

(19)



(11)

EP 4 495 497 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.01.2025 Bulletin 2025/04

(51) International Patent Classification (IPC):
F24F 13/08 ^(2006.01) **F24F 13/14** ^(2006.01)
F24F 13/20 ^(2006.01) **F24F 13/32** ^(2006.01)

(21) Application number: **23187114.6**

(52) Cooperative Patent Classification (CPC):
F24F 13/084; **F24F 13/1486**; **F24F 13/20**;
F24F 13/32; **F24F 2221/36**

(22) Date of filing: **21.07.2023**

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

(72) Inventors:
• **Sa'dduin, Rami**
61130 Nidderau (DE)
• **Sipilä, Tomi**
18300 Heinola (FI)
• **Sutinen, Markku**
06150 Porvoo (FI)

(71) Applicant: **Viessmann Refrigeration Solutions
GmbH**
35108 Allendorf (DE)

(74) Representative: **Sperschneider, Alexandra**
Die Patenterie GbR
Patent- und Rechtsanwaltssozietät
Nürnberger Straße 19
95448 Bayreuth (DE)

(54) **COUPLING DEVICE, AIR CONTROL UNIT WITH COUPLING DEVICE AND COOLING UNIT WITH COUPLING DEVICE**

(57) The invention discloses a coupling device (1) for cooling units at least comprising one strut reinforced

basic body (2) and an at least partially bud-shaped portion.

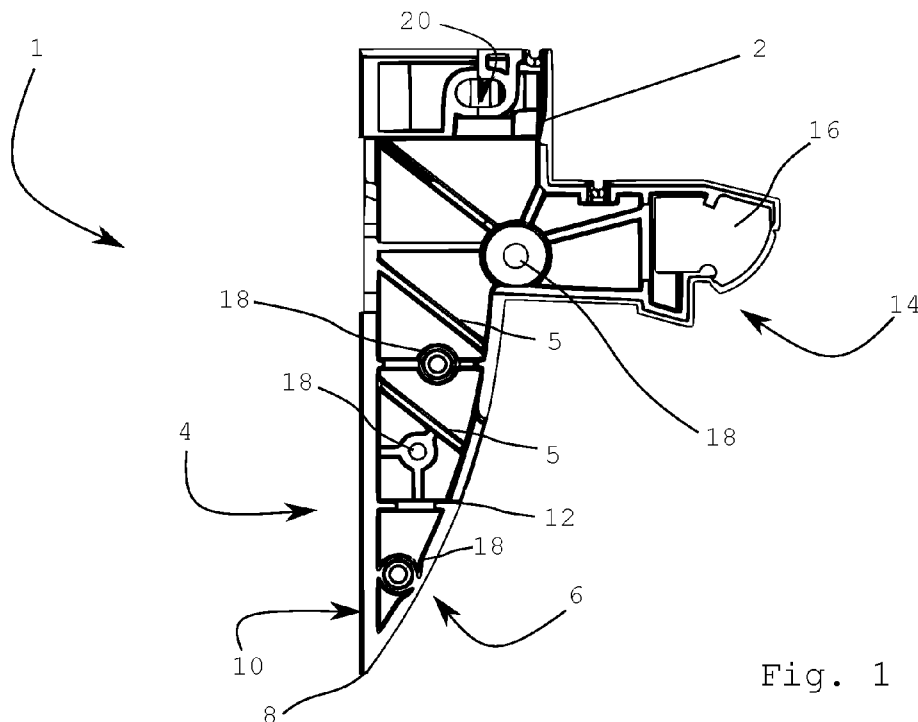


Fig. 1

EP 4 495 497 A1

Description

[0001] The present invention discloses a coupling device, an air control unit, and a cooling unit with at least such a coupling device and/or at least an air control unit.

FIELD OF INVENTION

[0002] The application relates to an improved air guidance in a cooling unit, for example a cooling island or cooling cabinet, especially to achieve an uniform air curtain avoiding turbulences, moisture intake, snow accumulation an increased energy consumption.

PRIOR ART

[0003] Known air deflectors are made of bent sheet metal. Since the shape and the tolerances are very difficult to control, the construction results in inconsistencies in shape and location of said air deflectors. This means that known air deflectors show a high inaccuracy resulting in distorted air flows and air curtains within the cooling units which are, however, necessary for the cooled goods in the cooling unit. So, the risk of deterioration and unusability of the goods is high.

SUMMARY OF INVENTION

[0004] The object of the present invention is to simplify the connection of air guiding channel parts for cooling units. Another object of the present invention is improving the stability of the connection of air guiding channel parts with respect to vibrations of the cooling aggregate. It is also object of the present invention that air turbulences, moisture intake, snow accumulation an increased energy consumption of the cooling unit are avoided. Finally, it is also object of the present invention that homogenous and uniform air curtains in cooling units are provided.

[0005] This object is solved by the invention according to claim 1, claim 9 and claim 13.

[0006] A key point of the invention is a coupling device for cooling units at least comprising a basic body having a front side and a backside wherein both sides differ in their geometric embodiment, wherein the coupling device comprises at least an at least partially bud-shaped portion and at least one lateral projection portion which is arranged in vertical direction above the at least partially bud-shaped portion.

[0007] The advantage of this coupling device is the at least partially bud-shaped structure which is configured to hold an air guiding element. Especially this at least partially bud-shaped structure of the coupling device is advantageous for the at least one guided air flow. Due to this at least partially bud-shaped geometry, an especially smooth and non turbulent air flow results. Moreover, the at least one lateral projection is advantageous for stabilizing the whole basic body.

[0008] Further advantageous embodiments are part of

the subclaims.

[0009] In an advantageous embodiment of the coupling device, the basic body is designed to be at least partially strut-reinforced. The at least partially strut-reinforced basic body is very light weight and very stable. By using the struts, this allows unnecessary material to be saved, while at the same time ensuring particularly high stability and effective force transfer.

[0010] In a present embodiment of the invention the front side of the basic body is rib-shaped due to the several struts extending at least partially along the front side protruding therefrom. This ensures the stability and the light weight of the coupling device. The coupling device can be advantageously produced via injection moulding or additive manufacturing (e.g. 3D printing).

[0011] In addition, it is possible that at least one or more through holes are provided through which fixing means can be guided. These through openings can have an internal thread. In the simplest embodiment example, the fixing means may be in the form of screws. These through openings are used later in the installation process to combine a vertical beam and air guidance element via the coupling device with each other.

[0012] However, the through openings can also be used to connect coupling device and air guidance element and/or coupling device and vertical beam, later in the installation process.

[0013] In a further present embodiment of the invention, the bud-shaped portion also comprises at least partially a bud-shaped protrusion on its backside. It is advantageous for the air flow guidance, also called air curtain, within the cooling unit. This at least one protrusion is suitable for receiving at least one air guidance element at which the striking airflow splits up and can thus be guided onwards in a targeted manner.

[0014] In the simplest embodiment example, the at least one air guidance element is mounted at least partially on the at least one at least partially bud-shaped protrusion. Moreover, due to the special shaped protrusion, it is possible to couple the corresponding air guidance element, which can be provided as an aluminium profile, in a very secured way. The free end of the air guidance element is slid on the protrusion, covering it. So, the protrusion is to be understood as a support for positioning the air guidance element. This is advantageous because this arrangement results in a very stable position of the air guidance element avoiding air flow turbulences or moisture intake, for example.

[0015] In a very advantageous embodiment, the air guidance elements are provided as aluminium profiles (Al-profiles). By coupling the Al-profile with the coupling device, especially with two coupling devices, at each of the two free ends of each the Al-profile for providing the smallest unit of an air control unit. The coupling devices, which can be made of plastic, ensure that the air guidance element is fixed in a secure position.

[0016] In a further present embodiment of the invention, the at least one lateral protrusion of the basic body

comprises at least one guiding channel for at least one transmission means and/or at least one emission means. The at least one lateral protrusion being part of the basic body is advantageous for guiding means. These means can be for example LED stripes, electric cables and/or control cables.

[0017] The list is not complete, so that other types of transmission or emission conductors may also be present. For this purpose, the projection is designed in such a way that it expands a hollow interior volume. In this way, cables can be inserted, laid or be removed quickly and easily without the need for complex holes in the basic body itself. It is possible to avoid complex aluminium profiles for guiding cables. The coupling device which is advantageously made of plastic, is a very cheap and flexible solution for introducing and guiding conductor elements.

[0018] In a further present embodiment of the invention, the backside of the basic body provides a further protrusion. This can be shaped rectangular or even squared. This further protrusion is arranged in vertical direction higher than the at least partially bud-shaped protrusion. This further protrusion can be understood as a guidance for at least one support element. The at least one support element can have a multi-edged design. The at least one support element provides the connection between coupling device and other components of the air control unit. For example, it is conceivable that the support element holds the further projection, for example, it can be plugged onto it.

[0019] In a further present embodiment of the invention, the coupling device can be formed by two basic bodies. This is advantageous because in dependence of the construction of the cooling unit, coupling devices with just one basic body and/or coupling device with two basic bodies can be provided. If a coupling device with two basic bodies is needed, the two basic bodies are arranged in a mirror symmetrical way. In a preferred embodiment, the mirror plane is arranged in vertical direction along the straight side of the basic body. By arranging the basic bodies in this way, a bud-shaped portion results with a vertically downward directed tip-shaped free end. This mirror symmetrical bud-shaped portion provides advantageously two at least partially bud-shaped protrusions on its backside. These two protrusions are necessary for the mounting of two air guidance elements, one for each protrusion. It has shown especially advantageous in this respect if the at least one air guidance element shows the outer outline shape of the bud-shaped portion.

[0020] If, for example, two base bodies are provided with mirror symmetry to each other, one air guidance element can also be accommodated by the projection of the bud-shaped portion of each base body. Of course, it is also imaginable that only one air guidance element is provided, which is accommodated by both projections accordingly.

[0021] Due to the advantageous geometric shape of

the free end of the coupling device in combination with the mounting of the at least one air guidance element, it is possible for the first time to provide smooth air flows on predetermined flow paths. This can significantly improve the cooling effect of the cooled air flow in cooling units.

[0022] But this kind of guiding is, of course, not limited to the doubled basic body coupling device. It is also possible for a wall arranged cooling cabinet having coupling devices with only one basic body each.

[0023] In a further advantageous embodiment, the cooling unit in which the coupling devices are used, is made as a cooling island or a cooling cabinet. In dependence of the cooling unit, there are two main possibilities to provide the coupling device.

[0024] There are cooling units which are arranged directly on the wall of a supermarket store. This kind of cooling unit is generally accessible only from one main front direction. The rear wall is arranged against the wall. The cooling unit can be also called a single cooling cabinet. For this embodiment, each coupling device comprises just one basic body.

[0025] On the other hand, large supermarkets often provide freestanding cooling units which are also called cooling islands. These can be accessed by all sides and, for example, provide two or more physically separated cooling areas. For this kind of cooling island, the provided coupling devices can comprise two basic bodies which are arranged in a mirror symmetrical way to each other. However, it is also imaginable that in such cooling islands coupling devices with a single basic body and coupling devices with two basic bodies are used.

[0026] In a further advantageous embodiment, the coupling device comprises further at least one recess for accommodating at least one component connector and/or at least one component connector housing. This is very advantageous for the later mounting procedure of the cooling unit. By using component connectors and/or component connector housings, it is very fast to connect wall elements, e.g., made of glass, to arrange the cooling unit. An unnecessarily high pressure on the wall elements can be avoided. In a simple example, each basic body provides one recess. Advantageously, the recess is accessible from the top. So, it can be easily handled during the mounting or even during the repairing, if necessary.

[0027] Moreover, the present invention also discloses an air control unit with at least one coupling device as described above. The air control unit further comprises at least one air guidance profile, what is to be understood synonymous to air guidance element, which is connected via the at least one at least partially bud-shaped protrusion on the backside of the corresponding basic body.

[0028] In a further advantageous embodiment, the at least one coupling device is further connected to at least one vertical beam. This vertical beam can be understood as the connector between the at least one coupling device on the one hand and the cooling unit on the other hand. As example, the beam can be made of metal. The

beam is fixed on the front side of the basic body stabilizing its position. In dependence of the cooling unit size, it is imaginable that two or more beams are provided to secure the position of the coupling devices within the cooling unit.

[0029] In addition, it is also imaginable to use fixing means, for example screws, to couple the vertical beam via the coupling device with the air guidance element. This represents a simplified and quick mounting since the coupling device provides several holes through which the fixing means can be guided.

[0030] In a further advantageous embodiment, the air control unit can further comprise at least one honeycomb structure element which is designed to be permeable to air flow. Advantageous, this honeycomb structure element is arranged in cooled air flow direction after the air guidance element. So, the cooled air flow is initially guided along the air guidance elements to then flow in and through the at least one honeycomb structure element. Here, too, the number of honeycomb elements depends on the size of the whole cooling unit. The honeycomb structure element is advantageously because it splits off the inflowing cooled air flow in a smooth way. So, the resulting flow paths of the splitted cooled air flow are curtainlike resulting is a very effective, non-turbulent cooling curtain. Moreover, the resulting layered cooling curtain can be arranged in every direction which is needed. So, for example, horizontal and/or vertical directed cooling curtains are also possible to provide.

[0031] In a further advantageous embodiment, the air control unit also comprises at least further support elements for arranging insulation elements. This is an advantage because these insulation elements keep the cooled air flow cold and effective.

[0032] Finally, the present invention also discloses a cooling unit with at least one coupling device and/or with at least one air control unit.

[0033] Further advantages, features and configuration possibilities result from the following figure description of non-restrictive embodiment examples.

BRIEF DESCRIPTION OF THE DRAWING

[0034] Embodiments of the invention are described and shown by way of examples and with reference to the accompanying drawings in which:

Fig. 1 shows a front view of the front side of a coupling device;

Fig. 2 shows a front view of the back side of a coupling device;

Fig. 3 shows a perspective view of Fig. 1;

Fig. 4 shows a perspective view of Fig. 2;

Fig. 5 shows a perspective view of an example of

parts of an air control unit;

Fig. 6 shows a perspective view of an example of further parts of an air control unit;

Fig. 7 shows a perspective view of an example of further parts of an air control unit of Fig. 6 in a different perspective view;

Fig. 8 shows an enlarged section of an example of an air control unit for a single cooling unit;

Fig. 9 shows an example of an air control unit for a single cooling unit;

Fig. 10 shows another embodiment of the present inventions from front view;

Fig. 11 shows another embodiment of the present inventions from back view;

Fig. 12 shows a perspective view of an example with further parts of an embodiment of Fig. 10 in a different perspective view;

Fig. 13 shows a perspective view of a further example with further parts of an embodiment of Fig. 10 in a different perspective view;

Fig. 14 shows a perspective view of a further example with further parts of an embodiment of Fig. 10 in a different perspective view;

Fig. 15 shows a section of an air control unit with the coupling device embodiment according to Fig. 10; and

Fig. 16 shows a perspective view of an air control unit for a cooling unit.

[0035] In the drawings, elements provided with the same reference signs essentially correspond to each other, unless otherwise indicated. Furthermore, components are not shown and described which are not essential for understanding the technical teachings disclosed herein. Furthermore, the reference signs are not repeated for all elements already introduced and shown, provided that the elements themselves and their function have already been described or are known to a person skilled in the art.

DETAILED DESCRIPTION OF EMBODIMENT EXAMPLES

[0036] In Fig. 1 a front view of a coupling device 1 is shown. More precisely, the front side 4 of the basic body 2 of the coupling device 1 is shown here. It is further shown that the front side provides several struts 5, which can be

arranged diagonally and/or in any direction. The basic body 2 further comprises an at least partially bud-shaped portion 6 extending from top to bottom and ending in a tip-like free end 8.

[0037] The bud-shaped portion 6 is only formed partially bud-shaped having in this example on straight side 10. The path of the opposite side 12 is formed convex curved. So, an at least partially bud-shape results.

[0038] Moreover, the convex curved side 12 is followed by a lateral projection portion 14 extending sideways. This projection portion 14 can also comprise a guiding channel 16 for at least one transmission and/or emission means (not shown here). This guiding channel 16 enables the fast and easy guiding of cables or LED stripes, for example.

[0039] Finally, the front side 4 also provides several through holes 18. These through holes 18 are used for fixing the vertical beam (not shown here) to the coupling device 1 front side 4.

[0040] In vertical direction on the top of the coupling device 1, there is a recess 20 in which at least one component connector and/or at least one component connector housing (not shown here) can be arranged. By using this fixing system - component connector and component connector housing - a very easy and fast mounting of two parts can be realised. Advantageously, the component connector housing is already arranged in the recess 20. After arranging two wall parts, for example, of the cooling unit to one another, the component connector is inserted in the recess 20 and so also in the component connector housing and finally tilted around certain degrees resulting in a safe but releasable position.

[0041] In Fig. 2 the back side 22 of the coupling device 1 is shown. This backside 22 provides several protrusions. At first, the at least bud-shaped portion 6 provides a protrusion 24. This protrusion 24 is also shaped according to the at least partially bud-shaped portion 6 being spaced from its edges. This protrusion can serve as a support for the air guidance element (not shown here). Moreover, a second protrusion 26 can be also provided on the backside 22.

[0042] Finally, the back side 22 may provide a third protrusion 28 which is used for the arrangement of an insulation panel (not shown here).

[0043] Fig. 3 discloses a perspective view of the front side 2 of Fig. 1. Fig. 4 discloses a perspective view of the back side 22 of Fig. 2. In Fig. 3 and Fig. 4 it is clearly shown that the struts 5 and the protrusions 24, 26, 28 are protruding.

[0044] Fig. 5 shows a section of an air control unit 30 for a single cooling unit. Here, two coupling devices 1 are arranged in line but separated with an air guidance element 32. To arrange the air guidance element 32, it is necessary that both coupling devices 1 are arranged by their back side to each other. So, the protrusions 24 can be used for mounting the also at least partially bud-shaped air guidance element 32.

[0045] In Fig. 6 and Fig. 7 another embodiment of the air control unit 30 is shown. Here, additionally, a covering means 34 for the air channel (not shown here) is disclosed. Fig. 6 and Fig. 7 just differ in their perspective view. The covering means 34 is additionally mounted on the further protrusion 28 of the backside 22 (not shown here).

[0046] Fig. 8 shows an enlarged section of an example of an air control unit 30 for a single cooling unit. The front side 4 of the coupling device 1 is shown. The at least partially bud-shaped portion 6 relates to the air guidance element (here not shown). In addition, the coupling device 1 is covered with an additional cover means 34a to avoid dust contamination and unbalanced air flow. Below the lateral projection 14, a honeycomb structure element 38 is placed on a support 39. This support 39 is followed by a side wall 40 extending in vertical direction. As indicated by using reference F, the cooled air flow flows from bottom upwards, along the convex side 12 with the air guidance elements (not shown in detail here), passing through the honeycomb structure element 38 and leaving a staggered air flow F1.

[0047] Fig. 9 shows an example of an air control unit 30 for a single cooling unit to be arranged on a wall (not shown here). The coupling device 1, more specific, its front side 4 is coupled with a vertical beam 36 via fixing means. Moreover, the coupling device 1 is connected to a covering means 34a which protects the air flow from dust. At a distance to the convex curved side 12 of the coupling device 1, two honeycomb structure elements 38 are arranged. Below these two honeycomb structure elements 38, a side wall 40 is mounted to avoid the air flow guided within to flow in an uncontrolled way. By using the side wall 40 in combination with the air guidance element (not shown here) and the honeycomb structure elements 38, the air flow flows along path F from bottom upwards, passes the air guidance elements, flows through the honeycomb structure elements 38 resulting in smooth, staggered flow paths F1 as shown in Fig. 8.

[0048] In Fig. 10 and Fig. 11 another embodiment of the present invention is disclosed.

[0049] In Fig. 10 a front view of another coupling device 1 is shown. Here, this coupling device 1 comprises two basic bodies 2. The basic bodies 2 are arranged via their straight sides 10 resulting in a mirror plane M. So, both basic bodies are arranged in a symmetrical way to each other. It is imaginable to use two single basic bodies 2 and to fix them at each other. But it is also possible to produce this double-bodied coupling device 1 as one piece via injection moulding or additive manufacturing. This embodiment shown here will be used for cooling islands which can be arranged, for example, free in the selling room. Fig. 11 shows the corresponding backside 22 of the coupling device 1 from Fig. 10. Also, the back sides 22 are mirror symmetrical to each other with respect to mirror plane M.

[0050] In Fig. 12 a section of three doubled coupling devices 1 is shown. Always two coupling devices 1 are

distanced via an air guiding element 32. On top of the air guiding element 32, an insulation element 42, e.g., an insulation foam, is additionally arranged. This is optional. In dependence of the size of the cooling unit, it is possible to arrange as many as necessary coupling devices 1 in line. So, it is possible to designate it as module.

[0051] In Fig. 13 the assembly of Fig. 12 is shown, but with additional covering means 34a.

[0052] In Fig. 14 a perspective back side view is shown indicating the arrangement of the air guidance element 32 on the back side 22 of a doubled basic body 2 as coupling device 1. Here, the coupling device 1 is made by one piece, but it is shown that the two basic bodies 2 are mirror symmetrical to each other. For better understanding and illustration, just one air guidance element 32 is arranged on an at least partially bud-shaped protrusion 24. The second, at least partially bud-shaped protrusion 24 is shown freely accessible. So, in this embodiment, each at least partially shaped protrusion 24 on the backside 22 is coupled with an air guidance element 32. Of course, this is not limiting. It is also imaginable that both at least partially bud-shaped protrusions are coupled with just one air guidance element 32 which extends over the protrusions accordingly.

[0053] In Fig. 15 a section of an air control unit 30 is shown. Here, the coupling device 1 is also provided with doubled basic bodies 2. Beside the bud-shaped portion 44, honeycomb structure elements 38 are arranged to control the cooled air flow F. The honeycomb structure elements 38 are placed on supports 36 on which the side walls 40 are mounted. The cooled air flow F flows upwards in arrow direction F, flows along the air guidance elements 32 extending in longitudinal direction of the air control unit 30 and passes through the honeycomb structure elements 38 as air flow F1.

[0054] Finally, Fig. 16 shows an example of an air control unit 30 for a cooling island (not shown here). The section of Fig. 15 is here completed by vertical beams 36. By using these vertical beams 36 the air control unit 30, which can also be called middle air channel, can provide controlled air flows in two opposite directions being very effective when operating a cooling island. The air flow F1 (see Fig. 15) emerging from the honeycomb structure element 38 can also be called air curtain. This air curtain shows smooth, non-turbulent behaviour.

[0055] Although the invention has been illustrated and described in more detail by the advantageous embodiments, the invention is not limited by the disclosed examples. Other variations may be derived therefrom by those skilled in the art without departing from the scope of protection of the invention. In particular, the invention is not limited to the combinations of features disclosed below, but other combinations and partial combinations obviously executable by the person skilled in the art may also be formed from the disclosed features.

LIST OF REFERENCE SIGNS

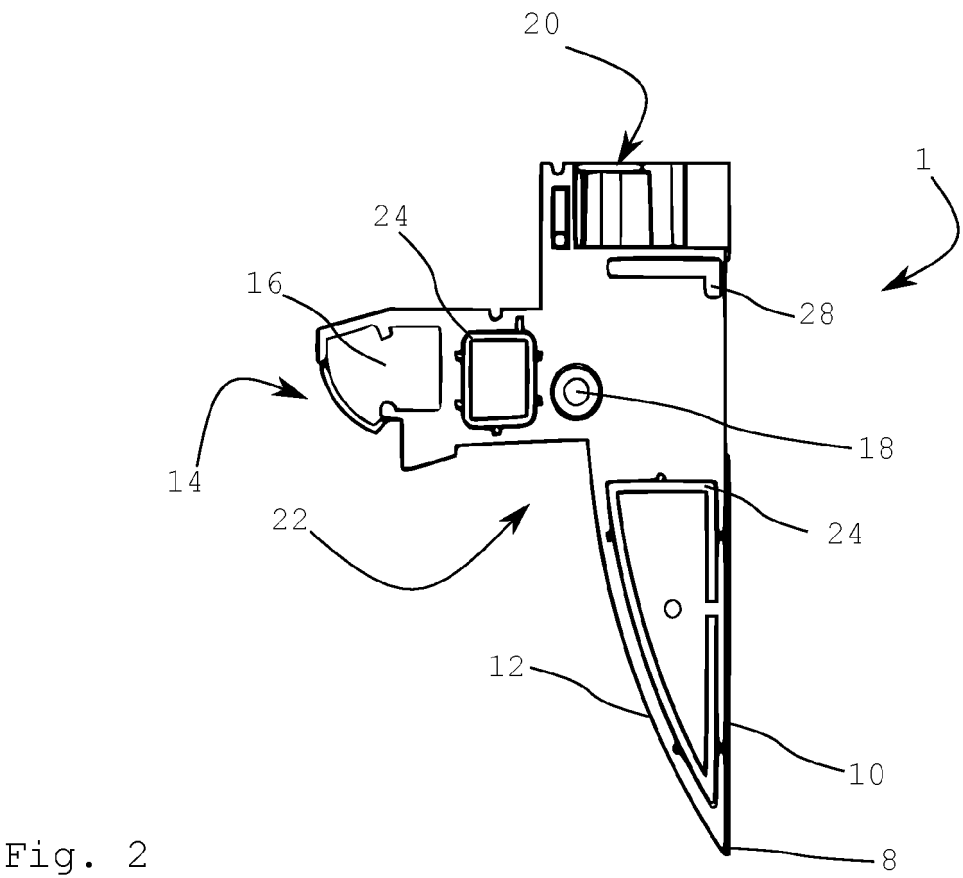
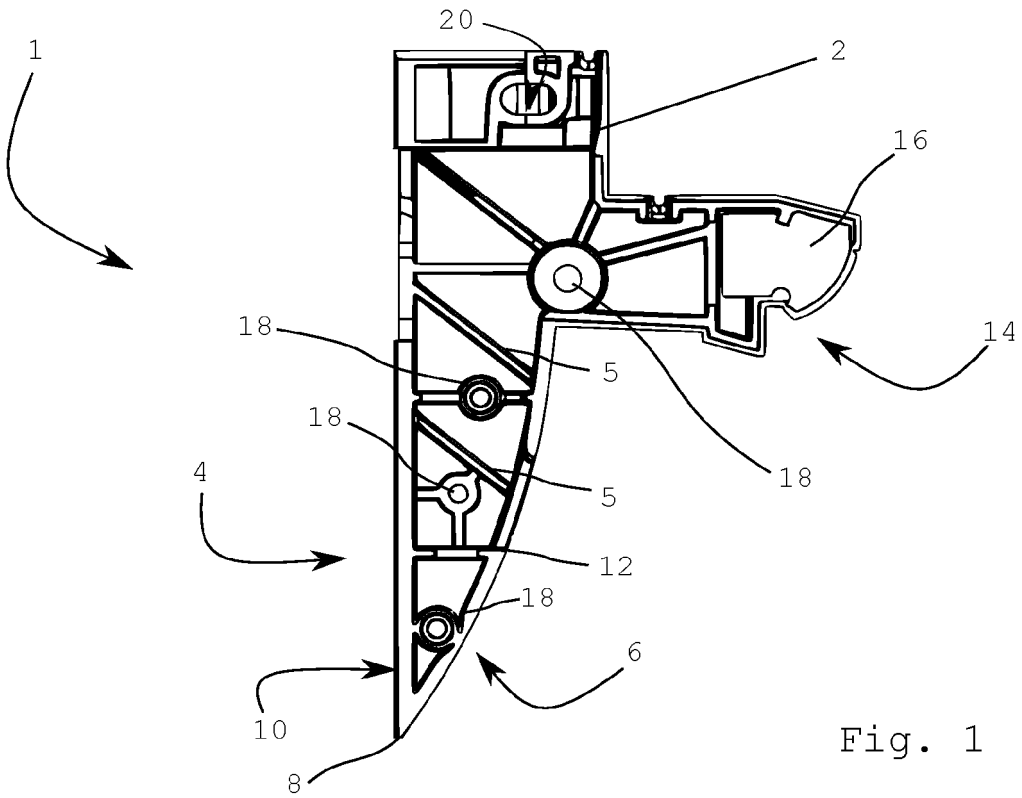
[0056]

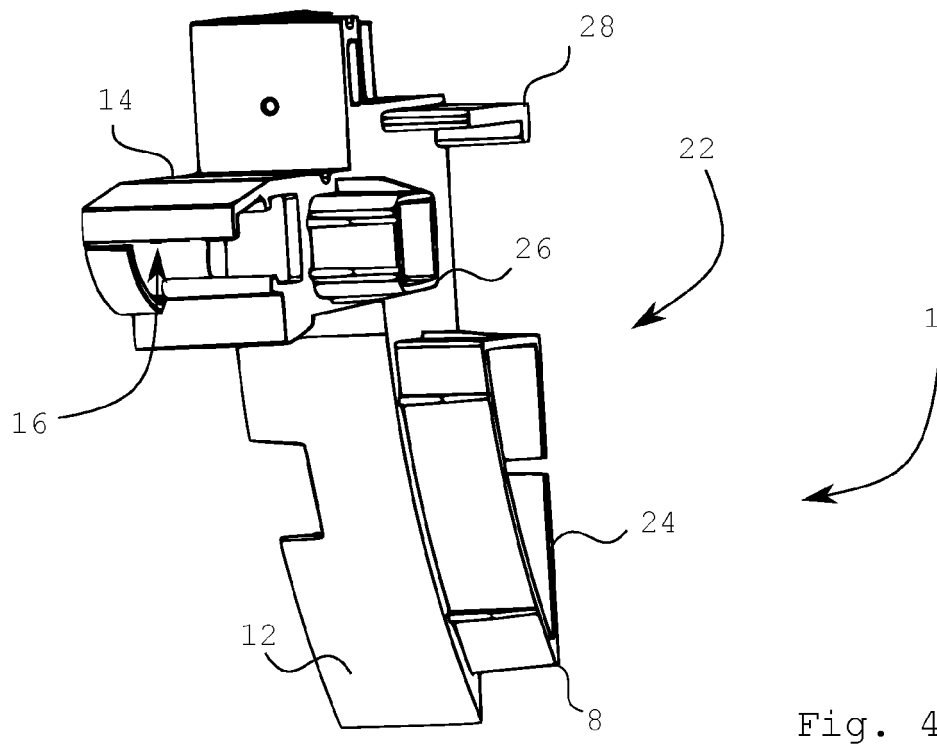
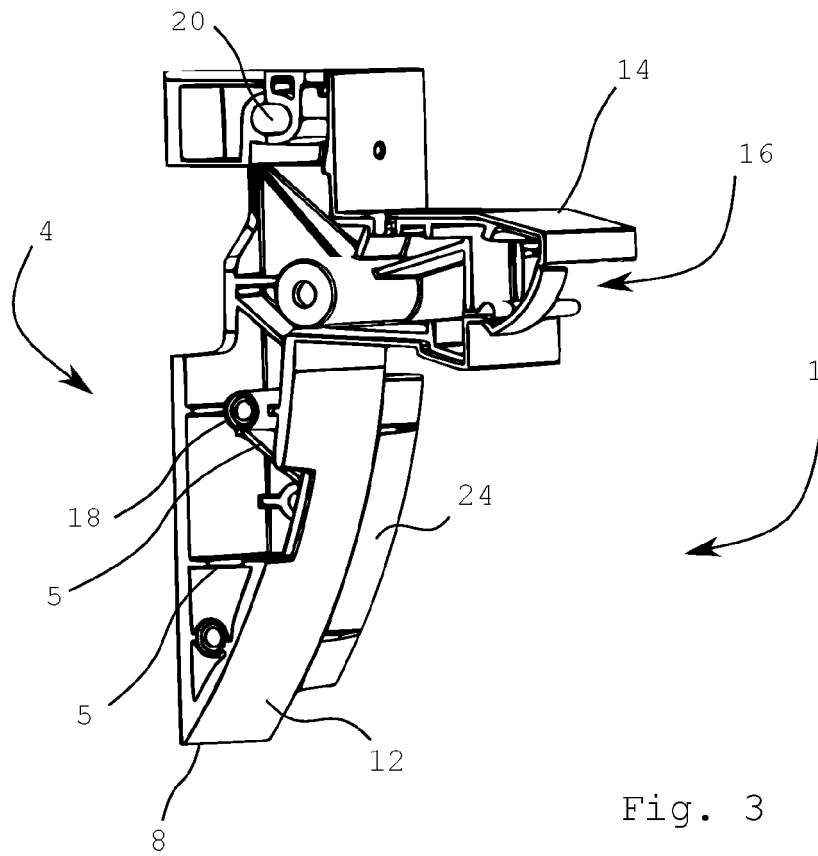
5	1	coupling device
	2	basic body
	4	front side
	6	partially bud-shaped portion
	8	free end
10	10	straight side
	12	convex side
	14	lateral projection portion
	16	guiding channel
	18	holes
15	20	recess
	22	backside
	24	at least partially bud-shaped protrusion
	26	further protrusion
	28	further protrusion
20	30	air control unit
	32	air guidance element
	34	covering means
	34a	covering means
	36	vertical beam
25	38	honeycomb structure element
	39	support
	40	side wall
	42	insulation element
	44	bud-shaped portion
30	F	air flow
	F1	further air flow
	M	mirror plane

Claims

- 35 1. Coupling device (1) for cooling units at least comprising
 - a. at least one basic body (2) having a front side (4) and a backside (22), wherein both sides differ in their geometric embodiment;
 - b. wherein the coupling device (1) comprises at least an at least partially bud-shaped portion (6) and at least one lateral projection portion (14) which is arranged in vertical direction above the at least partially bud-shaped portion (6).
- 40 2. Coupling device according to claim 1, **characterized in that**
 - 45 the basic body (2) is designed to be at least partially strut-reinforced.
- 50 3. Coupling device according to claim 2, **characterized in that**
 - 55 the front side (4) is rib-shaped due to the several struts (5) extending at least partially along the front side (4) protruding therefrom.

4. Coupling device according to claim 1,
characterized in that
the at least partially bud-shaped portion (6) also
comprises at least partially a bud-shaped protrusion
(24) on the backside (22) of the coupling device (1). 5
5. Coupling device according to claim 1,
characterized in that
the at least one lateral protrusion (14) comprises at
least one guiding channel (16) for at least one trans- 10
mission means and/or at least one emission means.
6. Coupling device according to claim 1,
characterized in that
the backside (22) of the basic body (2) provides a 15
further protrusion (26; 28).
7. Coupling device according to claim 1,
characterized in that
this is formed by two basic bodies (2). 20
8. Coupling device according to claim 7,
characterized in that
at least is front side (4) is mirror symmetrical. 25
9. Coupling device according to claim 1,
characterized in that
it comprises further at least one recess (20) for
accommodating at least one component connector
and/or at least one component connector housing. 30
10. Air control unit (30) with at least one coupling device
(1) according to at least one of the claims 1 to 9,
wherein the coupling device (1) is connected with an
air guidance element (32) via the at least one at least 35
partially bud-shaped protrusion (24) on the backside
(22) .
11. Air control unit (30) according to claim 10, wherein
the at least one coupling device (1) is further con- 40
nected to at least one vertical beam (36).
12. Air control unit (30) at least according claim 10,
comprising at least one honeycomb structure ele- 45
ment (38) which is designed to be permeable to air
flow.
13. Air control unit (30) at least according claim 10,
comprising at least further support elements for ar- 50
ranging insulation elements.
14. Cooling unit with at least one coupling device (1)
according to at least one of the claims 1 to 9 and/or
with at least one air control unit (30) at least accord- 55
ing to claim 10.





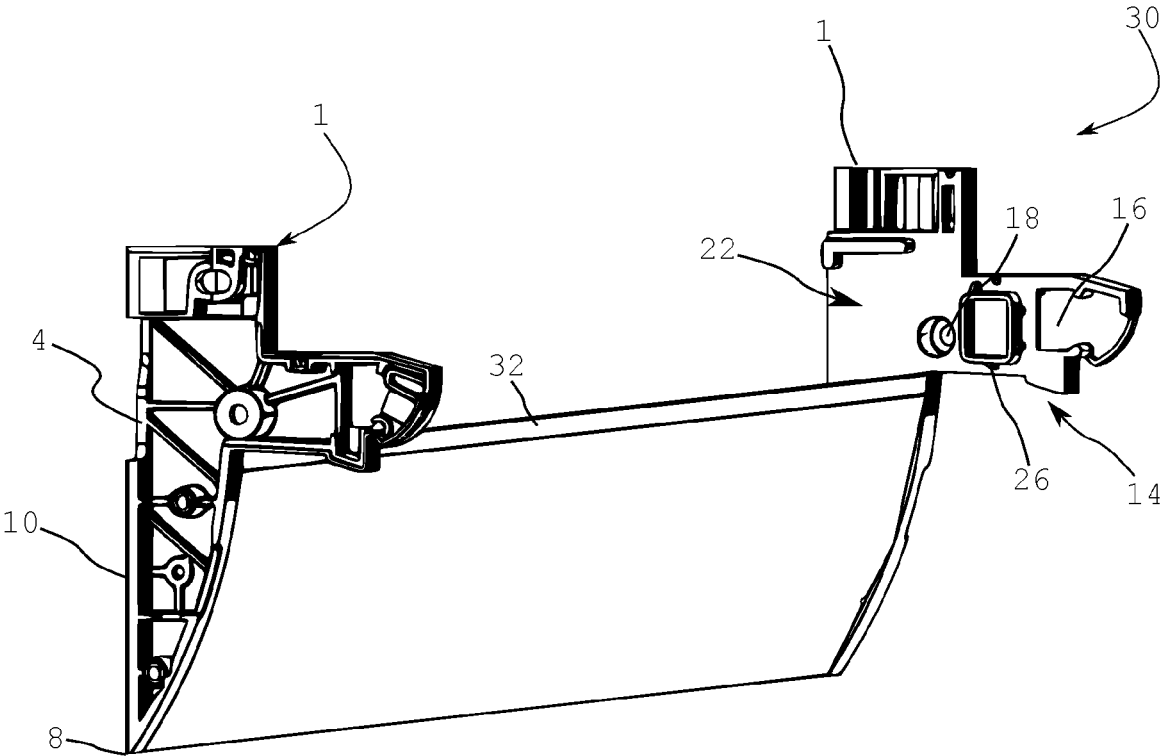


Fig. 5

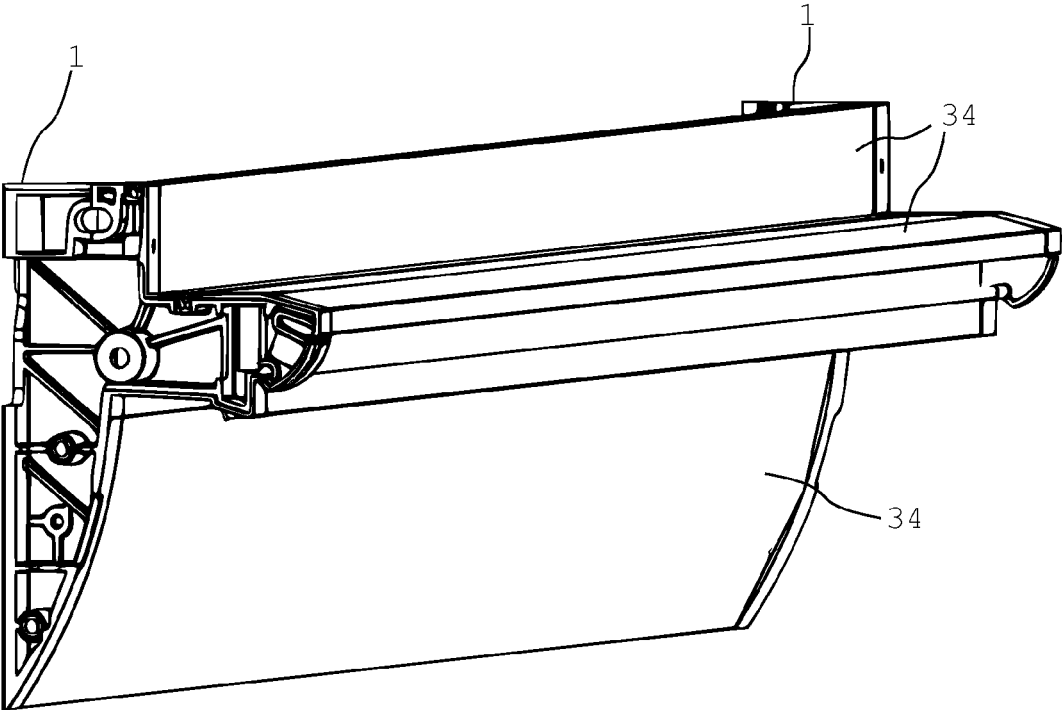


Fig. 6

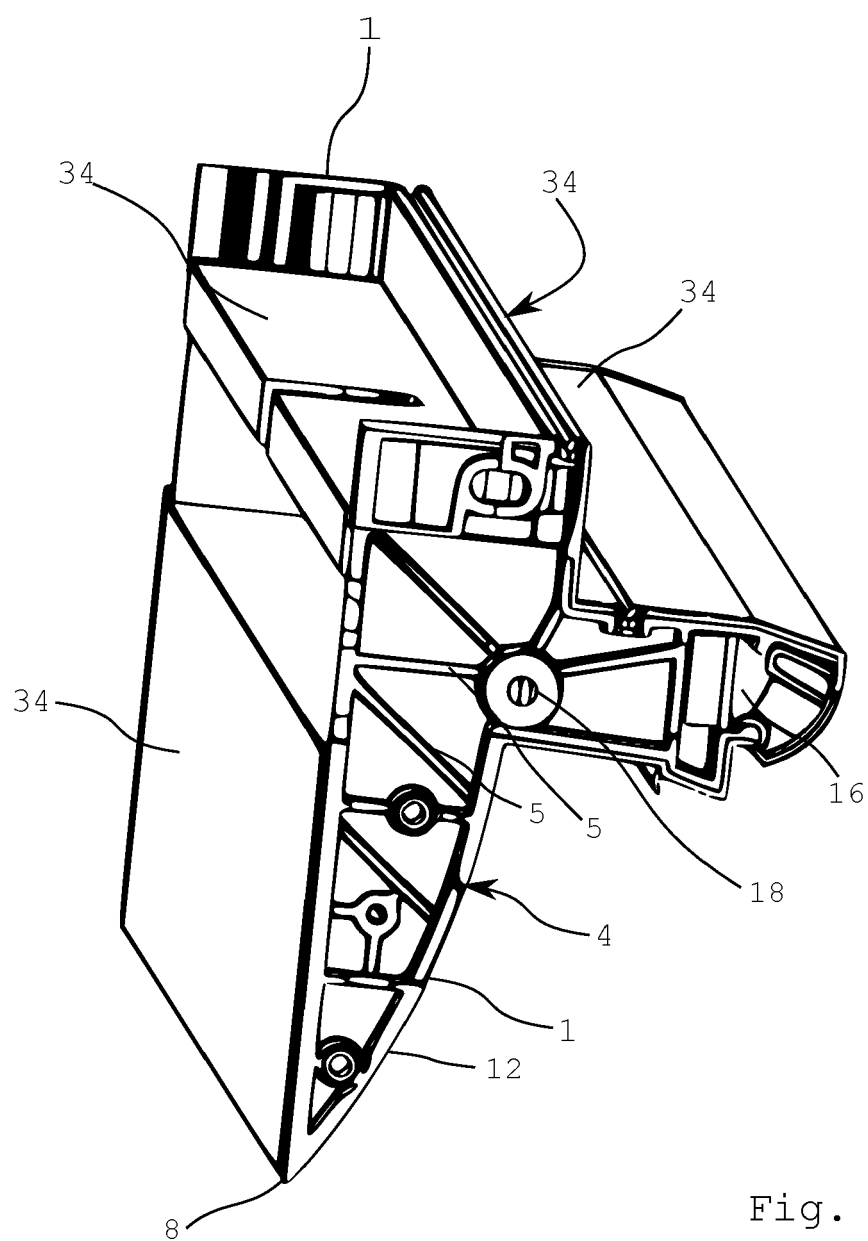


Fig. 7

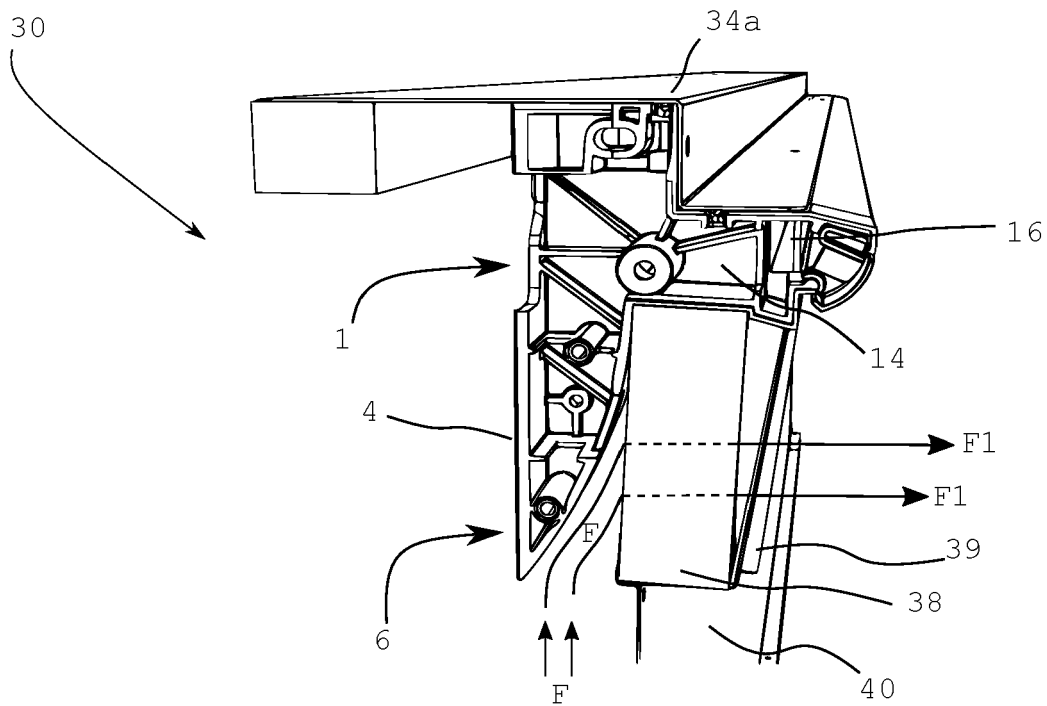


Fig. 8

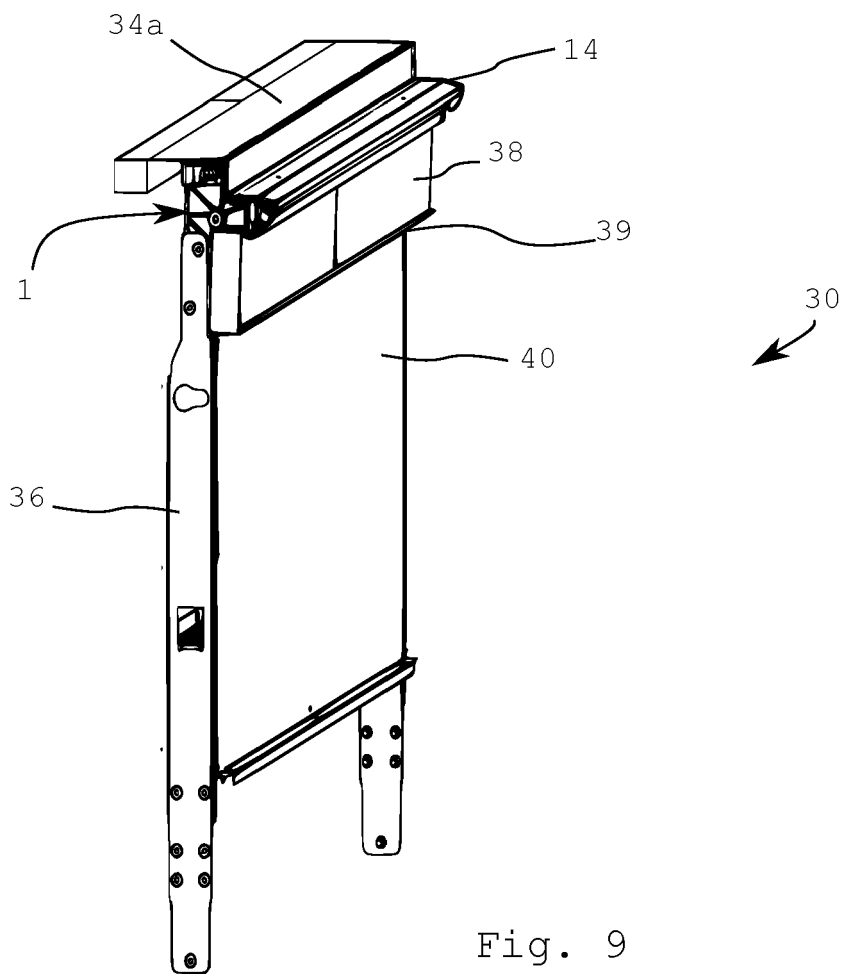


Fig. 9

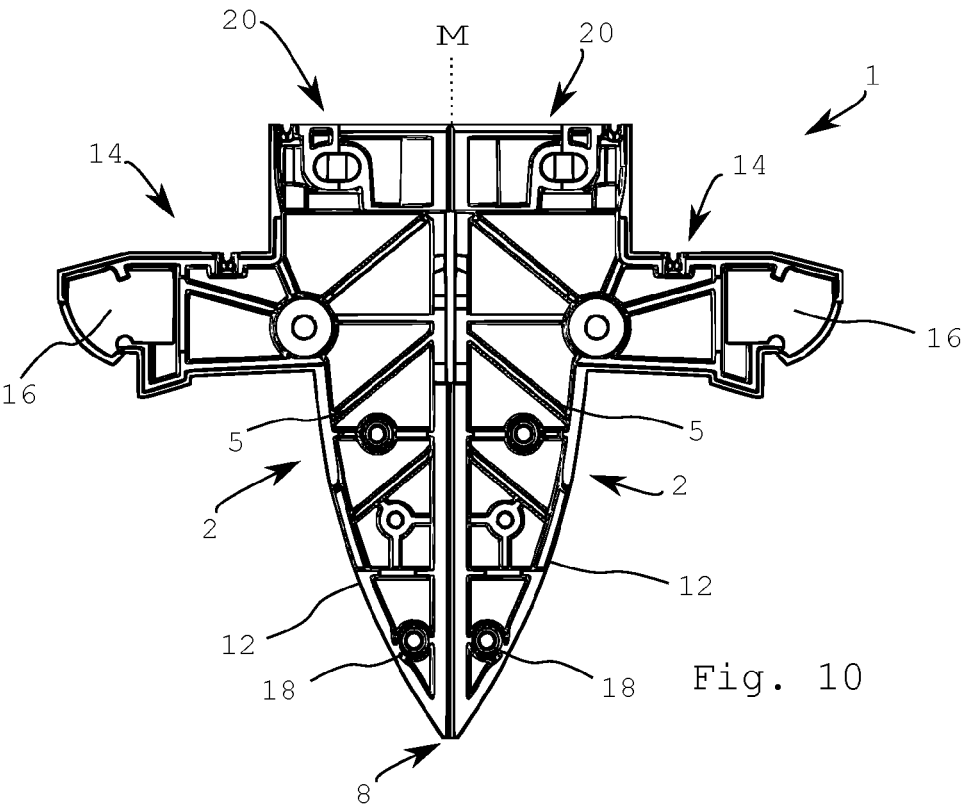


Fig. 10

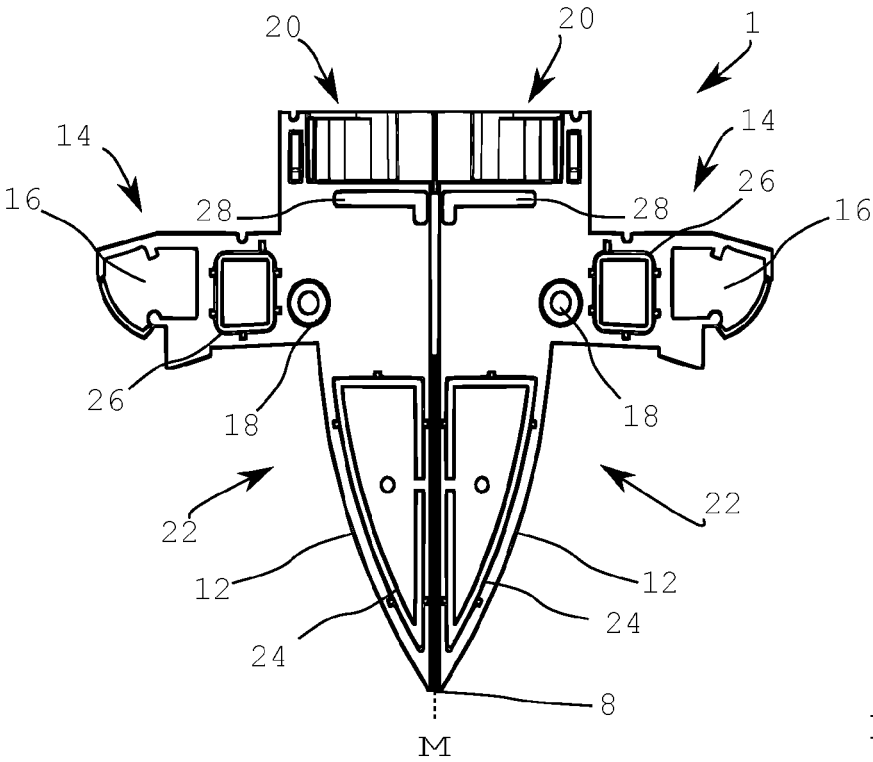


Fig. 11

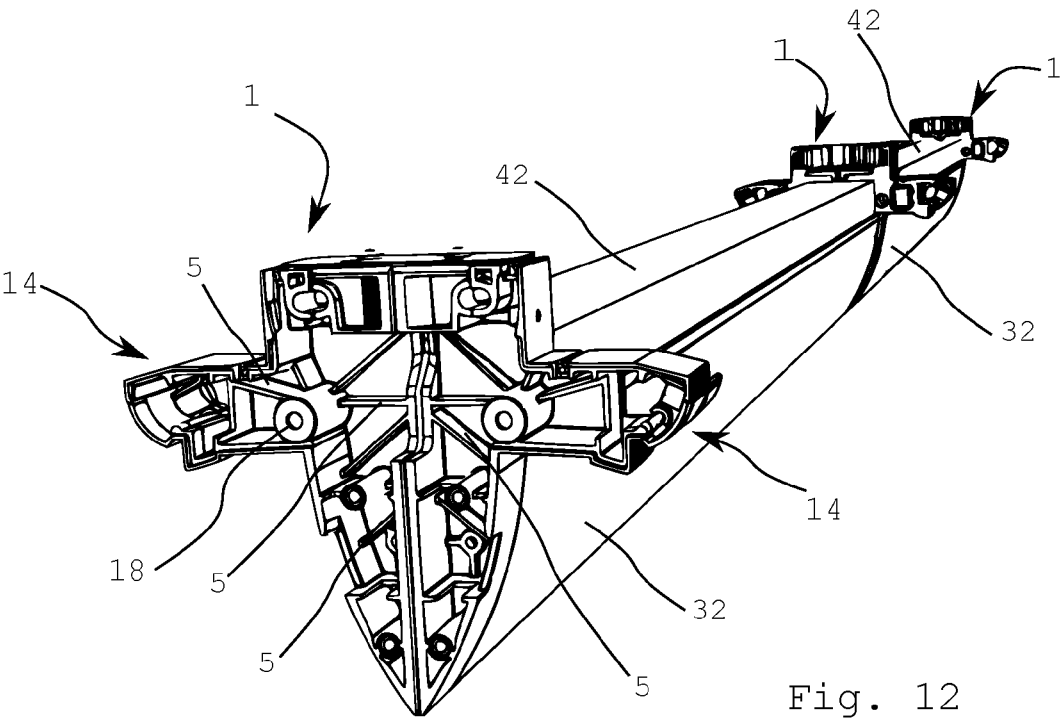


Fig. 12

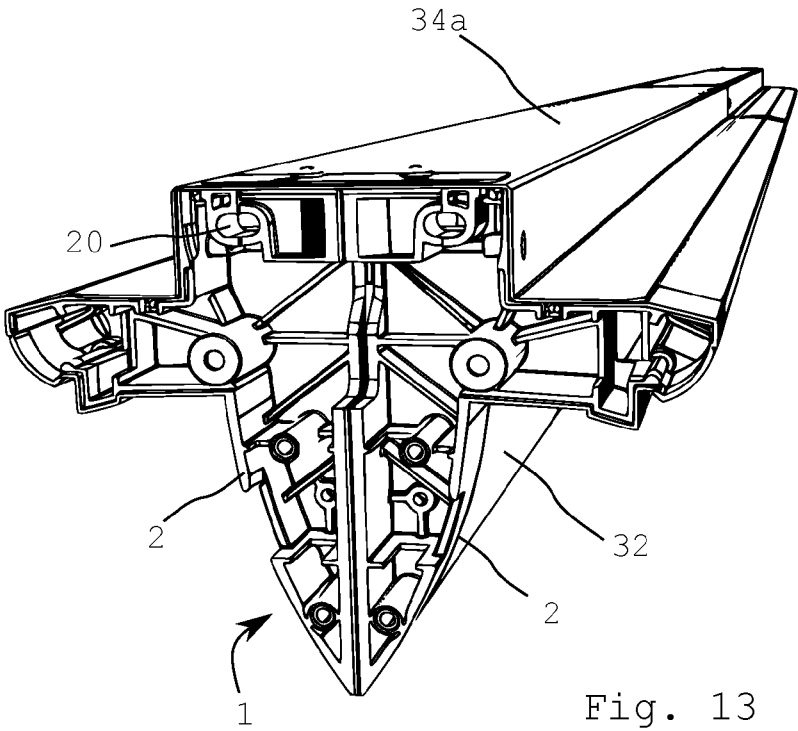


Fig. 13

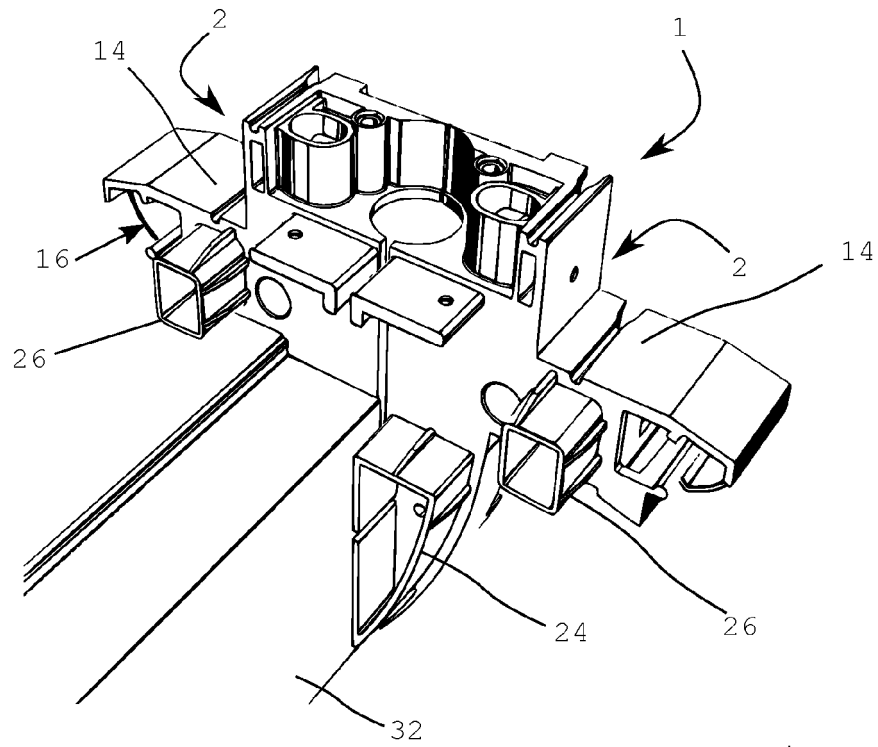


Fig. 14

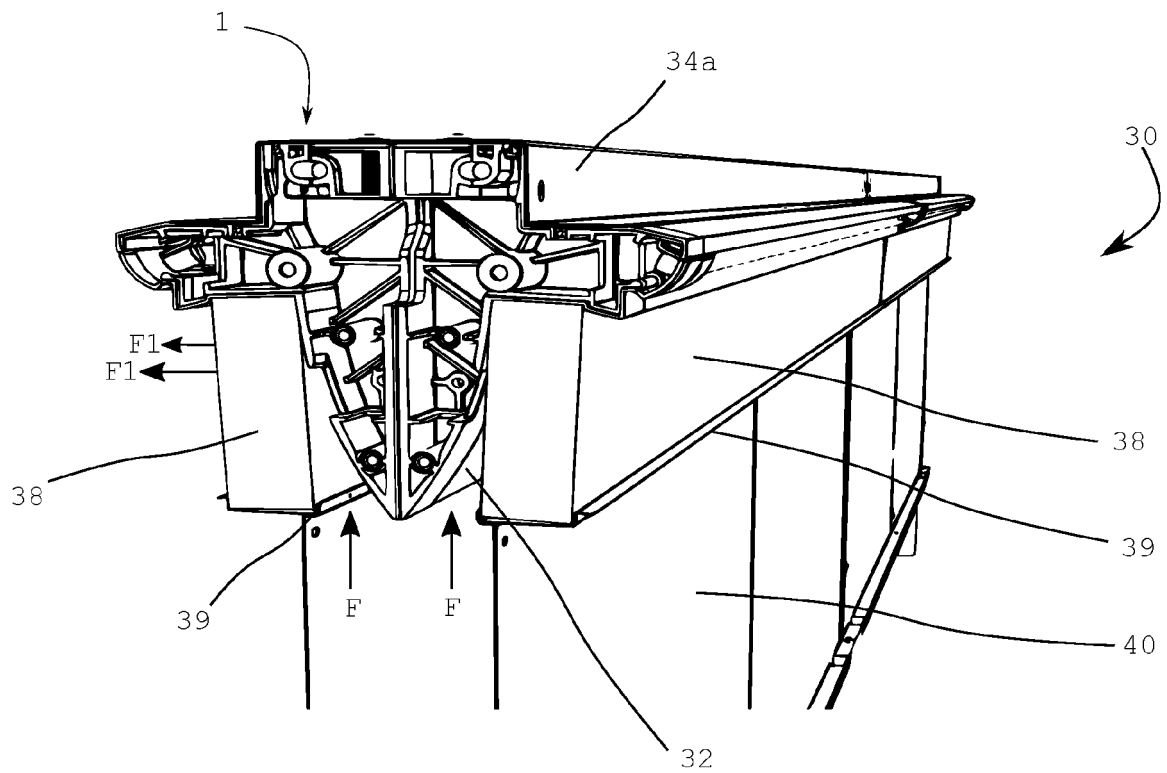


Fig. 15

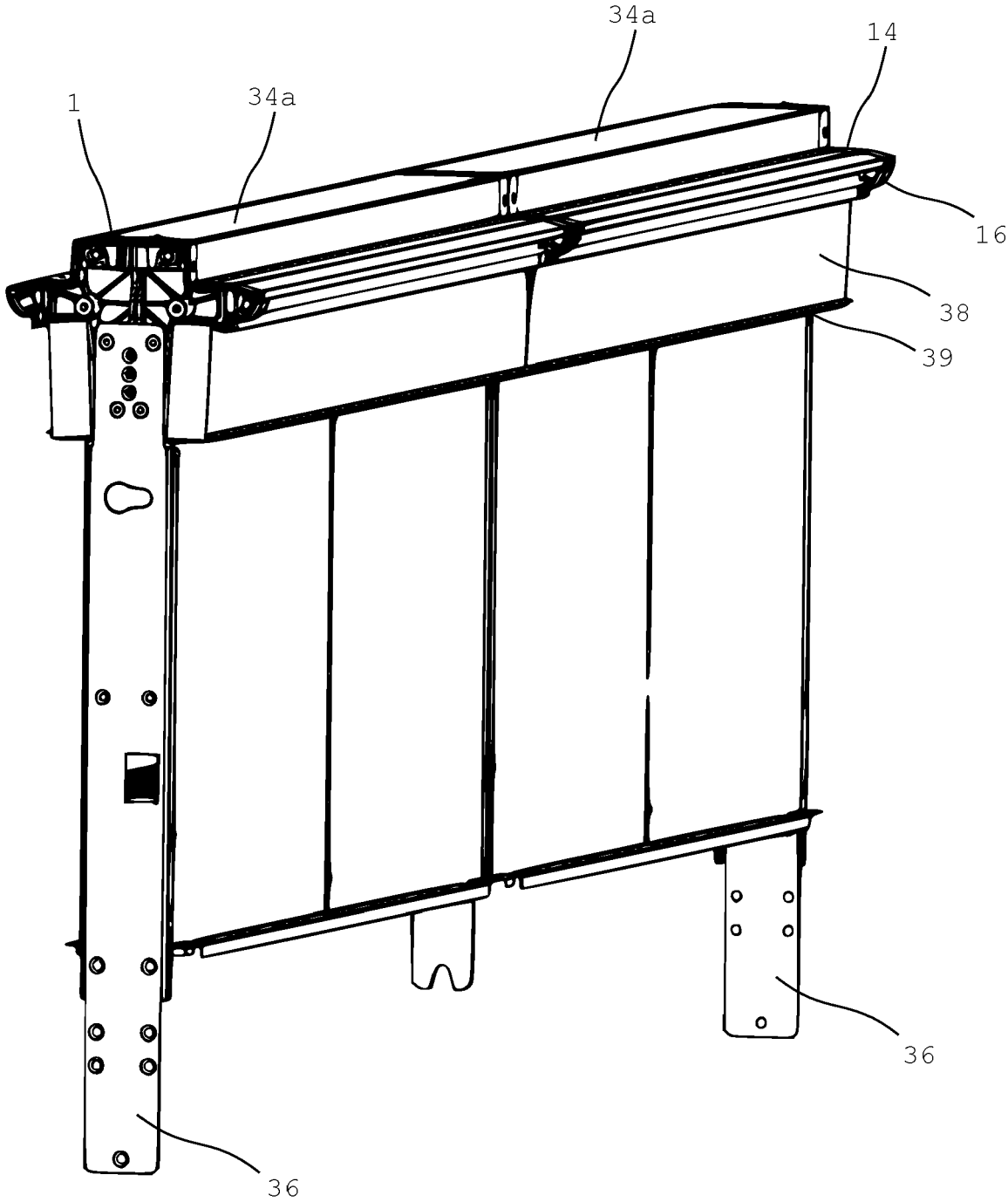


Fig. 16



EUROPEAN SEARCH REPORT

Application Number

EP 23 18 7114

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 6 230 512 B1 (CORREA JUAN CARLOS CARNE [BR]) 15 May 2001 (2001-05-15) * column 2, line 30 - column 4, line 62; claim 1; figures 2-5 *	1-14	INV. F24F13/08
X	WO 2007/012158 A1 (SPRINGER CARRIER LTDA [BR]; MORAES LUCIANO DA LUZ [BR]) 1 February 2007 (2007-02-01) * page 3 - page 8; claims 1-3; figures 1-3 *	1	ADD. F24F13/14 F24F13/20 F24F13/32
X	US 6 324 859 B1 (TESCHE CARLOS ALFONSO [BR] ET AL) 4 December 2001 (2001-12-04) * column 2, line 52 - column 5, line 23; claim 1; figures 2-8 *	1	
A	DE 20 2018 101601 U1 (DENCOHAPPEL CZ A S [CZ]) 1 April 2018 (2018-04-01) * paragraph [0009] - paragraph [0015]; claims 1-6; figure 1 *	1-14	
			TECHNICAL FIELDS SEARCHED (IPC)
			F24F
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		23 December 2023	Silex, Anna
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 23 18 7114

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

23-12-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6230512 B1	15-05-2001	AU 7900898 A	10-01-2000
		US 6230512 B1	15-05-2001
		WO 9967579 A1	29-12-1999
WO 2007012158 A1	01-02-2007	BR PI0520443 A2	13-06-2009
		CN 101268318 A	17-09-2008
		EP 1910762 A1	16-04-2008
		HK 1124653 A1	17-07-2009
		KR 20080015943 A	20-02-2008
		WO 2007012158 A1	01-02-2007
US 6324859 B1	04-12-2001	AR 018911 A1	12-12-2001
		AU 7901198 A	10-01-2000
		BR 9811218 A	25-07-2000
		CN 1265736 A	06-09-2000
		US 6324859 B1	04-12-2001
		WO 9967580 A1	29-12-1999
DE 202018101601 U1	01-04-2018	CZ 31065 U1	03-10-2017
		DE 202018101601 U1	01-04-2018
		FR 3064698 A3	05-10-2018
		PL 127185 U1	08-10-2018
		RU 187117 U1	19-02-2019