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

(11) EP 2 336 574 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.06.2011 Bulletin 2011/25

(21) Application number: **10015815.3**

(22) Date of filing: **20.12.2010**

(51) Int Cl.:
F04D 29/42 *(2006.01)* ***F04D 29/62*** *(2006.01)*
F04D 29/66 *(2006.01)*

(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

(30) Priority: **21.12.2009 IT TO20091018**

(71) Applicant: **Rimor S.r.l.**
10156 Torino (IT)

(72) Inventor: **Avonto, Alessandro Armando**
10090 Castiglione Torinese (TO) (IT)

(74) Representative: **Cian, Paolo**
Saconney & Cian
Corso Vittorio Emanuele II, 14
10123 Torino (IT)

(54) A soundproof box for a centrifugal fan

(57) A soundroof box for a centrifugal fan, comprising a support frame (201) adapted to support a motor (M) of the fan on one side and to support a scroll (C) of the fan on the other side; a soundproof motor covering (20) applied on the support frame and adapted to surround the motor; and a soundproof scroll case (30), separated from the motor covering and adapted to contain the scroll, such a scroll case having a substantially prismatic shape and comprising a pair of terminal walls (301) and a plurality of sidewalls (303) mounted between the terminal walls. The scroll case can be selectively mounted according to a plurality of different angular orientations with respect to the support frame, around the axis of rotation of the fan wheel, which correspond to respective angular orientations of the scroll.

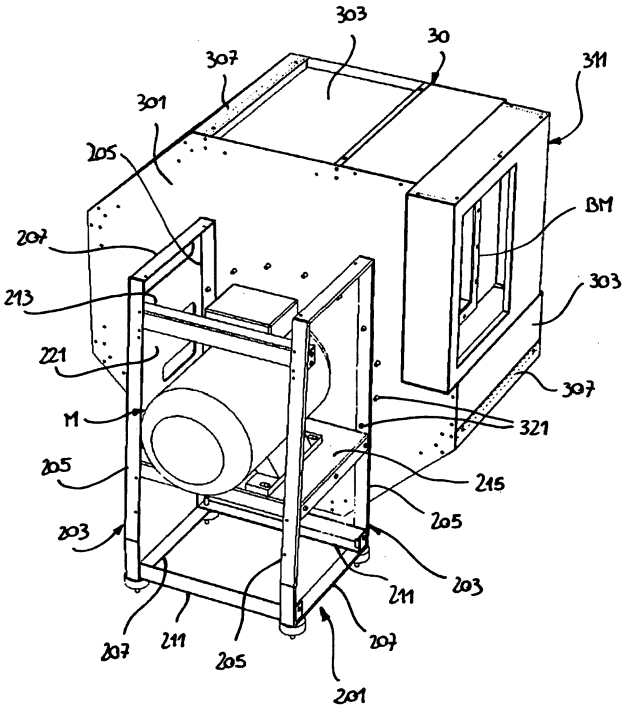

Fig. 2

EP 2 336 574 A1

Description

[0001] The present invention relates to a soundroof box for a centrifugal fan.

[0002] Essentially, a centrifugal fan consists of a scroll, of a wheel arranged inside the scroll, and of an electric motor for driving the wheel directly or through a transmission. Air Is intaked by the effect generated by the wheel that is rotated by the electric motor, is therefore centrifuged towards the outside by the wheel, and the scroll, the profile of which is so shaped as a wound nozzle, collects the air discharged from the periphery of the wheel and send it the outlet mouth with a greater pressure and a predetermined speed, with the the aim of developing industrial processes such as drying, transport of materials and other.

[0003] Therefore, the source of noise of the fan can be divided into:

- noise associated with the electric motor (friction of the air entering and coming out from the fan arranged on the back, that cools the motor itself);
- noise associated with the case of the fan (friction of the air entering and coming out as a result of the rotation of the wheel);
- noise associated with the inlet mouth (friction of the air entering with a predetermined speed);
- noise associated with the discharge outlet (friction of the air coming out with a predetermined speed).

[0004] Usually, known soundproof boxes for industrial fans consist of a case adapted to contain the fan, which is formed by sheet panels that are covered inside by a soundproof material.

[0005] However, such a known solution has the drawback of being little versatile, so that a soundroof box made for a specific electric fan can not be fitted with other different electric fan configurations, or it can be adapted only to a few kinds of electric fans similar to that for which it has been designed.

[0006] Effectively, the factors to be taken into account in the design of a fan are many, from which the configuration of the fan itself strongly depend.

[0007] One of such factors consists of the presence or not of pipes connected to the inlet and/or outlet mouths, depending on the type of intended use: for example, the inlet mouth can be connected to a pipe for intaking air fom a zone far from the fan, and the outlet mouth can be connected to an other pipe or to a circuit for discharging air in an other zone far from the fan; or, the inlet mouth can be free (such as in fans applied to burners), the fan inletting air from the environment and discharging it in a circuit (in this case the intaked air can be or not filtered by suitable filters); or, the outlet mouth can be free, the fan sucking air from a circuit and discharging it in the environment (such as in the case of industrial vacuum cleaners).

[0008] Another parameter at stake consists of the arrangement of the scroll. UNI specifications recognize eight different angular orientations of the scroll with respect to the axis of rotation of the wheel, that are spaced 45° one to the other. Moreover, the scroll can be overturned of 180° in order to be fitted to a right-handed or a left-handed wheel.

[0009] An other factor consists of the kind of installation of the electric fan.

[0010] Usually, a support structure is provided, so-called chair, that on the one hand acts as a base for the electric motor and, on the other hand, allows the scroll to be fixed. However, other configurations lacking in the chair exist, in which the scroll is fixed to a different support, or configurations in which the chair supports a shaft connected to the wheel, which shaft receives the motion through a transmission from an electric motor arranged close to the chair.

[0011] Other design parameters are the diameter and the width of the scroll, as a function of the flow rate and pressure required for the fan. The flow rate depends on the duty to be carried out by the fan. The pressure depends on the length and configuration of the pipes connected to the inlet and/or outlet mouths, as well as on the kind of duty required. Each fan has a wheel diameter that, combined with the speed of rotation, generates a predetermined pressure; moreover, the width of the scroll is strictly linked with the flow rater. This means that two fans having the same diameter, one of which is wide the double of the other, indicatively have the same pressure at the outlet mouth, but the one has a flow rate double with respect to the other.

[0012] From what stated above, the fact that fans may have an extremely great numbers of range of configurations derives. Known soundproof boxes are not suitable to be fitted to a great number of fan versions. In practice, the box need to be custom-made when the configuration of the fan to which it is directed is know.

[0013] An object of the invention is that of proposing a soundproof box that is so shaped as to allow a high structural modularity to be achieved, and that alloww therefore a mass production by industry to be achieved.

[0014] Such an object is reached, according to the invention, by a soundproof box comprising

a support frame for supporting a motor of the fan on one side and holding up a scroll of the fan on the other side,

a soundproof motor covering applied on the support frame and adapted to surround the motor,

a soundproof scroll case separated from the motor covering and adapted to contain the scroll, said scroll case having a substantially prismatic shape and comprising a pair of end walls and a plurality of side walls mounted between said end walls, and

connection means for mounting the scroll case on the support frame, said connection means being positioned between the support frame and one of the end walls of the scroll case, and being arranged in

such a manner as to allow the scroll case to be selectively mounted according to a plurality of different angular orientations with respect to the support frame, around the axis of rotation of the fan wheel, which correspond to respective angular orientations of the scroll.

[0015] In a box according to such an Idea of solution, the scroll case can be rotated as a result of the various orientations of the fan, and it can be arranged both in the right-handed and in the left-handed configuration, while the sidewalls can be replaced in order to allow different widths of the scroll to be fitted and in order to allow filters, partition walls and possible further fittings to be installed. More in general, the various members of the box can be manufactured as a series of parts that can be combined in several manners as a result of the requirements.

[0016] Particular embodiments of the invention are the subject of the depending claims, the content of which should be considered as an integrating part of the present description.

[0017] Further characteristics and advantages of the invention will appear from the following detailed description, provided as a purely non-limitative example, with reference to the appended drawings in which:

- figure 1 is a perspective view from the motor side, of a centrifugal electric fan provided with a soundproof box according to the invention;
- figure 2 is a view similar to figure 1, from which cover members of the motor covering have been removed;
- figure 3 is a perspective view from the scroll side, of the motor of the fan of figure 1 and of the respective covering;
- figure 4 is a view similar to figure 3, from which the motor has been removed;
- figure 5 is a view similar to figure 4, from which an inner partition wall has been furtherly removed;
- figure 6 is a perspective view from the scroll side, of the fan of figure 1;
- figure 7 is a view similar to figure 6, from which a terminal wall has been removed;
- figure 8 is a view similar to figure 7, from which a noise reducing plenum associated with the discharge outlet of the fan has been furtherly removed;
- figure 9 is a view similar to figure 8, from which the scroll of the fan has been furtherly removed;
- figure 10 is a perspective view from the motor side, of the scroll case of the fan of figure 1;
- figure 11 is a view similar to figure 10, from which a terminal wall has been removed;
- figure 12 is a view similar to figure 11, from which a noise reducing plenum associated with the outlet mouth of the fan has been furtherly removed;
- figure 13 is a view similar to figure 12, from which the wheel of the fan has been furtherly removed;
- figure 14 is a perspective view of a second embodiment of the soundproof box according to the invention;
- figure 15 is an elevational view from the motor side, of a scroll case of the box of figure 14;
- figure 16 is a perspective view from the scroll side, of the scroll case of figure 15; and
- figure 17 is a view similar figure 16, from which a terminal wall has been removed.

[0018] With reference to figures 1 to 13, a soundroof box for a centrifugal fan is indicated 10 as a whole. The fan conventionally comprises a scroll C, that can be seen for example in figure 7, a wheel (not shown) arranged inside the scroll C, and an electric motor M for driving the wheel G, that can be seen for example in figure 2. The shaft A projecting from the electric motor M, on which the fan wheel is fast, can be seen for example in figure 3.

[0019] In the following description the terms "front" and "rear" are referred to a direction from the scroll to the electric motor.

[0020] The soundproof box 10 according to the invention comprises a soundproof motor covering 20, adapted to encircle the electric motor M of the fan, and a soundproof scroll case 30, adapted to contain the scroll C of the fan.

[0021] With particular reference to figures 1 to 5, the motor covering 20 is applied on a support frame 201, commonly called "chair", acting as a base for the electric motor M, on the one side, and allowing the scroll C to be assembed, on the other side, as it will be clarified in the following.

[0022] The chair 201 comprises a pair of side frames 203 arranged at opposite sides of the motor M, each of which comprises a pair of uprights 205 and a pair of crosspieces 207, connecting the uprights 205 to each other at opposite ends thereof. The side frames 203 are connected to each other by a pair of lower interconnection crosspieces 211, arranged at the base of the chair 201, by an upper interconnection crosspiece 213, arranged close to the top of the chair 201 at the rear side thereof, and by a bracket 215 arranged at a middle height of the chair 201. Such a bracket 215 serves as a support base for the electric motor M.

[0023] The chair 201 described above is made in order to be fitted to different heights of the motor, by changing the height of assembly of the bracket 215.

[0024] The motor covering 20 comprises a plurality of covering members fixed to the chair 201 so as to surround the motor M. Such covering members consist in general of sheet panels sheathed by soundproof material on the inner side of the motor covering 20. In particular, a pair of side panels 221 respectively fixed on the side frames 203 of the chair 201, an upper panel 223 fixed on the top of the chair 201, and a rear covering 225 fixed on the rear side of the chair 201, which extends In height from the top of the chair 201 to below the bracket 215, are provided.

[0025] A convex portion of the rear covering 225, indicated 227 in the figures, projects rearwardly so as to form

a cavity between it and a flat partition wall 229 that can be seen in figure 4, which is also fixed on the rear side of the chair 201 and extend between the upper interconnection crosspiece 213 and the bracket 215. In the partition wall 229, that is sheathed by soundproof material, is formed an opening 229a through which the rear portion of the electric motor M projects, that is therefore arranged in the cavity between the convex portion 227 of the rear covering 225 and the partition wall 229. Therefore, the partition wall 229 separates the inner space of the motor covering 20 into two separated cavities, one of which contains the rear portion of the motor, and the other, arranged above the bracket 215, contains all the remaining portion of the motor.

[0026] Therefore, the convex portion 227 of the rear covering 225 and the partition wall 229 form a noise trap arranged behind the motor M that, beyond reducing the noise, separates the air intake of the cooling fan (not shown) of the motor with respect to the outlet so that the motor M does not receive already warm air, but always cool air. The cooling fan of the motor, conventionally arranged at its rear side, sucks cool air through slits 227a formed on the convex portion 227 of the rear covering 225, and directs it along the outer surface of the case of the motor M trough the opening 229a in the partition wall 229. Air warmed by contact with the motor M is therefore discharged through slits 221a formed on the side panels 221.

[0027] The chair 201 has the function, beyond that of supporting the motor and the covering members, of allowing the box to be lifted and palletized, as well as to allow cables to enter the motor.

[0028] With particular reference to figures 6 to 13, the scroll case 30 has a substantially prismatic shape and comprises a pair of terminal walls 301 and a plurality of sidewalls 303 mounted between such terminal walls. The terminal walls 301 and the sidewalls 303 consist in general of sheet panels sheathed by soundproof material on the inner side of the scroll case 20. Depending on the requirements, and as in the example shown, some of the sidewalls may have openings at wich planar filters 303a are mounted. Air intaked to the electric fan enters trough the filters 303a. A partition wall (not shown) sheathed by soundproof material, arranged between the scroll C and the terminal wall 301 on the front side, that may be provided for dampening the noise associated with the inlet mouth, which partition wall makes in the substance a double wall on the front side.

[0029] In the example shown, the inlet mouth BA of the fan is free, that is lacks in any pipe connected to it, so that it sucks air directly from the surrounding environment. In the case in which sucking takes place through a pipe, the terminal wall 301 on the front side is provided with an opening for connection to such an intake pipe.

[0030] Advantageously, the scroll case 30 comprises a main portion having the geometry of an octagonal prism provided with angles of 45°, which correspond geometrically to the positions admitted for orientation of the scroll C, and an outlet portion so shaped as to receive the outlet mouth BM of the scroll. Effectively, the scroll case 30 loses the octagonal geometry at the outlet mouth, since its shape fits the outlet mouth BM of the scroll 30. In the example shown in figures 1 to 13, the cross-sectional profile of the main portion of the scroll case 30 is defined by a regular octagon portion having six equal sides and six equal angles of 45°.

[0031] The sidewalls 303 of the main portion of the scroll case 30 that has an octagonal geometry, are mounted in the following manner. A pair of linear interconnection members 305 is mounted at each side corner of the octagonal prism, said members being arranged at opposite sides of the corner, which interconnect the terminal panels 301 of the scroll case 30. Each corner is covered by a bent covering plate 307 that is fixed to the respective pair of linear interconnection members 305 of the corner.

[0032] The two linear interconnection members 305 associated with each side face of the octagonal prism, serve as an assembly frame for the sidewalls 303 of the scroll case 30.

[0033] Of course, in the case in which the inlet mouth is connected to a pipe, the filters 303a and the double wall are not present. In such a case, since the double wall is absent and therefore there is not any axial obstacle caused by it, the scroll case can be sized so that is has a reduced width, simply by choosing the linear interconnection members 305 so that they have a smaller length, and sidewalls so that they have 303 a smaller width.

[0034] The sidewalls of the scroll case 30, at the outlet portion of such a case, consist of a plurality of panels, some of which are folded at an angle, which are connected to each other and are arranged in such a manner as to leave an opening at the outlet mouth BM of the scroll. Moreover, the sidewalls at the outlet portion of the scroll case 30 are arranged in such a manner to define a shelf or seat, at which a noise reducing plenum 311 of a known type is mounted, in order to attenuate the noise connected with the outlet mouth of the electric fan. In the case in which the outlet mouth is not free but is connected to a pipe, such a noise reducing plenum is not applied.

[0035] Connection means are provided for mounting the scroll case 30 on the motor covering 20, which are positioned between the chair 201 and the rear terminal wall 301 of the scroll case 30. In particular, such connection means comprise a set of screw studs 321, that can be seen in particular in figure 11, which are applied on the rear wall of the scroll C, and are arranged circumferentially around the opening AI formed in such a wall and provided for introduction of the shaft A of the electric motor M.

[0036] The screw studs 321 are adapted to engage corresponding sets of through holes 323, 325, that can be seen in figures 9 and 3, which are formed on the rear terminal wall 301 of the scroll case 30 and on the front uprights 205 of the chair 201, respectively. The screw studs 321 of the scroll C are conventionally arranged

according to an octagonal simmetry around the axis of rotation of the wheel of the electric fan. The number of the through holes 323 of the rear terminal wall 301 of the scroll case 30 is equal to the number of the screw studs 321, and such holes are arranged in the same manner as the screw studs 321. The through holes 325 on the front upright 205 of the chair 201 are instead four, and they are arranged according to a rectangular diagram. In the installed condition, the screw studs 321 of the scroll C pass through the through holes 323 of the rear terminal wall 301 of the scroll case 30, and four of them pass also through the through holes 325 on the front uprights 205 of the chair 201. At the side opposite to the scroll, fixing of the scroll C, the scroll covering 30 and the chair 201 is conventionally completed by bolts screwed on the screw studs 321 (as an alternative, fixing of the scroll, the scroll case and the chair may be carried out by welding).

[0037] Therefore, the arrangement of the screw studs 321 and the holes 323, 325 allows the scroll C and the scroll case 30 fast to it, to be selectively mounted according to a plurality of different angular orientations with respect to the chair 201, according to the axis of rotation of the wheel of the electric fan. Moreover, the chair 201 has the favorable effect of stiffening the scroll C.

[0038] Therefore, the box according to the invention can be shaped according to the different scroll orientations defined by UNI specifications. Moreover, the box can be so shaped as to be fitted to a right-handed of left-handed scroll. This can be carried out simply by overturning each terminal wall 301 of the case of 180°, and by arranging consequently the soundproof material on the face of each of them that is arranged on the inner side of the scroll case 30.

[0039] Therefore, according to the invention it is possible to preset a series of different sizes of the terminal walls 301, each of which can receive several similar diameters of wheel, and therefore of the scroll. In order to shape the box for fans designed for the same difference of pressure, but for different flow rate, It is sufficient to choose the linear interconnection members 305 and the sidewalls 303 so that their length and their width, respectively, is adapted to receive a scroll having the desired width. Effectively, a series of fans having the same difference of pressure but different flow rate, can be received in the same box, only by changing the linear interconnection members and the sidewalls.

[0040] In synthesis, in the box according to the invention, the scroll case can be rotated in order to be fitted to different orientations of the fan, and it can be arranged both according to a right-handed or left-handed configuration, the chair can be composed for different sizes of the motor, and the sidewalls can be replaced in order to be adapted with different widths of the scroll, and to allow filters, possible partition walls and further fittings to be instated. In practice, it is possible to manufacture upstream series of details that, arranged in several manners, allow different possible configurations to be obtained.

[0041] With reference to figures 14 to 17, a second embodiment of the soundproof box according to the invention will be described. The elements corresponding to those of the previous embodiment have been indicated by the same numeral references, and they will not be furtherly described.

[0042] Such a second embodiment mainly differs from the previous one in the shape of the scroll case 30 and in the presence of an outer noise trap associated with the inlet of the fan.

[0043] Also in this case, the scroll case 30 comprises a main portion having the geometry of an octagonal prism provided with angles of 45°, that correspond geometrically to the orientation positions admitted for the scroll C, as well as an outlet portion so shaped as to receive the outlet mouth BM of the scroll. In the example shown in figures 14 to 17, the cross-sectional profile of the main portion of the scroll case 30 is defined by an octagon portion having four equal sides and six equal angles of 45°. Such a profile is designed starting from a nominal ottagon, from which a pair of parallel sides extend, and from which furthermore one of such extended sides and one of the other sides perpendicular to it extend, until they are connected to each other. Therefore, a heptagon having six equal angles of 45° and an angle of 90° is obtained, in which four sides are equal to each other, while the two sides adjacent to the angle of 90° and the remaining side parallel to one of the sides adjacent to the angle of 90°, have a length greater than that of the four equal sides (see in particular figure 15). The portion adjacent to the angle of 90° is intended to receive the outlet mouth BM of the scroll.

[0044] As stated above, moreover, an outer noise trap is associated with the inlet of the fan. Therefore, the scroll case 30 lacks in any inlet openings on the sidewalls 303, while an opening 331 aligned with the inlet mouth BA of the scroll (see figure 17) is formed on the front terminal wall 301. A noise trap 341 that surrounds the opening 331 is fixed on the terminal wall 301, at such an opening.

[0045] The noise trap 341 has a substantially prismatic shape and comprises a pair of terminal walls 342 and a plurality of side walls 343 mounted between the terminal walls 342. The rear terminal wall 342 of the trap is fixed to the front terminal wall 301 of the scroll case 30. The terminal walls 342 and the side walls 343 consist in general of sheet panels sheathed by soundproof material on the inner side of the trap 341. According to the requirements, and such as in the example shown, some of the sidewalls may have openings at which planar filters to you 343a are mounted. Entry of inlet air to the electric fan takes place through the filters 343a.

[0046] Moreover, in figure 14 it can be seen that shaped slits 251 are formed on the side panels 221 of the motor covering, in order to allow the chair 201 to be hooked and transported by a lifting system (not shown).

[0047] Moreover, a pair of support beams 253 fixed on opposite sides of the chair 201 can be seen, which extend

below the scroll case 30 and the outer noise trap 341 in order to provide a support for them.

[0048] The boxes described can be fitted to other installation configurations different from those shown. In particular, they can be fitted to a configuration in which the chair supports a shaft connected to the wheel, which shaft receives the motion through a transmission from an electric motor also supported by the chair. In this case, the scroll case is similar to those described above, and it is mounted on the chair. Instead, the motor covering can be made such as a soundproof box applied to the chair around the motor only, or such as a larger case surrounding both the motor and the whole chair.

Claims

1. A soundproof box for a centrifugal fan, **characterized in that** it comprises
   a support frame (201) for supporting a motor (M) of the fan on one side and holding up a scroll (C) of the fan on the other side,
   a soundproof motor covering (20) applied on the support frame and adapted to surround the motor,
   a soundproof scroll case (30) separated from the motor covering and adapted to contain the scroll, said scroll case having a substantially prismatic shape and comprising a pair of end walls (301) and a plurality of side walls (303) mounted between said end walls, and
   connection means (321, 323, 325) for mounting the scroll case on the support frame, said connection means being positioned between the support frame and one of the end walls of the scroll case, and being arranged in such a manner as to allow the scroll case to be selectively mounted according to a plurality of different angular orientations relative to the support frame, around the axis of rotation of the fan wheel, which correspond to respective angular orientations of the scroll.

2. A box according to claim 1, wherein said support frame comprises a pair of side frames (203), between which a bracket (215) is mounted adapted to serve as a support base for the motor, and wherein said motor covering comprises a plurality of covering members (221, 223, 225, 229) fixed to the support frame so as to surround the motor, said covering members consisting of panels sheathed by a soundproof material on the Inner side of the motor covering (20).

3. A box according to claim 2, wherein said covering members comprise a rear covering (225) on the side opposite to the scroll, from which a convex portion (227) protrudes so as to form a cavity adapted to house a rear portion of the motor, and a flat partition wall (229) interposed between said cavity and a further cavity containing the remaining portion of the motor, said convex portion of the rear covering (225) and said partition wall (229) forming a noise trap for the motor and defining a separation between an Inlet (227a) and an outlet (221a) for air cooling the motor.

4. A box according to any one of the preceding claims, wherein said scroll case comprises a main portion having an octagonal prism geometry with angles of 45°, and an outlet portion so shaped to house the outlet mouth (BM) of the scroll of the motor.

5. A box according to claim 4, wherein the main portion of the scroll case has a cross-sectional profile defined by a portion of regular octagon having six equal sides and six equal angles of 45°.

6. A box according to claim 4, wherein the scroll case has a cross-sectional profile defined by a heptagon having six angles of 45° and an angle of 90°, in which four sides are equal to each other, while the two sides adjacent to the angle of 90° and the remaining side parallel to one of the sides adjacent to the 90° angle, have a length greater than that of the four equal sides.

7. A box according to any one of claims 4 to 6, wherein a pair of linear interconnecting members (305) is mounted in the main portion of the scroll case, at each side corner of the octagonal prism, said linear interconnecting members being that are arranged on opposite sides of the corner and interconnect the terminal panels (301) of the scroll case (30), and wherein the linear interconnecting members (305) associated with each single side face of the octagonal prism serve as an assembly frame for a respective side wall (303) of the scroll case (30).

8. A box according to claim 7, wherein each side corner of the octagonal prism is covered by a bent covering plate (307), which is fixed to the respective pair of linear interconnecting members (305) of the side corner.

9. A box according to any one of the preceding claims, wherein a partition wall sheatehed by a soundproof material is arranged Inside the scroll case, said partition wall being interposed between the scroll (C) and the end wall (301) of the scroll case (30) on the side opposite to the motor.

10. A box according to any one of claims 4 to 9, in which a noise reducing plenum (311) is fixed to the outlet portion of the scroll case.

11. A box according to any one of the preceding claims, wherein an opening (331) aligned with the inlet mouth (BA) of the scroll is formed on the terminal

wall (301) on the side opposite to the motor, and wherein an outer noise trap (341) surrounding the opening is fixed at said opening, said outer noise trap having a substantially prismatic shape and comprising a pair of terminal walls (342) and a plurality of side walls (343) mounted between said terminal walls, in which said terminal walls and said side walls consists of panels sheathed by a soundproofing material on the inner side of the outer noise trap.

12. A box according to any one of the preceding claims, wherein said connection means comprise a set of screw studs (321) applied circumferentially to one of the terminal walls of the scroll (C), said screw studs being adapted to engage corresponding sets of through holes (323, 325) formed on one of the end walls of the scroll case (30) and on the support frame (201), respectively.

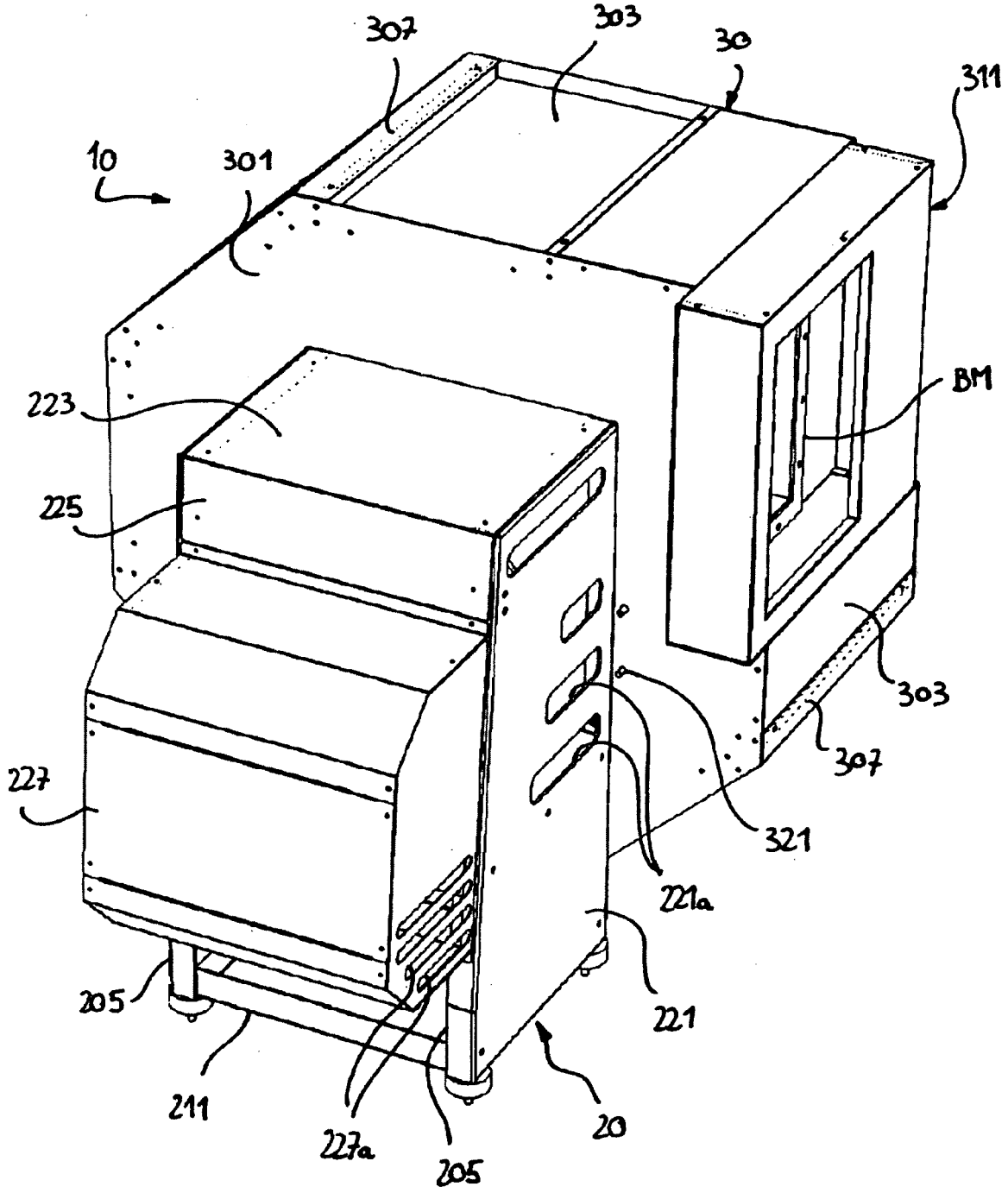
307
303
30
311
10
301
223
BM
225
303
307
227
321
221a
205
221
211
227a
205
20

Fig. 1

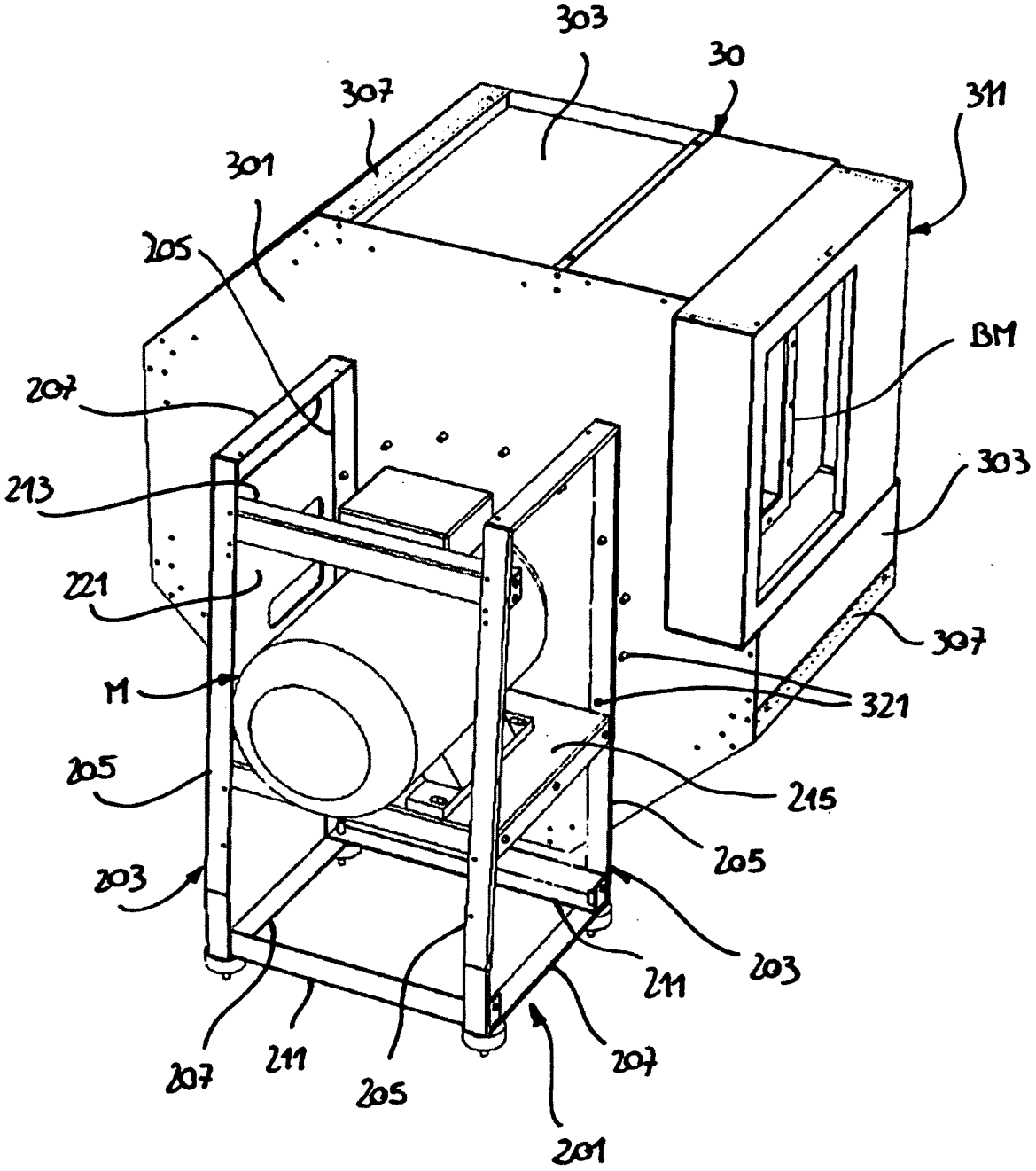
303
30
307
311
301
205
BM
207
303
213
221
307
M
321
205
215
205
203
203
211
207
211
207
205
201

Fig. 2

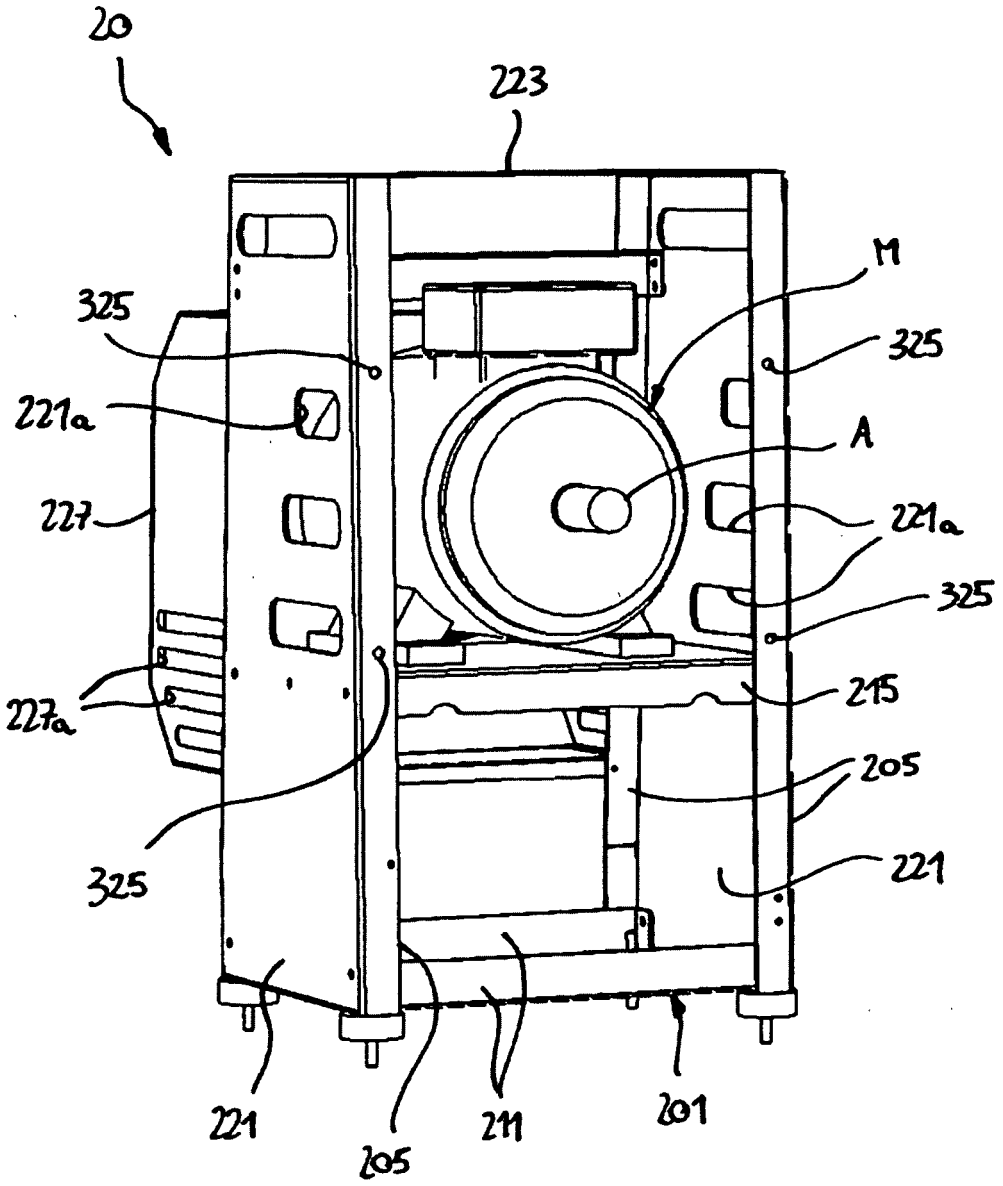
20
223
M
325
325
221a
A
227
221a
325
227a
215
205
325
221
221
205
211
201

Fig. 3

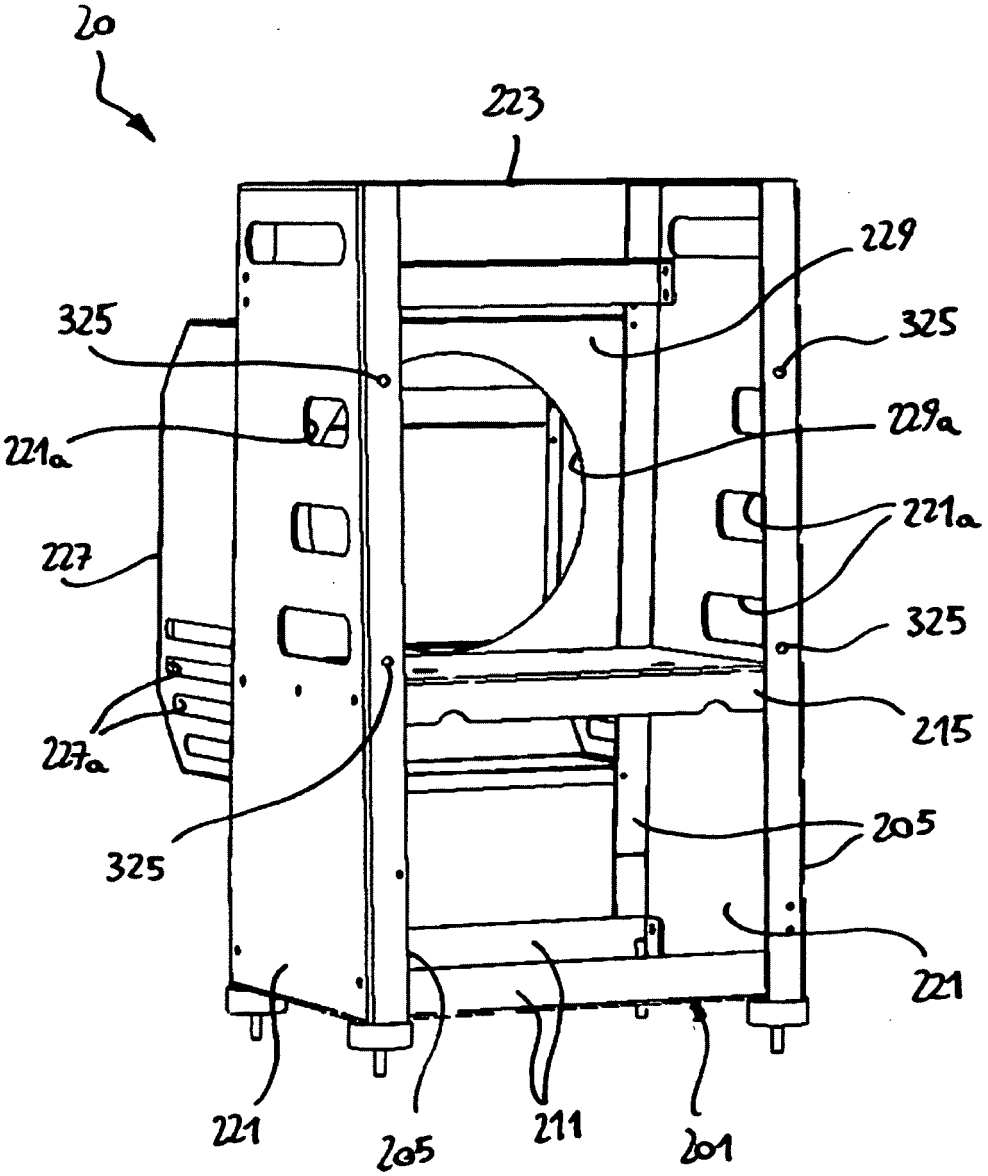
20
223
229
325
325
221a
229a
227
221a
325
227a
215
325
205
221
221
205
211
201

Fig. 4

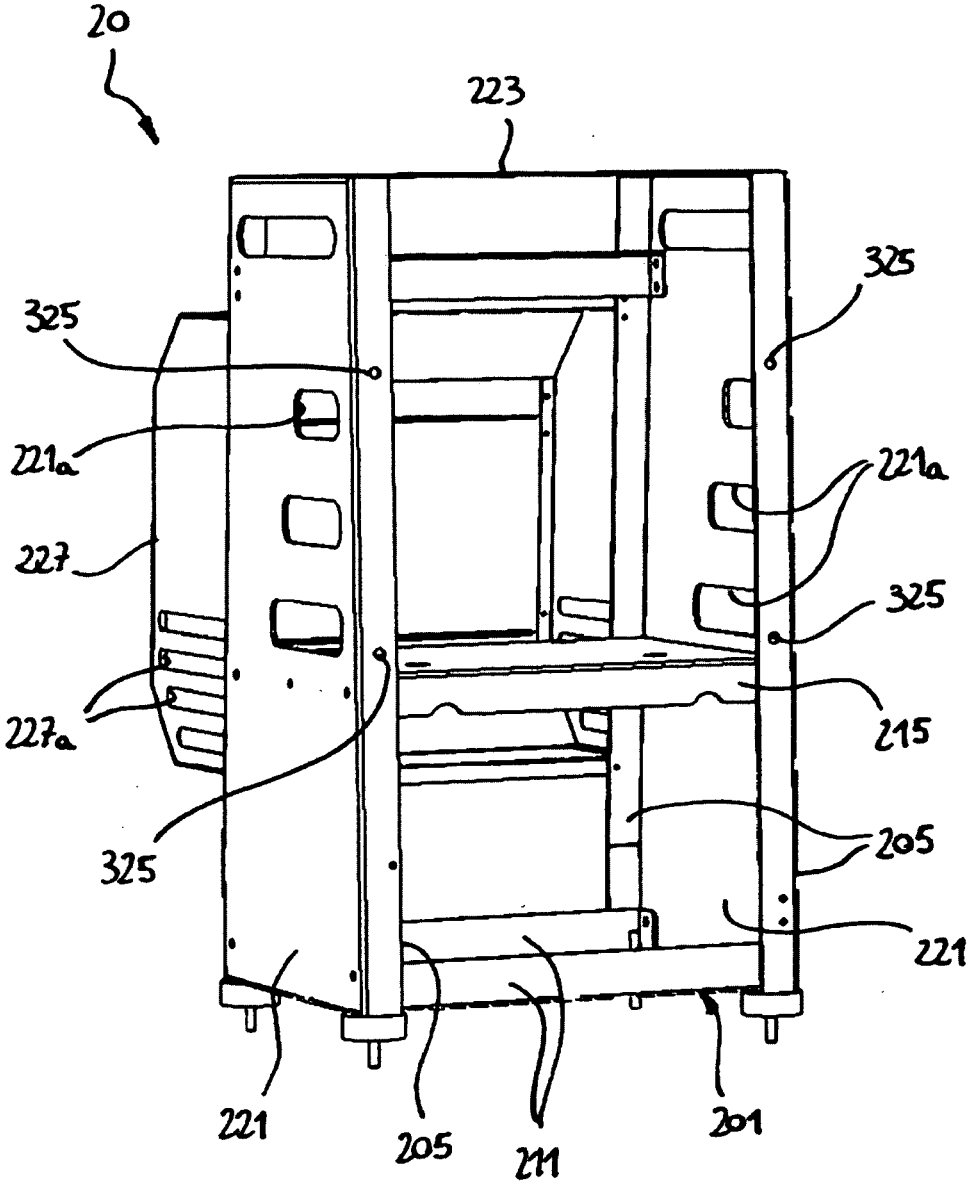
20
223
325
325
221a
227
227a
325
221a
325
215
205
221
221
205
211
201

Fig. 5

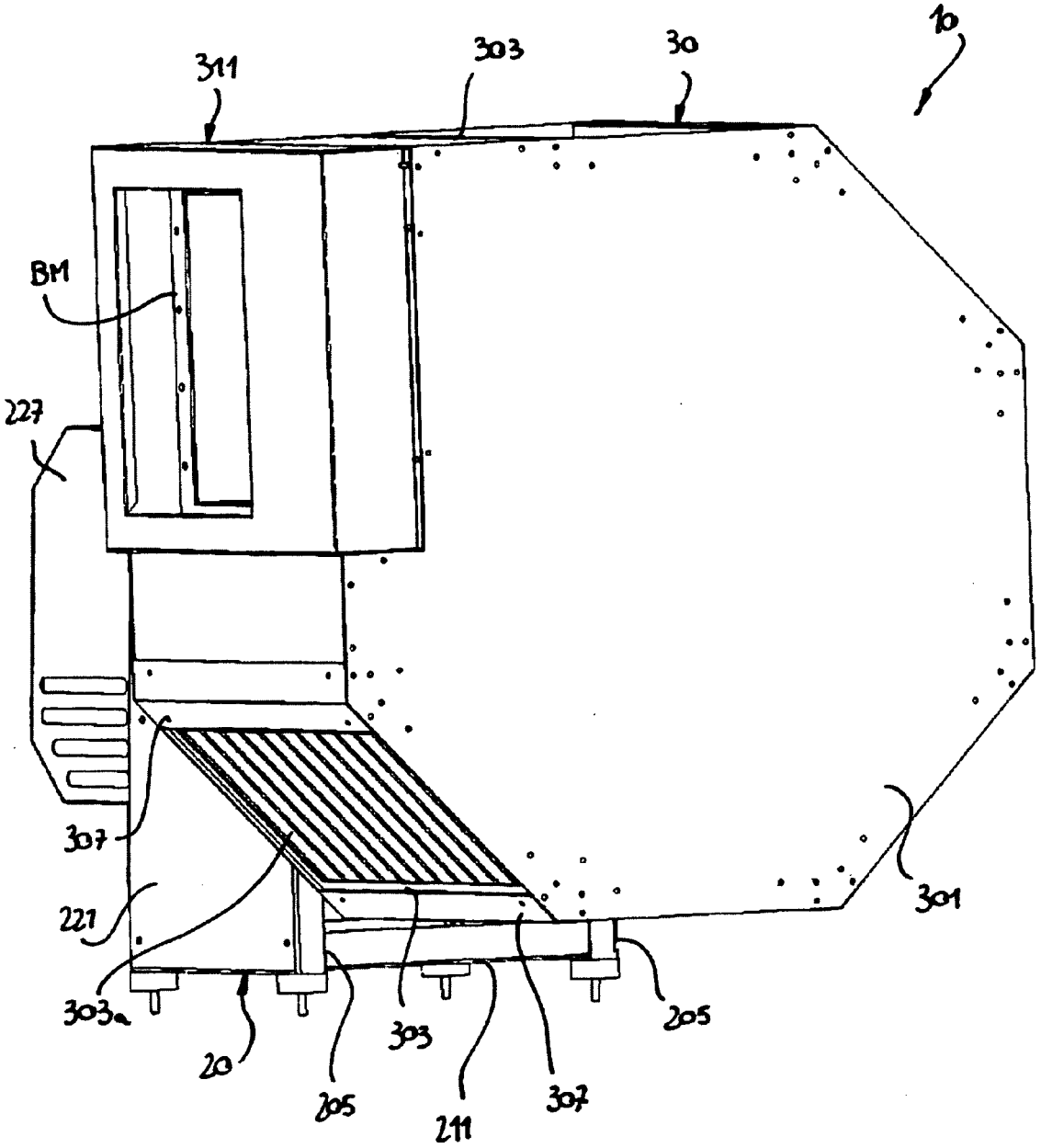

Fig. 6

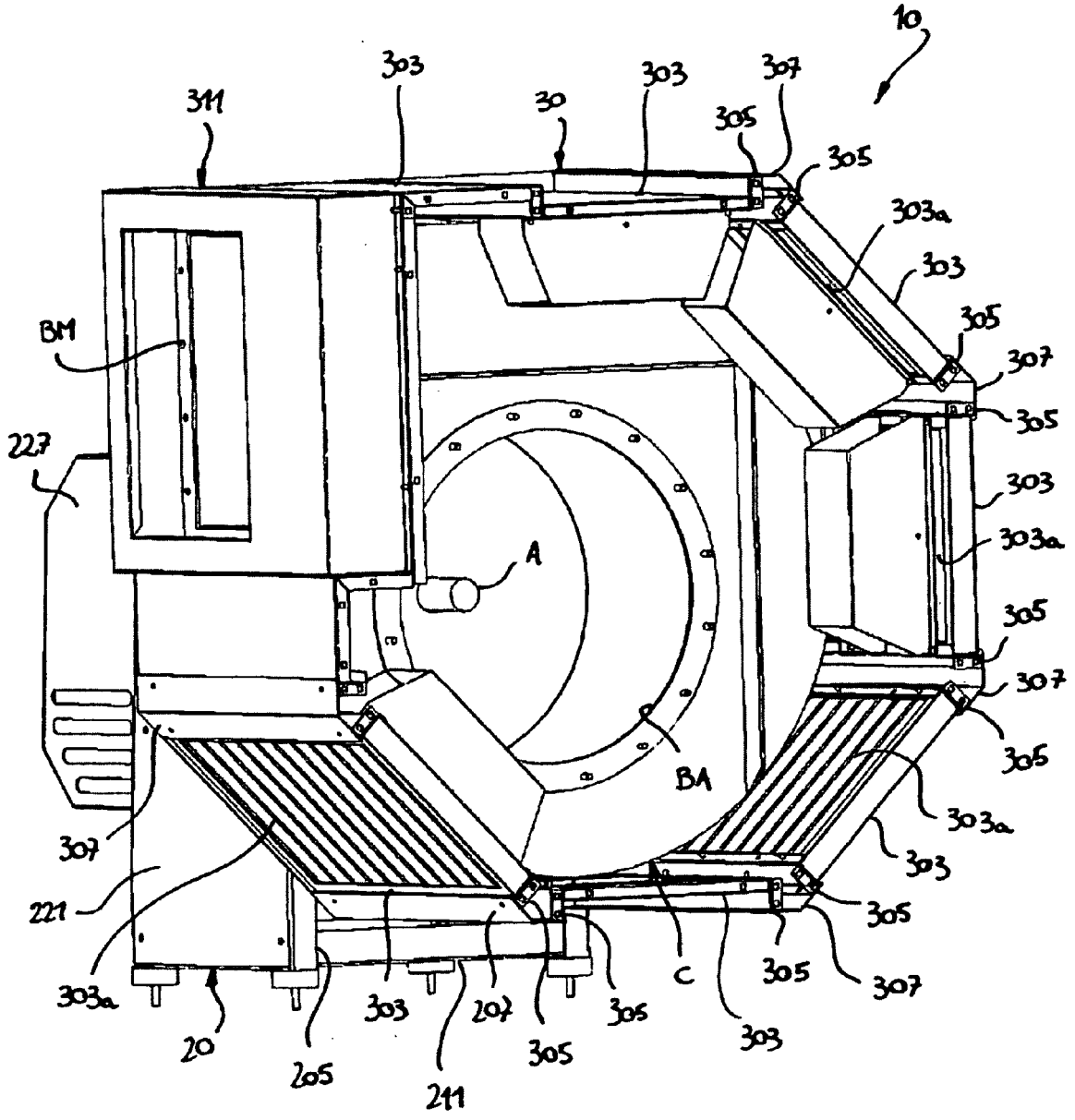
10
311
303
30
303
307
305
305
303a
303
305
307
305
303
303a
305
307
305
303a
303
305
307
305
C
303
305
307
303a
20
205
303
207
211
305
BM
227
A
BA
307
221

Fig. 7

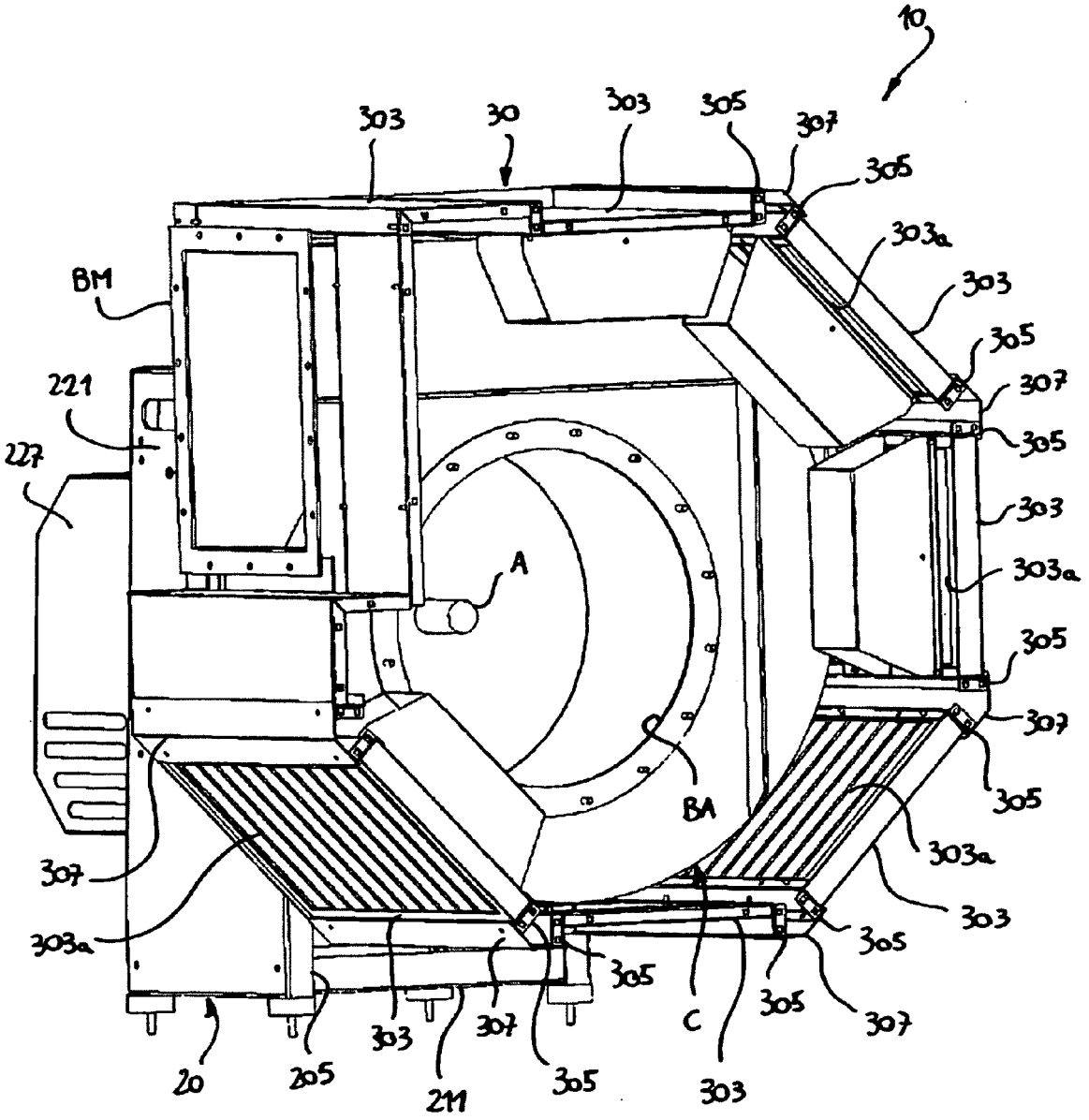
10
303
30
303
305
307
305
303a
303
305
307
305
303
303a
305
307
305
303a
303
305
307
305
C
305
307
303
305
211
305
303
307
303a
20
205
BM
221
227
A
B1

Fig. 8

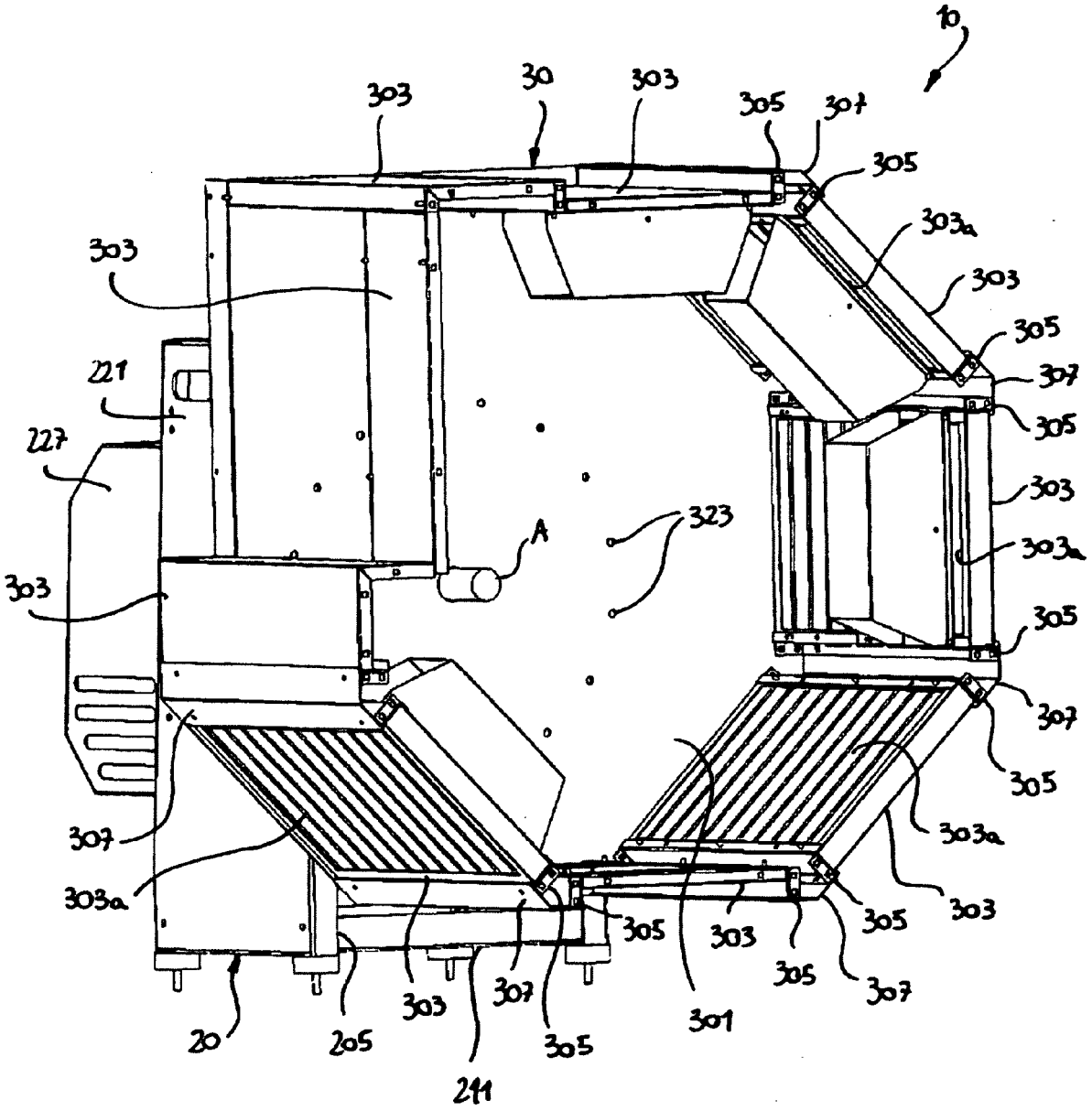
10
30
303
303
305
307
305
303a
303
305
307
305
303
303a
305
307
305
303a
303
305
303
305
307
301
305
307
303
205
20
211
221
227
A
323

Fig. 9

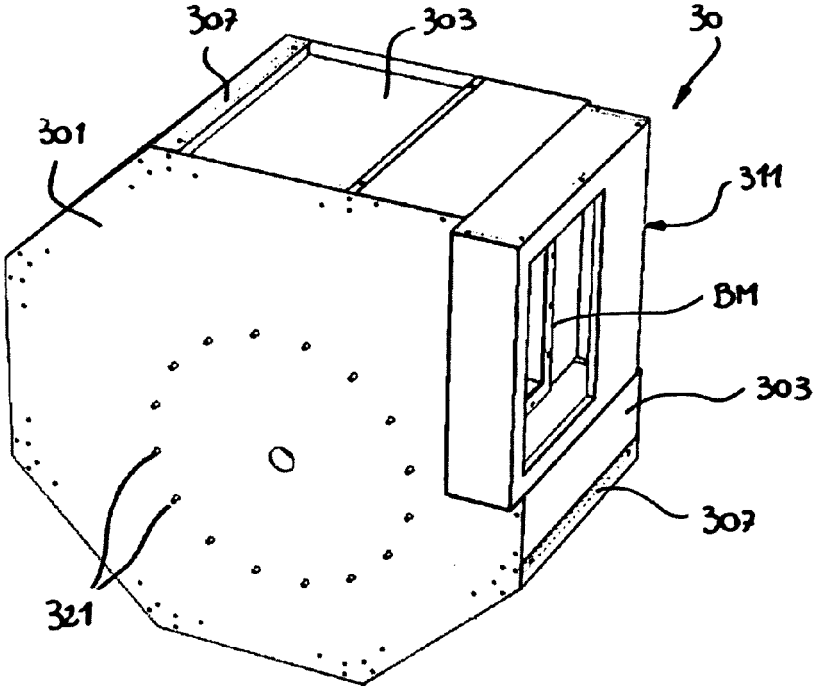
307
303
30
301
311
BM
303
307
321

Fig. 10

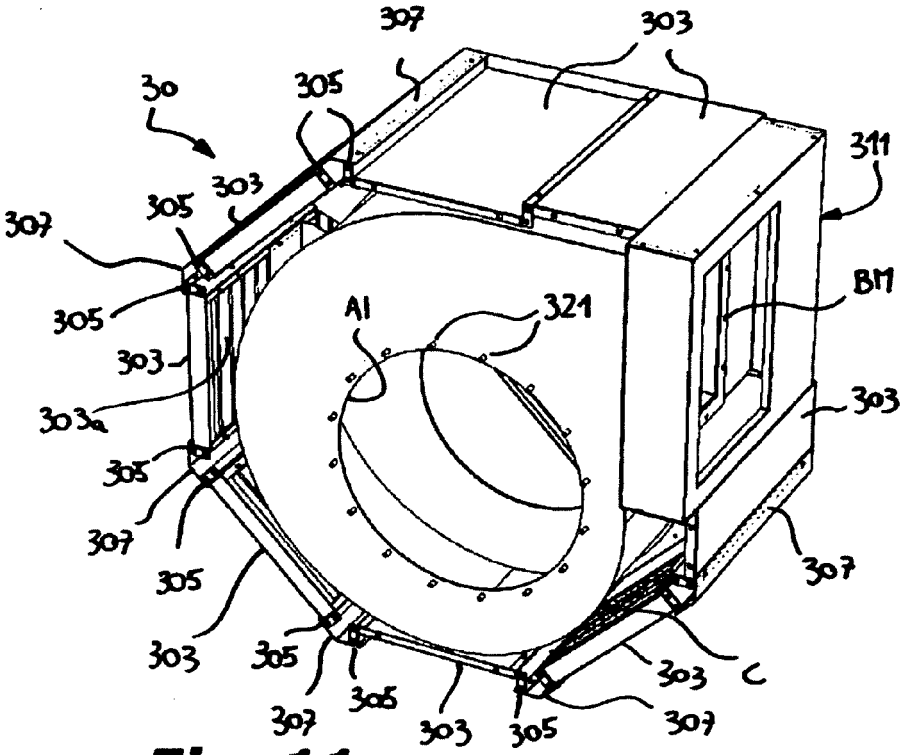
307
303
30
305
311
303
305
307
BM
305
A1
321
303
303a
305
307
305
303
305
307
305
303
305
307
303
C
307

Fig. 11

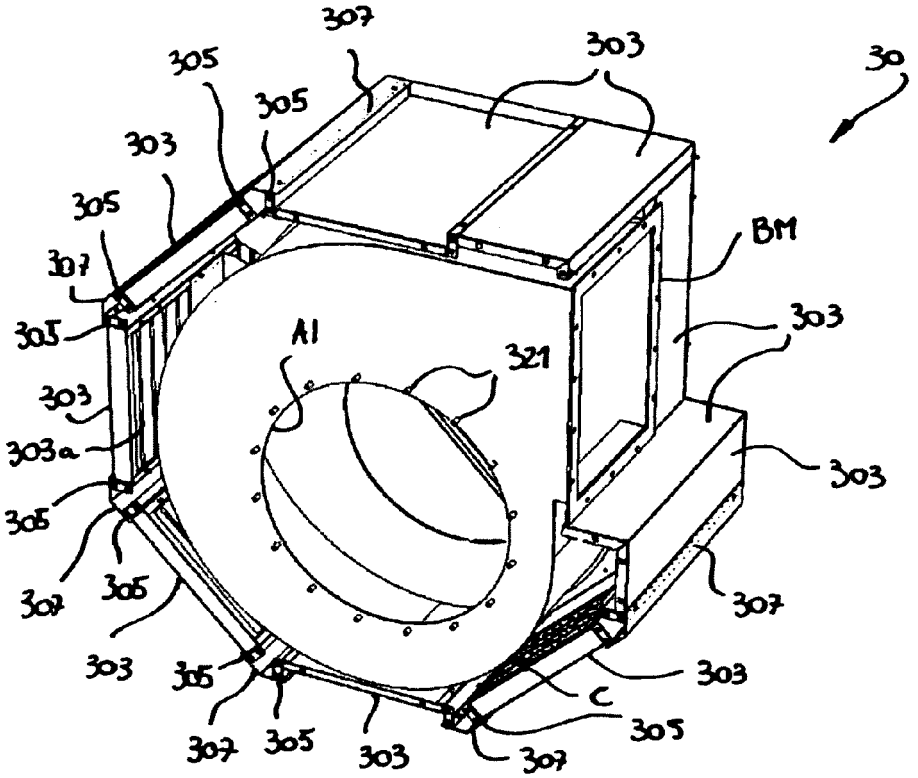
307
303
30
305
305
303
305
BM
307
303
305
A1
321
303
303a
303
305
307
305
303
305
C
303
307
305
307
305
303
307

Fig. 12

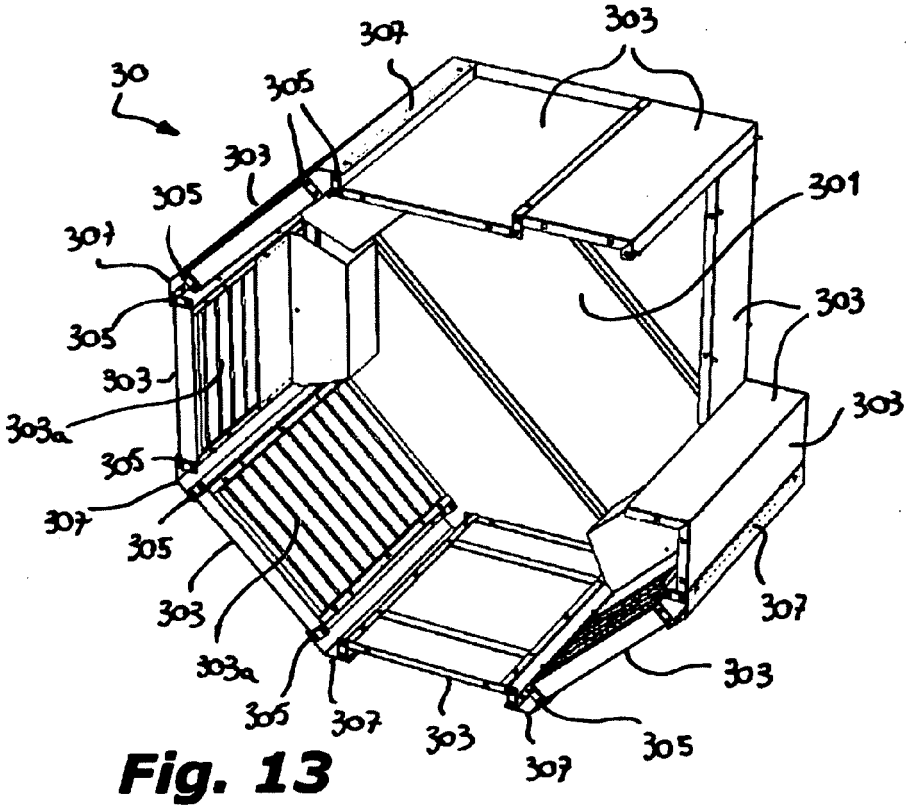
307
303
30
305
303
301
305
307
303
305
303
303a
303
305
307
305
303
303a
305
307
303
307
305

Fig. 13

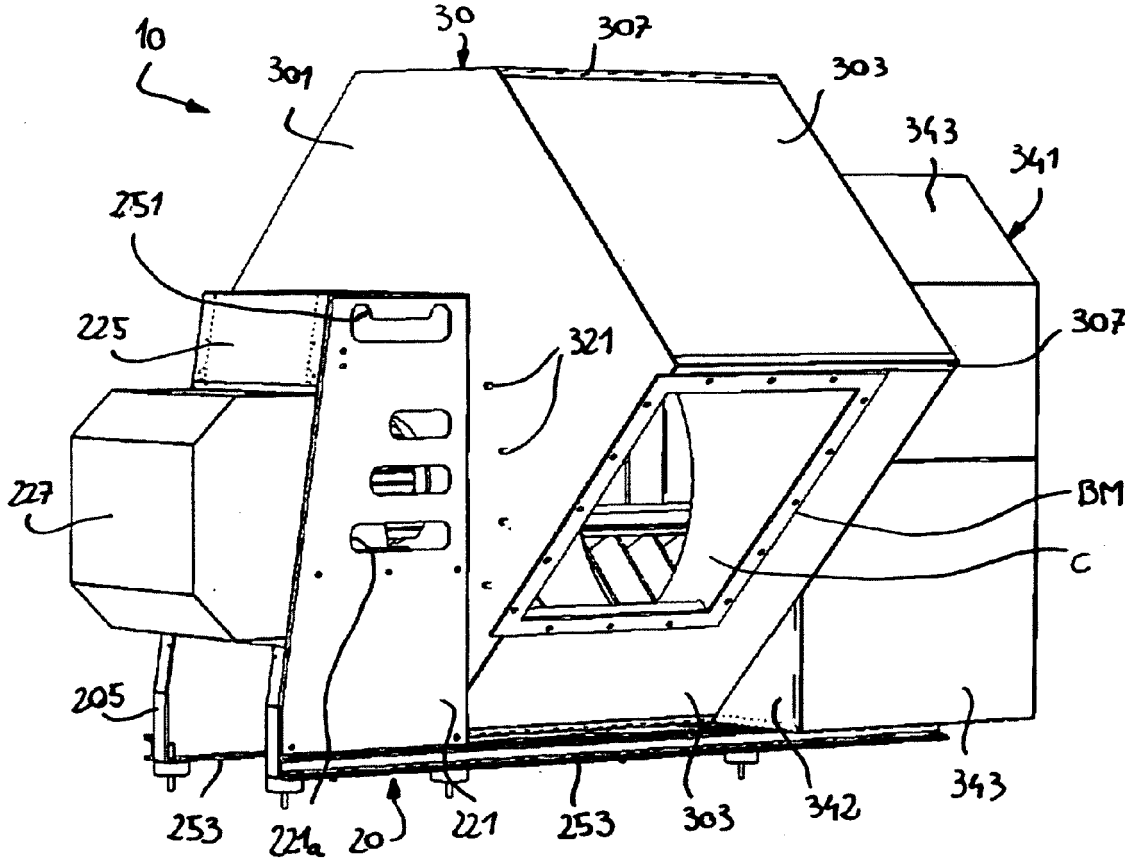
10
30
307
301
303
343
341
251
225
321
307
227
BM
C
205
253
221a
20
221
253
303
342
343

Fig. 14

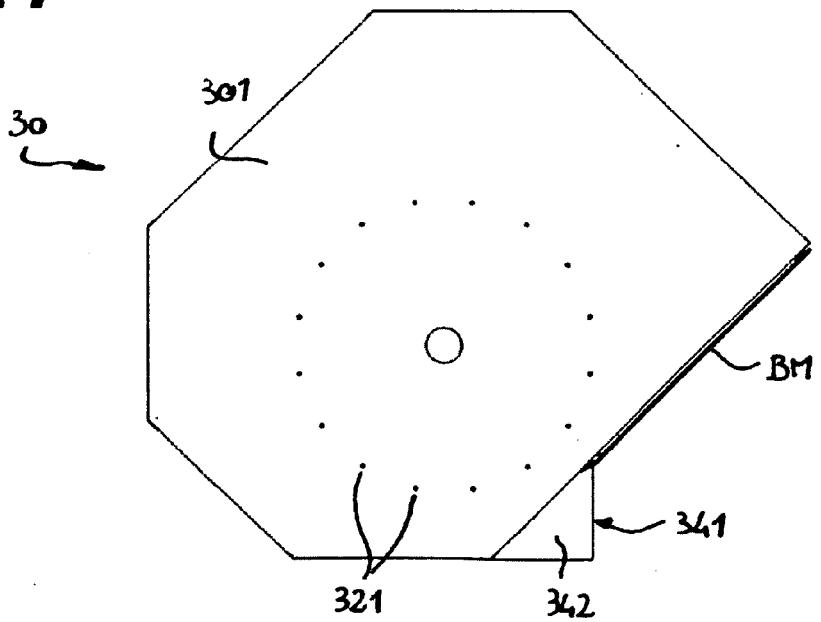
30
301
BM
341
321
342

Fig. 15

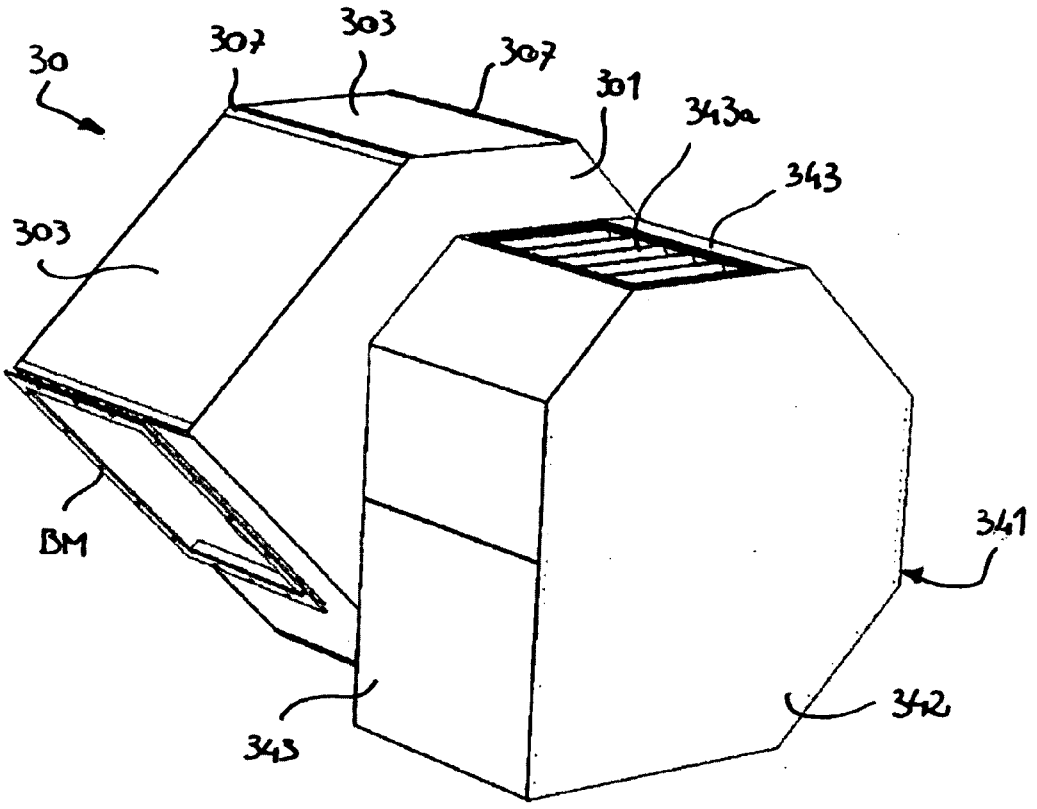
30
307
303
307
301
343a
343
303
BM
341
343
342

Fig. 16

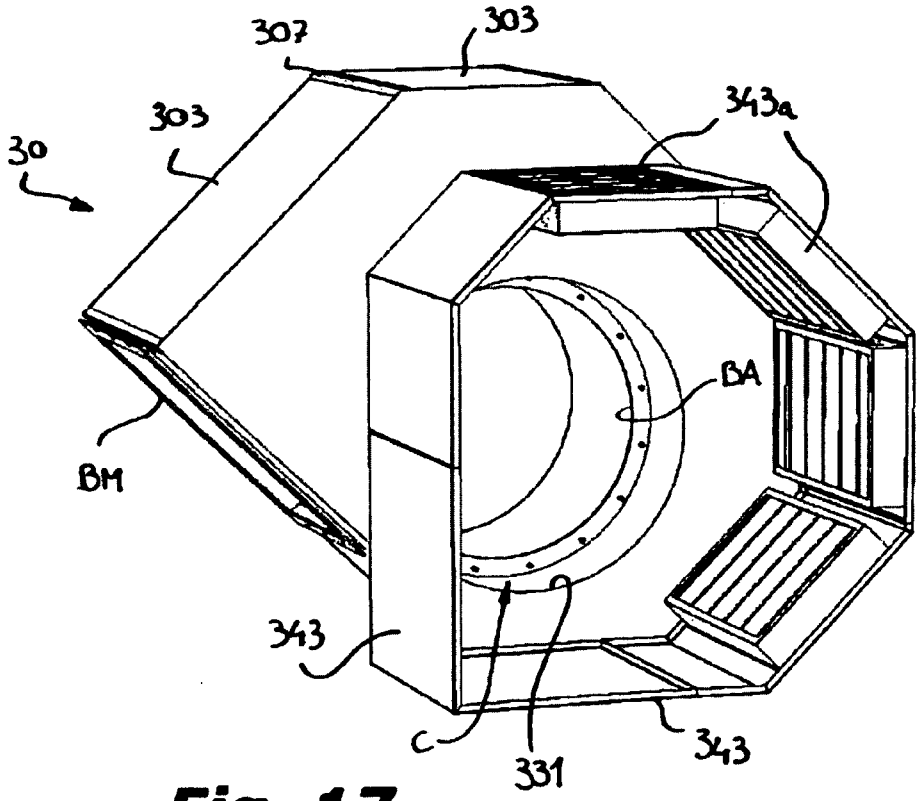
307
303
303
343a
30
BA
BM
343
C
331
343

Fig. 17

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 10 01 5815

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	US 4 279 325 A (CHALLIS LOUIS A) 21 July 1981 (1981-07-21) * column 1, lines 7-9 * * column 4, line 58 - column 7, line 23; figures 1-3 * -----	1-12	INV. F04D29/42 F04D29/62 F04D29/66
A	FR 1 327 918 A (MORTREUX M. A.) 24 May 1963 (1963-05-24) * page 2; figures 1-12 * -----	1-12	
A	GB 741 975 A (MATTHEWS & YATES LTD) 14 December 1955 (1955-12-14) * the whole document * -----	1-12	
A	US 1 163 543 A (ROBERT A. ILG) 7 December 1915 (1915-12-07) * figures 1-10 * -----	1-12	
			TECHNICAL FIELDS SEARCHED (IPC) F04D F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 April 2011	Homan, Peter

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 10 01 5815

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.

19-04-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4279325 A	21-07-1981	DE 2628511 A1	20-01-1977
		FR 2316458 A1	28-01-1977
		GB 1554286 A	17-10-1979
		JP 52006109 A	18-01-1977
		US 4174020 A	13-11-1979
FR 1327918 A	24-05-1963	NONE	
GB 741975 A	14-12-1955	NONE	
US 1163543 A		NONE	

EPO FORM P0459

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