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(71) Applicant: **Norcros Group (Holdings) Limited**
Wilmslow, Cheshire SK9 1BU (GB)

(72) Inventor: **BREEDS, Andrew John**
Cheddar, BS27 3EB (GB)

(74) Representative: **Stoner, Gerard Patrick**
Mewburn Ellis LLP
City Tower
40 Basinghall Street
London EC2V 5DE (GB)

(54) **PLUMBING FIXTURE WITH AERATOR**

(57) A tap has a flat spout with upper and lower faces defining a flow channel of oblong cross-section leading to a slot-form discharge outlet. An aerator, also of oblong cross-section, is mounted in the flow channel which is of oblong cross-section both upstream and downstream of the aerator. The discharge outlet opens downwardly at the tip of the spout from a flow channel region downstream of the aerator. A displaceable wall plate in the lower face of the spout has an air intake conduit formed through plate to supply air to an air inlet of the aerator.

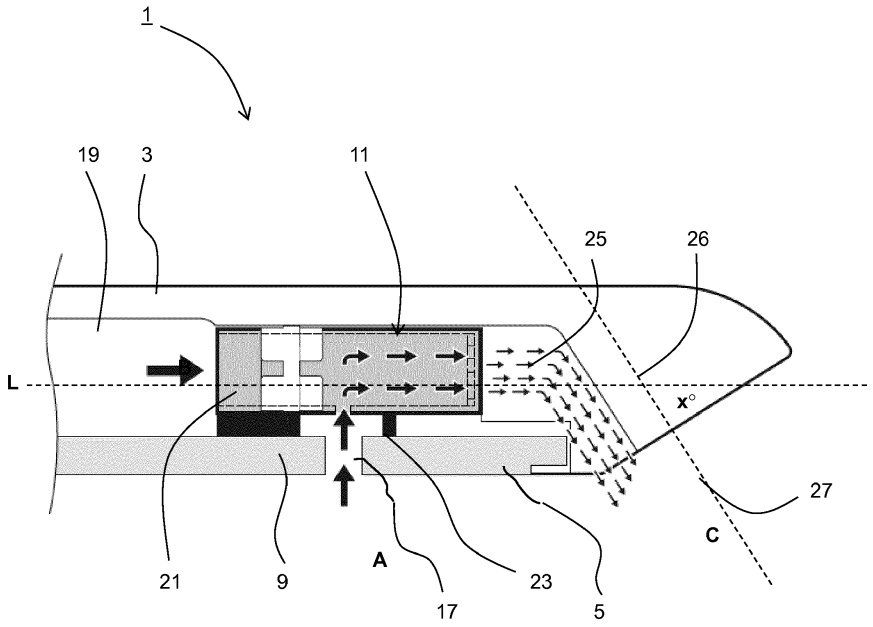

Fig. 2

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Description

Field of the Invention

[0001] The present invention relates to plumbing fixtures providing user outlets, such as taps (faucets), and more particularly to plumbing fixtures of this type which have aerators.

Background

[0002] Aerators for taps are well known, for example aerators produced and marketed by Neoperl GmbH under the name NEOPERL ® (see www.neoperl.de), and operate to reduce water consumption. An aerator is a generally tubular device with a water inlet, an air inlet, internal structure to promote mixing of the air and water, and an outlet for the aerated water. They come in a variety of sizes and shapes but typically have either a circular or a substantially rectangular sectional shape across the flow direction to the outlet (flow axis). Some aerators also have a flow-regulating device, e.g. an adjustable element for presetting a desired water flow rate, or a dynamic device element operable to approximate the flow to a predetermined rate during variations in supply pressure.

[0003] Aerators are generally mounted at the discharge outlet of a spout of the fixture where water emerges. Usually the aerator is a discrete device or module. They may be provided as an external auxiliary device to be attached to the end of a spout using e.g. a screw thread fitting or the like. Or, the aerator may be incorporated into the spout design, with the device fully recessed into the form envelope at the discharge outlet end of the spout. The aerator and spout are designed with an air entry region at the spout discharge opening, e.g. next to it or extending around it, for air to flow back up into the spout to the air inlet of the aerator and join the water flow. Incidentally the term "air inlet" is used for simplicity; in practice there might be plural separate openings of the aerator air inlet.

[0004] Since the aerator is at the discharge outlet, its cross-sectional shape is chosen to match the spout design and generally determines the shape of the aerated water jet which flows out of the spout, so that an aerator with a circular cross section will produce a round columnar jet of water, whereas an aerator with an oblong rectangular cross section will typically produce a blade-like or ribbon-form jet of water and is used in a tap with a corresponding spout form. Aerators with a rectangular cross-section usually cannot be attached via a screw thread; they are inserted directly into the free end of the rectangular-section spout and retained there.

SUMMARY OF THE INVENTION

[0005] An aim herein is to provide new and useful aerator spout structures for plumbing fixtures and especially taps, preferably providing for greater freedom in the design of the spout while still enabling simple or conventional aerator structures or aerator modules to be used. Specific preferred aims include an aerator spout of flattened form (i.e. having an oblong cross-section, e.g. so as to produce a ribbon-form flow from a slot-form discharge opening) in which the discharge opening can be directed in a different direction from the flow axis direction of the aerator at its outlet.

[0006] We propose a plumbing fixture such as a tap, having a spout with a discharge outlet and a spout wall defining a flow channel leading to the discharge outlet, the spout comprising:

an aerator located in the flow channel of the spout, the aerator having an air inlet, a water inlet, and an outlet for an aerated stream of water generated in the aerator; and

at least one air intake conduit formed through the spout wall of the spout to supply air to the air inlet of the aerator.

[0007] Preferably the spout has a downstream portion extending downstream of the aerator to the discharge outlet, which outlet is thereby spaced from the aerator. [The term 'downstream' is used with reference to the flow of water through the plumbing fixture.] The size, shape and orientation of the outlet opening at the discharge outlet determine the cross-sectional form and direction of the stream of aerated water produced by the plumbing fixture, which is a significant design feature for which design freedom is desirable. In our proposal these features can differ from the corresponding features at the aerator outlet. For example to achieve a ribbon-form stream of water, the outlet may desirably have an elongate slot form cross-section, e.g. a generally rectangular slot.

[0008] Firstly the outlet opening - in principle an opening in the wall of the spout, although it might be in practice be simply the end of a tube - may be directed differently from, e.g. transversely to, the flow axis at the outlet of the aerator. Secondly (additionally or alternatively) at least a portion of the downstream portion of the flow channel may be angled with respect to the flow channel defined by the flow axis of the aerator. The angle of this different direction of the opening, or of the downstream flow channel portion, to the flow axis of the aerator may be e.g. 40° or more, 60° or more, 70° or more, or 80° or more, or they may be substantially perpendicular. Thirdly the outlet opening may have a cross-sectional shape and/or a cross-sectional flow area different from that of the outlet of the aerator. These features are enabled because in our proposal the aerator outlet need not be at the discharge outlet; the aerator can draw in air even when positioned at a relatively upstream position and not aligned with the outlet.

[0009] Accordingly, in the present proposal, the aerator need not be located immediately adjacent the free end of the spout of the plumbing fixture. Furthermore, the aerator may be hidden by aerator housing or spout,

and may not be visible in normal use of the plumbing fixture. This may be desirable from an aesthetic perspective.

[0010] This is in contrast to problems with known designs, where due to the need to provide a flow path for air to the air inlets of the aerator, typically the aerator must be located at the free end of the spout of the plumbing fixture, in other words, at its outlet. Accordingly the aerator is typically visible in normal use of the plumbing fixture, which is generally not desirable from an aesthetic perspective. Furthermore, the spout must usually be 'downward-facing' to some degree in normal use, so that the stream of water which issues from the spout via the aerator is appropriately directed into e.g. a hand basin, and this is generally achieved by incorporating a bend into the spout; an aerator in such a spout must therefore be housed in a final downwardly-angled portion of the spout. The incorporation of such a downwardly-angled part in the spout may be undesirable from an aesthetic point of view, and limits design. In particular, it may be inconsistent with providing a flat tap, where a ribbon of water issues with a 'waterfall effect' from a flat horizontal spout.

[0011] By using the present proposals, by contrast, the aerator can be spaced back behind the spout opening and their flow axes need not be aligned.

[0012] The flow channel may have an oblong e.g. generally rectangular cross-section (i.e. transverse to the flow direction). The aerator also may have an oblong e.g. generally rectangular cross-section. The discharge outlet opening may be oblong, e.g. an elongate slot. Any of these oblong forms may have an aspect ratio of at least 2 i.e. width at least twice the height.

[0013] The flow axis of the flow channel in the spout may continue straight through the aerator location, i.e. a straight line starting spaced upstream of the aerator and continuing through the aerator to a position spaced downstream thereof, e.g. at the position of the discharge outlet (although the latter might be transverse to the line).

[0014] The spout may be generally flat in form.

[0015] The spout may include a displaceable wall portion e.g. in the form of a plate, which is fixable to a body of the spout and provides access to the aerator when removed or displaced. Such an arrangement allows for any of installation, maintenance, repair or adjustment of the aerator. There may be a gasket or other seal member interposed between the displaceable wall portion and the spout body to prevent leakage from the flow channel.

[0016] Where the spout includes a spout body and a displaceable wall portion e.g. plate, the at least one air conduit formed through a wall of the spout may be formed through this displaceable wall portion. This may allow for ease of manufacture of the spout including such an air conduit. The exact number and shape of the air conduits formed through the wall of the spout may vary depending on the air flow requirements of the aerator within the spout. For example, where the aerator has two or more inlets, two or more corresponding air conduits may be provided through the wall of the spout to provide airflow to each of these respective inlets. However, in some cases, a single conduit may be sufficient. An air inlet is typically through a side opening of the aerator module. Conventional aerator modules may conveniently be used.

[0017] A seal element may be provided to engage between the aerator and spout wall (e.g. at a said displaceable portion thereof) to provide an air inflow region isolated from the water flow. This seal element may be integral with a seal member for sealing a said displaceable wall portion.

[0018] The displaceable wall portion may fit within a recessed portion of the spout body, so that when the plate is attached to the spout body, the plate lies flush with the spout body. Recessing the plate so that it lies flush may be desirable aesthetically, and additionally prevent buildup of excess dirt and/or scale that may otherwise occur around the edges of a non-flush element.

[0019] The spout may be integrally formed with a body of the plumbing fixture. The fixture may comprise a cast component constituting at least the spout body.

[0020] In a particularly preferred embodiment the fixture is a tap and the spout thereof has a flat, straight body form with wide upper and lower faces. A displaceable wall plate is provided in the lower face. The flow channel has oblong or slot-form cross-section both upstream and downstream of the aerator, which is also of oblong cross-section. The discharge outlet opens downwardly from the downstream flow channel region at or adjacent the tip of the spout, desirably through the lower face of the spout. An air conduit is defined through (or around) the displaceable wall plate, and leads into an air inflow region between the wall plate and a side wall of the aerator having the air inlet opening(s) thereof. A sealing gasket may be provided having a peripheral portion to seal between the plate and the spout body and an air isolation portion to seal between the plate and the aerator around the air conduit and air inlet.

[0021] The aerator may be removably fixed within the spout. For example, the aerator may be fixed into the flow channel of the spout by fixing means e.g. a screw. Preferably, the flow channel at the location at which the aerator is inserted is approximately the same width as the aerator. This can prevent leakage of water around the edges of the aerator, which may lead to unwanted ingress of water into the air inlet channels of the aerator, and prevent proper functioning of the aerator.

[0022] The aerator may comprise a flow-regulating device, e.g. as typically used in combination with well-known aerators. This is advantageous as it can provide for consistency in flow from the plumbing fixture.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] An embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is an exploded perspective view showing components of a tap spout with an aerator;

Figure 2 is a schematic cross-sectional view of the assembled spout;

Figure 3(a) is a view of the underside of the spout;

Figure 3(b) is the same view but with a plate and aerator removed to show the flow channel, aerator and outlet regions in the spout, and

Figure 4 is an exploded perspective view showing components of a modified embodiment.

DETAILED DESCRIPTION

[0024] Figure 1 shows an exploded perspective view of a tap spout 1, e.g. the spout of a mixer tap for a bath or basin. The spout 1 comprises a spout body 3 and a plate 5 which is removably attached to the spout body using, in this embodiment, screws 7 at each corner of the plate. A gasket 9 is interposed between the plate 5 and the spout body 3, to help prevent leakage from the flow channel (not shown) within the spout at the join between the spout body and the plate. An aerator 11 is also located within the spout. The aerator is conveniently fixed in place using a screw, here a grub screw 13, which passes through the plate 5, though a slot 15 in the gasket 9, and into a receiving portion of the aerator 11. The aerator may have a flow-regulating portion to regulate the flow of water through the aerator.

[0025] There are two air intake conduits 17 formed through the plate, i.e. formed through a wall of the spout. These air inlets are positioned so as to be adjacent to air inlets on the underside of the aerator 11. Accordingly, during operation of the plumbing fixture in which the invention is incorporated, ambient air may pass through these inlets, and into the air inlets of the aerator. It is therefore not necessary to provide a flow path for air to the aerator from an outlet of the tap. The size of these air inlets is not particularly limited, but must be large enough to allow for a sufficient flow of air through the conduits as required by the aerator.

[0026] Figure 2 shows a schematic cross-sectional view of the spout 1. The cross-section is taken through an air intake conduit 17. The spout comprises the spout body 3 and detachable plate 5. A flow channel 19 is defined by the spout body and the plate. An aerator 11 is located within this flow channel, which is sized appropriately to reduce or prevent leakages of water around the edge of the aerator. Arrows A and B show the flows of water and air respectively into the aerator 11. Water enters the aerator at a water inlet 21, including a flow regulator as is conventional. Air enters the aerator at air inlet 23. Gasket 9 prevents water in the flow channel 19 from entering the air inlet 23 of the aerator 11, and additionally from leaking out of the air intake conduit 17 formed in the spout, by providing sealing between the aerator 11 and the flow channel 19 defined by the spout.

[0027] The aerator 11 provides for mixing of the respective flows of air and water in such a way as to generate a suitably aerated stream of water C, which exits through the aerator outlet 25. On exiting the aerator, the aerated stream of water passes through an outlet channel 26 downstream of the aerator, before exiting the spout through spout outlet 27. The outlet channel 26 is angled with respect to the longitudinal centreline of the aerator L, forming an angle of x° with this centreline. In the present embodiment, the angle is approximately 45°. Such an arrangement allows for the spout body to have a narrow width along its length with no significant bends, whilst also providing for a downwardly-directed stream of water to be issued from the outlet.

[0028] The aerator 11 is not immediately adjacent the spout outlet 27, because there is a portion of the spout which extends downstream of the aerator, defining the outlet channel 26. As a result of this, the aerator is generally not visible in normal use of the spout, as it is concealed by the spout body 3 and plate 5. Such an arrangement may be more aesthetically appealing than an arrangement where the aerator is visible during normal use of the spout.

[0029] The size and shape of the spout outlet may be varied accordingly to the desired size and shape of the stream of water which, in use, emerges from the outlet. In this embodiment, the spout outlet is approximately rectangular (shown in more detail in Fig. 3), and accordingly the stream of water which, in use, issues from the spout is a ribbon, or blade of water, having an approximately rectangular cross section.

[0030] Figure 3(a) shows a view of the underside of the embodiment. The plate is attached to the spout body using screws 7 which engage with corresponding holes formed in the spout body 3. The plate therefore forms part of a wall of the spout. Two air intake conduits are formed through plate 5 (i.e. through a wall of the spout), either side of grub screw 13. Spout outlet 27 has an approximately rectangular shape, and accordingly a stream of water which passes through the outlet will also have an approximately rectangular cross section i.e. will be a ribbon or blade of water.

[0031] Figure 3(b) shows a view from the same angle as Fig. 3(a), with the plate 5 removed to show the flow channel 19 and aerator 11 within the spout body 3. There is a recessed portion 29 formed in the spout body, into which plate 5 sits. The flow channel 19 narrows at the location at which the aerator is located, so that it is approximately the same width as the widest part of the aerator. This can help to provide sealing and prevent leakage of water around the sides of the aerator.

[0032] Figure 4 shows an exploded view - as in Fig. 1 - of a modified embodiment, with refinements to improve the sealing of the construction. A first refinement is for the air intake 17. A supplementary seal locating member 8, in the form of a small rectangular metal plate, has a central hole 81 which anchors over a projecting boss 51 on the plate 5 around the hole for the grub screw 13. The locating member 8 sits in the through-hole or slot 15 in the gasket 9, and has air intake openings 82 to either

side which align with the air intake openings 17 in the plate 5 and aerator. This feature provides more positive location and spacing of the co-operating elements, and ensures that the portions of the gasket around the air intake remain in place without shifting relative to the water flow path. A second refinement is seen at the front of the gasket and plate 5, where the gasket 9 is provided with a pair of dependent blocking lugs 91. These locate in corresponding notches 52 at the front of the plate, and in the assembled position are compressed to seal against the front edge of the surrounding spout body 3 opening at either side of the spout. They then prevent water from running by capillary action along the narrow groove between the plate 5 and the surrounding spout body 3, which might otherwise sometimes lead to dripping from the underside of the spout.

Claims

1. A plumbing fixture such as a tap, having a spout (1) with a spout wall defining a flow channel (19) for water and a discharge outlet (27) for water, the spout comprising
an aerator (11) located within the flow channel of the spout, the aerator having an air inlet (23), a water inlet (21) and an outlet (25) for an aerated stream of water generated in the aerator, and
an air intake conduit (17) formed through the wall of the spout to supply air to the air inlet (23) of the aerator (11).

2. A plumbing fixture of claim 1 wherein the spout wall comprises a displaceable wall portion (5), fixable to a spout body (3), for providing access to the aerator, and said air intake conduit (17) in the spout is in said displaceable wall portion (5).

3. A plumbing fixture of claim 2 comprising a gasket (9) interposed between the spout body (3) and the displaceable wall portion (5).

4. A plumbing fixture of any one of the preceding claims in which the flow channel (19) has a downstream portion defined by a portion of the spout extending downstream of the aerator (11).

5. A plumbing fixture of claim 4 wherein the downstream flow channel portion is at an angle of from 40° to 90° with a flow axis of the aerator (11).

6. A plumbing fixture of any one of the preceding claims wherein the aerator (11) is removably fixed within the spout.

7. A plumbing fixture of any one of the preceding claims wherein the aerator (11) comprises a flow-regulating portion.

8. A plumbing fixture of claim 1 which is a tap wherein the spout has a flat body form with upper and lower faces, a displaceable wall plate (5) in the lower face and a flow channel (19) of oblong cross-section;
the flow channel is of oblong cross-section both upstream and downstream of the aerator (11), which is also of oblong cross-section;
the discharge outlet (27) opens downwardly from a region of the flow channel downstream of the aerator (11), at or adjacent a tip of the spout, and
the air intake conduit (17) is formed through the displaceable wall plate (5).

9. A tap of claim 8 in which the air intake conduit (17) leads into an air inflow region between the plate (5) and a side wall of the aerator (11) having the air inlet opening (23) thereof, and a sealing gasket (9) is provided having a peripheral portion, to seal between the plate (5) and a body (3) of the spout, and an air isolation portion to seal between the plate (5) and the aerator (11) around the air conduit (17) and air inlet.

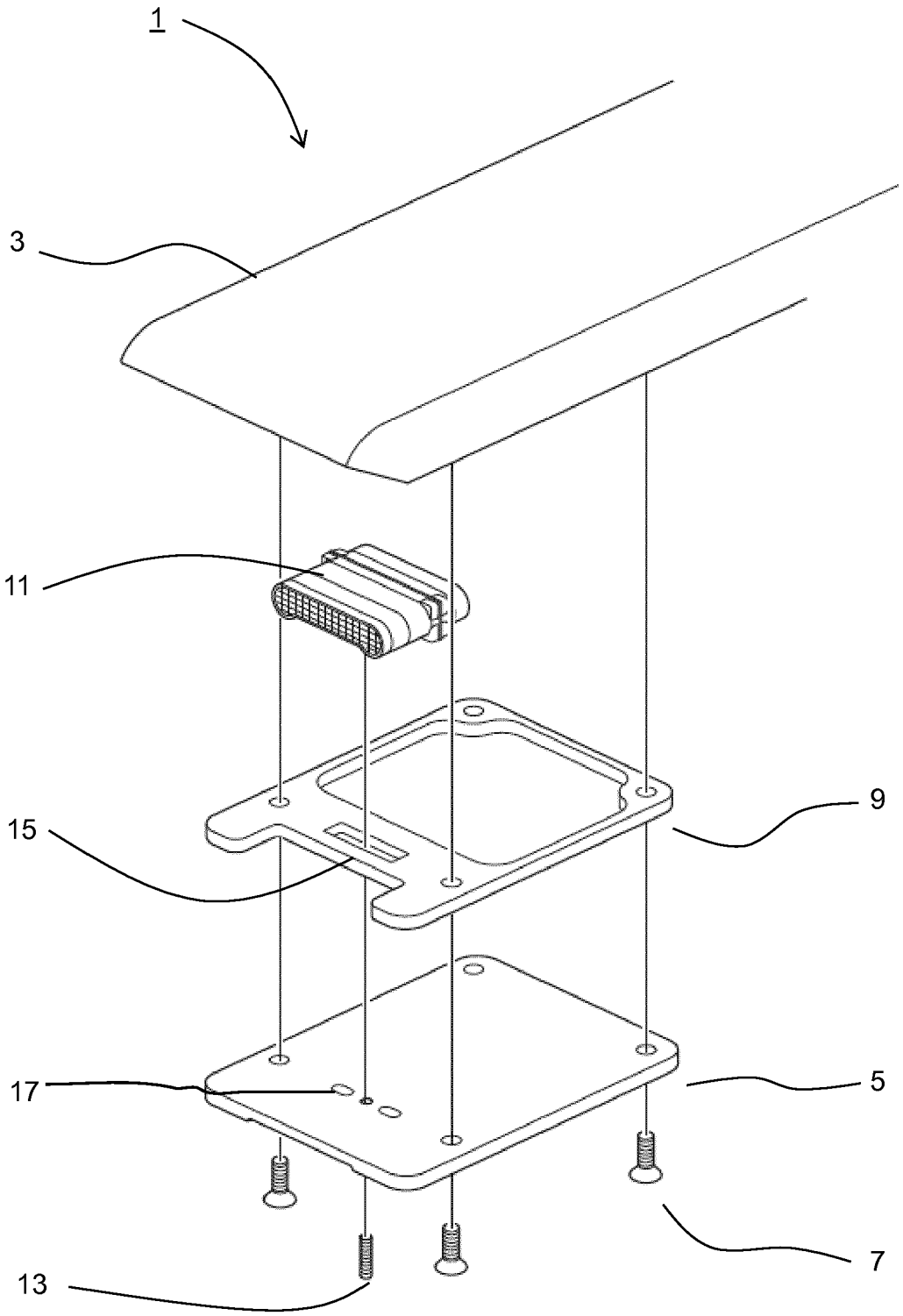

Fig. 1

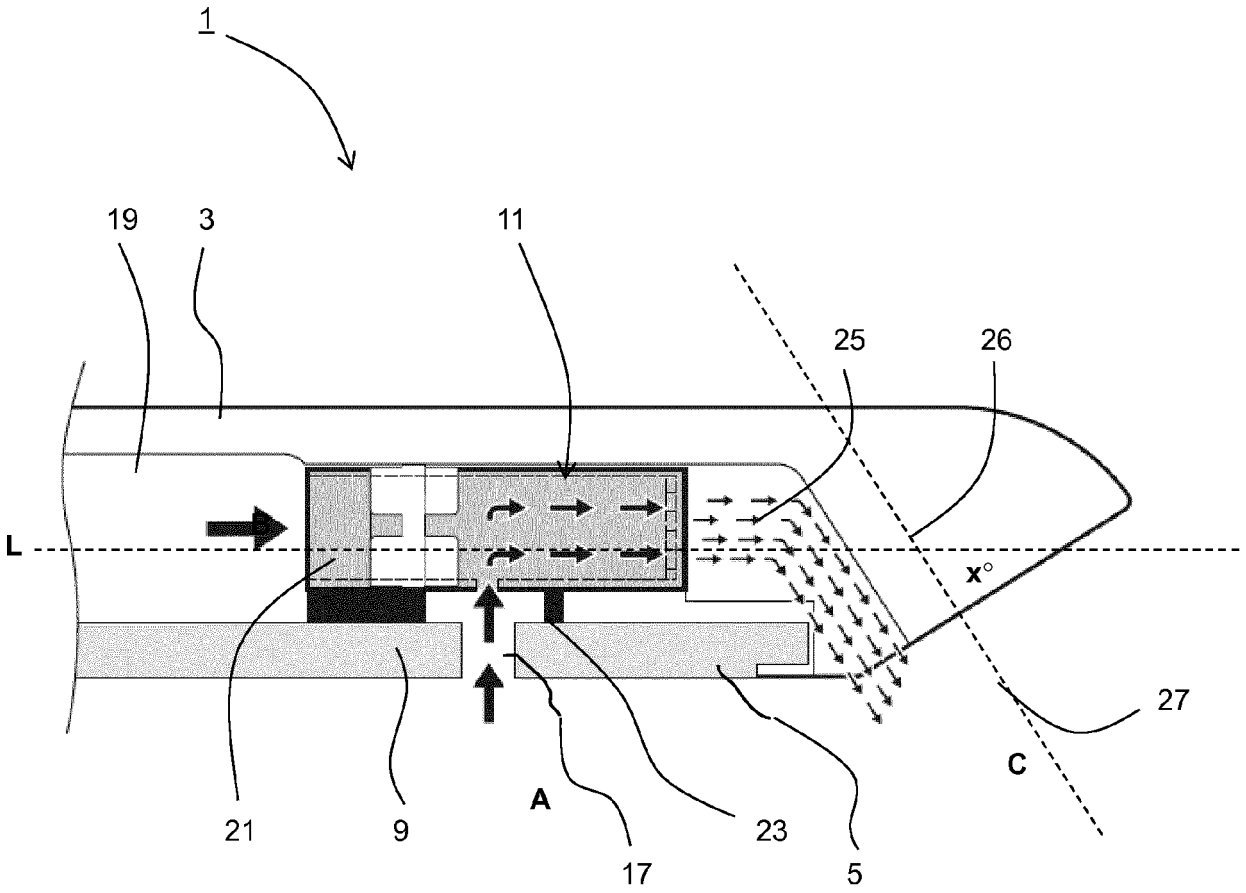

Fig. 2

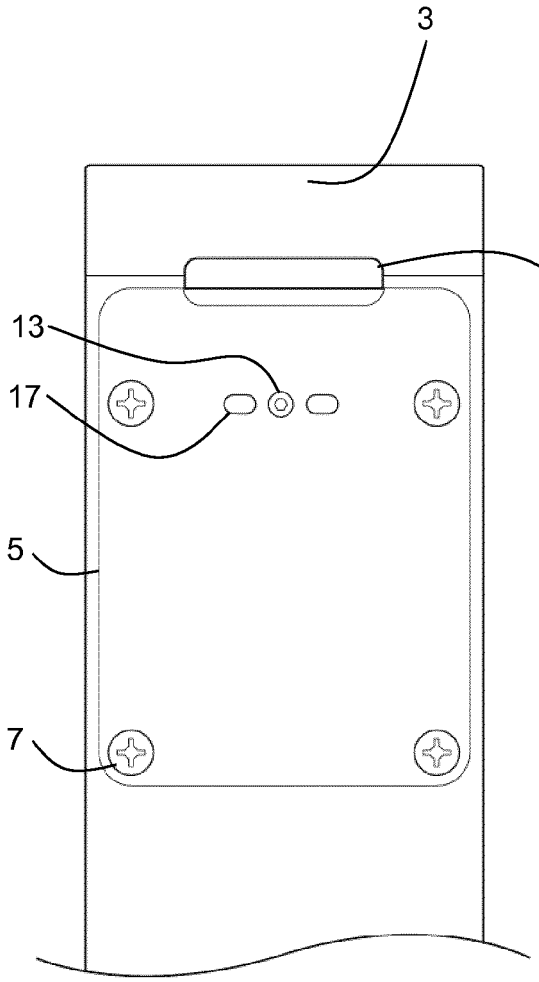

Fig. 3a

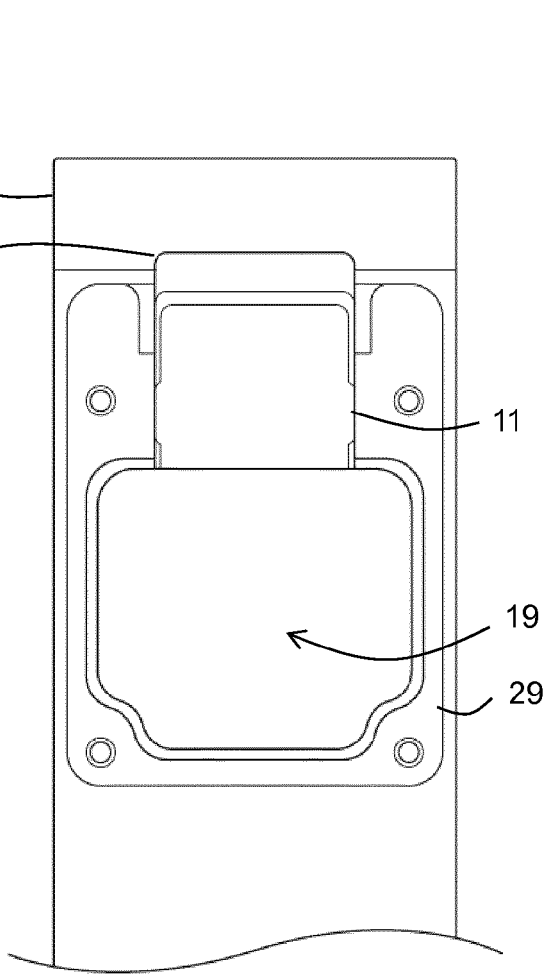

Fig. 3b

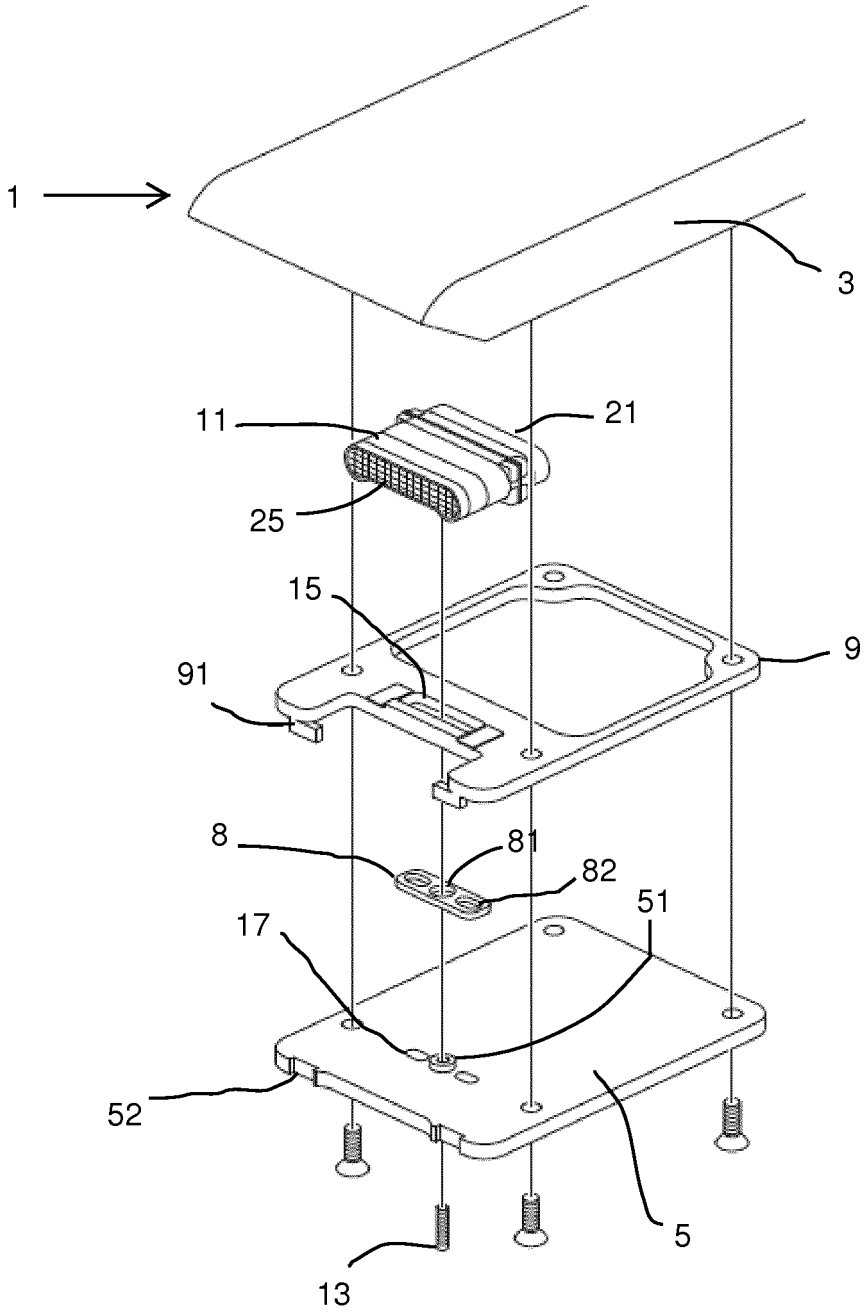

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 18 15 6265

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A	* page 12, line 19 - page 16, line 15; figures 1-19 *	8,9	

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 July 2018	Stefanescu, Radu

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82