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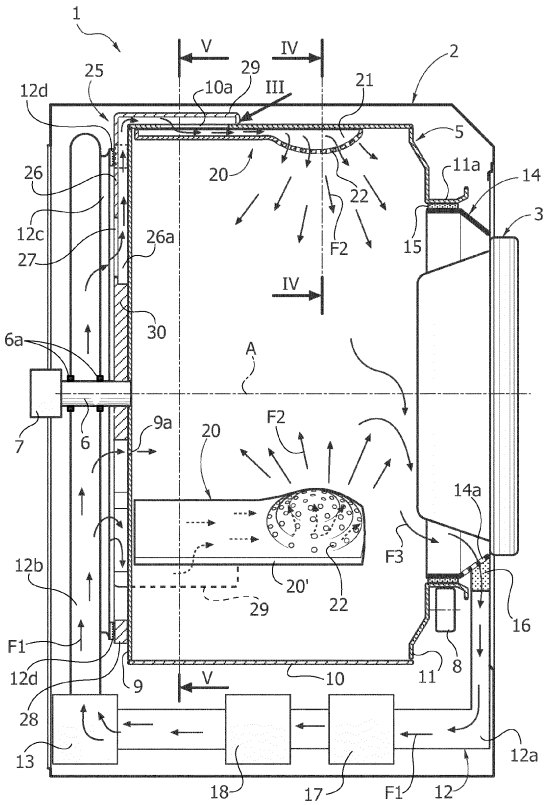
(54) **Laundry-drying machine**

(57) A laundry-drying machine comprises a drum (5) rotatable about a substantially horizontal axis (A) and having an inlet for the air (10a) and an outlet for the air (14, 14a). The drum (5) is designed to be traversed by drying air, forced by means of a fan (13) and heated via heating means (18) before being introduced into the drum (5) through the aforesaid inlet (10a). The fan (13) and the heating means (18) are operatively associated to an air-conveying duct (12) having a delivery section (12b, 12c), which is in fluid communication with the aforesaid inlet (10a), and a suction section (12a), which is in fluid communication with said outlet (14, 14a). Provided inside the drum (5) is at least one laundry-agitation member (20), having a cavity (21) configured for receiving at least part of the hot air introduced into the drum (5), and one or more passages (22) for diffusing the hot air from the internal cavity (21) towards a central area of the drum (5), where the aforesaid inlet for the air comprises at least one passageway (10a) in a position corresponding to the agitation member (20) and in fluid communication with the corresponding cavity (21). Mounted on the outside of the drum (5) is a directing device (25), fixed in rotation with respect to the structure of the drum (5), which is operatively coupled to the delivery section (12b, 12c) of the duct (12) and is configured for conveying at least part of the air coming from the duct (12) to the passageway (10a), and hence the cavity (21) of the corresponding agitation member (20).

FIG. 2



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Description

Field of the invention

[0001] The present invention relates to a laundry-drying machine, of the type indicated in the preamble of Claim 1.

Prior art

[0002] Laundry-drying machines typically comprise a substantially parallelepipedal cabinet, housed in which in a rotatable way is a drum, driven by an electric motor so as to turn about a substantially horizontal axis. The front of the drum has an opening that is accessible via a door hinged to the front wall of the cabinet in order to enable loading and unloading of the laundry to be dried. In some solutions, the access door is hinged to the upper part of the cabinet and the cylindrical wall of the drum is in turn provided with a door. Usually provided inside the drum are laundry-agitation members or paddles, associated to the peripheral wall of the drum itself.

[0003] The machine has a system for conveying a flow of drying air, including at least one duct operatively associated to which are a fan and air-heating means. The fan is operative for forcing the air into the drum, via a delivery branch of the system, after the air itself has been heated by the heating means, for example comprising an electrical resistance. The hot air traverses the inside of the drum and is saturated with the humidity yielded by the laundry articles contained therein, said articles being thus progressively dried. In evacuation machines, the system for conveying the air is provided in such a way that the fan sucks fresh air into the cabinet of the machine and/or from the environment where the laundry dryer is installed and then forces the heated air into the drum; the moist air leaving the drum is then expelled from the appliance. In condensation machines, the system for conveying the air is substantially of a closed-circuit type: in this case, the moist air leaving the drum passes in a suction branch of the circuit, upstream of the fan, along which there is a condenser designed to subtract humidity from the air, said dehumidified air being then again heated and re-introduced into the drum via the delivery branch of the circuit.

[0004] In dryers according to the prior art, the hot drying air is introduced into the drum substantially axially, through its rear wall, purposely provided with an inlet constituted by an array of holes. The duct that conveys the heated air downstream of the fan is shaped in such a way that at least its terminal portion forms a chamber, within which the air diffuses and then penetrates into the drum through the aforesaid array of holes. This chamber has in general an at least approximately circular profile so as to circumscribe a region of diffusion of the air that substantially faces the array of holes.

[0005] The moist air exits from the drum through its front wall, which is provided with a central outlet, used - in the case of front-loading machines - also for loading and unloading the laundry. Along the circuit, usually downstream of the outlet of the drum, a filter is provided accessible to the user of the machine, having the function of withholding the fluff released by the garments during treatment and entrained by the forced flow of air.

[0006] In order to improve the quality of the drying treatment, it has been proposed to exploit the paddles inside the drum in order to diffuse the drying air on the laundry also in a radial direction with respect to the axis of rotation of the drum. A solution of this type is known from DE-A-19623959, on which the preamble of Claim 1 is based.

[0007] In said solution, at least one paddle has an internal cavity, delimited at the rear by the rear wall of the drum. The array of holes of the rear wall of the drum has some dedicated holes, which are set in a position corresponding to the cavity of the paddle: in this way, during rotation of the drum, the dedicated holes cyclically face the diffusion chamber that constitutes the terminal part of the air duct. A part of the flow of drying air can thus penetrate into the cavity of the paddle, which is provided with outlets that make it possible to orient the drying air towards the central area of the drum. The remaining part of the flow of drying air penetrates, instead, axially into the drum, through the other holes of the array provided in the end wall.

Summary of the invention

[0008] From practical tests, the Applicant has ascertained that the solution according to the prior document cited presents a low efficiency. The object of the present invention is consequently to provide a laundry-drying machine of the type indicated at the start having a circuit for conveying the drying air that will present an enhanced efficiency, and will be simple to produce, inexpensive, and reliable.

[0009] According to the present invention, said object is achieved by a laundry-drying machine having the characteristics forming the subject of the attached claims. The attached claims form an integral part of the technical teaching provided herein in relation to the invention.

[0010] In accordance with a first embodiment of the invention, there is provided a laundry-drying machine, comprising a drum rotatable about a substantially horizontal axis and having a rear wall, a front wall and a substantially cylindrical peripheral wall, which extends between the front and rear walls, the drum having at least one inlet for the air and at least one outlet for the air, the machine further comprising a fan and air-heating means, wherein the drum is designed to be traversed by hot air, forced by means of the fan and heated via the heating means before being introduced into the drum through said at least one inlet, the fan and the heating means being operatively associated to an air-conveying duct having a delivery section, which is in fluid communication with said at least one inlet, and a suction section, which is in fluid communication with said at least one outlet,

wherein inside the drum at least one laundry-agitation member is provided, associated to the cylindrical wall, the at least one agitation member having a cavity, configured for receiving at least part of the hot air introduced into the drum, and one or more passages for diffusing the hot air from the internal cavity towards a central area of the drum, wherein said at least one inlet for the air comprises at least one passageway in a position corresponding to the at least one agitation member and in fluid communication with the cavity thereof.

[0011] The machine according to the above said first embodiment of the invention is **characterized in that** outside the drum a directing device is mounted, connected in rotation to the structure of the drum, which is operatively coupled to the delivery section of the duct and is configured for directing at least part of the air coming from the duct to said at least one passageway, and hence to the cavity of the corresponding agitation member.

[0012] Preferably, the delivery section of the duct comprises a stationary end chamber, the directing device has at least one first body portion that is operatively interposed between the end chamber and the rear wall of the drum, and the at least one first body portion has at least one inlet opening for hot air, which faces inside the end chamber.

[0013] The at least one first body portion is preferably generally parallel to the rear wall of the drum to define a respective stretch of radial path for air.

[0014] In one embodiment, the at least one passageway comprises an opening in the peripheral wall of the drum.

[0015] Preferably, the directing device has at least one second body portion substantially parallel to the peripheral wall of the drum, to define a corresponding stretch of axial path for the hot air, an area of the peripheral wall of the drum in which the passageway is located being interposed between the second body portion and the corresponding agitation member.

[0016] The at least one first body portion has preferably a respective cavity for passage of the hot air. Preferably, the at least one second body portion has a respective cavity for passage of the hot air, which is in fluid communication with the cavity of the first body portion.

[0017] In one embodiment, the end chamber has a peripheral wall having a front edge and the directing device has a surface bearing on which said front edge abuts with interposition of sliding seal means.

[0018] The drum has preferably a plurality of agitation members, the directing device has a plurality of first body portions and the first body portions extend radially with respect to said axis. Preferably, the first body portions are connected together by arch-shaped walls, the first body portions and the arch-shaped walls defining the above said surface.

[0019] In one embodiment, the directing device has a plurality of second body portions, between each second body portion and a corresponding agitation member there being interposed an area of the peripheral wall of the drum in which a respective passageway is located.

[0020] The at least one passageway preferably comprises an opening in the rear wall of the drum, an area of the rear wall of the drum in which the passageway is located being interposed between the first body portion and the corresponding agitation member.

[0021] The at least one first body portion and/or the at least one second body portion has preferably an open box structure, to delimit with the rear wall or the peripheral wall of the drum, respectively, a corresponding stretch of path for the hot air.

[0022] The at least one inlet for the air comprises preferably at least one further passageway for the hot air, which includes one or one or more respective through openings in the rear wall of the drum. Preferably, the directing device defines, between the delivery section of the duct and the rear wall of the drum at least one sub-chamber, said one or more through openings of said further passageway being in a position corresponding to the at least one sub-chamber.

[0023] In accordance with a second embodiment of the invention, there is provided a laundry-drying machine, comprising a drum rotatable about a substantially horizontal axis and having a rear wall, a front wall, and a substantially cylindrical peripheral wall, which extends between the front and rear walls, the rear wall having an inlet for the air and the front wall having an outlet for the air, the machine further comprising a fan and air-heating means,

wherein the drum is designed to be traversed by hot air, forced by the fan and heated by the heating means before being introduced into the drum at said inlet, the fan and the heating means being operatively associated to an air-conveying duct having a delivery section, which is in fluid communication with said inlet, and a suction section, which is in fluid communication with said outlet,

wherein inside the drum at least one laundry-agitation member is provided, which is associated to the peripheral wall, the at least one agitation member having a cavity, configured for receiving at least part of the hot air introduced into the drum, and one or more passages for diffusing the hot air from the cavity towards a central area of the drum.

[0024] The machine according to the above said second embodiment of the invention is **characterized in that** inside the drum a baffle device is mounted, configured for directing in a radial direction at least part of the flow of air introduced into the drum, to the inside of the cavity of the at least one agitation member.

[0025] Preferably the baffle device comprises a baffle including a first wall generally facing the rear wall of the drum and at a distance therefrom, the baffle having, at a peripheral edge of the first wall, a passageway for connection with the cavity of the agitation member. Preferably, the baffle has at least one radial guide cavity for directing the air to the connection passageway. Always preferably, the at least one radial cavity of the baffle is delimited laterally by a pair of second walls that extend

from the first wall towards the rear wall of the drum.

[0026] In one embodiment, the first wall of the baffle has, in a central area thereof, one or more through holes, the section of passage of the one or more through holes being smaller than the section of passage of the inlet of the air of the rear wall of the drum.

[0027] The above said inlet of the air comprises preferably a plurality of through holes of the rear wall of the drum.

[0028] The machine according to the second embodiment preferably comprises a plurality of said agitation members, the baffle device being configured for conveying at least part of the flow of air to the cavity of each agitation member. In such a case, very preferably, the first wall of the baffle has a plurality of said radial cavities, each for directing air to a respective said connection passageway.

[0029] Preferably, the first wall of the baffle has a generally circular shape and/or comprises a plurality of radial stretches, each including a respective radial cavity.

[0030] The baffle may be advantageously made of a single piece with the agitation member or agitation members.

[0031] The baffle and the agitation member, or each agitation member, may be made of plastic material.

[0032] In accordance with a third embodiment of the invention, there is provided a laundry-drying machine, comprising a drum having a rear wall, a front wall and a substantially cylindrical peripheral wall, at least the peripheral wall being rotatable about a substantially horizontal axis, the rear wall having an air inlet, the front wall having an air outlet, and the peripheral wall being substantially unperforated, the machine further comprising a fan and air-heating means,

wherein the drum is designed to be traversed by hot air, forced by the fan and heated by the heating means before being introduced into the drum at said inlet, the fan and the heating means being operatively associated to an air-conveying duct having a delivery section, which is in fluid communication with said inlet, and a suction section, which is in fluid communication with said outlet,

wherein inside the drum at least one laundry-agitation member is provided, fixed to the peripheral wall, the at least one agitation member having a cavity with one or more air inlet passages and one or more air outlet passages.

[0033] The machine according to the above said third embodiment of the invention is **characterized in that** the one or more inlet passages and the one or more outlet passages of the agitation member are prearranged in such a way that, in at least one angular position assumed by the agitation member during rotation of the peripheral wall of the drum, at least part of the hot air forced into the drum penetrates the cavity of the agitation member after it has passed through part of the laundry.

[0034] Preferably, the one or more inlet passages are generally directed towards the inside of the drum and the one or more outlet passages are generally directed towards the outside of the drum at the air outlet thereof.

[0035] Very preferably, the at least one agitation member has a body with an upper face and a front face, the one or more inlet passages being provided in the upper face and the one or more outlet passages being provided in the front face. In one such embodiment, preferably, at least one upper portion of the front face of the at least one agitation member faces said air outlet of the drum, in said upper portion there being defined a plurality of said outlet passages. Very preferably, at least one lower portion of the front face of the at least one agitation member faces the front wall of the drum, said lower portion being substantially free of outlet passages.

[0036] In one embodiment, the air outlet of the drum comprises a mouth for loading and unloading laundry, the machine being a front-loading machine, and at the mouth of the drum an entrance of the aforesaid suction section is provided. Preferably, said entrance comprises a housing for a filter. Very preferably, the entrance or housing has a front, at least part of the front facing the front face of the agitation member.

[0037] Preferably, said air inlet of the drum comprises a plurality of through holes of the rear wall of the drum.

[0038] Preferably, the upper face of the at least one agitation member has an asymmetrical profile.

[0039] The machine comprises preferably a plurality of said agitation members.

[0040] In accordance with the above said third embodiment of the invention there is also provided a method for drying laundry in a laundry-drying machine, comprising a laundry drum with a peripheral wall to which at least one laundry-agitation member is fixed, comprising the steps of

- setting in rotation at least the peripheral wall of the drum, with the at least one agitation member that causes a tumbling of the laundry inside the drum;
- forcing a flow of hot air into the drum through a rear wall thereof, in such a way that hot air impinges upon the laundry to remove humidity therefrom; and
- expelling hot air that has taken up humidity from the laundry through a front wall of the drum,

wherein, in at least one angular position assumed by the agitation member during rotation of the peripheral wall of the drum, at least part of the hot air forced into the drum penetrates the cavity of the agitation member after it has passed through part of the laundry.

[0041] Preferably, said part of the flow of hot air passes in the cavity of the agitation member when the latter is at a region of lower dead centre of the rotation of the drum.

[0042] Very preferably said part of the flow of hot air leaving the cavity of the agitation member is directed towards an air filter.

Brief description of the drawings

[0043] Further purposes, characteristics, and advan-

tages of the invention will emerge clearly from the ensuing detailed description, with reference to the attached drawings, which are provided purely by way of non-limiting example and in which:

- Figure 1 is a schematic perspective view of a laundry-drying machine according to the above said first embodiment of the invention;
- Figure 2 is a schematic cross section, at a larger scale, of the machine of Figure 1;
- Figure 3 is a schematic perspective view, substantially according to the arrow 3 of Figure 2, of a directing device of the machine;
- Figure 4 is a schematic cross section, according to the line IV-IV of Figure 2, at a larger scale;
- Figure 5 is a schematic cross section, according to the line V-V of Figure 2, at a larger scale, with a rear wall of a drum of the machine represented only partially;
- Figure 6 is a schematic cross section similar to the one of Figure 5, corresponding to a first variant of the first embodiment of the invention;
- Figure 7 is a schematic cross section similar to the one of Figure 2, corresponding to a second variant of the first embodiment of the invention;
- Figure 8 is a schematic cross section, similar to the one of figure 2, of a machine according to the above said second embodiment of the invention;
- Figures 9 and 10 are schematic cross sections, according to the lines III-III and IV-IV of Figure 8;
- Figure 11 is a schematic perspective view, according to the arrow V of Figure 8, of a component of the machine of figure 8;
- Figure 12 is a schematic perspective view of a component similar to that of Figure 11, in a possible variant;
- Figure 13 is a schematic perspective view of a component similar to that of Figures 11 and 12, in a further possible variant;
- Figure 14 is a schematic cross section, similar to the one of figure 2, of a machine according to the above said third embodiment of the invention;
- Figure 15 is a schematic perspective view of a laundry-agitation member of the machine of Figure 14; and
- Figure 16 is a schematic perspective view of a portion of the machine of Figure 14.

Description of preferred embodiments of the invention

[0044] Reference to "an embodiment" or "one embodiment" in the framework of the present description is meant to indicate that a particular configuration, structure, or characteristic described in relation to the embodiment is comprised in at least one embodiment. Hence, phrases such as "in an embodiment" or "in one embodiment" and the like that may be present in various points of the present description do not necessarily all refer to one and the same embodiment. In addition, the details, configurations, structures, or characteristics may be combined in any adequate way in one or more embodiments. The references used in what follows are provided only for convenience and do not define the sphere of protection or the scope of the embodiments.

[0045] It is moreover pointed out that in the sequel of the present description only the elements useful for an understanding of the invention will be described, it being taken for granted that the machine forming the subject of the invention comprises all the other elements in themselves known for normal operation of a laundry dryer.

[0046] With particular reference to Figures 1 and 2, designated as a whole by 1 is a laundry-drying machine according to the present invention, which is assumed as being of the closed-circuit condensation type. The machine 1 has a load-bearing structure, including a cabinet 2 provided with a front door 3. Designated by 4 is a user interface or control panel, forming part of a control system of the machine 1, the interface 4 enabling selection of the drying programs and the possible associated options.

[0047] Rotatably mounted inside the cabinet 2 is a laundry drum 5, having a generally cylindrical shape and mounted for turning about a substantially horizontal axis A. Inside the cabinet 2 means are provided, of any known type, for supporting the drum 5 in a rotatable way, as well as motor means, which are designed to cause rotation of the drum 5 in an r.p.m. range for example comprised between 0 and approximately 250 r.p.m., preferably between 0 and approximately 150 r.p.m. In a preferred embodiment, one or more of the programs that can be selected and started by a user via the interface 4 include at least one step of satellization of the load, i.e., a step in the course of which the r.p.m. of the drum 5 is equal or a little greater than the minimum r.p.m. that enables the laundry to remain adherent to the walls of the drum so as to reduce the stresses on the garments.

[0048] In the example illustrated, the aforesaid means include a rear shaft 6, coaxial to the axis A and associated to an electric motor 7, as well as a pair of front wheels, one of which is designated by 8. The shaft 6 is carried by a corresponding hub (not illustrated) associated to the load-bearing structure that also supports the motor 7. The wheels 8 are provided with corresponding supports (not illustrated) associated to the load-bearing structure of the machine in order to turn about respective axes parallel to the axis A. It should be noted that, in embodiments not represented, the means for supporting the drum 5 and driving it in rotation may differ from the ones exemplified, according to any known technique, and comprise, for example, two pairs of bottom wheels, for supporting the drum 5 in a front area and a rear area, and a motor mounted underneath the drum, with an associated transmission belt fitted on the peripheral wall of the drum.

[0049] The drum 5 has a structure that comprises a rear wall 9, to which the shaft 6 is rendered fixed, a substantially cylindrical peripheral wall 10, and a front wall

11. The rear wall 9 has an array of through holes 9a. In an embodiment not illustrated, and unlike the known art, the rear wall 9 is, instead, without holes. The cylindrical wall 10 is prevalently unperforated, apart from the presence of one or more localized openings provided according to one embodiment of the invention that, as will emerge hereinafter, constitute part of an inlet for the hot drying air into the drum. The front wall 11 is generally flange-shaped so as to present a central opening (not indicated) for access to the inside of the drum 5 and moreover functioning as outlet for the air from the drum itself. The peripheral area of the front wall 11 is moreover shaped so as to define a guide 11a for engagement and rolling of the wheels 8. The door 3 of the machine 1 is mounted in a position corresponding to a front opening (not indicated) provided in the front wall of the cabinet 2, said opening being substantially coaxial to the central opening of the front wall 11 of the drum 5 and coaxial to the axis A.

[0050] The machine 1 comprises ventilation means, designed to generate a forced flow of air, and heating means, which are designed to heat the air of the forced flow. In the example of embodiment illustrated, the ventilation means include a substantially closed path for the air, defined inside the cabinet. The aforesaid path includes a duct, designated as a whole by 12: in Figure 2, the arrows F1 indicate the flow along the aforesaid duct. The ventilation means moreover comprise a fan 13 that is operative along the duct 12.

[0051] Designated by 14 is an annular conveying and sealing member, of a conception in itself known, which is mounted on the load-bearing structure and extends between the front opening of the cabinet 2 and the front opening of the drum, defined in the front wall 11. In order to prevent any dispersion of the flow of hot air, between a cylindrical part of the member 14 and a respective cylindrical part of the wall 11 annular-seal sliding means 15 are provided, for example made of a material such as felt, associated to the aforesaid cylindrical part of the member 14.

[0052] A lower area of the member 14 comprises passageways, for example in the form of holes 14a, which basically provide the mouth of a suction section of the drying circuit. Advantageously, in said area a removable filter 16 for withholding fluff is mounted in a known way.

[0053] Provided along the aforesaid suction section of the drying circuit, designated by 12a, is a condenser device 17, of a conception in itself known and, downstream of this, means 18 for heating the drying air. The heating means 18 may include one or more electrical resistances, which are also set downstream of the fan 13. In one embodiment, the machine may include a heat pump that fulfils both functions of heating and functions of condensation of the drying air, all according to the known art.

[0054] Set downstream of the fan 13 is the delivery section of the circuit, designated by 12b, which terminates with a stationary diffusion chamber 12c, substantially bell-shaped or dome-shaped. In the embodiment illustrated, the drive shaft 6 of the drum 5, or the corresponding hub, extends through the duct 12 and the chamber 12c, with interposition of corresponding seal means aimed at preventing any dispersion of the flow of hot air.

[0055] Provided inside the drum 5 is at least one laundry-agitation member or paddle: in the embodiment exemplified, the drum 5 has inside it three paddles, two of which are designated by 20 in Figure 2. The three paddles 20 axially extend in a direction generally parallel to the axis A and are set up against the internal surface of the peripheral wall 10 of the drum 5, spaced at approximately 120° apart. As may be seen also in Figure 4, each paddle 20 has an internal cavity 21, which, as will be seen hereinafter, is configured for receiving at least part of the flow of hot air forced into the drum 5, as well as one or more passages 22 for diffusing the hot air from the cavity 21 towards the central area of the drum 5, as indicated by the arrows F2 in Figure 2. The paddles have a substantially open boxlike structure, with the corresponding cavity that is delimited laterally and at the front by a peripheral wall 20', the front edge of which bears upon the internal surface of the peripheral wall 10 of the drum, with possible interposition of a gasket.

[0056] In the embodiment exemplified, the paddles 20 have a rear portion 20a having a generally restricted cross section, to which there corresponds a restricted portion of the corresponding internal cavity 21, and a front portion 20b having a wider cross section, to which there corresponds a wider portion of the corresponding cavity 21. In the example, the front portion 20b includes a dome-shaped part. It should be noted that the shape of the members 20 must be understood as merely an example and that, in the practical embodiment of the invention, said shape may differ from the one illustrated in the figures, for example including rounded edges and/or a substantially constant cross section.

[0057] Preferably, the passages 22 are provided only in the front portion 20b of the paddles 20, even though not excluded is the presence of passages 22 also in the rear portion 20a.

[0058] In the embodiment exemplified, the inlet for the hot air into the drum 5 comprises, in addition to the holes 9a of the rear wall 9, at least one passageway in a position corresponding to at least one paddle 20, in fluid communication with the cavity of the latter.

[0059] According to a characteristic of the first embodiment of the invention, mounted on the outside of the drum 5 is a directing device, fixed in rotation with respect to the structure of the drum itself, which is operatively coupled to the duct 12 and is configured for conveying at least part of the hot air coming from said duct as far as the aforesaid passageway, and then the cavity 21 of the corresponding paddle 20.

[0060] In a preferred embodiment, such as the one illustrated in the figures, the aforesaid passageway is located in the cylindrical wall 10 of the drum in an area corresponding to a respective paddle 20. Such a passageway, designated by 10a in Figures 2 and 5, may

comprise one or more through openings of the wall 10. The dimensions of the passageway 10a are such that it is located in an area of the wall 10 that is circumscribed by the peripheral wall 20' of the corresponding paddle, on the inside of the drum 5.

[0061] With reference also to Figure 3, the aforesaid directing device, designated as a whole by 25, has at least one first body portion 26 that is operatively set between the end chamber 12c of the duct 12 and the rear wall 9 of the drum 5, where the body portion 26 has at least one inlet opening 27 for the hot drying air, which faces the inside of the end chamber 12c.

[0062] In the embodiment illustrated, the directing device 25 includes three body portions 26, which extend radially with respect to the axis A. The angular distance between these portions 26, defined hereinafter as "radial portions", substantially corresponds to that of the paddles 20: consequently, in the example considered, the radial portions 26 are spaced at approximately 120° apart.

[0063] The radial portions 26 extend generally parallel to the rear wall 9 of the drum 5 to define a corresponding stretch of radial path for the drying air. For said purpose, each radial portion 26 has a respective cavity, designated by 26a, for passage of the drying air, onto which the openings 27 open. In the embodiment illustrated, for this purpose, the radial portions 26 have an open boxlike structure, for delimiting with the rear wall 9 of the drum 5 a corresponding stretch of path for the drying air. For this purpose, the front surface of the body of the device 25 bears upon the rear wall 9 of the drum 5, with possible interposition of seal means.

[0064] The cavity 26a has a relatively contained depth - in the region of 1 - 2 cm - so as not to require a significant reduction of the size of the drum, without, however, determining significant losses of charge and/or pressure of the flow of air.

[0065] The end chamber 12c has a generally circular profile defined by a substantially cylindrical peripheral wall (not indicated). Between the front edge of said peripheral wall and the rear surface of the directing device annular-seal sliding means 12d (Figure 2) are provided, aimed at preventing any dispersion of the flow of hot air. Also said means may for example be made of a material such as felt. Given that, in the case exemplified, the part of the body of the directing device 25 set between the chamber 12c and the rear wall 9 of the drum 5 includes radial portions 26, the latter are connected together by walls having a development of an arc of circumference, designated by 28 in Figure 3. Said arch-like walls 28 hence define, together with respective stretches of the radial portions 26, the annular surface with respect to which the seal means 12d operate.

[0066] In the preferred embodiment illustrated, the directing device 25 then includes at least one second body portion, which is substantially parallel to the peripheral wall 10 of the drum 5 to define a corresponding stretch of axial path for the drying air. In the case exemplified, three of the aforesaid second portions are provided, hereinafter defined as "axial portions", designated by 29.

[0067] The axial portions 29 depart substantially orthogonal from the distal end of the radial portions 26 and have an arched profile, conformable to the peripheral wall 10 of the drum 5. The axial portions 29 bear in fact upon the outside of the wall 10 of the drum 5 to delimit therewith the aforesaid stretch of axial path for the hot air, and in such a way that an area of the peripheral wall 10 in which a corresponding passageway 10a is located is set between a respective axial portion 29 and a corresponding paddle 20, as may be clearly seen for example in Figure 5.

[0068] In the example illustrated, the axial portions 29 have a respective cavity 29a (Figures 3 and 5) for passage of the hot drying air, each of which is in communication with the cavity 26a of the corresponding radial portion 26. For this purpose, once again with reference to the embodiment illustrated, also the axial portions 29 have an open boxlike structure in order to delimit, with the peripheral wall 10 of the drum 5, the corresponding stretch of path for the drying air. Also the cavities 29a have a relatively contained depth, in the region of 1 - 2 cm so as to limit the overall dimensions thereof without, however, determining any significant losses of charge and/or pressure of the flow of air.

[0069] Once again with reference to the non-limiting example of embodiment illustrated in Figure 3, the radial portions 26 have respective bottom stretches 30, preferably massive, basically having structural functions, which converge in a central part 31 provided with a through hole 31a for the shaft 6 of the drum 5.

[0070] From what has been described previously, it will be appreciated that the inlet openings 27 of the directing device 25 face the inside of the end chamber 12c of the delivery section 12b of the circuit of the forced air (Figure 2), with the cavities 26a of the radial portions 26 that communicate directly with the cavities 29a of the radial portions 29 and then, via the passageways 10a of the peripheral wall 11 of the drum 5, with the cavities 21 of the paddles 20.

[0071] In the examples of embodiment provided, the drum 5 is equipped with a plurality of paddles 20, with the device 25 configured for enabling the drying air to reach the internal cavity of each of said paddles. Obviously, the drum could have a single hollow paddle 20, with the device 25 shaped accordingly.

[0072] In the examples of embodiment provided, the body of the device 25 has a substantially spider shape, in its part operatively set between the chamber 12c and the rear wall 9 of the drum 5, but it will be appreciated that said part could have an as a whole circular shape, it remaining understood that at least one radial cavity 26a with the corresponding inlet opening 27 is present therein. Likewise, also the part of the device 25 that embraces the peripheral wall 10 of the drum could have a substantially cylindrical shape, it remaining understood that at least one axial cavity 29a is present therein, in communication with a radial cavity 26a and in a position corresponding to a corresponding passageway 10a.

[0073] In the embodiment at the moment deemed preferential, the device 25 is made of a single piece, for example of moulded plastic material, which can be obtained in a simple and inexpensive way. Said single piece can be readily fixed on the outside of the drum 5 with modalities that are evident to a person skilled in the art, for example via screws that secure the structure of the device 25 to the rear wall 9 and/or to the peripheral wall 10 of the drum. Fixing of the device 25 may also be obtained at least in part by snap-action engagement means or the like, in part defined in the plastic piece.

[0074] Operation of the machine 1, as regards circulation of the air, is very simple. The hot air is forced by the fan 13 into the delivery section 12b of the circuit and penetrates into the chamber 12c. From here, a part of the flow of hot air penetrates substantially axially inside the drum 5, through the openings 9a of its rear wall 9. It will be appreciated, in this regard, that the openings 9a (the position of which is also represented with a dashed line in Figure 5) are positioned in the areas delimited between the massive portions 30 and the arched walls 30 of the device 25, which provide a sort of sub-chambers directly facing the chamber 12c of the delivery section. Another part of the hot drying air penetrates, instead, through the inlet openings 27, into the cavities 26a of the radial portions 26. The respective parts of flow traverse the cavities 26a, in a radial direction with respect to the axis A, until they reach the cavities 29a of the axial portions 29, performing an - even minimal - axial path, and then reach the inside of the cavities 21 of the paddles 20 via the passageways 10a: the hot air is then diffused towards the central area of the drum 5 through the holes 22, as exemplified by the arrows F2 of Figure 2. After it has lapped the laundry, the air now saturated with humidity exits from the drum 5 through the opening of its front wall 11, as indicated by the arrows F3 of Figure 2, and then penetrates into the suction section 12a of the circuit, passing through the filter 16. The air in the suction section 12a is dehumidified by the condenser device 17 and then again heated by the heating means 18, to go back into circulation. Consequently, in the preferred solution according to the invention, at least part of the flow of the hot drying air is divided, on the outside of the drum 5, into a plurality of partial flows, which are directed into different regions of the space containing the laundry to be dried.

[0075] This enables a more uniform distribution of the current of hot air inside the drum 5, improving the efficiency of the drying process.

[0076] In DE-A-19623959 the introduction of hot air into the drum in a radial direction takes place through the cavities of just the paddle that comes to be set facing the dedicated holes of the rear wall of the drum, i.e., the paddle that, during the motion of rotation of the drum, each time occupies the lowest position. Unlike DE-A-19623959, according to the invention, all the paddles are designed to be simultaneously traversed by flows of drying air. This in particular guarantees an efficient drying action in conditions of satellization of the garments, i.e., when these remain adherent to the internal surface of the drum during its rotation; for example, said condition is generated during cycles of drying of wool or delicate garments.

[0077] It is once again pointed out that in the embodiment represented in the figures (see by way of reference Figure 3) the width and the length of the radial portions 26 must be understood as purely an example. In a particularly advantageous embodiment as the one illustrated in Figure 6, the radial portions 26 are shaped with cavities 26a that develop more in length, towards the central part 31. In this way, the openings 27 for inlet of the air can be shifted accordingly towards the centre, in the proximity of or in a position corresponding to the part 31. In this way, moreover, the arched walls 28 can have a smaller radius, as in the example illustrated in Figure 6.

[0078] As may be appreciated, with such an arrangement, the diffusion chamber 12c of the delivery section 12b of the circuit (Figure 2) can have a diameter, and hence a volume, that is decidedly smaller as compared to the solution provided in DE-A-19623959, a fact that enables a further increase in the containment of any dispersion of heat and the minimization of the charge losses. In a further variant in this sense, the surface of seal with respect to the means 12d, which have a decidedly smaller diameter, may be possibly provided via the central part 31, as far as which the radial cavities 26a provided with the openings 27 extend. The fact that the flow of the heated air is divided into partial flows that pass through reduced sections of passage also enables maintenance of a good outflow pressure of the hot air towards the laundry, with reduced or absent losses of speed (unlike what occurs in the prior solution cited, in which the terminal diffusion chamber of the delivery section of the system, having necessarily to be of large dimensions, has the effect of causing a reduction of the speed of the hot air flow and turbulence).

[0079] In the preferred embodiment the device 25 is made of a single piece, but it will be appreciated that its various functional and structural parts could be configured as distinct components operatively coupled together so as to guarantee a sufficient seal to the flow of air.

[0080] In a possible variant embodiment, one or more passageways 10a are provided, instead of on the peripheral wall 10, in the proximity of, or in a position corresponding to, the outer edge of the rear wall 9 of the drum 5. In such an embodiment, exemplified in Figure 7, the cavity 21 of the corresponding paddle 20, delimited laterally by a peripheral wall 20", is open at the rear, i.e., in a position corresponding to the wall 9, so as to be set facing the corresponding passageway 10a. In this case, also between the rear edge of the paddle 20 and the rear wall 9 there may be provided seal means. It will be appreciated that in said embodiment, which is functionally similar to the one described previously, it is not necessary to envisage the axial portions 29 of the directing device 25.

[0081] In figures 8-11 there is shown the above said second embodiment of the invention. In said figures the same reference numerals of the preceding figures are used, to indicate elements that are technically equivalent to those previously described.

[0082] Also in this case, the drum 5 has a rear wall 9, with respect to which the shaft 6 is rendered fixed, a substantially cylindrical peripheral wall 10, and a front wall 11. The rear wall 9 has, in a central region thereof that surrounds the area of fixing of the shaft 6, an inlet for a flow of hot drying air, preferably constituted by an array of through holes, one of which is designated by 9a'. The cylindrical wall 10 is, instead, unperforated, and the front wall 11 is generally flange-shaped so as to present a central opening (not indicated) for access to the inside of the drum 5 that moreover functions as outlet for the air from the drum itself The peripheral area of the front wall 11 is moreover shaped so as to define a guide 11a, for engagement and rolling of the wheels 8. The door 3 of the machine 1 is mounted at a front opening (not indicated) provided in the front wall of the cabinet 2, said opening being substantially coaxial to the central opening of the front wall 11 of the drum 5 and coaxial to the axis A.

[0083] The machine 1 comprises ventilation means, designed to generate a forced flow of air, and heating means, which are designed to heat the air of the forced flow. In the example of embodiment illustrated, the ventilation means include a substantially closed path for the air, defined inside the cabinet. The aforesaid path includes a duct, designated as a whole by 12, which sets the opening of the front wall 11 of the drum 5 in communication with the inlet represented by the holes 9a' of the rear wall 9: in Figure 8, the arrows F1 indicate the flow along the aforesaid duct. The ventilation means moreover comprise a fan 13 that is operative along the duct 12.

[0084] Designated by 14 is an annular conveying and sealing member, of a conception in itself known, which is mounted on the load-bearing structure and extends between the front opening of the cabinet 2 and the front opening of the drum, defined in the front wall 11. In order to prevent any dispersion of the flow of hot air, between a cylindrical part of the member 14 and a respective cylindrical part of the wall 11 annular-seal sliding means 15 are provided, for example made of a material such as felt, associated to the aforesaid cylindrical part of the member 14.

[0085] A lower area of the member 14 comprises passageways, for example in the form of holes 14a, which basically provide the mouth of a suction section of the drying circuit. Advantageously, in said area a removable filter 16 for withholding fluff is mounted in a known way.

[0086] Provided along the aforesaid suction section of the drying circuit, designated by 12a, is a condenser device 17, of a conception in itself known and, downstream of this, means 18 for heating the drying air. The heating means 18 may include one or more electrical resistances, which are also set downstream of the fan 13. In one embodiment, the machine may include a heat pump that fulfils both functions of heating and functions of condensation of the drying air, all according to the known art.

[0087] Set downstream of the fan 13 is the delivery section of the circuit, designated by 12b, which terminates with a stationary diffusion chamber 12c, having a generally circular profile defined by a cylindrical wall. Between the front edge of said cylindrical wall and the surface of the rear wall 9 of the drum annular-seal sliding means are provided (not represented) aimed at preventing any dispersion of the flow of drying air. Also said means may for example be made of a material such as felt. In the embodiment illustrated, the drive shaft 6 of the drum 5, or the corresponding hub, extends through the duct 12 and the chamber 12c, with interposition of corresponding seal means aimed at preventing any dispersion of the flow of drying air.

[0088] Provided inside the drum 5 is at least one laundry-agitation member or paddle: in the embodiment exemplified, the drum 5 has inside it three paddles, two of which are designated by 20 in Figure 8. The three paddles 20 axially extend in a direction generally parallel to the axis A and are set up against the internal surface of the cylindrical wall 10 of the drum 5, spaced at approximately 120° apart. Each paddle 20 has a cavity 21 that, as will be seen hereinafter, is configured for receiving at least part of the flow of hot air forced into the drum 5, as well as one or more passages 22 for diffusing the hot air from the cavity 21 towards the central area of the drum 5, as indicated by the arrows F2 in Figure 8. The paddles have a substantially open boxlike structure, with the corresponding cavity that is delimited laterally and at the front by a peripheral wall 20', the front edge of which bears upon the internal surface of the cylindrical wall 10 of the drum, with possible interposition of a gasket.

[0089] In the embodiment exemplified, and as may be seen also in Figures 9 and 10, the paddles 20 have a rear portion 20a having a generally restricted cross section, to which there corresponds a restricted portion of the corresponding cavity 21, and a front portion 20b having a wider cross section, to which there corresponds a wider portion of the corresponding cavity 21. In the example, the front portion 20b includes a dome-shaped part. It should be noted that the shape of the members 20 must be understood as merely an example and that, in the practical embodiment of the invention, said shape may differ from the one illustrated in figures 8-11, for example including rounded edges and/or a substantially constant cross section.

[0090] Preferably, the passages 22 are provided only in the front portion 20b of the paddles 20, even though not excluded is the presence of passages 22 also in the rear portion 20a (see, for example, Figure 11, where some passages 22 are exemplified also in the portion 20a).

[0091] According to the main characteristic of the second embodiment of the invention of figures 8-11, mounted inside the drum 5 is a baffle device, configured for conveying at least part of the flow of air introduced into

the drum 5 in a radial direction with respect to the axis A, to the cavity 21 of at least one agitation member or paddle 20.

[0092] With reference also to Figure 11, the aforesaid baffle device comprises a baffle, designated as a whole by 25', fixed in rotation with respect to the structure of the drum 5. The baffle 25' includes a first wall 26' generally facing, or parallel to, the rear wall 9 of the drum 5 and at a distance therefrom. The distance between the two walls 9 and 26' is relatively contained (in the region of 1 - 2 cm) so as not to reduce excessively the useful space inside the drum 5 without, however, determining any significant losses of charge and/or pressure in the flow of air entering the drum 5. The baffle 25' then has a passageway 27' (Figure 11) for connection with the cavity 21 of a corresponding paddle 20, said passageway being defined at the peripheral edge of the wall 26'. In the embodiment illustrated, the cavity 21 of the paddles is open at the rear end, at the passageway 27'.

[0093] As may be appreciated, with the arrangement described, defined between the walls 9 and 26' is a relatively thin chamber, in which part of the hot drying air can diffuse radially (as indicated by the arrows F3 of Figure 8) until it reaches, through the passageways 27', the internal cavities 21 of the paddles 20, and then exits towards the central area of the drum 5 through the passages 22 of the members 20 themselves, as indicated by the arrows F2.

[0094] In an embodiment at the moment deemed preferential, the baffle 25' has at least one radial cavity, for directing the air to a respective connection passageway 27'. In this way, the losses of charge and/or pressure of the flow of air can be contained, when this flows radially inside the drum, between the walls 9 and 26'. Such an embodiment is exemplified in Figure 12, where the aforesaid cavity is designated by 28'. Said cavity 28' is delimited at the front by the wall 26' and laterally by a pair of second walls 29' that extend towards the rear wall 9 of the drum, starting from the rear surface of the wall 26'. Preferably, the walls 29' bear upon the rear wall 9 of the drum, with possible interposition of a gasket.

[0095] In the example of Figure 12, given the presence of three paddles 20, the baffle 25' has three radial cavities 28', delimited laterally by respective pairs of walls 29'. At the opposite end with respect to the passageways 27', the walls 29' preferably have connection stretches 30' in order to circumscribe a central cavity 31' which is initially reached by the flow of hot drying air introduced into the drum 5 through the holes 9a' of the rear wall 9.

[0096] The wall 26' of the baffle 25' may be unperforated or else have, as in the embodiments exemplified, one or more through holes 32 in a central region thereof: with particular reference to Figure 12, said central area is preferably circumscribed by the connection stretches of the walls 29', i.e., is at the cavity 31'. In this way, part of the flow of hot air that penetrates through the holes 9a' of the rear wall 9 can be directed into the drum also in a generally axial direction, as exemplified by the arrows F4 of Figure 8, through the holes 32. In addition or as an alternative, one or more through holes may be provided in the wall 26' at the radial cavities 28'.

[0097] It will be appreciated that the holes 32 generally face the holes 9a', which are set in the region circumscribed by the diffusion chamber 12c. Preferably, the section of passage of the holes 32 (or of the holes 32 as a whole) is smaller than the section of passage of the holes 9a' (or of the holes 9a' as a whole) in order to ensure that part of the flow in any case traverses the radial cavities 28'. For this purpose it is also possible to envisage, within the cavity 31' of the baffle 25', a further sub-cavity defined by a cylindrical wall projecting from the wall 26', with the holes 32 provided only at said sub-cavity.

[0098] In the examples of embodiment provided, the drum 5 is equipped with a plurality of paddles 20, with the baffle 25' configured for enabling hot air to reach the cavity 21 of each of said paddles, via corresponding radial cavities 28'. Obviously, the drum could have a single hollow paddle 20, with the baffle 25' shaped accordingly.

[0099] In the examples of embodiment of Figures 11-12, the wall 26' of the baffle 25' has a generally circular shape, but said shape must be deemed merely an example. A different embodiment is illustrated in Figure 13, where the reference numbers of the previous figures 8-12 are used to indicate elements that are technically equivalent to the ones already described above. In said embodiment, the wall 26' of the baffle 25' is substantially spider shaped; i.e., it comprises a plurality of radial stretches, each including the respective radial cavity 28'.

[0100] In the embodiment at the moment deemed preferential, the baffle 25' is made of a single piece with the paddles 20, for example made of moulded plastic material, which can be obtained in a simple and inexpensive way. Said single piece can be fixed inside the drum 5 with modalities that appear evident to a person skilled in the art, for example via screws that secure the paddles 20 to the peripheral wall 10 of the drum and/or screws that secure the wall 26' of the baffle 25' to the rear wall 9 of the drum, with possible interposition of spacer bushings. Fixing between the aforesaid single piece and the drum can be obtained also at least in part by snap-action engagement means or the like, in part defined in the plastic piece. Of course, the installation of the baffle 25' and of the associated paddles 20 is carried out prior to completion of the drum 5, i.e., prior to fixing of the front wall 11 and/or rear wall 9 to the cylindrical wall 10.

[0101] Operation of the machine 1, as regards circulation of the air, is very simple. The hot air is forced by the fan 13 into the delivery section 12b of the circuit and penetrates into the chamber 12c. From here, the flow of hot air penetrates, through the holes 9a', into the drum 5: part of the flow proceeds axially (arrows F4) towards the centre of the drum itself, whereas part of the flow proceeds radially along the cavities 28' of the baffle 25', until it reaches the inside of the paddles 20, from where then the hot air is diffused towards the central area of the drum 5 through the holes 22. After it has lapped the laun-

dry, the air now saturated with humidity exits from the drum 5 through the opening of its front wall 11, as indicated by the arrows F5 of Figure 8, and then penetrates into the suction section 12a of the circuit, passing through the filter 16. The air in the suction section 12a is dehumidified by the condenser device 17 and then again heated by the heating means 18 to go back into circulation.

[0102] Hence, in the preferred solution, the flow of the hot air is divided, inside the drum 5, into a plurality of partial flows F2, F4, which are directed in different regions of the space containing the laundry to be dried.

[0103] This enables a more uniform distribution of the current of hot air inside the drum 5, improving the efficiency of the drying process.

[0104] Unlike DE-A-19623959, also in the embodiments of figures 8-13, all the paddles are designed to be simultaneously traversed by flows of drying air. This in particular guarantees an efficient drying action in conditions of satellization of the garments, i.e., when these remain adherent to the internal surface of the drum during its rotation; for example, said condition is generated during cycles of drying of wool or delicate garments.

[0105] The diffusion chamber 12c of the machine 1 according to the embodiments of the invention of figures 8-13 can have a decidedly smaller volume as compared to the solution provided in DE-A-19623959, which enables containment of any dispersion of heat. The fact that the flow of the heated air is divided into partial flows that pass in the drum 5 through reduced sections of passage also enables maintenance of a good pressure of outflow of the hot air towards the laundry, with reduced or absent losses of speed (unlike what occurs in the prior solution cited, in which the terminal diffusion chamber of the delivery section of the system, having necessarily to be of large dimensions, has the effect of causing a reduction of the speed of the hot air flow and turbulence).

[0106] In the preferred embodiment the paddles 20 are made of a single piece with the baffle 25', but it will be appreciated that the components in question could be configured as distinct components operatively coupled together so as to guarantee a sufficient seal to the flow of air.

[0107] In figures 14-16 there is shown the above said third embodiment of the invention. In said figures the same reference numerals of the preceding figures are used, to indicate elements that are technically equivalent to the one previously described.

[0108] With respect to the similar figures 2 and 8, in figure 14 with 11a' is designated a central mouth for loading and unloading of laundry, which moreover function as outlet for the air from the drum itself; as in the previous embodiments, the duct 12 sets the mouth 11a' of the front wall 11 of the drum 5 in communication with the inlet represented by holes 9a" of the rear wall 9 thereof: in Figure 14, the arrows F1 indicate the flow along the aforesaid duct. Also in this case, at least a lower area of the conveying member 14 is provided with passageways, for example in the form of holes 15a, which basically provide the entrance of a suction section of the drying circuit. Advantageously, said holes 15a are defined at a housing for a removable filter 16, for withholding fluff.

[0109] In this embodiment, fixed inside the drum 5 is at least one laundry-agitation member or paddle: in the embodiment exemplified, the drum 5 has inside it three paddles, two of which are designated by 20 in Figure 14. The three paddles 20 axially extend in a direction generally parallel to the axis A and are set up against the internal surface of the cylindrical wall 10 of the drum 5, spaced at approximately 120° apart. Each paddle 20 has a cavity 21, designed to receive at least part of the flow of hot air forced into the drum 5, as well as one or more inlet passages for the air and one or more outlet passages for the air.

[0110] As will emerge more clearly hereinafter, according to the third embodiment of the invention of figures 14-16, the one or more inlet passages - designated by 22' also in Figure 15 - and the one or more outlet passages - designated by 23 also in Figure 15 - of at least one paddle 20 are prearranged in such a way that, in at least one angular position assumed by the paddle itself during rotation of the peripheral wall 10, at least part of the hot air forced into the drum 5 penetrates into the cavity 21 of the paddle after it has passed through part of the laundry.

[0111] For this purpose, in a preferred embodiment, the one or more inlet passages 22' face the inside of the drum 5, and the one or more outlet passages 23 face, instead, the outside of the drum 5, towards the air outlet represented by the mouth 11a' of the front wall 11 of the drum 5.

[0112] The paddles 20 have a substantially boxlike structure to define the corresponding cavities 21. In the embodiment exemplified, and as may be seen in particular in Figure 15, the body of the paddles 20 has an upper face 20a' and a front face 20b', with a plurality of inlet passages 22' in the upper face 20a' and a plurality of outlet passages 23 in the front face 20b'.

[0113] In a preferred embodiment, and as emerges in particular from Figure 15, defined at least in an upper portion of the front face 20b' of the paddle 20 is a plurality of the outlet passages 23, with said upper portion that faces the mouth 11a'. Instead, a lower portion of the front face 20b' itself faces a corresponding region of the front wall 11 of the drum 5, and in said lower portion the outlet passages 23 are not strictly necessary.

[0114] As mentioned previously, at the mouth 11a' of the drum, the entrance of the suction section of the drying circuit 12a is located, which, in the non-limiting example considered herein, is basically constituted by a housing 115 for the filter 16. As may be appreciated in particular in Figures 14 and 16, at least one part of the body that defines the housing 15 faces the front face 20b' of the paddle 20 - in particular the portion of said face that directly faces the mouth 11a' - and has the holes 15a for passage of the air.

[0115] The array of holes 15a preferably extends for

an arched stretch of the housing 115 and/or of the member 14 around a region of bottom dead centre of rotation of the drum, said region being indicatively comprised between -30° and +30° from the bottom dead centre.

[0116] In the embodiment exemplified, the housing 115 has a top face 15' and a front face 15", both provided with corresponding arrays of holes 15a. As may be appreciated from Figure 16, at least the holes 15a of the face 15" face the front face 20b' of the paddle 20, and hence the corresponding outlet passages 23.

[0117] The lower face of the body of the paddles 20 is preferably generally curved, in a way conformable to the curvature of the peripheral wall 10 of the drum 5. Instead, in the preferred embodiment of the invention, at least the upper face 20a' of the paddles 20 has an asymmetrical profile in such a way that the paddle is as a whole (with reference to Figure 15) generally thinned out on the left and convex on the right. More in particular, from Figure 15 it may be noted how the upper face 20a' presents on the right a portion H which is basically shaped like a concave vault, with concavity facing downwards, and on the left a generally thinned-out portion T. Said profile is as a whole aerodynamic in relation to the preferential direction of rotation of the drum 5 of the machine, which here is assumed to turn prevalently in a clockwise direction. Of course, in the case of prevalent rotation in a counterclockwise direction, the arrangement of the portions H and T will be opposite to the one represented in Figure 15. The upper face 20a' of the paddle then has, in the case exemplified, also a generally rear portion R, which degrades towards the rear of the paddle itself, starting from the portions T and H.

[0118] It should be noted that in Figures 15 and 16 only some of the inlet passages 22' have been represented, but in the practical embodiment of the invention the entire upper face 20a' may present a more or less homogeneous array of passages 22', in the various portions H, T and R (see, for example, Figure 14).

[0119] In the examples of embodiment provided, the drum 5 is equipped with a plurality of paddles 20, but obviously the drum could have a single hollow paddle 20. Also the shape illustrated of the paddles, even though currently is deemed preferential, may differ, it remaining understood that the inlet passages 22' and the outlet passages 23 are present, facing respectively the inside and the outside - through the mouth 11a' - of the space containing the laundry defined by the drum 5.

[0120] Operation of the machine 1, as regards circulation of the air, is very simple. The drum 5 is set in rotation, with the paddles 20 fixed with respect thereto that fulfil the classic function of agitation of the laundry. The hot air is forced by the fan 13 in the delivery section 12b of the circuit and penetrates into the chamber 12c. From here, the flow of hot air passes through the holes 9a" and diffuses into the drum 5. In this way, the hot air impinges upon the laundry to remove moisture therefrom. The hot air that has taken up humidity from the laundry then exits from the drum 5 through the mouth 11a', at the entrance of the suction section 12a, here represented by the housing 115.

[0121] It will thus be appreciated that, during rotation of the drum 5, the paddles 20 - at least as regards the upper part of the their front faces 20b' - cyclically face the mouth 11a', and more in particular the front of the housing 115, provided with the passages 15a. In said situation, the paddle is in a position corresponding to the aforesaid region of bottom dead centre of rotation of the drum 5, and on its upper face at least part of the load of laundry impinges. In this way, part of the forced hot air tends to traverse said laundry - as indicated by the arrows F3 of Figure 14 - subtracting moisture therefrom, and then penetrates inside the cavity 21 of the paddle, through the inlet passages 22'; the air charged with moisture subtracted from the laundry then tends to exit at the front from the cavity 21 through the outlet passages 23 - as indicated by the arrows F4 of Figure 14 - favoured thereby by the action of suction exerted by means of the section 12a of the duct 12.

[0122] The air saturated with humidity then penetrates in the housing 115, through the corresponding passages 15a, is filtered through the filter 16, as indicated by the arrows F4 of Figure 14, and then proceeds into the suction section 12a. The air in the suction section 12a is dehumidified by the condenser device 17 and then again heated by the heating means 18 so that it goes back into circulation.

[0123] Of course, part of the hot air that traverses the drum 5 will reach the suction section 12a without passing in the paddles 20. Part of the hot air may also be induced to penetrate into the paddles 20 different from the one that is currently in the region of bottom dead centre; said air may in any case exit from the corresponding cavities during rotation, in particular through the corresponding outlet passages 23 temporarily facing the conveying and sealing member 14.

[0124] As may be readily understood, in the solution according to the embodiment of figures 14-16, in at least one angular position assumed by a paddle 20 during rotation of the peripheral wall 10, at least part of the hot air forced into the drum 5 penetrates into the cavity 21 only after it has traversed part of the laundry. Practical tests conducted by the Applicant have made it possible to ascertain that this methodology enables an efficient subtraction of humidity from the load of laundry, with advantages in terms of reduction of the drying times.

[0125] In addition to this, the diffusion chamber 12c of the machine 1 according to the invention can have a decidedly smaller volume as compared to the solution provided in DE-A-19623959, which enables containment of the dispersion of heat. In addition, this enables reduced or absent losses of speed of the hot air towards the laundry (unlike what occurs in the prior solution cited, in which the terminal diffusion chamber of the delivery branch of the system must necessarily be of large dimensions with the effect of causing a reduction of the speed of the flow of hot air).

[0126] In the preferred embodiment, the suction section 12a of the drying circuit comprises a housing 115 for the filter 16, but it will be appreciated that such a filter could be provided elsewhere along the circuit: in this case, the element 115 previously defined as "housing" will only have functions of inlet for the moist air leaving the drum in the suction section 12a.

[0127] In a possible embodiment, at least some of the holes 9a" provided in the rear wall 9 of the drum 5 can be provided for orienting a corresponding part of the forced flow downwards, i.e., towards the region of bottom dead centre, in order to increase further the efficiency of the machine. Said holes may, for example, comprise an outermost annular series of holes 9a of the array.

[0128] It should be pointed out that the solution of figures 14-16 may be used also in the case of drying machines, the drum of which is prevalently constituted by an unperforated cylindrical wall (with possible front and rear flanges each having a central opening), and in which the supporting structure of a drum 1 of this sort comprising a front baffle and a rear baffle, which in turn comprise respective cylindrical walls that project inside the cylindrical wall (or inside the aforesaid central openings of the two end flanges), with interposition of sliding seal means. In such a machine, hence, the front and/or rear of the space for containment of the laundry is delimited by a stationary wall of the structure of the machine, represented by the corresponding baffle. In such a type of machine, driving of the drum can be provided with a transmission belt fitted on the peripheral wall of the drum.

[0129] From the above description the characteristics of the present invention emerge clearly. The invention affords significant advantages in terms of efficiency as compared to the prior art mentioned in the introductory part of the present description, in terms of reduction of drying times, of containment of any dispersion of heat, of maintenance of the outflow pressure without significant losses of speed and concentration of the useful energy. Among the advantages, also the simplicity and low cost of the solution proposed are to be mentioned.

[0130] Of course, without prejudice to the principle of the invention, the details of construction and the embodiments may vary widely as compared to what has been described and illustrated herein, without thereby departing from the scope of the invention itself, as defined by the ensuing claims.

[0131] In the foregoing description reference has been made to a machine of the front-loading type, but it will be appreciated that the idea of solution underlying the invention may be readily applied also to top-loading drying machines. Likewise, the invention has been described with reference to a closed-circuit condensation dryer, but it will be appreciated that the invention may be used also in the case of expulsion dryers.

Claims

1. A laundry-drying machine, comprising a drum (5) rotatable about a substantially horizontal axis (A) and having a rear wall (9), a front wall (11) and a substantially cylindrical peripheral wall (10), which extends between the front and rear walls (9, 11), the drum (5) having at least one inlet for the air (9a; 10a) and at least one outlet for the air (14, 14a), the machine (1) further comprising a fan (13) and air-heating means (18),
wherein the drum (5) is designed to be traversed by hot air, forced by means of the fan (13) and heated via the heating means (18) before being introduced into the drum (5) through said at least one inlet (9a, 10a), the fan (13) and the heating means (18) being operatively associated to an air-conveying duct (12) having a delivery section (12b, 12c), which is in fluid communication with said at least one inlet (9a, 10a), and a suction section (12a), which is in fluid communication with said at least one outlet (14, 14a),
wherein inside the drum (5) at least one laundry-agitation member (20) is provided, associated to the cylindrical wall (10), the at least one agitation member (20) having a cavity (21), configured for receiving at least part of the hot air introduced into the drum (5), and one or more passages (22) for diffusing the hot air from the internal cavity (21) towards a central area of the drum (5),
wherein said at least one inlet for the air (9a, 10a) comprises at least one passageway (10a) in a position corresponding to the at least one agitation member (20) and in fluid communication with the cavity (21) thereof,
characterized in that outside the drum (5) a directing device (25) is mounted, connected in rotation to the structure of the drum (5), which is operatively coupled to the delivery section (12b, 12c) of the duct (12) and is configured for directing at least part of the air coming from the duct (12) to said at least one passageway (10a), and hence to the cavity (21) of the corresponding agitation member (20).

2. The laundry-drying machine according to Claim 1, wherein

- the delivery section (12b, 12c) of the duct (12) comprises a stationary end chamber (12c);
- the directing device (25) has at least one first body portion (26) that is operatively interposed between the end chamber (12c) and the rear wall (9) of the drum (5); and
- the at least one first body portion (26) has at least one inlet opening (27) for hot air, which faces inside the end chamber (12c),

where preferably the at least one first body portion (26) is generally parallel to the rear wall (9) of the

drum (5) to define a respective stretch of radial path for air.

3. The laundry-drying machine according to Claim 1 or Claim 2, wherein the at least one passageway comprises an opening (10a) in the peripheral wall (10) of the drum (5), where in particular the directing device (25) has at least one second body portion (29) substantially parallel to the peripheral wall (10) of the drum (5), to define a corresponding stretch of axial path for the hot air, an area of the peripheral wall (10) of the drum (5) in which the passageway (10a) is located being interposed between the second body portion (29) and the corresponding agitation member (20).

4. The laundry-drying machine according to Claim 2 or Claim 3, wherein the at least one first body portion (26) has a respective cavity (26a) for passage of the hot air, where in particular the at least one second body portion (29) has a respective cavity (29a) for passage of the hot air, which is in fluid communication with the cavity (26a) of the first body portion (26).

5. The laundry-drying machine according to Claim 2 or Claim 3, wherein the drum (5) has a plurality of agitation members (20), the directing device (25) has a plurality of first body portions (26) and the first body portions (26) extend radially with respect to said axis (A).

6. A laundry-drying machine, comprising a drum (5) rotatable about a substantially horizontal axis (A) and having a rear wall (9), a front wall (11), and a substantially cylindrical peripheral wall (10), which extends between the front and rear walls (9, 11), the rear wall (9) having an inlet for the air (9a') and the front wall (11) having an outlet for the air (14, 14a), the machine (1) further comprising a fan (13) and air-heating means (18),
wherein the drum (5) is designed to be traversed by hot air, forced by the fan (13) and heated by the heating means (18) before being introduced into the drum (5) at said inlet (9a'), the fan (13) and the heating means (18) being operatively associated to an air-conveying duct (12) having a delivery section (12b, 12c), which is in fluid communication with said inlet (9a'), and a suction section (12a), which is in fluid communication with said outlet (14, 14a),
wherein inside the drum (5) at least one laundry-agitation member (20) is provided, which is associated to the peripheral wall (10), the at least one agitation member (20) having a cavity (21), configured for receiving at least part of the hot air introduced into the drum (5), and one or more passages (22) for diffusing the hot air from the cavity (21) towards a central area of the drum (5),
characterized in that inside the drum (5) a baffle device (25') is mounted, configured for directing in a radial direction at least part of the flow of air (F3) introduced into the drum (5), to the inside of the cavity (21) of the at least one agitation member (20).

7. The laundry-drying machine according to Claim 6, wherein the baffle device comprises a baffle (25') including a first wall (26') generally facing the rear wall (9) of the drum (5) and at a distance therefrom, the baffle (25') having, at a peripheral edge of the first wall (26'), a passageway (27') for connection with the cavity (21) of the agitation member (20), where preferably the baffle (25') has at least one radial guide cavity (28') for directing the air to the connection passageway (27), the at least one radial cavity (28') of the baffle (25') being preferably delimited laterally by a pair of second walls (29') that extend from the first wall (26') towards the rear wall (9) of the drum (5).

8. The laundry-drying machine according to Claim 7, wherein the first wall (26') of the baffle (25') has, in a central area (31) thereof, one or more through holes (32), the section of passage of the one or more through holes (32) being smaller than the section of passage of the inlet of the air (9a') of the rear wall (9) of the drum (5).

9. The laundry-drying machine according to any one of Claims 6 to 8, wherein the first wall (26') of the baffle (25') has a generally circular shape.

10. The laundry-drying machine according to any one of Claims 6 to 9, wherein the baffle (25') is made of a single piece with the agitation member (20) or agitation members (20) and/or the baffle (25') and the agitation member (20), or each agitation member (20), are made of plastic material.

11. A laundry-drying machine, comprising a drum (5) having a rear wall (9), a front wall (11) and a substantially cylindrical peripheral wall (10), at least the peripheral wall being rotatable about a substantially horizontal axis (A), the rear wall (9) having an air inlet (9a''), the front wall (11) having an air outlet (11a'), and the peripheral wall being substantially unperforated, the machine (1) further comprising a fan (13) and air-heating means (18),
wherein the drum (5) is designed to be traversed by hot air, forced by the fan (13) and heated by the heating means (18) before being introduced into the drum (5) at said inlet (9a''), the fan (13) and the heating means (18) being operatively associated to an air-conveying duct (12) having a delivery section (12b, 12c), which is in fluid communication with said inlet (9a''), and a suction section (12a), which is in fluid communication with said outlet (11a'),
wherein inside the drum (5) at least one laundry-

agitation member (20) is provided, fixed to the peripheral wall (10), the at least one agitation member (20) having a cavity (21) with one or more air inlet passages (22') and one or more air outlet passages (23),
characterized in that the one or more inlet passages (22') and the one or more outlet passages (23) of the agitation member (20) are prearranged in such a way that, in at least one angular position assumed by the agitation member (20) during rotation of the peripheral wall (10) of the drum (5), at least part of the hot air forced into the drum (5) penetrates the cavity (21) of the agitation member (20) after it has passed through part of the laundry, where in particular said at least one angular position is a position in which the agitation member (20) is at a region of bottom dead centre of the rotation of the drum (5).

12. The laundry-drying machine according to Claim 11, wherein the one or more inlet passages (22') are generally directed towards the inside of the drum (5) and the one or more outlet passages (23) are generally directed towards the outside of the drum (5) at the air outlet (11a') thereof, at least one upper portion of the front face (20b') of the at least one agitation member (20) preferably facing said air outlet (11a') of the drum (5), in said upper portion there being defined a plurality of said outlet passages (23), and at least one lower portion of the front face (20a') of the at least one agitation member (20) preferably facing the front wall (11) of the drum (5), said lower portion being substantially free of outlet passages (23).

13. The laundry-drying machine according to any Claim 11 or Claim 12, wherein the air outlet of the drum (5) comprises a mouth (11a") for loading and unloading laundry, the machine being a front-loading machine, and wherein at the mouth (11a') of the drum (5) an entrance (115) of the aforesaid suction section (12a) is provided, where preferably said entrance comprises a housing (15) for a filter (16), very preferably the entrance or housing (15) having a front (15"), at least part of the front (15") facing the front face (20b') of the agitation member (20).

14. The laundry-drying machine according to any one of the claims 11 to 13, wherein the upper face of the at least one agitation member (20) has an asymmetrical profile.

15. A method for drying laundry in a laundry-drying machine (1), comprising a laundry drum (5) with a peripheral wall (10) to which at least one laundry-agitation member (20) is fixed, comprising the steps of

- setting in rotation at least the peripheral wall (10) of the drum (5), with the at least one agitation member (20) that causes a tumbling of the laundry inside the drum (5);
- forcing a flow of hot air into the drum (5) through a rear wall (9) thereof, in such a way that hot air impinges upon the laundry to remove humidity therefrom; and
- expelling hot air that has taken up humidity from the laundry through a front wall (11) of the drum (5),

wherein, in at least one angular position assumed by the agitation member (20) during rotation of the peripheral wall (10) of the drum (5), at least part of the hot air forced into the drum (5) penetrates the cavity (21) of the agitation member (20) after it has passed through part of the laundry, where in particular said part of the flow of hot air passes in the cavity (21) of the agitation member (20) when the latter is at a region of lower dead centre of the rotation of the drum (5).

FIG. 1

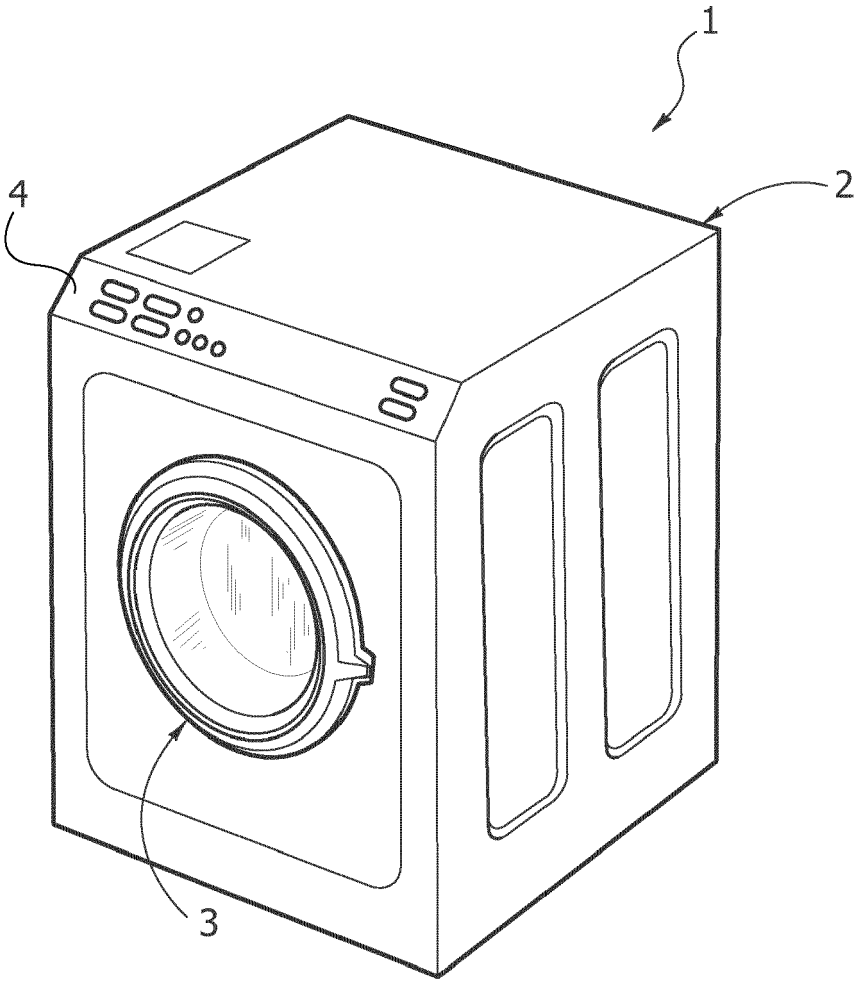
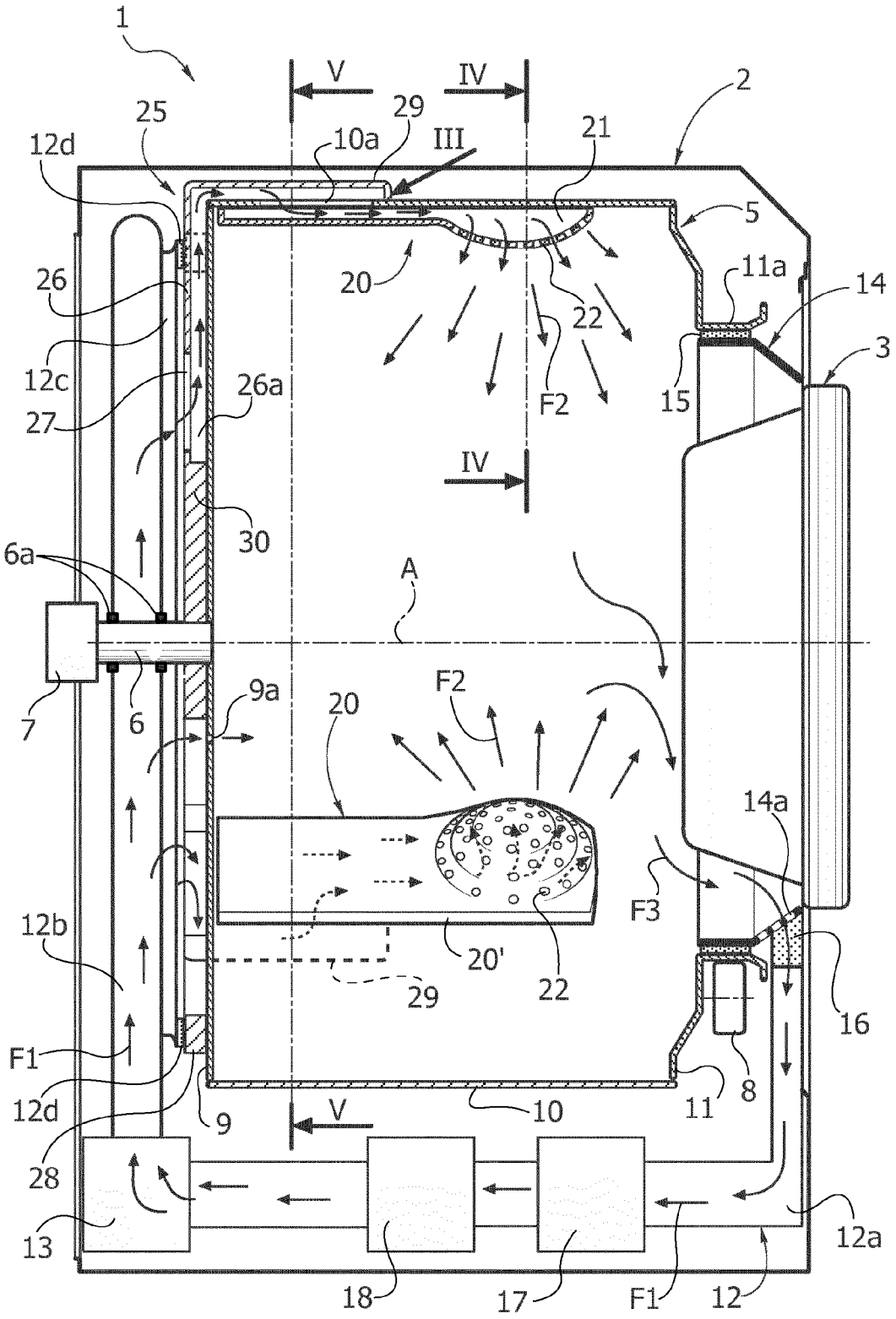


FIG. 2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12c
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15
27
IV
30
6a
A
7
6
9a
20
F2
14a
F3
12b
20'
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18
17
F1
12
12a

FIG. 3

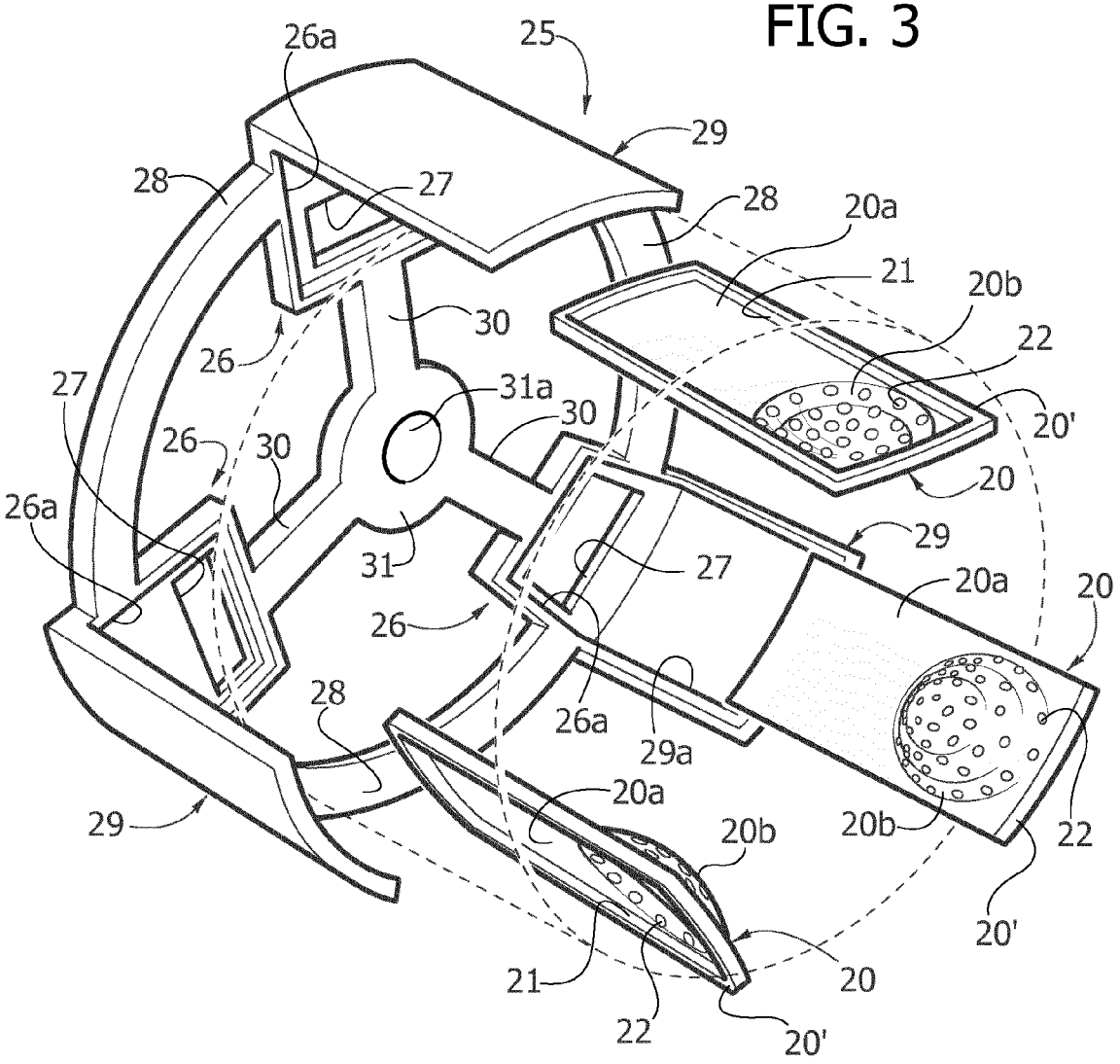
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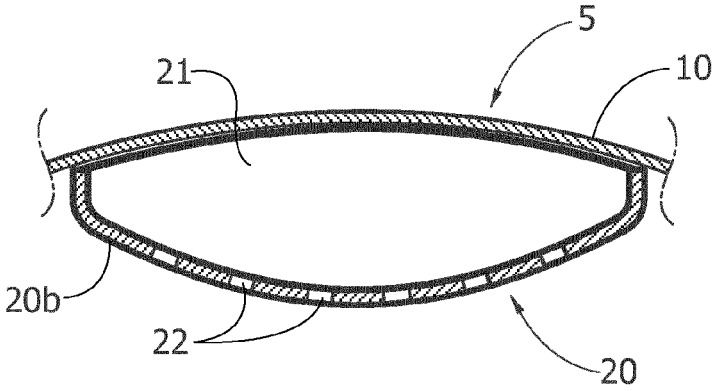
FIG. 4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20b
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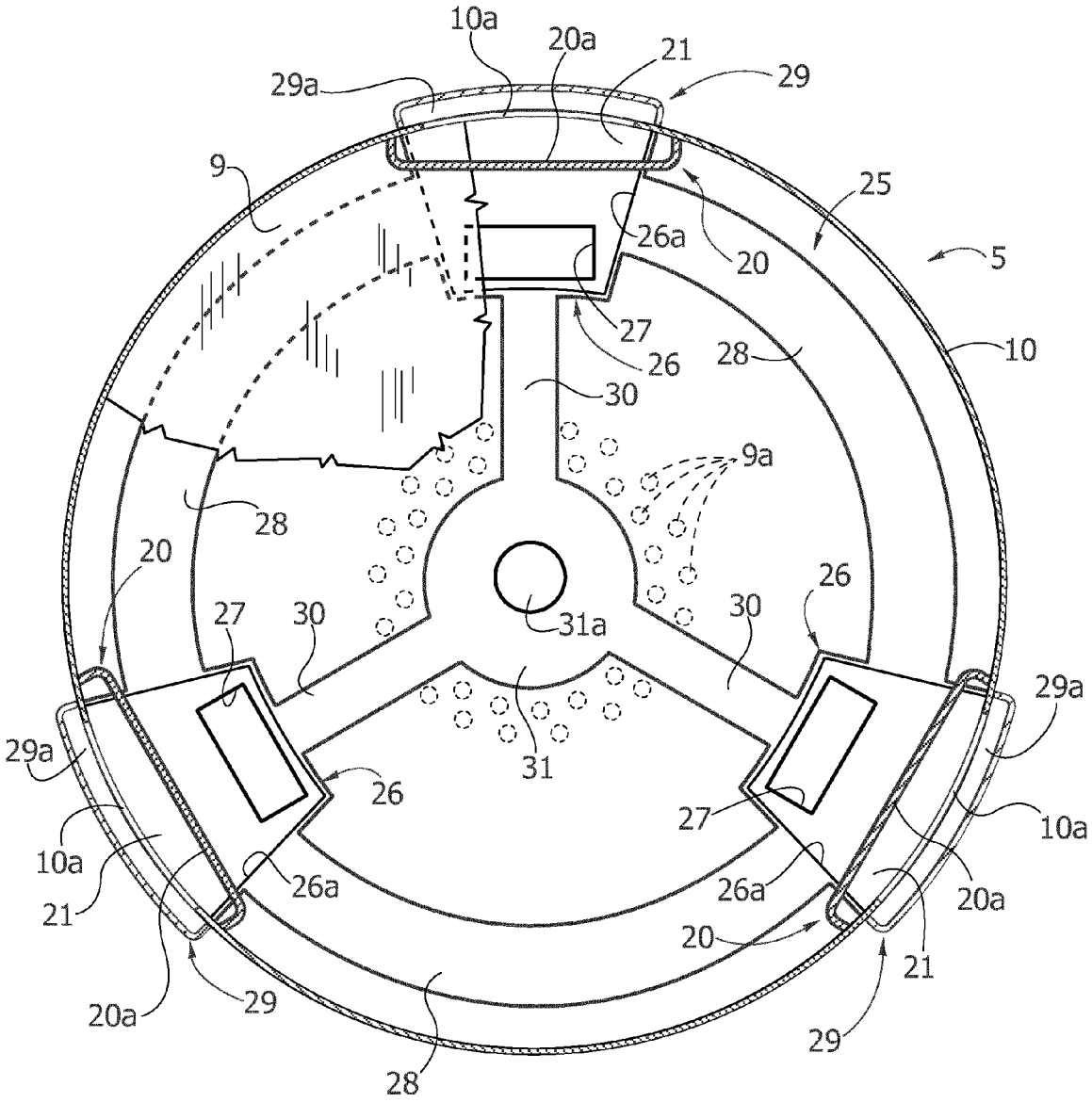
FIG. 5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31a
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29a
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20a
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29
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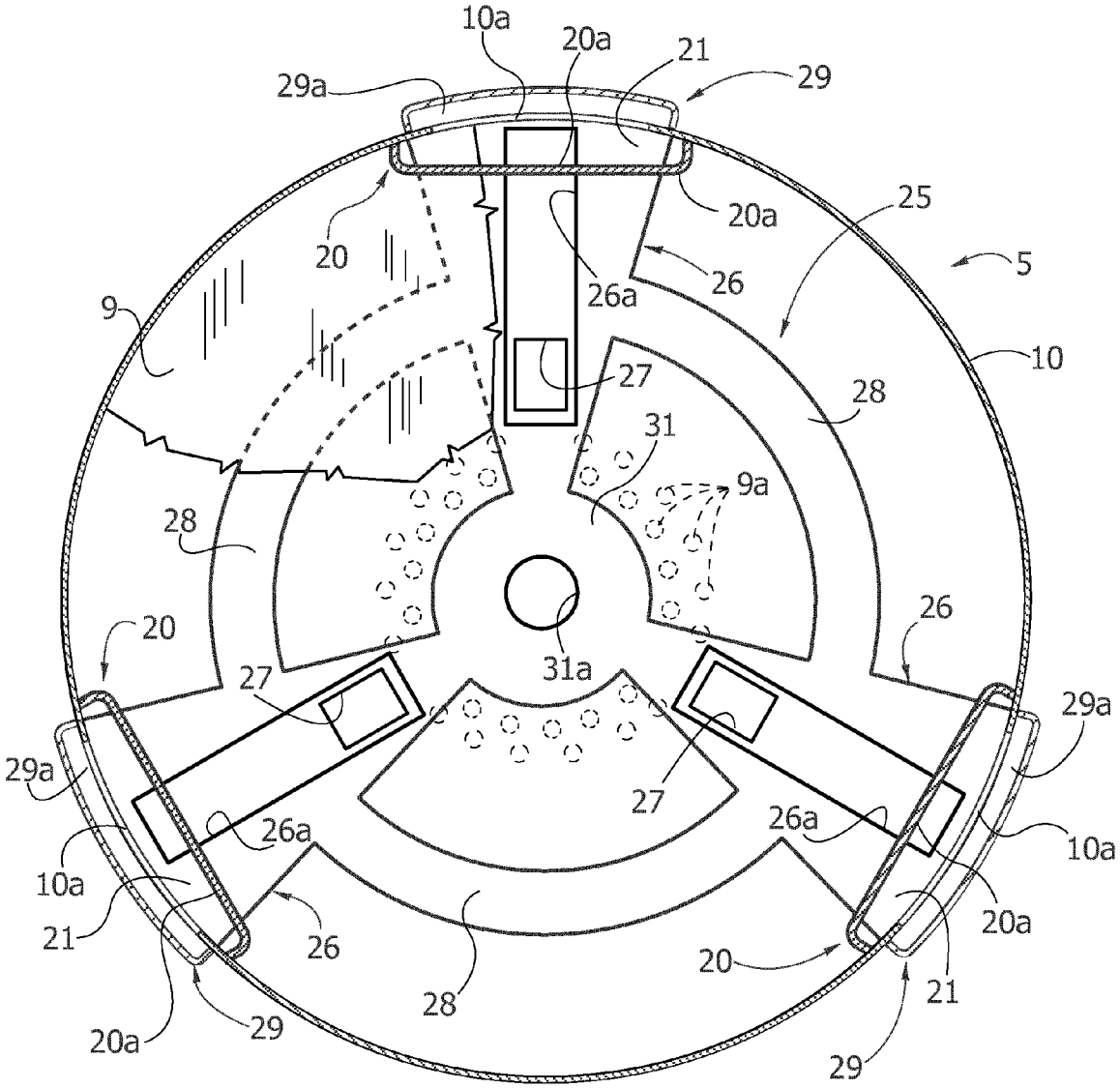
FIG. 6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31a
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20a
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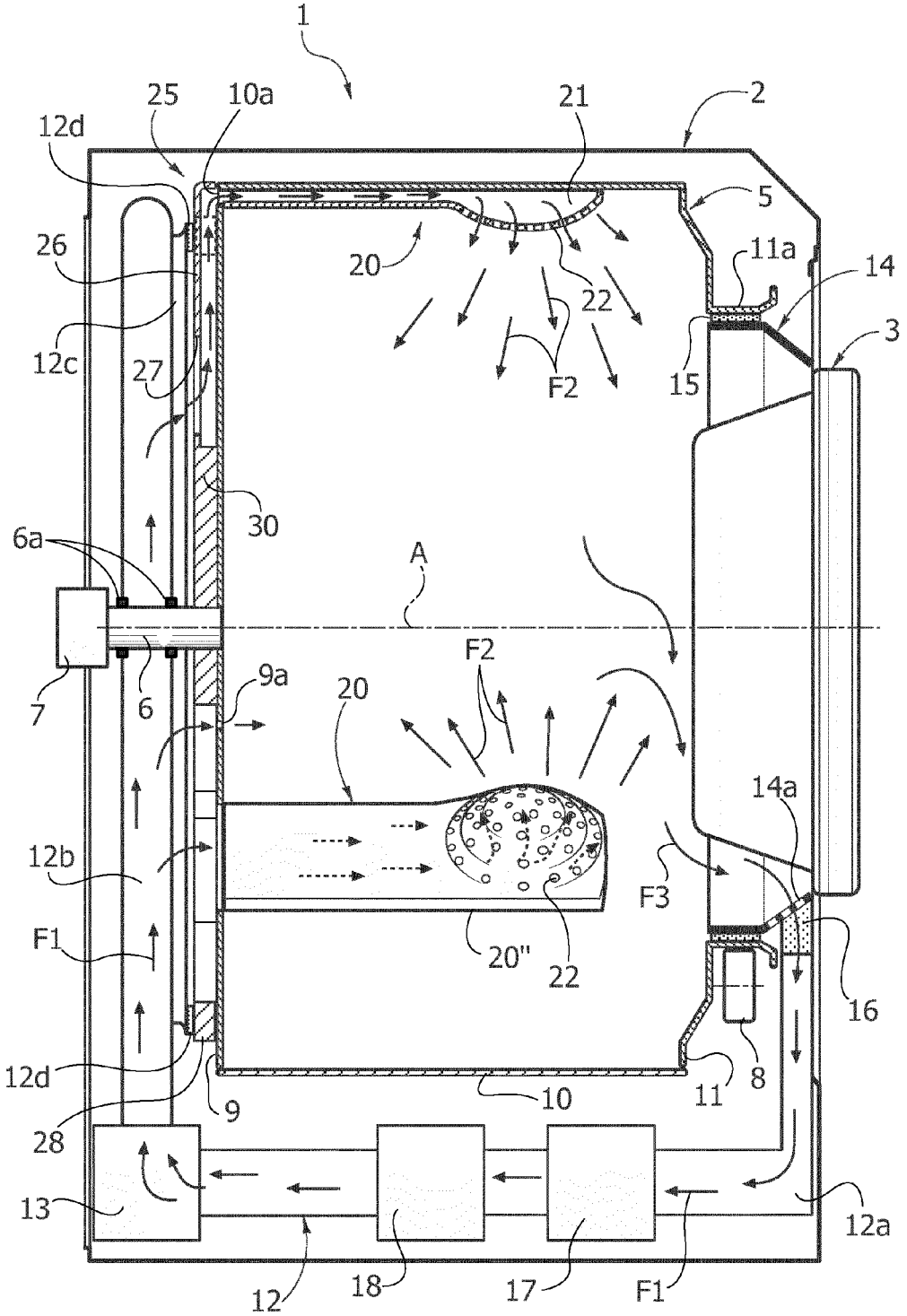
FIG. 7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F2
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9a
20
14a
12b
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12a
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18
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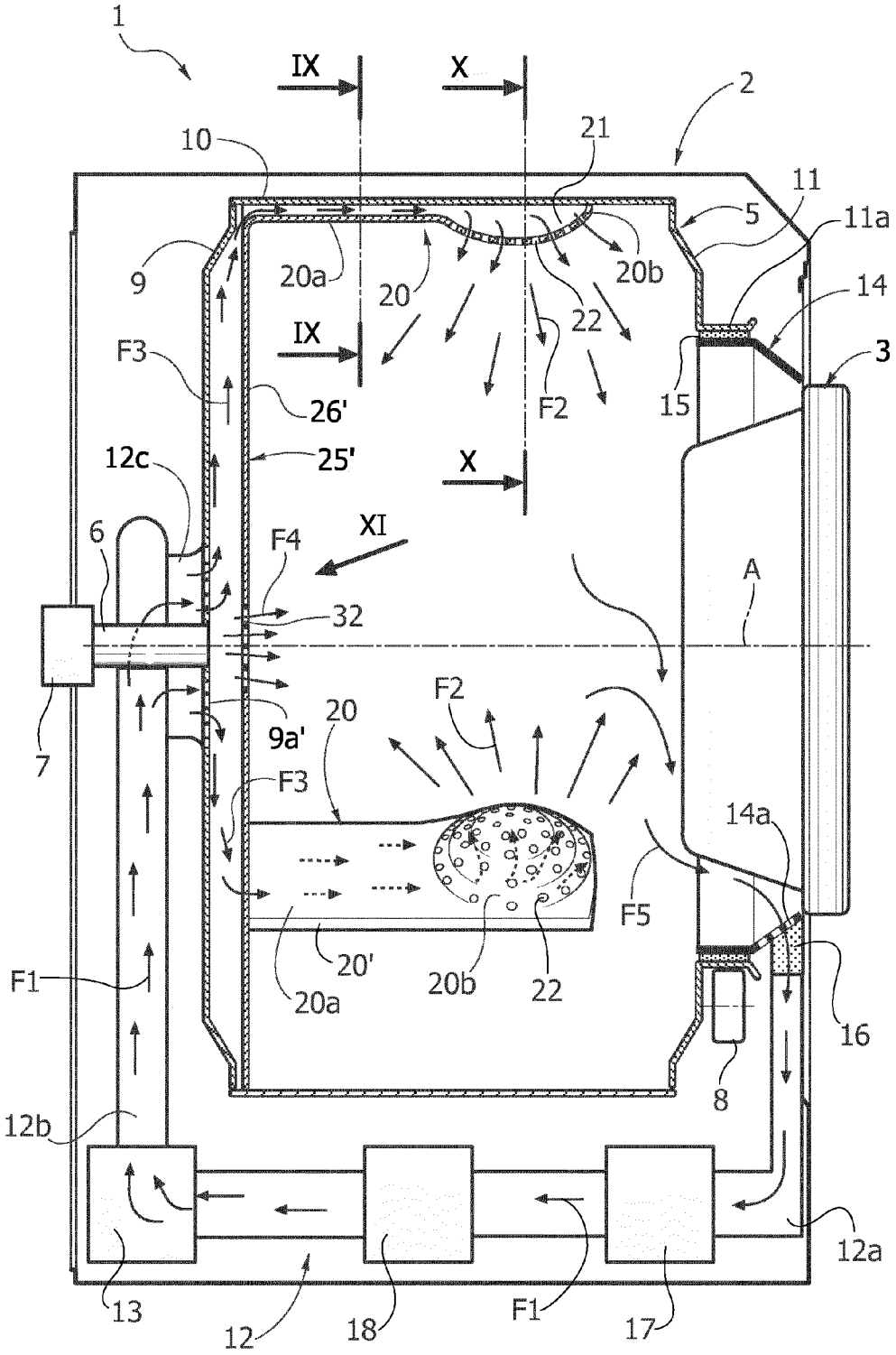
F1

FIG. 8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F2
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F1
17

FIG. 9

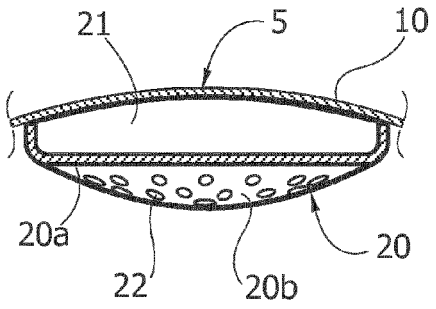


FIG. 10

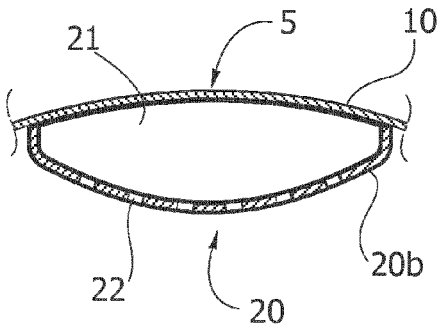
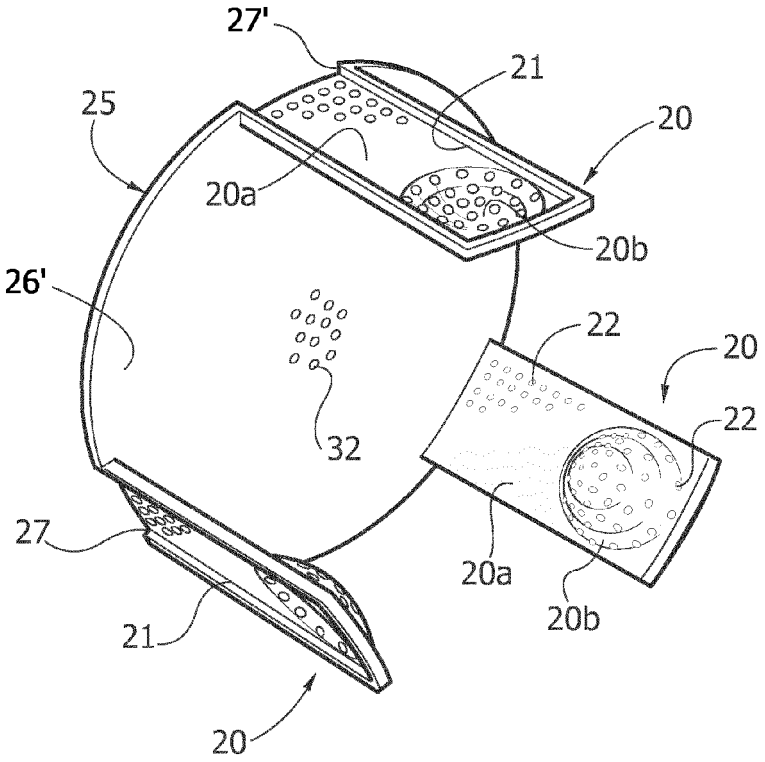


FIG. 11



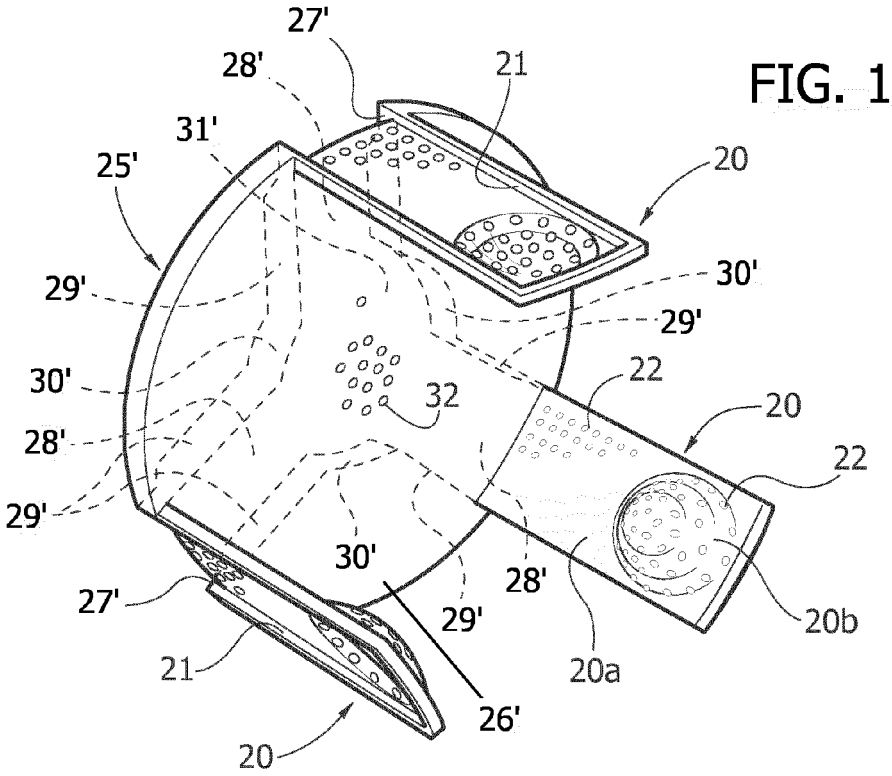

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FIG. 12

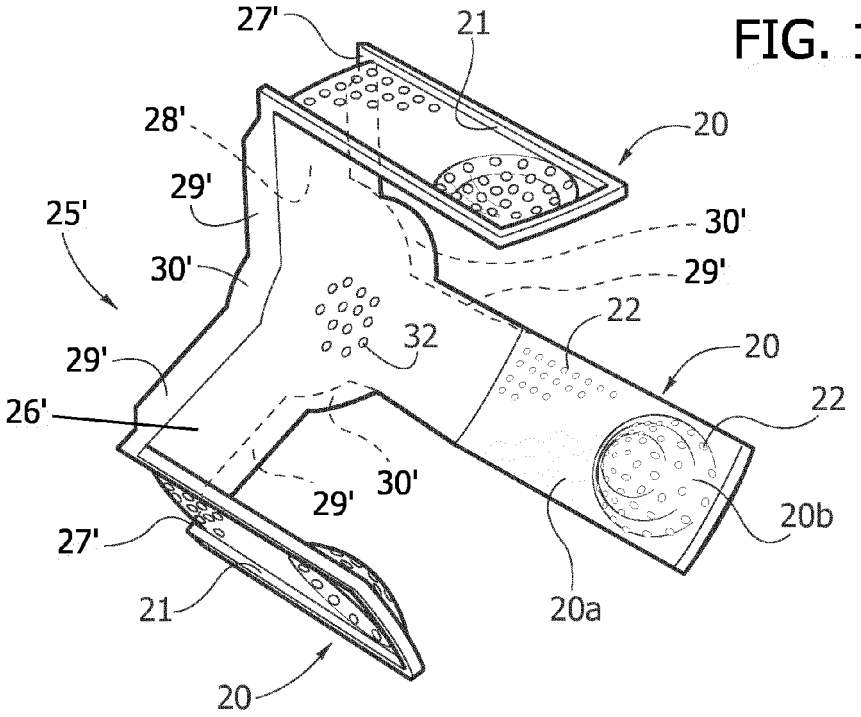
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FIG. 13

FIG. 14

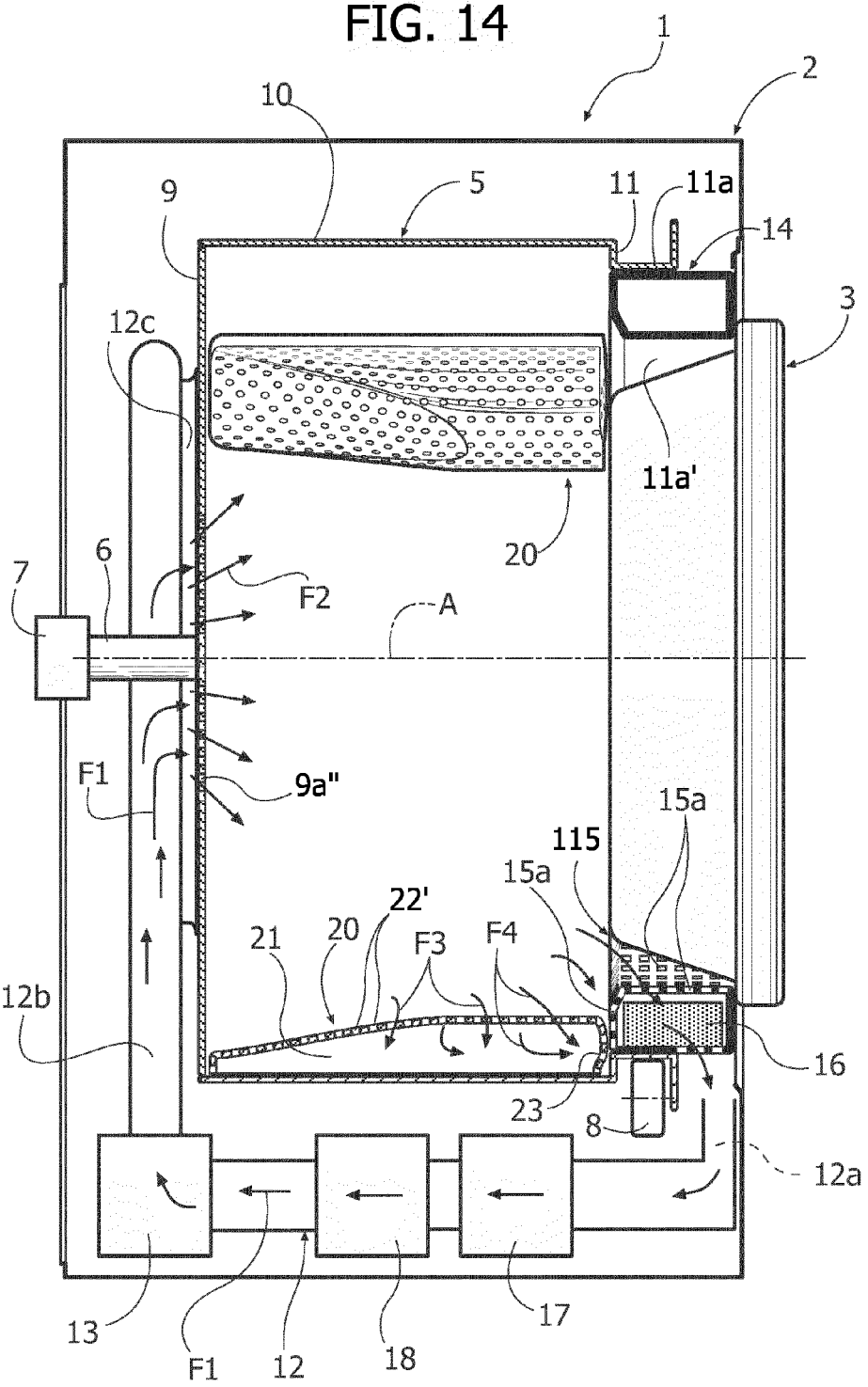
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FIG. 15

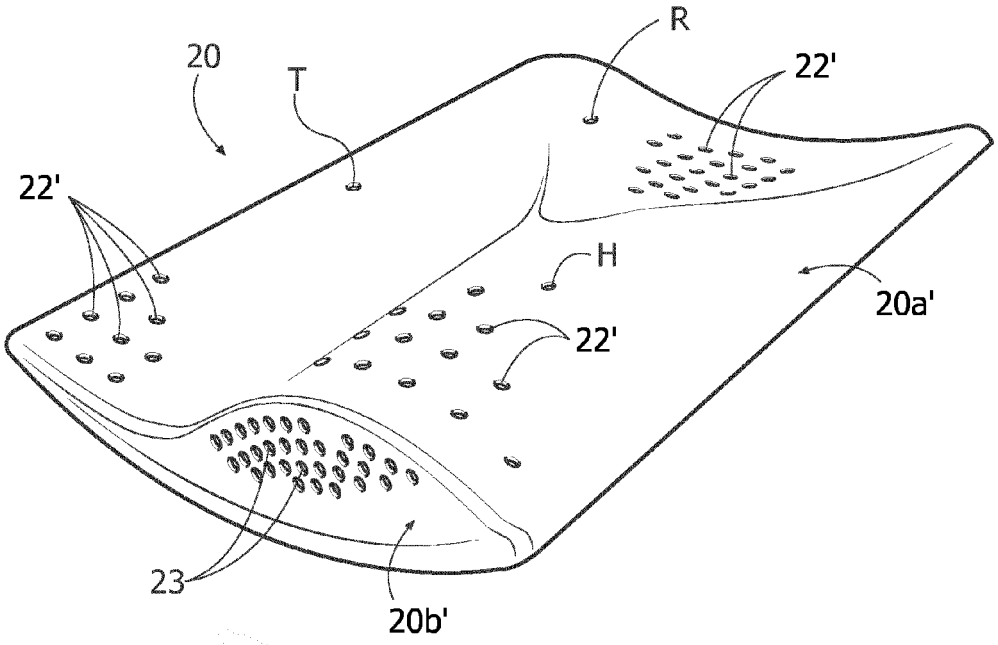
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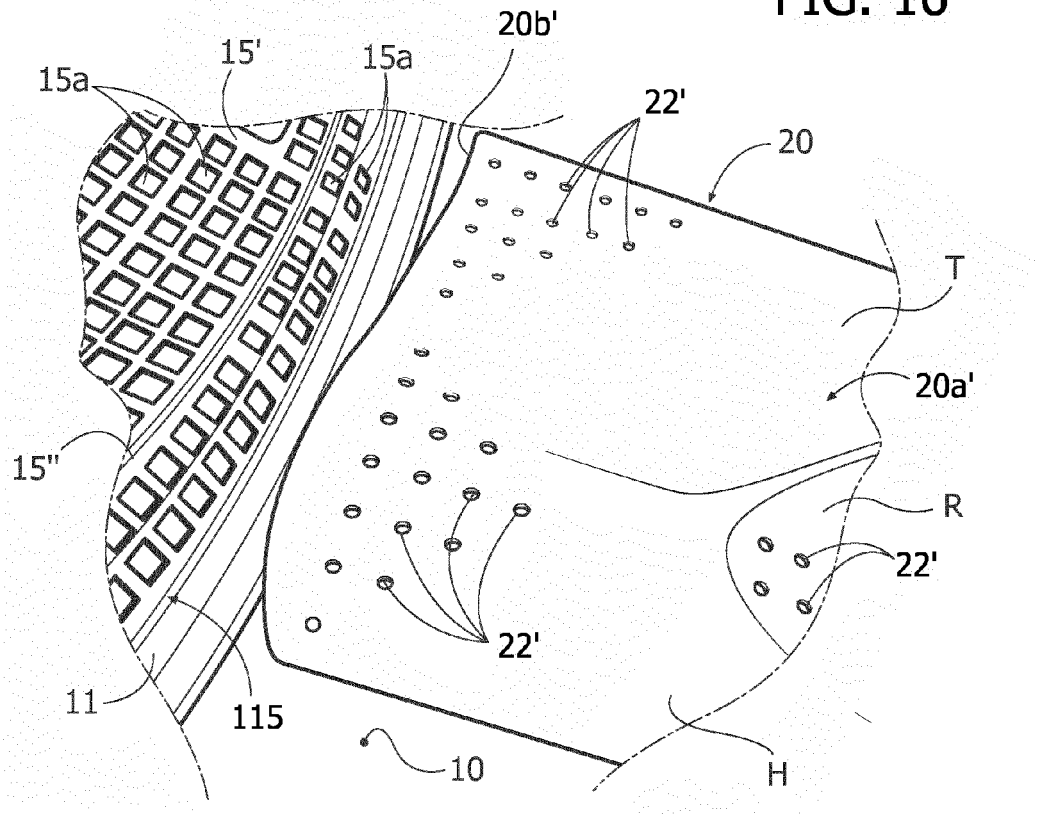
FIG. 16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EUROPEAN SEARCH REPORT

Application Number
EP 12 19 6670

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D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	14 March 2013	Jezierski, Krzysztof

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