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(71) Applicant: **Esse 3 S.r.l.**
60030 Morro d'Alba (AN) (IT)

(72) Inventor: **GIACALONE, Ignazio**
60044 Fabriano (AN) (IT)

(74) Representative: **Palestrini, Mauro**
Brema S.r.l.
Piazza E. Enriquez, 22c
47891 Dogana (SM)

(54) **FAN APPARATUS SUITABLE FOR BEING USED IN A DOMESTIC EXTRACTOR**

(57) A fan apparatus (1) suitable for being used in a domestic extractor comprises a conveyor (2) for gaseous substances, fitted with a spiral-shaped scroll (3), which has a section (4) for the inlet of gaseous substances from the atmosphere and a section (5) for the outlet of gaseous substances, positioned axially and circumferentially to the scroll (3) respectively; said conveyor (2) further comprising a blade rotor (6) rotationally supported by and within the conveyor (2); as well as a motor (7) connected to the rotor (6) and also supported by the conveyor (2). The blade rotor (6) includes a flange (27) peripherally bearing a series of blades (35) with active profiles provided with two mutually consecutive arcs (26,28) and having converse concavities; and includes a band (30) connecting the peripheral edges of the active profiles from the opposite side of the flange (27).

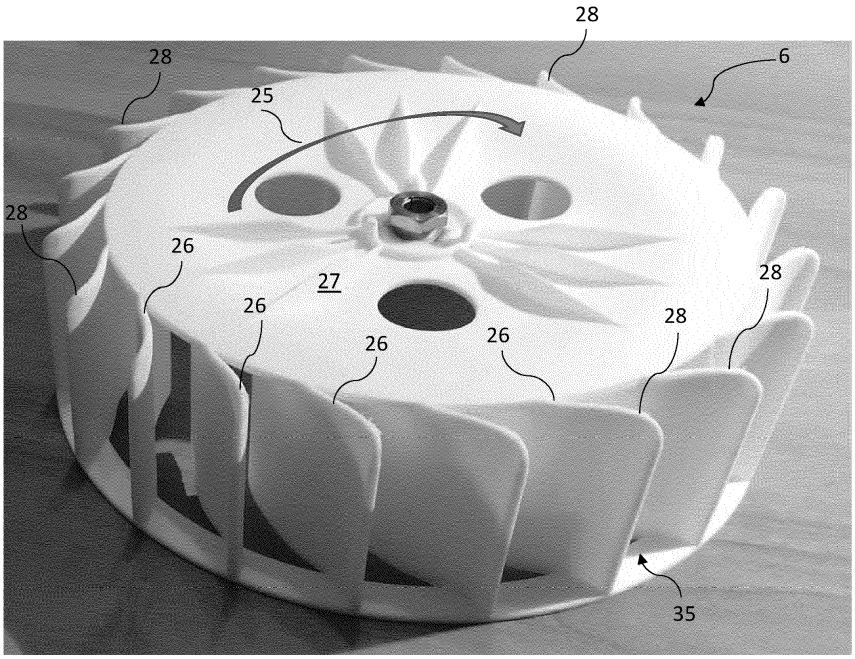

FIG.6A

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Description

[0001] The present invention relates to a fan apparatus suitable for being used in a domestic extractor, which can in particular be fitted to household appliances such as hoods, hobs, furnishing components such as hanging cabinets, chests of drawers, etc.

[0002] As it is known, modern fan apparatuses for household appliances must comply with increasingly stringent manufacturing regulations and standards in terms of energy consumption, exhaust fluid dynamics and the expulsion of gaseous substances, as well as in terms of the ambient noise limits permitted during their operation.

[0003] To find solutions that adequately compromise between these often opposing needs, the manufacturing of these apparatuses can draw on commercial engines of various types, performances and costs which: are nevertheless not always sufficient in themselves to achieve the desired performance; as such, require structural adaptations to be implemented, especially with regard to fluid dynamics; and are made even more demanding by the design, specific shape and performance of the appliance that will be fitted with this product.

[0004] Such adaptations relate, for instance, to the construction of particular exhaust chambers (also known as sealed chambers) in tailored and specific shapes, as determined by the various household appliances.

[0005] Although all known fan apparatuses have some shared components - such as conveyors of gaseous substance equipped with a spiral-shaped scroll, with an section for the inlet of gaseous substances from the atmosphere and an section for the outlet of said gaseous substances, positioned axially and circumferentially to the scroll, respectively; and further comprising blade rotors rotationally supported by and within the conveyor; and driven by a relative motor also supported by the conveyor - in practice, each known type of fan apparatus has its' own specific structural identity that is difficult to modify and is largely non-transferrable as is from one apparatus to another.

[0006] Consequently, the specific nature of each solution, on the one hand, impacts on the relative costs and, on the other, makes it difficult to find alternative solutions that involve, for instance, cheaper engines and/or simpler and cheaper-to-build sealed chambers.

[0007] The aim of the present invention is to overcome these issues by proposing a solution with a high degree of structural standardisation, which is able to incorporate various engines without great difficulty or high costs, and/or which - in terms of specific customisations such as of the sealed chambers - can also allow laborious adaptations or special manufactures to be avoided, thus impacting positively in terms of manufacturing cost savings. Last but not least, another aim of the invention is to resolve the issue of maximising energy efficiency and reducing the noise level of these apparatuses. According to the invention, these aims are achieved by a fan apparatus suitable for being used in a domestic extractor as defined in the accompanying claims.

[0008] The technical characteristics and other advantages of the invention will be made clear in the description below with reference to the accompanying drawings, wherein:

- Figures 1 and 2 are axonometric views of a complete apparatus according to the invention, viewed from two different points of view;
- Figures 3, 4 and 5 are, respectively, an axonometric view of the invention in the preceding figures, with some parts removed to better highlight others; a plan view; and an enlarged side view of the same invention;
- Figures 6A and 6B show, respectively, an axonometric view of a blade rotor fitted on the apparatus, shown axonometrically from two different points of view;
- Figures 7A,7B, up to Figure 15, show various schematic illustrations of examples of possible uses of the invention according to different types of household appliances and/or furniture for which it is intended.

[0009] Referring to the figures in the accompanying drawings, in Figure 1 and Figure 2 the reference number (1) has been assigned to a complete fan apparatus for household appliances, essentially comprising a conveyor (2) for gaseous substances, fitted with a spiral-shaped scroll (3), which has a section (4) for the inlet of gaseous substances from the atmosphere and a section (5) for the outlet of said gaseous substances, positioned axially and circumferentially to the scroll (3), respectively.

[0010] The inlet section (4) is circular, whereas the outlet section (5) is rectangular in shape.

[0011] Inside the scroll (3), the conveyor includes a blade rotor (6), which is rotationally supported by the conveyor (2) itself, and includes a motor (7) connected to the rotor (6) and also supported by the conveyor (2).

[0012] Figure 3 shows, in particular, that the scroll (3) includes a shell (8) and a side wall (9) which are separate from each other but which operationally combine to form the scroll (3). The shell (8) is made in the form of an open-contoured, rectangular-profiled duct (10) following the shape of the scroll. The side wall (9), on the other hand, consists of a flat wall facing the shell (8) to which it is connected upon the closure of the contour of the duct (10).

[0013] The apparatus (1) also comprises a motor (7) bracket (11) detached and separate from the section (4) for t,he inlet of gaseous substances, which is to say said bracket (11) is supported by the side wall (9) and includes a through-housing (12) obtained by crossing through the entire thickness of the side wall (9).

[0014] The housing (12) is shaped to complement each specific model of the motor (7) with which the apparatus (1) is fitted. In other words, for each type and size of motor

(7) to be used in the exhaust apparatus (1), a specific implementation of the scroll (3) should be envisaged in which many side walls (1) - each specialised for each of the types and sizes of motors (7) available - can be applied to a single shell (2).

[0015] The scroll (3) spirals outwards from the centre to the edge of the scroll (3) in what appears to be an anticlockwise rotation when viewed from the direction and in the sense of travel of the gaseous substances through the inlet section (4) of the apparatus (1), as shown in Figures 1-4, viewed from outside the inlet section (4).

[0016] Naturally, when viewed from the other side of the side wall (4), the spiral (3) has a clockwise rotation, in keeping with the direction of rotation of the motor (7). Since all standard commercial motors (7) are manufactured with a clockwise rotation, the particular structure of the scroll (3) according to the present description prevents having to search for specially manufactured motors, instead having access to cheaper, generally-manufactured motors normally available on the market.

[0017] As regards the greater or lesser axial span of the various motors (7), Figure 5 clearly shows that the particular structure of the scroll (3) grants maximum freedom to use motors (7) of differing heights where their geometric size can indifferently be contained within the mass of the scroll (3), which is to say, where their mass can, if necessary, pass through the inlet section (4) to then proceed outside of it, as shown, for instance, in Figure 5. Naturally, the spiral of the scroll (3) can also be made to have a clockwise rotation depending on manufacturing needs.

[0018] Figures 6A and 6B show, in particular, a said blade rotor (6) that includes a series of blades (35) supported by a flange (27) movable by the drive of the motor (7). The blades (35) are equipped with active profiles - they are intended to be skimmed by the stream of gaseous substances. The active profiles are substantially composed of two consecutive cylindrical flaps, at variable distances from the centre of the rotor's rotational flange (27), which have generating arcs equipped with mutually converse concavities.

[0019] More particularly, an arrow (25) shows an indicative and non-limiting direction of rotation of the rotor (6); simultaneously with this direction, the blade-profiled arc (26) which is proximal to the motorised flange (27) points a convex profile towards the gaseous substances, while the distal arc (28) points a concave profile towards the gaseous substances.

[0020] In addition, regarding both the choice of whether to make one or other arc (26,28) of the active profiles of the blades (35) concave or convex, and the choice of whether to give one or other' of said arcs a longer span, the present description should be taken as indicative and non-limiting only. Indeed, according to each case and the requirements of use, one or other of all possible variants will be adoptable without departing from the inventive idea of the present invention in doing so. Naturally, these possible variants should be understood to include the possibility of indifferently adopting both clockwise-rotating motors (7) and anticlockwise-rotating motors (7).

[0021] Returning, now, to the description of the present indicative and non-limiting example of the invention, it can be seen that, on its flat face (29), which is substantially parallel to the connection flange (27) of the motor (7), the rotor (6) has a flat annulus-shaped band (30), which monolithically connects with the terminal edges of the distal arcs (28) of said active profiles.

[0022] The rotor (6) is attached to the side wall (9) of the apparatus (1) and inside the duct (10), in close proximity thereto but without contact; opposite to said side wall is the flat annulus-shaped face (30), in such a way that it forms a meatus therewith so as to offer a high resistance to the travel of the gaseous substances. This allows an effective labyrinthine seal to be obtained, which counters any short-circuiting as the gaseous substance fluid travels towards lower-pressure atmospheres.

[0023] The combination of the geometric characteristics of the profiles (26,28) of the blades (35) and the characteristics of the flat counterfacing surfaces of the rotor (6) and of the side wall (9), is particularly synergistic and advantageous from the perspective of energy consumption and the reduction of the noise level produced during the use of the apparatus (1).

[0024] Indeed, the opposing curvature-shaped structure of the blade profile, together with the gradual variation of their curvatures and the widths of their characteristic arcs, allow for an optimal compromise between the energy absorption and performance efficiency of the apparatus; the labyrinthine seal made between the mutually parallel flat faces of the rotor (6) and the side wall (9) also contribute to increasing volumetric efficiency and to reducing the flow turbulence of gaseous substances, which further contributes to increasing energy efficiency and minimising noise emission during the use of the apparatus (1).

[0025] The fan apparatus (1) may comprise means (13) of supplying the inlet section (4), variously specialised in shape and size according to the form of use of the exhaust apparatus (1).

[0026] A first implementation of the means (13) of supplying the inlet section (4) takes the form of an anti-injury grating (14) as shown, for instance, in Figures 1, 2, 5, 6, 7A, 7B.

[0027] In these figures, it can be seen that the grating (14) can be of different shapes according to the types of motor (7) and according to the size that each of them will form in the inlet section (4). Naturally, since the motor (7) is supported by the side wall (9), which is located on the opposite face of the conveyor (2), if a single apparatus (1) is to be used to alternatively accommodate two different types of motor (7), it is sufficient to mount the specific side wall (9) and the specific grating (14) on the same scroll (3) so as to be able to quickly and easily switch from one configuration of the exhaust apparatus (1) to another.

[0028] Figure 7B shows an alternative form of use in

which the apparatus (1) is subject to an exhaust hood being materialised that is applied to the ceiling of a room.

[0029] In this case, the means (13) of supplying the inlet section (4) include a hood filter group, which is referenced as a whole with the number (15). In this type of use, the fan apparatus (1) according to the invention offers the further advantage of being able to have a sealed chamber directly incorporated within the conveyor (2) of the apparatus (1) itself, which is sufficient in itself for the hood to function optimally and which makes it unnecessary to carry out further interventions for the manufacture of an external "ad hoc" sealed chamber; this means evident savings in terms of the cost of producing the fitted hood.

[0030] Figures 8 and 9 shows an implementation of the apparatus (1) according to which the means (13) of supplying the inlet section (4) include a flange (16) for connecting an exhaust duct (18).

[0031] Figure 9 shows an exemplifying and non-limiting example of the use of this implementation, where the apparatus (1) can be considered fixed inside and at the base of a casing of a cabinet with drawers and attached to an exhaust duct (18) that can also be potentially offset from the gaseous substance inlet section (4) of the apparatus (1).

[0032] Figures 10, 11 and 12 show a further implementation of the exhaust apparatus (1) in which the means (13) of supplying the inlet section (4) include a cylindrical-cuboid connection unit (17) to connect the circular-shaped inlet section (4) of the apparatus (1) to a multi-sided exhaust duct (18).

[0033] In the examples in Figures 10 and 11, the exhaust duct (18) is rectangular in shape and is offset, but it could also be coaxial with the inlet section (4) according to the plant engineering situations for which it is intended.

[0034] Figures 13, 14 and 15 illustrate a further implementation of the fan apparatus (1), wherein the means (13) of supplying the inlet section (4) include a flattened-bell shaped exhaust manifold (19).

[0035] The bell shape has a square-shaped inlet (20) and a circular outlet (21) that complements the inlet section (4) of said conveyor (1).

[0036] Such an implementation is very small in size and is optimally suited to being used, for instance, inside a furniture casing, the bell shape being vertically oriented, as shown in Figures 13 and 14, and in a hanging position and leaning against one of the vertical walls of the cabinet housing it.

[0037] Since the apparatus (1) occupies a very small space, most of the internal space of the furniture still remains usable without any limitations whatsoever, unlike as occurs in the prior art, where the furniture space that houses the traditionally-manufactured exhaust apparatuses is practically unusable for purposes other than housing the exhaust apparatus.

[0038] The invention described above fully achieves the aims indicated in the foregoing and is suitable, on the one hand, for providing highly-standardisable materialisations, which allow economies of scale and reduce production costs; and, on the other hand, for providing a high versatility of alternative and different uses that can be configured with extreme simplicity and speed.

[0039] Indeed, an assembly group that uses a single model of the shell (8) can be assembled rather easily and quickly using entire groupings of tailored side walls (9), the components of which are different based on, for instance, their respective motor (7) brackets (11).

[0040] The various assembly groups thus obtained can then be just as quickly and simply configured in a further multiplicity of different ways, based on the specific requirements of use, by attaching further accessories - chosen based on the uses for which they are intended - to the basic conveyor (2).

[0041] In addition, the invention described above is suitable for the above-listed advantages as it allows the performance of the apparatus to be optimised in terms of energy and noise efficiency. The invention as designed herein is clearly capable of industrial application, and many modifications and variations can be made to it without departing from the claims set forth below. All details may also be replaced by technically equivalent elements.

Claims

1. Fan apparatus suitable for being used in a domestic extractor, comprising a conveyor (2) for gaseous substances, fitted with a spiral-shaped scroll (3), which has a section (4) for the inlet of gaseous substances from the atmosphere and a section (5) for the outlet of said gaseous substances, positioned axially and circumferentially to the scroll (3) respectively, said scroll (3) including a shell (8) and a side wall (9), the shell (8) taking the form of an open-contoured duct (10) following the shape of said scroll, the side wall (9) being flat, counterfacing the shell (8) to which it is connected upon the closure of the contour of said duct (10); said conveyor (2) further comprising a blade rotor (6) rotationally supported by and within the conveyor (2); as well as a motor (7) connected to the rotor (6) and also supported by the conveyor (2); said apparatus (1) **characterised in that** said blade rotor (6) includes a flange (27) peripherally bearing a series of blades (35) with active profiles provided with two consecutive arcs (26,28) having mutually converse concavities; and **in that** it comprises a band (30) connecting the peripheral edges of said active profiles from the opposite side of said flange (27).

2. Fan apparatus according to Claim 1, **characterised in that** said band (30) of the rotor (6) and said side wall (9) are facing each other in close proximity to form a sealing meatus between them.

3. Fan apparatus according to Claim 1 or 2, **charac-**

terised in that it comprises a motor (7) bracket (11) detached and separate from the section (4) for the inlet of gaseous substances.

4. Fan apparatus according to Claim 1 or 2, **characterised in that** said bracket (11) is supported by said side wall (9).

5. Fan apparatus according to Claim 4, **characterised in that** said bracket (11) includes a through-housing (12) obtained by crossing through said side wall (9), with said housing (12) shaped to complement each specific model of said motor (7).

6. Fan apparatus according to one of the preceding claims, **characterised in that** said scroll (3) spirals outwards from the centre to the edge of the scroll (3) in an anti-clockwise rotation when viewing said spiral from the direction and in the sense of travel of the gaseous substances through the inlet section (4) of the apparatus (1).

7. Fan apparatus according to one of the preceding claims, **characterised in that** it comprises specialised means (13) of supplying the inlet section (4) based on the form of use of said apparatus (1).

8. Fan apparatus according to Claim 7, **characterised in that** said means (13) of supplying the inlet section (4) include anti-injury grating (14) .

9. Fan apparatus according to Claim 7, **characterised in that** said means (13) of supplying the inlet section (4) include a hood filter group (15) .

10. Fan apparatus according to Claim 7, **characterised in that** said means (13) of supplying the inlet section (4) include a flange (16) for connecting an exhaust duct (18).

11. Fan apparatus according to Claim 7, **characterised in that** said means (13) of supplying the inlet section (4) include a cylindrical-cuboid connection unit (17) to connect a multi-sided exhaust duct (18).

12. Fan apparatus according to Claim 7, **characterised in that** said means (13) of supplying the inlet section (4) include a flattened-bell shaped exhaust manifold (19).

13. Fan apparatus according to Claim 12, **characterised in that** said bell shape has a square-shaped inlet (20) and a circular outlet (21) that complements the inlet section (4) of said conveyor (1) .

14. Assembly group of a fan apparatus according to one of the preceding claims, **characterised in that** one model of the shell (8) can be attached to at least one grouping of side walls (9), the components of which are different based on their respective motor (7) brackets (11).

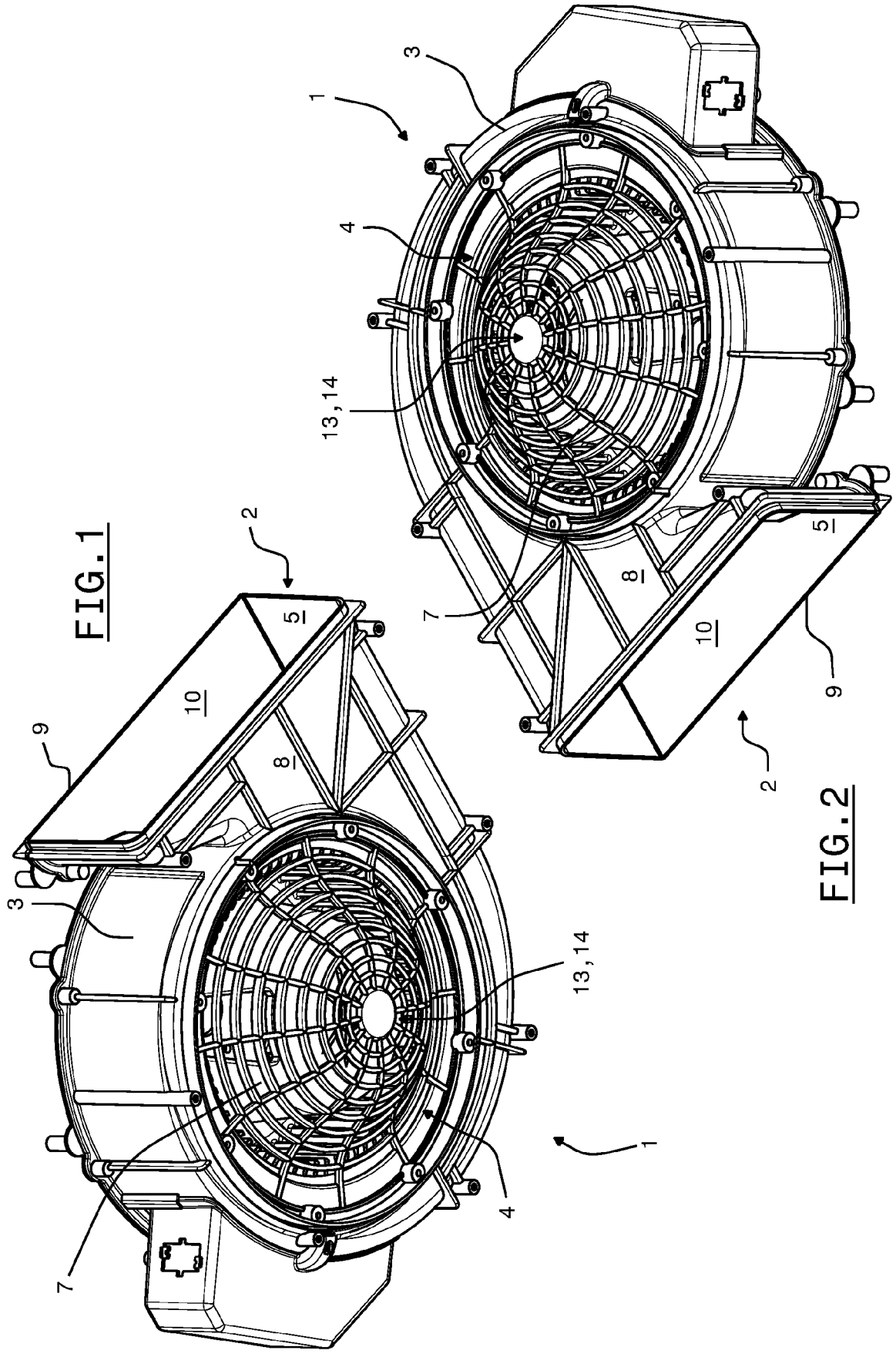


FIG.1

FIG.2

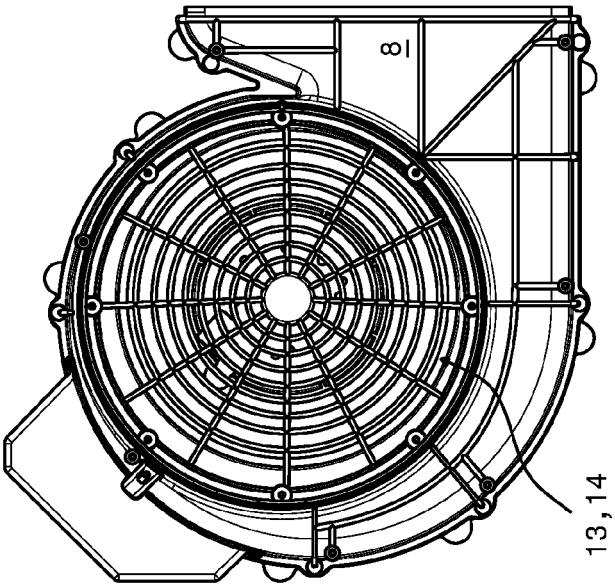


FIG.4

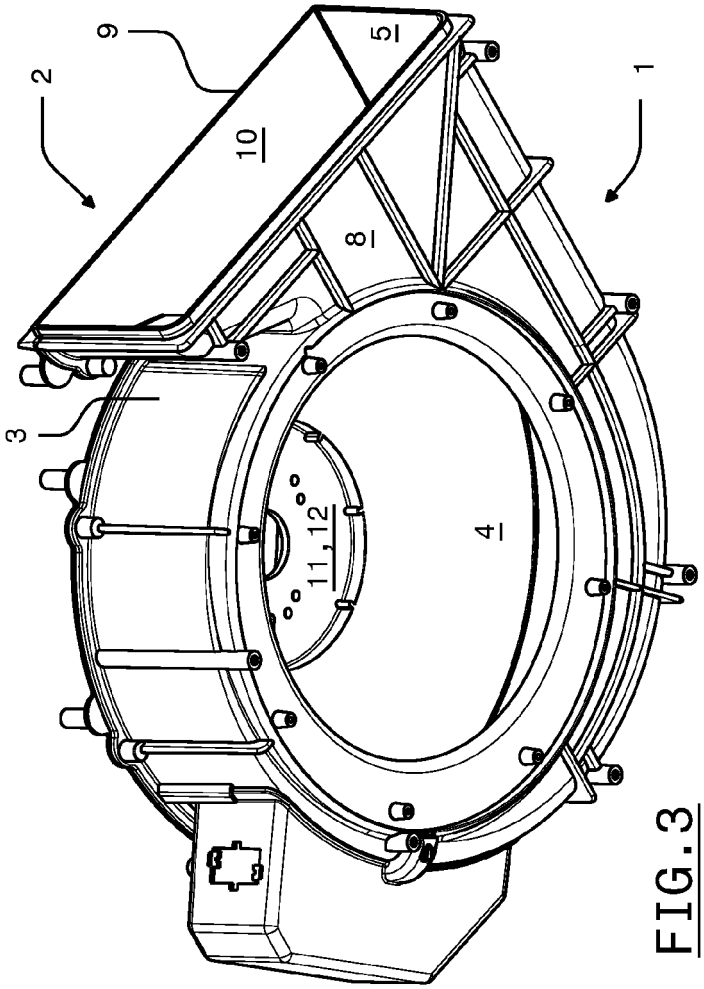


FIG.3

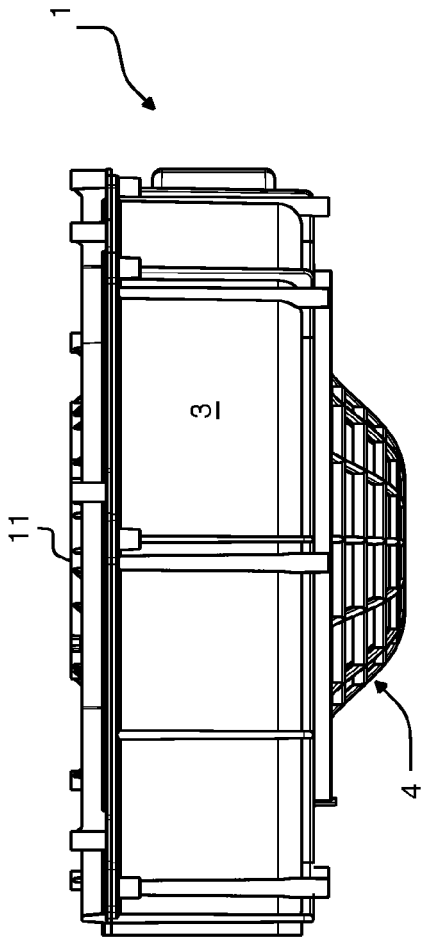


FIG.5

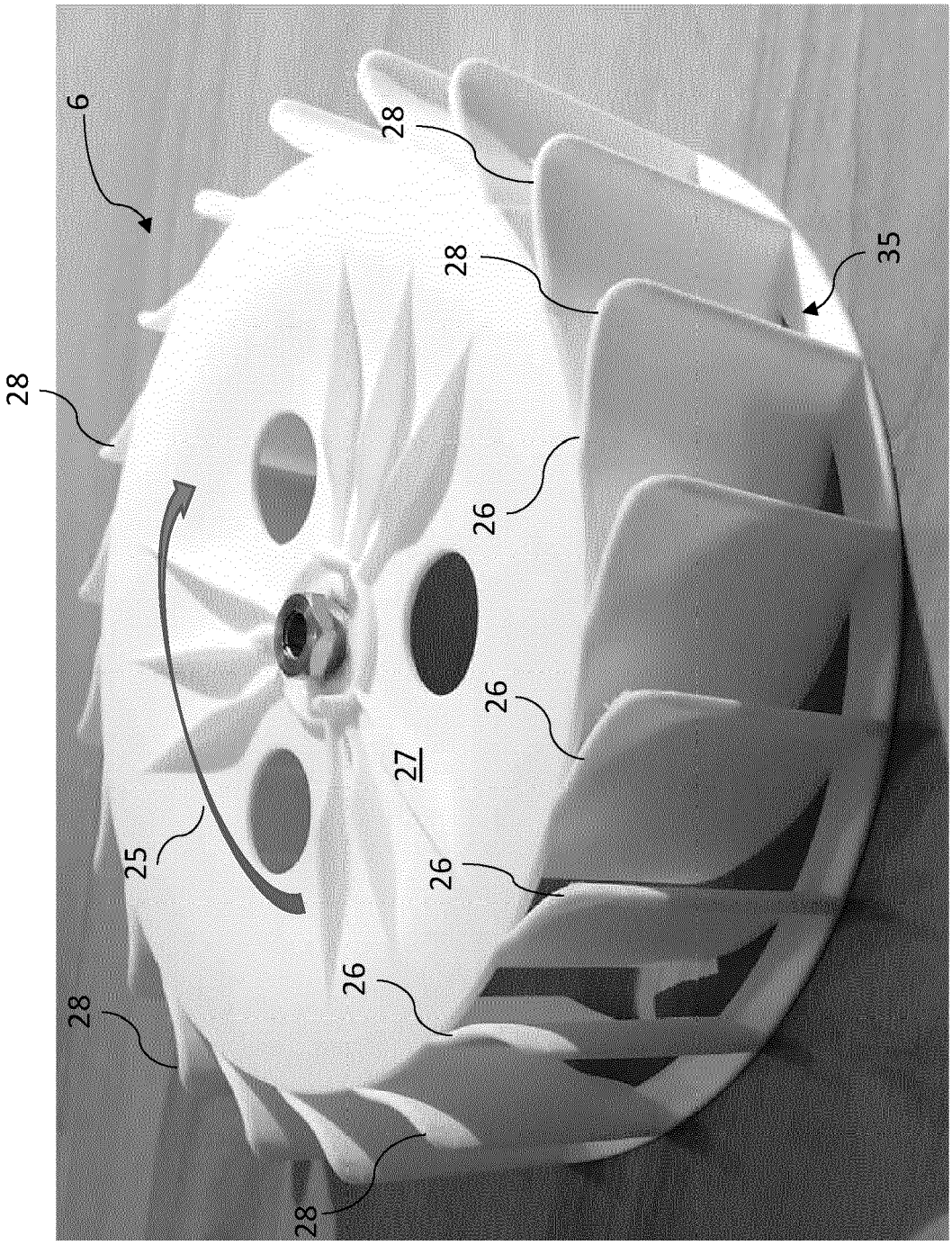
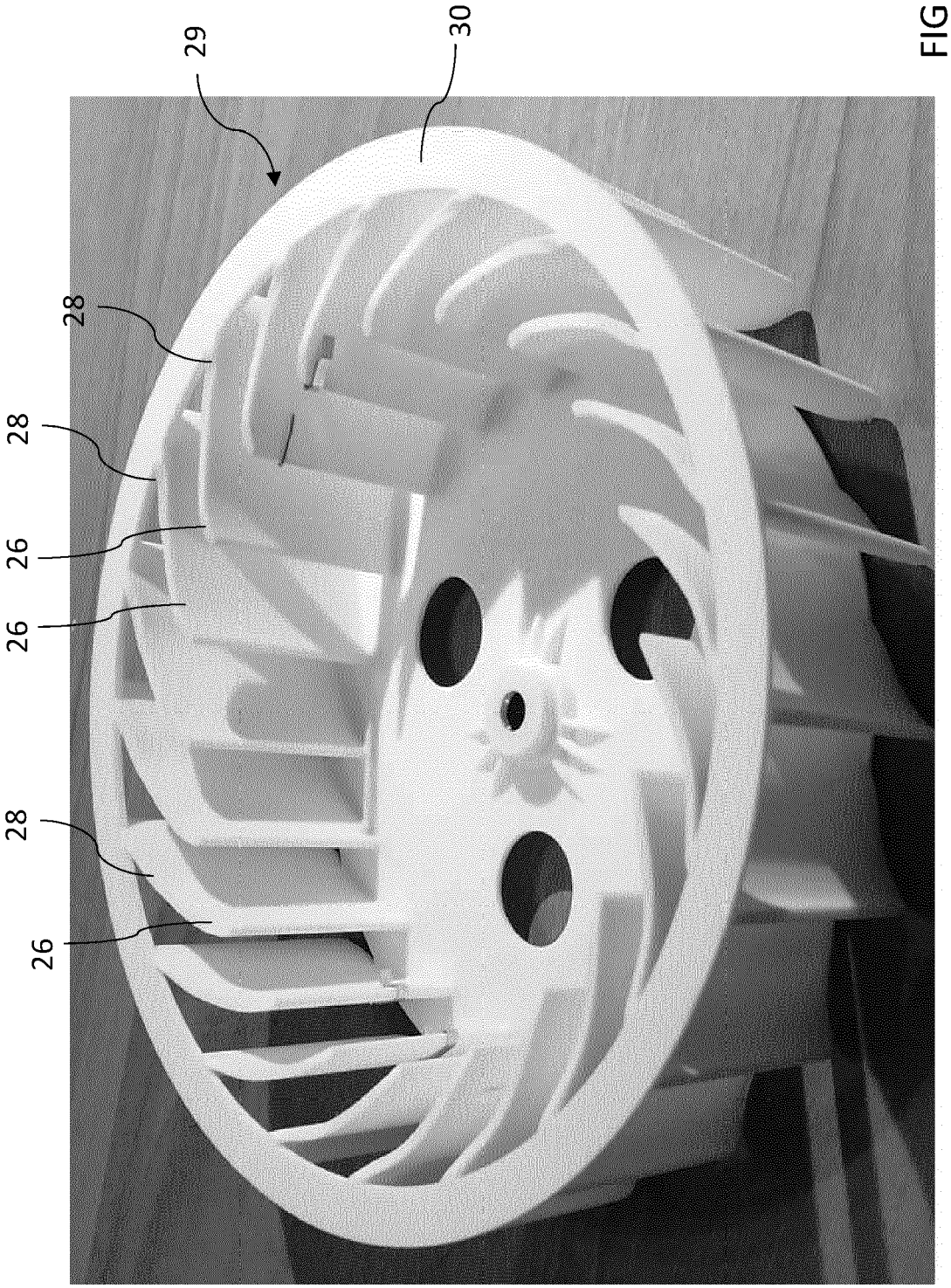


FIG.6A

FIG.6B



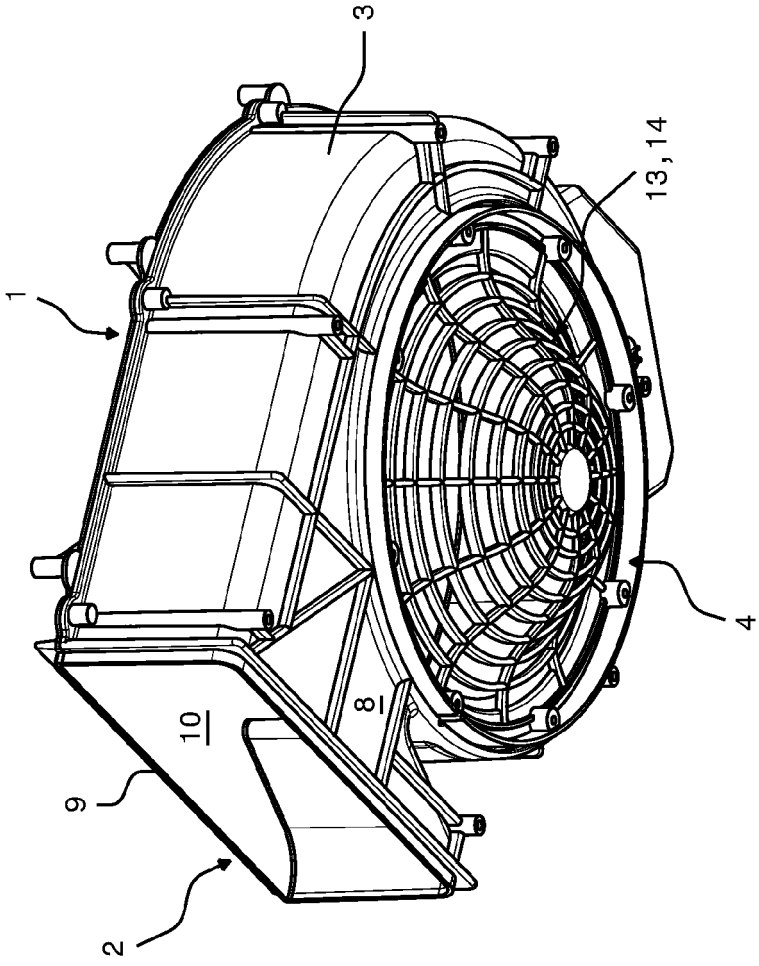


FIG.7A

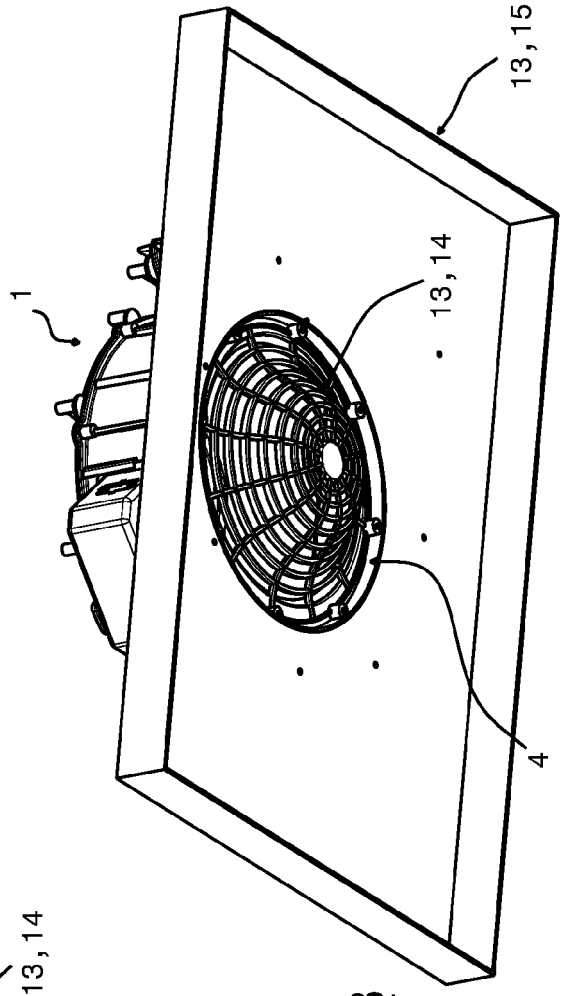


FIG.7B

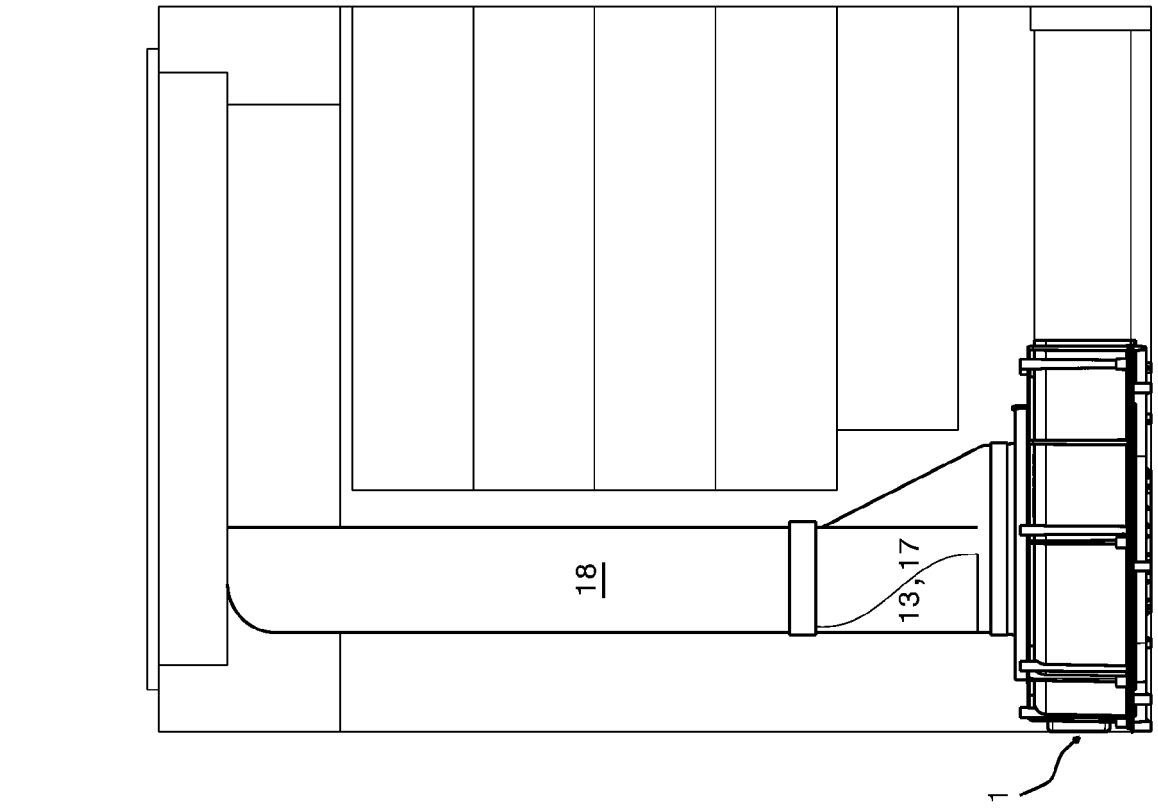


FIG.9

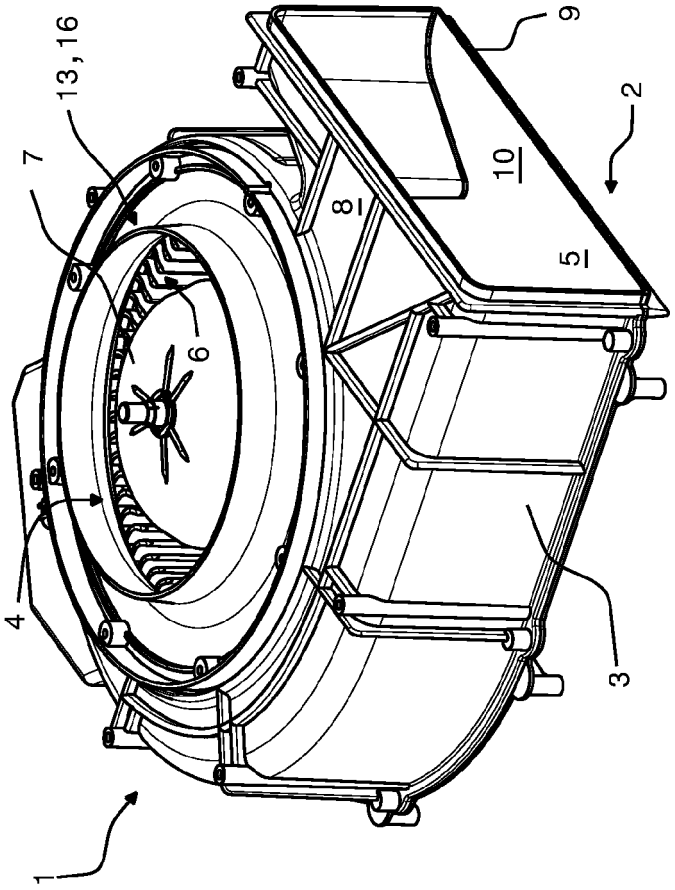


FIG.8

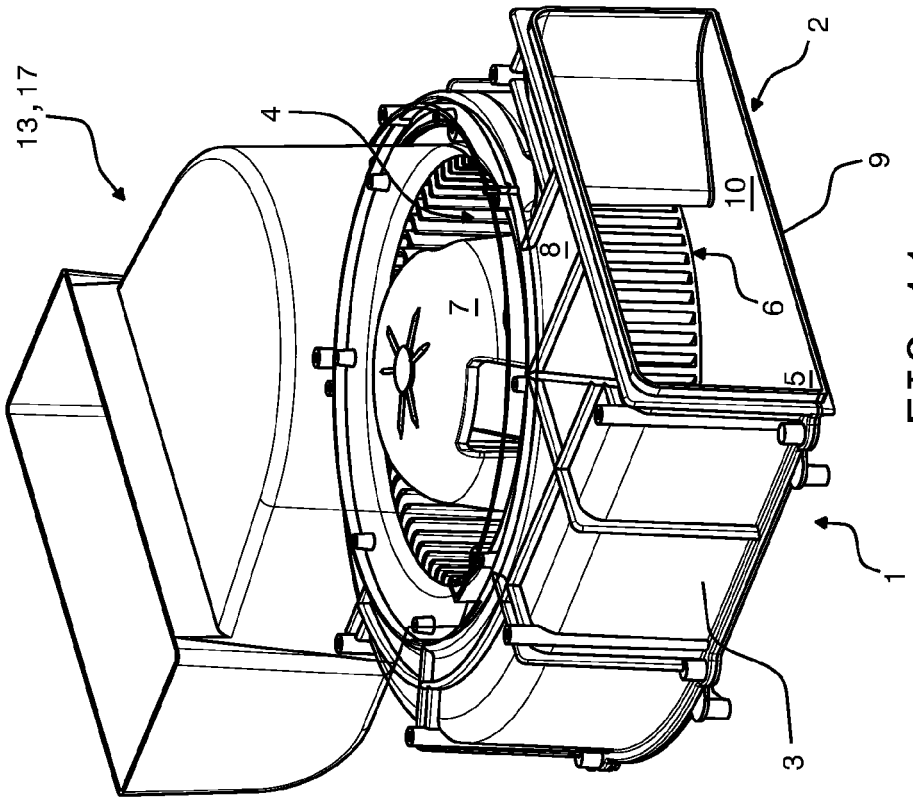


FIG.11

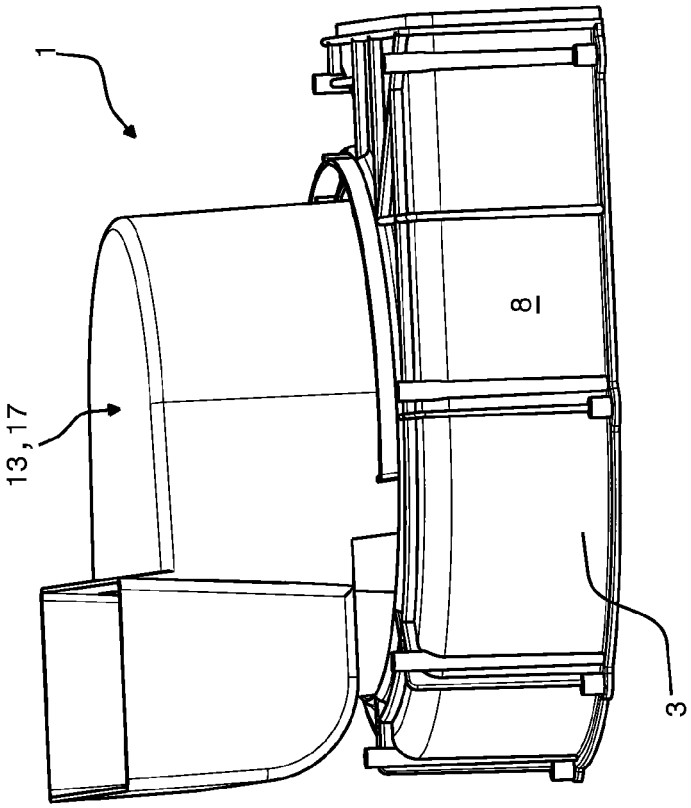


FIG.10

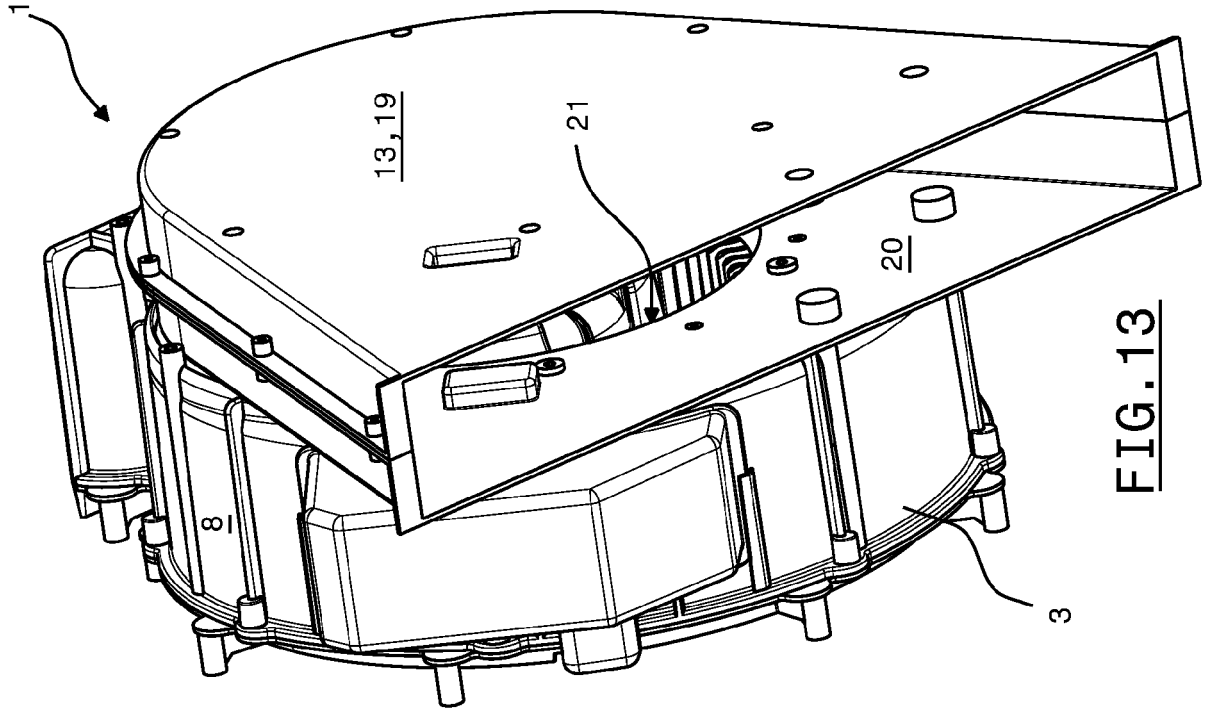


FIG.13

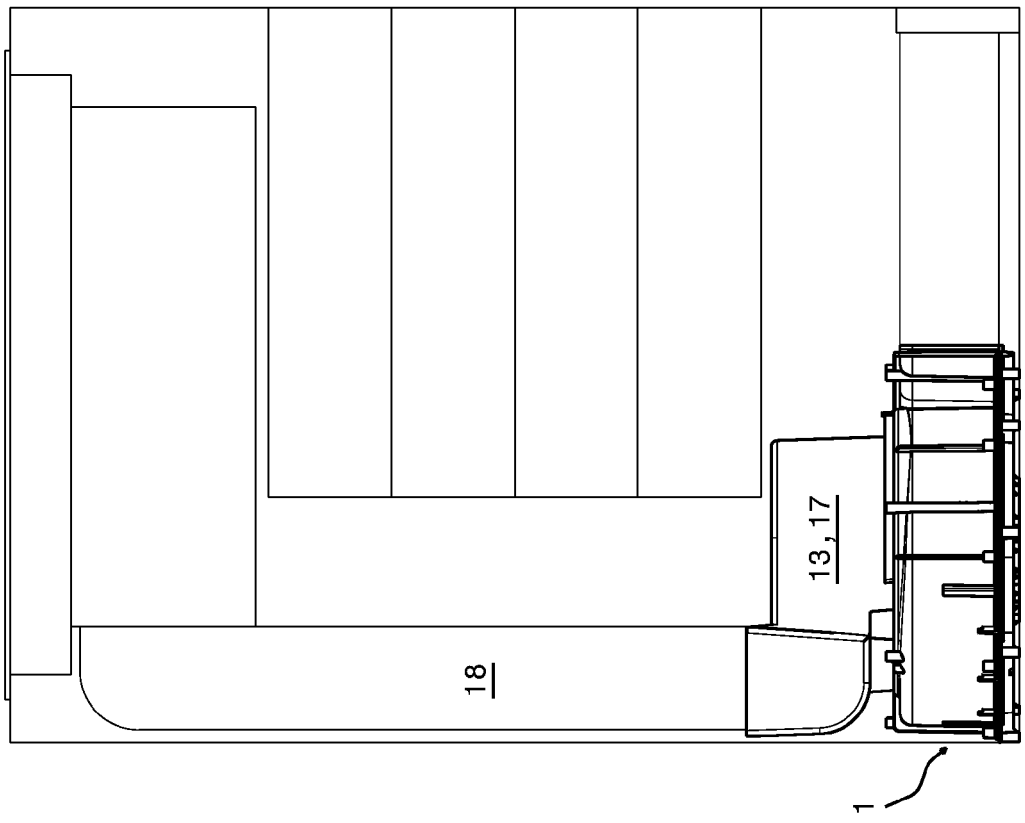


FIG.12

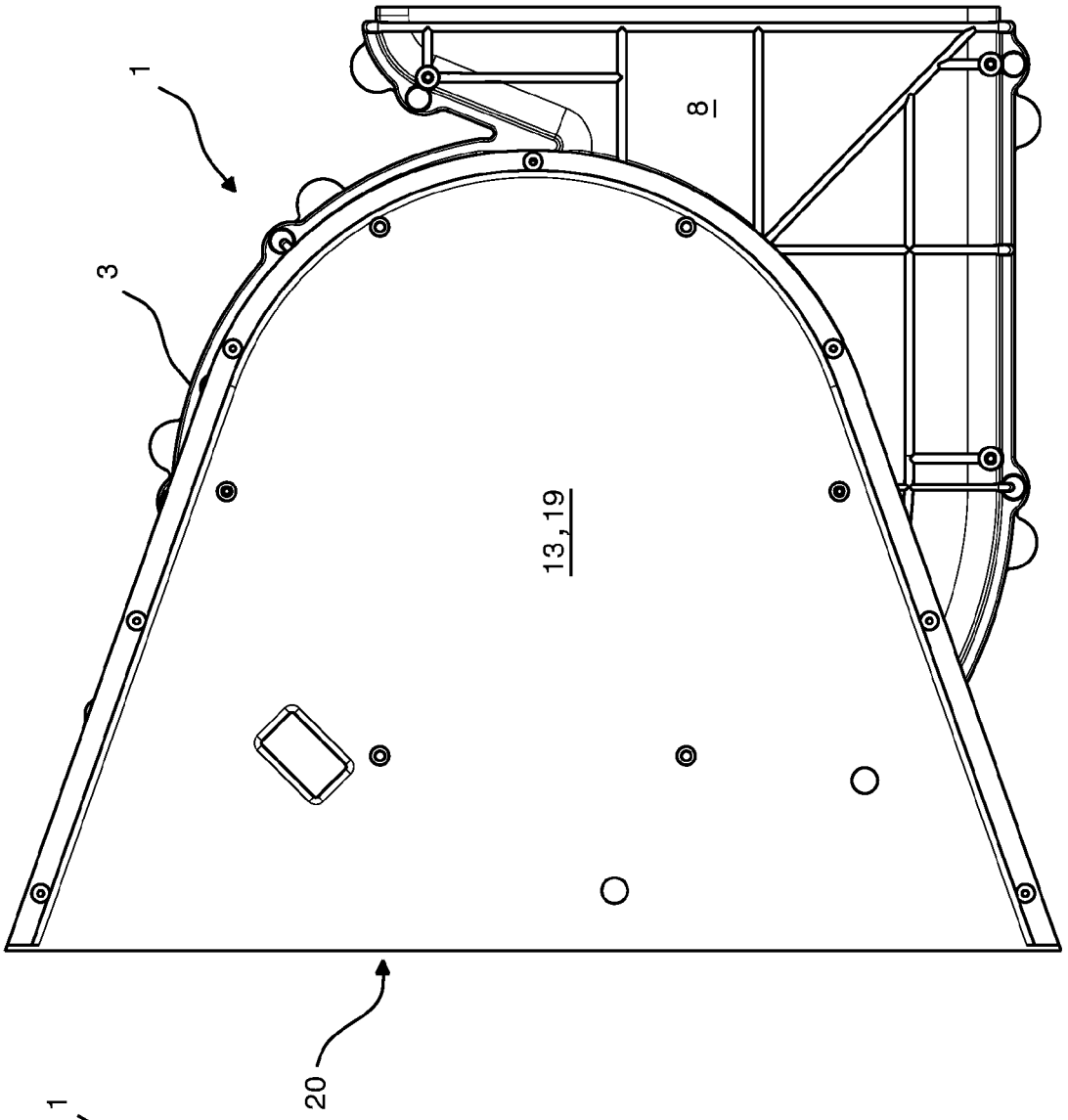


FIG.15

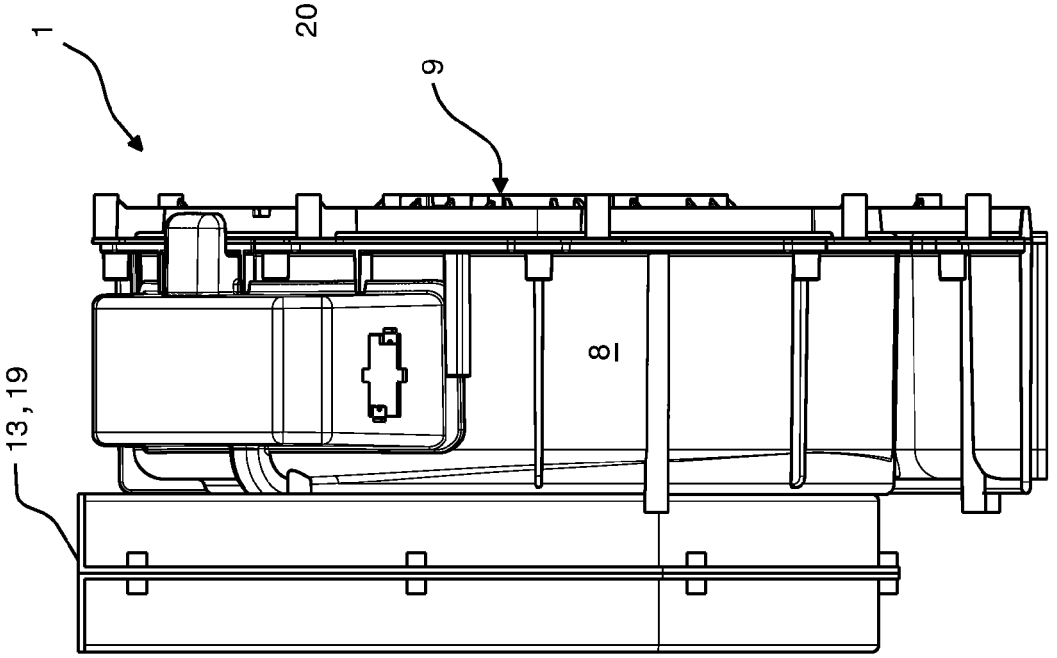


FIG.14

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EUROPEAN SEARCH REPORT

Application Number
EP 20 02 0268

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GB 1 569 147 A (FUTURUMVERKEN AB) 11 June 1980 (1980-06-11) * page 2, lines 58-61; figures 1-3 *	1-14	INV. F24C15/20 F04D29/42 F04D29/24 F04D29/28 F04D29/30
Y	US 2016/017892 A1 (FUJISONO TAKASHI [JP] ET AL) 21 January 2016 (2016-01-21) * figure 1B *	1-14	
A	BE 1 024 509 A1 (WTW SOLUTIONS VOF [BE]) 20 March 2018 (2018-03-20) * figure 3 *	1-14	
A	WO 2016/147437 A1 (SANDEN HOLDINGS CORP [JP]) 22 September 2016 (2016-09-22) * figures 1,6 *	1-14	
A	CN 107 061 366 A (GUANGDONG MIDEA KITCHEN APPLIANCES MFG CO LTD; MIDEA GROUP CO LTD) 18 August 2017 (2017-08-18) * figures *	1-14	
Y	JP H07 119691 A (NIPPON DENSO CO) 9 May 1995 (1995-05-09) * paragraph [0010]; figures 3,4,8 *	1-14	TECHNICAL FIELDS SEARCHED (IPC) F24C F04D F23D
A	US 9 885 364 B2 (SHARP KK [JP]) 6 February 2018 (2018-02-06) * figures 8,9,11 *	1-14	
A	JP 2000 240590 A (HITACHI LTD) 5 September 2000 (2000-09-05) * figures 1,2 *	1-14	
A	WO 2018/070643 A1 (SO AE RYUN [KR]) 19 April 2018 (2018-04-19) * figure 2 *	1-14	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	26 August 2020	Adant, Vincent

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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