for example spray paint can. The user moves printing module manually in order to spray paint onto a surface for example onto wall. In this way the wireless application based spray printer device is used for printing the images on a surface, such as for wall decoration. The camera module can be for example a smartphone, which tracks the position of the printer module in an x-y plane on the surface to be painted.

When the camera module and the printing module is switched on the picture data from camera module is sent to printing module. Then the tracking led on the printing module will be switched on when the trigger lever is pressed by a user. At the same time the

printing module sends the time stamp package to the camera module. The time stamp is received by camera module and the camera module sensor (CCD, CMOS, NMOS etc. type image sensors) detects the first frame with the illuminated tracking led and sends the time stamp of said frame back to the printing module. The printing module calculates based on these two time stamps the time delay in the system. The results of calculations are used by the software program implemented in the printing module to compensate the tracking delay. The camera module continuously calculates coordinates of the tracking LED and sends the coordinate data to the printing module. The printing module calculates the delay and uses the calculated coordinates to decide the opening of the printing valve a result of which the colour is sprayed onto the surface. The closing time of the printing valve is constant and predetermined before the printing by user.

The software program in the camera module calculates the position of the printing module by detecting the light spot on the camera frame made by the illuminated tracking LED on the printing module and sends the coordinate information back to the printing module where the data is processed and location of the printing module (tracking LED that is in line with the printer nozzle) is calculated. For calculation of the exact pixel coordinate of the printing module tracking LED is used. The tracking LED on the printing module creates an illuminated spot on the frame of the camera in the camera module. The frame is processed by thresholding to remove other light areas from the camera and then contour of the light spot is traced and centroid of the light spot is calculated. Additionally to eliminate potentially unvented light sources from the frame algorithm is used that when the spring switch is pressed by the trigger lever by the user on the printer module, initiates two events in the printing module simultaneously. First, the notification of the trigger pressing event is sent to the camera module, then printing module waits until camera module has received the information of the pressing of the trigger lever in said printing module after that the control unit of the printing module turns on the tracking LED. Then software in the camera module can eliminate other light sources by comparing frames before the tracking LED is turned on and after.

For transmitting data between the camera module and the printing module is used for example Bluetooth connection in the camera module and printing module. According to the location of the printing module decision is made by the software program whether

the printing module is to produce a coloured area on the surface (herein referred to as a pixel) or not. In alternative embodiment the camera module finds tracking LED coordinates and sends the position data to the printing module as described above, but the position calculation is based not only to position data from camera module but also sensor data from the inertial measurement unit (IMU) on the printer module PCB. The printing module control unit calculates current estimated position of the printing module and decides if the current pixel needs to be printed or not. The inertial measurement unit is used as described in document Francois Caron, et al "GPS/IMU data fusion using multisensory Kalman filtering: introducing of contextual aspects" Volume 7, Issue 2, June 2006, pages 221-230.

Alternatively the printing module position data calculation can be done in the camera module. The tracing of the tracking LED on the printing module is done identically as described above but instead of transmitting the coordinates to the printing module the calculation and decision making is all done by the software program running on camera module MCU. To the printing module only open valve command is sent. For this solution an external radio transmitter is used which is connected to the camera module's USB port (micro USB, mini USB etc.). The separate radio transmitter enables faster communication than Bluetooth and therefore higher accuracy because the transmitter uses a custom protocol (developed by authors of the present invention) which enables low and constant latency delay communication between modules. Compared to Bluetooth protocol the developed custom protocol enables to send data in the exact moment when needed as the Bluetooth sends data packages periodically for example after every 7,5 ms (millisecond).

The result is an image that is printed on the surface one pixel at a time. The software program running on camera module saves the pixels already printed on the surface, avoiding repeated layers and identifying any missing pixels. The user can use their smartphone to either upload their own picture or purchase one from an existing gallery that is created in collaboration with artists and designers and then simply spray print it onto surface such as wall (see FIG 3).

The gallery of artwork itself may be created in collaboration with artists and designers – upon uploading their design, a standard licensing agreement will be concluded between parties and if the author so wishes, a countdown tool will also be employed to limit the times the artwork can be bought and/or sold.

Brief description of drawings

The present invention is explained more in detail with references to figures added, where

Figure fig 1 illustrates the general concept of the printing system according to the present invention, shown is a camera module and printing module;

Figure fig 2 illustrates a setting up a camera module and a printing module according to the method of the present invention;

Figures fig 3A, 3B and 3C illustrate a perspective views of a printing module according to the present invention;

Figure fig 4A illustrates the side view of the printing module;

Figure fig 4B illustrates the cross-section view of the printing module along the line A-A in the fig 4A;

Figure fig 4C illustrates in more detail the sectional view of the printing head of the printing module;

Figures fig 5A, 5B, 5C and 5D illustrate accordingly the perspective view of the printing module with aerosol spray paint reservoir, a side view, a rear view and a top view of the printing module;

Figure fig 5E illustrates a sectional view of the printing module with aerosol spray paint reservoir along the line B-B in the fig 5C;

Figure fig 6A illustrates a perspective view of an alternative embodiment of the printing module with a number of printing valves to which are connected flow channels for spray paint and sprayers;

Figures fig 6B and fig 6C illustrates a side view and a top view of the alternative embodiment of the printing module in fig 6A;

Figure fig 6D illustrates a cross-sectional view of the alternative embodiment of the printing module along the line C-C in the fig 6C;

Figure fig 7 is a schematic overview of an electronics arranged in the printing module to control printing and position of the printing module during the spray painting.

Detailed description of invention

The present invention comprises of two modules: a printing module 1 and camera module 101. The camera module 101 comprises a camera 102, a sensor, a transceiver (receiver and transmitter – a communication module, not shown in the drawings), a processor and software for identification position of the printing module 1 in real time

near to the painted surface. The software tracks the location of the printing module in 2-dimension when the printer module is moved before the painted surface for in an x-y plane.

The printing module 1 (fig 3A-3C) comprises a housing 2 with gripping means 3 to connect and fix an aerosol spray paint reservoir (a spray can) 201 to said housing 2, a printing head 4 comprising a flow channels 5 for spray paint, valves 6, sprayer 7, an electronics 8 (fig 7) comprising a control processor unit 801, processors, valve control means 806, memory means 802, connectors, inertial measurement unit (IMU) 803, Bluetooth low energy (BLE) unit 804, a transmitter, a tracking sensor (for example tracking LED) 805; a battery compartment 9 in the housing and power supply 10 (battery means), on/off and control switches 11. The control unit 801 is connected with power supply (battery means) 10. The inertial measurement unit (IMU) 803 used in present invention is an electronic device that measures and reports a printing module specific force and angular rate by using a combination of accelerometers and gyroscopes. In alternative embodiment of the invention the IMU has GPS devices. The Bluetooth low energy unit is used to provide reduced power consumption communication between the printing module 1 and the camera module 101.

In addition the housing 2 may be provided with rollers or wheels 12 placed to the housing so that the printing module 1 can be moved in the front of surface within predetermined distance to help user and guarantee that the colour pixel sprayed from printing head has controlled size. The transmitter 13 fixed in the printing head is for example LED diode, ultrasonic transmitter, laser beam from laser diode or radio transmitter. The housing 1 is printed with 3D printing technology or injection moulded comprising the gripping means 3 for gripping and fixing the spray can to upper part of the housing 2.

To the upper part of the housing 2 is attached a spray activation device 14 (for example needle assembly) comprising an extension or a needle 15, a filter 16, a seal 17 (O-ring) and a fastener, for example a nut) 18 for fixing said spray activation device to the housing 2. The needle 15 is a tube with outer diameter corresponding to the diameter of the opening in the aerosol spray paint reservoir 201 valve (not shown in the drawings). When the spray paint reservoir is connected to the spray activation device the needle 15 is pressed to the opening in the spray paint reservoir valve. Same time the needle pushes down and opens spray paint reservoir valve to direct pressurised

aerosol spray paint from the spray paint reservoir to the needle tube and through flow channel 5 and filter 16 to printing head valve 6. The spray paint under the pressure can flow to the printing head valve 6 which is in closed state when the printing device is not working. The leak proof fastening is created between the external wall of the spray paint reservoir nozzle and said needle 15. In addition the sealing (O-ring) 17 is placed between the spray activation device 14 and printing head valve 6 to prevent paint leakages.

The printing head valve 6 comprises electromagnets (not shown in the drawings) for opening said valve and a closing means (not shown in the drawings) such as a spring for closing said printing valve. The printing valve 6 is followed by a spray channel 23 and a spray nozzle 7 or sprayer for forming shape of the printed pixel. The printing valve 6 is controlled by the electronics 8 placed into housing 2. The electronics 8 comprises control processor unit 801 which controls an opening and closing of the printer head valve 6. The software in the control processor unit 801 controls and communicates with the camera module 101 through transmitter 802 and sensors in the printing head 4. To the control processor unit is connected the inertial measurement unit 803 for controlling location of the printing head where said unit comprises for example a movement sensors, accelerometers and gyroscopes. The electronics comprises also receiver or Bluetooth low energy unit 804 (BLE) for receiving signal from the camera module (for example from the smartphone) and directing the picture characteristics or pixels to SprayPrinter device. When the printing valve is opened by the electromagnets the spray paint under the pressure flows through the spray channel 22 to the sprayer 7. The printing valve 6 is controlled by the electromagnets and electronics and when the signal is received from the camera module the printing valve opens accordingly to the picture to be printed to the surface. To control more effectively the work of the printer module to the upper part of the housing is attached the trigger lever 19 which activates a spring switch 20 when said trigger lever is pressed down by user. The spring switch controls the power circuit which provides the power to the electromagnets of the printing valve.

The lower part of the housing provided with a compartment 9 for a battery means which are intended to supply the printer module and electronics with power. In the bottom of the housing is placed on-off switch 21 to turn the power on or off. The battery means are connected to the electronics 8 placed in the printer module. For charging the

battery means the printer module is provided with a USB input (micro-B, mini-B, type-A, type-B etc.) 23.

Into the lower part of the housing are arranged a rollers or wheels 12 which will support the printing module when said module is placed to the surface to be painted. This will help user to maintain the right distance of the printing module from the painted surface.

In the top of the printer module housing above the spray nozzle is arranged the sensor or tracking LED 13 for tracking the position of the printing module 1.

The camera module 101, that is positioned toward the surface to be painted, transmits video feed to the processor inside the camera module. Software thresholds each frame, so that only well illuminated areas are light, everything else is dark. Within this the time that the printing module waited before lighting the tracking LED, the info about trigger pressing reaches the camera module so the software can anticipate the event of LED lighting up and take notice of it. Now, as the software has info about which light area is made by the tracking LED, it traces the edges of this particular area. Then the software calculates the centroid of this area and transmits the pixel coordinates of the centre to the printing module. This is done with each frame. Based on position data from camera module and sensor data from the inertial measurement unit (IMU) the control unit calculates current estimated position of the printing module and decides if the current pixel needs to be printed or not and then opens the printing valve 6 for n ms if needed.

Alternatively when the LED beacon position coordinates are sent to the printing module the calculation of the coordinates does not only rely on the information of the camera module but also on the data from the inertial measurement unit (IMU), the printing module control unit calculates next current estimated position of the printing module and decides if the next current pixel needs to be printed or not and then opens the printing valve for x ms if needed. Said process is done repeatedly until the user releases the printing module trigger lever 19. Each time when the trigger lever in the printing module is pressed again the position of the printing module is determined according to the process described above.

Alternatively by pressing trigger lever by user the printing module will wait commands to open/close printing valve from camera module. Whereas the camera module finds a tracking LED in the camera frame and a tracking software in the camera module

calculates pixel coordinates of the LED light centroid and based on the pixel value of said coordinates decides whether to send or not the command to printing module to open the printing valve. Said step is continuously repeated until the image is spray printed into surface and user releases the printing module trigger lever.

In the fig 6A – 6D is described an alternative embodiment of the present invention where the printing head comprises a number of printing valves connected with spray channels to the corresponding number of the spray nozzles. The number of printing valves are controlled by control processor unit and valve control means by using the corresponding software. The number of printing nozzles in said alternative embodiment allows to release several paint pixels to the surface to be painted simultaneously. Said construction gives to the user additional possibilities to increase painting speed. In addition said construction allows to use for every different color own printing valve.

In one embodiment a wireless application based spray printer device for wall decoration comprises a housing having a part for receiving an aerosol paint can, a top of the housing is designed as printing head comprising means for receiving and fixing aerosol paint can nozzle, whereas said means comprising a channel for receiving aerosol paint can nozzle, whereas said channel having extension so that the nozzle of the aerosol paint can will be pushed down when nozzle is inserted to said channel, a printing valve comprising electromagnets for opening printing valve and the printing valve closing means such as spring, the printing valve is followed by a spray channel for directing paint to the sprayer, an electronics comprising radio receiver for receiving signals from camera module such as smartphone and means for controlling printing valve electromagnets. Said electronics in the printing head comprises a sensors such movement sensors, accelerometers and gyroscopes. A wireless application based spray printing system for wall decoration comprises a spray printer device, camera module and software for controlling said camera module and spray printer device. The spray printer device converts digital designs into wall art wirelessly when user uses a software app after choosing the suitable image from a gallery made up of custom art and images, attaching the printing device to a spray can and printing the picture on the desired wall surface. The location of the spray printer device is controlled by camera module whereas the printing valve of the spray printer device is actuated when said

device location corresponds to the place in the painted picture where the colour pixel is intended to be painted.

The inventor and applicant of the present invention are seeking to address several related challenges with its innovative product. These include but are not limited to:

- Offering a sustainable solution for home decoration that supports the re-use mentality – instead of purchasing one-time wall stickers or other similar products, SprayPrinter allows the user to easily 're-invent' their creative output by printing more artworks or replacing or redoing the existing pieces, thereby avoiding excessive consumption and consumerism;
- Increasing the competitiveness of the creative industries by launching an innovative product that will successfully compete with existing solutions and diversify the market;
- Contributing to the creation of aesthetically pleasing and inspiring living environments with high added value as SprayPrinter's solution may be used both indoors and outdoors and also on very large surfaces, which gives it great potential and a wide range of possible applications in both urban landscapes and interiors;
- Creating a community of like-minded people and artists – as one part of SprayPrinter's solution includes creating a large gallery of artworks and designs that the home user can choose from, in addition to bringing together the authors behind the artwork who wish to share and sell their art, it will create a community of people with shared interests, a love for art and a drive to apply aesthetic visual solutions to both their living and urban spaces.

The wireless application based spray printer device for surface painting (as named SprayPrinter device) is unique in its capabilities and is unrivalled on the marketplace today. The main innovation lies in:

- the novel use of Bluetooth, sensors and LED lights in connecting and controlling the smartphone, the mobile app and the printer head, resulting in wireless printing capabilities;
- the use of accelerometers and gyroscopes for improving the accuracy of the device and thus achieving better-quality prints. The accelerometer provides an

acceleration as function of time which when integrated over the time the signal is measured provides a velocity and then integrating velocity over time will give position. The gyroscope provides an orientation and based on the distance calculated and the orientation, the new position of the print head can be estimated by adding this distance with it orientation to the last known position to provide the instant position of the print head.

- the use of state-of-the-art electromagnetic valves that can open and close up to 200 times per second, giving users the freedom to move their hands freely just as with a regular paintbrush;
- the use of spray paint in the creation process, whereas the number of layers (i.e. colours) is defined by the user.

These aspects combined makes the printing process unique, hassle-free and easy, eliminates the need for any other devices and/or wires and gives the user complete freedom in choosing and installing their art.

Compared to other surface art products such as wall stickers, prints, paintings, designer wallpaper etc., the SprayPrinter offers a solution that is highly customizable without any extra cost and easy to obtain and install. SprayPrinter feeds into the current maker culture that is gaining global traction as people are increasingly turning to customized, non-mass-produced and do-it-yourself solutions (see for more information on the DIY and maker movement).

Using SprayPrinter does not require any artistic talent compared to having to produce the artwork yourself and then having it printed) and there is no extra cost inherent in the chosen level of customization or the size of the piece. The user is allowed complete freedom and is not restricted by the size, style, content or any other aspect of the desired artwork – they are involved in the decorating process, which makes the process intimate and adds personal value to the user's living/working/etc. environment.

The main improvements of the present invention are:

	V1	**V2**
Max image size	320x320 px	1920x1080px (full HD)

How many printers can be tracked by single camera module	1	5
Max hand movement speed	5cm/s	20cm/s
Worktime for 1m² of layer	20min	5min
Tracking LED	Visible light	Infrared/visible light (visible for iPhones)
Communication between printer and phone	Bluetooth	Bluetooth and separate radio transmitter for greater printing speed and accuracy
Image treatment	None in the app	Breaking into layers can be done in the app
Perspective correction (Keystoning)	no	Yes
Pixel size	10 mm	3-10 mm
Speed	10pxl/s	200pxl/s
Accuracy	+/- 20mm	+/- 2mm

The hardware and software of the device enables to achieve greater printing accuracy (from 15 to 2 millimetres), printing speed (from 15 to 200 pixels/second) and reduced time delay (up to 2-3 milliseconds).

List of structural elements:

1- Printing module

101- Camera module

102- Camera

2- Housing

201- Aerosol spray paint reservoir

3- Gripping means

4- Printing head

5- Flow channel

6- Printing head valve

7- Spray nozzle or Sprayer

8- Electronics

801- Control processor unit

802- Memory means

803- IMU

804- BLE

805- Tracking sensor

9- Battery compartment

10-Power supply (battery means)

11-Off/on and control switches

12-Rollers

13-Transmitter

14-Spray activation device

15-Extension (needle)

16-Filter

17-Seal (O-ring)

18-Fastener (Nut)

19-Trigger lever

20-Spring switch

21-On-off switch

22-Spray channel

23-USB input

Claims:

1. A wireless application based spray printer device comprises a housing (2) having a gripping means (3) for gripping and attaching an aerosol spray paint reservoir (201) to said housing, a spray activation device (14) attached to the upper portion of the housing and having an extension (15) for pushing down an aerosol spray paint reservoir valve and for directing aerosol spray paint into a printing head (4) when spray paint reservoir is attached to the spray printer device, a top of the housing (2) is designed as a printing head (4) comprising a printing valve (6) having a means for opening said printing valve and a valve closing means, a spray channel (22) attached to the printing valve (6) and followed by a spray nozzle (7) for forming a printed pixel to the painted surface, an electronics (8) comprising radio transceiver for receiving and transmitting signals from camera module and to camera module and means for controlling printing valve (6).

2. The wireless application based spray printer device according to claim 1 whereas the electronics (8) comprises a control processor unit (801) with memory means (802) for software to control printing and to determining a position of the spray printing device and a wireless transceiver unit (804) to transfer data between the printer device module and the camera module.

3. The wireless application based spray printer device according to claim 1 and 2 whereas the means for opening the printing valve (6) are electromagnets controlled by a valve control means (806) connected to the control unit (801).

4. The wireless application based spray printer device according to claim 1 whereas said electronics (8) in the printing head (4) comprises an inertial measurement unit (803) comprising sensors such as movement sensors, accelerometers and gyroscopes.

5. The wireless application based spray printer device according to claim 1 whereas the printing valve closing mean is a spring.

6. The wireless application based spray printer device according to claim 1 whereas the printing head (4) comprises a number of printing valves (6) having the printing valve opening and closing means, a number of spray channels connecting printing valves with number of spray nozzles.

7. A wireless application based spray printing system comprising a spray printer device printing module, a camera module and a software program for controlling said camera module and a position of a spray printer device printing module.

8. The wireless application based spray printing system according to claim 7 whereas a spray printer device converts digital designs into surface art wirelessly when user uses a software app after choosing the suitable image from a gallery made up of custom art and images, attaching the printing device to a spray can and printing the picture on the desired surface.

9. The wireless application based spray printing system according to claim 7 where the location of the spray printer device is controlled by camera module whereas the printing valve of the spray printer device is actuated when said device location corresponds to the place in the painted picture where the colour pixel is intended to be painted.

10. A wireless application based spray printing system where after switching on the printer module by user the system software boots and initializes the printing module, sends from camera module printing parameters to the printing module and after confirmation from the microcontroller unit (MCU) the printing parameters, the camera module starts sending image data packages to the printing module, after having received last image data package the control unit in printing module confirms transmission.

11. The wireless application based spray printing system according to claim 10 where by pressing trigger lever by user the printing module waits until the camera module has detected the pressing of the trigger lever in said printing module and then the control unit of the printing module lights up the tracking beacon (tracking LED), at the same time the control unit sends info that the trigger lever was pressed to the camera module thereafter

a) the printing module sends a time stamp package to the camera module

b) the time stamp is received by camera module and the camera module image sensor detects the first frame with the illuminated tracking led and sends time stamp of said frame back to the printing module,

c) the printing module calculates based on these two time stamps the time delay in the system whereas the results of calculations are used by the system to compensate the tracking delay, thereafter

d) the printing module uses the calculated coordinates to decide the opening the printing valve whereas the closing time of the printing valve is constant and predetermined before the printing by user.

12. The wireless application based spray printing system according to claim 11 where the camera module continuously calculates coordinates of the tracking LED in the step b) and send calculated coordinate data to the printing module.

13. A wireless application based spray printing system according to claim 11 where in addition to camera based tracking in a step c) is used a inertial measurement unit (IMU) for calculating position of the printing module on the surface.

14. A wireless application based spray printing system according to claim 10 where by pressing trigger lever by user the printing module will wait commands to open/close printing valve from camera module whereas

- the camera module finds a tracking LED in the camera frame and a tracking software in the camera module calculates pixel coordinates of the LED light centroid and based on the pixel value of said coordinates the camera module decides whether to send or not the command to printing module to open the printing valve,

the calculation of the position data of the printing module is continuously repeated by the tracking software in camera module until the image is spray printed into surface and user releases the printer module trigger lever.

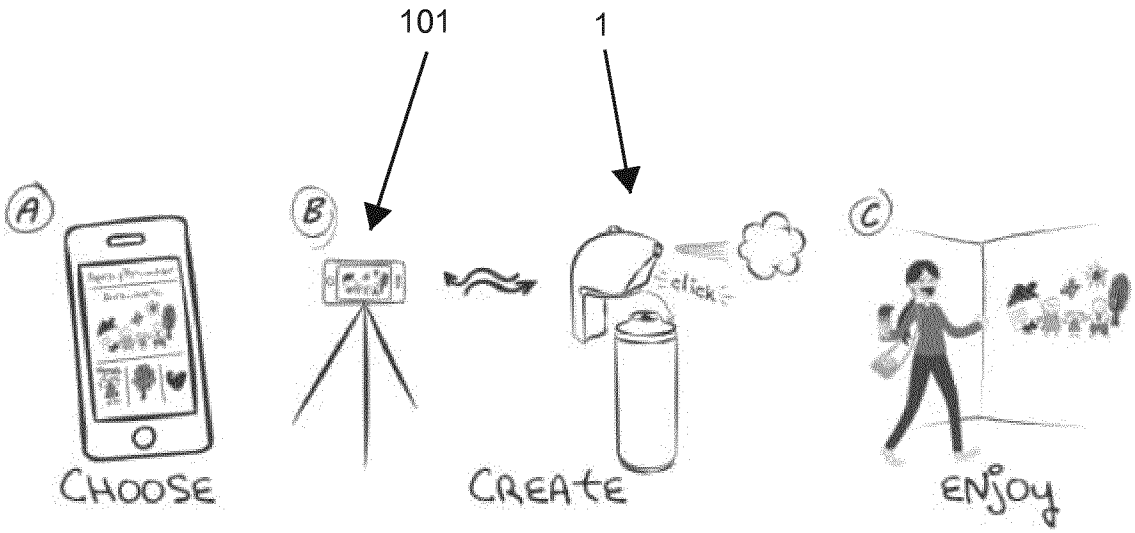


FIG 1

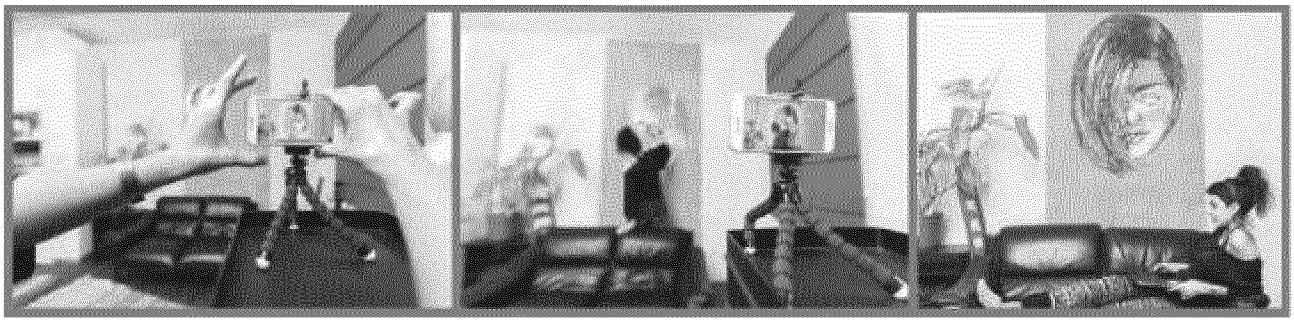


FIG 2

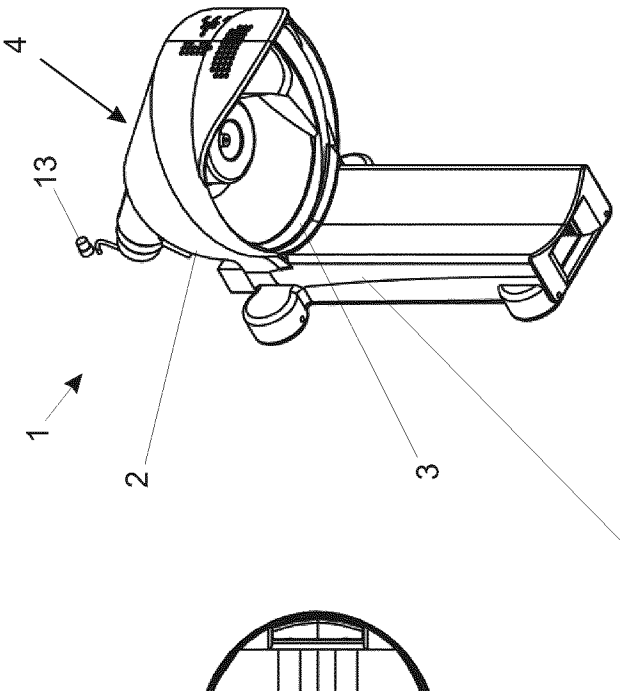


FIG 3C

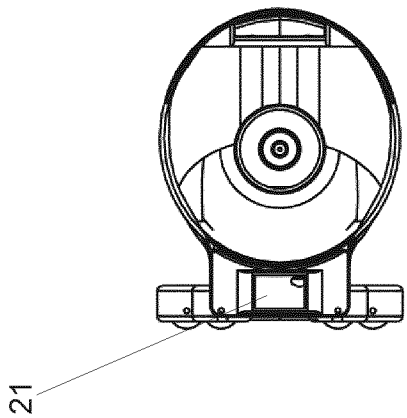


FIG 3B

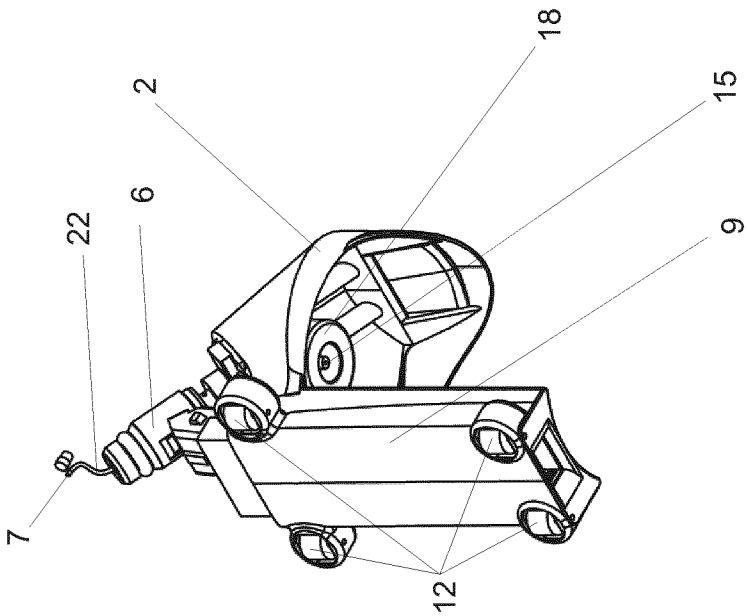


FIG 3A

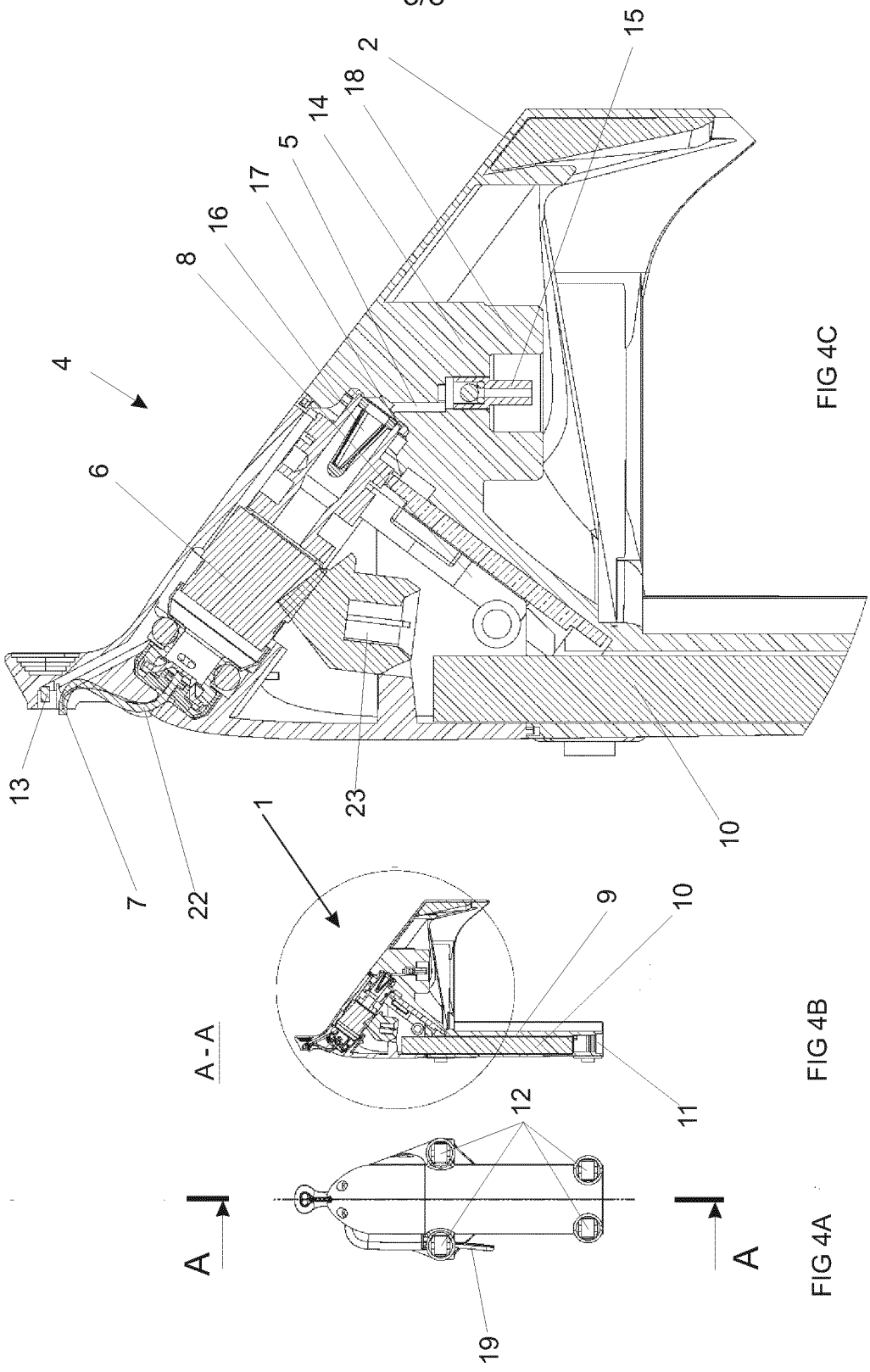


FIG 4C

FIG 4B

FIG 4A

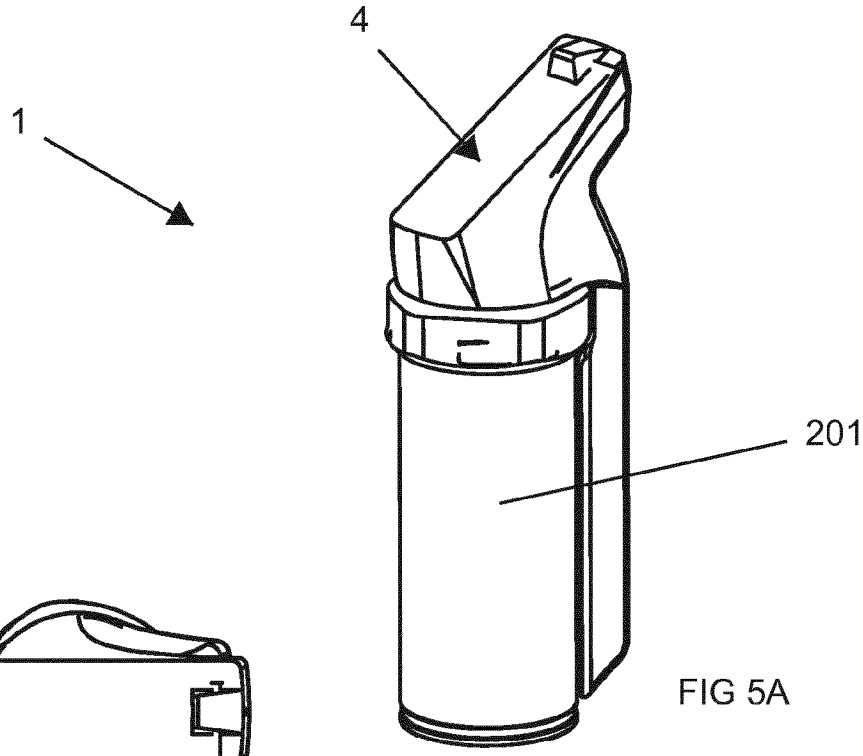
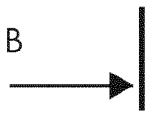


FIG 5A

FIG 5D



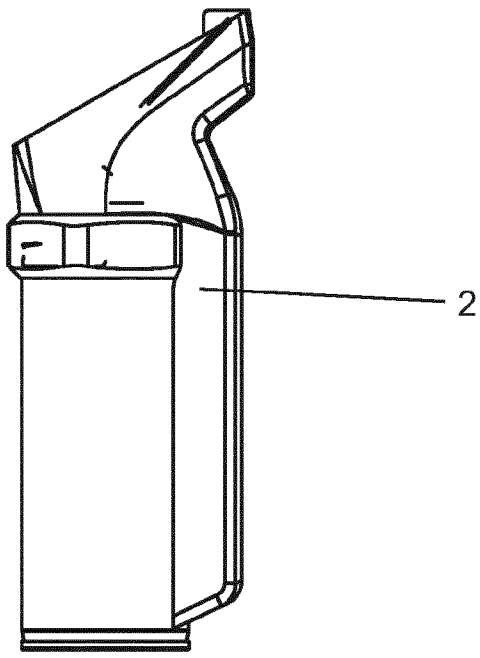
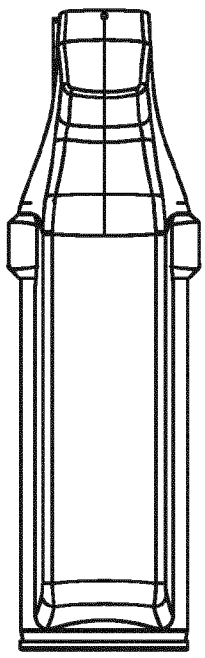


FIG 5B



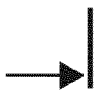


FIG 5C

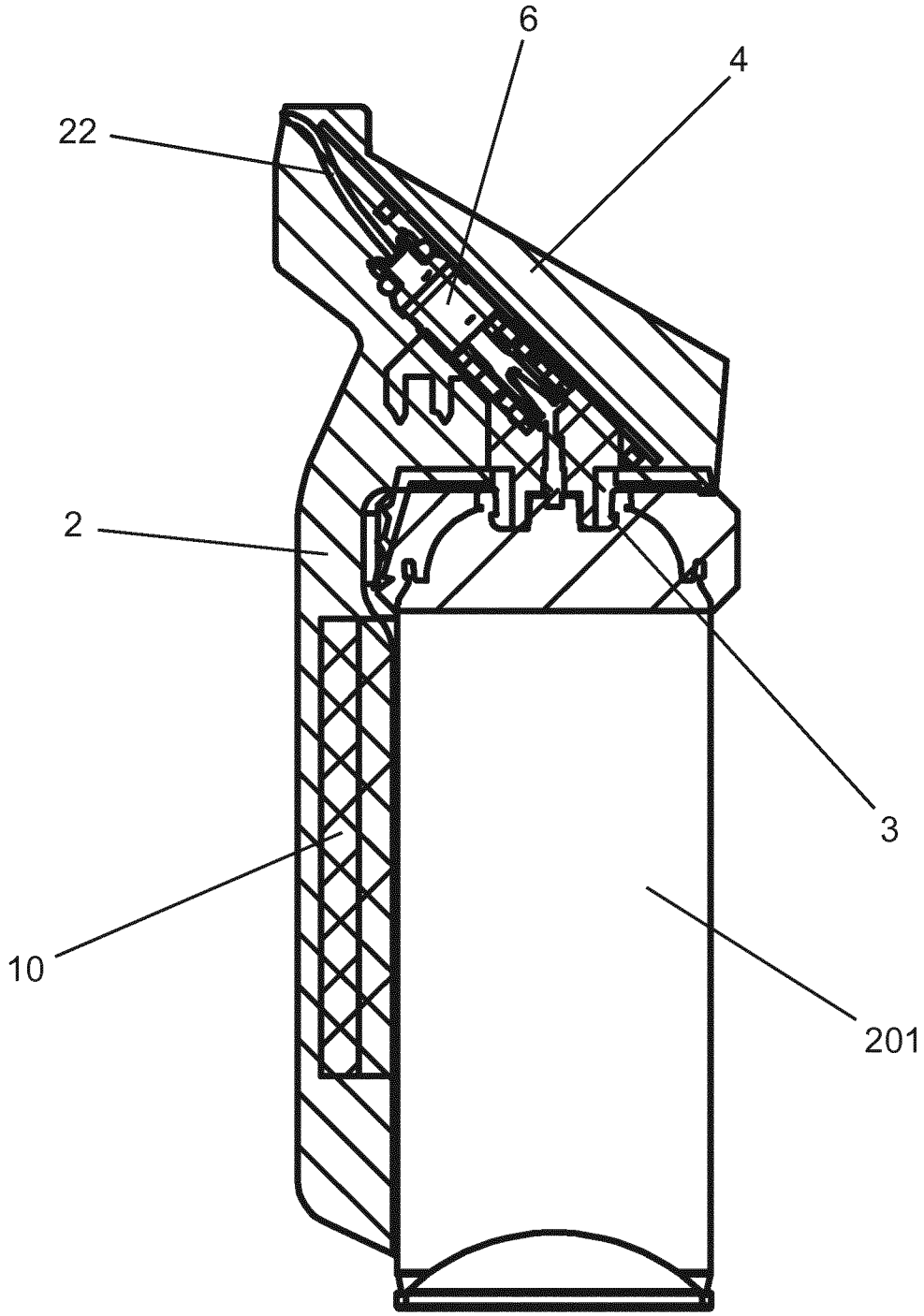


FIG 5E

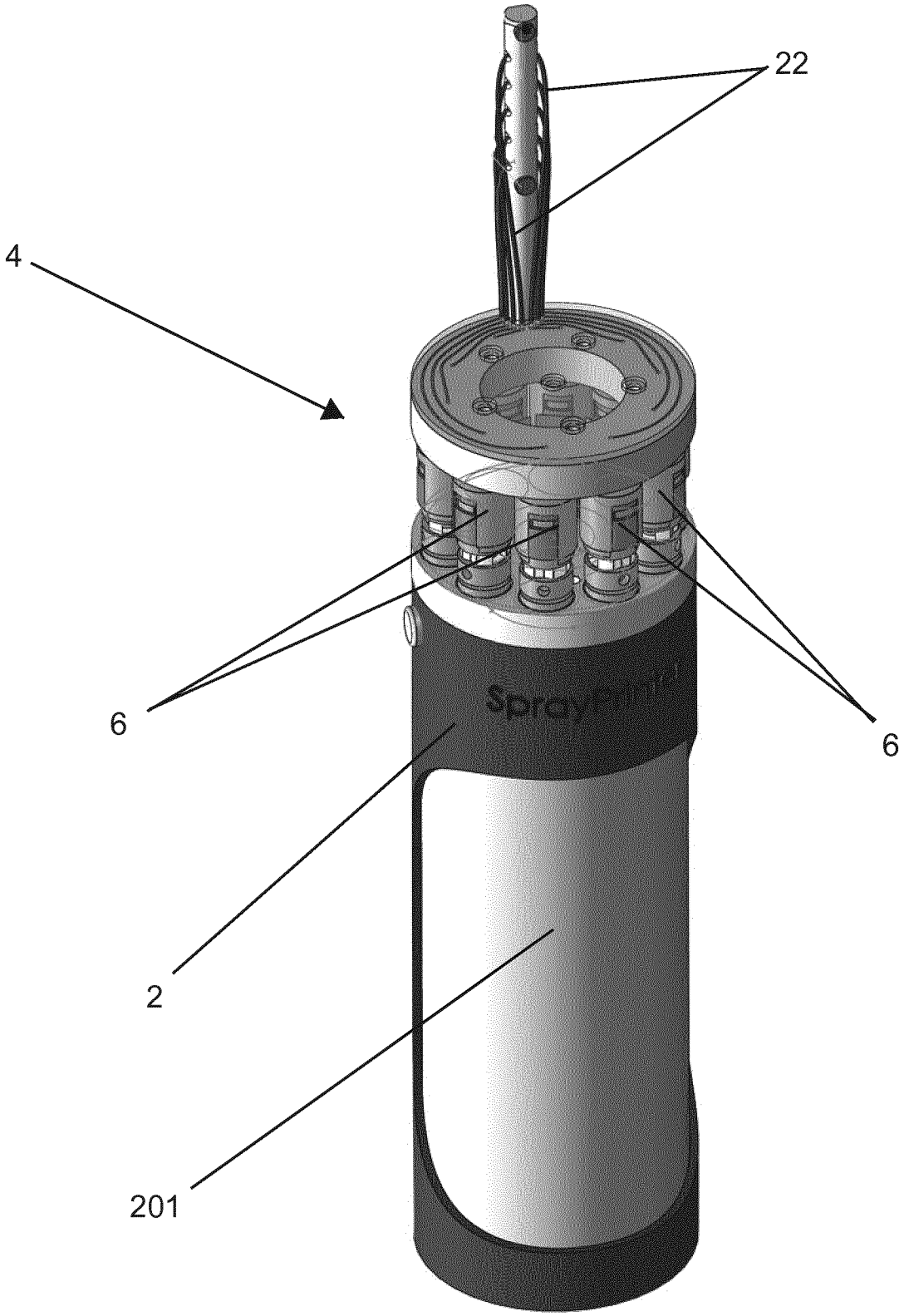


FIG 6A

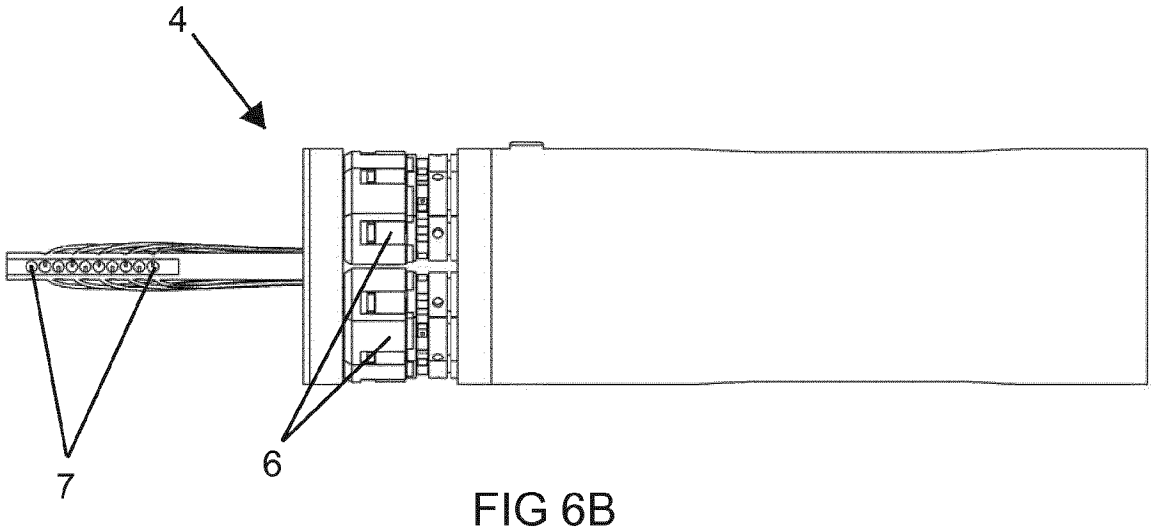


FIG 6B

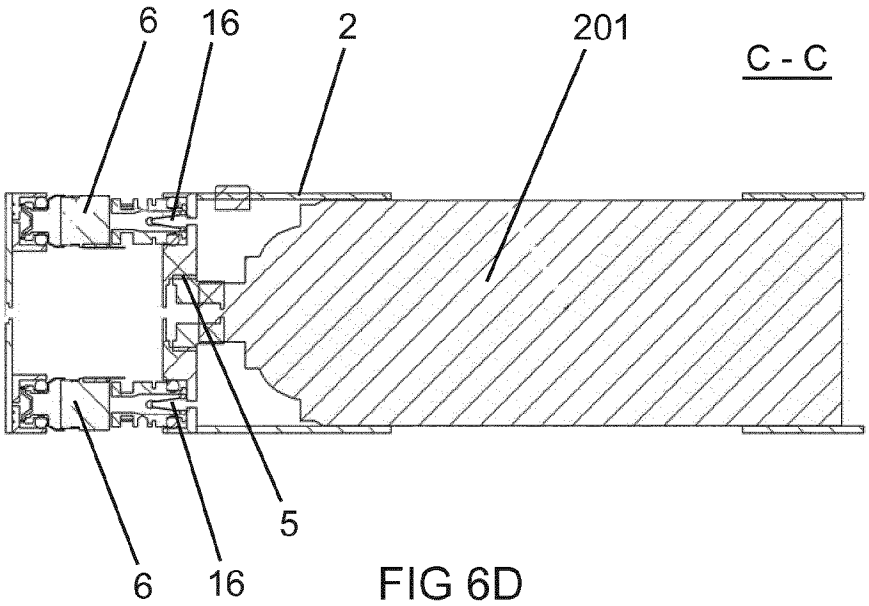


FIG 6D

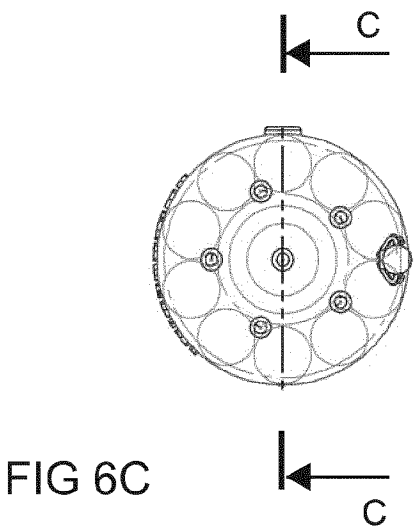


FIG 6C

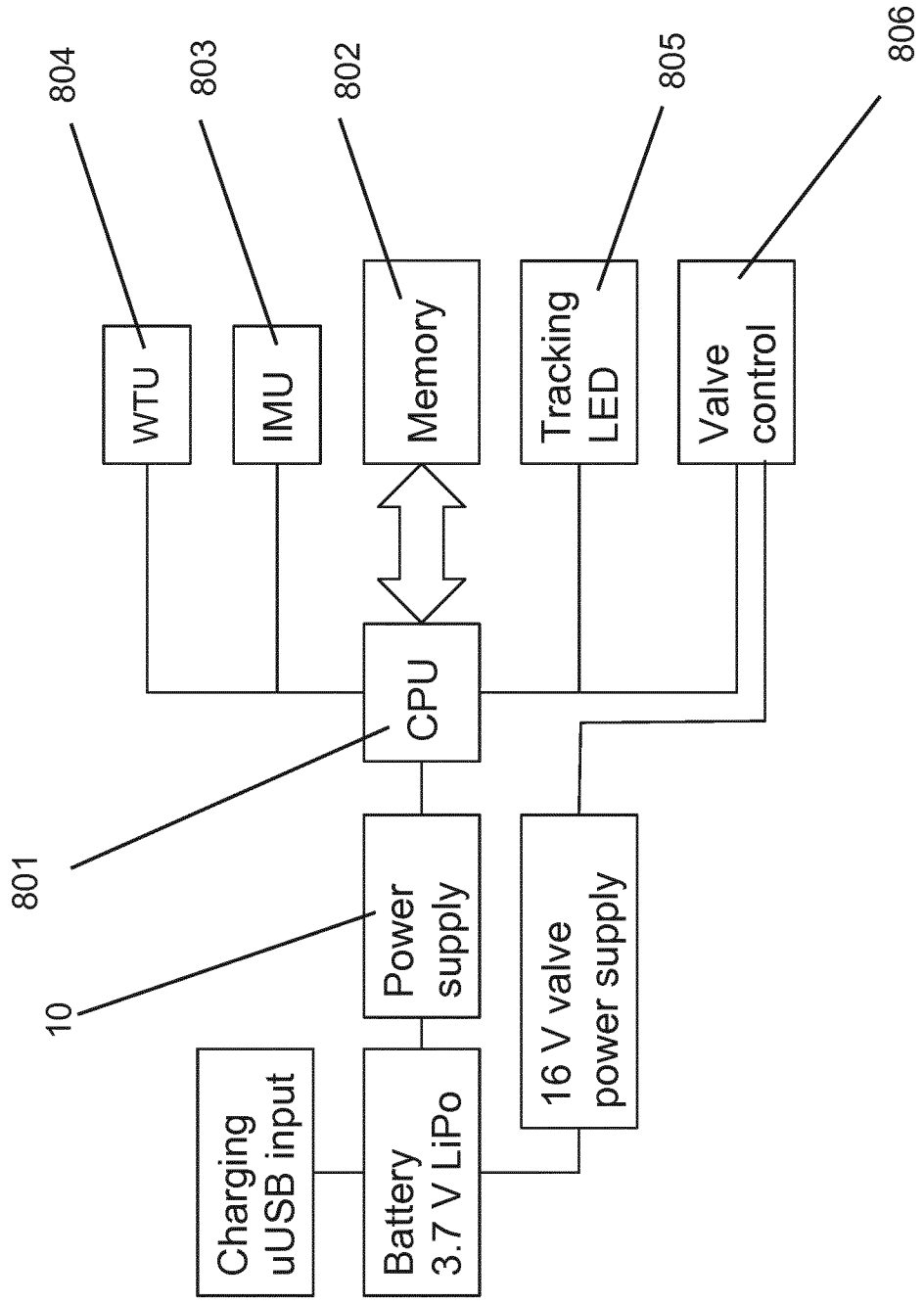

804
803
802
805
806
WTU
IMU
Memory
Tracking LED
Valve control
CPU
801
10
Power supply
16 V valve power supply
Charging uUSB input
Battery 3.7 V LiPo

FIG 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/076749

A. CLASSIFICATION OF SUBJECT MATTER
INV. B05B12/00
ADD.

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)
B05B

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 641 661 A1 (HEXAGON TECHNOLOGY CT GMBH [CH]) 25 September 2013 (2013-09-25) abstract; figures 1,6-8 paragraph [0171] - paragraph [0184]	1-14
A	US 5 868 840 A (KLEIN II RICHARD J [US] ET AL) 9 February 1999 (1999-02-09) the whole document	1-14

☐ 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
23 January 2017	31/01/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Moroncini, Alessio

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2016/076749

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2641661 A1	25-09-2013	BR 102013005874 A2	04-08-2015
		CA 2809876 A1	20-09-2013
		CN 103317846 A	25-09-2013
		EP 2641661 A1	25-09-2013
		KR 20130106785 A	30-09-2013
		KR 20150086219 A	27-07-2015
US 5868840 A	09-02-1999	NONE	