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(54) **Tumble dryer**

(57) A tumble dryer (100) comprises a dryer cabinet, comprising a plastic basement (115) having formed therein passages for a drying air flow; a drum (105) rotatably accommodated within the cabinet; and a plurality of rollers (215) provided within the cabinet for rotatably supporting the drum (105). The rollers (215) are rotatably supported by respective pins (210) provided on the plastic basement (115).

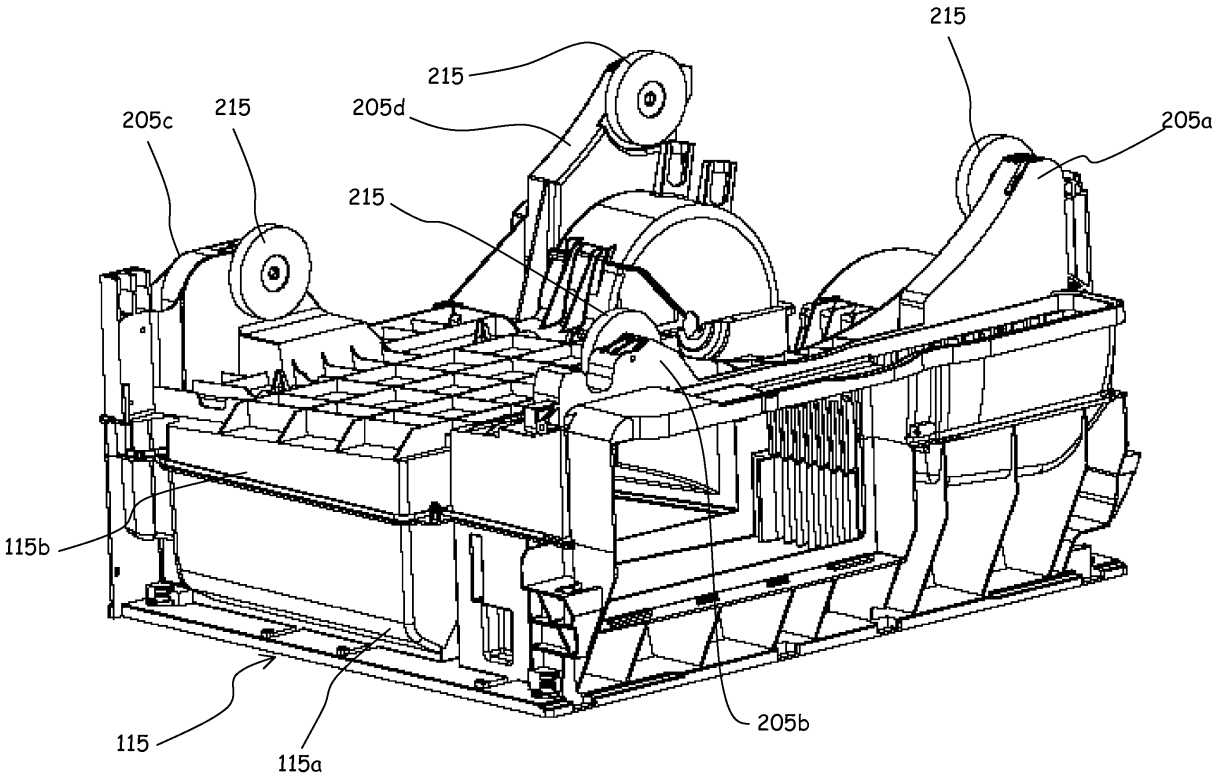

FIG. 3

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Description

Background of the invention

Field of the invention

[0001] The present invention generally relates to clothes and laundry drying machines, particularly to tumble dryers comprising a rotatable drum arranged for causing agitation of the articles to be dried. More specifically, the present invention relates to the aspects of rotatably supporting the dryer drum within a dryer cabinet.

Description of the related art

[0002] Tumble dryers are home appliances adapted to dry clothes, garments, laundry in general by circulating hot, dry air within a tumbler or drum (sometimes also referred to as drying tub) designed to contain the articles to be dried.

[0003] Tumble dryers having the drum formed of a generically cylindrical body open at its front and rear ends, abutting against front and rear bulkheads are known in the art.

[0004] The drum is rotatably mounted within a machine cabinet, and in operation it is made to rotate in order to cause agitation of the articles to be dried, which repeatedly tumble with the drum while being invested by the drying air flow.

[0005] One similar drying machine is described for example In US 2006/0218976; the drying machine drum is installed within the machine cabinet above a plastic base, made of lower and upper base portions formed by injection molding, wherein air passages are formed for the drying air flow.

[0006] In a known type of tumble dryer, also referred to as "condenser dryer", the drying air flow is typically caused to pass through the drum, exiting therefrom from the front access opening, then it passes through a condensing system, where the humid air is at least partially dried, and the dried air flow is caused to invest a heating arrangement, like an electrical resistance, to be warmed; the warmed drying air flow then passes again through the drum, and repeats the cycle.

[0007] The condensing system may be an air-air heat exchanger, exploiting air taken in from the outside. Other known dryers exploit a heat pump to dry the drying air flow; in these dryers, the function of the heating arrangement may be performed by the heat pump itself, and the electrical resistance may thus not be provided for.

[0008] Solutions known in the art for rotatably supporting the drum within the machine cabinet make use of a plurality of rollers.

[0009] For example, in US 2,803,142 solutions using four pulleys are discussed, and an alternative solution using three pulleys is presented; the three pulleys, two of which are located on one side of the center of rotation of the drum, whereas the third pulley is located at the opposite side, are mounted through brackets to a base of the cabinet.

[0010] In some tumble dryers known in the art, such as that described in US 3,816,942, the drum is supported on a generally horizontal axis by a system including a pair of rollers supported on brackets fixed to a rear bulkhead, and by a pair of slide bearings supported by similar brackets fixed to a front bulkhead, the bulkheads being in turn fixed to panels of the cabinet.

[0011] In EP 404252 a drying machine is disclosed wherein the drum rests on four supporting rolls, with axis parallel to the drum axis, which rotate on supports secured to the external structure of the machine and disposed in pairs along two generatrices of the drum in symmetrical position with respect to a vertical plane crossing the drum rotation axis. Four upper rolls keep the drum in position on the supporting rolls.

[0012] In US 7,140,123 a drying apparatus is described in which the drying tub is rotatably supported by the apparatus housing. The tub is rotatably supported by front and rear brackets mounted to the front and rear walls of the housing, respectively, by means of respective annular support members protruding therefrom. Four rollers are provided, arranged in pairs at the front and rear brackets to elastically support the drying tub when an excessive amount of clothes is put thereinto.

[0013] According to other known solutions, the drum is rotatably supported by two rollers fixed to the front part of the appliance, and a bearing pin located on the back panel of the appliance.

Summary of the invention

[0014] The Applicant has observed that the prior-art solutions for rotatably supporting the drum are not completely satisfactory.

[0015] In particular, those solutions in which the elements (rollers, baring pin) that support the drum are mounted to parts of the machine cabinet, like for example front or rear panels thereof, are believed to be disadvantageous because in order to allow the rotation of the drum the machine cabinet needs to be closed. The Applicant believes that having the possibility to allow the rotation of the drum before closing the machine cabinet is particularly useful for performing intermediate functional tests during the assembly of the machine.

[0016] Additionally, with the drum supporting elements mounted to parts of the machine cabinet, undesired vibrations are transmitted to the cabinet by the rotation of the drum.

[0017] In view of the state of the art outlined in the foregoing, the Applicant has tackled the problem of how to devise an alternative solution for rotatably supporting the drum within the machine cabinet.

[0018] According to an aspect of the present invention, a tumble dryer is provided comprising:

- a dryer cabinet, comprising a plastic basement hav-

ing formed therein passages for a drying air flow;

- a drum rotatably accommodated within said cabinet;
- a plurality of rollers provided within said cabinet for rotatably supporting the drum;

characterized in that
said rollers are rotatably supported by respective bushings, pins that are provided on said plastic basement.

[0019] Said plastic basement may be formed by injection moulding.

[0020] The plastic basement may comprise a lower basement portion and an upper basement portion attached to the lower basement portion. Thus facilitates the manufacturing of the plastic basement.

[0021] The pins are preferably provided on the upper basement portion.

[0022] Each of said pins may protrude from a respective bracket formed in the plastic basement.

[0023] One or more of said brackets are formed in a single piece construction with the plastic basement, particularly with the upper basement portion.

[0024] The pins are preferably formed in a single piece construction with said plastic basement, in particular with the respective bracket. This reduces the number of components.

[0025] The rollers may be mounted on the respective pins by means of screws or by snap-fit engagement.

[0026] The plastic basement may be adapted to accommodate a condenser or a heat pump.

[0027] Said plastic basement is preferably adapted to the mounting thereon of panels of the machine cabinet, particularly bulkheads for the drum.

[0028] Thus, according to the present invention, the plastic basement that is used to guide the drying air flow is also exploited as the support element of the rollers that in turn rotatably support the drum.

[0029] An advantage of the present invention is that it is possible to perform intermediate functional tests during the drier manufacturing process, because for the rotation of the drum it is not necessary to fully assemble the drier; in particular, the panels of the machine cabinet need not be mounted. The cabinet panels can be assembled essentially at the end of the manufacturing, with less risks of scraping or other aesthetical defects.

[0030] The machine assembly is also made easier and faster, and service or maintenance of the drier are also facilitated.

[0031] Another advantage is that since the support of the drum is entrusted to the plastic basement, vibrations deriving from the rotation of the drum are effectively damp.

[0032] By having the roller pins formed integrally, in a single piece with the plastic basement, the number of dryer components is reduced, and this is advantageous in terms of manufacturing costs, inventory management, assembly operations.

Brief description of the drawings

[0033] These and other features and advantages of the present invention will be made apparent by the following detailed description of some embodiments thereof, provided merely by way of non-limitative examples, made in conjunction with the attached drawings, wherein:

Figure 1 is a perspective and partially exploded view of a tumble dryer according to an embodiment of the present invention;

Figure 2 is a perspective view of a plastic basement embedding drying air ducts which is used to rotatably support the drum, in an embodiment of the present invention;

Figure 3 is a perspective view of the plastic basement of Figure 2, with applied rollers for rotatably supporting the drum;

Figure 4 is a schematic top view of the plastic basement with the applied rollers;

Figure 5 is a schematic view in elevation of the basement with the drum; and

Figures 6 and **7** are schematic perspective views of the basement mounted to front and rear bulkheads;

Detailed description of embodiments of the invention

[0034] With reference to the drawings, a tumble dryer according to an embodiment of the present invention is depicted in **Figure 1** in perspective and partially exploded view. The tumble drier, generally denoted as **100**, comprises a drum **105** for the loading of the articles to be dried, such as clothes, garments, linen, and similar articles.

[0035] The drum **105** is a generically cylindrical body, for example made of stainless steel, open at the two ends **105a** and **105b** thereof (a front end **105a** and a rear end **105b**). Proximate to each of the ends **105a** and **105b**, a recessed circumferential groove **110a** and **110b** is formed in the exterior surface of the drum **105**; the two grooves, as will be clear from the following, form abutment surfaces for supporting rollers rotatably supporting the drum **105.**

[0036] The drum **105** is rotatably supported on a basement **115**, by means of rollers which are mounted thereon, as will be described in detail later on.

[0037] The basement **105** forms the base of a machine cabinet which encloses the drum **105** as well as other machine components like for example a motor for rotating the drum **105**, *e.g.* by means of a belt transmission (not shown in the drawing); the cabinet further comprises a front panel **120**, with a drum access opening **120** closable by an associated door (not shown in the drawing), an

essentially close rear panel **130**, and two side panels **135** (only one of which is shown in the drawing). A top panel (also not shown in the drawing) closes the machine cabinet from above. The front and rear panels **120** and **130** form respectively front and rear bulkheads, against which the rim of the front and rear drum ends **105a** and **105b** abuts (gaskets or seals may be provided along the rims of the drum ends **105a** and **105b**, and/or on the inner side of the front and rear panels 120 and **130**, in corresponding positions).

[0038] The basement **115**, shown *per-se* and in greater detail in **Figures 2** and **3**, is formed by a lower basement portion **115a** and an upper basement portion **115b**, mounted the latter onto the former; the lower and upper basement portions **115a** and **115b** are in plastic material, and they may for example be formed by injection moulding. The lower and upper basement portions **115a** and **115b** are attached so as to make one integral to the other by means of welding or gluing along their matching edges. In alternative embodiments of the invention, the basement **105** may be formed directly in a single piece construction.

[0039] The lower and upper basement portions **115a** and **115b** are shaped in such a way that, when they are assembled, they define a sort of shell and form therebetween passages, ducts for a flow of drying air which, by means of suitable means like fans (accommodated within the machine cabinet), is caused to repeatedly circulate through the drum **105**, for drying the articles contained therein. In particular, the basement **115** is structured to be able to receive an air flow exiting the drum from the front end **105a** and which is conveyed by an air conveyor (not shown) provided on the inner side of the front panel **120** (the plastic basement may also be adapted to the intake of air from the exterior environment), and to deliver the air flow to a heater, like an electrical resistance, arranged at the rear of the machine cabinet, for example supported by the rear panel **130**. Within the basement **115**, a condenser, for example an air-air heat exchanger or an evaporator of a heat pump (not shown in the drawings) is accommodated, for drying the humid air flow that comes from the drum. In case a heat pump is used, the provision of the electrical resistance may be dispensed for, its function being accomplished by the heat pump itself.

[0040] As clearly visible in **Figures 2** and **3**, the plastic basement **115**, particularly, in the exemplary embodiment herein considered, the upper basement portion **115b**, is shaped so as to define four brackets **205a**, **205b**, **205c** and **205d**, located substantially at the four corners of the upper basement portion **115a**. The brackets **205a** and **205b** are positioned at the front of the basement **115**, which in use is located in correspondence of the front panel **120**, whereas the brackets **205a** and **205d** are positioned at the rear of the basement **115**, in use located in correspondence of the rear panel **130**. In particular, the brackets **205a** and **205d**, which in use stand on the right side of the machine cabinet (looking it from the front) are higher than the bracket **205c**, located on the left-rear corner of the basement **115**, which in turn is higher than the bracket **205b**, located on the left-front corner of the basement **115**. The four brackets **205a**, **205b**, **205c** and **205d** are formed with a curved profile to define a sort of cradle for the drum **105**. Although in the exemplary embodiment herein presented the brackets **205a**, **205b**, **205c** and **205d** are in a single piece construction with the upper basement portion **115b**, nothing prevents that, in alternative invention embodiments, one or more of the brackets is manufactured separately from the plastic basement and mounted thereto by means of any suitable means.

[0041] Each of the brackets **205a**, **205b**, **205c** and **205d** supports, essentially at the top thereof, a respective bush or pin **210**, with axis lying in a plane parallel to a base plane of the basement **115** (*i.e.*, in use, the pins extend horizontally); the pins **210** of the front brackets **205a** and **205b** protrude towards the rear of the machine cabinet, whereas the pins **210** of the rear brackets **205c** and **205d** protrude towards the front of the machine cabinet. The pins may be formed integral to, in a single piece construction with the upper basement portion **115b**, *i.e.* they may be obtained by means of the moulding process that produces the upper basement portion **115b**, or they may be realized as separate pieces, that are then mounted to the brackets **205a**, **205b**, **205c** and **205d**, for example by means of screws or welding or other suitable means.

[0042] As shown in **Figure 3**, each pin **210** rotatably supports a respective roller **215**. The rollers **215** may be coupled to the pins **210** my means of screws, or by snap-fit engagement. The rollers **215** may be in plastic material, and they may preferably be in a low-friction material adapted to absorb vibrations, or at least include a band in such a material.

[0043] As visible in **Figures 1** and **5**, the drum **105** rotatably lies on the four rollers **215**; in particular, the two rollers **215** located at the front of the machine engage the front circumferential groove **110a** formed in the exterior surface of the drum **105**, whereas the two rollers **215** located at the rear of the machine engage the rear circumferential groove **110b**. The two grooves **110a** and **110b** form respective guides for the rollers **215**.

[0044] Advantageously, the front and rear panels **120** and **130** are mounted to and supported by the basement **115**, as depicted in **Figures 6** and **7**, for example by means of screws or similar means. In particular, the brackets **205a**, **205b**, **205c** and **205d** may be exploited for mounting the panels to the plastic basement.

[0045] From the above, it can be appreciated that, according to the present invention, the plastic basement that is used to guide the drying air flow is exploited as the support element of the rollers that in turn rotatably support the drum.

[0046] An advantage of the present invention is that it is possible to perform intermediate functional tests during the drier manufacturing process, because for the rotation

of the drum it is not necessary to fully assemble the drier; in particular, the panels of the machine cabinet need not be mounted. The cabinet panels can be assembled essentially at the end of the manufacturing, with less risks of scraping or other aesthetical defects.

[0047] The machine assembly are also made easier and faster, and service or maintenance of the drier are also facilitated.

[0048] Another advantage is that since the support of the drum is entrusted to the plastic basement, vibrations deriving from the rotation of the drum are effectively damp.

[0049] By having the roller pins formed integrally, in a single piece with the plastic basement, the number of dryer components is reduced, and this is advantageous in terms of manufacturing costs, inventory management, assembly operations.

[0050] The present invention has been here described by presenting some possible embodiments thereof, however those skilled in the art will recognize that several alternatives to the described embodiments are possible, as well as different embodiments.

[0051] For example, a different number of rollers may be provided for supporting the drum; for instance, one of the two front rollers, or one of the two rear rollers may be omitted (in this case, the remaining roller is preferably positioned at the middle of the basement **115**).

Claims

1. A tumble dryer comprising:

- a dryer cabinet, comprising a plastic basement (**115**) having formed therein passages for a drying air flow;
- a drum (**105**) rotatably accommodated within said cabinet;
- a plurality of rollers (**215**) provided within said cabinet for rotatably supporting the drum;

characterized in that
said rollers are rotatably supported by respective pins (**210**) provided on said plastic basement.

2. The tumble dryer of claim 1, wherein said plastic basement is formed by injection moulding.

3. The tumble dryer of claim 2, wherein said plastic basement comprises a lower basement portion (**115a**) and an upper basement portion (**115b**) attached to the lower basement portion.

4. The tumble dryer of claim 3, wherein the pins are provided on said upper basement portion.

5. The tumble dryer of any one of the preceding claims, wherein each of said pins protrude from a respective bracket (**205a-d**) formed in the plastic basement.

6. The tumble dryer of claim 5, wherein one or more of said brackets are formed in a single piece construction with the plastic basement.

7. The tumble dryer of any one of the preceding claims, wherein said pins are formed in a single piece construction with said plastic basement, in particular with the respective bracket.

8. The tumble dryer according to any one of the preceding claims, wherein said rollers are mounted on the respective pins by means of screws or by snap-fit engagement.

9. The tumble dryer of any one of the preceding claims, wherein said plastic basement is adapted to accommodate a condenser or a heat pump.

10. The tumble drier of any one of the preceding claims, wherein said cabinet comprises panels (120,130), and said plastic basement is adapted to the mounting thereon of said panels.

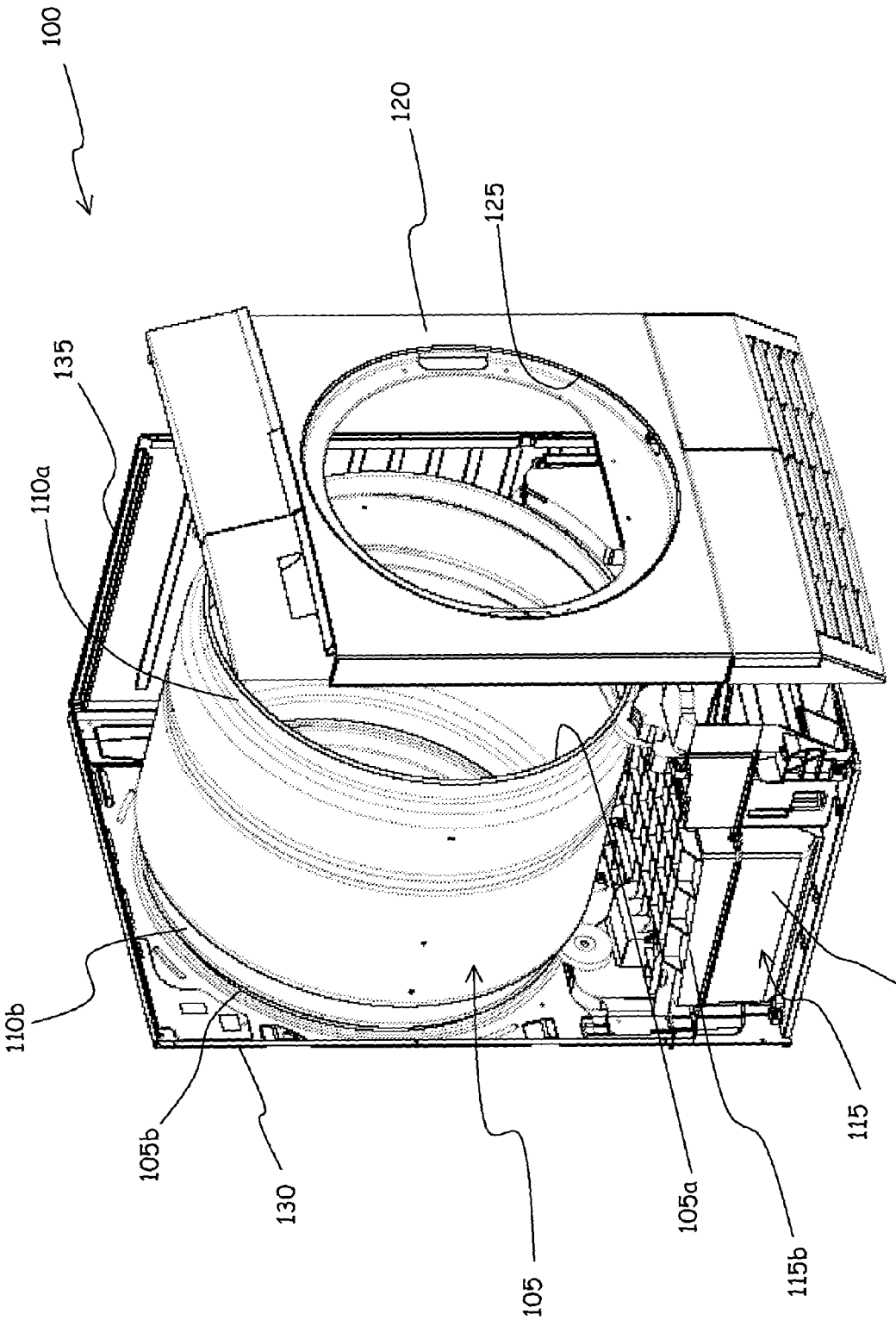

FIG. 1

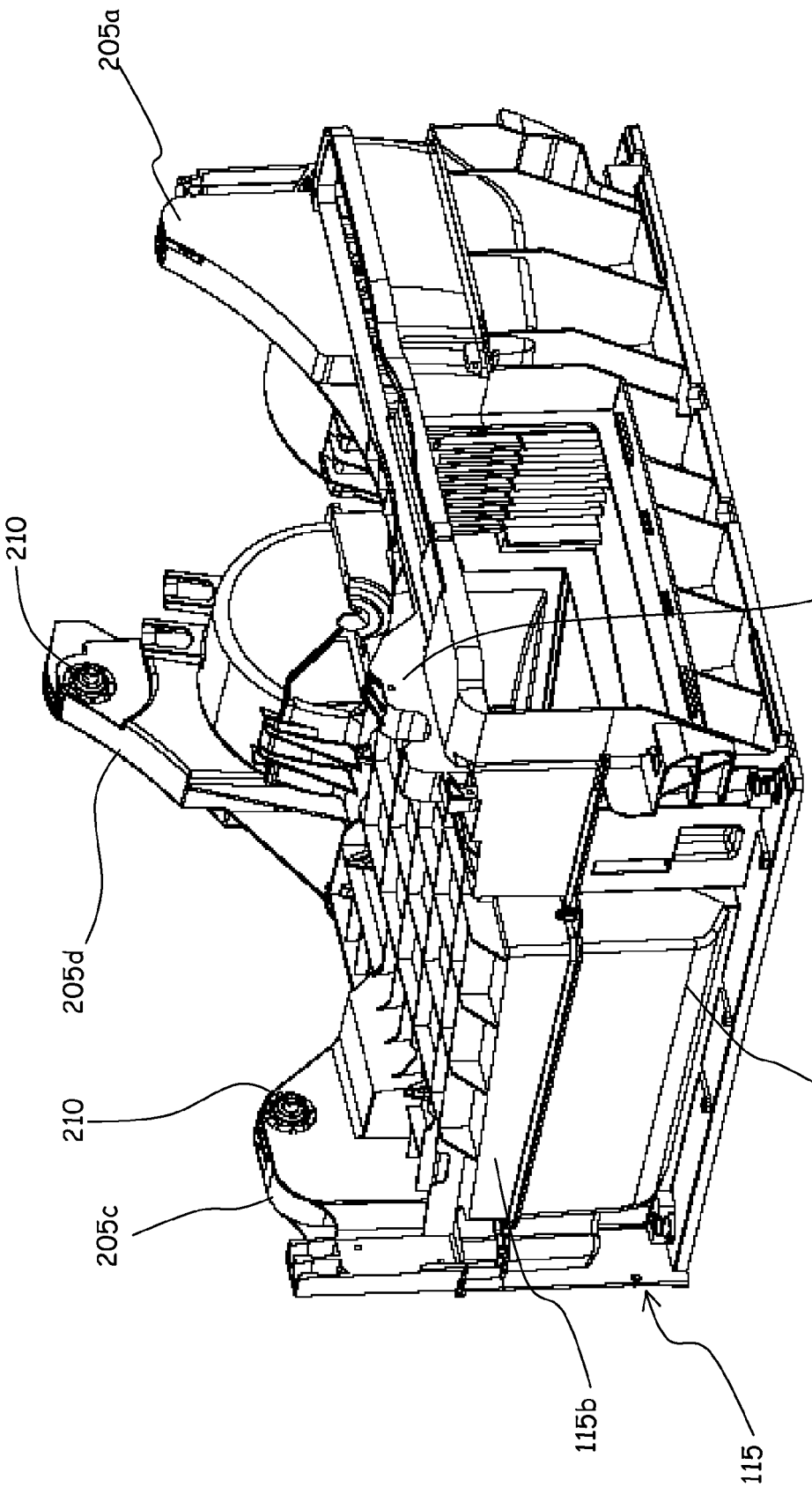

FIG. 2

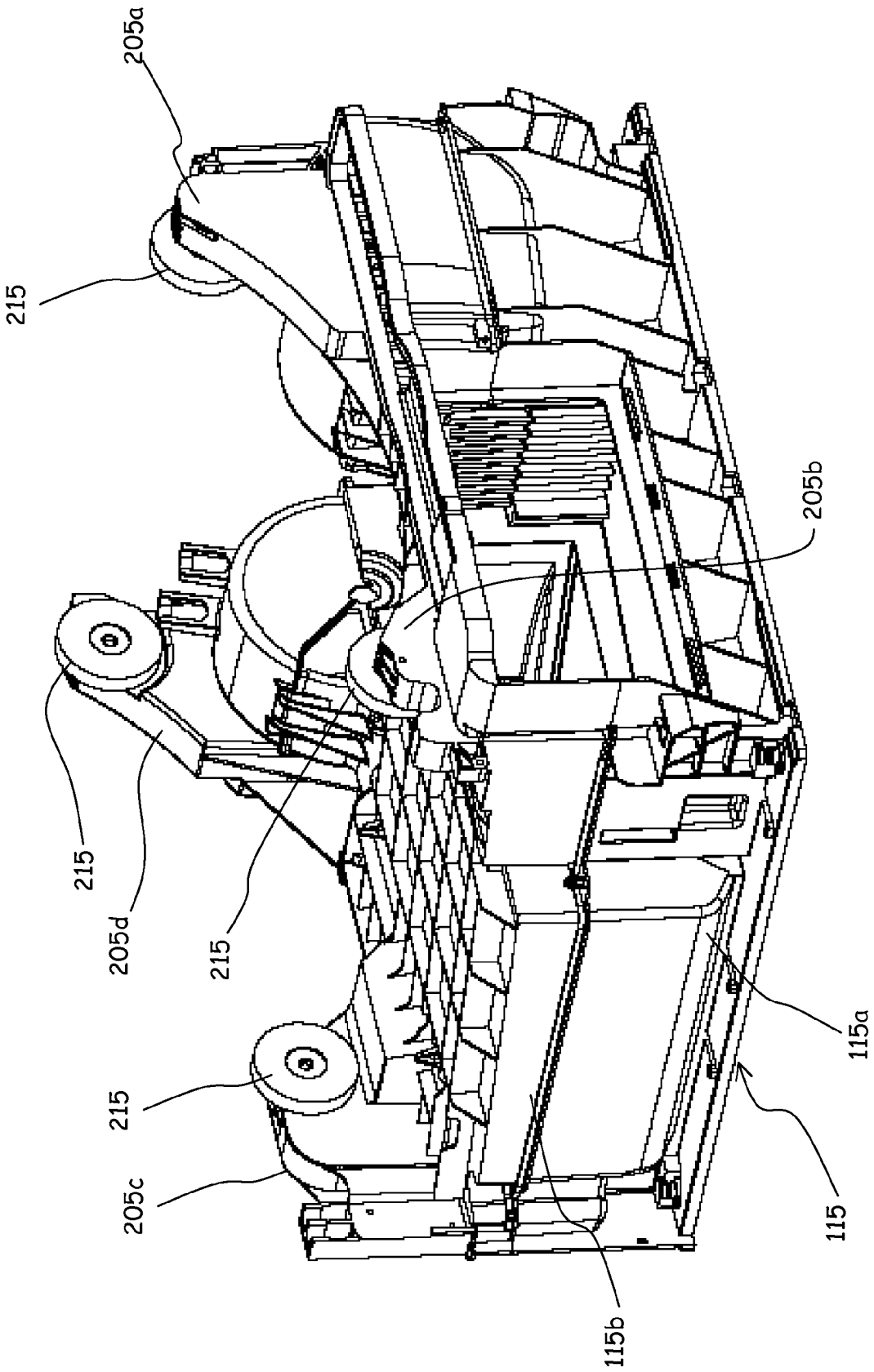

FIG. 3

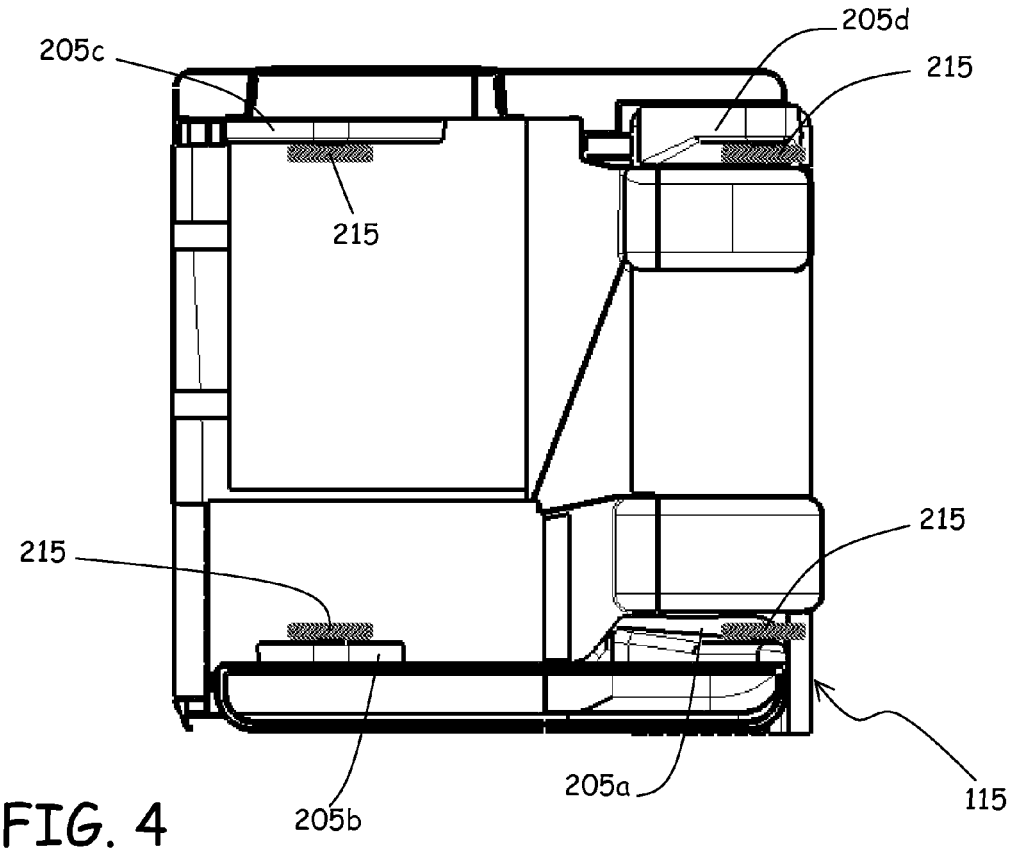

FIG. 4

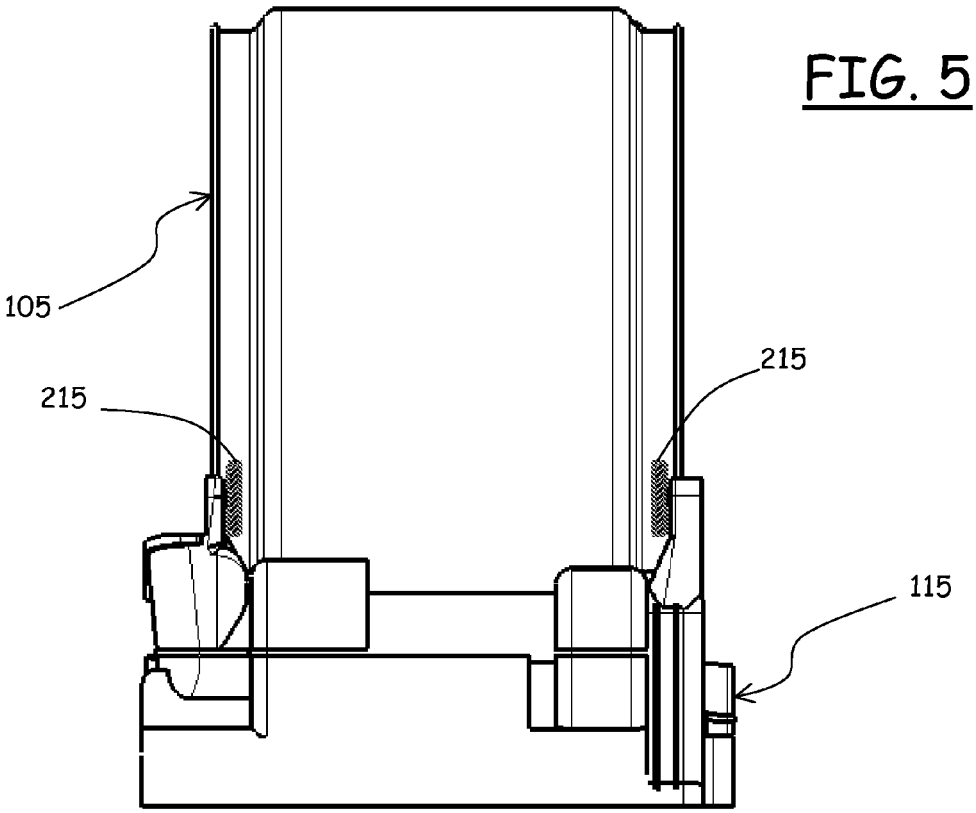

FIG. 5

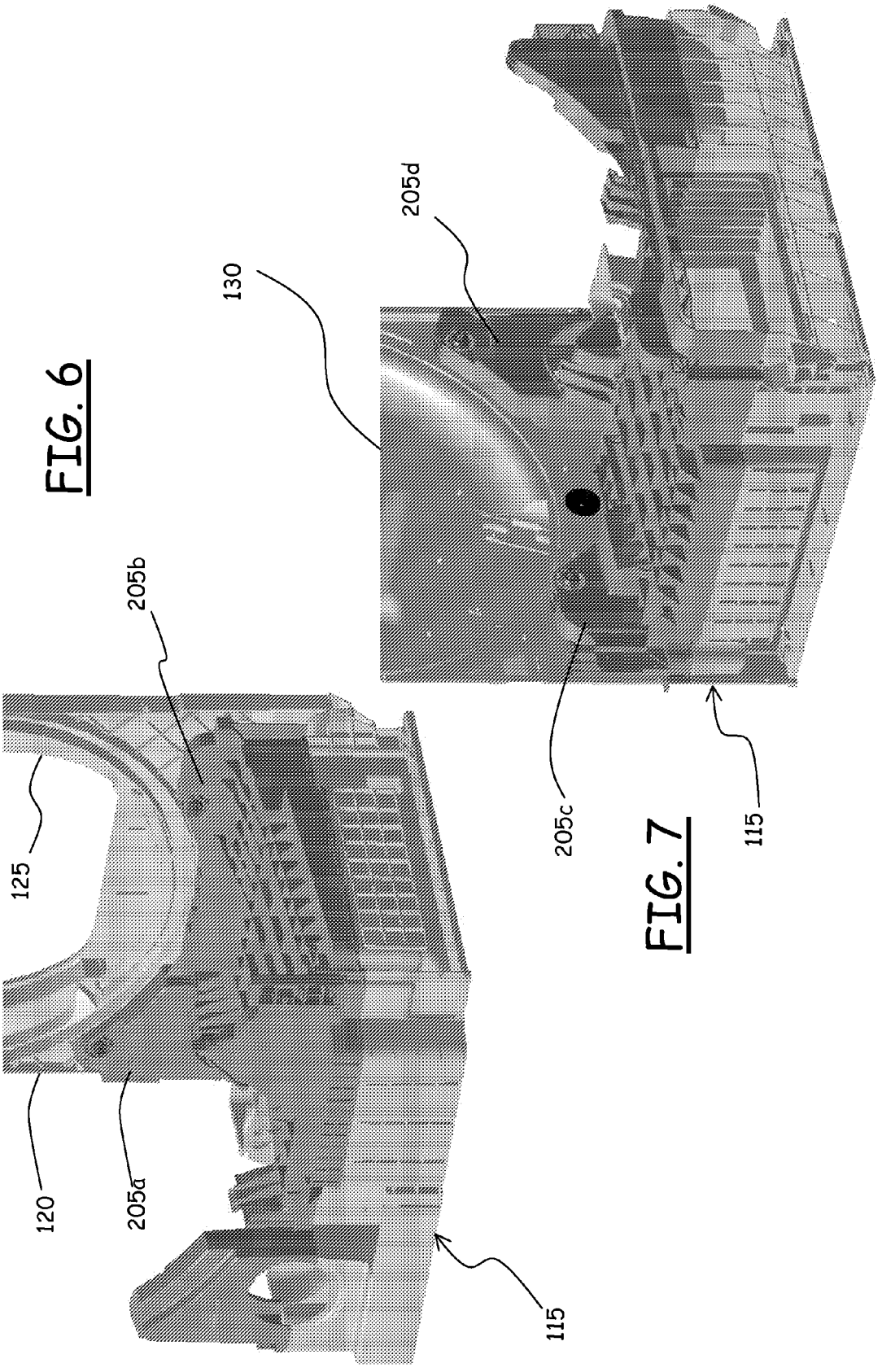

FIG. 6

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 08 10 2753

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	EP 1 541 742 A (MIELE & CIE [DE]) 15 June 2005 (2005-06-15) * paragraphs [0001], [0002], [0009], [0010]; claims; figures * -----	1,2 3-10	INV. D06F58/06
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A	US 4 754 556 A (CARR KEITH E [US]) 5 July 1988 (1988-07-05) * the whole document * -----	1-10	
			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	23 October 2008	Clivio, Eugenio

CATEGORY OF CITED DOCUMENTS

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

REFERENCES CITED IN THE DESCRIPTION

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