(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 828 485 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.06.2021 Bulletin 2021/22

(51) Int Cl.:
F25D 17/04 *(2006.01)* ***F25D 3/06*** *(2006.01)*
F25D 11/00 *(2006.01)*

(21) Application number: **20209856.2**

(22) Date of filing: **25.11.2020**

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
KH MA MD TN

(30) Priority: **29.11.2019 NL 2024343**

(71) Applicant: **Incarlin B.V.**
9503 GA Stadskanaal (NL)

(72) Inventor: **SMARIUS, Petrus Franciscus**
5268 LM Helvoirt (NL)

(74) Representative: **V.O.**
P.O. Box 87930
2508 DH Den Haag (NL)

(54) **PASSIVE THERMALLY INSULATED TRANSPORT CONTAINER**

(57) Passive, thermally insulated container with a heat accumulator (29, 30) for transporting products in the container at a temperature above or below ambient temperature. The container has thermally insulated top, bottom and vertical walls bounding a transport chamber (8) for accommodating products to be transported. Goods carriers in the transport chamber are shaped and dimensioned for leaving passages for circulation of air through the goods carriers and/or between the goods carriers and the vertical walls. At least one vane (35, 36) is suspended in said transport chamber in a rotatable manner about at least one pivot axis (77), respectively, wherein said at least one pivot axis is situated at at least one fixed location, respectively, relative to said transport chamber, so that said at least one vane rotatably moves about said at least one pivot axis, respectively, in reaction to agitation of the container.

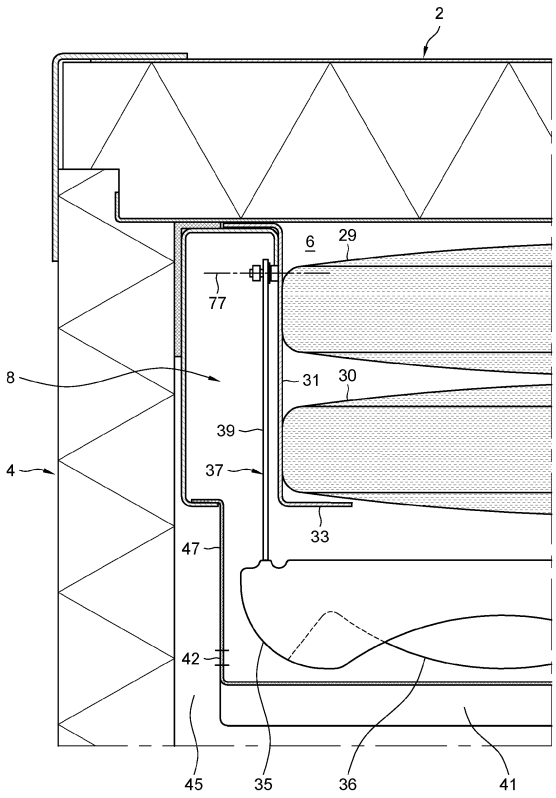

Fig. 5

EP 3 828 485 A1

Description

FIELD AND BACKGROUND OF THE INVENTION

[0001] The invention relates to a passive, thermally insulated container for transporting products at a temperature above or below ambient temperature. In this context 'passive' is understood as without provisions for supplying energy for causing a heat flow opposite to the heat flow from the environment into the transport chamber as a result from the difference in temperature between the environment of the container and the transport chamber.

[0002] Such containers are for instance used in the distribution of food such as bakery product such as pastry and cake, meat and meat products, dairy products and fruits from a production facility or distribution centre to retail outlets and commercial and institutional kitchens, i.e. over relatively short distances to a substantial number of addresses. The containers are mostly for keeping the products cool (e.g. frozen or at or near 4 °C), but in some applications, such as the supply of food to events or the delivery of hot meals, the containers may also be arranged to keep the products warm.

[0003] Passive thermally insulated containers are particularly suitable for such applications, because of the simplicity and ruggedness and because it is not necessary to provide energy to the containers.

[0004] Such containers usually have thermally insulated side, top and bottom walls bounding a transport chamber for accommodating the products to be transported, goods carriers in the transport chamber shaped and dimensioned for leaving passages for circulation of air through the goods carriers and/or between the goods carriers and the vertical walls and at least one heat accumulator. The goods carriers can for instance be crates, boxes, platforms, gratings or plates, which may optionally be provided with wheels or sliders.

[0005] In use, the heat accumulators are cooled to a temperature below the desired temperature in the transport chamber if the products are to be maintained cooler than the ambient temperature or heated to a temperature above the desired temperature in the transport chamber if the products are to be maintained warmer than the ambient temperature. During transport of products to be kept cool, the cooled heat accumulator in the transport chamber absorbs heat from the transport chamber, thereby counteracting heating up of the transport chamber as a result of heat flow from the environment into the transport chamber. Conversely, during transport of products to be kept warm, the heated heat accumulator in the transport chamber gives off heat to the transport chamber, thereby counteracting cooling of the transport chamber as a result of heat flow from the transport chamber to the environment.

SUMMARY OF THE INVENTION

[0006] It is an object of the present invention to provide a passive, thermally insulated transport container in which products can be maintained within a desired temperature range longer, without increasing capacity of the heat accumulator or thermal insulation.

[0007] According to the invention, this object is achieved by providing a container according to claim 1.

[0008] Hence, the invention differs from the above-described known containers in that:
at least one vane is suspended in said transport chamber in a rotatable manner about at least one pivot axis, respectively, wherein said at least one pivot axis is situated at at least one fixed location, respectively, relative to said transport chamber, so that said at least one vane rotatably moves about said at least one pivot axis, respectively, in reaction to agitation of the container.

[0009] In use, agitation of the container occurs in particular during transport in a vehicle, for instance if a lorry or van transporting the container drives over bumps and undulations of a road surface, accelerates and decelerates. Agitation of the container also occurs for instance if the container is rolled over bumps and undulations of a pavement or floor surface and if the container is lifted and lowered.

[0010] Because at least one vane is movably suspended in the transport chamber so as to rotatably move in reaction to agitation of the container, agitation to which the container is submitted during transport causes the vane or vanes to rotatably move, which in turn causes agitation of the air in the transport chamber adjacent to the vane or vanes. Thus, air in the container is mixed, which counteracts the formation of relatively warm or cold spots in the container where product temperature exceeds the maximum temperature of a desired temperature range or is below the minimum temperature of the desired temperature range. Thus, products in zones of the transport chamber where temperature tends to converge to the ambient temperature earlier than in other zones of transport chamber can be maintained within a desired temperature range for a longer period of time. Accordingly, the products can be transported in the container longer while ensuring that the temperatures of all products in the container are maintained within the desired temperature range.

[0011] Particular elaborations and embodiments of the invention are set forth in the dependent claims.

[0012] Further features, effects and details of the invention appear from the detailed description and the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is a side view of an example of a container according to the invention;
Fig. 2 is a front view of the container shown in Fig. 1;
Fig. 3 is a cross-sectional side view along a plane III-III in Fig. 2;

Fig. 4 is a cross-sectional front view along a plane IV-IV in Fig. 3; and

Fig. 5 is an enlarged view of detail V in Fig. 4.

DETAILED DESCRIPTION

[0014] In the drawings an example of a container 1 according to the invention is shown. The container 1 is a passive, thermally insulated container for transporting products at a temperature below ambient temperature. The container 1 is passive, i.e. it is not provided with any equipment for driving a heat flow opposite to the heat flow through the thermal insulation. Accordingly, the container 1 is of a relatively low cost design and can be used without provisions for supplying energy during transport or recharging batteries or the like between transports.

[0015] The container 1 has thermally insulated vertical, top and bottom walls 2-7 bounding a transport chamber 8 for accommodating products to be transported. The wall 2 is a top wall and the wall 7 is a bottom wall, which is mounted on a cart 10 equipped with caster wheels 11 and wheels 12 with rotation axes in fixed orientations relative to a platform 13 of the cart 10. The cart is not shown in Figs. 3 and 4. The vertical walls 3-6 form a front door 3, side walls 4, 5 and a rear wall 6. The front door 3 is pivotable between an open position (not shown) and a closed position about hinges 22, 23. The door 3 can be locked in the closed position by means of bolts 24, 25 hooking behind bolt catchers 26, 27. The bolts 24, 25 are coupled to a handle 28 for simultaneous operation of the bolts 24, 25.

[0016] Goods carriers, in this example in the form of crates 9, are arranged in the transport chamber 8. Instead of crates, the goods carriers may also be provided in other forms, for instance in the form of boxes, platforms, gratings or plates, which may optionally be provided with wheels or sliders. The crates 9 are shaped and dimensioned for leaving passages for circulation of air through the crates 9 and between the crates 9 and the vertical walls 3-6 bounding the transport chamber 8. For allowing circulation of air through the crates 9, the crates 9 are provided with openings 14-18 in vertical walls 19, 20 and bottom wall 21 of the crates 9 as is shown for the topmost one of the crates 9 in figs. 3 and 4. For allowing air circulation between the crates 9 and the vertical walls 3-6 bounding the transport chamber 8, the vertical walls 19 are located spaced (preferably at least 0.5 cm) from the vertical walls 3-6 bounding the transport chamber 8. Flanges projecting from the vertical walls of the crates 9 to the vertical walls 19, 20 can maintain this spacing. The flanges can be provided with openings or recesses for allowing air to pass through, in particular through the flanges that are oriented horizontally or with a substantial horizontal directional component (e.g. at angles of 30° or more to the vertical direction). Other solutions for keeping the crates or other goods carriers spaced from the vertical walls bounding the transport chamber, such as projections from the vertical walls bounding the transport chamber, are also conceivable.

[0017] Thermal insulation is achieved by counteracting heat flows in the form of conduction, convection and radiation. This is achieved by providing the walls 2-7 with insulating material of sufficient thickness (conduction) and sufficient sealing of the transport chamber 8 from the environment (convection). The walls 2-7 may also be provided with reflective surfaces such as aluminium foil (radiation). The insulating material may for instance be plastic foam, which consists of small spaces surrounded by solid walls, fibrous material, or loose-fills (e.g. a mass of unstructured fibres composed of rock slag, glass or alumina-silica or powders, such as perlite, silica aerogel or adiatomaceous earth). The thermal insulation is preferably sufficient to achieve a U value of less than 0.8 $W/m^2.K$ or, with increasing preference, less than 0.65 $W/m^2.K$ or 0.5 $W/m^2.K$.

[0018] Heat accumulators 29, 30 are supported in the transport chamber 8 by support members 31, 32 and rest on flanges 33, 34 of the support members 31, 32. In Fig. 3, the container 1 is shown without the heat accumulators 29, 30, which are removable for re-cooling in a freezer. The heat accumulators 29, 30 are preferably plastic containers filled with a gel on water basis, so that the water can be frozen to ice, thereby accumulating a large amount of energy at the transition from water to ice. The containers may also include additives such as salt or alcohol, to lower the temperature of the water/ice transition, for increasing the cooling effect of frozen heat accumulators 29, 30. Instead of inside the transport chamber 8, the heat accumulators may also be provided elsewhere in the container, for instance in a separate compartment in the container in convective heat exchange communication with the transport chamber. Also, as an alternative, a single heat accumulator or a larger number of heat accumulators may be provided.

[0019] Vanes 35, 36 are movably suspended in the transport chamber 8 so as to move in reaction to agitation of the container 1, such as agitation to which the container 1 is submitted during transport.

[0020] Agitation to which the container 1 is submitted during transport causes the vanes 35, 36 to move, which in turn causes agitation of the air in the transport chamber 8 adjacent to the vanes 35, 36. Thus, air in the transport chamber 8 in the container 1 is mixed, which counteracts the formation of relatively warm or cold spots in the container 1 where product temperature exceeds the maximum temperature of a desired temperature range. Thus, products in zones of the transport chamber 8 where temperature tends to rise fastest can be maintained within a desired temperature range for a longer period of time. Accordingly, products can be transported in the container 1 longer while ensuring that the temperatures of all products in the container 1 are maintained within the desired temperature range.

[0021] The vanes 35, 36 are suspended for oscillating movement in reaction to the agitation of the container 1, so that agitation is converted into movement of the vanes

35, 36, and thereby movement of air in the transport chamber 8, particularly effectively. As an alternative, it would for instance be possible to cause the vanes to rotate in one sense of rotation only, e.g. using a one way clutch, in response to agitation of the container.

[0022] In the present example, agitation of the container 1 as occurring during transport is converted particularly efficiently into movement of the vanes 35, 36, because the vanes 35, 36 are parts of swings 37, 38. Suspended as part of the swings 37, 38, the vanes 35, 36 move out of positions of equilibrium particularly easily, and keep swinging after an impulse for a relatively long time. However, other suspensions of the vanes allowing oscillating movement are also conceivable, such as suspension by one or more springs.

[0023] For obtaining a compact construction that effectively induces heat distribution, the vanes 35, 36 are arranged below the heat accumulators 29, 30. Furthermore, suspension arms 39, 40 of the swings extend vertically along portions of the heat accumulators 29, 30 and are suspended so as to be pivotable about pivot axes 77 (see Figs. 3 and 5) above a lowermost end of the heat accumulators 29, 30. Thus, oscillation of the swings 37, 38 causes the vanes 35, 36 to move mainly horizontally along paths closely below the heat accumulators 29, 30, so that air cooled by the heat accumulators 35, 36 is effectively urged away from the heat accumulators towards the vertical walls 3-6 of the transport chamber 8, where the relatively cooled air can sink between the products in the crates 9 and the vertical walls 3-6 of the transport chamber 8.

[0024] Heat distribution is enhanced particularly effectively, because all the crates 9 are arranged below the heat accumulators 29, 30 and the vanes 35, 60 are arranged between, on one side, the heat accumulators 29, 30 and, on an opposite side, all the crates 9. Thus, cooled air urged away from the heat accumulators 29, 30 tends to sink along all the crates 9.

[0025] If the container is to be used for transporting heated products that are to be kept at a temperature well over the ambient temperature, for the same reasons as discussed above, the vertical configuration of vanes, crates and heat accumulators is preferably inverted, i.e. the heat accumulators are then preferably arranged at a bottom end of the container, the vanes are then preferably arranged above the heat accumulators and the crates are then preferably all arranged above the vanes.

[0026] For avoiding damage to the vanes 35, 36 when the container 1 is loaded, unloaded or cleaned and for a particularly even temperature distribution, a shield 41 is provided between, on one side, the vanes 35, 36 and, on an opposite side, the crates 9. The shield 41 is shaped and dimensioned for leaving passages 42-46 for circulation of air between the shield 41 and the vertical walls 3-6. The passages 42 form openings in flanges 47 of the shield 41, which allow cool air to move off the shield 41 towards the side walls 4, 5. Furthermore, the shield 41 is dimensioned so as to leave a gap 43 between the shield 41 and the door 3, a gap 44 between the shield 41 and the rear wall 45 and gaps 45, 46 between the shield 41 and the side walls 4, 5. The shield 41 also shields products in upper crates 9 from excessive cooling by the heat accumulators 29, 30, while urging air to the gaps 43-46 along the vertical walls 3-6 promotes the descent of cool air towards the lower crates that are more remote from the heat accumulators 29, 30.

[0027] As is best seen in Fig. 3, the vanes 35, 36 are arranged generally parallel to each other in a row in a horizontal direction transverse to main axes of extension of the vanes 35, 36. Thus, the vanes 35, 36 occupy a relatively flat horizontal layer in the transport chamber 8 between the crates 9 and the heat accumulators 29, 30 and nevertheless are capable of effectively displacing air from near the heat accumulators 29, 30.

[0028] For a compact construction occupying little space in the transport chamber 8, it is also advantageous that the vanes 35, 36 are elongated in a horizontal direction. Furthermore, the vanes have heights varying along the length of the vanes 35, 36. This further enhances displacement of air in the directions of the main axes of extension of the vanes 35, 36.

[0029] Some of the vanes 35, 36 have a smallest height in a central portion of the vane 35 and wherein some of the vanes 36 have a smallest height in at least two sections in longitudinal direction of that vane, spaced from a centre of that vane 36. The two types of vanes 35, 36 are arranged in an alternating fashion. If the vanes 35, 36 are not moving in a synchronized fashion, air displaced by a high portion of one vane 35 or 36 can pass relatively easily along an adjacent low portion of a neighbouring vane 36, 35. Thus, air is to a lesser extent trapped between vanes 35, 36 and a larger volume of air displaced by one vane 35, 36 is picked up by the neighbouring vane 36, 35 upon the next movement of the neighbouring vane 36, 35.

Claims

1. A passive, thermally insulated container (1) for transporting products at a temperature above or below ambient temperature, the container (1) comprising:

   a top wall (2), vertical walls (3, 4, 5, 6) and a bottom wall (7), which are thermally insulated and which are bounding a transport chamber (8) for accommodating products to be transported;
   goods carriers (9) in the transport chamber (8), wherein the goods carriers (9) are shaped and dimensioned for leaving passages for circulation of air through the goods carriers (9) and/or between the goods carriers (9) and the vertical walls (3, 4, 5, 6); and
   at least one heat accumulator (29, 30);

   characterized in that:

at least one vane (35, 36) is suspended in said transport chamber (8) in a rotatable manner about at least one pivot axis (77), respectively, wherein said at least one pivot axis (77) is situated at at least one fixed location, respectively, relative to said transport chamber (8), so that said at least one vane (35, 36) rotatably moves about said at least one pivot axis (77), respectively, in reaction to agitation of the container (1).

2. A container (1) according to claim 1, wherein the at least one vane (35, 36) is suspended for oscillating movement in reaction to the agitation of the container (1).

3. A container (1) according to claim 2, wherein the at least one vane (35, 36) is part of a swing (37, 38).

4. A container (1) according to claim 3, wherein the at least one vane (35, 36) is arranged below the at least one heat accumulator (29, 30), wherein suspension arms (39, 40) of the swing (37, 38) extend vertically along at least a portion of the at least one heat accumulator (29, 30), and wherein the suspension arms (39, 40) are suspended so as to be pivotable about said at least one pivot axis (77), and wherein said at least one pivot axis (77) is situated above a lowermost end of the at least one heat accumulator (29, 30).

5. A container (1) according to any of the preceding claims, wherein all the goods carriers (9) are arranged below the at least one heat accumulator (29, 30) or all the goods carriers (9) are arranged above the at least one heat accumulator (29, 30), and wherein the at least one vane (35, 36) is arranged between, on one side, the at least one heat accumulator (29, 30) and, on an opposite side, all the goods carriers (9).

6. A container (1) according to any of the preceding claims, further comprising a shield (41) between, on one side, the at least one vane (35, 36) and, on an opposite side, the goods carriers (9), wherein the shield (41) is shaped and dimensioned for leaving passages (42, 43, 44, 45, 46) for circulation of air through the shield (41) and/or between the shield (41) and the vertical walls (3, 4, 5, 6).

7. A container (1) according to any of the preceding claims, comprising a plurality of said at least one vane (35, 36) arranged generally parallel to each other in a row in a horizontal direction transverse to main axes of extension of the vanes (35, 36).

8. A container (1) according to any of the preceding claims, wherein the at least one vane (35, 36) is elongated in a horizontal direction, and wherein at least one of the at least one vane (35, 36) has heights varying along the length of that at least one of the at least one vane (35, 36).

9. A container (1) according to any of the preceding claims, wherein at least a plurality of said at least one vane (35, 36) have heights varying along the lengths of respective vanes of said plurality, wherein some of the respective vanes of said plurality have a smallest height in a central portion of a respective vane, and wherein some of the respective vanes of said plurality have a smallest height in at least two sections in longitudinal direction of a respective vane, spaced from a centre of a respective vane.

10. A container (1) according to any of the preceding claims, wherein said top wall (2), said vertical walls (3, 4, 5, 6) and said bottom wall (7) have a heat conductivity of less than 0.8 $W/m^2.K$.

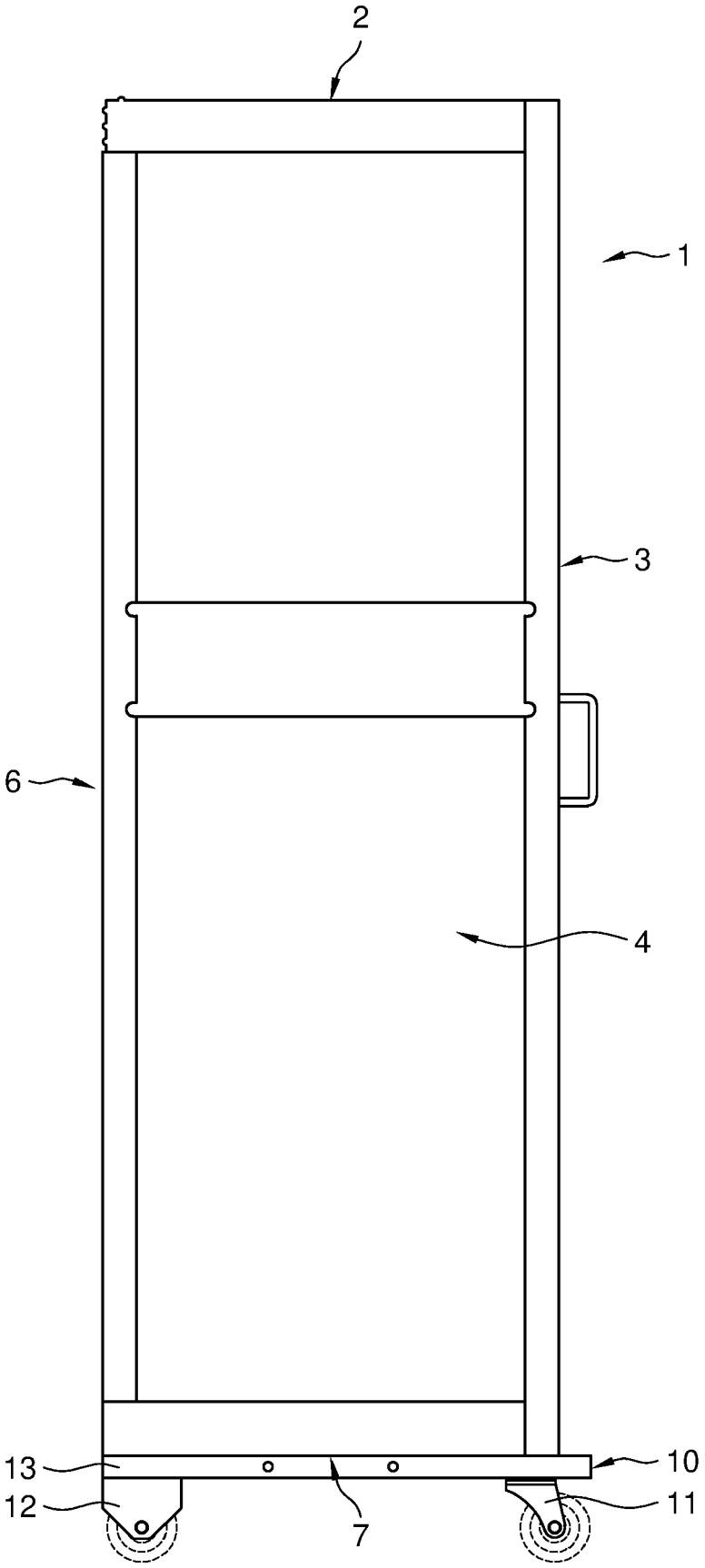

Fig. 1

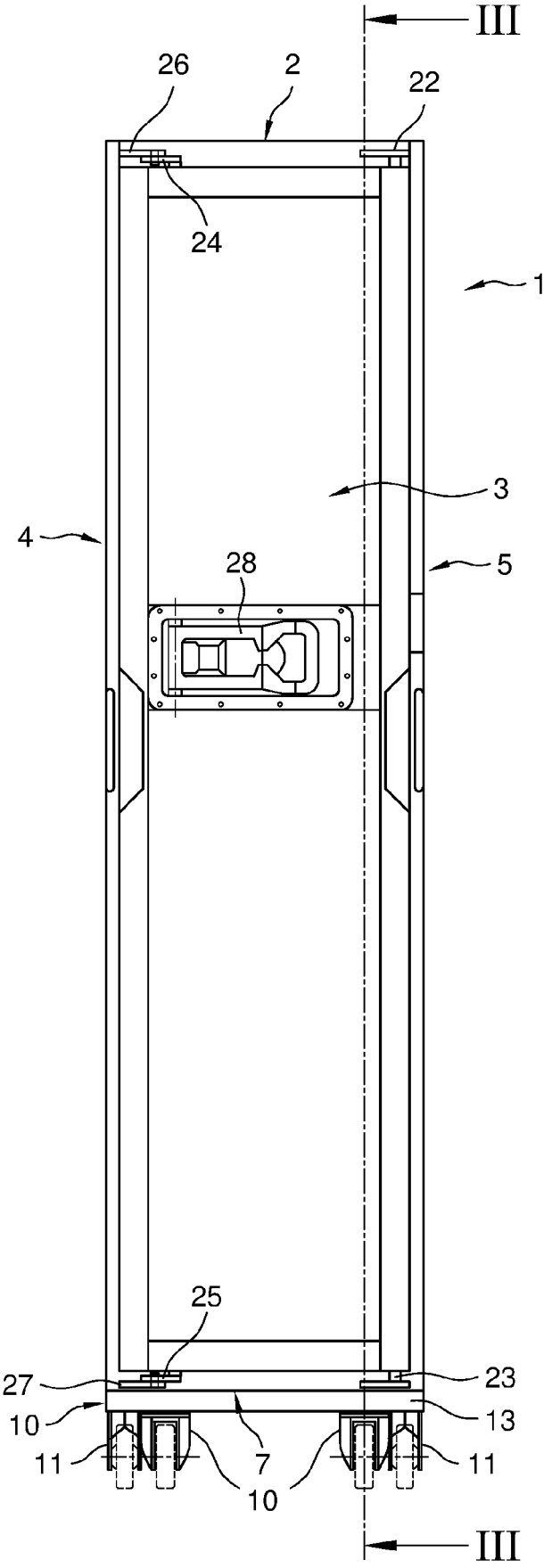

Fig. 2

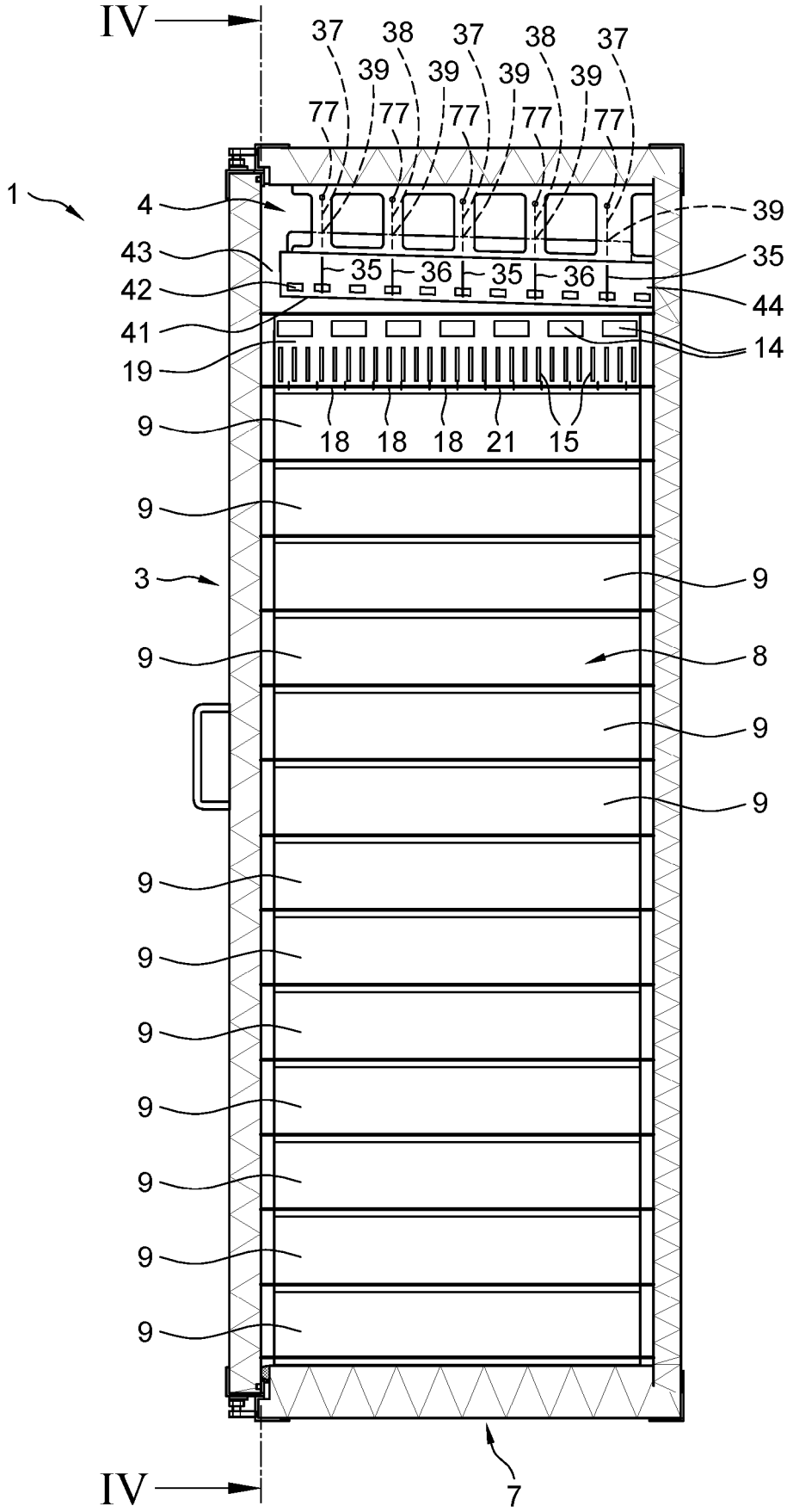
IV
37
38
37
38
37
39
39
39
39
77
77
77
77
77
1
4
39
43
35
36
35
36
35
42
44
41
14
19
9
18
18
18
21
15
9
3
9
8
9
9
9
9
9
9
9
9
9
9
9
IV
7

Fig. 3

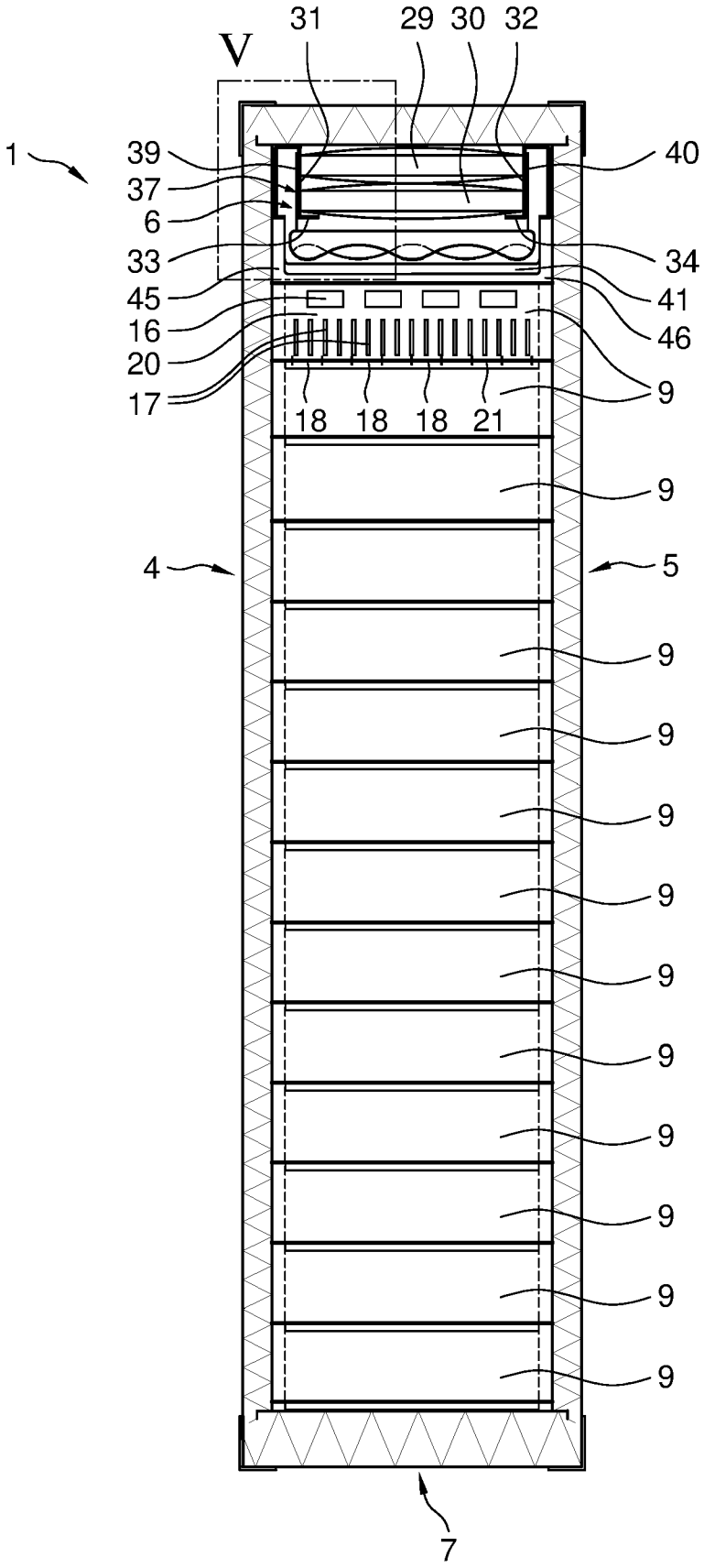

Fig. 4

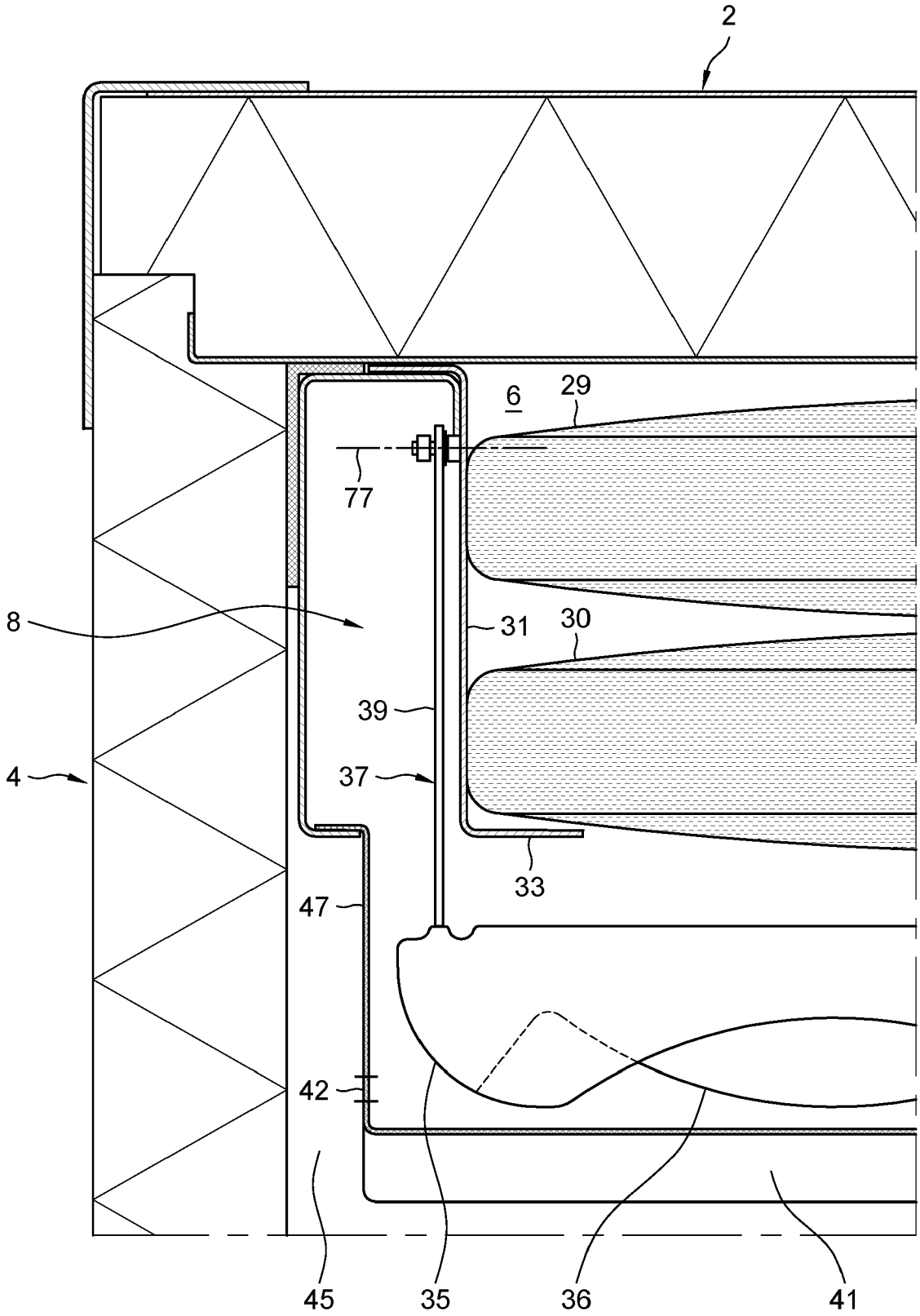

Fig. 5

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 20 20 9856

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 A	US 1 939 957 A (DAY FRED J) 19 December 1933 (1933-12-19) * page 1, line 64 - page 3, line 123; figures 1-5 *	1-3,5,10 4,6-9	INV. F25D17/04 F25D3/06 F25D11/00
A	DE 20 2012 101093 U1 (VIESSMANN KAELTETECHNIK AG [DE]) 3 July 2012 (2012-07-03) * the whole document *	1-10	
A	WO 2017/060760 A1 (INNOVATION THRU ENERGY CO LTD [JP]) 13 April 2017 (2017-04-13) * the whole document *	1	
A	US 2006/174648 A1 (LANTZ GARY [US]) 10 August 2006 (2006-08-10) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (IPC)

F25D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	1 April 2021	de Graaf, Jan Douwe

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 20 20 9856

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.

01-04-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 1939957 A	19-12-1933	NONE	
DE 202012101093 U1	03-07-2012	NONE	
WO 2017060760 A1	13-04-2017	CN 106895629 A	27-06-2017
		CN 208720605 U	09-04-2019
		US 2018283763 A1	04-10-2018
		WO 2017060760 A1	13-04-2017
US 2006174648 A1	10-08-2006	NONE	

EPO FORM P0459

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