

(19)



(11)

**EP 4 299 994 A1**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**03.01.2024 Bulletin 2024/01**

(51) International Patent Classification (IPC):  
**F24F 7/06** <sup>(2006.01)</sup> **F24C 15/20** <sup>(2006.01)</sup>  
**F24F 13/12** <sup>(2006.01)</sup> **F24F 13/24** <sup>(2006.01)</sup>  
**F24F 7/00** <sup>(2021.01)</sup>

(21) Application number: **23180792.6**

(22) Date of filing: **22.06.2023**

(52) Cooperative Patent Classification (CPC):  
**F24F 13/12; F24C 15/2021; F24F 7/06;**  
**F24F 13/24; F24F 2007/001**

(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**

(71) Applicant: **Røros Metall AS**  
**7374 Røros (NO)**

(72) Inventor: **Augensen, Håvard**  
**3014 Drammen (NO)**

(74) Representative: **Acapo AS**  
**Edvard Griegs vei 1**  
**5059 Bergen (NO)**

(30) Priority: **22.06.2022 NO 20220713**

(54) **VENTILATION UNIT AND FLOW-REGULATOR PLATE IN AN VENTILATION UNIT**

(57) The present invention is related to a ventilation unit comprising a fume hood and a suction pipe. A flow-regulator plate is arranged in the ventilation unit to be moved over an opening between the fume hood and the suction pipe. A first end of the flow-regulator plate er

bent at the least 90 degrees in relation to the remaining parts of the flow-regulator plate, in a direction towards the fume hood.

The invention is further related to a flow-regulator plate to be used in such a ventilation unit.

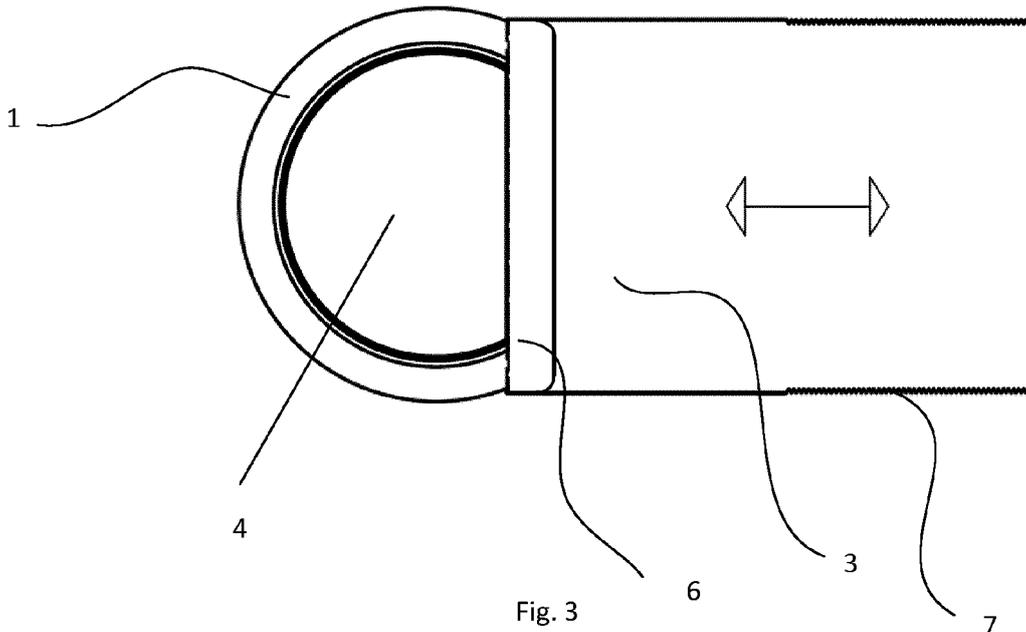


Fig. 3

**EP 4 299 994 A1**

## Description

**[0001]** The present invention is related to a ventilation unit and flow-regulator plate in an ventilation unit, according to the independent claims.

## Background

**[0002]** Loss of energy, and energy savings are increasingly important in building, and disbursements to heating and/or cooling are often considerable. Thus, it is important to avoid uncontrolled airflows, uncontrolled inlets and outlets of air. While avoiding loss of temperature, the indoor climate must be ensured, and the air should be replaced regularly. This often involves a balanced ventilation system, whereby a given amount of air are let in and out of the building, often through a heat exchanger.

**[0003]** Further, there is a need for replacement of air and ventilation during cooking, wherein it is desirable to work under a suction fan, such that the smell from cooking is removed from the building, rather than being spread throughout the building. This is especially important in buildings having several residences, such as a block. This is solved by using a ventilation unit such as a kitchen hood, arranged at the site of cooking, in such a way that smell from food and smoke/fume are removed before it is spread into the room.

**[0004]** There are several types of ventilation units, for instance free-hanging which filters and circulates the air back to the room, free-hanging ventilation units which draw the air out of the building and integrated ventilation units being connected to a ventilation system for the building. Free-standing ventilation units are often provided with a separate motor creating negative pressure and drawing air out of the room. Integrated ventilation units rarely has a separate motor, but are often connected to a centralized motor, wherein the ventilation unit is provided with a flow-regulator plate which may be regulated in such a way that balanced airflow is achieved, and in such a way that all residences of the building are provided with approximately the same ventilation.

**[0005]** A ventilation unit further comprises a fume hood and/or grating/filter at the inlet, and a pipe connected to the outlet or the pipe may be part of the ventilation system. In the following this pipe will be referred to as a suction-pipe.

**[0006]** When the ventilation unit is connected to a centralized ventilation system, it may also be used to exchange air when there is no cooking, hereinafter referred to as base ventilation. The amount of air to be drawn out must be adjusted carefully according to the ventilation system in general, to avoid overpressure or underpressure in the building. Further, if there are several residences in the building, the ventilation system and the ventilation unit must be adjusted to achieve sufficient ventilation in all residences, independent of distance to the centralized motor. This requires that the flow-regulator plate must be adjustable to give correct counter pressure to

the ventilation system, and the residences closest to the the motor must have less opening than the residences furthest away when the flow-regulator plate is adjusted to base ventilation. In addition, the flow-regulator plate must be adjustable in such a way that the ventilation unit may be used upon cooking in regular way. This is also known as forced ventilation.

**[0007]** When the ventilation unit is a part of a the ventilation system and used for base ventilation, it will always be an opening in the ventilation unit wherein air is drawn out, and this may cause sound or hum which may be experienced as troublesome.

**[0008]** Several flow-regulator plates for such use are known, such as sliding flow-regulator plates wherein a flow-regulator plate is slid into the suction pipe, as the flow-regulator plate covers the whole or parts of the cross section of the pipe. However, such a solution requires that the whole flow-regulator plate may be arranged on the side of the suction pipe, and further, it is a problem that the distal end of the flow-regulator plate may be vibrating when air flows through the pipe. This will create noise.

**[0009]** Another type of flow-regulator plate is a single leaf damper, wherein a flow-regulator plate shaped as the cross-section of the pipe, is rotated around a radial axis, and limits thus the cross section of the pipe. It is also known flow-regulator plates being rotational connected radially in the centre, and which may be folded such that they only partly limits the cross section. These are all limiting the cross section of the pipe even when fully opened, and therefore noise is often created when air passes by.

**[0010]** Thus, it is an object of the invention to provide a flow-regulator plate which may offer a completely closed or complete open passage into the suction pipe, as well as it may limit a given part of the cross section of the pipe. Further, it is an object to provide a flow-regulator plate and a ventilation system which does not make sound when air passes through, in such a way that the room wherein the ventilation unit is arranged, is quiet.

## The invention

**[0011]** The object of the invention is fulfilled with a ventilation unit as stated in the independent claims. Further advantageous features are stated in the dependent claims.

**[0012]** The invention is related to a ventilation unit comprising a fume hood and a suction pipe. A flow-regulator plate is arranged to be moved over an opening between the fume hood and the suction pipe, as a first end of the flow-regulator plate is bent at least 90 degrees in relation to the rest of the flow-regulator plate, in a direction towards the fume hood.

**[0013]** The invention is further related to a flow-regulator plate to be used in such a ventilation unit.

**[0014]** The ventilation unit may further comprise a device to generate an air flow through the fume hood and

into the suction pipe. The device may be a motor being arranged in the ventilation unit, or a motor or pump being a part of the ventilation system, such as in a house or larger tenement house having several residences.

**[0015]** The flow-regulator plate regulates the air flow through the suction pipe, by moving the plate over the opening and thereby limiting the cross section which may be used for air flow. The means for generating pressure in the system will thus not be regulated, and the suction of other ventilation means will not be considerably influenced.

**[0016]** By "fume hood" it is in the context of this application meant to be an arrangement above a fireplace or a kitchen stove, wherein smoke, damp and other gases passes before it is guided into the smoke or suction pipe. The fume hood often has a tapered cross section wherein the smaller cross section is facing the suction pipe, and may for instance be a ventilator hood or a ventilator grid being installed above the fire place / kitchen stove. The fume hood may be extractable in order to occupy less space when the ventilation unit is not in use. The ventilation unit may be installed free-hanging from the ceiling or on a wall, or it may be integrated in a cupboard.

**[0017]** A ventilation unit according to the invention may further comprise a housing wherein the fume hood and the suction pipe is fastened, wherein the fume hood is fastened on one side of the housing, and the suction pipe is fastened on the opposite side, in such a way that the flow of air passes through the housing. The housing, the fume hood and/or the suction pipe may constitute the outer part of the ventilation unit, or they may be fully or partly surrounded by an outer chassis.

**[0018]** "Fastened to", in the context of this application, should include both fastened directly to and fastened by means of further elements.

**[0019]** The suction pipe may be arranged to a pipe socket being fastened or integrated in the housing, or alternatively the suction pipe itself may be provided with a flange at the opening, wherein the flange is fastened on the inside of the housing. In the following we will refer to "supporting surface" to refer to the flange or the area on the inside of the housing, around the opening of the suction pipe. The flow-regulator plate is arranged to be moved over the opening of the suction pipe and preferably to be bearing against the supporting surface, at least when the flow-regulator plate is moved to cover parts or the whole of the opening.

**[0020]** By "bearing against" it should, in the context of this application, be understood that the flow-regulator plate may be arranged up to the supporting surface, and/or in direct contact with the supporting surface, but it should not be exerted any pressure between the flow-regulator plate and the supporting surface, and thus the flow-regulator plate may be moved unhindered. However, when the device generates a flow of air through the suction pipe, reduced pressure will be created on the upstream side of the flow-regulator plate, and the flow-regulator plate will be drawn towards the supporting sur-

face in such a way that a tight connection is created.

**[0021]** The flow-regulator plate may have the same cross section as the suction pipe, however, it may be advantageous if the flow-regulator plate is larger and may cover the opening of the suction pipe completely, and further that some margin for correct positioning of the flow-regulator plate in completely closed position is given. Further, it may be an advantage that the flow-regulator plate bear against the supporting surface around the whole opening, and thus prevents air from being drawn through the ventilation unit. The flow-regulator plate may also be smaller than the opening of the suction pipe, but then the suction through the ventilation unit may not be completely closed by moving the flow-regulator plate over the opening. This may for instance be an alternative in base ventilation.

**[0022]** A motor may be arranged to the flow-regulator plate to move and guide the flow-regulator plate. The motor may be arranged in direct engagement with the flow-regulator plate, or by several rotation means. By "direct engagement" it should in this context be understood that the motor shaft is directly fastened to the flow-regulator plate without any cogwheels/gears/transmission belts or the similar. By "by several rotation means" it should in this context be understood that the motor shaft is connected to the flow-regulator plate via cogwheels/gear/transmission belts or the similar.

**[0023]** When the motor is in direct engagement with the flow-regulator plate, the motor shaft will be equal to a rotation axis for the flow-regulator plate, and the motor will be fastened to a pivot point of the flow-regulator plate. This will be space saving and may be a good solution when the space is limited. When the motor is arranged to the the flow-regulator plate by rotation means, the motor shaft may be in an angle to the flow-regulator plate and the movement of the plate, and this makes several physical arrangements of the motor possible. The motor may for instance be placed at the outer edge of the flow-regulator plate in such a way that the flow-regulator plate is rotated or moved sideways.

**[0024]** The flow-regulator plate is arranged to be moved radially over the opening of the suction pipe, meaning that the flow-regulator plate is arranged in parallel with a radial cross section of the suction pipe, and that the flow-regulator plate is partly or completely removed from the opening of the suction pipe when the suction is at maximum. The flow-regulator plate may be moved linearly, or by a rotational movement, over the opening.

**[0025]** The flow-regulator plate has a first end which is arranged to be moved over the opening of the suction pipe. The first end is bent in a direction away from the opening of the suction pipe, meaning in a direction towards the fume hood, and may protrude further backwards towards the flow-regulator plate. The angle between the first end and the remaining part of the flow-regulator plate may be 90 degrees, meaning that the first end is perpendicular to the remaining part of the flow-

regulator plate, but is preferably more than 90 degrees and thus the first end will protrude backwards toward the flow-regulator plate. The end should be bent or curved away from the suction pipe in such a way that it does not prevent the movement of the flow-regulator plate over the opening of the suction pipe even if it bears against the supporting surface of the suction pipe/the housing.

**[0026]** The first end of the flow-regulator plate may be bent about 180 degrees, in such a way that it is folded backwards until it is parallel with the remaining part of the flow-regulator plate. In one embodiment, the end is bent 170 degrees. The distance between the flow-regulator plate and the first end of the flow-regulator plate, may be about 20-25 mm, that is a diameter of the of the first end is about 20-25 mm. At a standard suction pipe having a diameter of about 12,5 cm, an optimal diameter of the curvature of the first end would be 22 mm.

**[0027]** The end is preferably curved in an even curve, and by having such a curved embodiment of the first end, the flow of air will not pass a sharp/straight edge, and thus less vibration in the flow-regulator plate will be created. Since the end is curved in a direction away from the opening of the suction pipe, turbulent flow will not be created inside the suction pipe, and this results in less noise and sound.

**[0028]** The flow-regulator plate may have many shapes, which is convenient regarding the opening of the suction pipe, the movement of the flow-regulator plate and the rest of the ventilation unit. The part of the flow-regulator plate which is not "a first end" is preferably flat.

**[0029]** A ventilation unit according to the invention may further comprise electronic components, control boxes, electric converters etc. being arranged to the housing. Lights, control switches / user panel etc. may be fastened to the housing or the chassis for easy operation by an end-user. Further, a ventilation unit preferably comprises a number of filters for filtering the air drawn through the ventilation unit, as the filters may be removed from the ventilation unit for cleaning or to be exchanged. In some embodiments, a ventilation unit according to the present invention may further comprise rails for extraction of the filter and/or the the fume hood when the ventilation unit is used. The filter and/or rails may preferably be fastened to the housing.

**[0030]** The amount of air which may be drawn through the ventilation unit may be adjusted by regulating how much of the opening of the suction pipe the the flow-regulator plate covers. Maximum and minimum opening may be limited by providing the flow-regulator plate and support surface with reciprocal knobs, notches, protrusions, indents or the similar which mechanically will limit the movement of the flow-regulator plate. This is particularly advantageous when the ventilation unit is installed in a larger system having several residences.

**[0031]** The motor used to move the flow-regulator plate, may alternatively or in addition, be adjusted in such a way that it stops at different positions, such as a stepper

motor. This makes it easy to fine-tune the positions, and this may be performed remotely without the need of an operator having access to the ventilation unit. This will also make it possible for an operator to adjust all the ventilation units in a system having several residences from a PC, without access to the residences. This will be very advantageous at the least at start-up of a new system, or after development/ renovation of the system.

**[0032]** When installing a ventilation unit according to the present invention, an operator will adjust maximum and minimum opening in relation to other units in the system. This may be performed manually by knobs and mechanical limitations, or by use of an adjustable motor such as a stepper motor, as mentioned above. The suction pipe is coupled to a suction system or a suction pipe in the residence, in such a way that the air is transported out of the residence. After installation, a user may use the ventilation unit as usual, by operating the user panel placed on the outside of the ventilation unit. When the user adjusts to maximum suction the flow-regulator plate will be moved to the position giving maximum opening of the suction pipe, but the suction will not exceed the maximum allowable in regard to the installation. Correspondingly, when the user turns the ventilation unit off, it will not be closed completely, but the flow-regulator plate will be moved to the position giving minimum opening of the suction pipe.

#### Example

**[0033]** The invention will in the following be described with reference to a preferred embodiment shown in the Figures. The example is not limiting the invention as defined in the accompanying claims, but is given to illustrate details.

**[0034]** Embodiments are shown in the following figures, where

Figure 1 shows a flow-regulator plate being partly moved over a supporting surface for the suction pipe, seen from below,

Figure 2 shows the flow-regulator plate in perspective from below,

Figure 3 shows an alternative embodiment of a flow-regulator plate being partly moved over a supporting surface for the suction pipe, seen from below, and

Figure 4 shows parts of the suction pipe and the flow-regulator plate in Figure 3, seen from the side.

**[0035]** The different parts are not necessarily to scale in relation with respect to one another. The same or similar parts are given the same reference number in different embodiments. "From below" refers to positions when a ventilation unit is installed, meaning the side where the fume hood will be fastened. The flow of air is indicated by an arrow in Fig 4.

**[0036]** Figure 1 and 3 show parts of a ventilation unit, wherein only a flow-regulator plate 3 and a supporting

surface 1 at an opening 4 of a suction pipe 2 is shown. The flow-regulator plate of Figure 1 is designed as a sector of a circle, being rotational connected at the point opposite the circular arc, having an axial rotation axis A at the side of the opening 4 of the suction pipe 2. Figure 1 further shows a motor 5 rotating the flow-regulator plate, as the motor is in direct engagement with the flow-regulator plate, and rotates it over the opening of the suction pipe in such a way that the opening is limited.

**[0037]** The flow-regulator plate of Figure 3 is designed as a square, being moved linearly over the opening of the suction pipe. The motor may be connected to the flow-regulator plate by rotation means such that the motor shaft is perpendicular to the flow-regulator plate. The rotation means may for instance be in engagement with the teeth 7 shown along two sides adjacent to the first end 6.

**[0038]** The flow-regulator plate 3 shown in Figure 1 and 3 have a first end 6 being the first end to be moved over the opening 4 of the suction pipe when the flow-regulator plate 3 is moved. The first end is curved in an even curvature away from the opening of the suction pipe, while the rest of the flow-regulator plate is flat. In the shown embodiment, the curve is 170 degrees, and thus the first end is nearly parallel with the remaining parts of the flow-regulator plate, but in opposite direction. The distance L between the first end 6 and the remaining part of the flow-regulator plate, meaning the diameter of the curvature is preferably 20 mm. The flow-regulator plate is shown in detail in Figure 2 and 4, respectively.

**[0039]** The example is given for a specific embodiment, and the invention is not limited to this but includes modifications and variations within the scope of the claims stated below.

## Claims

1. Ventilation unit comprising a fume hood and a suction pipe (2), wherein a flow-regulator plate (3) is arranged in the ventilation unit to be moved over an opening (4) between the fume hood and the suction pipe, **characterized in that** a first end (6) of the flow-regulator plate (3) is bent at the least 90 degrees in relation to the remaining parts of the flow-regulator plate, in a direction towards the fume hood.
2. Ventilation unit according to claim 1, **characterized in that** the first end (6) of the flow-regulator plate is bent towards the fume hood and further backwards towards the flow-regulator plate.
3. Ventilation unit according to claim 2, **characterized in that** the first end (6) of the flow-regulator plate (3) is bent about 180 degrees, in such a way that it is parallel with the flow-regulator plate.
4. Ventilation unit according to any one of claims 2 or 3, **characterized in that** the distance (L) between the flow-regulator plate and the first end of the flow-regulator plate, is at least 20 mm.
5. Ventilation unit according to any one of the preceding claims, **characterized in that** a motor (5) is arranged to the flow-regulator plate (3) to generate movement of the flow-regulator plate in relation to the opening (4) between the fume hood and the suction pipe.
6. Ventilation unit according to any one of the preceding claims, **characterized in that** the flow-regulator plate is arranged for radial movement in relation to the opening of the suction pipe, preferably a linear or rotation movement.
7. Ventilation unit according to any one of the preceding claims, **characterized in that** a number of knobs are arranged on the flow-regulator plate and/or an adjacent supporting surface, in such a way that the flow-regulator plate will be stopped at different positions.
8. Flow-regulator plate for be used in a ventilation unit comprising a fume hood and a suction pipe, wherein the flow-regulator plate is arranged in the ventilation unit to regulate an opening between the fume hood and the suction pipe **characterized in that** a first end (6) of the flow-regulator plate (3) is bent at the least 90 degrees in relation to the remaining parts of the flow-regulator plate, in a direction towards the fume hood when the flow-regulator plate is arranged in the ventilation unit.
9. Flow-regulator plate i according to claim 8, **characterized in that** a part of the flow-regulator plate (3) being arranged to bear against a supporting surface (1) around the opening of the suction pipe, is flat.
10. Flow-regulator plate according to claims 7 or 8, **characterized in that** the first end (6) of the flow-regulator plate is bent at the least 180 degrees in relation to the remaining part of the flow-regulator plate.
11. Flow-regulator plate according to any one of the claims 8-10, **characterized in that** the first end of the flow-regulator plate (6) is curved in an even curvature.

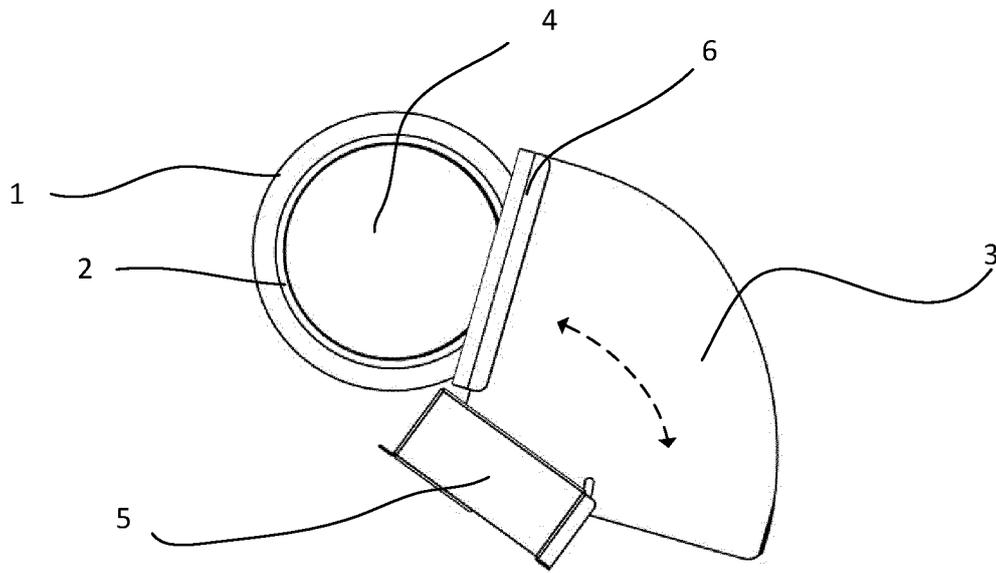


Fig. 1

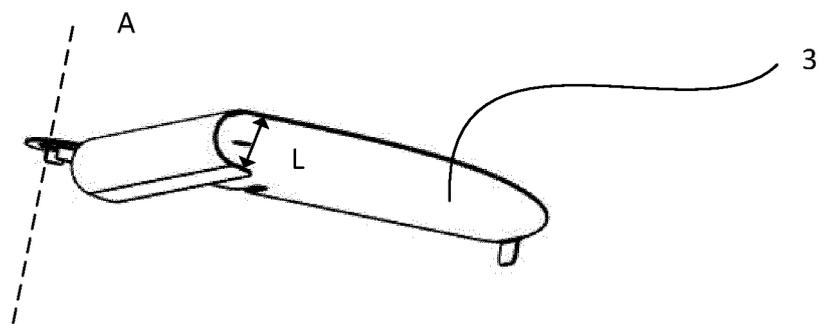
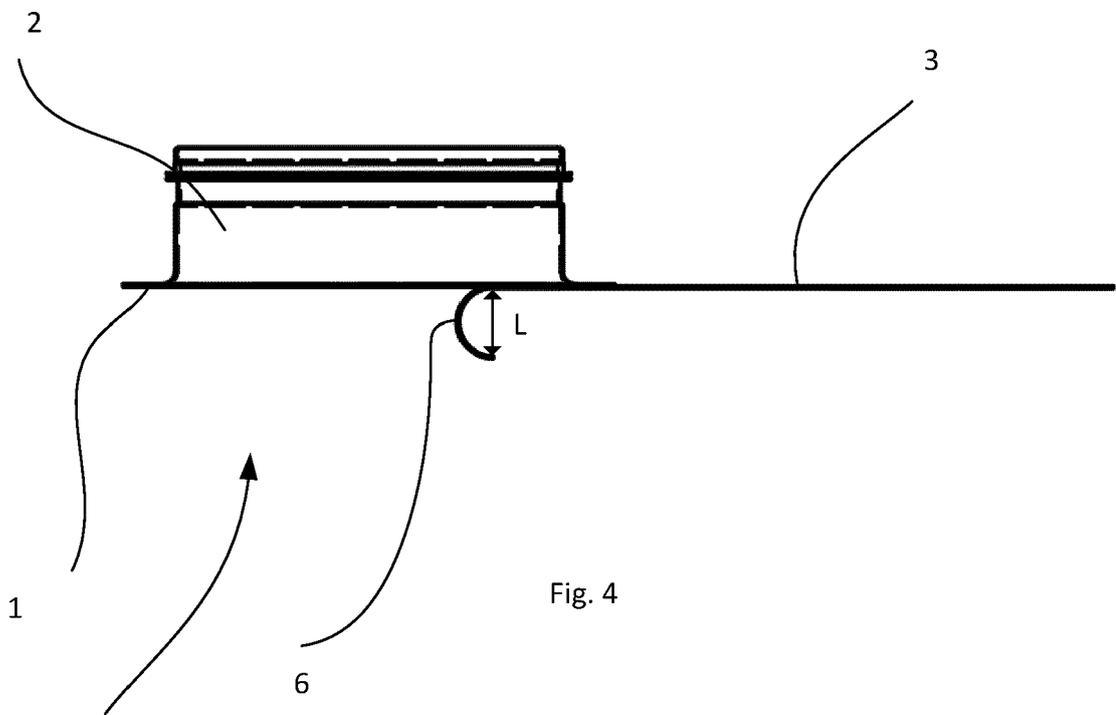
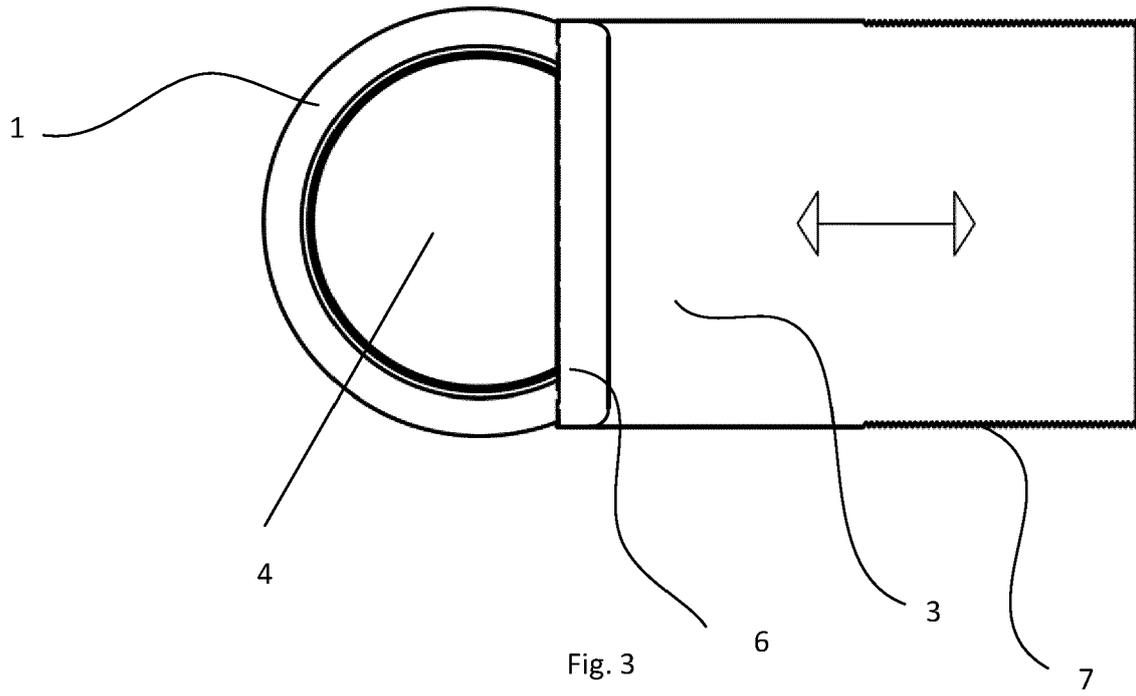


Fig. 2





EUROPEAN SEARCH REPORT

Application Number  
EP 23 18 0792

5

10

15

20

25

30

35

40

45

50

55

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	KR 2021 0153247 A (SEOL CHUL HWAN [KR]) 17 December 2021 (2021-12-17)	1-4, 6, 8-11	INV. F24F7/06
Y	* abstract; figures 1-7 * -----	5, 7	F24C15/20 F24F13/12
Y	KR 2019 0138214 A (DONGKUN HUAHAK CO LTD [KR]) 12 December 2019 (2019-12-12)	5	F24F13/24 F24F7/00
Y	* abstract; figures 1-4 * -----		
Y	BE 1 028 669 A1 (VERO DUCO [BE]) 28 April 2022 (2022-04-28)	7	
	* abstract; figures 1-6 * -----		
			TECHNICAL FIELDS SEARCHED (IPC)
			F24F F24C
The present search report has been drawn up for all claims			
Place of search <b>Munich</b>		Date of completion of the search <b>16 November 2023</b>	Examiner <b>Decking, Oliver</b>
CATEGORY OF CITED DOCUMENTS		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	
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			

2  
EPO FORM 1503 03:82 (P04C01)

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

EP 23 18 0792

5 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.

16-11-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
<b>KR 20210153247 A</b>	<b>17-12-2021</b>	<b>NONE</b>	
<b>KR 20190138214 A</b>	<b>12-12-2019</b>	<b>NONE</b>	
<b>BE 1028669 A1</b>	<b>28-04-2022</b>	<b>BE 1028669 A1</b> <b>NL 2026607 B1</b>	<b>28-04-2022</b> <b>03-06-2022</b>

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82