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(54) Laundry treating machine

(57) The invention refers to a laundry treating machine. A laundry treating machine according to the invention comprises a casing (1) formed by side walls (2), an upper wall portion (3) and a bottom wall portion (4), said casing (1) accommodating therein a laundry container (6), at least one air flow path and further operational devices (5) for carrying out a treatment on said laundry. A laundry treating machine according to the invention is characterized in that said bottom wall (4) comprises an air passage (12) in fluid communication with the at least one air flow path.

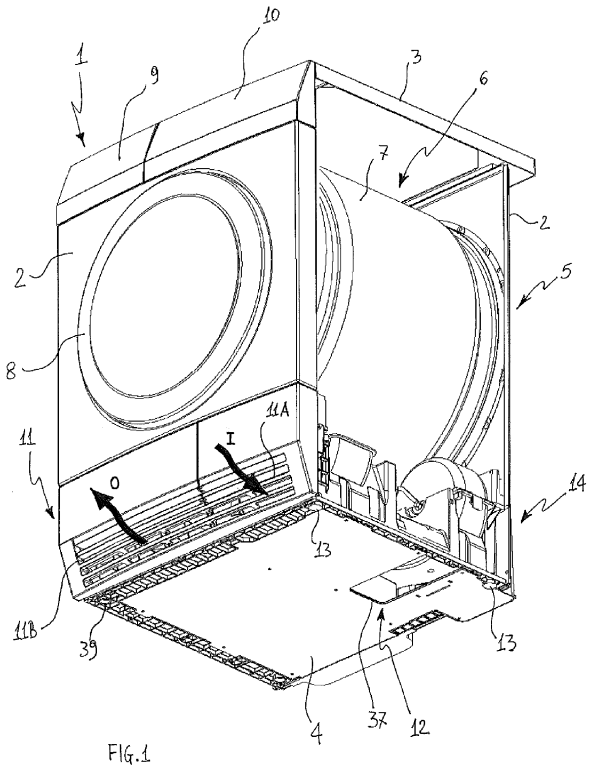

FIG.1

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Description

[0001] Laundry treating machines capable of carrying out a drying process on laundry generally comprise a casing that houses a laundry container, like a rotating drum, where laundry to be treated is received, and an air circuit for carrying out drying operation by circulating hot air through the laundry container. Air circulating means and heating means are provided in the air circuit for circulating and heating drying air, respectively. In condenser type dryers, condensing means are further provided in the air circuit for removing moisture from drying air passing through articles to be treated thereby allowing said air to be recirculated cyclically within the air circuit. Moisture removed from articles is either collected in a tank periodically emptied by a user or it is directly exhausted by a pipe connected to a waste water net.

[0002] Washing-drying appliances, i.e. appliances provided for performing articles washing and drying operations in a single machine are also known and generally comprise a water circuit including pumping means for allowing washing water to be supplied to a laundry treating chamber and a drying arrangement as described before for drying laundry.

[0003] In the following description the invention will be disclosed with particular reference to a machine suitable for carrying out a drying operation on laundry such as a laundry drying machine or a washing-drying machine. However, in general, principles of the invention may be applied to a laundry treating appliance, for example in cases when an air flow is needed to cool machine operating devices or part thereof.

[0004] In a known condenser type laundry dryer, means for condensing moisture removed by articles are configured in many different ways. Typical examples comprise an air-air heat exchanger or an evaporator of a heat pump circuit incorporated within the dryer. Such condensing means or components thereof require to be cooled in order to constantly provide a cold surface where wet drying air can be condensed or to remove heat produced by said components, like a compressor in a heat pump circuit. Normally, air taken from dryer machine surroundings is used as cooling means of a condenser or components thereof. For this reason a plurality of inlet/outlet openings are provided in a laundry dryer casing.

[0005] Such openings are generally provided on one or more vertical side walls of the casing, and more generally in the front wall. However such construction may result in poor air intaking or air exhausting because of high flow resistance due to conduit path arrangement for connecting said openings to pumping means inside the appliance. A further drawback of such opening configuration consists in that warm air exhausted from a first opening provided on laundry dyer casing may be intaken through a second opening thereby reducing air cooling capacity and the overall performance of the drying cycle.

[0006] Another drawback of providing openings on vertical side walls of the casing consists in that objects resting around the appliance may obstruct at least partially said openings causing a reduction in appliances performance, or even damages to its components.

[0007] Still another drawback of such opening arrangement is the high noise generated by air mass moved through the openings. This undesired noise is particularly disadvantageous because prevents the appliance to be used during night hours and/or to be placed close to rooms where silent is needed, such as bedrooms.

[0008] The aim of the present invention is therefore to solve the noted drawbacks and thus providing a laundry treating machine having an improved opening arrangement for drawing air from/to the laundry machine.

[0009] An object of the present invention is to provide a laundry treating machine having a more efficient opening arrangement for a cooling air circuit.

[0010] Another object of the present invention is to provide a laundry treating machine having an improved performance in cooling condensing means and/or components thereof, said laundry treating machine ensuring an efficient cooling air flow.

[0011] A further object of the invention is to provide a laundry treating machine producing a low noise during working operation compared to laundry treating machine of known type.

[0012] Another object of the invention is to provide a laundry treating machine avoiding the risk that openings leading air from/to a cooling air circuit may be completely obstructed by objects resting close to laundry dryer.

[0013] Advantages, objects, and features of the invention will be set forth in part in the description and drawings which follow and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention.

[0014] According to the present invention there is provided a laundry treating machine comprising a casing formed by side walls, an upper wall portion and a bottom wall portion, said casing accommodating therein a laundry container, at least one air flow path and further operational devices for carrying out a treatment on said laundry, characterized in that said bottom wall comprises an air passage in fluid communication with the at least one air flow path.

[0015] Preferably, said air passage comprises a first inlet fluid opening and at least a second fluid inlet opening is provided on one of the side walls.

[0016] Preferably, said second fluid inlet opening is provided on the front wall of the casing.

[0017] Preferably, the first inlet fluid opening is arranged downstream of the second fluid inlet opening relative to the direction of air moving along said air flow path.

[0018] Preferably, a fluid outlet opening is provided on the front wall of the casing.

[0019] Preferably, said at least one air flow path comprises a cooling air open-circuit for cooling at least a part of said operational devices, said air passage being provided in fluid communication with said cooling air open-

circuit.

[0020] Preferably, said first and second fluid inlet opening are in fluid communication with the cooling air open-circuit.

[0021] Preferably, said operational devices comprise at least one of the following: motor means, fluid compressing means, heat exchanging means, fluid condensing and/or evaporating means, a portion of a heat pump circuit.

[0022] Preferably, the laundry treating machine comprises a basement having a hollow space formed on a lower side thereof, the bottom wall being associated under the basement for substantially closing said hollow space thereby forming an air conduit.

[0023] Preferably, said basement has an upper side comprising seats formed thereon for receiving operational devices of the laundry treating machine.

[0024] Preferably, motor means are interposed between, and coaxially arranged with, pumping means on seats, said motor means and pumping means being further arranged in parallel with said conduit on a level of said basement (14) which is separated from conduit by a wall.

[0025] Preferably, said pumping means and conduit are associated through a conveyor which is adapted to reverse an air path of about 180 degrees and to increase its height from a first lower level of said basement to a second upper level thereof.

[0026] Preferably, said conveyor comprises a inner transverse section surface area which gradually increases from conveyor joining section with conduit to conveyor joining section with pumping means so as to create a Venturi effect.

[0027] Preferably, said conveyor is arranged perpendicularly relative to the bottom wall and it is removably attached to said wall by means of a spring clip.

[0028] Preferably, said laundry treating machine is a laundry dryer or a washing-drying appliance.

[0029] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate a possible embodiment of the invention and together with the description serve to explain the principles of the invention. Like reference numbers represents like features throughout the accompanying drawings, wherein:

[0030] Figure 1 shows a perspective bottom view of a laundry treating machine according to the invention with an upright side wall removed;

[0031] Figure 2 shows a perspective sectional view of a basement of the laundry treating machine illustrated in Figure 1.

[0032] Figure 3 shows a rear sectional view of air pumping means and condensing means arranged on the laundry treating machine basement illustrated in Figure 2.

[0033] Figure 4 shows a perspective sectional view of the laundry treating machine basement of Figure 2 from a reverse angle view.

[0034] Figure 5 shows a perspective bottom view of the laundry treating machine basement of Figure 2 where a bottom wall portion has been removed;

[0035] Figure 6 shows an exploded view of an attachment between an air flow conveyor and a bottom wall of the laundry treating machine basement illustrated in Figure 2.

[0036] Figure 7 shows a partially exploded view of the laundry treating machine basement illustrated in Figure 2.

[0037] With reference to Figure 1, a laundry treating machine according to the invention comprises a casing 1 formed by two couples of upright side walls 2 arranged perpendicularly one another, respectively on the treating machine rear and front part, and on the lateral side thereof. In Figure 1 one of the lateral side walls has been removed for showing some of the laundry treating machine operational devices 5 accommodated within casing 1. An upper wall portion 3 and a bottom wall portion 4 close the ends of the box-like structure formed by the upright side walls 2 joined together.

[0038] A laundry container 6 comprising a drum (not shown) rotatably mounted in a tub 7 is provided within the casing 1. A front door 8, pivotally coupled to the front upright side wall 2, is provided for allowing access to the drum interior region to place laundry to be treated therein. An extractable moisture tank in the form of a drawer 9 is slidably arranged on the top of the casing 1, for being periodically emptied by a user in case the laundry treating machine cannot be connected to a waste water net through a pipe. A user control interface 10 is arranged on the top of the casing 1 near the drawer 9 for input of laundry treatment programs and displaying machine working conditions.

[0039] On a bottom portion of the casing 1 and preferably in its front upright side wall 2 an air passage 11 is provided for draining air from/to the laundry treating machine. In the exemplary embodiment of the invention disclosed in the Figures, air passage 11 is divided into two portions 11A, 11B for allowing cooling air to enter and exit the casing 1, as indicated by arrows "I" and "O" in Figure 1, in order to cool condensing means arranged in a drying air circuit passing through the laundry container 6 for removing moisture from said drying air. If desired, portions 11A and 11B of air passage 11 may be arranged on different upright side walls 2 other than the laundry treating machine front wall.

[0040] According to the invention, an air passage 12 is formed as an opening 37 in the bottom wall portion 4. Such air passage 12 is always accessible to air because the bottom wall 4 extends in a position that is spaced apart and substantially parallel to a floor on which the laundry treating machine is placed. The distance between bottom wall 4 and a floor is determined in an adjustable manner through vertically adjustable supports 13 (only two of them are shown in Figure 1) placed under the casing 1. The bottom wall portion 4 comprises a sheet

that is removably mounted onto a lower side 16 of (i.e. under) a basement 14 which is preferably made of polymeric material. The lower side 16 and the bottom wall portion 4 delimit a hollow space 38 adapted to convey air inside the machine and/or to discharge air outside the machine.

[0041] In particular, bottom wall 4 rests on the same level of a lower edge 39 of basement 14 that surrounds a hollow space 38 upwardly limited by surfaces placed on a higher level relative to edge 39. On an upper side 17 of the basement 14, seats 18A-18F are formed for receiving therein operational devices 5 of the laundry treating machine, like condensing means 19, air pumping means 20, motor means for powering air pumping means 20 and other functional devices for operating laundry treating machine to carry out a drying treatment on laundry as, for example, heat pump circuit components (not shown in Figure 1) like fluid compressing means, heat exchanging means, fluid condensing and/or evaporating means. In practice, basement 14 comprises a lower side 16 forming at least a portion of a first air path wherein the air is drawn in from outside the machine and/or the air is exhausted outside the machine and further comprises an upper side 17 forming at least a portion of a second air path that passes through one or more of said operational devices 5.

[0042] As shown in Figure 2, when the bottom wall portion 4 is associated under the basement 14 facing the lower side 16 of the latter, said bottom wall 4 substantially covers the hollow space 38 formed in the lower side 16 of basement 14 thereby forming an inlet conduit 15 for conveying air entering the laundry treating machine through air passages 11A, 12 as shown by arrows "I" and "II". Such conduit 15 has a lower surface 15A defined by the bottom wall 4 and upper surfaces 15B that are defined by the basement 14 itself through the surfaces upwardly limiting the hollow space 38 formed in the basement 14 lower side 16. If desired, air passage 12 in the bottom portion 14 may be the only aperture for allowing fluid communication between the environment where the laundry treating machine is installed and an air path circulating within said machine. In particular, air passage 12 may be in fluid communication with a laundry treatment air flow path, such as the drying air passing through the drum.

[0043] Conduit 15 sucks air taken from outside by pumping means 20 for cooling condensing means 19 resting within seat 18A. Pumping means 20 are powered though an electric motor (not shown) housed in the seat 18B which is formed in the upper side 17 of basement 14. Said motor powers also further pumping means (not shown) that are arranged coaxially with pumping means 20 and received within seat 18D to circulate drying air through the laundry container 6. Motor means are interposed between pumping means 20 and those for circulating drying air. Rotational axis of the electric motor shaft extends parallel to the air flow path within conduit 15.

[0044] Pumping means 20, that preferably comprises a centrifugal fan, are arranged on a level of the basement 14 that extends just over conduit 15 that rests on a lower level, therefore air path along conduit 15 is reversed and lead to said level by means of a conveyor 21 arranged between the air inlet port of pumping means 20 and conduit 15. Conveyor 21 is preferably made of felt and it is designed to reduce flow resistance when the air reverses its path of about 180 degrees increasing its height relative to the floor where the laundry treating machine rests. In this way performance of the laundry treating machine is not negatively affected, while an improved compactness in distributing operational devices on the basement 14 may be achieved.

[0045] In Figure 6 it is shown in detail a configuration of conveyor 21 and its attachment to the bottom wall 4. Conveyor 21 comprises an elongated cup-like body 22 having two opposite ends 23, 24 respectively adapted to be joined to a section of conduit 15 and to an air inlet port of pumping means 20. Said ends 23, 24 are linked each other by walls 25A, 25B, that cooperate with basement 14 to create a Venturi effect in the air flowing outside conduit 15 and entering pumping means 20 through conveyor 21. For this aim, the inner transverse section surface area of said conveyor 21 gradually increases from the conveyor inlet port to be associated with conduit 15 to the conveyor outlet port to be associated with pumping means 20. Therefore while passing through conveyor 21, air increases its pressure and reduces its speed. A portion 26 (see Figures 1 and 3) of the basement 14 forms at least a part of a volute 31 and an air inlet port for pumping means 20 and it extends between ends 23, 24 thereby defining two separate ports for admitting and draining air from conveyor 21. As can be seen in Figure 7, volute 31 is formed by portion 26 of basement 14 and by a cover 32 which is removably attached to portion 26 through snap-fit fasteners 33 (Figure 3) thereby closing seat 18C. Even though it is not shown in the Figures, a similar arrangement is also provided for pumping means received within seat 18D to circulate drying air through the laundry container 6.

[0046] Conveyor 21 is arranged perpendicularly relative to bottom wall 4 and it is removably attached to said wall 4 by means of a spring clip 27 provided with protruding portions 27A, 27B that can be received within slots 28A, 28B formed onto the bottom wall 4 and within slots 29A formed onto a base member 30 in a position corresponding to that of slots 28A. When in locking condition, spring clip 27 extends over the base member 30 with its protruding portions 27A and under the bottom wall 4 with its protruding portion 27B. Base member 30 lies over the bottom wall 4 on the lower surface 15A of conduit 15. In order to tightly seal conveyor 21 onto the conduit 15 outlet section and the air inlet port of pumping means 20, a gasket may be over-injected on the edges of conveyor 21 that join conduit 15 and the edge of portion 26 defining the air inlet port of pumping means 20.

[0047] Air sucked by pumping means 20 is output centrifugally from the latter and directed towards condensing

means 19 as shown by arrows in Figure 2. Preferably, condensing means 19 are in the form of an air-air cross-flow type heat exchanger When air passes through condensing means 19 its path lies on an upper level compared to the air flowing within conduit 15. Even the flow direction of air within conduit 15 is substantially perpendicular to that of air flowing through condensing means 19. Seat 18A, that houses condensing means 19, is shaped to diffuse air coming out from pumping means 20 to the whole surface of condensing means 19.

[0048] In Figure 3 it is shown from a rear sectional view of the basement 14 the air path flowing through condensing means 19 and then downwardly towards bottom wall 4. Air that exits condensing means 19 is guided from said upper side 17 to a lower side 16 of basement 14 by means of a conduit portion, or conveyor, 40 formed in the basement 14, for example by joining a cover to a upper side 17 of basement 14. Conveyor 40 may have the same features of conveyor 21, i.e. they may be substantially identical. Air conveyed by conduit portion 40 is also reversed in its flow direction of about 180 degrees and it is then received in an outlet conduit 34 which is formed in a manner similar to inlet conduit 15, i.e. by a lower surface 34A defined by the bottom wall 4 and an upper surface 34B that is defined by the basement 14 itself through the surface upwardly limiting a further hollow space 38 formed in the basement 14 lower side 16. Another view of air path leaving condensing means 19 for entering outlet conduit 34 is shown in Figure 4 where outlet conduit 34 has been partly cut away and in Figure 5 where the bottom wall 4 has been removed. Outlet conduit 34 and inlet conduit 15 are separated and substantially tightly sealed by a partition 35 (Figures 3 and 5) that extends downwardly (i.e. towards bottom wall 4) from joining region between upper surface 15B of inlet conduit 15 and upper surface 34B of outlet conduit 34. Upper surfaces 15B, 34B and partition 35 are made integrally, i.e. as a unitary body, such as a single-piece construction by molding.

[0049] Outlet conduit 34 leads air from condensing means 19 to exit laundry treating machine through an outlet air passage 11B as indicated by arrow "O" in Figure 1, 4 and 5. Air coming out from air passage 11B hardly affects temperature of cooling air sucked into the laundry treating machine thanks to the provision of an air passage 12 in the bottom wall 4. In fact, provision of air passage 12 as the sole or auxiliary air inlet port ensures to provide the laundry treating machine with air in the conditions as it is in the environment where said machine is placed.

[0050] Figure 7 further illustrates how the basement 14 can be assembled with conveyor 21 and further covers 32, 36 to house operational devices of laundry treating machine. Cover 36, in particular, is removably joined preferably by snap-fit means in the front upper part of the basement 14 to direct drying air flow from the condensing means 19 to the laundry container 6. Assembling operation of laundry treating machine, and, in general of its operational devices, may be greatly simplified and made more compact.

[0051] Preferably, the upper surfaces 15B, 34B of the basement 14 can comprise one or more opening so as to direct a part of the air flowing along the lower side 16 of the basement 14 into at least one of the seats 18A-18F for cooling purpose, for example to cool an electric motor or heat pump circuit components.

[0052] Conclusively it can be stated that a laundry treating machine according to the invention has an efficient and reliable opening arrangement for drawing air from/to said machine. Thanks to the opening arrangement according to the invention, noise produced by a laundry treating machine for moving air mass can be greatly lowered, thereby allowing the machine to be placed and operated both close to rooms where low noise or silent is required both during night hours. According to the invention, performances of a condenser-type laundry treating machine may be improved by enhancing air flow used for cooling condensing means or component thereof.

[0053] The present invention can be applied to air paths or air circuits of any type of laundry treating machine, such as condenser-type laundry dryer and open-circuit laundry dryers, or to washing machines in those cases when an air supply or discharge is needed. In particular, as far as laundry drying machines is concerned, an air passage can be provided on the bottom wall 4 of casing to improve performances of drying air circuit or performances of operational devices cooling air. The invention provides the advantage of ensuring that an appropriate air flow can be drained from/to the drying machine even if objects may be present in the area surrounding said machine.

Claims

1. A laundry treating machine comprising a casing (1) formed by side walls (2), an upper wall portion (3) and a bottom wall portion (4), said casing (1) accommodating therein a laundry container (6), at least one air flow path and further operational devices (5) for carrying out a treatment on said laundry, **characterized in that** said bottom wall (4) comprises an air passage (12) in fluid communication with the at least one air flow path.

2. A laundry treating machine according to claim 1 wherein said air passage (12) comprises a first inlet fluid opening (37) and at least a second fluid inlet opening (11A) is provided on one of the side walls (2).

3. A laundry treating machine according to claim 2 wherein said second fluid inlet opening (11A) is provided on the front wall (2) of the casing (1).

4. A laundry treating machine according to claim 2 or 3 wherein the first inlet fluid opening (37) is arranged

downstream of the second fluid inlet opening (11A) relative to the direction of air moving along said air flow path.

5. A laundry treating machine according to any preceding claim wherein a fluid outlet opening (11B) is provided on the front wall (2) of the casing (1).

6. A laundry treating machine according to any preceding claim wherein said at least one air flow path comprises a cooling air open-circuit for cooling at least a part of said operational devices (5), said air passage (12) being provided in fluid communication with said cooling air open-circuit.

7. A laundry treating machine according to claim 6 and any claim 2 to 4 wherein said first and second fluid inlet opening (37, 11A) are in fluid communication with the cooling air open-circuit.

8. A laundry treating machine according to claim 6 or 7 wherein said operational devices (5) comprise at least one of the following: motor means, fluid compressing means, heat exchanging means, fluid condensing and/or evaporating means, a portion of a heat pump circuit.

9. A laundry treating machine according to any preceding claim further comprising a basement (14) having a hollow space (38) formed on a lower side (16) thereof, the bottom wall (4) being associated under the basement (14) for substantially closing said hollow space (38) thereby forming an air conduit (15).

10. A laundry treating machine according to claim 9 wherein basement (14) has an upper side (17) comprising seats (18A-18F) formed thereon for receiving operational devices (5) of the laundry treating machine.

11. A laundry treating machine according to claims 9 and 10 wherein motor means are interposed between, and coaxially arranged with, pumping means (20) on seats (18B, 18C, 18D), said motor means and pumping means (20) being further arranged in parallel with said conduit (15) on a level of said basement (14) which is separated from conduit (15) by a wall (15B).

12. A laundry treating machine according to claim 11 wherein pumping means (20) and conduit (15) are associated through a conveyor (21) which is adapted to reverse an air path of about 180 degrees and to increase its height from a first lower level of said basement (14) to a second upper level thereof.

13. A laundry treating machine according to claim 12 wherein said conveyor (21) comprises a inner transverse section surface area which gradually increases from conveyor (21) joining section with conduit (15) to conveyor (21) joining section with pumping means (20) so as to create a Venturi effect.

14. A laundry treating machine according to claim 12 or 13 wherein said conveyor (21) is arranged perpendicularly relative to the bottom wall (4) and it is removably attached to said wall (4) by means of a spring clip (27).

15. A laundry treating machine according to any preceding claim wherein said machine is a laundry dryer or a washing-drying appliance.

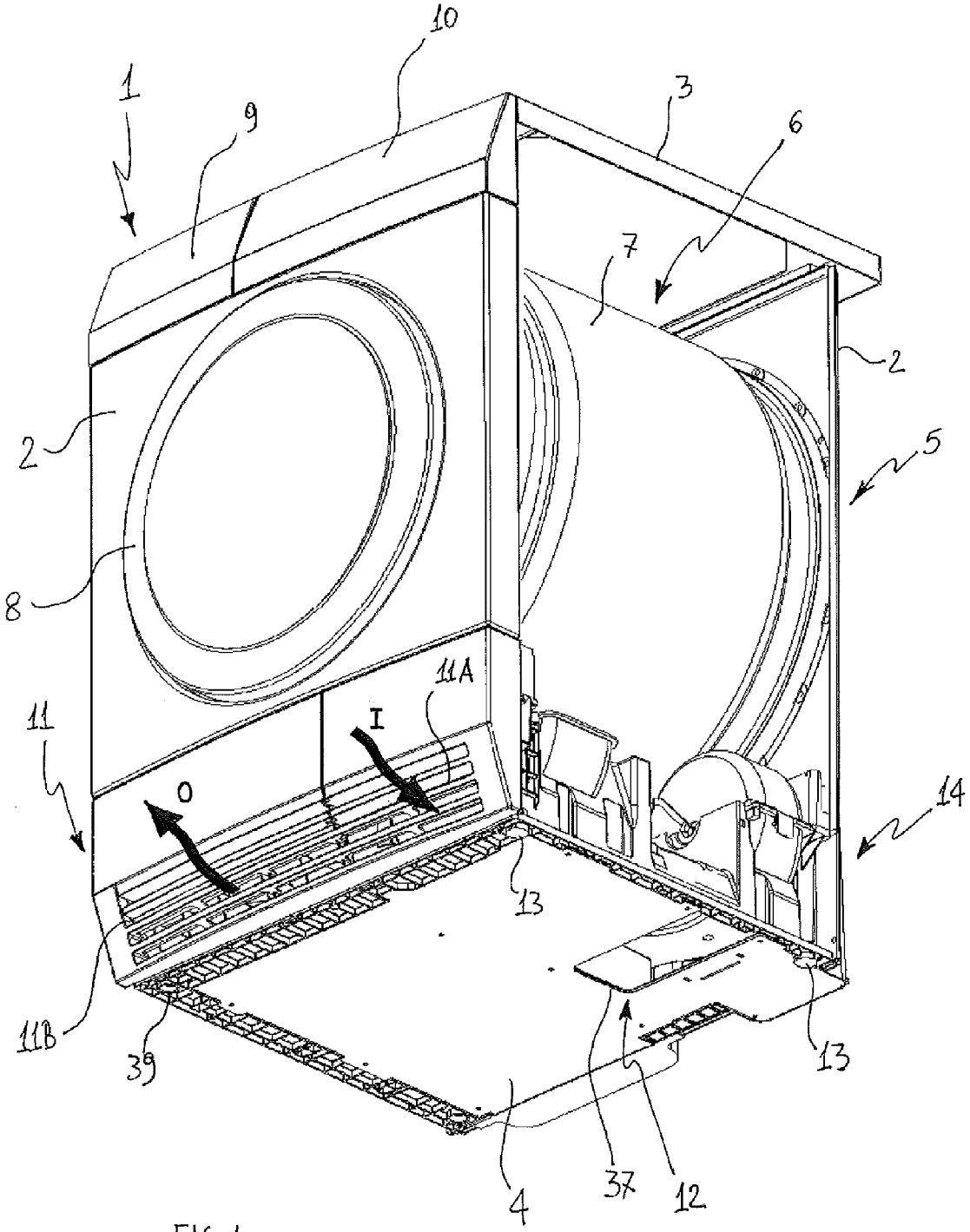

FIG.1

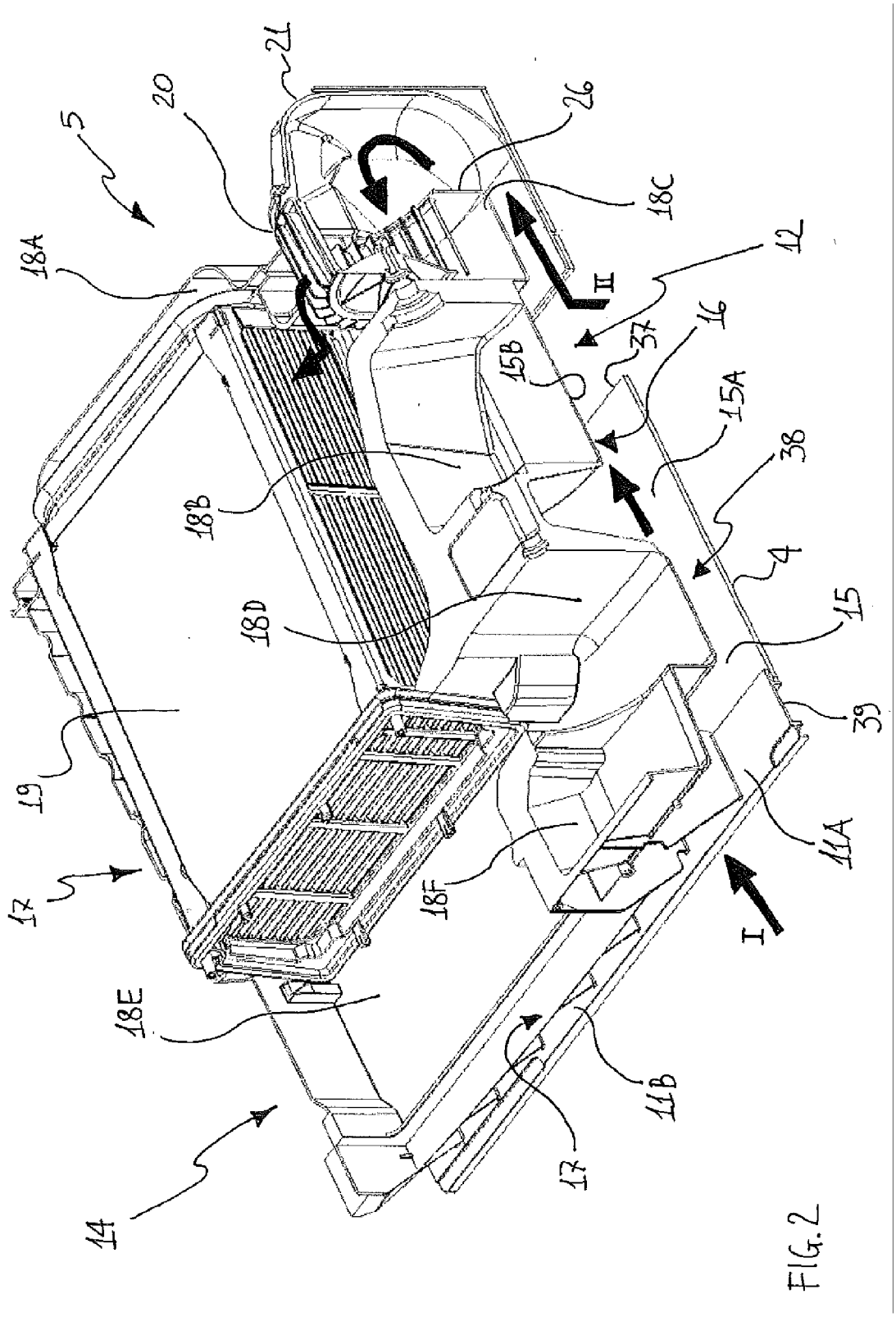
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FIG. 2

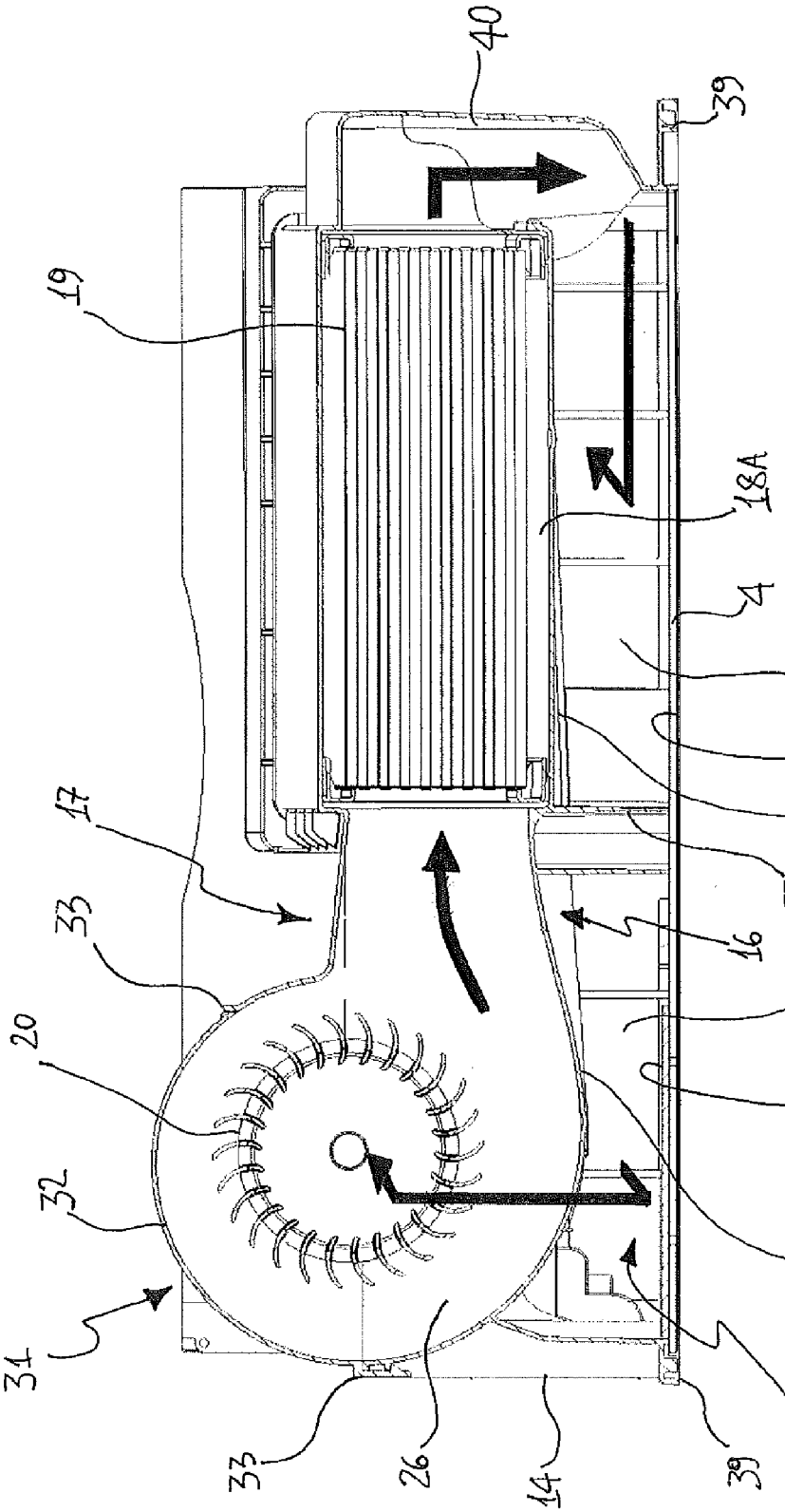
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FIG. 3

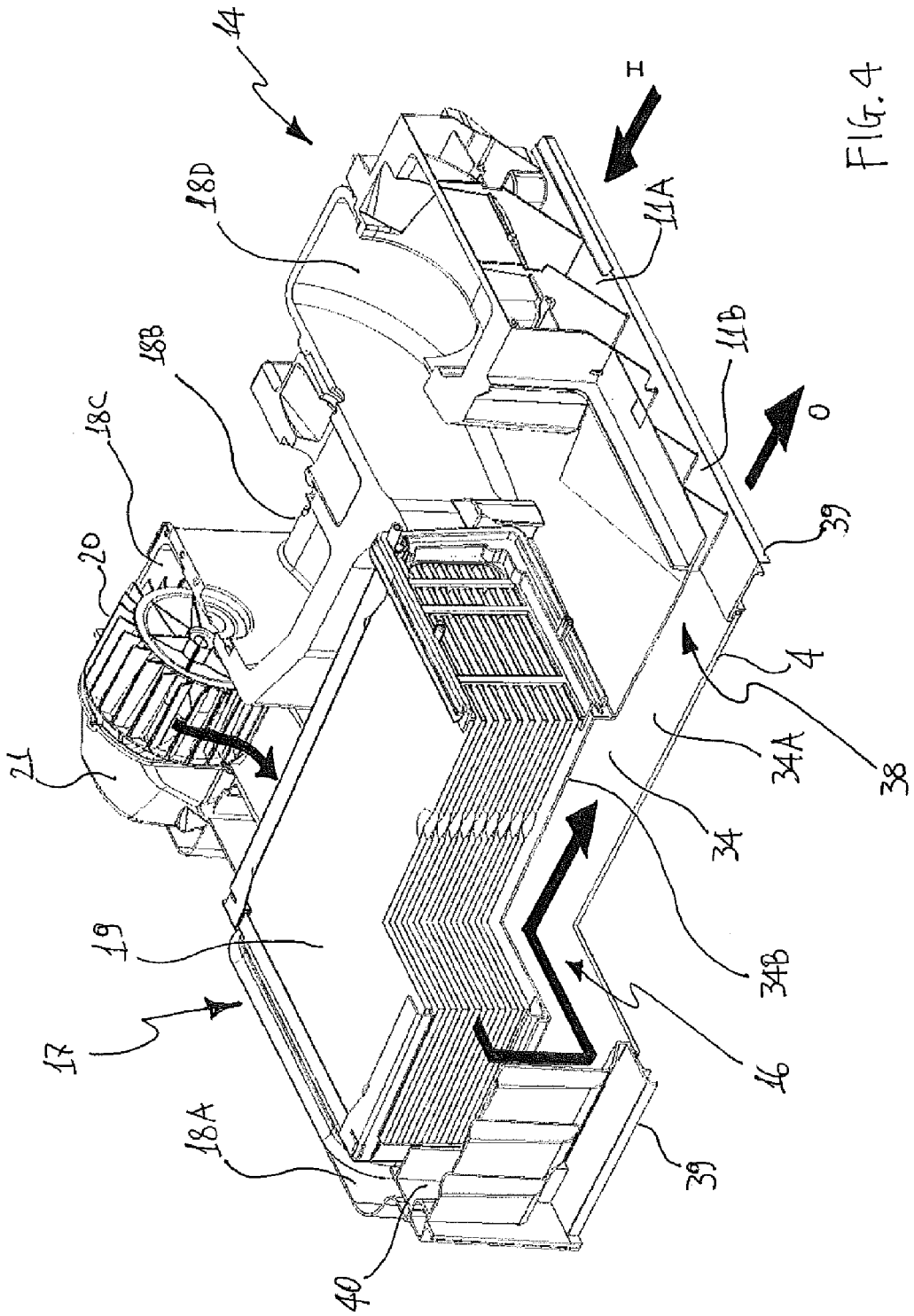

FIG. 4

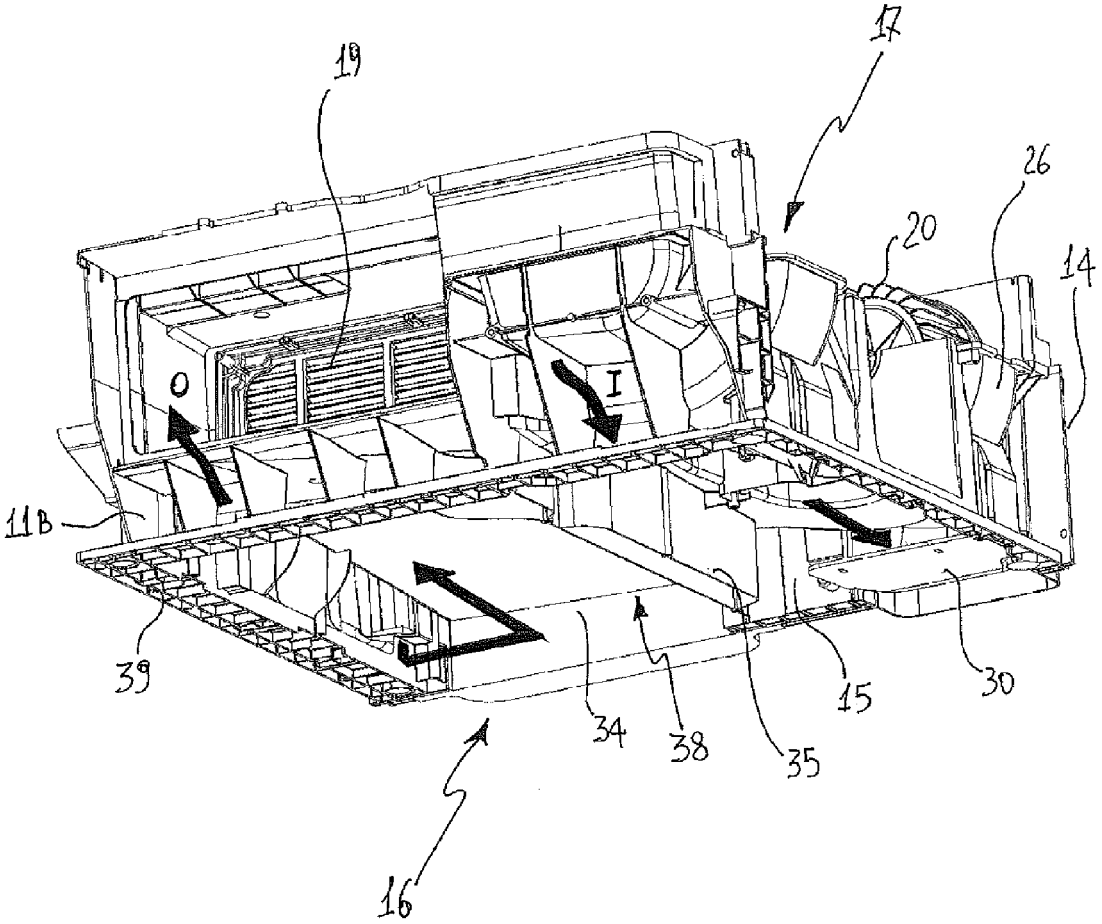

FIG. 5

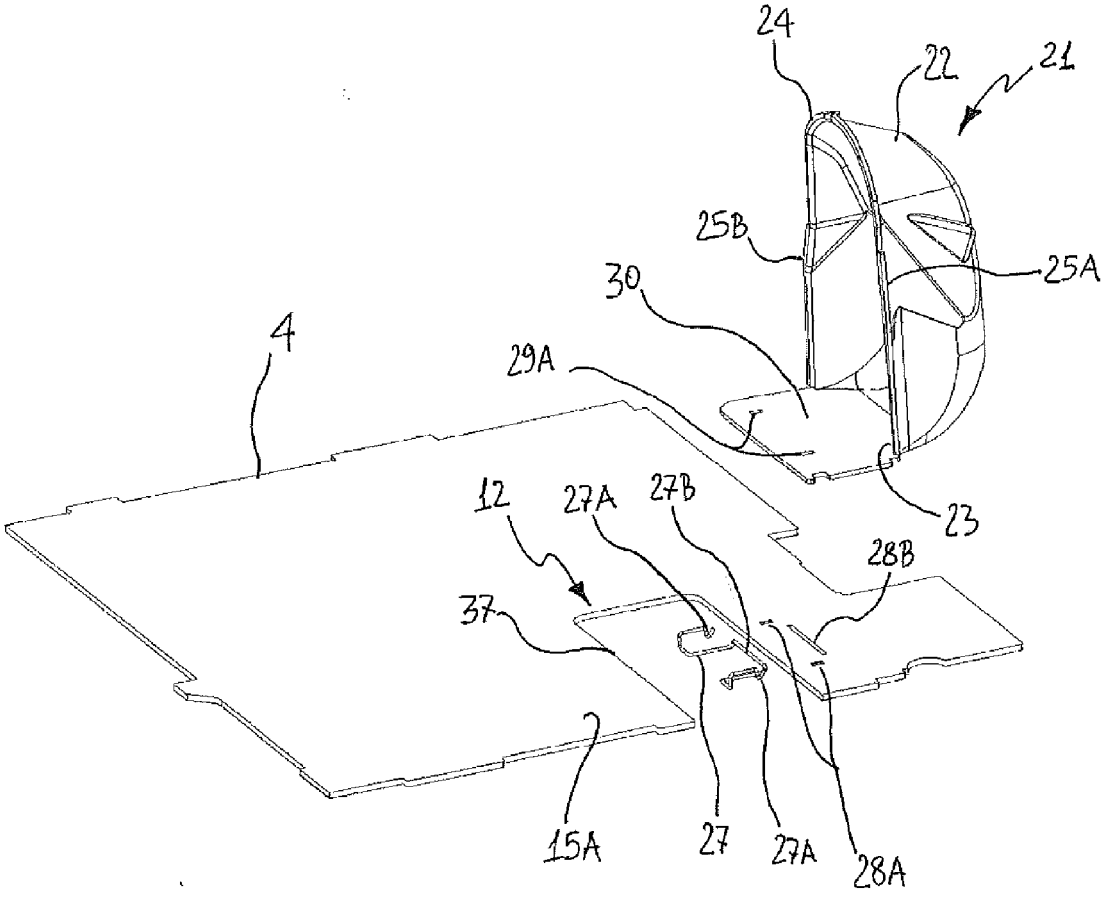

FIG. 6

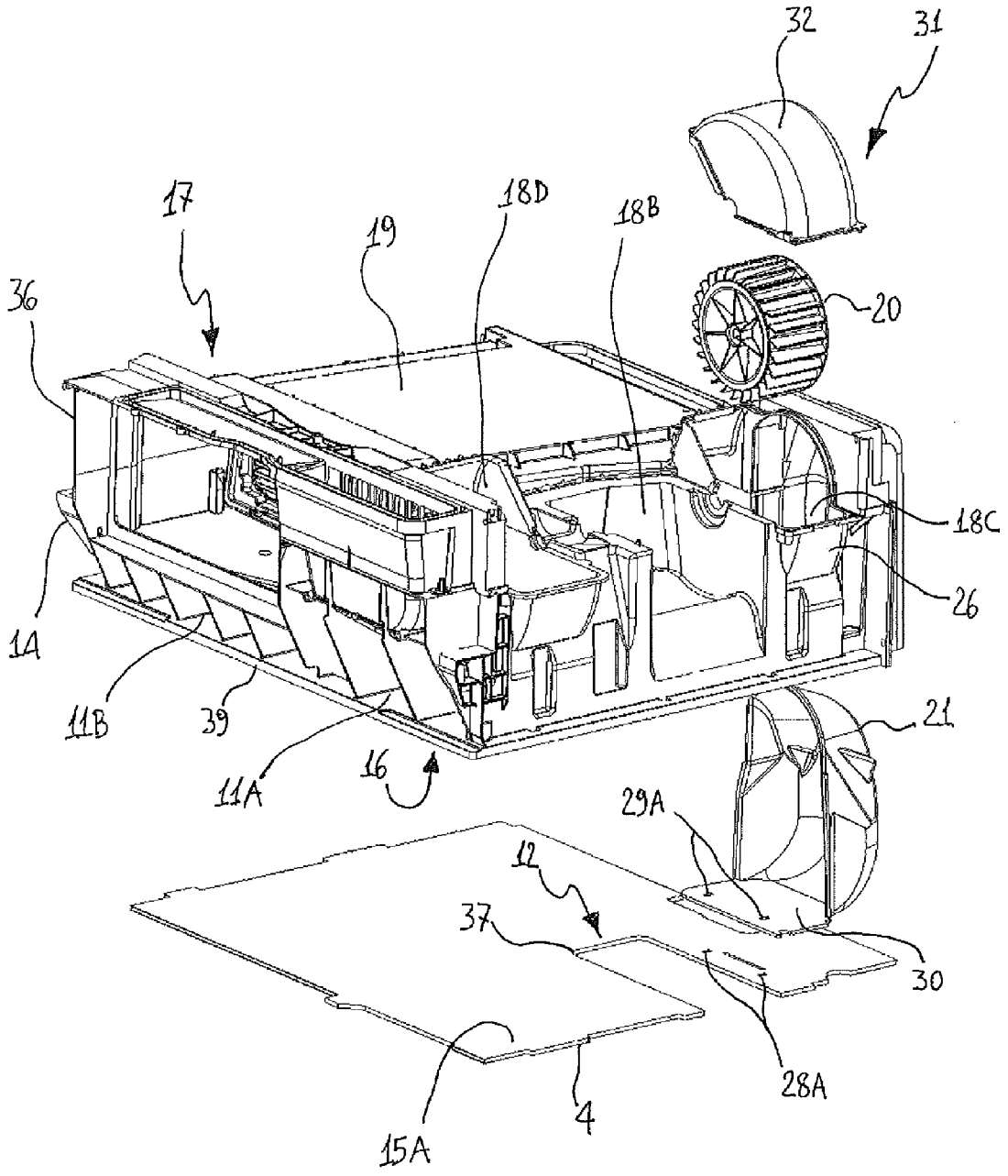
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FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 10 17 3929

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 March 2011	Kising, Axel

CATEGORY OF CITED DOCUMENTS

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