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(54) **Boot for fuel nozzle with a screen display system**

(57) A display system configured for fixing to a fuel dispensing nozzle, the display system comprising an electronic display screen a display controller connected to the electronic display screen, a power source for providing electric power to the electronic display screen and to the display controller, and a sleeve having an internal channel for receiving the fuel dispensing nozzle, wherein the sleeve comprises an embedding material embedding at least the display controller and the power source for shielding the display controller and the power source as a potential source of ignition from the outside of the sleeve, and at least a portion of the sleeve comprises an elastic material exercising a contracting force around the channel for pressing the sleeve against the nozzle so as to fixate the display with respect to the nozzle when the nozzle is fitted into the channel.

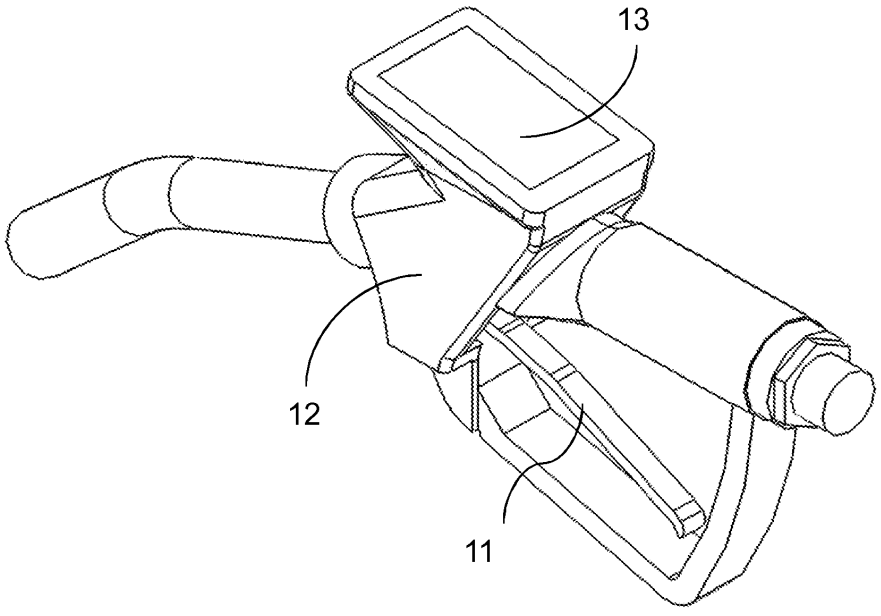

Figure 2

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Description

[0001] The invention relates to a display system configured for fixing to a fuel dispensing nozzle, the display system comprising an electronic display screen, a display controller connected to the electronic display screen, and a power source for providing electric power to the electronic display screen and to the display controller.

BACKGROUND

[0002] In retail gasoline dispensing facilities hand held fuel dispensing nozzles are used to dispense fuel, most likely, in a tank of a motorized vehicle. The dispensing nozzle, containing a spout which can be inserted into the opening of the tank in the vehicle, is connected through a hose with the fuel pumping system and the storage tank of the gasoline dispensing facility. The nozzle itself is used to control the fluid flow after the spout is positioned into the opening of the tank in the vehicle. To control the fluid flow, the nozzle has an integrated valve which can be mechanically opened and closed on the costumers demand by using a trigger of the nozzle.

[0003] A known nozzle for a fuel dispensing system is disclosed in international patent application PCT/GB1999/000661 with title "Nozzle for a fuel dispensing system."

[0004] The known nozzle comprises a display coupled to a control system to display information to a customer. The display may display anything from transactional information to advertising and other information. The nozzle also comprises a keypad to allow a customer to input information to the control system.

[0005] The known nozzle has a communication system capable of wireless, remote communication with an associated fuel dispensing system. Information may be transmitted from the dispenser to the nozzle to facilitate nozzle control or display to a customer, and information received at the nozzle may be transmitted to the dispenser for further processing or display.

[0006] Despite these and other attempts to provide electronic and computer capabilities to a dispensing nozzle, none of the attempts meet the requirements from directives to enforce safety for products in the high volatile environment wherein the nozzle is utilized. In particular the current European ATEX directives raise safety requirements for devices used within an atmosphere where a mixture of air and flammable substances potentially could occur.

[0007] None of the known fuel nozzles with an electronic display are sufficiently safe to pass ATEX requirements. In fact, it was not known how an electronic display could be combined with a nozzle in a sufficiently safe manner. As a result, none of the known nozzles having an integrated display screens have met with commercial success.

SUMMARY OF THE INVENTION

[0008] It would be advantageous to have an electronic display fixed to a fuel nozzle which is safer.

[0009] This object is achieved by the display system according to the invention. The display system is configured for fixing to a fuel dispensing nozzle. The display system comprises an electronic display screen, a display controller connected to the electronic display screen, a power source for providing electric power to the electronic display screen and to the display controller, and a sleeve having an internal channel for receiving the fuel dispensing nozzle. The sleeve comprises an embedding material embedding at least the display controller and the power source for shielding the display controller and the power source from the outside of the sleeve as a potential source of ignition, and at least a portion of the sleeve comprises an elastic material exercising a contracting force around the channel for pressing the sleeve against the nozzle so as to fixate the display with respect to the nozzle when the nozzle is fitted into the channel.

[0010] Preferably, the embedding material is a synthetic material.

[0011] The electronic components needed for driving an electronic display screen, i.e., a controller and a power source are embedded in the embedding material. In this way the controller and particularly the power source are shielded from the outside of the sleeve and the controller and particularly the power source are at the same time shielded from the inside the sleeve, e.g. from the channel. Thus there is no risk of these elements even if close to the fuel nozzle's spout that they could ignite fuel fumes.

[0012] One example of a modification which was previously made to nozzles due to increased safety regulations is that nozzles are no longer allowed to be fitted with a pin for keeping the trigger engaged while the spout of the nozzle is inserted in a car's tank inlet. As a result nozzles are now manually operated, typically by a costumer. The costumer's visual attention is necessarily focused directly on the fuel nozzle itself, making the top of the fuel nozzle a desirable site for advertising.

[0013] The sleeve has an internal channel for receiving the fuel dispensing nozzle. Accordingly there is no need to modify the fuel dispensing nozzle in any way. This is very advantageous since fuel dispensing nozzles are certified. A modified nozzle would have to be certified again were it to be retrofitted with a sleeve. In fact, since at least a portion of the sleeve comprises an elastic material exercising a contracting force around the channel for pressing the sleeve against the nozzle so as to fixate the display with respect to the nozzle when the nozzle is fitted into the channel, there is no need to use any other type of fixing means. Fixing means such as screws, clamps and the like would impose a safety risk. Fixing means such as glue would impair servicing and repair of the display system.

[0014] In fact due to the use of a sleeve the display system is very suitable for retrofitting an existing nozzle

with a display screen.

[0015] Potential sources of ignition include electric sparks, electrostatic discharges, high-power electronics and hot surfaces. Since at least the display controller and the power source are embedded a potential spark emanating from them is retained inside the sleeve. Even if the potential for sparks is not reduced by the choice of sleeve-material in which the controller and power source are embedded, the risk of a spark is significantly reduced by retaining it in the sleeve.

[0016] By making the sleeve of an embedding material which is slightly conductive electrostatic discharges are also prevented.

[0017] The embedding material may be thermally conductive to improve heat conductance away from the electronics.

[0018] The display controller and the power source are embedded, that is fixed firmly in the surrounding mass of embedding material which is a close and snug fit. As a result of the embedding the display controller and the power source are an integral part of the sleeve.

[0019] The screen is preferably integrated with the sleeve so as to form a one-part display system in which the screen is integrated. Preferably, the screen is at least partially embedded in the embedding material. For example, the sides of the electronic display screen may be embedded in the embedding material. In that case a back side of the screen may also be embedded in the embedding material.

[0020] A front-side of the screen, on which images may be displayed, faces a direction away from the sleeve. The front-side may or may not be embedded in the embedding material. Embedding the front-side in the embedding material has the advantage that the protection of the sleeve extends to the front-side of the screen. Not embedding the front-side in the embedding material has the advantage that the display quality of the display system is improved. The front side of a LED display, especially of an organic LED display screen is not considered a high safety risk.

[0021] Preferably, the display controller and the power source are completely embedded; however, they may be enveloped by the embedding material from all sides except from one which is shielded by the electronic display screen. In particular, it is preferred that the power source, e.g., a rechargeable battery is completely embedded, i.e., embedded from all sides.

[0022] A spark emanating from the power source or controller is either stopped by the surrounding embedding material or by the display screen.

[0023] The power source may comprise a rechargeable battery having recharging means for charging the battery from a wireless energy source. The recharging means would, e.g. be converting energy from a wireless source to energy stored in the battery. For example, the power source may comprise a rechargeable battery which is charged from an inductive source. The inductive source may be close to a cradle of the fuel dispensing station to which the nozzle is attached through a hose.

[0024] A power supply comprising a non-rechargeable battery integrated in the sleeve is not feasible since electronic displays require relatively much power. Batteries with a high capacity, needed for a long standing operation impose a safety risk in a volatile environment. Furthermore the space for batteries in the sleeve is limited. Exchangeable batteries with smaller size and lower capacity are less suitable because they have to be protected which makes it complex en expensive to exchange.

[0025] In an embodiment, the elastic material circumferentially surrounds a part of the channel. In this way the sleeve may be attached to the nozzle by an elastic force.

[0026] In an embodiment, the embedding material is a flexible or/and stretchable material. By using a flexible material the electronic components that are embedded in the flexible material are protected while the sleeve is fixed around the fuel nozzle.

[0027] It is preferred to use a shape for the display system, and in particular for the sleeve, that makes it hard to pull the sleeve back from the nozzle once it has been applied, this increases resistance against vandalism. To achieve this goal it is advantageous to use a flexible material.

[0028] An advantage of a flexible sleeve is that it may be pulled over the nozzle together with its integrated electronics. In an embodiment, the sleeve retains its flexibility when it is pulled over the nozzle.

[0029] An example of a suitable flexible material is PolyUrethane. The PolyUrethane may be colored into a desired color. Other choices for the flexible material are possible.

[0030] In an embodiment, the sleeve is a scuff guard. The scuff guard protects the connection between the nozzle and the hose to which the nozzle is attached. The connection is for example, a screwed connection.

[0031] In an embodiment the embedding material and the elastic material are the same material. Preferably, the portion of the sleeve which exerts a contracting force with an elastic material and the portion which embeds in a embedding material are formed as one-piece. This has the advantage all electronic elements are integrated without the possibility that the electronic elements will be exposed to a highly volatile environment. It also has the advantage that the integrity of the sleeve is improved thus reducing its vulnerability to vandalism.

[0032] In a particularly advantageous embodiment, the sleeve entirely consists of the same material. The material produces three advantageous effects with a single production step, first the non-conductive property of the material isolates the electronic parts from the surroundings by embedding them, second the elastic property acts as a means to fixate the sleeve to the nozzle, third the sleeve acts as a scuff guard, for protecting the connection between nozzle and hose. In this embodiment the elastic material may also circumferentially surrounds a part of the channel

[0033] In an embodiment, the sleeve is sufficiently flexible so that different shaped nozzles fit into the channel. This has the advantage that one sleeve design may be used for multiple nozzles of different designs.

[0034] In an embodiment, the electronic screen is a LED display screen, preferably an organic LED display screen.

[0035] An organic LED display screen require less power compared to LCD screens. Furthermore organic LED display screen have a broader operating temperature so that no additional heating or cooling features are required. For example, an OLED display screen may be used that can operate when external temperature ranges form -40°C to +70°C, without the need for heaters or coolers.

[0036] The low power light emitting diode display, such as but not limited to an active matrix organic light emitting diode (AMOLED) display, comprises a substrate whereon a pixels of light emitting materials are sandwiched between thin electrodes. Since the light emitting material itself illuminates when power is applied to the corresponding electrodes, these kinds of displays do not require a backlight. Furthermore, an area on the display that should be black need not be illuminated and does not require energy. In comparison a regular LCD with backlight wastes power because the liquid crystal acts as a polarizer which filters half of the light emitted by the backlight. Therefore an organic LED requires less power in comparison with regular liquid crystal displays with backlight. In addition thereto organic LED display screen have a broader operating temperature so that no additional heating or cooling features are required. Therefore the low power light emitting diode display forms an integral part of the sleeve that can be completely encapsulated by a synthetic material. The synthetic material could be PolyUrethanel.

[0037] The display, such as the light emitting diode display, may be connected with a printed circuit board (PCB) to address the display. Driver electronics, including features for power supply, could be assembled on or attached to the PCB. The display and additional electronics are preferably forming a one-part electronic assembly that could be completely encapsulated with a synthetic material.

[0038] In an embodiment, the electronic display screen is a flexible electronic display screen. An advantage of a flexible electronic display screen, for example, a flexible organic LED display, is that the sleeve and all its integrated (embedded) electronics can be made flexible. Also the display controller may be mounted on a flexible PCB. The sleeve may be pulled over the nozzle together with its flexible integrated electronics, e.g., its flexible electronic display screen and/or flexible PCB.

[0039] Depending on the molding process, high pressures to inject the synthetic material into the open areas in the mold could be required. In such case a light emitting diode display which is build on a glass substrate could break during the molding process.

[0040] By using a flexible display, for example a display wherein the functional layers for the display are deposited on a transparent and flexible plastic foil such as polyethylenenaphthalate or polyethyleneterephthalate this problem is avoided. Instead of producing on the transparent substrate, the functional layers can be applied on a non transparent substrate as well and covered with a transparent layer. In an embodiment the functional layers for the display are deposited on a flexible substrate such as a copper or steel foil.

[0041] The flexible display also offers more design freedom compared to a display containing a glass substrate. For example, the sleeve may be partially formed into three dimensional figures, e.g., for advertising purposes. In a three dimensional figured sleeve, a flexible display is fitted more easily than a flat and rigid display. For example, the area where the display is placed may be half-cylindrical.

[0042] A flexible display further increases the vandalism resistance of the display system. By making the display flexible the sleeve is harder to pull back from the nozzle, since the rigid surface of the display is no longer available as a suitable target on which a force can be applied. Having a flexible display, preferably together with a sleeve made out of a flexible material is particularly resistant to vandalism.

[0043] In an embodiment the display screen comprises a flexible display screen bended, such that a first portion of the display screen makes an angle with a second portion of the display screen. After the display system is applied to the nozzle, the nozzle will be inserted along a bended path into a tank inlet. The angle under which the screen is best visible may vary between different car brands. By offering the display screen under for example two different angles good visibility of the screen is assured for a larger variety of car models.

[0044] In an embodiment, the substrate on which the functional layers for the display are deposited is also used as an electronic circuit board comprising the display controller. In doing so all the electronic functions are build on one substrate by which a connection between the display and electronic assembly is eliminated. Reducing connections increases safety.

[0045] In an embodiment, the embedding of the display controller and the power source is obtained by molding over.

[0046] Preferably, the sleeve is used to form the scuff guard for the hand held fuel dispensing nozzle. For doing so the display and driver electronics are inserted into a mold and completely over-molded with a plastic forming process, such as but not limited to reactive injection molding (RIM). Importantly, the display and additional electronics are completely encapsulated by the synthetic material of the scuff guard, resulting in a closed integer product without electrical contact for connection and without components that require much energy and or without components that could cause sparks or high temperatures.

[0047] In an embodiment, the display screen, power source and display controller form one part. This eases inserting of the electronics into a mold.

[0048] In an embodiment, the display system further comprises a wireless receiver for receiving digital data for display on the electronic screen, the embedding material of the sleeve also completely embedding the receiver. The wireless receiver may be used for receiving any one of firmware updates, digital data for processing and/or display on the display screen, in particular digital video data, and/or image data.

[0049] In an embodiment, the wireless receiver is a wireless transceiver, i.e., a wireless transmitter and a wireless receiver combined together in a single unit. For example, a user of the display system may use the display system to enter commands. For example, the display screen may be a touch screen. The command may be forwarded to a server for appropriate processing. For example, the user could place an order, e.g. for a meal, via the display system.

[0050] Sending or receiving information between the display system and a server may be routed via a dispensing facility, e.g., a dispensing facility to which the display system is attached via the nozzle and a hose.

[0051] In an embodiment, the sleeve completely covers at least all components of the sleeve except the outer part of the electronic display screen. Preferably, all parts, in particular all electronic parts of the display system are embedded in the sleeve, so as to form, a one-piece integrated display system.

[0052] In an embodiment, the sleeve completely covers at least all components of the sleeve including the outer part of the electronic display screen. In this embodiment, a material transparent to visible light is used to cover the display. In an embodiment the entire sleeve is made of the same transparent material. Preferably, the sleeve is made of the same transparent, flexible, elastic, material. The material may be slightly conductive for preventing electronic discharges.

[0053] In an embodiment, the power source comprises a power receiver for wirelessly receiving power. If power is transferred to the power source without a wire the power transfer will not be a likely source for ignition.

[0054] A further aspect of the invention concerns fuel dispensing nozzle comprising a display system according to the invention.

[0055] In an embodiment of the fuel dispensing nozzle, the fuel dispensing nozzle is attached to a hose. The hose comprises a wire for transferring power to a power transmitter for wirelessly transmitting power. The power transmitter is arranged with respect to the power receiver so that power may be transmitted during operational use of the display system. Power transmitter may be part of the hose or of the nozzle. The power transmitter is located at the end of the hose near the display system. In this embodiment, there is no need to have a rechargeable element in the power source, since it can be permanently powered. However, still the display system may be created as a single one-part wireless piece, thus implying the safety advantages.

[0056] When the power supply receives energy from an energy source external to the display system, wires could be used to supply the display system with energy from the external source. The wires could run from the external source, e.g., in the dispensing facility, down the fuel dispensing hose, to the nozzle. A complication is that the nozzle is often twisted and turned by the user relative to the fuel dispensing hose by which cables are also twisted and turned as which could cause damage to wires.

[0057] We found that the known manner of providing power from an external source to a fuel nozzle by wires running down the hose, described in U.S. Pat. No. 5,267,592, to be insufficiently safe. The known technique for providing electrical power to a fuel dispensing nozzle uses resilient conductive plungers to make an electrical connection between the nozzle and the hose. A nut fixed to the nozzle is containing springs which are in contact with the electrical contacts which are fixed on the hose and via wires connected to the remotely located power supply. It has the disadvantage that electrical contacts are mechanically connected which is therefore not reliable. Furthermore these electrical contacts are exposed to the volatile environment. The sparks and high surface temperatures which could appear with the known technique would cause dangerous situations when used in a highly volatile environment. The disadvantages of the mechanically connected wires are eliminated by a wireless power transfer using technologies such as described in US patent No 5,184,309.

[0058] A further aspect of the invention concerns a method for fixing a display system to a fuel dispensing nozzle. The display system comprising an electronic display screen, a display controller connected to the electronic display screen, a power source for providing electric power to the electronic display screen and to the display controller, and a sleeve having an internal channel for receiving the fuel dispensing nozzle, the comprising a embedding material embedding at least the display controller and the power source for shielding the display controller and the power source from the outside of the sleeve as a potential source of ignition. The method comprises fitting the nozzle into the channel thus exercising a contracting force around the channel for pressing the sleeve against the nozzle by a portion of the sleeve comprising an elastic material, accordingly fixing the display with respect to the nozzle.

[0059] This method of fixing a display system has several advantages. It allows attaching the display system without any risk of electronics being exposed to a volatile environment and without using any further fixating means, such as screws. Further fixating means are likely not safe, and in any case require further scrutiny in light of safety. Furthermore, the nozzle does not need to be adapted in any way, thus avoiding recertification of the nozzle. Finally, this method allows retrofitting an existing nozzle with the new functionality provided by the display

system.

[0060] The invention provides the possibility to use an electronic display which satisfies safety regulations and which may be used in a volatile environment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0061] The invention is explained in further detail by way of example and with reference to the accompanying drawings, wherein:

Figure 1 is a schematic representation of a gasoline dispensing facility,
Figure 2 is a graphic representation of a display system while fixed to a fuel dispensing nozzle,
Figure 3 is a graphic representation of an electronic assembly containing a display and other electronics,
Figures 4a, 4b and 4c are schematic illustrations for a way of manufacturing a scuff guard with integrated display,
Figure 5a is a graphic representation of a scuff guard with an integrated flexible display screen,
Figure 5b is a graphic representation of the scuff guard of figure 5a with a with a cutaway view of the integrated electronic assembly,
Figure 6 is a graphic representation of a scuff guard with an integrated non-flexible display screen with a cutaway view of the integrated electronic assembly,
Figure 7 is schematic representation of a power supply from a source to the integrated electronic assembly in the scuff guard,
Figure 8 is a schematic representation of the power supply from a source to the integrated electronic assembly in the scuff guard via a wire led through the hose of the nozzle

[0062] Throughout the Figures, similar or corresponding features are indicated by same reference numerals.

List of Reference Numerals:

[0063]

1 a pumping apparatus
2 a gasoline storage tank
3 ground floor
4 a fuel dispensing nozzle
5 a hose
6 a base position
7 a spout
8 a tank
9 a vehicle
10 a substrate
11 a trigger
12 a scuff guard
13 a display
14 light emitting material
15 a flexible printed circuit
16 electronic display controller
17 extra electronic components
18 a power receiving element
19 wires
20 a capacitor
21 an internal channel
131 a flexible display
101 an electronic assembly
100 an electronic assembly
30 a cavity
31 a core
32 synthetic material
33 transparent protection
40 an external source
41 wires
42 an additional part
43 a power transmitter
44 an additional part
45 a flat cable

DETAILED EMBODIMENTS

[0064] While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail one or more specific embodiments, with the understanding that the

present disclosure is to be considered as exemplary of the principles of the invention and not intended to limit the invention to the specific embodiments shown and described.

DETAILED DESCRIPTION

[0065] Figure 1 graphically represents a fuelling system in a typical retail gasoline dispensing facility. The fuelling system contains a pumping apparatus 1 that is on one side connected with a gasoline storage tank 2 that normally is positioned under the ground floor 3. On the other side the pumping system 1 is connected with a fuel dispensing nozzle 4 by a hose 5. The pumping apparatus 1 starts operating after the customer takes the fuel dispensing nozzle 4 from its base position 6. The customer will position the spout 7 attached to the end of fuel dispensing nozzle 4 into the opening of a tank 8. Typically, tank 8 will be the tank of a vehicle 9. Vehicle 9 is typically a car or a motorcycle.

[0066] Figure 2 shows nozzle 4 in more detail. To nozzle 4 a display system is attached. The display system has a sleeve, here in the form of a scuff guard 12. Scuff guard 12 comprises an electronic display screen 13. Display screen 13 is positioned such that it can be viewed by a user, while the user uses nozzle 4 to refuel his vehicle 9. As an example, the display may comprise a substrate 10 upon which pixels of light emitting materials 14 are applied. Furthermore, it can be seen in Figure 2 that the nozzle is nozzle is fitted into a channel of the scuff guard 12. The spout went completely through the sleeve.

[0067] The electronics of the display system, such as a display controller and a power source are integrated into the scuff guard 12, this is not visible in Figure 2, but can be seen in Figures 5b and 6. The electronics of the display system are shielded by scuff guard 12 from the surrounding area, and in particular from the spout of the nozzle. In the embodiment shown in figure 2 the sleeve also acts as a scuff guard, but this is not necessary. For example, the sleeve may be positioned over an existing scuff guard.

[0068] The fuel delivery can be controlled by the costumer using the trigger 11, shown in figure 2. This trigger is mechanically connected with a valve that is integrated in the fuel dispensing nozzle 4. This mechanical configuration of the valve and additive components for its operation in itself are known for someone skilled in the art and therefore not shown in the graphical representations. Trigger 11 and the integrated mechanical valve control system are part of the nozzle and not part of the display system. The sleeve wherein the display and associated electronics are integrated may be pulled over an existing nozzle.

[0069] Figure 3 shows an electronic assembly 100, before embedding in scuff guard 12. The electronics form one part together with display screen 13.

[0070] In this embodiment, display 13 comprises pixels of light emitting materials such as in, but not limited to, an active matrix organic light emitting diode display (AMOLED). These kinds of displays typically comprise of a substrate 10 whereon pixels of light emitting materials 14 are applied. The light emitting materials illuminate light when power is supplied to the electrodes. Therefore these kinds of displays do not need a backlight which makes them more efficient and suitable for low power applications. Typically the operation voltage of an organic LED is between 2 and 10 volts, which makes it possible to operate the display on intrinsic safety concerning the directive for electronics in high volatile environments.

[0071] Furthermore a flexible substrate could be used, to obtain a flexible display that offers advantages in design freedom and integration in the scuff guard 12. In addition thereto an organic LED has the advantage that the viewing angle can be up to 160 degree. Thus a bended display will still show clear images.

[0072] Figure 3 shows an exemplary embodiment of an electronic assembly 100. Electronic assembly 100 comprises a display screen 13, a display controller 16 connected to the electronic display screen, and a power source 18 for providing electric power to the electronic display screen and to the display controller.

[0073] In figure 3, display 13 is connected through a flexible printed circuit 15 with the electronic display controller 16 for driving the display. Instead of a printed circuit 15 other connections are possible. In addition, extra electronic components 17 for other electronic functions, like wireless communication or car recognition systems may be assembled onto the flexible printed circuit 15.

[0074] In figure 3, the power supply 18 is a wireless power supply. Power supply 18 may also be assembled on PCB 15 or connected through wires 19 with the PCB 15.

[0075] A small capacitor 20 or a rechargeable battery may be assembled on or attached to the PBC 15 as well. If the display system obtains wireless energy via a power transmitter located at the end of the hose, then the capacity of the capacitor 20 and/or the rechargeable battery may be reduced or omitted.

[0076] Optionally, any one of scuff guard 12, display screen 13, and PCB 15 are not flexible.

[0077] Preferably, the display system, in particular, the electronic assembly 100 forms a whole, without moving parts. Preferably, the electronic assembly 100 does not contain parts that generate heat in such amounts that a heat sink would be required to keep the operating temperature below a predetermined maximum safety temperature. Therefore it is possible to completely encapsulate the electronic assembly with a synthetic material. Preferably the electrical assembly 100 is encapsulated with synthetic material during the forming of the scuff guard by processes like, but not limited to, molding, e.g., reactive injection molding. All known nozzles with a display consist of assembled parts.

[0078] Figures 4a, 4b and 4c shows a schematic representation of how the scuff guard 12 with integrated display 13 could be manufactured by using a molding tech-

nology. After the insertion of the electronic assembly 100 in the cavity 30, the core 31 and the cavity 32 are joined together and a synthetic material in liquid phase is inserted to fill the open areas between the core 31 and the cavity 32. After the liquid solidifies due to cooling or due to a chemical reaction of the liquid material, the core and cavity are separated, and the scuff guard with integrated electronic assemble 100 is ejected. Different molding processes which can be used to integrate a part in the synthetic material are in itself known by someone skilled in the art.

[0079] Preferably, during the molding the display controller and the power source are molded over.

[0080] The synthetic material from which the sleeve, e.g., the scuff guard, may be made is preferably a embedding material, so that the embedded electronics are shielded from the outside of the sleeve as a potential source of ignition.

[0081] The synthetic material from which the sleeve, e.g., the scuff guard, may be made is preferably at least somewhat elastic material, so that is exercises a contracting force around the channel for pressing the sleeve against the nozzle so as to fixate the display with respect to the nozzle. Figure 2 shows how the display remains fixed because of the tight fit of the sleeve.

[0082] Depending on the molding process, high pressures to inject the synthetic material into the open areas in the mold could be required. In such case a light emitting diode display which is build on a glass substrate could break during the molding process. A solution is the use of a flexible display wherein the functional layers for the display are deposit on a transparent and flexible plastic foil such as polyethylenenaphthalate or polyethyleneterephthalate.

[0083] A flexible display also offer more design freedom compared to a display containing a glass substrate. In addition, the substrate upon which the functional layers for the display are deposited could be used as electronic circuit board as well. In doing so all the electronic functions are build on one substrate by which a connection between the display and electronic assembly is eliminated.

[0084] Figures 5a and 5b show the result of the molding process shown in figures 4a, 4b and 4c. Shown is internal channel 21 for receiving the fuel dispensing nozzle.

[0085] Figure 6 shows an embodiment of the scuff guard 12 with the integrated electronic assemble 100. Part of the scuff guard 12 has been removed to show how the electronic assemble 100 is completely encapsulated by the synthetic material 30 of the scuff guard 12. Electronic assemble 100 is completely integrated and power is supplied wirelessly via the power receiver element 18.

[0086] A transparent anti-scratch layer 33 may be applied to the front side, i.e. the display side, of screen 13 or 131. For example, the OLED may be applied to one side of a substrate and the transparent anti-scratch layer 33 may be applied to another side of the layer. Transparent anti-scratch layer 33 is optional, both for flexible and non-flexible displays.

[0087] Energy may be supplied to the power source in the scuff guard in several different ways. It is preferred that the energy transfer is wireless. Figure 7 and 8 show two different but safe ways to transfer power to the display system when fitted onto the nozzle. In Figure 7, power is transferred only when the nozzle is in a base position. In figure 8, power is transferred locally at the nozzle.

[0088] Figure 7 shows how the energy could be wireless supplied to the fuel dispensing nozzle 4. The energy is primarily supplied from an external source 40 and led through wires 41 to an additional part 42 that may be assembled in the base position 6 of the fuel dispensing nozzle 4. The power transmitter 43 which is integrated in the additional part 42 is facing the power receiving element 18 when the nozzle is positioned in its base station 6. While the nozzle is seated in base position 6, a rechargeable element of the power source, e.g., a rechargeable battery, or capacitor 20 may be charged.

[0089] When the costumer takes the nozzle 4 from its base station 6, the distance between the power transmitter and the power receiver will increase and the power is not transferred anymore. It is preferred, if the rechargeable capacity 20 has just enough capacity for powering the display screen and associated electronics for a predetermined period. The predetermined period is chosen in relation to the time one fuel delivery cycle takes and the time to charge the battery again when the nozzle 4 is positioned in its base position 6.

[0090] The rechargeable element, e.g., capacitor 20 could be placed on the flexible printed circuit 15. In such a manner all electronic parts which are needed inside the nozzle can be integrated and fixed in the scuff guard without the need of mechanical or electrical contacts to the outside of the sleeve.

[0091] This embodiment has several advantages. It avoids having to guide a wire down the hose. Accordingly, those wires cannot be damaged due to wear or due to vandalism. Moreover, no provisions need to be made to account for twisting of the hose.

[0092] In another embodiment shown in Figure 8 the power is primarily supplied from an external source 40 and led through wires 41 which are attached or integrated in the hose 5. At the end of the hose 5 the additional part 42 is mounted wherein the wires 41 are connected to an integrated power transmitter element (like transmitter 43), which is facing the power receiving element 18 in the display system. The power receiving element 18 is integrated in the additional part 44 and connected through wires or flat cable 45 with the electronic assembly 100 in the scuff guard 12 of the nozzle 4. Importantly the electronic connection is embedded in synthetic material to make the assembly one whole part. In this architecture a constant power could be wireless transferred from the power transmitting element and power receiving element without making physical contact and the risks of twisting and turning cables.

[0093] One possible option to transfer energy wireless is to use inductivity. Both in figure 7 and 8, wires 41 for the wireless power transfer are connected to a primarily coil that is responsible for the power transmission. The primary coil is integrated in the additional part 42. The primary coil is facing a capture coil which is integrated and in connection with the electronic assembly inside the scuff guard 12 of the nozzle 4. In this architecture the power is efficiently wireless transferred from the power transmitting element and power receiving element without making physical contact.

[0094] Wireless energy transfer is also possible by utilizing an optical power converter for conversion of light into electric power. The light is initially generated with a light source in the base station 6 and is guided through an optical wire that is connected to the optical transmitter which is integrated in the additional part 44. A further explanation of wireless energy transfer may be found in U.S. Patent No. 5,184,309.

Claims

1. A display system configured for fixing to a fuel dispensing nozzle, the display system comprising

- an electronic display screen
- a display controller connected to the electronic display screen,
- a power source for providing electric power to the electronic display screen and to the display controller, and
- a sleeve having an internal channel for receiving the fuel dispensing nozzle,

wherein

- the sleeve comprises an embedding material embedding at least the display controller and the power source for shielding the display controller and the power source as a potential source of ignition from the outside of the sleeve, and
- at least a portion of the sleeve comprises an elastic material exercising a contracting force around the channel for pressing the sleeve against the nozzle so as to fixate the display with respect to the nozzle when the nozzle is fitted into the channel.

2. A display system as in any one of the preceding claims wherein the material is a flexible material.

3. A display system as in any one of the preceding claims wherein the embedding material is a stretchable material

4. A display system as in any one of the preceding claims wherein the material embedding at least the display controller and the power source and the elastic material are the same material.

5. A display system as Claim 4, wherein the sleeve entirely consists of the same material.

6. A display system as in any one of the preceding claims, wherein the electronic screen is a LED display screen.

7. A display system as in Claim 6, wherein the LED display screen is an organic LED display screen.

8. A display system as in any one of the preceding claims wherein the electronic display screen is a flexible electronic display screen.

9. A display system as in any one of the preceding claims wherein the embedding of the display controller and the power source is obtained by molding over.

10. A display system further comprising a wireless receiver for receiving digital data for display on the electronic screen, the material of the sleeve also embedding the receiver.

11. A display system as in any one of the preceding claims wherein the sleeve completely covers at least all electronic components of the sleeve except the outer part of the electronic display screen.

12. A display system as in any one of the preceding claims, wherein the sleeve is a scuff guard.

13. A display system as in any one of the preceding claims wherein the power source comprises a power receiver for wirelessly receiving power.

14. A fuel dispensing nozzle fitted into the channel of a display system according to any one of the preceding claims.

15. A fuel dispensing nozzle fitted into the channel of a display system according to Claim 13 attached to a hose, the hose comprising a wire for transferring power to a power transmitter for wirelessly transmitting power, the power transmitter being arranged with respect to the power receiver so that power may be transmitted during operational use of the display system.

16. Method for fixing a display system to a fuel dispensing nozzle, the display system comprising

- an electronic display screen
- a display controller connected to the electronic display screen,

- a power source for providing electric power to the electronic display screen and to the display controller, and
- a sleeve having an internal channel for receiving the fuel dispensing nozzle, the comprising a material embedding at least the display controller and the power source for shielding the display controller and the power source from the outside of the sleeve as a potential source of ignition,

wherein the method comprises

- fitting the nozzle into the channel thus exercising a contracting force around the channel for pressing the sleeve against the nozzle by a portion of the sleeve comprising an elastic material, accordingly fixing the display with respect to the nozzle.

Amended claims in accordance with Rule 137(2) EPC.

1. A display system configured for fixing to a fuel dispensing nozzle, the display system comprising

- an electronic display screen
- a display controller connected to the electronic display screen,
- a power source for providing electric power to the electronic display screen and to the display controller, and
- a sleeve having an internal channel for receiving the fuel dispensing nozzle, wherein

- the sleeve comprises an embedding material embedding at least the display controller and the power source for shielding the display controller and the power source as a potential source of ignition from the outside of the sleeve,
- at least a portion of the sleeve comprises an elastic material exercising a contracting force around the channel for pressing the sleeve against the nozzle so as to fixate the display with respect to the nozzle when the nozzle is fitted into the channel,
- the display screen is an organic LED display screen, and
- the embedding of the display controller and the power source is obtained by molding over.

2. A display system as in any one of the preceding claims wherein the material is a flexible material.

3. A display system as in any one of the preceding claims wherein the embedding material is a stretchable material

4. A display system as in any one of the preceding claims wherein the material embedding at least the display controller and the power source and the elastic material are the same material.

5. A display system as Claim 4, wherein the sleeve entirely consists of the same material.

6. A display system as in any one of the preceding claims wherein the electronic display screen is a flexible electronic display screen.

7. A display system further comprising a wireless receiver for receiving digital data for display on the electronic screen, the material of the sleeve also embedding the receiver.

8. A display system as in any one of the preceding claims wherein the sleeve completely covers at least all electronic components of the sleeve except the outer part of the electronic display screen.

9. A display system as in any one of the preceding claims, wherein the sleeve is a scuff guard.

10. A display system as in any one of the preceding claims wherein the power source comprises a power receiver for wirelessly receiving power.

11. A fuel dispensing nozzle fitted into the channel of a display system according to any one of the preceding claims.

12. A fuel dispensing nozzle fitted into the channel of a display system according to Claim 10 attached to a hose, the hose comprising a wire for transferring power to a power transmitter for wirelessly transmitting power, the power transmitter being arranged with respect to the power receiver so that power may be transmitted during operational use of the display system.

13. Method for fixing a display system to a fuel dispensing nozzle, the display system comprising

- an electronic display screen, the display screen is an organic LED display screen,
- a display controller connected to the electronic display screen,
- a power source for providing electric power to the electronic display screen and to the display controller, and
- a sleeve having an internal channel for receiving the fuel dispensing nozzle, the comprising a material embedding at least the display controller and the power source for shielding the display controller and the power source from the outside of the sleeve as a potential source of ignition,

the embedding of the display controller and the power source is obtained by molding over,

wherein the method comprises

- fitting the nozzle into the channel thus exercising a contracting force around the channel for pressing the sleeve against the nozzle by a portion of the sleeve comprising an elastic material, accordingly fixing the display with respect to the nozzle.

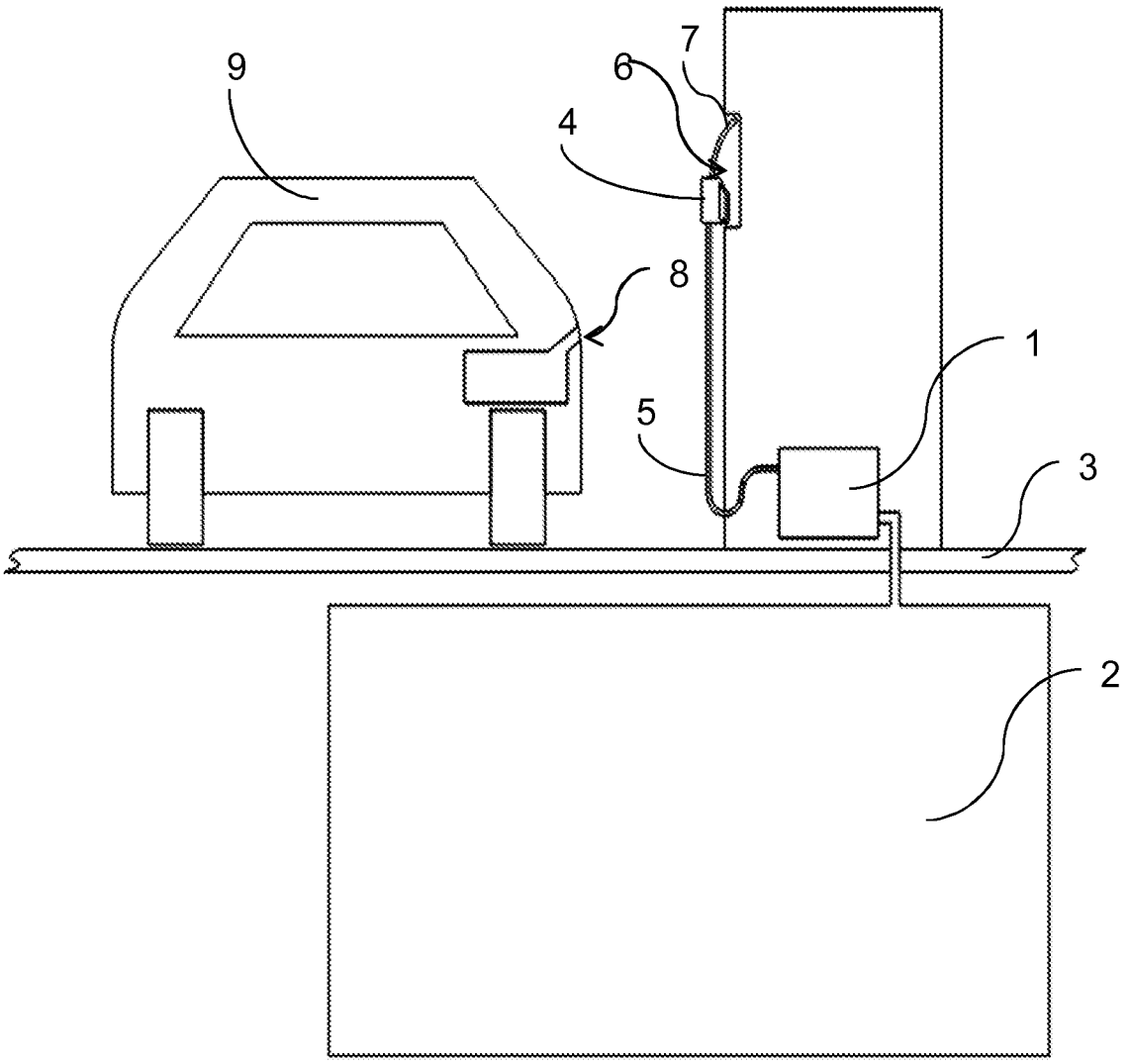

Figure 1

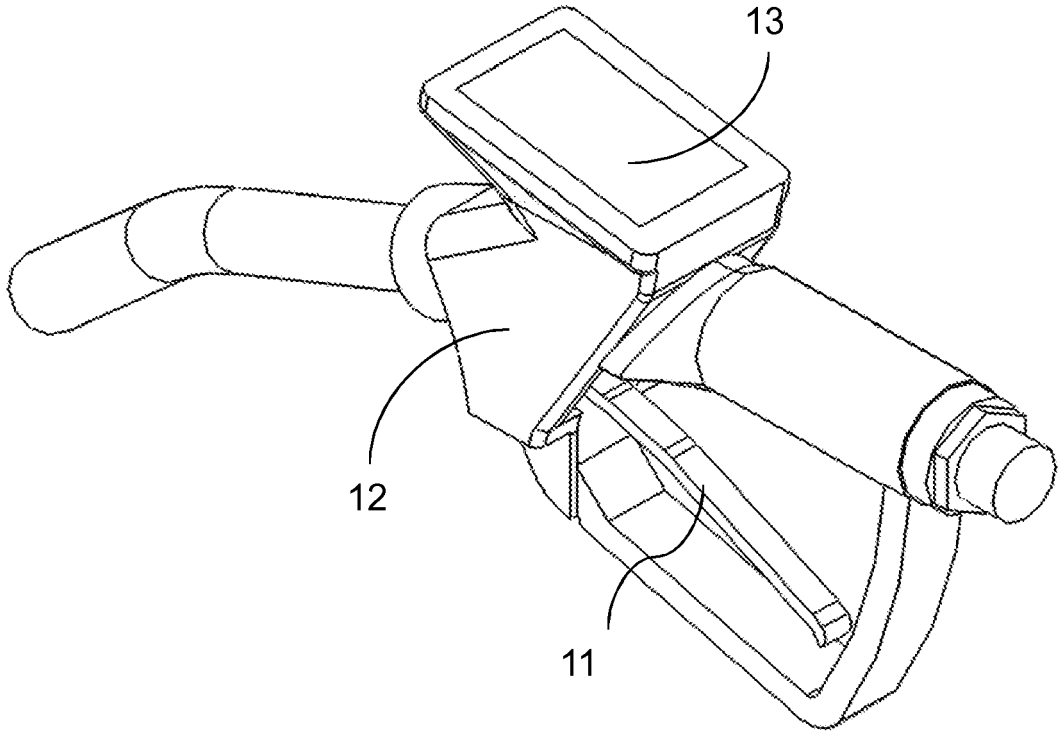

Figure 2

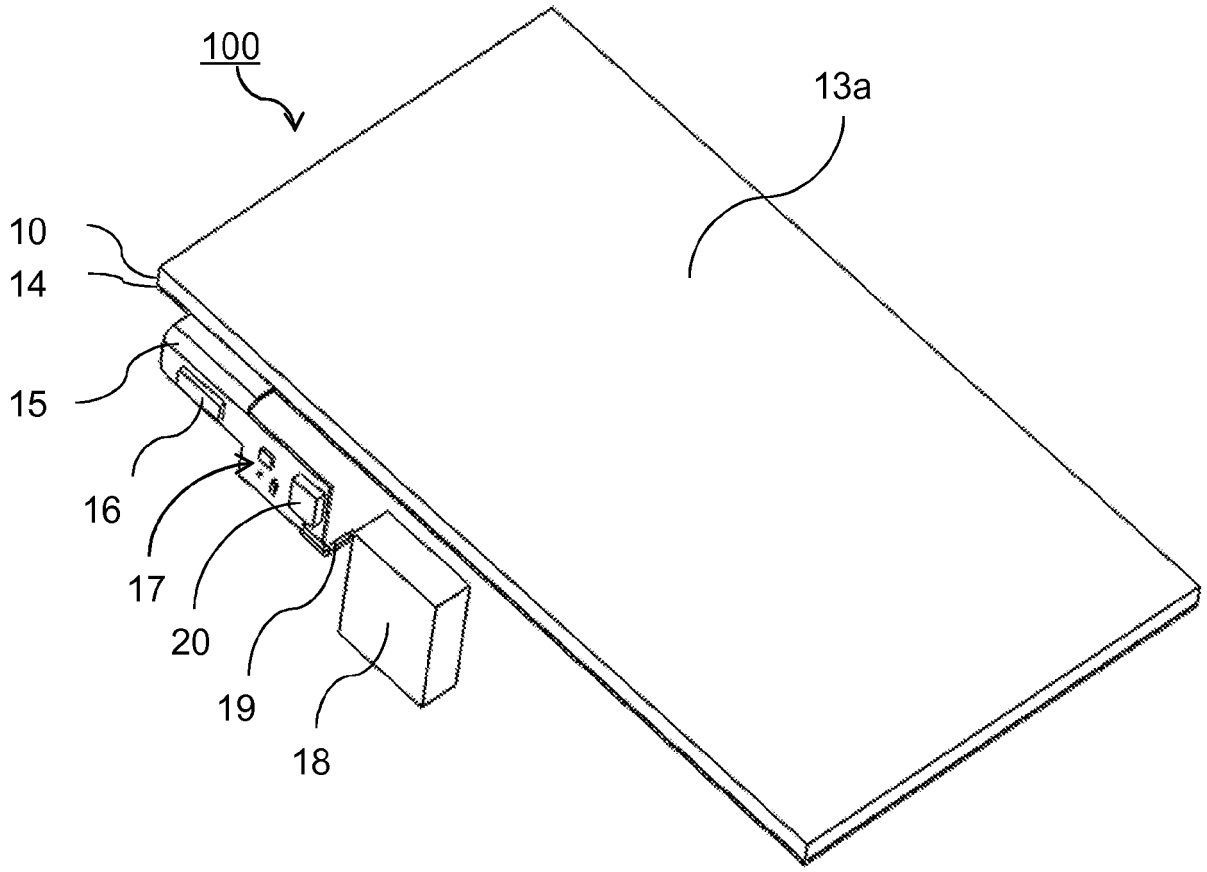

Figure 3a

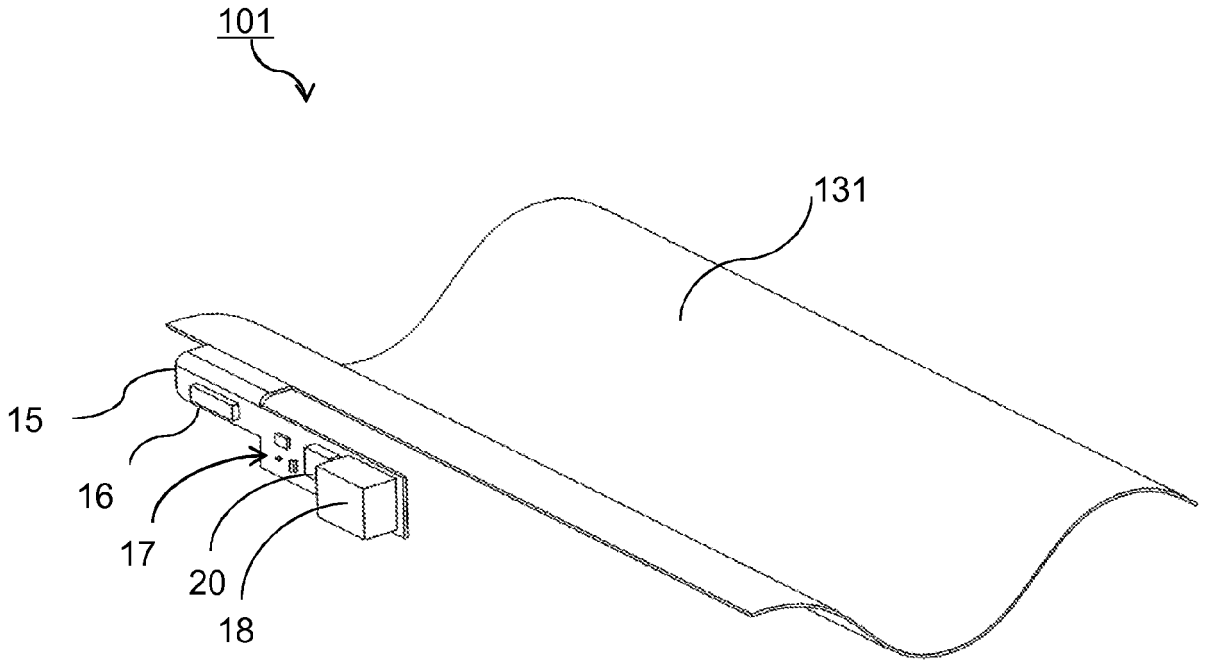

Figure 3b

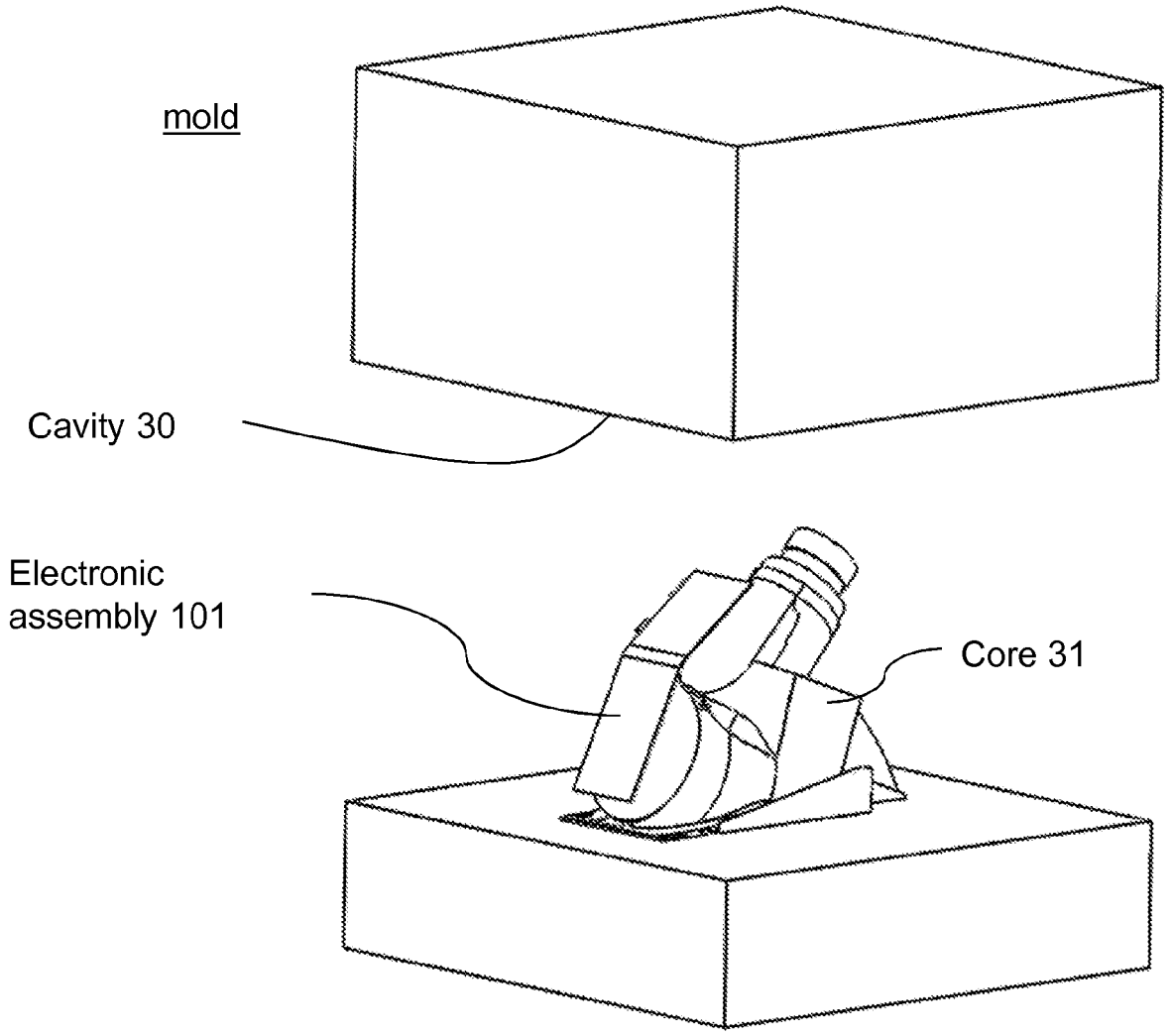

Figure 4a

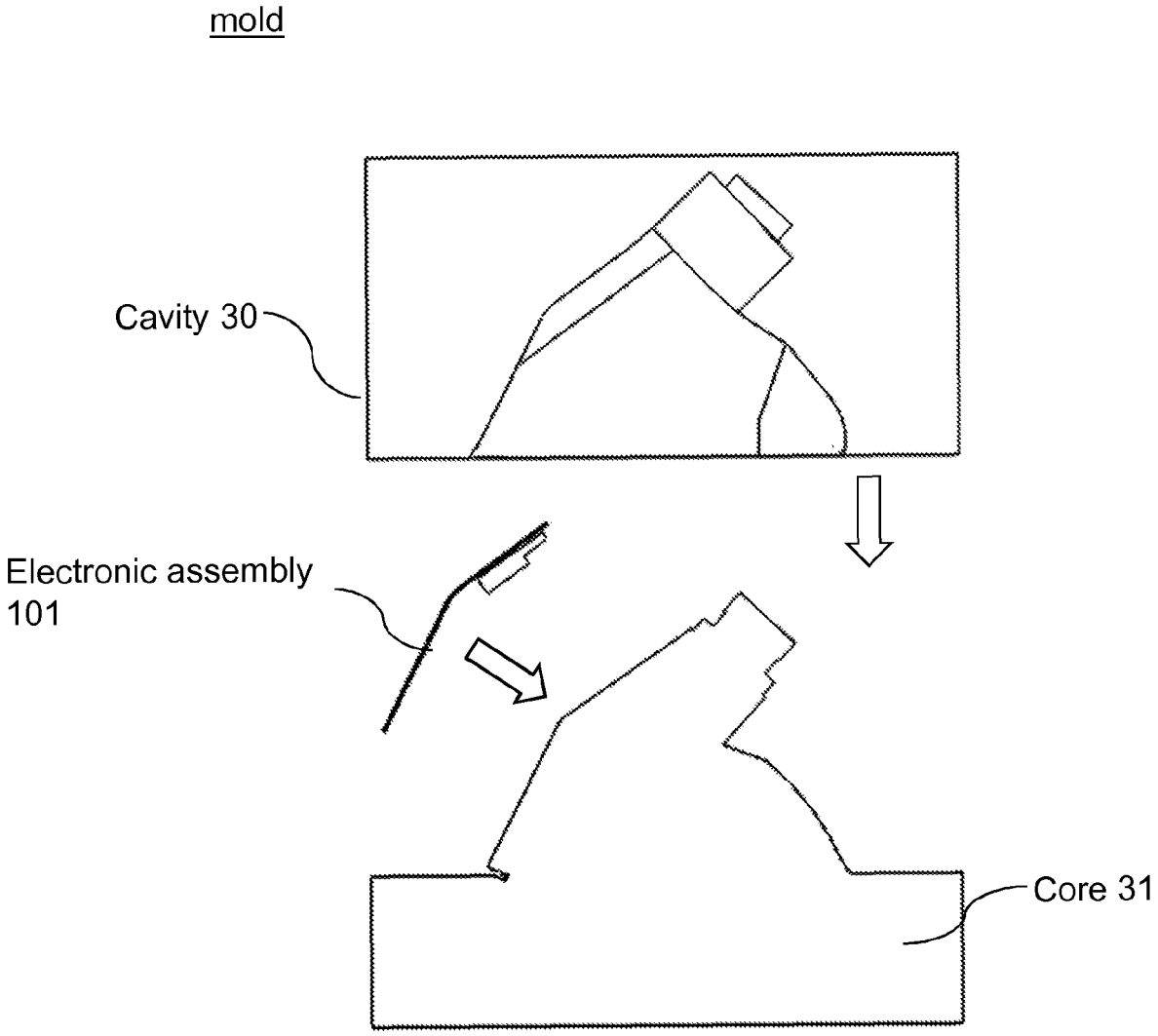

Figure 4b

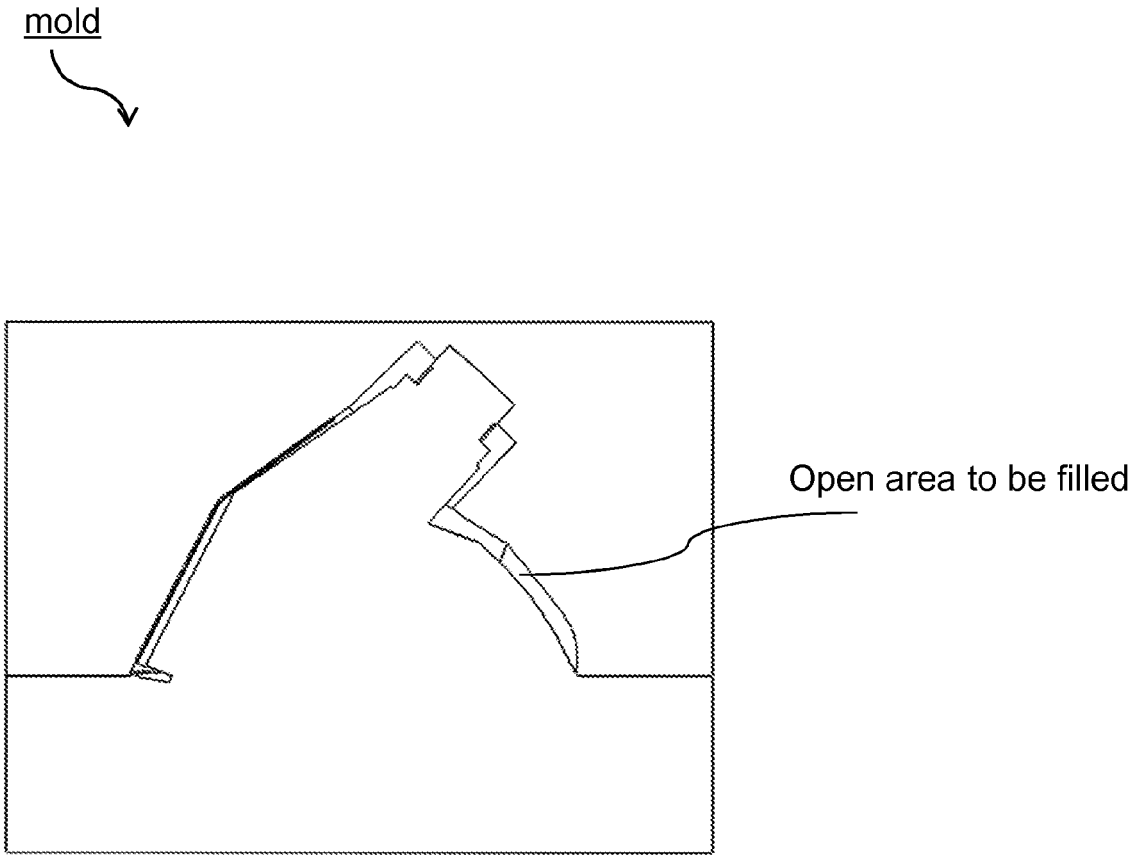

Figure 4c

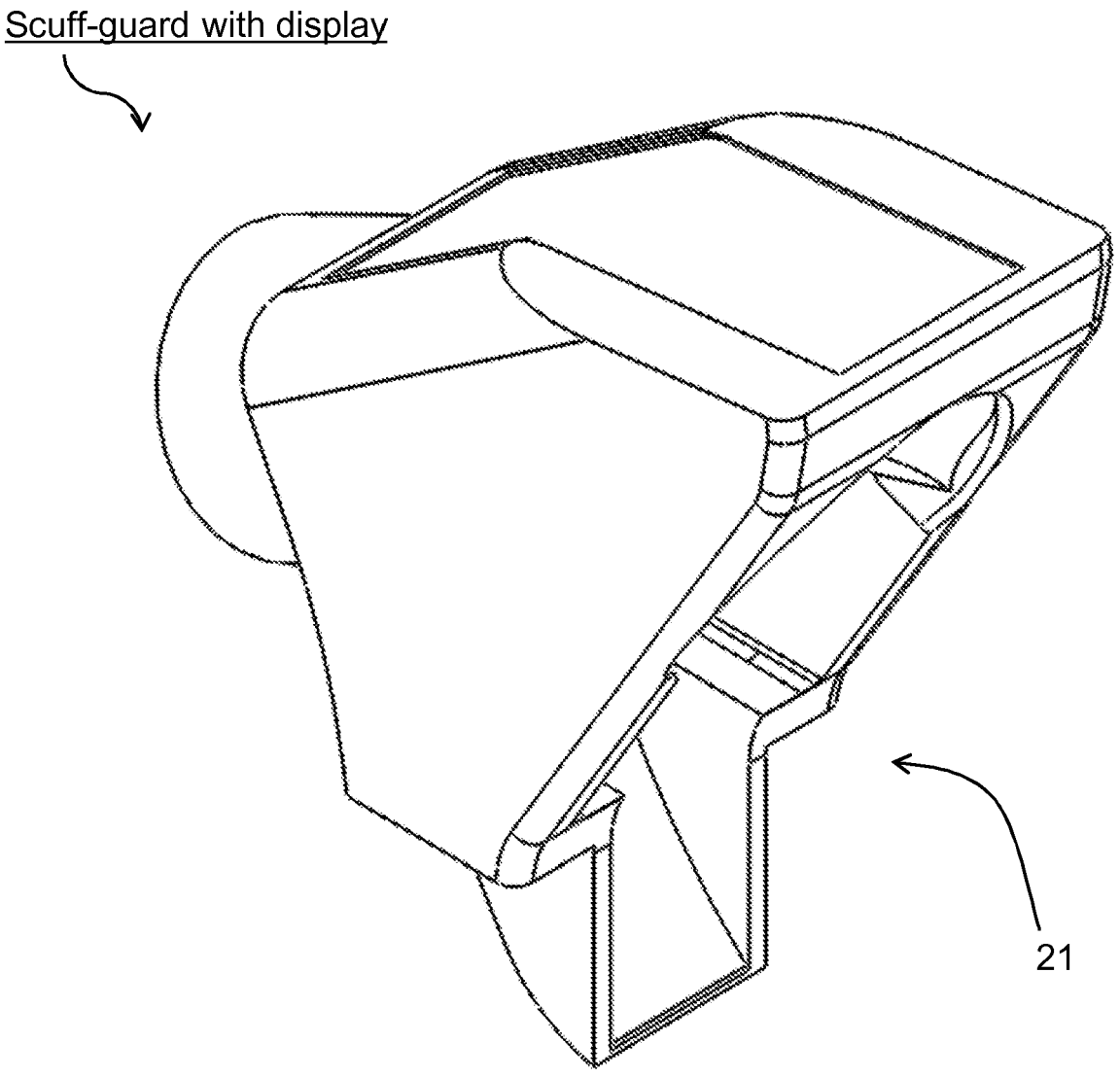

Figure 5a

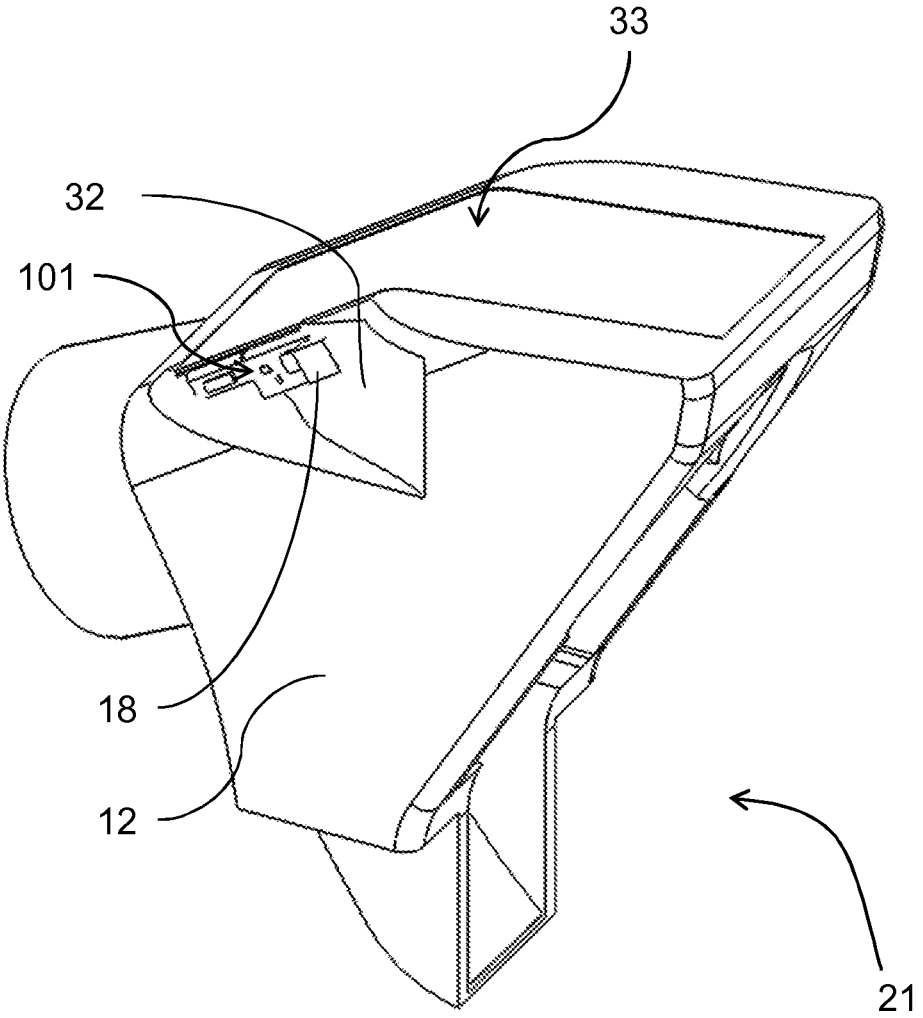

Figure 5b

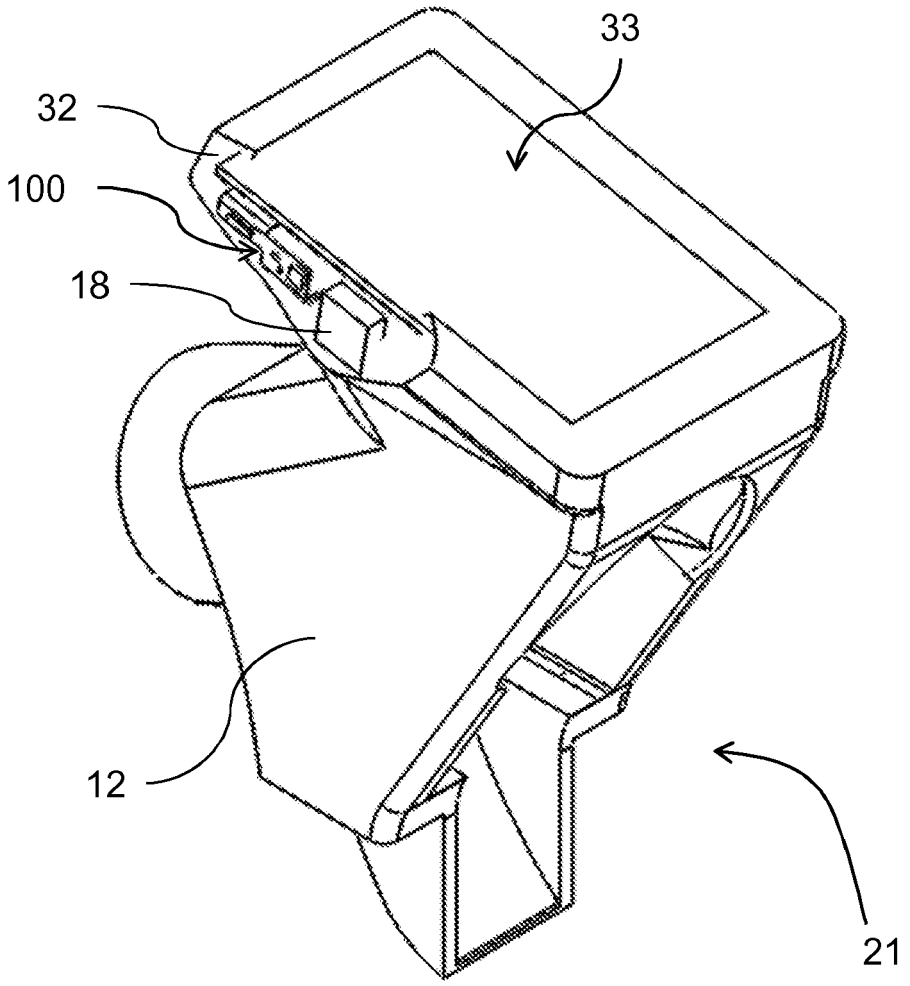

Figure 6

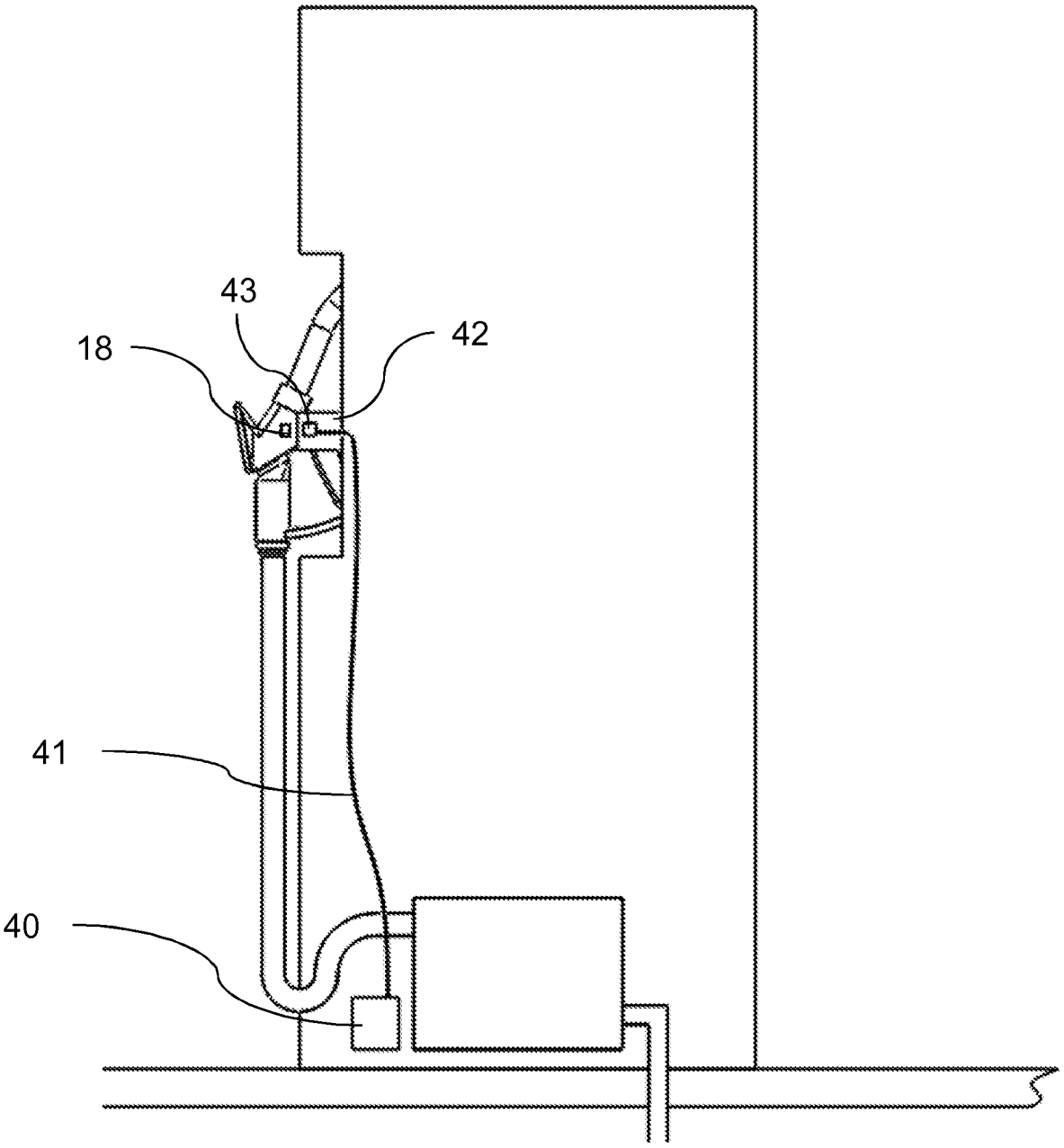

Figure 7

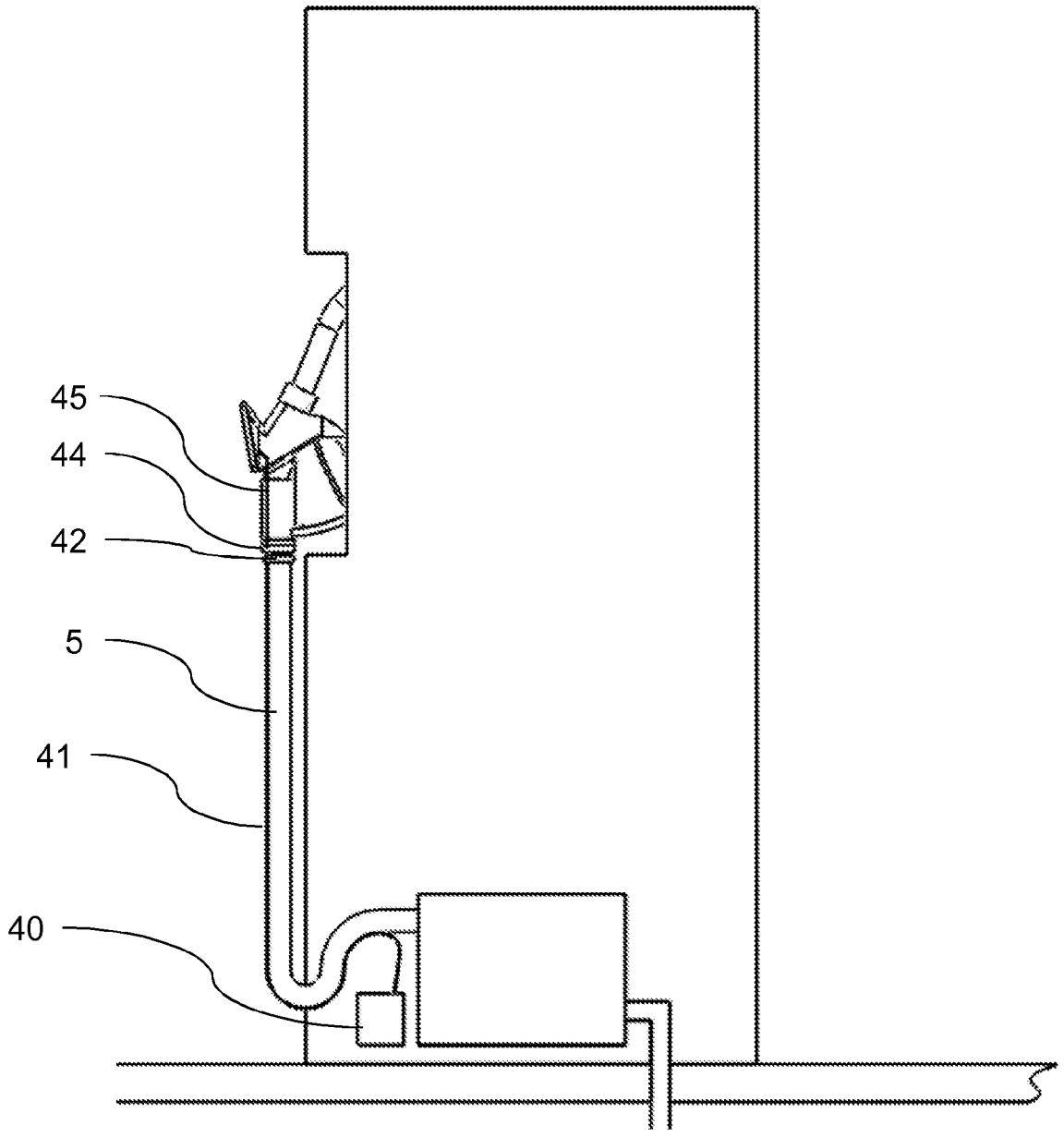

Figure 8

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EUROPEAN SEARCH REPORT

Application Number
EP 11 16 0514

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Place of search	Date of completion of the search	Examiner
Munich	28 July 2011	Müller, Claus

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