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(54) **BACKFLOW PREVENTION VALVE OF A GAS BURNER APPLIANCE AND ASSEMBLY COMPRISING THE BACKFLOW PREVENTION VALVE**

(57) Backflow prevention valve (20) of a gas burner appliance. The valve comprises a support structure (28) provided by a fan module housing (16) of the gas burner appliance, wherein said support structure (28) defines at least partially a gas/air mixture outlet (22) to be opened and closed by the valve (20). The valve comprises a valve body (29), wherein said valve body (29) comprises a valve flap section (29a) acting together with a valve seat (31) provided by the support structure (28), a valve mounting section (29b) and valve hinge sections (29c) through which the valve flap section (29a) is connected to the valve mounting section (29b). The valve comprises a mounting bracket (30) for mounting the valve body (29) at the support structure (28) in such a way that the valve mounting section (29b) of the valve body (29) is sandwiched between the support structure (28) and the mounting bracket (30), wherein the support structure (28) comprises posts (32) being an integral part of the support structure (28), wherein said posts (32) act together with recesses (33) of the mounting bracket (30) in such a way that the posts (32) penetrate through the recesses (33) and mount the mounting bracket (30) and thereby the valve body (29) at the support structure (28).

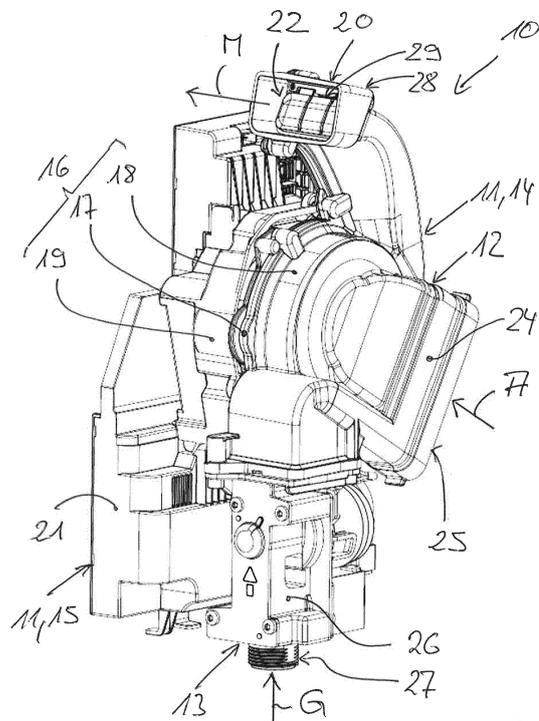


Fig. 1

Description

[0001] The present patent application relates to a back-flow prevention valve of a gas burner appliance. Further on, the present patent application relates to an assembly comprising such a backflow prevention valve.

[0002] EP 3 015 768 A1 discloses an assembly comprising a gas valve for providing a gas flow, a fan for providing an air flow and a gas/air mixer for mixing the gas with the air thereby providing a gas/air mixture. The fan comprises a fan housing with a fan plate housing part and a fan impeller housing part, wherein the fan impeller housing part is mounted to the fan plate housing part. The fan comprises further a fan impeller, said fan impeller being positioned within an interior space of the fan module housing defined by the fan plate housing part and the fan impeller housing part. A burner door through which the assembly is connectable to a gas burner is provided together with the fan impeller housing part as monolithic element.

[0003] The assembly disclosed in EP 3 015 768 A1 comprises further a backflow prevention valve which is called non-return valve. The backflow prevention valve is positioned within the fan impeller housing part. The backflow prevention valve comprises a valve frame and a valve flap.

[0004] Against this background, a novel backflow prevention valve of a gas burner appliance is provided. The backflow prevention valve according to the present disclosure is defined in claim 1.

[0005] The backflow prevention valve of a gas burner appliance according to the present disclosure, which is positioned in a gas/air mixture flow channel having a gas/air mixture outlet through which a gas/air mixture can be provided to a burner of the gas burner appliance, comprises a support structure, a valve body and a mounting bracket.

[0006] The support structure of the backflow prevention valve is provided by a fan module housing of the gas burner appliance. The support structure defines at least partially said gas/air mixture outlet. The support structure comprises posts being an integral part of the support structure.

[0007] The valve body comprises a valve flap section acting together with a valve seat provided by the support structure, a valve mounting section and valve hinge sections through which the valve flap section is connected to the valve mounting section.

[0008] The mounting bracket of the novel backflow prevention valve is used to mount the valve body at the support structure in such a way that the valve mounting section of the valve body is sandwiched between the support structure and the mounting bracket. The mounting bracket comprises recesses or passage openings.

[0009] Said posts of the support structure act together with said recesses or passage openings of the mounting bracket in such a way that the posts of the support structure penetrate through the recesses or passage openings

of the mounting bracket and mount the mounting bracket and thereby the valve body at the support structure when the posts are reformed e.g. by hydroforming. So, when the posts are in a reformed status the same mount or fix the valve body at the support structure.

[0010] The novel backflow prevention valve has a simple construction requiring a minimum of parts and space.

[0011] The construction novel backflow prevention valve is cost effective.

[0012] The novel backflow prevention valve prevents backflow from a chimney in a reliable manner.

[0013] The support structure is preferably made from a rigid material or from a relative rigid material, preferably from metal. The valve body of the backflow prevention valve is preferably at least partially made from an elastic or flexible material or from a relative elastic or relative flexible material, preferably from rubber or a rubber-like material. The mounting bracket is preferably made from a rigid or from a relative rigid material, preferably from metal.

[0014] Relative rigid shall mean that the material from which the support structure and the mounting bracket are both made is substantially more rigid than the material from which the valve body is made.

[0015] Relative flexible or relative elastic shall mean that material from which the valve body is made is substantially more flexible or elastic than the material from which the support structure and the mounting bracket are made.

[0016] Preferably, the support structure of the novel backflow prevention valve comprises ribs having a rounded surface at which the valve hinge sections of the valve body are guided and/or the mounting bracket the novel backflow prevention valve comprises recesses or cutouts in the region of the valve hinge sections of the valve body. This allows a movement of the valve flap for closing and opening the back-flow prevention valve without a damaging risk of the valve body, namely of the valve hinge sections of the valve body.

[0017] Preferably, the valve mounting section of the valve body comprises at least one compression protrusion or at least one compression bead at a side facing towards the mounting bracket, wherein said at least one compression protrusion or compression bead is in contact with the mounting bracket and is compressed by the mounting bracket. This provides a reliable functionality of the novel backflow prevention valve, namely by providing a good sealing in the region of the valve mounting section of the valve body.

[0018] Preferably, the valve hinge sections of the valve body comprise reinforcement protrusions extending between the valve mounting section and the valve flap section at edges of the valve hinge sections. This provides a reliable functionality of the novel backflow prevention valve, namely by providing a defined movement of the valve flap when closing and opening the backflow prevention valve.

[0019] Preferably, the valve hinge sections and the

valve mounting section are completely made from the rubber or the rubber-like material, while the valve flap section is partially made from the rubber or the rubber-like material, wherein the valve flap section comprises a metal core element which is overmolded by the rubber or the rubber-like material. This provides a reliable functionality of the novel backflow prevention valve, namely by providing a defined weight of the valve flap thereby providing a good sealing in the region of the valve flap when the backflow prevention valve is closed.

[0020] The assembly of a gas burner appliance provided by the present application is defined in claim 14.

[0021] Preferred developments of the invention are provided by the dependent claims and the description which follows. Exemplary embodiments are explained in more detail on the basis of the drawing, in which:

- Figure 1 shows a perspective view of an assembly of a gas burner appliance comprising a gas valve, a fan assembly and a gas/air mixer and a backflow prevention valve;
- Figure 2 shows a detail of Figure 1 in the region of the backflow prevention valve;
- Figure 3 shows a first cross-section of the detail of Figure 2;
- Figure 4 shows a second cross-section of the detail of Figure 2;
- Figure 5 shows the detail of Figure 1 with a valve body and mounting bracket of the backflow prevention valve being removed;
- Figure 6 shows a third cross-section of the detail of Figure 2 with two positions of the valve body of the backflow prevention valve, namely with a opened position and closes position of the valve body;
- Figure 7 shows a perspective front view of the valve body of the backflow prevention valve;
- Figure 8 shows a perspective back view of the valve body of the backflow prevention valve;
- Figure 9 shows a perspective front view of the mounting bracket of the back-flow prevention valve;
- Figure 10 shows a perspective back view of the mounting bracket of the backflow prevention valve.

[0022] The present disclosure relates to a novel backflow prevention valve of a gas burner appliance and to an assembly of a gas burner appliance comprising the backflow prevention valve.

[0023] Figure 1 shows a perspective view of an assembly 10 of a gas burner appliance comprising a fan assembly 11, a gas/air mixer 12, a gas valve 13 and a backflow prevention valve 20.

[0024] The assembly 10 shown is a premix assembly providing a gas/air mixture M (see Figure 1) to a burner (not shown) of the gas burner appliance. The gas/air mixture M is provided by the gas/air mixer 12, namely by

mixing a flow of gas G (see Figure 1) with a flow of air A (see Figure 1) within the gas/air mixer 12. The flow of gas G is provided by the gas valve 13. The fan assembly 11 is positioned downstream of the gas/air mixer 12.

[0025] The fan assembly 11 sucks in the gas/air mixture M which is provided by the gas/air mixer 12. The amount of flow of the gas/air mixture M depends on the fan speed of the fan assembly 11, wherein the fan speed of the fan assembly 11 depends on the desired burner load of the gas burner appliance.

[0026] The fan speed of the fan assembly 11 defines the amount of the air flow A sucked in through the gas/air mixer 12 and thereby the amount of the gas/air mixture flow M. The opening position of the gas valve 13 is preferably controlled in such a manner that at any desired burner loads and therefore at any fan speeds of the fan assembly 11 the mixing ratio of gas G and air A within the gas/air mixture M is kept constant.

[0027] The fan assembly 11 comprises a fan module 14 and an electronic module 15.

[0028] The fan module 14 of the fan assembly 11 has a fan module housing 16 comprising a fan plate housing part 17, a fan impeller housing part 18 and a collar housing part 19. The fan impeller housing part 18 is mounted to the fan plate housing part 17 at a first side of the fan plate housing part 17. The collar housing part 19 is mounted to the fan plate housing part 17 at an opposite second side of the fan plate housing part 17. The collar housing part 19 and the fan impeller housing part 18 are both firmly attached to the fan plate housing part 17.

[0029] The fan module 14 of the fan assembly 11 further has fan impeller (not visible). Said fan impeller is positioned at the first side of the fan plate housing part 17 within a first interior space of the fan module housing 16 defined by the fan plate housing part 17 and the fan impeller housing part 18. The fan impeller is driven by a fan motor (not visible) of the fan module 14. The fan module 14 of the fan assembly 11 further has a cooling impeller (not visible). Said cooling impeller is positioned at the second side of the fan plate housing part within a second interior space of the fan module housing 16 defined by the fan plate housing part 17 and the collar housing part 19.

[0030] The fan module 14 of the fan assembly 11 further has first electronic components (not visible) for controlling the operation of the fan assembly 14. Said first electronic components are positioned - together with the cooling impeller 22 and the fan motor - within the second interior space.

[0031] Said first electronic components may comprise a speed sensor and power components. Said first electronic components may be cooled by said cooling impeller, preferably together with motor winding of the fan motor.

[0032] The electronic module 15 of the fan assembly 11 has an electronic module housing 21.

[0033] The electronic module housing 21 of the electronic module 15 is releasably mounted to collar housing

part 19 of the fan module housing 16.

[0034] The electronic module 15 of the fan assembly 11 has second electronic components (not visible) for controlling the operation of the fan assembly 11, said second electronic components being positioned within said electronic module housing 21. Said second electronic components which are positioned in the electronic module housing 21 are electrically or electronically connected to said first electronic components which are positioned in the fan module housing 16.

[0035] Said electronic module 15 has in addition to the second electronic components third electronic components. Said third electronic components control the operation of other components of the gas burner appliance, e.g. of the gas valve 13 of the assembly 10. Said third electronic components may also control the operation of an ignition device of the gas burner appliance and/or the operation of a water pump the gas burner appliance and/or the operation of a water valve of the gas burner appliance.

[0036] The gas/air mixer 12 is mounted to the fan assembly 11 in such a way that the fan assembly 11, namely the fan impeller of the same, sucks in the gas/air mixture provided by the gas/air mixer 12 such that said gas/air mixture can flow to a gas/air mixture outlet 22 of a gas/air mixture flow channel 23. Said gas/air mixture flow channel 23 is defined by the fan plate housing part 17 and the fan impeller housing part 18.

[0037] The gas/air mixer 12 has a gas/air mixer housing 24. The gas/air mixer housing 24 may be an integral element of the fan impeller housing part 18. The gas/air mixer 12 is mounted to the fan assembly 11 in such a way that a gas/air mixture outlet (not visible) of the gas/air mixer housing 24 is in communication with a gas/air mixture inlet (not visible) of a gas/air mixture flow channel 23. In Figure 1, an air inlet 25 of the gas valve housing 24 is visible.

[0038] The gas valve 13 has a gas valve housing 26. The gas valve 13 is mounted to the gas/air mixer 12 in such a way that a gas outlet (not visible) of the gas valve housing 26 is in communication with a gas inlet (not visible) of the gas/air mixer housing 24. In Figure 1, a gas inlet 27 of the gas valve housing 25 is visible.

[0039] As mentioned above, the gas/air mixture flow channel 23 gas the gas/air mixture outlet 22 through which the gas/air mixture can be provided to the burner (not visible) of the gas burner appliance.

[0040] The backflow prevention valve 20 is positioned in the gas/air mixture flow channel 23 for closing and opening the gas/air mixture outlet 22. The backflow prevention valve 20 prevents backflow from a chimney (not shown) of the gas burner appliance into the assembly 10.

[0041] The backflow prevention valve 20 comprises a support structure 28, a valve body 29 and a mounting bracket 30.

[0042] The support structure 28 of the backflow prevention valve 20 is provided by the fan module housing 16, namely by a section of the fan impeller housing part

18.

[0043] The support structure 28 is preferably made from a rigid material or from a relative rigid material. The support structure 28 is preferably made from a metal like aluminium, wherein the support structure 28 defines at least partially said gas/air mixture outlet 22.

[0044] The support structure 28 provides posts 32 being an integral part of the support structure 28. So, the posts 32 and the support structure 28 are preferably made from metal.

[0045] The valve body 29 of the backflow prevention valve 20 is at least partially made from an elastic or flexible material or from a relative elastic or relative flexible material. The valve body 29 of the backflow prevention valve 20 is at least partially made from rubber or a rubber-like material like a silicone material. Said valve body 29 comprises a valve flap section 29a acting together with a valve seat 31 provided by the support structure 28, a valve mounting section 29b and valve hinge sections 29c through which the valve flap section 29a is connected to the valve mounting section 29b.

[0046] The mounting bracket 30 of the backflow prevention valve 20 is used to mount the valve body 29 at the support structure 28 in such a way that the valve mounting section 29b of the valve body 29 is sandwiched between the support structure 28 and the mounting bracket 30.

[0047] The mounting bracket 30 is preferably made from a rigid material or from a relative rigid material. The mounting bracket 30 is preferably made from a metal.

[0048] Preferably, the support structure 28 and the mounting bracket 30 are both made from metal.

[0049] The posts 32 of the support structure 28 act together with recesses or passage openings 33 of the mounting bracket 30 in such a way that the posts 32 penetrate through the recesses or passage openings 33 and mount the mounting bracket 30 and thereby the valve body 29 at the support structure 28 when the posts 32 are reformed e.g. by hydroforming. In a reformed status of the posts 32 the posts 32 fix the mounting bracket 30 and the valve body 29 at the support structure 28.

[0050] The support structure 28 comprises integral ribs 34 having a rounded surface 34a at which the valve hinge sections 29c of the valve body 29 are guided. The mounting bracket 30 comprises recesses or cutouts 35 in the region of the valve hinge sections 29c of the valve body 29. These elements allow a defined movement of the valve flap 29a for closing and opening the backflow prevention valve 30 without a damaging risk of the valve body 29, namely of the valve hinge sections 29c of the valve body 29.

[0051] The valve mounting section 29b of the valve body 29 comprises at least one compression protrusion 36 or compression bead at a side of the valve mounting section 29b facing towards the mounting bracket 30. Said at least one compression protrusion 36 or compression bead is in contact with the mounting bracket 30 and is compressed by the mounting bracket 30. This provides

a reliable functionality of the backflow prevention valve 20, namely by providing a good sealing in the region of the valve mounting section 29b of the valve body 29.

[0052] Further on, the at least one compression protrusion 36 or compression bead provided at the valve mounting section 29b of the valve body 29 reduces stress transmitted to the valve hinge sections 29c of the valve body 29.

[0053] The valve hinge sections 29c of the valve body 29 comprise reinforcement protrusions 37 extending between the valve mounting section 29b and the valve flap section 29a at edges of the valve hinge sections 29c.

[0054] Said reinforcement protrusions 37 of the valve hinge sections 29c are provided at opposite sides of the valve body 29, namely at a side facing towards the support structure 28 and at a side facing away from the support structure 28. The reinforcement protrusions 37 provide a reliable functionality of the backflow prevention valve 20, namely by providing a defined movement of the valve flap 29a when closing and opening the backflow prevention valve 20.

[0055] The valve flap section 29a of the valve body 29 comprises slots 38 at a side facing away from the support structure 28 and facing away from the valve seat 31 provided by the support structure 28. The slots 23 provide flexibility to the valve flap section 29a to compensate flatness imperfections of the valve flap section 29a.

[0056] The valve flap section 29a of the valve body 29 further comprises a sealing protrusion 39 or sealing bead at a side facing towards the support structure 28 and facing towards the valve seat 31 provided by the support structure 28.

[0057] The side of the valve flap section 29a of the valve body 29 facing away from the valve seat 31 is rounded. This reduces the risk that the valve flap section 29a may stick at a surface when the backflow prevention valve 20 is opened.

[0058] The side of the valve flap section 29a of the valve body 29 facing towards from the valve seat 31 is flat. This provides a proper sealing function when the backflow prevention valve 20 is closed.

[0059] The valve body 29 of the backflow prevention valve 20 is provided by one monolithic element.

[0060] According to a first alternative, the valve flap section 29a and the valve mounting section 29b and the valve hinge sections 29c of the valve body 29 are all completely made from the rubber or the rubber-like material like the silicone material.

[0061] According to a second alternative, the valve hinge sections 29c and the valve mounting section 29b of the valve body 29 are completely made from the rubber or the rubber-like material, whereas the valve flap section 29a of the valve body 29 is partially made from the rubber or the rubber-like material. In this case, the valve flap section 29a comprises preferably a metal core element which is overmolded by the rubber or the rubber-like material. In this case the weight of the valve flap section 29a of the valve body 29 can be adjusted, e.g. by providing

a valve flap section 29a having a weight between 4 grams and 15 grams. This provides a very beneficial sealing function when the backflow prevention valve 20 is closed.

[0062] The novel backflow prevention valve 20 has a simply construction requiring a minimum of parts and space. The construction is cost effective. The novel backflow prevention valve 20 prevents backflow from a chimney in a reliable manner.

10 List of reference signs

[0063]

10	assembly
15	11 fan assembly
	12 gas/air mixer
	13 gas valve
	14 fan module
	15 electronic module
20	16 fan module housing
	17 fan plate housing part
	18 fan impeller housing part
	19 collar housing part
20	20 backflow prevention valve
25	21 electronic module housing
	22 gas/air mixture outlet
	23 gas/air mixture flow channel
	24 gas/air mixer housing
	25 air inlet
30	26 gas valve housing
	27 gas inlet
	28 support structure
	29 valve body
	29a valve flap section
35	29b valve mounting section
	29c valve hinge section
	30 mounting bracket
	31 valve seat
	32 post
40	33 recess / passage opening
	34 rib
	34a surface
	35 recess / cutouts
	36 compression protrusion
45	37 reinforcement protrusion
	38 slot
	39 sealing protrusion

50 Claims

1. Backflow prevention valve (20) of a gas burner appliance positioned in a gas/air mixture flow channel (23) having a gas/air mixture outlet (22) through which a gas/air mixture can be provided to a burner of the gas burner appliance, comprising:

a support structure (28) provided by a fan mod-

- ule housing (16) of the gas burner appliance, wherein the support structure (28) defines at least partially said gas/air mixture outlet (22), wherein the support structure (28) comprises posts (32) being an integral part of the support structure (28);
 a valve body (29), wherein the valve body (29) comprises a valve flap section (29a) acting together with a valve seat (31) provided by the support structure (28), a valve mounting section (29b) and valve hinge sections (28c) through which the valve flap section (29a) is connected to the valve mounting section (29b);
 a mounting bracket (30) for mounting the valve body (29) at the support structure (28) in such a way that the valve mounting section (29b) of the valve body (29) is sandwiched between the support structure (28) and the mounting bracket (30), wherein the mounting bracket (30) comprises recesses or passage openings (33), wherein the posts (32) of the support structure (28) act together with recesses or passage openings (33) of the mounting bracket (30) in such a way that the posts (32) of the support structure (28) penetrate through the recesses or passage openings (33) of the mounting bracket (30) and mount the mounting bracket (30) and thereby the valve body (29) at the support structure (28) in a reformed status of the posts (28).
2. Backflow prevention valve as claimed in claim 1, **characterized in that** the support structure (28) is made from a rigid material or from a relative rigid material, preferably from metal, the valve body (29) is at least partially made from an elastic or flexible material or from a relative elastic or flexible material, preferably from rubber or a rubber-like material, the mounting bracket (30) is made from a rigid material or from a relative rigid material, preferably from metal.
 3. Backflow prevention valve as claimed in claim 1 or 2, **characterized in that** the support structure (28) comprises ribs (34) having a rounded surface (34a) at which the valve hinge sections (29c) of the valve body (29) are guided.
 4. Backflow prevention valve as claimed in one of claims 1 to 3, **characterized in that** the mounting bracket (30) comprises recesses or cutouts (35) in the region of the valve hinge sections (29c) of the valve body (29).
 5. Backflow prevention valve as claimed in one of claims 1 to 4, **characterized in that** the valve mounting section (29b) of the valve body (29) comprises at least one compression protrusion (36) or at least one compression bead at a side of the valve mounting section (29b) facing towards the mounting bracket (30), said at least one compression protrusion (36) or at least one compression bead is in contact with the mounting bracket (30) and is compressed by the mounting bracket (30).
 6. Backflow prevention valve as claimed in one of claims 1 to 5, **characterized in that** the valve hinge sections (29c) of the valve body (29) comprise reinforcement protrusions (37) extending between the valve mounting section (29b) and the valve flap section (29a) at edges of the valve hinge sections (29c).
 7. Backflow prevention valve as claimed in claim 6, **characterized in that** the reinforcement protrusions (37) of the valve hinge sections (29c) are provided at opposite sides of the valve body (29), namely at a side facing towards the support structure (28) and at a side facing away from the support structure (28).
 8. Backflow prevention valve as claimed in one of claims 1 to 7, **characterized in that** the valve flap section (29a) of the valve body (29) comprises slots (38) at a side facing away from the support structure (28) and facing away from the valve seat (31) provided by the support structure (28).
 9. Backflow prevention valve as claimed in one of claims 1 to 8, **characterized in that** the valve flap section (29a) of the valve body (29) comprises a sealing protrusion (39) or sealing bead at a side facing towards from the support structure (28) and facing towards the valve seat (31) provided by the support structure (28).
 10. Backflow prevention valve as claimed in one of claims 1 to 9, **characterized in that** the valve body (29) is provided as one monolithic element.
 11. Backflow prevention valve as claimed in one of claims 1 to 10, **characterized in that** the valve flap section (29a), the valve mounting section (29b) and the valve hinge sections (29c) are all completely made from rubber or rubber-like material.
 12. Backflow prevention valve as claimed in one of claims 1 to 11, **characterized in that** the valve hinge sections (29c) and the valve mounting section (29b) are both completely made from the rubber or the rubber-like material, the valve flap section (29a) is partially made from the rubber or the rubber-like material, wherein the valve flap section (29) comprises a metal core ele-

ment which is overmolded by the rubber or the rubber-like material.

13. Backflow prevention valve as claimed in in one of claims 1 to 12, **characterized in that** the valve flap section (29a) has weight between 4 grams and 15 grams.

14. Assembly (10) of a gas burner appliance, comprising

a fan assembly (11) having fan module (14) and an electronic module (15), said fan module (14) having

a fan module housing (16) comprising a fan plate housing part (17), a fan impeller housing part (18) and a collar housing part (19), wherein the fan impeller housing part (18) is mounted to the fan plate housing part (17) at a first side of the fan plate housing part (17), and wherein the collar housing part (19) is mounted to the fan plate housing part (17) at an opposite second side of the fan plate housing part (17);

a gas/air mixer (12) having a gas/air mixer housing (24) for providing a gas/air mixture by mixing gas and air,

wherein the gas/air mixer (12) is mounted to the fan assembly (11) in such a way that the fan assembly (11) sucks in the gas/air mixture provided by the gas/air mixer (12) such that said gas/air mixture flows to a gas/air mixture outlet (22) of a gas/air mixture flow channel (23);

a backflow prevention valve (20) positioned within the gas/air mixture flow channel (23);

characterized in that the backflow prevention valve (20) is provided by the backflow prevention valve as claimed in one of claims 1 to 13.

15. Assembly (10) of claim 14, comprising

a gas valve (13) having a gas valve housing (26), wherein the gas valve (13) is mounted to the gas/air mixer (12) in such a way that a gas outlet of the gas valve housing (26) is in communication with a gas inlet of the gas/air mixer housing (24),

wherein the gas/air mixer (12) is mounted to the fan assembly (11) in such a way that a gas/air mixture outlet of the gas/air mixer housing (24) is in communication with a gas/air mixture inlet of the gas/air mixture flow channel (23).

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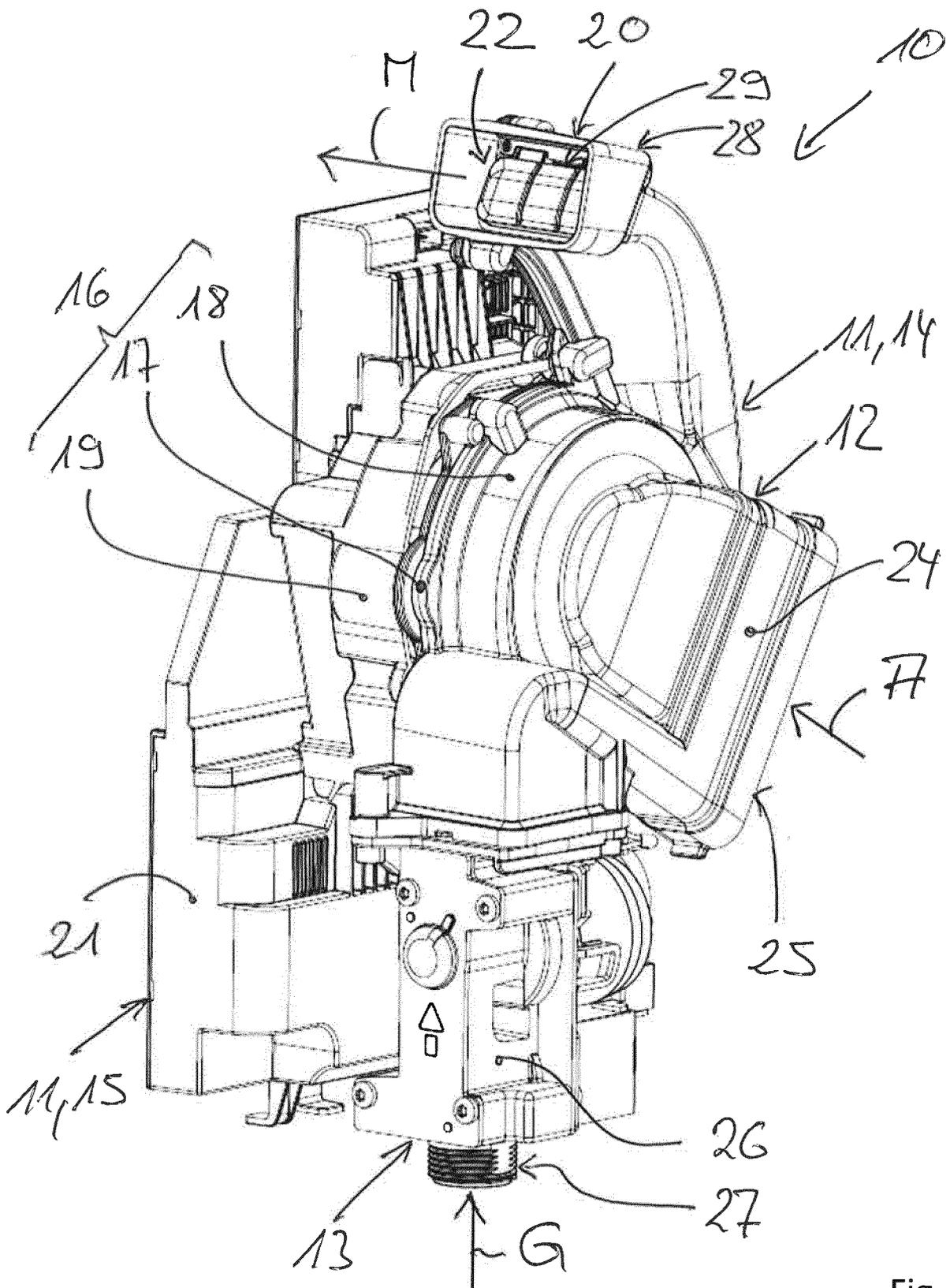


Fig. 1

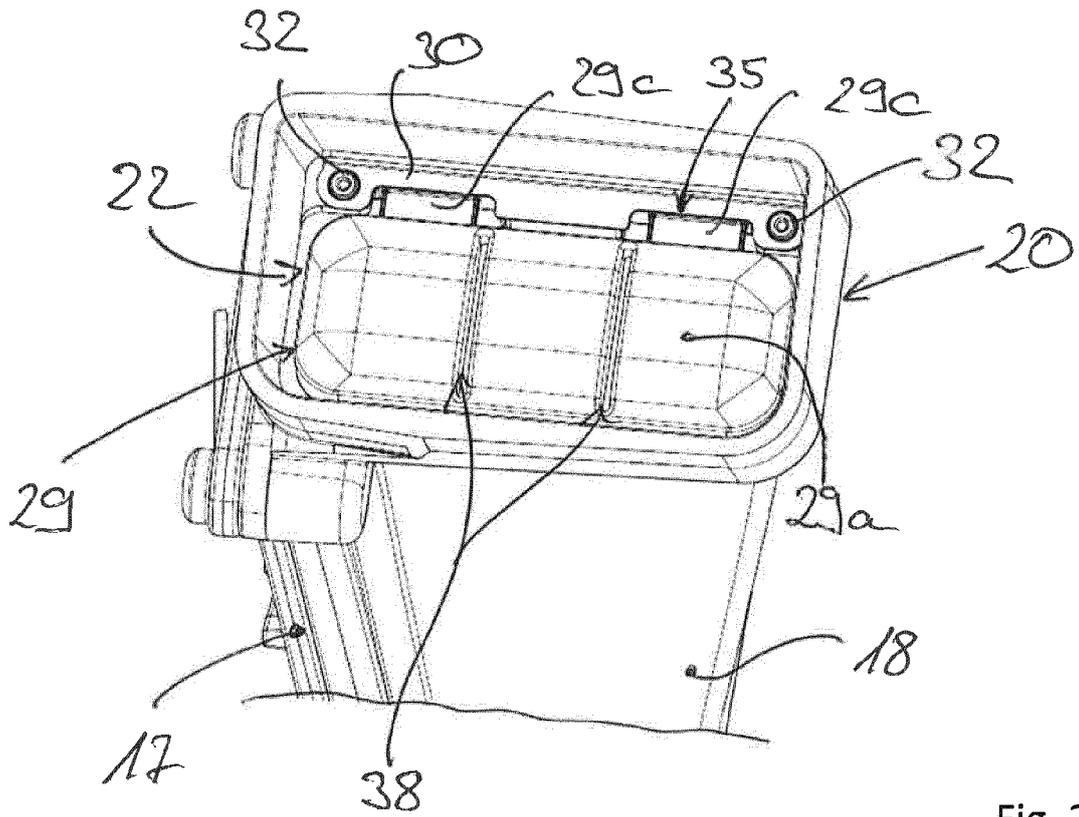


Fig. 2

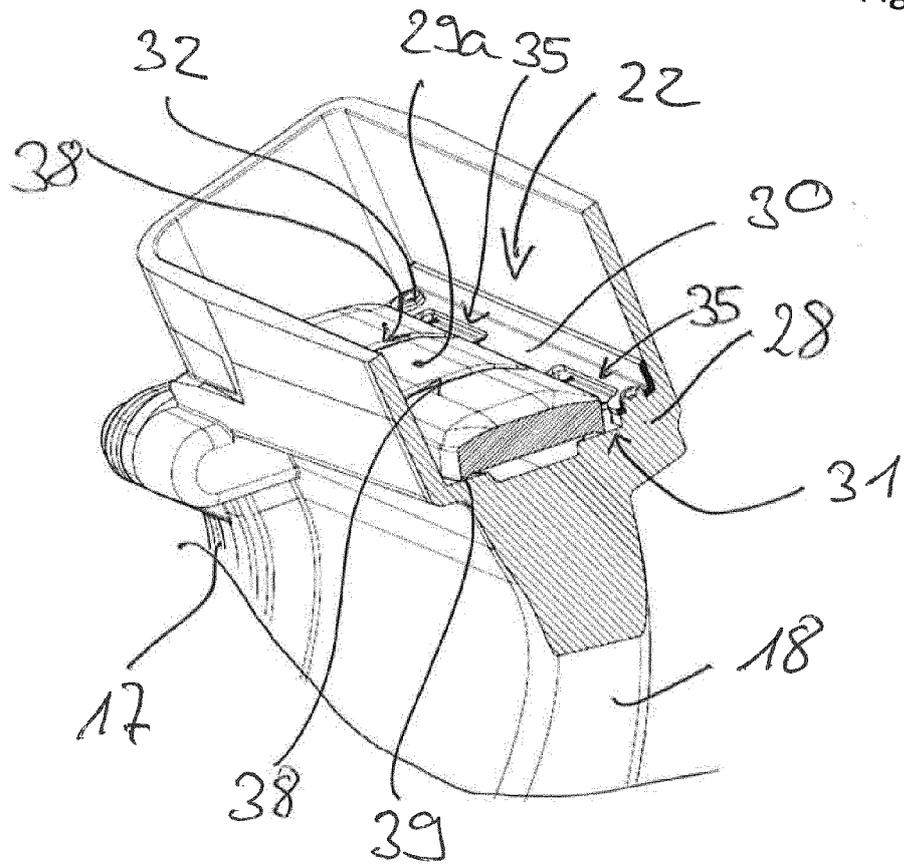


Fig. 3

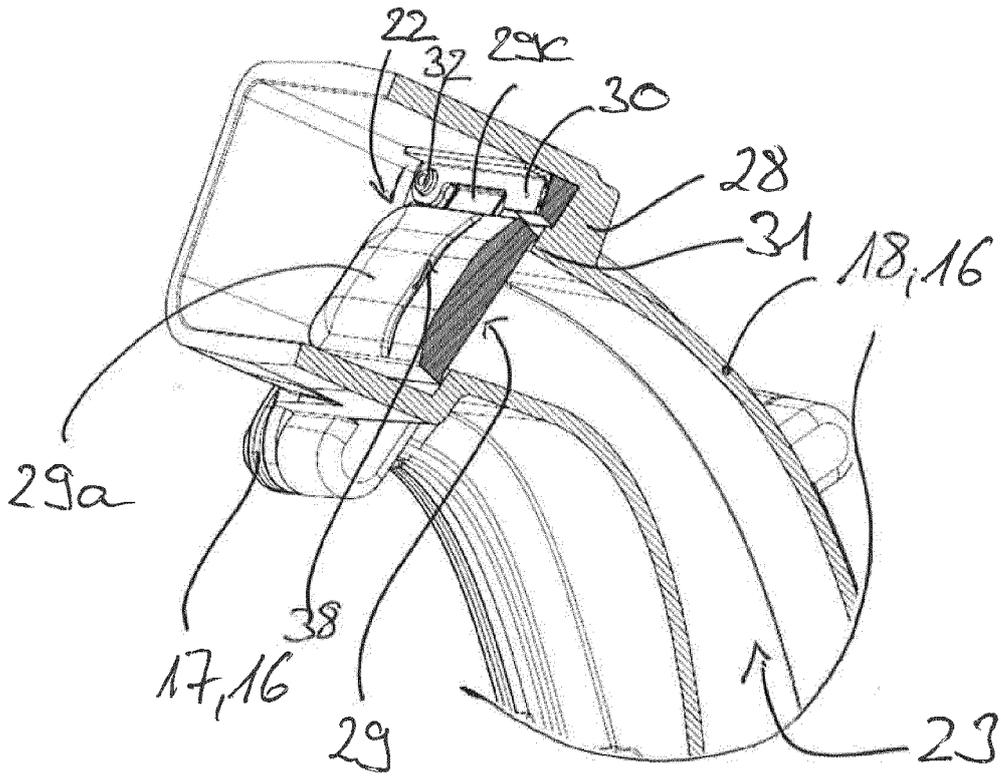


Fig. 4

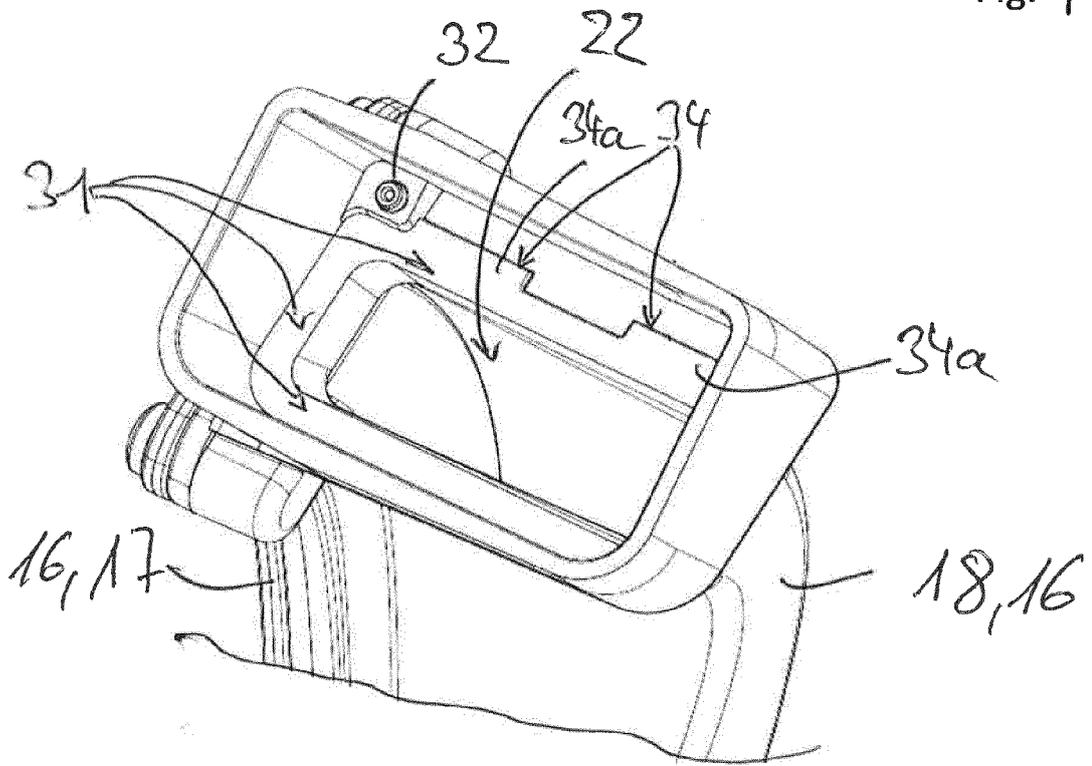


Fig. 5

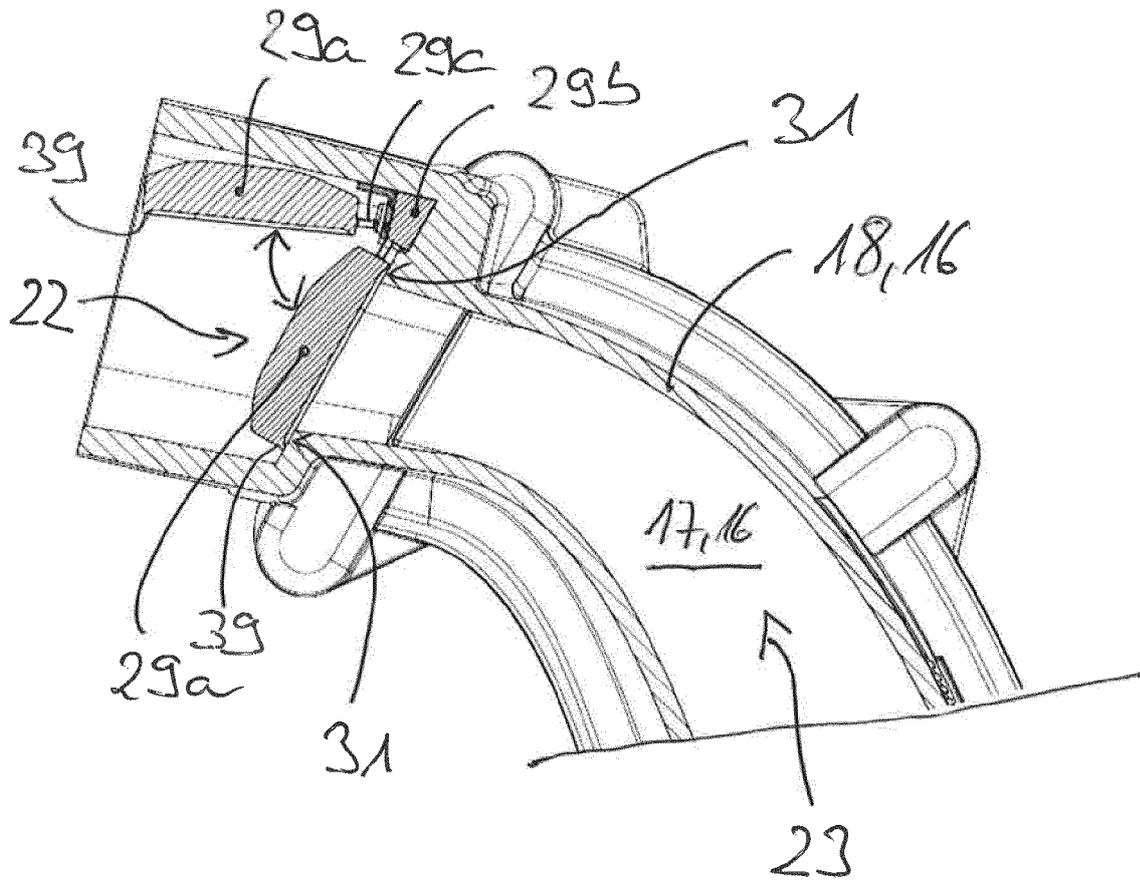


Fig. 6

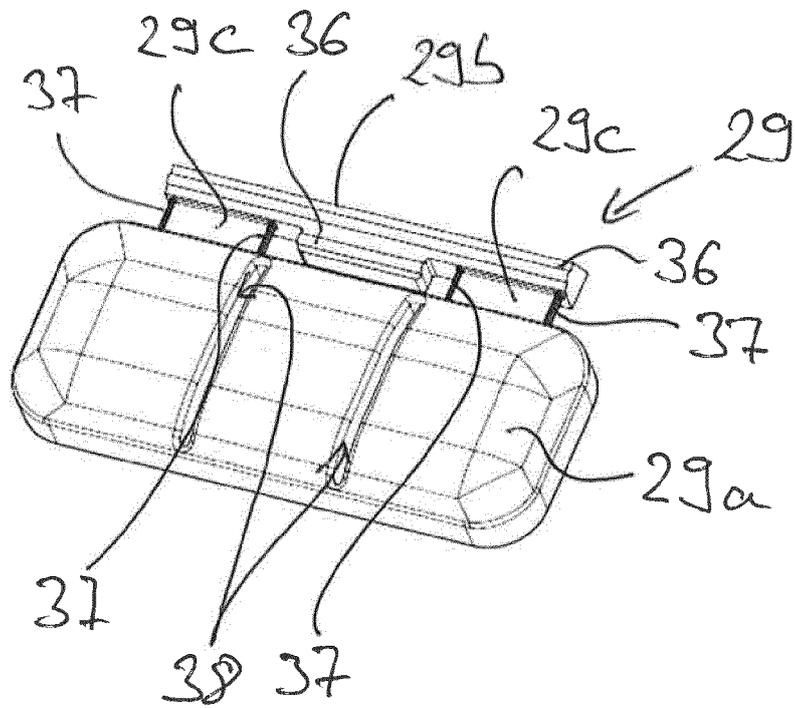
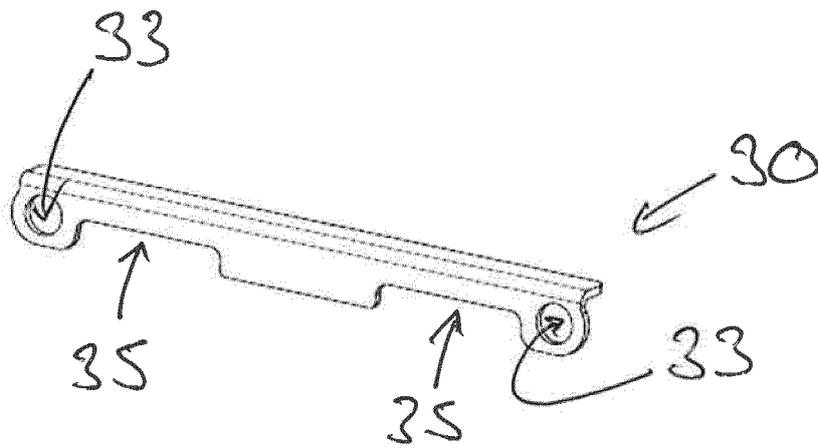
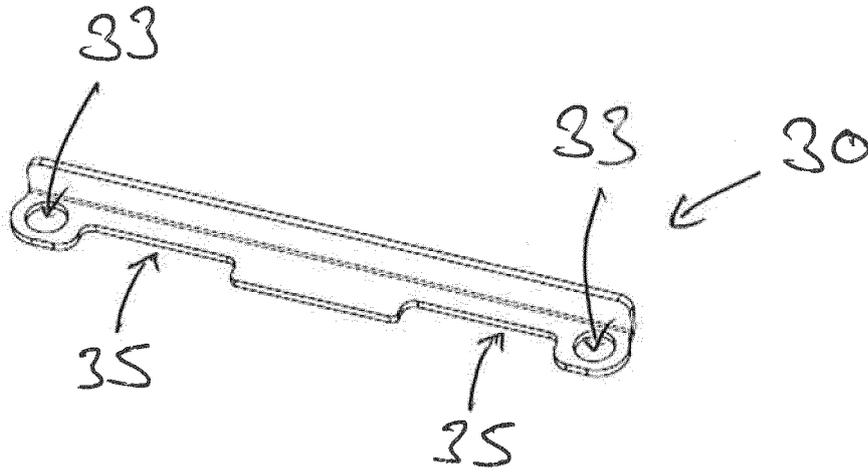
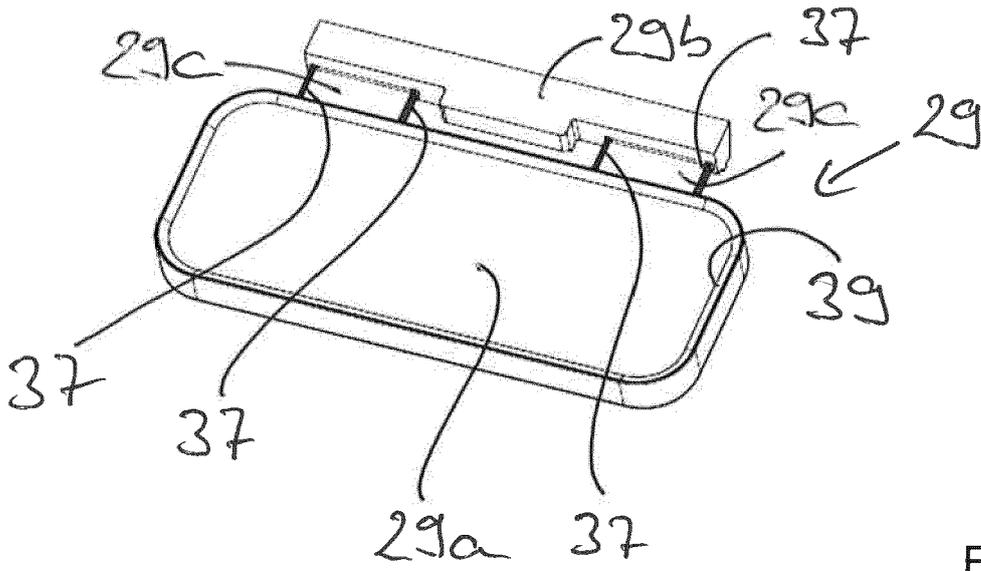


Fig. 7





EUROPEAN SEARCH REPORT

Application Number
EP 19 17 7940

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search Munich		Date of completion of the search 7 October 2019	Examiner Hauck, Gunther
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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