



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
17.10.2012 Bulletin 2012/42

(51) Int Cl.:
D06F 58/24 (2006.01)

(21) Application number: **11425105.1**

(22) Date of filing: **15.04.2011**

(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

(72) Inventor: **Fumagalli, Aldo**
20900 Monza MB (IT)

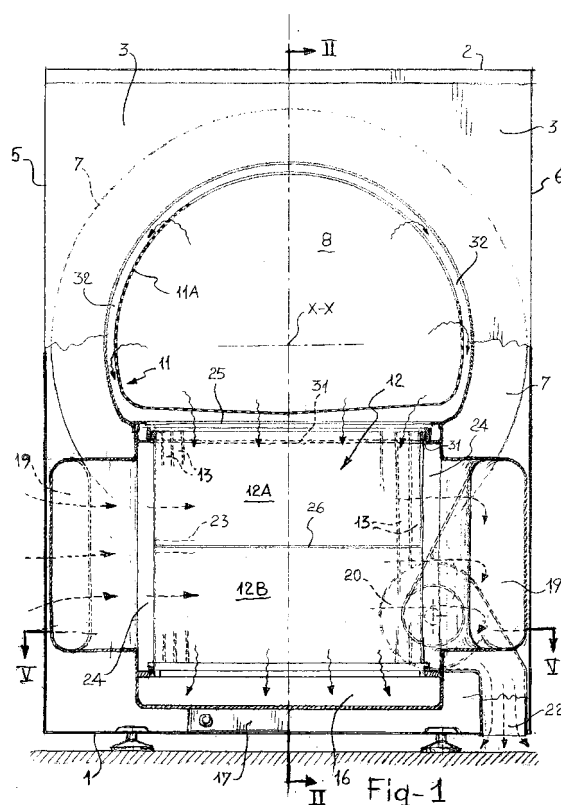
(74) Representative: **Perani, Aurelio et al**
Perani & Partners
Piazza San Babila, 5
20122 Milano (IT)

(71) Applicant: **Candy S.p.A.**
20900 Monza (MB) (IT)

(54) **Condenser for laundry drying machine**

(57) A laundry dryer machine, wherein a flow of drying air is circulated through a path, which comprises a fan (9) for moving said flow, a motor (10) for driving said fan, at least one filter (11) for filtering the flow, a drum (7) for containing the laundry to be dried, a condenser (12) with a plurality of channels (13) for the flow of drying air, for removing the moisture absorbed by the flow through the laundry in the drum (7), a container (17) for collecting condensate, a box-like structure for containing the components of the machine, said structure having a base (1), a top surface (2), a front vertical wall (3), a back vertical wall (4) and corresponding lateral vertical walls (5, 6), an opening (8) formed in said front vertical wall (3) for loading the laundry to be dried, a door (8A) adapted to open and close said opening (8) for loading and removing laundry, a conduit (19) for conveying a flow of cooling air to the condenser (12).

The condenser (12) is located in a niche (24) formed in the front vertical wall (3) of said containing structure under said door (8A) and said plurality of channels (13) of the condenser (12) for the flow of drying air extend from top to bottom, toward the base (1) of the box-like containing structure.



Description

[0001] The present invention relates to a laundry dryer machine, wherein a flow of drying air is circulated through a path, which comprises a fan for moving said flow, a motor for driving said fan, at least one filter for filtering the flow, a drum for containing the laundry to be dried, a condenser with a plurality of channels for the flow of drying air, for removing the moisture absorbed by the flow through the laundry in the drum, a container for collecting the condensate removed from the flow of drying air, a box-like structure for containing the components of the machine, said structure having a base, a top surface, a front vertical wall, a back vertical wall and corresponding lateral vertical walls, an opening formed in said front vertical wall for loading the laundry to be dried into the drum, a door adapted to assume an open position and a closed position to open and close said opening for loading and removing laundry, a conduit for conveying a flow of cooling air to the condenser, said conduit having a fan, a motor for driving it, as well as a first air intake opening and a second air exhaust opening, both openings communicating with the environment outside the machine.

[0002] Laundry dryer machines as described above are known in the art, examples thereof being disclosed in EP 1,990,464 and EP 1,925,713.

[0003] According to the prior art, the condenser for removing moisture from the flow of drying air and conveying the condensate into a collecting tray is generally located near the base of the containing structure of the machine proximate to such condensate collecting tray.

[0004] Furthermore, still according to the prior art, as a result of the particular arrangement of the condenser in the machine, the channels through which the flow of moist drying air moves across the body of the condenser are arranged in a horizontal position, or slightly inclined in the direction of flow.

[0005] The configuration and position of the condenser according to the prior art involves certain drawbacks, some of which affect the energy efficiency of the machine, and others have effects on the maintenance and fabrication of the machine.

[0006] The position of the condenser near the base of the machine requires the provision of a special door whose size conforms to the size of the condenser, to allow inspection and removal for the required periodical revision and cleaning. The provision of a door and a corresponding opening patently involves an increase of the manufacturing costs for the containing structure of the machine. Furthermore, since the condenser is located at the bottom of the machine and has a considerable weight, it is somewhat difficultly removable, whereby periodic cleaning of its channels is not performed by users but preferably by specially skilled maintenance personnel, which involves corresponding costs. Finally, the somewhat horizontal orientation of the condenser channels through which the drying air flows facilitates the build-up of deposits within the channels, which slow down the flow

of drying air and hence reduce the overall energy efficiency of the machine.

[0007] Therefore, the object of the present invention is to modify a condenser for removing moisture from the flow of drying air in a laundry dryer machine to allow removal thereof for cleaning even without the help of specially skilled maintenance personnel and without providing a special door and corresponding opening to access the condenser for removal.

[0008] A further object is to improve the overall energy efficiency of the machine. These objects are fulfilled by a laundry dryer machine as defined in the characteristics of claim 1 hereinafter, which shall be intended to be integrated herein by reference.

[0009] The characteristics and advantages of the present invention will appear more clearly from the following detailed description of a few practical embodiments, illustrated by way of non-limiting examples in the annexed drawings, in which:

- Figure 1 is a front schematic and partially vertically sectional view of the laundry dryer machine of the invention, according to a first embodiment thereof;
- Figure 2 is a vertically sectional view of the machine, as taken along the line II-II of Figure 1;
- Figure 3 is an enlarged schematic view of the vertical section of Figure 2, showing the body of the condenser and the door for access to the drying drum;
- Figure 4 is an enlarged view of a detail of Figure 3, at the junction of the condenser sections;
- Figure 5 is a partially horizontally sectional view, as taken along the line V-V of Figure 1;
- Figure 6 shows a portion of the front schematic sectional view of Figure 1, with the means for removing the sections that compose the condenser;
- Figure 7 shows a front schematic partially vertically sectional view of a second embodiment of the laundry dryer machine of the invention, with the filters for the drying air flow in an operating position;
- Figure 8 shows the embodiment of Figure 7 with one of the filters for the drying air flow removed from its operating position and with the first section of the condenser also removed from its operating position.

[0010] Referring to the above figures, the laundry dryer machine of the invention comprises a box-like structure containing the various devices, which is comprised of a base 1, a top wall 2, a front vertical wall 3, a back vertical wall 4 and lateral vertical walls 5 and 6.

[0011] The containing structure houses the drum 7, which rotates about a generally horizontal axis X-X, and is adapted to contain the laundry to be dried, which is loaded and unloaded through an opening 8 formed in the front wall 3 of the containing structure. The opening 8 is in the form of a tubular recess 3A of the wall whose axis is parallel to the axis of rotation X-X of the drum 7.

[0012] The opening 8 is closed by a door 8A, which is mounted in the wall 3 to be opened and closed by the

user of the machine by conventional fastening and support means, which are not shown as they are unnecessary for the understanding of the present invention.

[0013] The door 8A of the prior art generally has the shape of a washing-machine window.

[0014] The drum 7 is conventionally mounted in such a configuration as to rotate by the action of support and drive means, which are known in the art and not shown, as they are unnecessary for the understanding of the present invention.

[0015] The laundry loaded into the drum 7 through the opening 8, which is closed by the door 8A, is dried by a flow of drying air, which is circulated through a path comprising a fan 9 for moving said flow, a motor 10 for driving said fan, at least one filter 11 for filtering the flow, the cavity of the drum 7 containing the laundry to be dried, a condenser 11 with a plurality of inner channels 13, a conduit 14 connecting the condenser 12 to the inlet 15 of the fan 9, with a manifold portion 16 for grouping the outlets of the condenser channels 13.

[0016] A conventional tray 17 is placed under the manifold portion 16 of the channel 14, for collecting the condensate obtained from the removal of moisture absorbed by the flow through the laundry in the drum 7.

[0017] Downstream from the fan 9, the drying air path comprises a device 18 that heats the drying air flow if and when this is required by the operating cycle of the laundry dryer machine.

[0018] The heating device 18 conventionally consists of an electrical resistor.

[0019] The box-like containing structure also houses a conduit 19 for conveying a flow of drying air onto the condenser 12, said conduit being equipped with a fan 20 which, in the illustrated embodiment, is driven by the same electric motor 10 that drives the fan 9. Alternatively, the fan 20 may be driven by a dedicated independent electric motor.

[0020] The conduit 19 has a first air intake opening 21 and a second exhaust opening 22, both openings 21 and 22 communicating with the environment outside the machine.

[0021] The drying air that flows through the conduit 19 moves across the condenser 12 through dedicated channels, referenced 23.

[0022] According to the invention, the condenser 12 is placed under the door 8A through which the laundry is loaded into the drum 7, more particularly in a niche 24 formed in the front vertical wall 3 of the containing structure, between the lower profile 25 of the door 8A and the upper wall of the portion 16 of the channel 14.

[0023] Still according to the invention, the condenser 12 comprises at least one first and one second sections, referenced 12A and 12B respectively, in which respective portions of the channels 13, through which the drying air flows, are referenced 13A and 13B.

[0024] The two sections of the condenser 12 are vertically arranged one above the other, with their respective channel portions 13A and 13B aligned together to form

a single channel 13. A partition 26 is placed at the junction between the channel portions 13A and 13B, with holes 27 formed at the longitudinal axis of the channel portions 13A and 13B to ensure continuity of the channel 13. Pads 28, for instance made of rubber or plastic, are placed adjacent to the through holes 27 and project out of both sides of the partition 26, thereby acting as seals to hold the channels 13 separate from the channels 23 through which the cooling air is caused to flow.

[0025] When the condenser 12 is in its operating position in the niche 24, the channels extend from top to bottom, preferably in a vertical direction relative to the base 1 of the containing structure.

[0026] Otherwise, the channels 13 may be inclined to the base 1.

[0027] The channels 23 for the drying air flow extend transverse, preferably perpendicular to the direction of the channels 13.

[0028] As a whole, each of the sections 12A and 12B of the condenser 12 has a rectangular parallelepiped shape and the niche 24 has a corresponding volumetric conformation, of slightly larger size, to allow insertion and removal of the individual sections 12A and 12B, or at least the first section 12A as well as proper positioning to ensure continuity of the channels 13.

[0029] The insertion and removal of the sections 12A and 12B of the condenser 12 are allowed by the provision of a first rod-like element 29 attached to one side of the section 12A and a second rod-like element 30 attached to one side of the second section 12B. These elements 29 and 30 extend adjacent the sections 12A and 12B to a position beyond the entrance 31 of the niche 24, where their free ends 29A and 30A are bent, for instance, into hooks for manual grasping by a user.

[0030] The bottom 24A of the niche 24 has an opening 24B which communicates with the manifold portion 16 of the conduit 14 for circulation of the drying air flow.

[0031] For accurate placement and removal of the sections 12A and 12B of the condenser, conventional slide guides may be formed in the walls of the niche 24 and conventional counter-guides may be formed in the corresponding sides of the sections 12A and 12B, said guides and counter-guides being in mutual sliding engagement.

[0032] The opening of the door 8A for loading the laundry into the drum 7 allows immediate access to the entrance 31 of the niche 24, as well as immediate access to the ends 29A and 30A of the elements 29 and 30 for removal of the sections 12A and 12B of the condenser 12, thereby avoiding the need of providing specially dedicated doors for access to the condenser, unlike the prior art.

[0033] Preferably, the door 8A has a contour with an essentially rectilinear section at the entrance 31 of the niche 24, the rest of the contour maintaining its circular shape.

[0034] With this shape, the condenser 12 has the required overall size to ensure its function of exchanging

heat between the hot moist flow of drying air and the flow of cooling air.

[0035] The vertical dimensions of the sections 12A and 12B are determined according to the available width of the opening 8 when the door 8A is opened to remove each section of the condenser first from the niche 24 and then out of the opening 8.

[0036] Furthermore, the provision of a condenser 12 composed of two sections 12A and 12B allows frequent cleaning of the section that is more exposed to the build-up of thread-like deposits circulated with the flow of drying air, i.e. the first section 12A, as the door 8A is opened for loading or unloading laundry. According to the invention, in the embodiment as shown in Figures 1 and 2, the filter 11 inserted within the path of drying air is in the form of a tubular body inserted in the tubular recess 3A of the opening 8.

[0037] The cross section of the filter 11 conforms to that of the inner contour of the tubular recess of the opening 8, an annular channel 32 being thus formed between the wall 11A made of filter material of the filter 11 and the wall surrounding the recess 3A.

[0038] The filter 11 has a flange 11B which axially abuts against the inner edge 3B of the tubular recess thereby isolating said annular chamber 32 from the cavity of the drum 7.

[0039] The flow of drying air axially enters the tubular body of the filter 11 and exits therefrom to enter the annular gap 32. From the latter, it flows through the entrance 31 of the niche 24 into the channels 13 of the condenser 12 and moves to the bottom, where it enters the manifold portion 16 of the conduit 14, under the suction effect of the fan 9.

[0040] The position of the filter 11 within the opening 8 allows immediate inspection of the cleaning conditions of the filter as the door 8A is opened and particularly, if the tubular wall 11A of the filter 11 is dirty, the user will be motivated to clean it, even before removing the laundry at the end of a drying cycle. Referring to the second embodiment of the laundry dryer machine of the invention, as shown in Figures 7 and 8, it shall be noted that the filter for the drying air flow comprises two curved hollow bodies, referenced 33 and 34 respectively, facing toward each other, in the contour of the tubular recess 3A of the opening 8. Such curved hollow bodies 33 and 34 extend between a gridlike wall 35 that covers the upper part of the first section 12A of the condenser 12 and a wall opposed thereto, referenced 36, also in grid form which forms a chamber with the contouring wall of the tubular recess 3A of the opening 8. Each of the hollow bodies 33 and 34 is preferably composed of a front wall 33A, 34A and a respective back wall 33B, 34B, made of a filter material, spaced from the former to form respective compartments 33C and 34C.

[0041] The latter communicate with the chamber 37 through respective openings 33D and 34D, aligned with respective passages 36A and 36B of the wall 36.

[0042] The contour of the tubular recess 3A of the

opening 8 has a first channel 38 located behind the hollow filtering body 33 and a second channel 39 behind the hollow filtering body 34. These channels extend parallel to the filtering walls 33B and 34B, are closed at their ends 38A and 39A and open at the other ends, where they open by their respective openings 38B and 39B into the first section 12A of the condenser 12, under the wall 35.

[0043] It will be appreciated from the above that the flow of drying air moved by the fan 9 out of the drum, enters the chamber 37 and then the chamber 33C or 34C of the filtering bodies 33 and 34. From the latter the flow passes through the filtering wall 33B, 34B respectively and accesses the condenser 12 through the channels 38 and 39.

[0044] Also according this second embodiment, any clogging of the filtering bodies 33 and 34 is immediately ascertained by the user as he/she opens the door 8A. Therefore, cleaning may be carried out by the user, even before removing the dried laundry.

[0045] Cleaning of one or both filtering bodies 33 and 34 is carried out by manually removing them towards the interior of the opening 8, as shown in Figure 8 and by pulling them off the machine without requiring any special inspection door for the filtration system.

[0046] It shall be noted that the provision of the filtering bodies 33 and 34 on opposed portions of the contour of the tubular recess 3A of the opening 8, with respective channels 38 and 39 for the flow, facilitates circulation of the air flow as the rotation of the drum 7 is reversed. This is because, depending on the direction of rotation of the drum, the drying air will preferentially flow into one or the other of the channels 38 and 39, and hence through the filtering body 33 or the one referenced 34, with doubtless advantages in terms of energy efficiency of the machine.

[0047] It shall be understood that variant embodiments other than those described and illustrated herein may be implemented by those skilled in the art, without departure from the scope of the present invention, as claimed below.

Claims

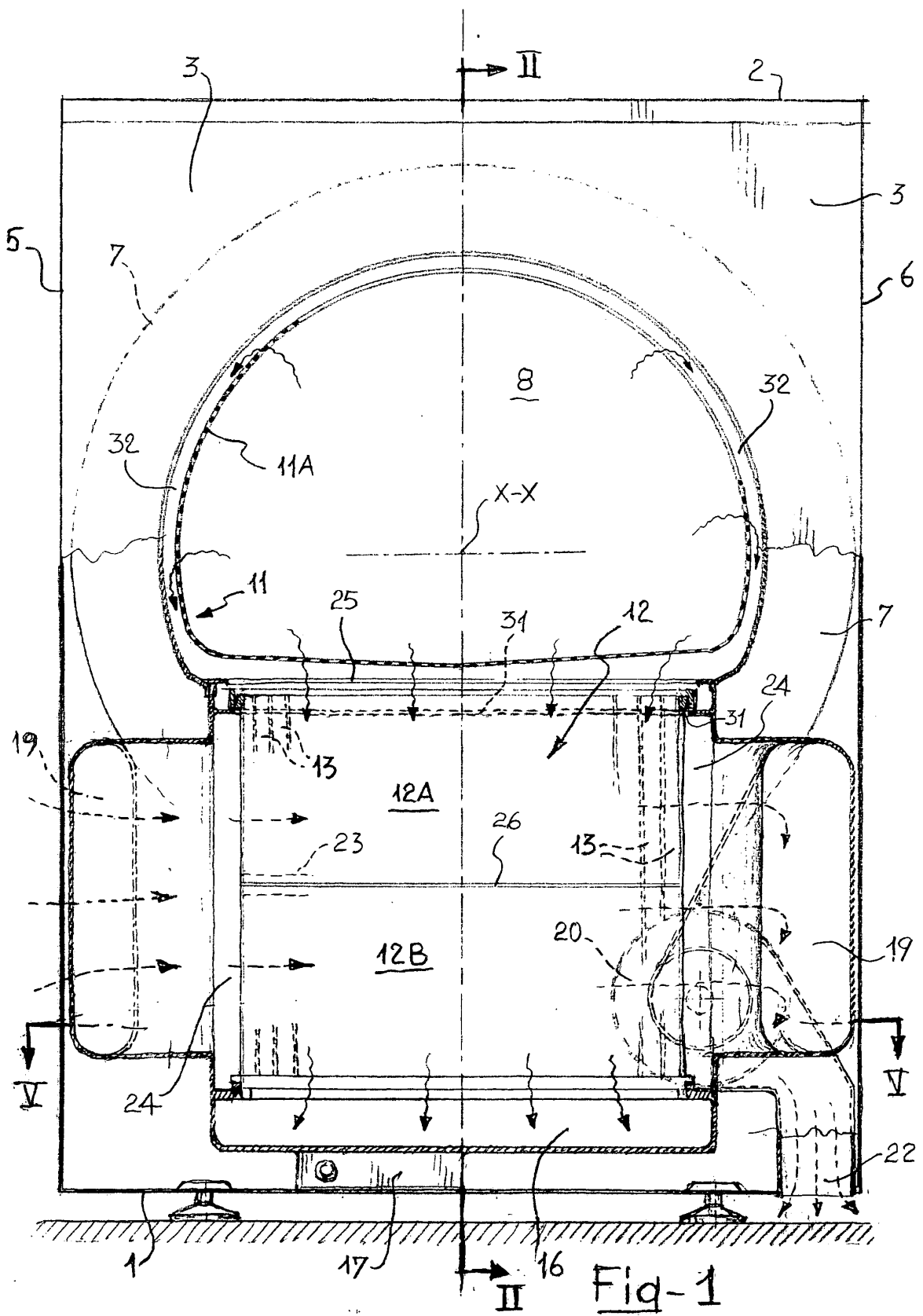
1. A laundry dryer machine, wherein a flow of drying air is circulated through a path, which comprises a fan (9) for moving said flow, a motor (10) for driving said fan, at least one filter (11) for filtering the flow, a drum (7) for containing the laundry to be dried, a condenser (12) with a plurality of channels (13) for the flow of drying air, for removing the moisture absorbed by the flow through the laundry in the drum (7), a container (17) for collecting the condensate removed from the flow of drying air, a box-like structure for containing the components of the machine, said structure having a base (1), a top surface (2), a front vertical wall (3), a back vertical wall (4) and corresponding lateral vertical walls (5, 6), an opening (8) formed in said front vertical wall (3) for loading

the laundry to be dried into the drum (7), a door (8A) adapted to assume an open position and a closed position to open and close said opening (8) for loading and removing laundry, a conduit (19) for conveying a flow of cooling air to the condenser (12), said conduit (19) having a fan (20), a motor (10) for driving it, as well as a first air intake opening (21) and a second exhaust opening (22), both openings communicating with the environment outside the machine, **characterized in that** said condenser (12) is located in a niche (24) formed in the front vertical wall (3) of said containing structure under said door (8A) and said plurality of channels (13) of the condenser (12) for the flow of drying air extend from top to bottom, toward the base (1) of the box-like containing structure.

2. A laundry dryer machine as claimed in claim 1, **characterized in that** said plurality of channels (13) of the condenser (12) for the flow of drying air extend vertically toward said base (1) of the box-like containing structure.
3. A laundry dryer machine as claimed in claim 1, **characterized in that** said condenser comprises a first section (12A) and at least one second section (12B), each channel (13A) of said plurality of channels for the flow of drying air of one section (12A) being disconnectably joined to a respective channel (13B) of said plurality of channels of the other section (12B) of the condenser, said first section (12A) being separable from the second (12B), and at least said first section having means (29, 29A) for insertion thereof in the niche (24) and removing it from the niche.
4. A laundry dryer machine as claimed in claim 3, **characterized in that** it includes seal elements (27, 28) between the first (12A) and second (12B) sections of the condenser (12), said seal elements being adapted to isolate the channels (13) through which the drying air flows from the cooling air flow at the junction thereof.
5. A laundry dryer machine as claimed in claim 3, **characterized in that** said means for removing said first condenser section include a removing element (29) with a manual grasping arrangement (29A) connected to said first section (12A) and accessible when the door (8A) for loading and unloading laundry is open.
6. A laundry dryer machine as claimed in claim 3, **characterized in that** said second section (12B) of the condenser is also removable from said niche (24) and said containing structure, after removal of said first section (12A).
7. A laundry dryer machine as claimed in claim 6, **char-**

acterized in that said means for removing said second condenser section include a removing element (30) with a manual grasping arrangement (30A) connected to said second section (12B) and accessible when the door (8A) for loading and unloading laundry is open.

8. A laundry dryer machine as claimed in any claim from 1 to 7, **characterized in that** said niche (24) for containing the condenser (12) is connected to said conduit (19) for conveying the cooling air flow to the condenser, thereby forming a portion of the conduit.



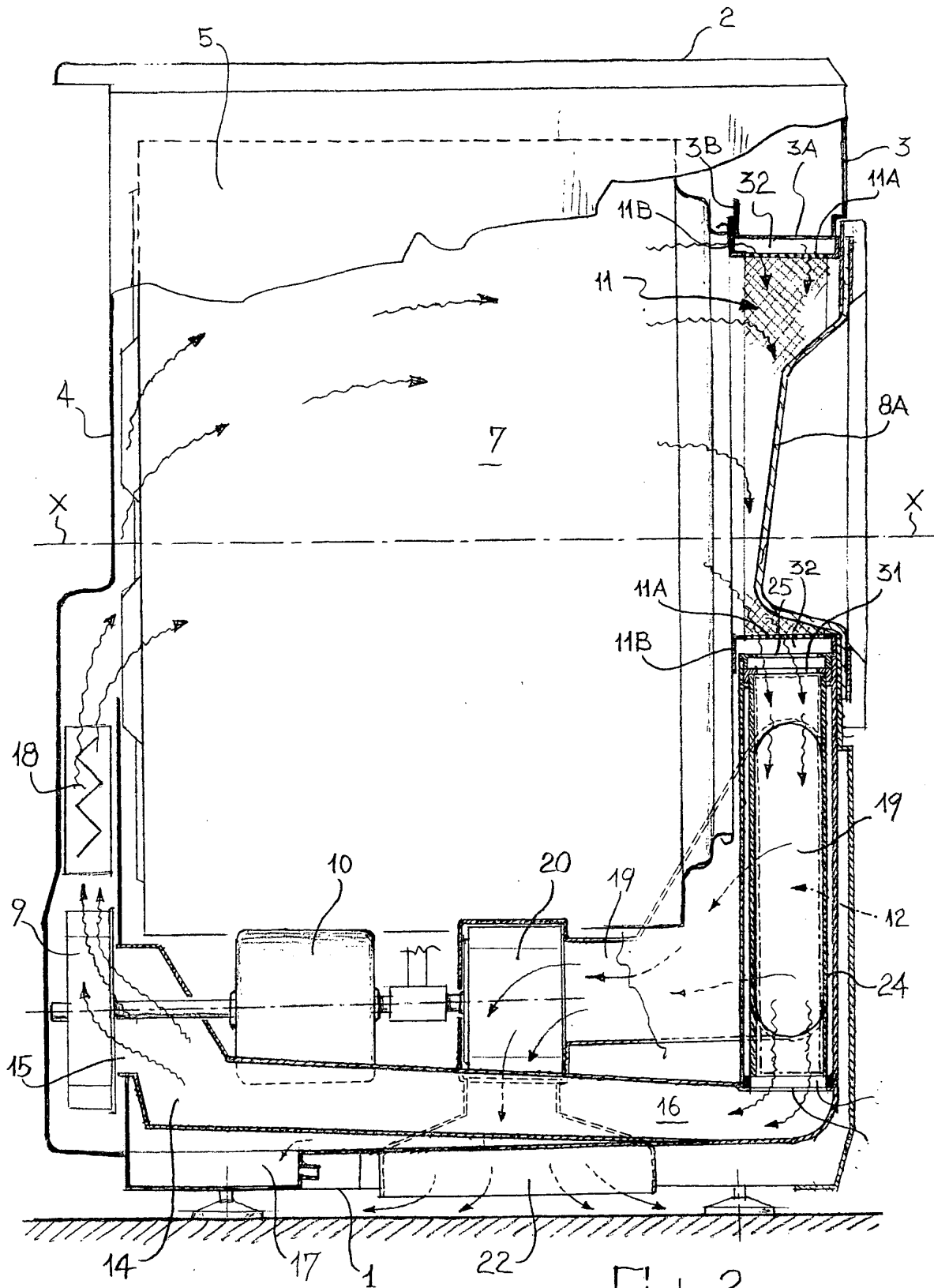
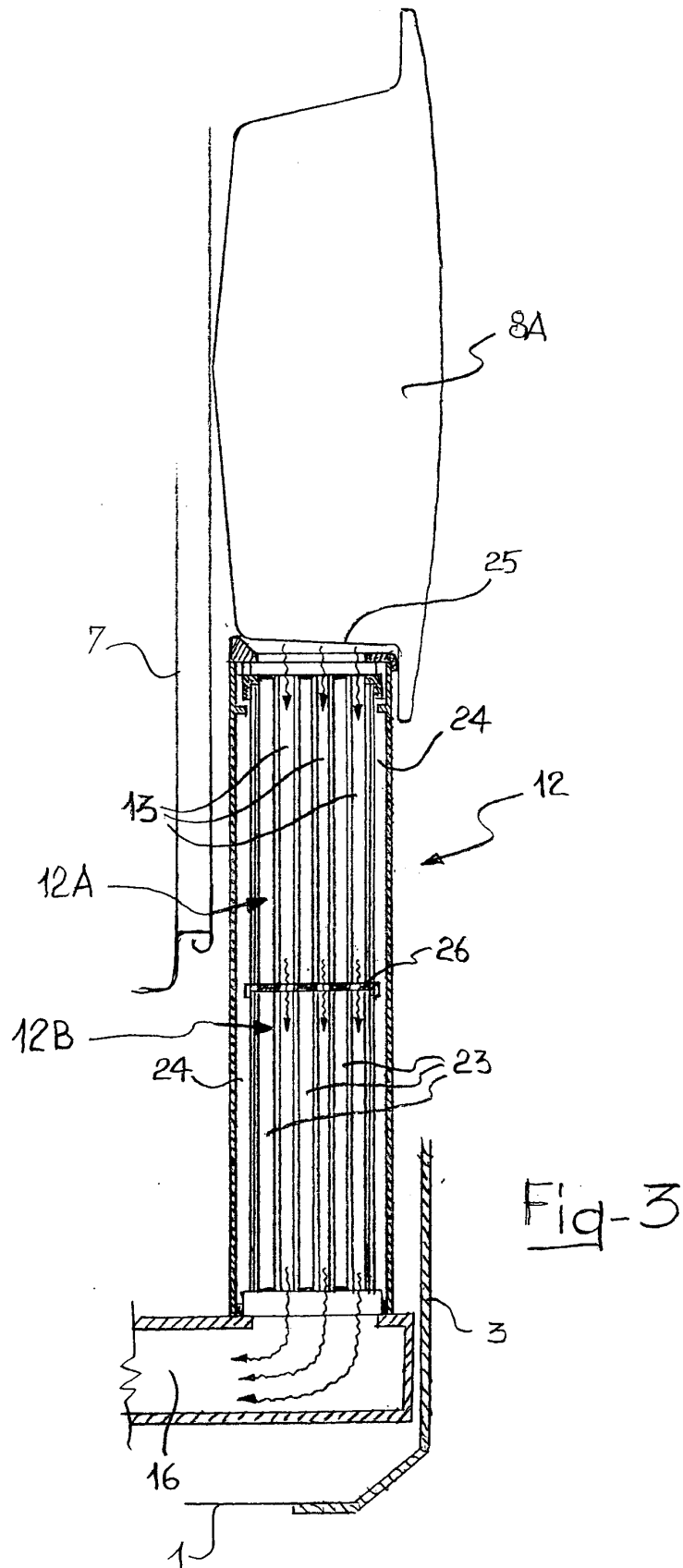


Fig. 2



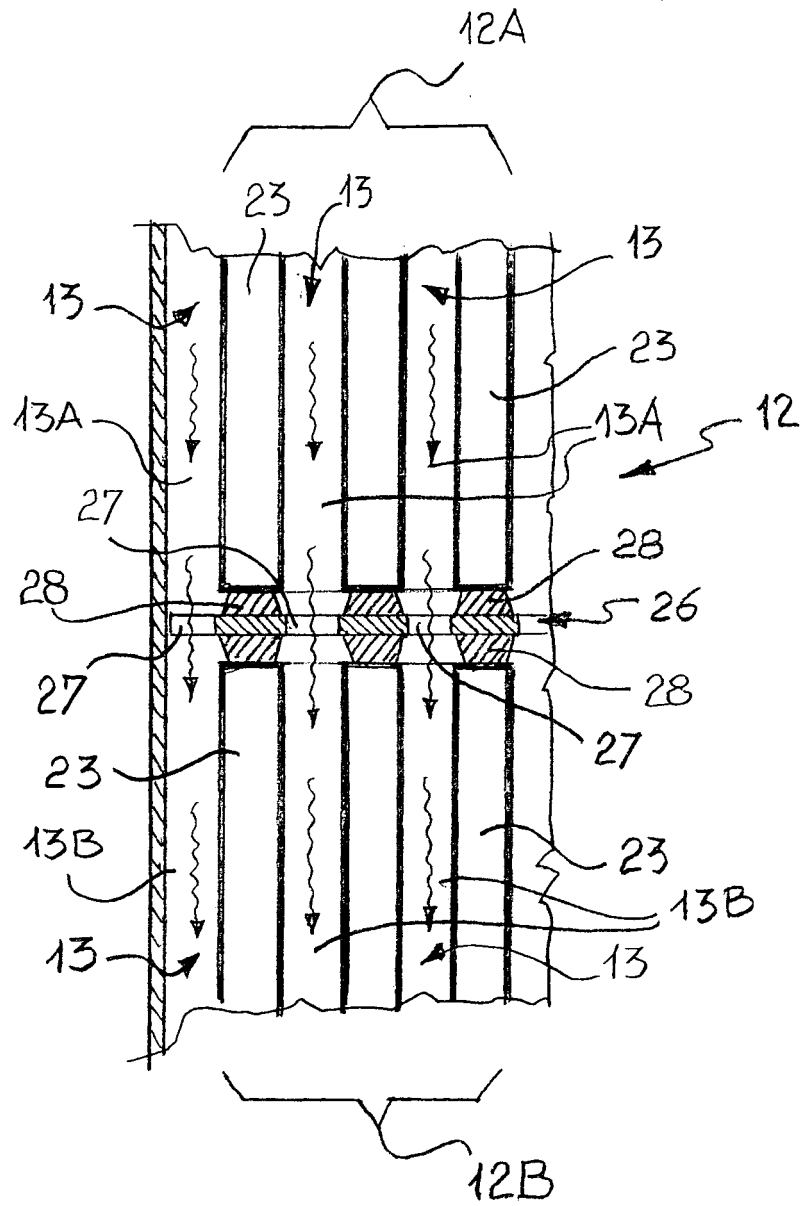


Fig-4

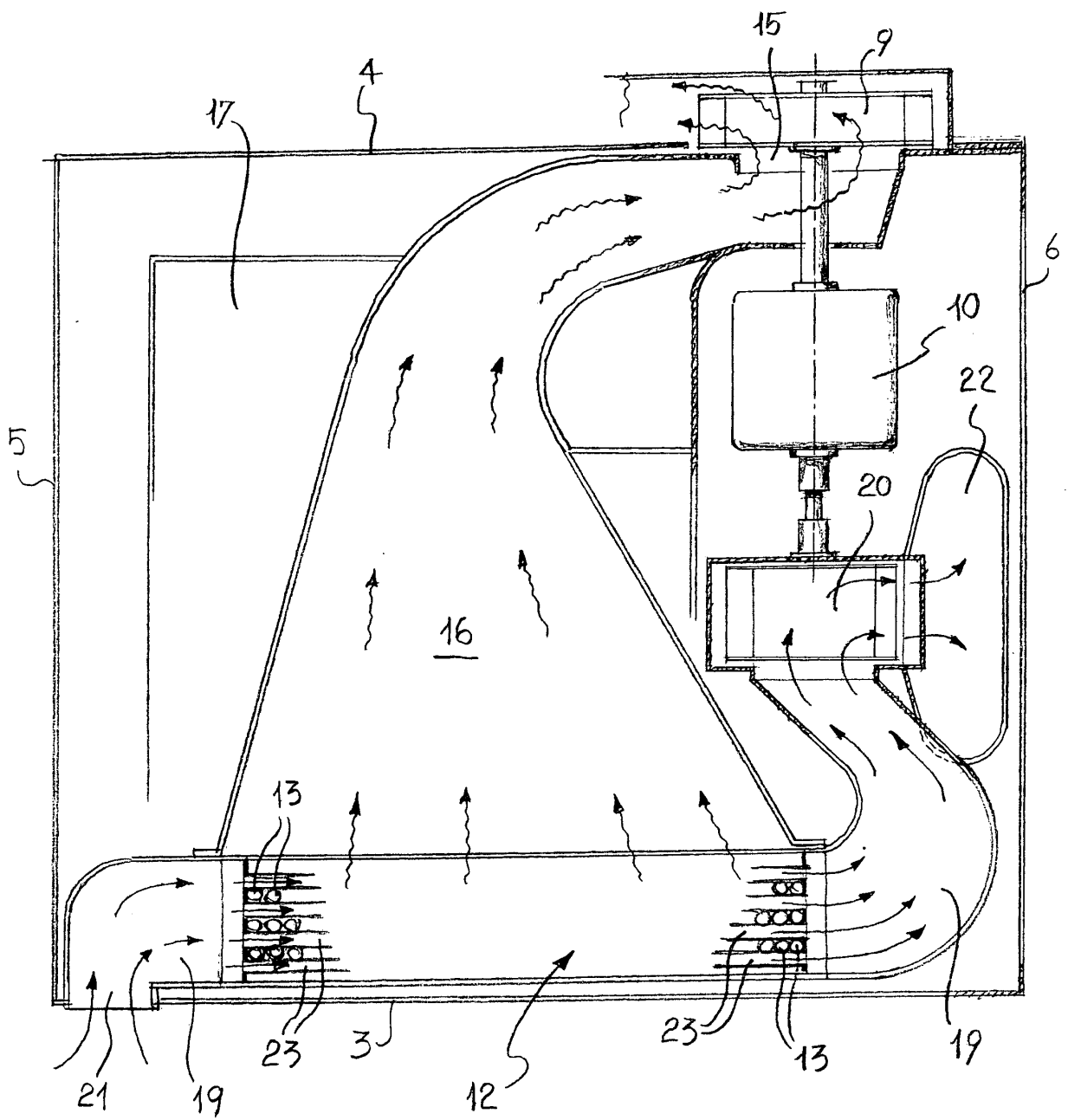
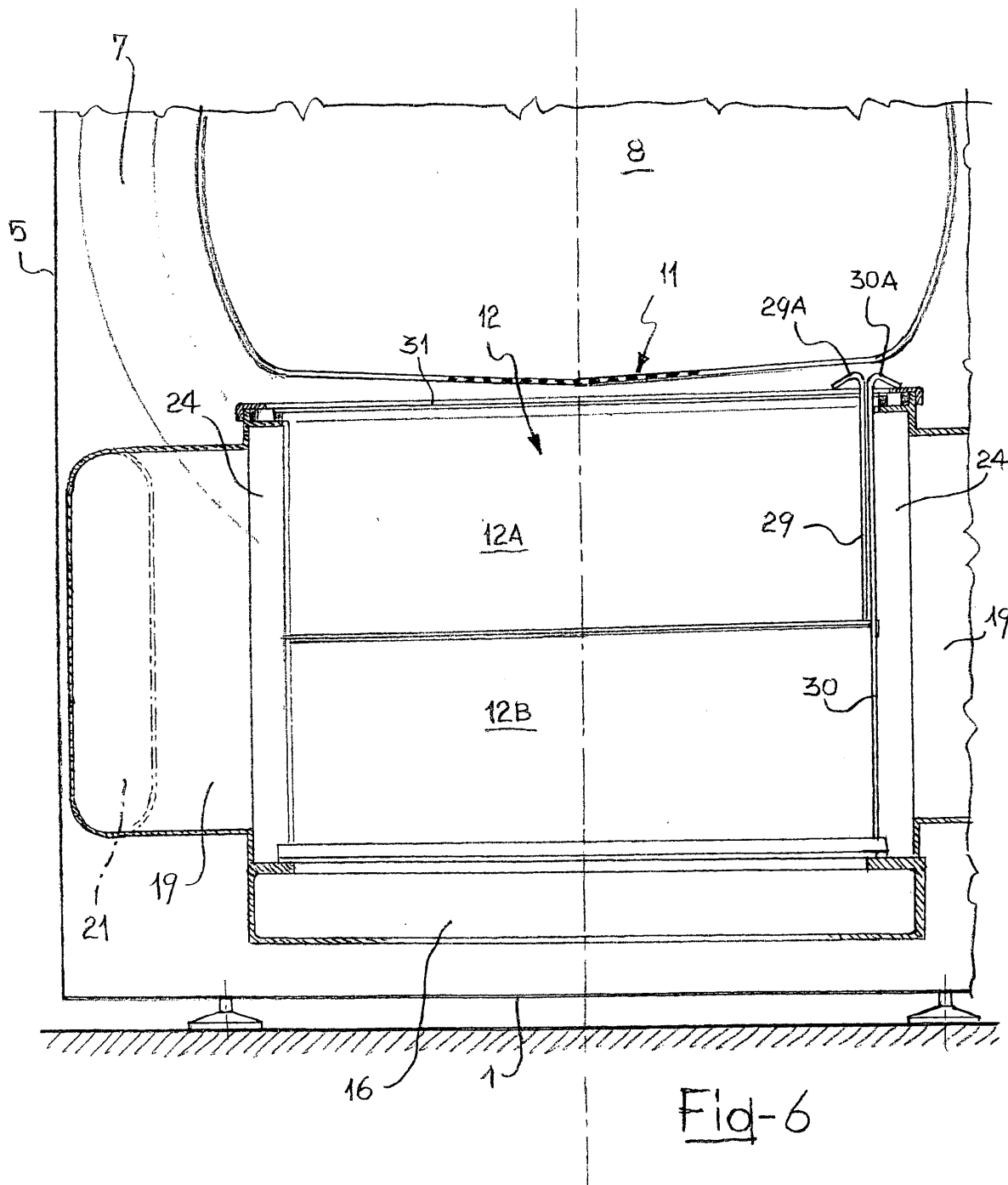
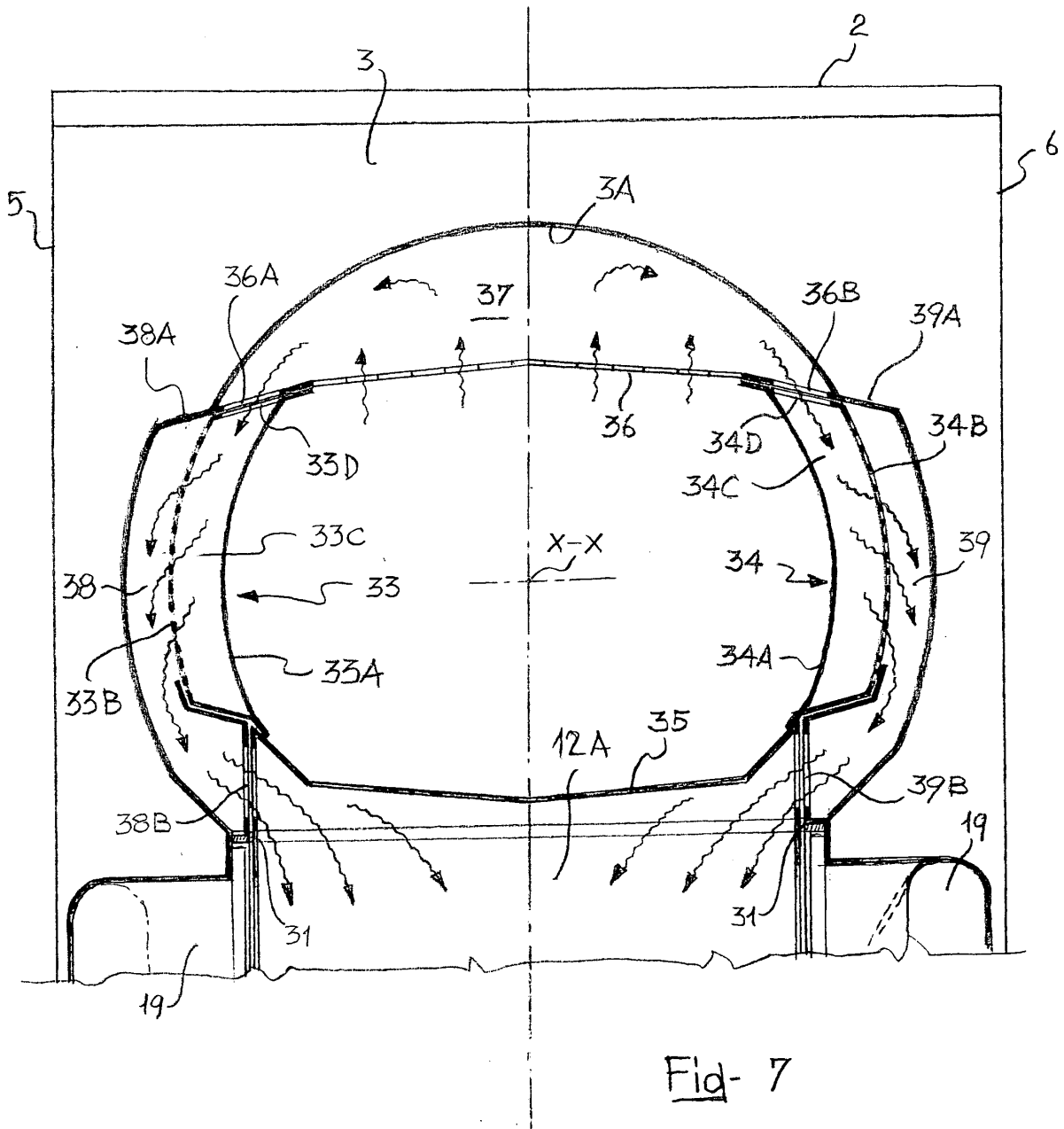
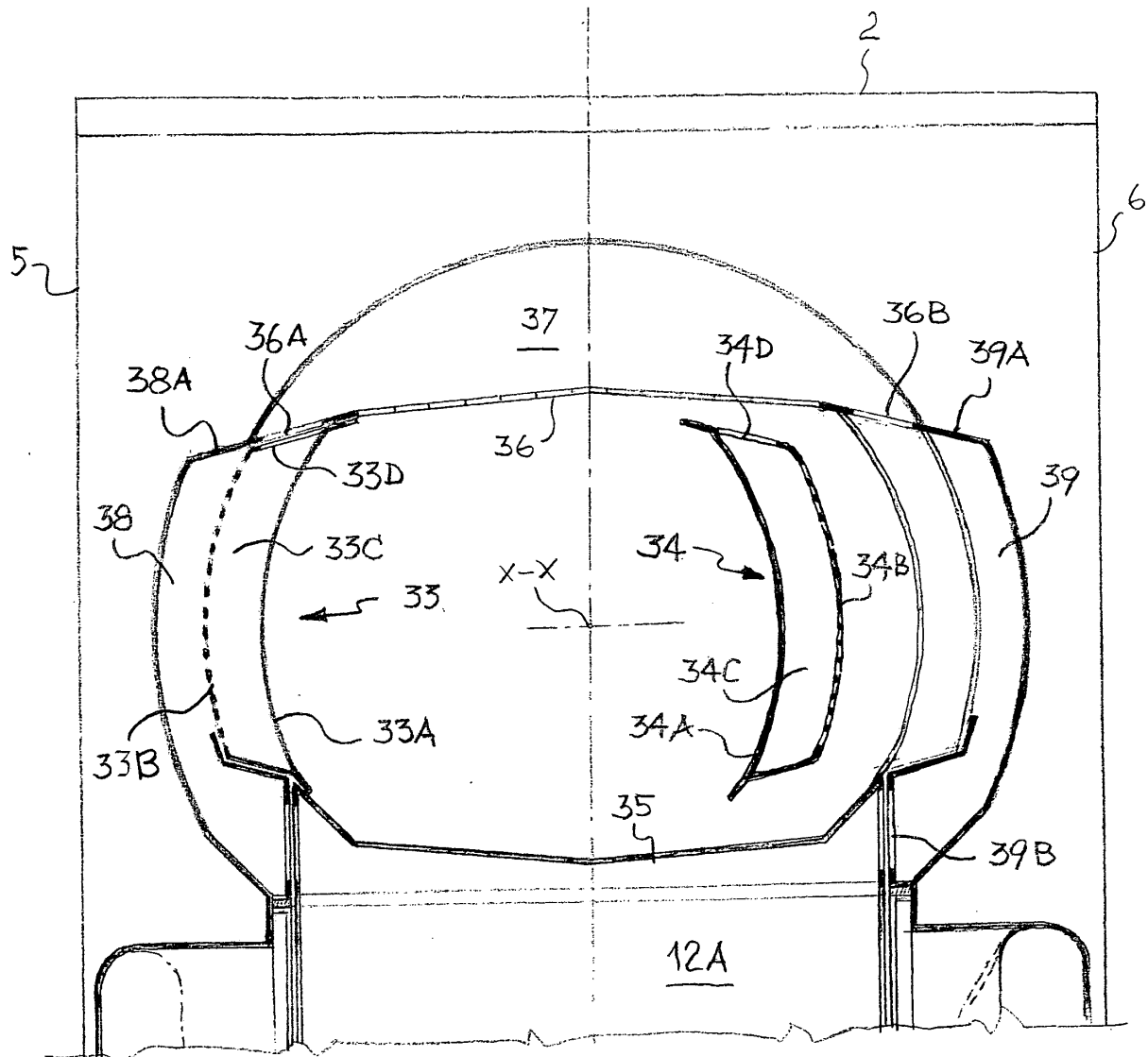


Fig-5







Fid-8



EUROPEAN SEARCH REPORT

Application Number
EP 11 42 5105

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 2 742 708 A (HOWARD MCCORMICK FRANCIS) 24 April 1956 (1956-04-24) * column 2, line 25 - column 3, line 45; figures 1,2 *	1,2,7	INV. D06F58/24
X	GB 2 261 060 A (WHIRLPOOL EUROP [NL]) 5 May 1993 (1993-05-05) * page 1, last paragraph - page 2, paragraph 3; figures 1-2 *	1,7	
X	US 2 780 009 A (STICKEL CARL A) 5 February 1957 (1957-02-05) * column 2, line 28 - column 2, line 63; figure 1 *	1,2,7	
A	EP 2 169 106 A2 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 31 March 2010 (2010-03-31) * paragraph [0015] - paragraph [0016]; figures 1-2 *	1-8	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 September 2011	Examiner Hannam, Martin
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			

 1
EPO FORM 1503 03.82 (P04C01)

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

EP 11 42 5105

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.

28-09-2011

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2742708	A	24-04-1956	NONE	
GB 2261060	A	05-05-1993	DE 4135845 A1	06-05-1993
US 2780009	A	05-02-1957	NONE	
EP 2169106	A2	31-03-2010	CN 101684606 A	31-03-2010

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1990464 A [0002]
- EP 1925713 A [0002]