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(54) **LAUNDRY DRYER**
WÄSCHETROCKNER
SECHE-LINGE

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Description

Technical field

[0001] The present invention relates, in general, to a laundry dryer. In particular, the present invention relates to a rotary-drum laundry dryer provided with a transportation device configured to protect the drum against damages that may occur during transportation of the laundry dryer.

Background of the invention

[0002] Laundry dryers typically have a bearing structure or cabinet which generally includes a basement on which a front wall and a rear wall, as well as lateral walls are mounted. In the dryer cabinet, accessible via a door provided on the cabinet front wall, a laundry drum is mounted, rotatable around an axis. Such an axis can be - substantially - horizontal, vertical or tilted. The drum, in operation, is made to rotate in order to cause agitation of the laundry items to be dried, which repeatedly tumble with the drum while being invested by a drying air flow.

[0003] The drying air flow is generated by an air generator, which includes a circuit for conveying a flow of drying air, such circuit includes a duct along which a fan propels the air into the drum, after the air itself has been dried and heated. The dried and hot air traverses the inside of the drum and is saturated with the moisture transferred by the laundry items contained therein, which items are thus progressively dried. The drying air is warmed by means of an electrical heater or using a heat pump system. Drying air is dried after having passed through the drum by an air moisture condenser that may be embodied as an air-air heat exchanger wherein an amount of cooling air provided for cooling a heat exchanger receiving moist air exiting the drum, or by a refrigerant evaporator of a heat pump system.

[0004] The hot air is generally introduced into the drum through the back of the same and the moist air exits from the drum through the front thereof, which is provided with a central opening, used - in case of front load machines - even with the aim of loading and unloading the laundry.

[0005] In some prior art dryers, the drum practically consists of a cylindrical wall having open ends, and gaskets of large diameter are provided at the front and rear ends of the cylindrical wall. The laundry is therefore confined between the cylindrical wall, the door of the dryer and the back wall of the cabinet. The drum, where the laundry is stored in order to be dried, is actuated through an electric motor, for example by means of a drive belt, and it is rotatably supported in the front and rear areas thereof by means of pairs of wheels or rollers. This solution has several drawbacks, first of all the wear-and-tear of the large gasket and the continuous contact and friction between the laundry - which rotates - and the back wall of the cabinet - stationary. This movement may damage the laundry or cause entanglement of the latter. In

addition, friction between tumbling laundry and stationary back wall of the cabinet causes energy losses and undesired electrical power consumption to rotate the drum.

[0006] To prevent the rotatable drum consisting of a cylindrical wall having open ends to be damaged during transportation of the laundry dryer, fixing means are provided, typically a pair of wedges made of polystyrene, configured to be interposed between, respectively, a circular front rim and a circular rear rim of the cylindrical wall of the drum and the respective gasket provided at the front and rear rims. Such wedges are installed on the radially inner surfaces of the front and rear rims, reaching such rims from the laundry treating volume defined by the cylindrical drum wall.

[0007] In other known solutions, the drum includes a back wall, which is configured as a separate piece with respect to the peripheral wall, and is rigidly fixed thereto so as to rotate together with the cylindrical drum wall. The drum is rotatably supported at the front part thereof through an abovementioned pair of rollers and at the rear part by a shaft, coaxial with the rotational axis of the drum.

[0008] With reference to this latter type of drum, during transportation of the laundry dryer and following a violent impact - it could happen that the rollers rotatably supporting the drum at the front part thereof create depressions in the outer peripheral wall of the drum, specifically at the supporting area of the rollers. It results that, an annoying and repetitive noise is generated during operation of the laundry dryer.

[0009] To avoid the above mentioned drawback, one or more wedges are provided to maintain the drum frontally lifted, and thus not into contact with the supporting rollers, during transportation of the laundry dryer. Once the laundry dryer is positioned in the place of use, the wedges are removed, whereby the drum is brought into contact with the rollers.

[0010] Once removed from the laundry dryer, the wedges can be lost or disposed. Consequently, in case of subsequent movement of the laundry dryer, for example during a relocation, the user has to find similar wedge elements in order to raise drum.

[0011] To overcome the above mentioned drawback, unmovable means for locking/unlocking the drum has been provided.

[0012] WO 2013/064568 discloses a laundry dryer comprising a body, a drum housed within the body, a plurality of rollers supporting the drum, and a transportation safety member, which prevents the drum from being damaged during transportation. The transportation safety member comprises a screw-shaped shaft extending from the body of the laundry dryer towards the drum, a resting member which is located at the shaft end facing the drum, and a head which is located at the lower end of the shaft. The transportation safety member has a first position wherein the resting member does not contact the drum and a second position wherein the resting member contacts the drum by being moved and provides the contact of the drum with the rollers to be broken.

[0013] The above technical solution presents some drawbacks. First, the transportation safety member is difficult to access for the user. In fact, being the transportation safety member operable from the lower side of the laundry dryer basement, if the user wants to activate the safety member, he has to overturn the laundry dryer on a side to make the lower basement side accessible. Secondly, being the transportation safety member a device of the piston type, and being the drum provided with a proper weight, during the operative position wherein the resting member contacts the drum, a depression may be created by the resting member on the drum. As a result, imbalances may be generated in the drum during use. Moreover, in case the depression is created at the drum area where the sliding contact with the rollers occurs, this might introduce annoying and repetitive noise.

[0014] CN2934310 discloses a washing cylinder fixed device. The fixed device comprises a machine casing and a washing cylinder, wherein the washing cylinder is hanged in the machine casing. The utility model is characterized in that a frame and a wheel shaft is positioned on the bottom plate of the machine casing, wherein at least two frames and two ends of the wheel shaft are respectively movable arranged on the two frames. A cam is arranged on the wheel shaft, and one end is extended outside the machine casing and fixed with a rocking handle. A keyway holder and lever are respectively arranged on the bottom plate of the machine casing positioned at two sides of the frame. The middle of the lever is movable articulated in the keyway holder. The adjacent ends of one pair of the levers corresponding to the cam are all positioned below the cam and a tension spring is arranged between the bottom plate of the machine casing and lever. The two ends of the tension spring are respectively connected with non adjacent ends of the corresponding levers and bottom plate of the machine casing. By using the fixed device, the components of the washing cylinder, machine casing and hanging piece of the washing machine are not easily damaged, which can reduce the failure rate of the washing machine and extend the service life of the washing machine. The utility model is suitable for the fixation of the washing cylinder in the process of mobility and transportation of the large-scale washing machine like the industrial washing machines etc.

[0015] DE102012215044 describes an equipment furnished with an oscillatory barrel unit for spinning. The barrel unit is suspended from resilient supports or is supported on them, where a resilient element is locked by a device for the transport-safe fixation of the barrel unit against a non-oscillatory element. The device is electrically controllable. The oscillatory element has a structure, which forms a positive-locking with an electrically indirectly moving element on the non-oscillatory element in electrically ineffective state. The positive locking is canceled in the electrically active state.

[0016] EP2388366 discloses a drum type washing machine comprising a cabinet, a tub arranged inside the

cabinet and a drum rotatably mounted in the tub, and a plurality of inflatable bags disposed between the cabinet and the tub for fixing the tub in a predetermined position during transportation.

[0017] DE3739036 discloses a domestic electrical appliance having a cupboard-like outer housing. Removable securing devices for fixing loose parts or parts connected in an oscillating manner to the housing during the transport of the domestic appliance are at least temporarily no longer needed after the installation of the domestic appliance. To prevent such securing devices, needed again for renewed transport, from being lost or mislaid, it is proposed to mount on the inner face of the front-wall flap receiving devices which at least partially reproduce essential features of the outer contour of the securing devices.

Summary of the invention

[0018] The main object of the invention is to provide a laundry dryer with a transportation device configured to prevent the drum from being damaged during transportation of the dryer.

[0019] Another object of the invention is to provide a laundry dryer with a transportation device which is easily accessible by the user in order to operate it between an enabled position and a disabled position.

[0020] A further object of the invention is to provide a laundry dryer with a transportation device wherein the transportation device can be applicable to different types of laundry dryers, either supported by a shaft or by rollers or by a combination of the two.

[0021] Furthermore, another object of the invention is to provide a laundry dryer with a transportation device which can be manufactured at competitive costs and easily installed in the laundry dryer.

[0022] The present invention relates to a laundry dryer according to independent claim 1.

[0023] It should be observed that, in the present description and in the attached claims, when relative terms such as "front", "back", "rear", "lateral", "top", "bottom", "ceiling", "lower", etc. are used, they refer to the normal operational position of the laundry dryer when in use, e.g. located on a floor which usually is (substantially) horizontal. The location of a door of the laundry dryer, generally coupled to a front wall of the cabinet in order to access the drum, defines the "front" of the laundry dryer itself. Given the horizontal plane on which the laundry dryer is located, "top" and "bottom" - as their normal common meaning - refer to the position of an object along a vertical axis perpendicular to the horizontal plane.

[0024] In the present description and in the attached claims, the term "strength" refers to the ability of a material to withstand an applied load without deforming. A load applied to a material induces internal forces within the material called stresses when those forces are expressed on a unit basis. The stresses acting on the material cause deformation of the material in various man-

ners. Deformation of the material is called strain when those deformations are placed on a unit basis. The applied loads may be axial (tensile or compressive), or shear.

[0025] Due to the fact that the transportation device - when in its enabled position - acts on a region of the drum having a higher strength, a deformation of the drum is prevented during transportation of the laundry dryer and/or in case of fall of the laundry dryer that may accidentally happen during its move.

[0026] According to the above mentioned aspect, the laundry dryer of the invention may include, alternatively or in combination, one or more of the following characteristics.

[0027] Preferably, the cabinet comprises a lower portion, a ceiling portion and a plurality of walls arranged around the drum between the lower portion and the ceiling portion and the transportation device is arranged on one of said walls. This advantageously allows the transportation device to be accessible from the outer part of the laundry dryer, by keeping the dryer in its normal operational position. In a preferred embodiment, the transportation device is arranged on a rear wall of the cabinet. Alternatively, the transportation device is arranged on a front wall of the cabinet.

[0028] In a preferred embodiment, the drum is supported by one or more idle rollers and the transportation device, when is placed in said enabled position, disengages the drum from said one or more rollers, while in said disabled position, the transportation device allows the drum to engage said one or more rollers.

[0029] In an alternative embodiment, the drum has a cylindrical mantle with a front open end for allowing loading/unloading of laundry to be dried and a rear end which is closed by a flange or back wall attached to the mantle for rotating therewith, a shaft portion journaled on a bearing portion being provided at the flange wall, the bearing portion allowing said shaft to rotate around an axis forming an angle with the drum rotational axis when said transportation device is placed in the enabled position. This advantageously avoids the shaft to be damaged when the transportation device is in its enabled position.

[0030] Advantageously, the drum is supported by one or more idle rollers which engage the drum in the second region having a lower strength than the strength of the the first region.

[0031] Preferably, the transportation device comprises at least one pin-cam assembly comprising a pin member and a cam member associated to said pin member such that a rotation of the pin member about its longitudinal axis causes the cam member to rotate about said longitudinal axis. In a preferred embodiment, the transportation device comprises a pair of pin-cam assemblies, each being provided in proximity of a respective idle roller which engages the drum in the second region.

[0032] Preferably, the pin member comprises a head portion projecting towards the outside of the cabinet and a tail portion projecting towards the inside of the cabinet,

the cam member being associated to the tail portion of the pin member.

[0033] Advantageously, the longitudinal axis of the pin member extends parallel to the rotational axis of the drum.

[0034] Preferably, the cam member comprises an opening for housing the tail portion of the pin member and a support portion, which contacts the first region of the drum when the transportation device is placed in the enabled position.

[0035] Preferably, the support portion of the cam member is knurled. This advantageously increases the grip between the cam member and the drum in the enabled position of the transportation device.

[0036] Preferably, the cam member comprises a raiser provided at the support portion. In a preferred embodiment, the raiser comprises a plurality of flaps, configured to match with the support portion. Advantageously, this further increases the grip between the cam member and the drum in the enabled position of the transportation device.

[0037] In an advantageous embodiment, the cam member further comprises a detent configured to cooperate with a hook provided within the dryer cabinet to avoid the transportation device to be accidentally disabled. Preferably, the hook is fixed to an inner surface of the rear wall of the cabinet. In an alternative embodiment, the hook is fixed to an inner surface of the front wall of the cabinet.

[0038] Advantageously, a stopper is also formed in the inner surface of the rear wall of the cabinet. The stopper is advantageously provided for limiting the rotation of the cam member about its longitudinal axis during the operation of the transportation device between the enabled position and the disable position.

[0039] In a preferred embodiment, the drum is supported by a plurality of idle rollers and the transportation device comprises a plurality of pin-cam assemblies, each provided in proximity of one of the plurality of idle rollers.

Brief description of the drawings

[0040] Further advantages of the present invention will be better understood with nonlimiting reference to the accompanying drawings, in which:

- Figure 1 is a perspective view of a laundry dryer realized according to the present invention;
- Figure 2 is a perspective view of the laundry dryer of Figure 1 with an element of the casing removed for showing some internal components;
- Figure 3 is a perspective exploded view of a portion of a laundry dryer of the invention;
- Figure 4 is a perspective exploded view of a second embodiment of a portion of the dryer of the invention;

- Figure 5 is a partial perspective view of some components of the embodiment of Figure 4, in the assembled condition;
- Figure 6 is a perspective view of a pin-cam assembly of the transportation device of the laundry dryer of the present invention;
- Figure 7 is a perspective view of a component of the transportation device of Figure 10; and
- Figure 8 is a front view of the rear wall of the laundry dryer of the invention, as seen from outside the laundry dryer, which shows the transportation device in its enabled position;
- Figure 9 is a partial front view of the rear wall of the laundry dryer of the invention, as seen from inside the laundry dryer, which shows the transportation device in its enabled position;
- Figure 10 is a view similar to that of Figure 9, with the drum removed for showing some components of the transportation device;
- Figure 11 is a view similar to that of Figure 9, which shows the transportation device of the laundry dryer of the invention in its disabled position;
- Figure 12 is a cross-sectional view taken along line D-D of Figure 9; and
- Figure 13 is a flow chart showing the steps of a method of disabling a transportation device provided to engage a drum of a laundry dryer according to the present invention.

Detailed description of the invention

[0041] With reference to Figures 1 and 2, a laundry dryer realized according to the present invention is globally indicated with 1.

[0042] Laundry dryer 1 comprises an outer box casing or cabinet 2, preferably but not necessarily parallelepiped-shaped, and a drying chamber, such as a drum 3, for example having the shape of a hollow cylinder, for housing the laundry and in general the clothes and garments to be dried. The drum 3 is preferably rotatably fixed to the cabinet 2. Access to the drum 3 is achieved for example via a door 4, preferably hinged to the cabinet 2, which can open and close an opening 4a realized on the cabinet 2 itself.

[0043] More in detail, the cabinet 2 generally includes a plurality of walls, i.e. a front wall 20, a rear wall 21 and two sidewalls 25, all mounted between a lower portion or basement 24 and a ceiling or top portion 26. Preferably, the basement 24 is molded via an injection molding process. Preferably, on the front wall 20, the door 4 is hinged

so as to access the drum 3. The cabinet 2, with its walls, defines the volume of the laundry dryer 1. The basement 24 rests on a floor and its vertical distance from the floor may be advantageously adjusted through regulating feet 46 provided on the lower surface of the basement 24 facing the floor.

[0044] The laundry dryer 1, and in particular the basement 24, defines an horizontal plane (X, Y) which is substantial the plane of the ground on which the laundry dryer 1 is positioned, thus it is considered to be substantially horizontal, and a vertical direction Z perpendicular to the plane (X, Y).

[0045] Inside the casing 2, the laundry dryer 1 also preferably comprises an electrically-powered motor assembly 5 structured for driving into rotation, on command, the drum 3 about its axis inside the cabinet 2. The door 4 and the electrically-powered motor assembly 5 are common parts in the technical field and are considered to be known; therefore they will not be described in detail.

[0046] Inside the casing 2, the laundry dryer 1 also preferably comprises an open-circuit or closed-circuit, hot-air generator 6, which is structured to circulate through the drum 3 a stream of hot air having a low moisture level, and which flows over and dries the laundry located inside the drum 3. The hot-air generator 6 is a common part in the technical field and is considered to be known; therefore, it will not be described in detail.

[0047] Further, the laundry dryer 1 may include a control unit (not shown) which controls both the electrically-powered motor assembly 5 and the hot-air generator 6 of the laundry dryer 1 to perform, on command, one of the user-selectable drying cycles preferably stored in the same central control unit. The programs as well as other parameters of the laundry dryer 1, or alarm and warning functions can be set and/or visualized in a control panel 11, preferably realized in a top portion of the laundry dryer 1, such as above the door 4.

[0048] With reference to Figures 3 and 4, the drum 3 includes a mantle, having preferably a substantial cylindrical, tubular body 3c, which is preferably made of metal material and is arranged inside the cabinet 2 and is apt to rotate around a general rotational axis R which can be horizontal, i.e. parallel to the (X, Y) plane, or tilted with respect to the latter. The cylindrical mantle 3c defines a first end 3a and a second end 3b and the drum 3 is so arranged that the first end 3a (including a circular front rim 3f) of the mantle 3c is faced to the laundry loading/unloading opening 4a realized on the front wall 20 of the cabinet 2 and the door 4, while the second end 3b has also a rim 3e which shows preferably a circular shape.

[0049] The second or rear end 3b of the drum 3 (including the rim 3e) is closed by a back or flange wall 8. Preferably, the drum back wall 8 is faced to the rear wall 21 of the cabinet 2 and is permanently and rigidly coupled to the second end 3b of the mantle 3c of the drum 3 so as to close said second end 3b. The back wall 8 forms, together with the mantle 3c, a substantially cylindrical, cup-shaped rigid container structured for housing the

laundry to be dried. Preferably, the drum back wall 8 is coupled to the circular rim 3e of the second end 3b of the drum mantle 3c.

[0050] In an alternative embodiment, the rotatable drum 3 is formed by two bodies joined together, one of this said two bodies being the mantle 3c and the other of said two bodies being the back wall 8 which is permanently fixed to the rear end 3b of the mantle 3c and rotates with the latter when the drum 3 rotates.

[0051] Preferably, the back wall 8 is furthermore suitably perforated so as to allow a stream of drying air to flow through the back wall 8 of the drum 3.

[0052] The perforated portion of the back wall 8 is located approximately at the center of the back wall 8 so as to be substantially coaxial to the longitudinal reference axis R of the rotatable drum 3, and is preferably substantially circular in shape. The remaining portion of the back wall 8, including an outer rim 8a thereof, is not perforated. Perforations in the back wall 8 will be called, in the following, vents 9.

[0053] The drum 3 further comprises a first region 33 having a first strength and a second region 34 having a second strength which is lower than the first strength, the function of which will be clearer in the following of the present detailed description.

[0054] In the embodiment illustrated, the first region 33 of the drum 3 is the one formed at the coupling zone between the circular rim 3e of the second end 3b of the mantle 3c and the back wall 8 of the drum 3, whereas the second region 34 of the drum 3 corresponds to other parts of the drum 3, for example the mantle 3a, the mantle first end 3a or the mantle second end 3b. Preferably, the first region 33 has a thickness of about 2.2 mm, whereas the second region 34 has a thickness of about 0,6 mm.

[0055] In an alternative embodiment, the first region 33 having a higher strength consists of a plurality of grooves (not shown), preferably circular grooves, formed at an outer surface of the drum 3.

[0056] The front rim 3f of the drum 3, for example the circular front rim of the substantially cylindrical mantle 3c, is furthermore coupled in preferably substantially airtight and axially rotating manner to the front wall 20 of the cabinet 2, preferably with the interposition of a first circular sealing gasket (not shown).

[0057] The front wall 20 is preferably coupled to the basement 24 and includes a front bulkhead (not shown), preferably made of plastic material, where the opening 4a of the door 4 is realized and to which the drum 3 is coupled for rotation. The front bulkhead is preferably covered by a panel extending around the opening 4a and defining the external front surface of the front wall 20 of the cabinet 2.

[0058] The rear wall 21 of the cabinet 21 includes a supporting panel or rear bulkhead 210. The back wall 8 of the drum 3 substantially faces the rear bulkhead 210, which is preferably made of plastic material, and is coupled in preferably substantially airtight and axially rotating manner to such rear bulkhead 210 with the interposition

of a second circular sealing gasket 32. Front circular sealing gasket (not shown) and rear circular sealing gasket 32 are preferably substantially coaxial to the longitudinal axis R of the drum 3.

[0059] A power cord (not shown in the drawings), provided with a plug, exits from the rear wall 21 of the cabinet 2 through a passage 212 formed in the rear bulkhead 210 and serves for powering the laundry dryer 1 when connected to power mains.

[0060] In the preferred embodiment shown in Figures 3 and 4, the rear wall 21 of the cabinet 2 mainly includes two elements, i.e. the rear bulkhead 210 and a cover 213. In particular, the rear bulkhead 210 includes a first surface 210a facing the interior of the cabinet 2, such as the back wall 8 of the drum 3, and a second surface 210b, facing the exterior or the outside of the cabinet 2. Moreover, the rear bulkhead 210 includes a through drum aperture 214 located in front of the back wall 8 of the drum 3, such that from thus drum aperture 214 the back wall 8 is visible, and a fan housing 215 for housing an impeller (not depicted) of a fan 12 (see Figure 2) of the drying process air circuit. The cover 213 is coupled to the rear bulkhead 210 in order to close the aperture 214 and the fan housing 215.

[0061] In a different embodiment, not depicted in the drawings, the cover 213 is formed as two separate pieces covering the drum aperture 214 and the fan housing 215, respectively. In a further different embodiment, also not depicted in the drawings, the rear bulkhead 210 includes a circular central bulge for closing the drum aperture and a fan housing closed by a lid.

[0062] In the embodiment of Figure 3, the drum 3 is preferably structured for being rotatably supported by a drum support assembly, including a plurality of idle rollers 10a, 10b (see Figure 2), which are arranged - off-axis with respect to the general rotational axis R of the drum 3 - approximately at the two axial ends 3a, 3b, with their rotation axis substantially parallel to the general rotational axis R of the drum 3, so as to allow the tubular body of the drum 3 to rotate about the longitudinal reference or general rotational axis R of the drum 3 inside the cabinet 2.

[0063] Preferably, two of such rollers 10a are located at the front end 3a of the drum 3 and two other of such rollers 10b are located at the back end 3b of the drum 3, which forms the second region of the drum 3. Advantageously, rollers 10a, 10b comprise a plastic, i.e. polymeric, material.

[0064] The two rollers (or more) 10b located at the rear end 3b of the drum 3 are fixed to the rear bulkhead 210, for example they are attached via bosses or pins or brackets 216 to the rear bulkhead 210 and are fixed therein by means of screws or snap-fitting connections (not depicted in the drawings). The bosses or brackets 216 are preferably formed as a single unitary piece with the rear bulkhead 210. The two rollers (or more) 10a located at the front end 3a of the drum 3 may be either connected to the front bulkhead or they might be connected to the

basement 24.

[0065] Figures 4 and 5 shows a variant of the embodiment of Figure 3. The bulkhead 210 is analogous to the embodiment of Figure 3 with the exception of the drum support assembly for the drum 3, as detailed below.

[0066] In this variant of Figure 4, the drum 3 is supported in rotation by a drum support assembly including two rollers (or more) 10a located at the front end 3a of the drum 3 and a shaft 41 provided at the back wall 8 of the drum 3. The shaft 41 is preferably coaxial with the general rotational axis R of the drum 3 and is supported in turn around the rotational axis R at the rear bulkhead 210. Moreover, the shaft 41 is journaled on a bearing portion 43 preferably provided at the rear bulkhead 210. Thus the rear bulkhead 210 includes a portion of the drum support assembly including the bearing portion 43, e.g. a plurality of ribs 218, preferably realized integral to the rear bulkhead 210.

[0067] The bearing portion 43 is provided for allowing the drum shaft 41 to rotate around an axis S forming an angle α with the rotation axis R of the drum 3.

[0068] With reference to Figures 3 to 12, the laundry dryer 1 further comprises a transportation device 40 configured to be operated for engaging/disengaging the drum 3 to/from the drum support assembly. Disengaging the drum from the drum support assembly is particularly useful and advantageous during transport of the laundry dryer 1, for example from the place of manufacturing to the store or the place of use.

[0069] In the preferred embodiments shown in the Figures, the transportation device 40 comprises a pair of pin-cam assemblies 410-420, which are arranged - preferably off-axis with respect to the general rotational axis R of the drum 3 - at the rear wall 21 of the cabinet 2. More specifically, the pair of pin-cam assemblies 410-420 are mounted in a rotatable manner on the rear bulkhead 210 of the cabinet 2. A pair of pass-through openings 213 is thus formed in the rear bulkhead 210 for housing a respective pin-cam assembly 410-420 of the transportation device 40. It is understood that any suitable number of pin-cam assemblies can be provided.

[0070] Each pin-cam assembly of the transportation device 40 comprises a pin member 410 rotatable about a longitudinal axis which extends parallel to the drum rotational axis R, and a cam member 420 associated to the pin member 410 such that a rotation of the pin member 410 about its longitudinal axis causes the cam member 420 to rotate about the pin member longitudinal axis.

[0071] More specifically, the pin member 410 comprises a head portion 411, a body portion 412, and a tail portion 413. The body portion 412 is configured to be housed within the pass-through opening 213 of the rear bulkhead 210; the head portion 411, in the assembled condition of the laundry dryer 1, partially projects from the rear bulkhead second surface 210b, facing the exterior or the outside of the cabinet 2; and the tail portion 414 is configured to be coupled with the cam member 420 in such a way, in the assembled condition of the

laundry dryer 1, the cam member 420 projects towards the drum from the rear bulkhead first surface 210a facing the interior of the cabinet 2. In this way, the pin member 410 can be rotated relative to the rear bulkhead 210 acting from the outer side of the laundry dryer.

[0072] A plurality of circular grooves 414 are preferably formed in an outer surface of the head portion 411 of the pin member 410, in order to improve the coupling between the pin member 410 and the pass-through opening 213 of the rear bulkhead 210 by reducing friction. The head portion 411 further comprises a lug 415, preferably L-shaped, provided for giving a reference of the pin-member rotational position relative to the rear bulkhead 210. In this regard, icons 230, 231 may be provided on the rear bulkhead second surface 210b, facing the exterior or the outside of the cabinet 2, indicating the enabled/disabled status of the transportation device when the lug 415 is placed in proximity of such icons. Preferably, and with reference to Figure 12, the head portion 411 of the pin member 410 is hollow and presents a seat 417 for allowing the user to insert an Allen key or similar means for manually disabling/enabling the transportation device 40.

[0073] A plurality of longitudinal flexible hook elements 416 preferably project from the body portion 412 of the pin member 410. These flexible hook elements 416 facilitate mounting operations of the cam member 420 on the pin member 410 and prevent accidental release of such coupling.

[0074] The cam member 420 comprises a body 421, which is preferably substantially elliptically shaped. A hub 422 configured to house the tail portion 413 of the pin member 410 is provided in the body 421 and ribs 423 departing from the hub 422 are provided for reinforcing the body structure. A support portion 424 is provided on the cam member 420 outer edge and it is suitably configured to contact the drum 3 when the transportation device 40 is placed in the enabled position. More particularly, the support portion 424 of the cam member 420 is configured to contact the higher strength first region 33 of the drum 3, preferably the one formed at the coupling zone between the circular rim 3e of the second end 3b of the mantle 3c and the back wall 8 of the drum 3.

[0075] The support portion 424 of the cam member 420 is preferably knurled, and the cam member 420 further comprises a raiser 425. A plurality of flaps 426 is preferably formed in the raiser 425, each flap 426 being configured to match with the knurled support portion 424 in order to advantageously improve the grip between the cam member 420 and the drum 3 when the transportation device 40 is in its enabled position.

[0076] A detent 427 may extend upwardly from the raiser 425 and may be configured to cooperate with a hook 219 provided in the rear bulkhead first surface 210a facing the interior of the cabinet 2 in order to aid to maintain the transportation device in the enabled position thereof in case of fall of the laundry dryer 1.

[0077] In the embodiment illustrated, only one hook

219 is provided, but it is to be understood that a pair of hooks 219 can be provided, one for each pin-cam assembly of the transportation device 40.

[0078] Advantageously, and with reference to Figure 11, a stopper 220 is also formed in a cavity 221 provided in the rear bulkhead first surface 210a facing the interior of the cabinet 2, in order to stop the rotation of each cam member 420 during operation of the transportation device 40 between the enabled position and the disable position.

[0079] Figures 9-10 and 11 show respectively the enabled position and the disabled position of the transportation device 40 for a laundry dryer 1 provided with a drum support assembly of the type shown in Figure 3, i.e. comprising two (or more) idle rollers 10a located at the front end 3a of the drum 3 and two (or more) idle rollers 10b located at the back end 3b of the drum 3.

[0080] In the engaged position, shown in Figures 9 and 10, the support portion 425 of each cam member 420 contacts with a respective portion of the first region 3e of the drum 3 thus raising and separating the drum 3 from the contact with the idle rollers 10a, 10b which support the drum 3 during rotation about its rotational axis R. Moreover, if provided, the detent 427 of a cam member 420 engages the hook 219 provided in the rear bulkhead first surface 210a, thereby blocking the cam member 420 in the engaged position.

[0081] Conversely, in the disabled position, shown in Figure 11, the support portion 425 of each cam member 420 is not into contact with a respective portion of the first region 3e of the drum 3 and the drum 3 is rotatably supported by the idle rollers 10a, 10b. Moreover, if provided, the detent 427 of a cam member 420 is disengaged from the hook 219 provided in the rear bulkhead first surface 210a and each cam member 420 abuts against the respective stopper 221.

[0082] For a laundry dryer 1 provided with a drum support assembled of the type shown in Figure 4, i.e. comprising two (or more) idle rollers 10a located at the front end 3a of the drum 3 and a shaft 41 journaled on a bearing portion 43, in the enabled position of the transportation device 40, each cam member 420 contacts with a respective portion of the first region 3e of the drum 3 thus separating the drum 3 from the contact with the idle rollers 10a which support the drum 3 during rotation about its rotational axis R. Moreover, due to the bearing portion 43, the drum shaft 41 rotates around the axis S forming an angle α with the rotation axis R of the drum 3. If provided, the detent 427 of a cam member 420 engages the hook 219 provided in the rear bulkhead first surface 210a.

[0083] Conversely, in the disabled position, each cam member 420 is not into contact with a respective portion of the first region 3e of the drum 3 and the drum 3 is rotatably supported by the idle rollers 10a. Moreover, if provided, the detent 427 of a cam member 420 is disengaged from the hook 219 provided in the rear bulkhead first surface 210a and each cam member 420 abuts against the respective stopper 221.

[0084] With reference now to Figure 13, it is described the method of disabling the transportation device 40 of a laundry dryer 1 described above with reference to Figures 1 to 12.

5 **[0085]** The method starts at step S0, where the control unit of the laundry dryer 1 is operated to set-up to zero a counter of the disabling attempts N.

[0086] From step S0, the method proceeds to step S1, where it is checked whether the transportation device 40 is enabled, i.e. whether the cam member(s) 420 engage the drum 3.

10 **[0087]** Preferably, step S1 comprises checking one or more parameters of the electrically-powered motor assembly 5 driving the drum 3. The above one or more parameters comprise electrical parameters, such as current, voltage, power, and frequency of the electrically-powered motor assembly 5 and/or mechanical parameters, such as the rotational speed and the rotor position of the electrically-powered motor assembly 5.

15 **[0088]** If the transportation device 40 is enabled (YES), the method proceeds to step S2, where a procedure for disabling the transportation device 40 is performed by the control unit. In particular, the disabling procedure includes rotating the drum 3 to cause the cam member(s) to rotate thereby disengaging the drum 3. Following disengagement, the drum 3 comes into contact with the drum supporting assembly, e.g. the idle rollers 10a, 10b.

20 **[0089]** The above disabling procedure can be a dedicated procedure, which is carried out before the start of the drying cycle of the laundry dryer 1. Alternatively, the disabling procedure can be an initial phase of the drying cycle, during which the drum 3 is operated at a different rotational speed, acceleration and/or direction from those provided for carrying out the drying cycle. Preferably, the drum 3 is operated at a rotational speed lower than that or those used during the drying cycle.

25 **[0090]** In a preferred embodiment, from step S2 the method proceeds to step S3, similar to step S1, where it is further checked whether the transportation device 40 is enabled.

30 **[0091]** If the transportation device 40 is not enabled (NO), the method proceeds to step S4, where the drying cycle is started or continued, based on a dedicated disabling procedure is provided or not.

35 **[0092]** If the transportation device 40 is enabled (YES), the method proceeds to step S5, where the counter is increased by one unit ($N = N+1$), and to step S6, where it is checked if the number N of disabling attempts has reached a threshold value N_{th} .

40 **[0093]** If the number N of disabling attempts has not reached a threshold value N_{th} (NO), the method returns to step S2, otherwise (YES) the method proceeds to step S9 passing through steps S7 and S8, which will be described in detail below.

45 **[0094]** In step S9 the control unit sends to the user an alarm signal indicating that the transportation device is enabled and/or a signal requiring a manual disabling of the transportation device 40, and then the method ends.

The user can then disable the transportation device 40, for example by manually rotating the pin-cam assembly with the help of an Allen key or the like.

[0095] The alarm signal can be one of a visual signal, an audio signal, a tactile signal or a combination thereof.

[0096] With reference back to step S1, if the transportation device 40 is not enabled (NO), or, as cited above, if in step S6 the number N of disabling attempts has reached a threshold value N_{th} (YES), the method skips the disabling procedure in step S7 and proceeds to step S8, where the state of the counter is checked and if the number N of attempts is found to be zero (YES), the method proceeds to step S4, otherwise (NO) the method proceeds to step S9 which has been described above.

[0097] In a variant of the method of the invention, in order to determine if the transportation device 40 is enabled, steps S1 and S3 comprise checking if an alarm signal has been sent to the user. In a further variant of the method, steps S1 and S3 comprise checking if the transportation device 40 has been manually disabled by the user.

[0098] Although a preferred embodiment has been shown and described, it would be appreciated by those skilled in the art that changes can be made in this embodiment without departing from the principles of the invention whose scope is defined by the appended claims.

Claims

1. A laundry dryer (1) comprising:

- a cabinet (2),
- a drum (3) rotatably accommodated within said cabinet (2);
- a transportation device (40) associated to the cabinet (2) and configured for being movable between an enabled position, where the transportation device (40) engages the drum (3) and a disabled position, where the transportation device (40) does not engage the drum (3);

characterized in that

the drum (3) comprises a first region (33, 3e) having a first strength and a second region (34, 3a, 3b, 3c) having a second strength which is lower than the first strength, whereby the term strength refers to the ability of a material to withstand an applied load without deforming, and said transportation device (40), when placed in said enabled position, engages a radially outer portion of the first region (33, 3e) of the drum (3) so that a deformation of the drum (3) is prevented during transportation of the laundry dryer (1) and/or in case of fall of the laundry dryer (1).

2. The laundry dryer (1) according to claim 1, wherein the cabinet (2) comprises a lower portion (24), a ceiling portion (26) and a plurality of walls (20, 21, 25) arranged around the drum (3) between the lower portion (24) and the ceiling portion (26), wherein the transportation device (40) is arranged on one of said walls (20, 21), so as to be accessible from an outer part of the laundry dryer (1).
3. The laundry dryer (1) according to claim 1 or 2, wherein the drum (3) is supported by one or more idle rollers (10a, 10b) and the transportation device (40), when is placed in said enabled position, disengages the drum (3) from said one or more idle rollers (10a, 10b) while in said disabled position, the transportation device (40) allows the drum (3) to engage said one or more idle rollers (10a, 10b).
4. The laundry dryer (1) according to any preceding claim, wherein the drum (3) has a cylindrical mantle (3c) with a front open end (3a) for allowing loading/unloading of laundry to be dried and a rear end (3b) which is closed by a back wall (8) attached to the mantle (3c) for rotating therewith, a shaft portion (41), journaled on a bearing portion (43), being provided at the back wall (8), the bearing portion (43) being provided at a cabinet wall facing the back wall (8) and allowing said shaft portion (41) to rotate around an axis (S) forming an angle (α) with the drum rotational axis (R) when said transportation device (40) is placed in the enabled position.
5. The laundry dryer (1) according to any preceding claim, wherein the drum (3) is supported by one or more idle rollers (10a, 10b) which engages the drum (3) in said second region (34, 3a, 3b).
6. The laundry dryer (1) according to any preceding claim, wherein said transportation device (40) comprises at least one pin-cam assembly (410, 420) comprising a pin member (410) and a cam member (420) associated to said pin member (410) such that a rotation of the pin member (420) about its longitudinal axis causes the cam member (420) to rotate about said longitudinal axis.
7. The laundry dryer (1) according to claim 6, wherein said pin member (410) comprises a head portion (411) projecting towards the outside of said cabinet (2) and a tail portion (413) projecting towards the inside of said cabinet (2), the cam member (420) being associated to the tail portion (413) of the pin member (410).
8. The laundry dryer (1) according to claim 6 or 7, wherein the longitudinal axis of the pin member (410) extends parallel to the rotational axis (R) of the drum (3).

9. The laundry dryer (1) according to any claim 6 to 8, wherein the cam member (420) comprises an opening (422) for housing the tail portion (413) of the pin member (410) and a support portion (424) which contacts the first region (33, 3e) of the drum (3) when the transportation device (40) is placed in the enabled position.
10. The laundry dryer (1) according to any preceding claim, wherein the drum (3) is supported by a plurality of idle rollers (10a, 10b) and said transportation device (40) comprises a plurality of pin-cam assemblies (410, 420), each provided in proximity of one of said plurality of idle rollers (10a, 10b).

Patentansprüche

1. Wäschetrockner (1), Folgendes umfassend:

- einen Schrank (2),
- eine Trommel (3), die drehbar in dem Schrank (2) untergebracht ist;
- eine Transportvorrichtung (40), die dem Schrank (2) zugeordnet und dazu ausgelegt ist, zwischen einer aktivierten Stellung, in der die Transportvorrichtung (40) in die Trommel (3) eingreift, und einer deaktivierten Stellung, in der die Transportvorrichtung (40) nicht in die Trommel (3) eingreift, bewegt zu werden;

dadurch gekennzeichnet, dass

die Trommel (3) einen ersten Bereich (33, 3e), der eine erste Festigkeit aufweist, und einen zweiten Bereich (34, 3a, 3b, 3c), der eine zweite Festigkeit aufweist, die geringer als die erste Festigkeit ist, umfasst, wobei sich der Begriff Festigkeit auf die Fähigkeit eines Materials bezieht, einer aufgebrachten Beanspruchung standzuhalten, ohne sich zu verformen, und wobei die Transportvorrichtung (40), wenn sie in die aktivierte Stellung gebracht wird, in einen radialen Außenabschnitt des ersten Bereichs (33, 3e) der Trommel (3) eingreift, sodass eine Verformung der Trommel (3) während des Transports des Wäschetrockners (1) und/oder bei einem Sturz des Wäschetrockners (1) verhindert wird.

2. Wäschetrockner (1) nach Anspruch 1, wobei der Schrank (2) einen unteren Abschnitt (24), einen Deckenabschnitt (26) und mehrere Wände (20, 21, 25), die zwischen dem unteren Abschnitt (24) und dem Deckenabschnitt (26) um die Trommel (3) herum angeordnet sind, umfasst, wobei die Transportvorrichtung (40) an einer der Wände (20, 21) angeordnet ist, um von einem äußeren Teil des Wäschetrock-

ners (1) zugänglich zu sein.

3. Wäschetrockner (1) nach Anspruch 1 oder 2, wobei die Trommel (3) von einer oder mehreren Laufrollen (10a, 10b) getragen wird und die Transportvorrichtung (40), wenn sie in die aktivierte Stellung gebracht wird, die Trommel (3) von der einen oder den mehreren Laufrollen (10a, 10b) trennt, und die Transportvorrichtung (40), wenn sie in die deaktivierte Stellung gebracht wird, zulässt, dass die Trommel (3) in die eine oder mehreren Laufrollen (10a, 10b) eingreift.
4. Wäschetrockner (1) nach einem der vorstehenden Ansprüche, wobei die Trommel (3) einen zylindrischen Mantel (3c) mit einem vorderen offenen Ende (3a) zum Be-/Entladen der zu trocknenden Wäsche und ein hinteres Ende (3b), das durch eine Rückwand (8) verschlossen ist, die am Mantel (3c) befestigt ist, um sich damit zu drehen, aufweist, wobei ein Wellenabschnitt (41), der auf einem Lagerabschnitt (43) gelagert ist, an der Rückwand (8) vorgesehen ist, wobei der Lagerabschnitt (43) an einer der Rückwand (8) zugewandten Schrankwand vorgesehen ist und zulässt, dass sich der Wellenabschnitt (41) um eine Achse (S) dreht, die einen Winkel (α) mit der Trommeldrehachse (R) ausbildet, wenn sich die Transportvorrichtung (40) in der aktivierten Stellung befindet.
5. Wäschetrockner (1) nach einem der vorstehenden Ansprüche, wobei die Trommel (3) von einer oder mehreren Laufrollen (10a, 10b) getragen wird, die in dem zweiten Bereich (34, 3a, 3b) in die Trommel (3) eingreift/eingreifen.
6. Wäschetrockner (1) nach einem der vorstehenden Ansprüche, wobei die Transportvorrichtung (40) mindestens eine Zapfen-Nocken-Anordnung (410, 420) umfasst, die ein Zapfenelement (410) und ein dem Zapfenelement (410) zugeordnetes Nockenelement (420) umfasst, sodass eine Drehung des Zapfenelements (420) um seine Längsachse bewirkt, dass sich das Nockenelement (420) um die Längsachse dreht.
7. Wäschetrockner (1) nach Anspruch 6, wobei das Zapfenelement (410) einen Kopfabschnitt (411), der zur Außenseite des Schanks (2) vorsteht, und einen Endabschnitt (413), der zur Innenseite des Schanks (2) vorsteht, umfasst, wobei das Nockenelement (420) dem Endabschnitt (413) des Zapfenelements (410) zugeordnet ist.
8. Wäschetrockner (1) nach Anspruch 6 oder 7, wobei sich die Längsachse des Zapfenelements (410) parallel zur Drehachse (R) der Trommel (3) erstreckt.
9. Wäschetrockner (1) nach einem der Ansprüche 6

bis 8, wobei das Nockenelement (420) eine Öffnung (422) zur Aufnahme des Endabschnitts (413) des Zapfenelements (410) und einen Trägerabschnitt (424), der den ersten Bereich (33, 3e) der Trommel (3) berührt, wenn die Transportvorrichtung (40) in die aktivierte Stellung gebracht wird, umfasst.

10. Wäschetrockner (1) nach einem der vorstehenden Ansprüche, wobei die Trommel (3) von mehreren Laufrollen (10a, 10b) getragen wird und die Transportvorrichtung (40) mehrere Zapfen-Nocken-Anordnungen (410, 420) umfasst, die jeweils in der Nähe einer der mehreren Laufrollen (10a, 10b) vorgesehen sind.

Revendications

1. Sèche-linge (1) comprenant :

- une caisse (2) ;
- un tambour (3) logé à rotation à l'intérieur de ladite caisse (2) ;
- un dispositif de transport (40) associé à la caisse (2) et conçu pour être déplaçable entre une position active, dans laquelle le dispositif de transport (40) est accouplé au tambour (3), et une position inactive, dans laquelle le dispositif de transport (40) n'est pas accouplé au tambour (3) ;

caractérisé en ce que

le tambour (3) comprend une première région (33, 3e) présentant une première résistance et une seconde région (34, 3a, 3b, 3c) présentant une seconde résistance qui est inférieure à la première résistance, le terme résistance correspondant à la capacité d'un matériau à résister à une charge appliquée sans se déformer, et ledit dispositif de transport (40), lorsqu'il est placé dans ladite position active, s'accouplant à une partie radialement extérieure de la première région (33, 3e) du tambour (3) de façon à empêcher une déformation du tambour (3) lors du transport du sèche-linge (1) et/ou en cas de chute du sèche-linge (1).

2. Sèche-linge (1) selon la revendication 1, dans lequel la caisse (2) comprend une partie inférieure (24), une partie plafond (26) et une pluralité de parois (20, 21, 25) disposées autour du tambour (3) entre la partie inférieure (24) et la partie plafond (26), dans lequel le dispositif de transport (40) est disposé sur l'une desdites parois (20, 21), de façon à être accessible depuis une partie extérieure du sèche-linge (1).
3. Sèche-linge (1) selon la revendication 1 ou 2, dans

lequel le tambour (3) est supporté par un ou plusieurs galets fous (10a, 10b) et le dispositif de transport (40), lorsqu'il est placé dans ladite position active, sépare le tambour (3) desdits un ou plusieurs galets fous (10a, 10b), tandis que dans ladite position inactive, le dispositif de transport (40) permet au tambour (3) d'interagir avec lesdits un ou plusieurs galets fous (10a, 10b).

4. Sèche-linge (1) selon l'une quelconque des revendications précédentes, dans lequel le tambour (3) comporte une enveloppe cylindrique (3c) avec une extrémité avant ouverte (3a) pour permettre le chargement/déchargement de linge à sécher et une extrémité arrière (3b) qui est fermée par une paroi arrière (8) attachée à l'enveloppe (3c) à des fins de rotation avec celle-ci, une partie arbre (41), tourillonnée dans une partie palier (43), étant placée au niveau de la paroi arrière (8), la partie palier (43) étant placée au niveau d'une paroi de caisse faisant face à la paroi arrière (8) et permettant à ladite partie arbre (41) de tourner autour d'un axe (S) formant un angle (α) avec l'axe de rotation du tambour (R) lorsque ledit dispositif de transport (40) est placé dans la position active.

5. Sèche-linge (1) selon l'une quelconque des revendications précédentes, dans lequel le tambour (3) est supporté par un ou plusieurs galets fous (10a, 10b) qui interagissent avec le tambour (3) dans ladite seconde région (34, 3a, 3b).

6. Sèche-linge (1) selon l'une quelconque des revendications précédentes, dans lequel ledit dispositif de transport (40) comprend au moins un ensemble goupille-came (410, 420) comprenant un élément formant goupille (410) et un élément formant came (420) associé audit élément formant goupille (410) de telle sorte qu'une rotation de l'élément formant goupille (420) autour de son axe longitudinal entraîne une rotation de l'élément formant came (420) autour dudit axe longitudinal.

7. Sèche-linge (1) selon la revendication 6, dans lequel ledit élément formant goupille (410) comprend une partie tête (411) faisant saillie vers l'extérieur de ladite caisse (2) et une partie queue (413) faisant saillie vers l'intérieur de ladite caisse (2), l'élément formant came (420) étant associé à la partie queue (413) de l'élément formant goupille (410).

8. Sèche-linge (1) selon la revendication 6 ou 7, dans lequel l'axe longitudinal de l'élément formant goupille (410) s'étend parallèlement à l'axe de rotation (R) du tambour (3).

9. Sèche-linge (1) selon l'une quelconque des revendications 6 à 8, dans lequel l'élément formant came

(420) comprend une ouverture (422) destinée à recevoir la partie queue (413) de l'élément formant goupille (410) et une partie de support (424) qui vient en contact avec la première région (33, 3e) du tambour (3) lorsque le dispositif de transport (40) est placé dans la position active. 5

10. Sèche-linge (1) selon l'une quelconque des revendications précédentes, dans lequel le tambour (3) est supporté par une pluralité de galets fous (10a, 10b) et ledit dispositif de transport (40) comprend une pluralité d'ensembles goupille-came (410, 420), placés chacun à proximité de l'un de ladite pluralité de galets fous (10a, 10b). 10

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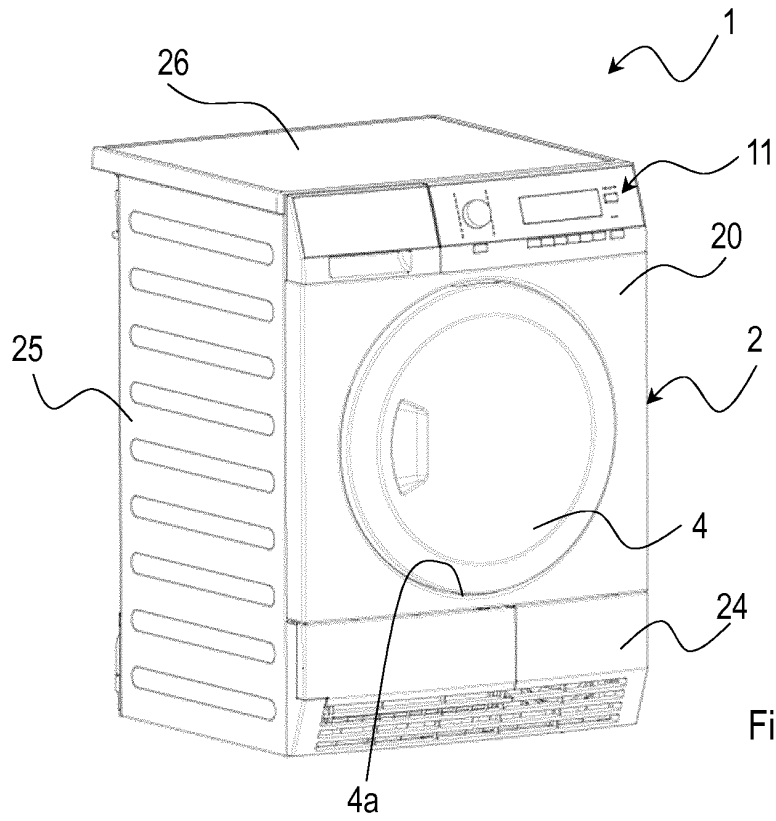


Fig. 1

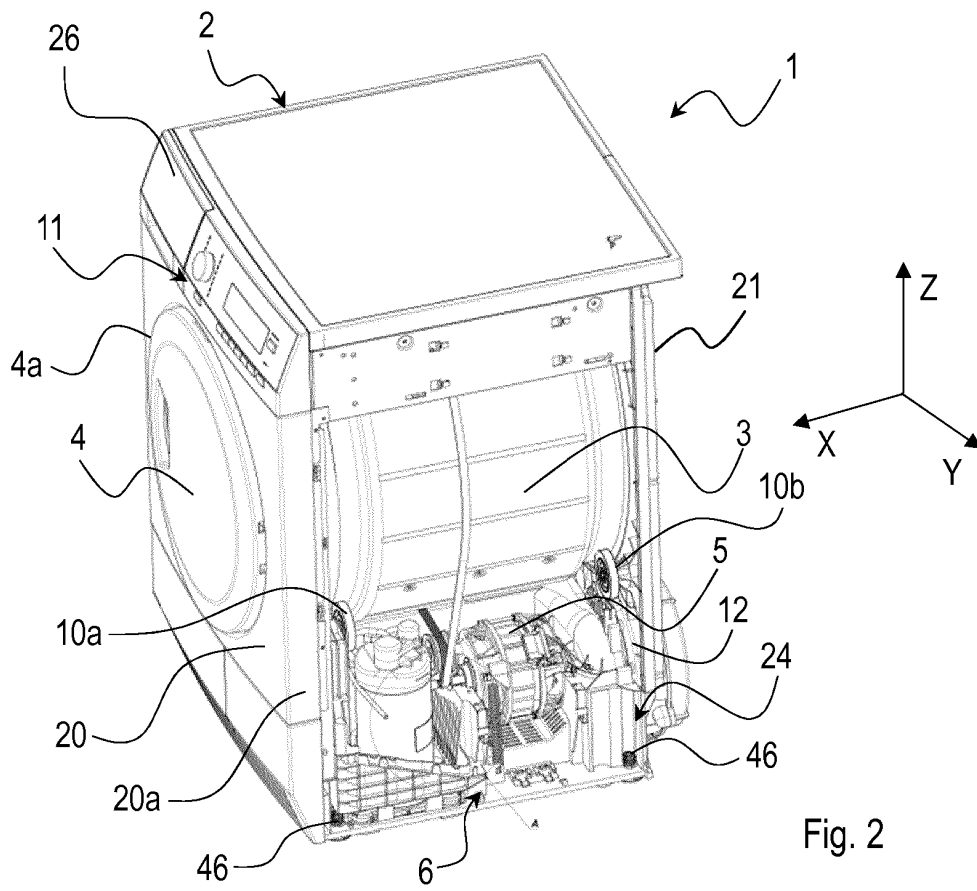


Fig. 2

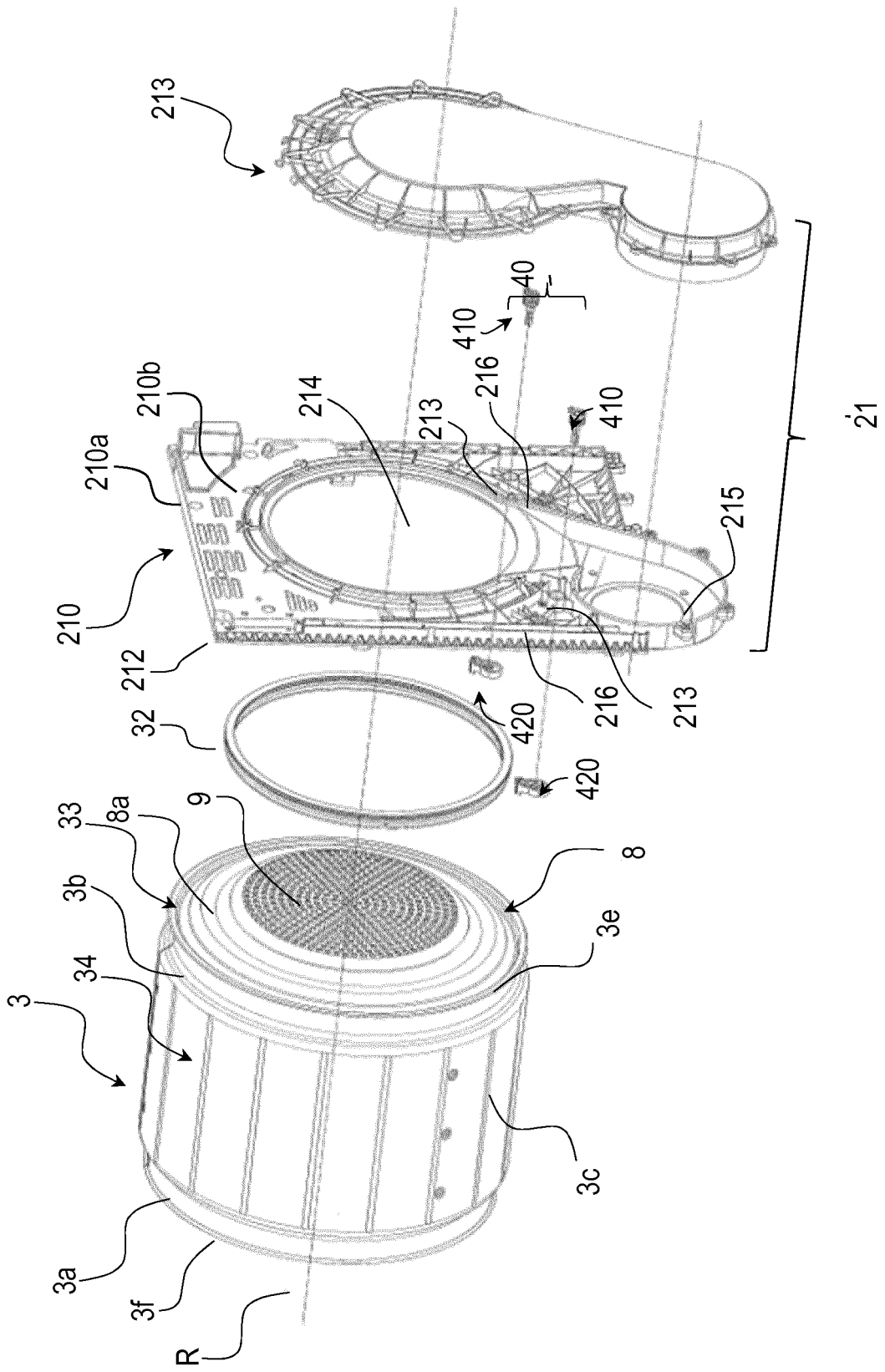


Fig. 3

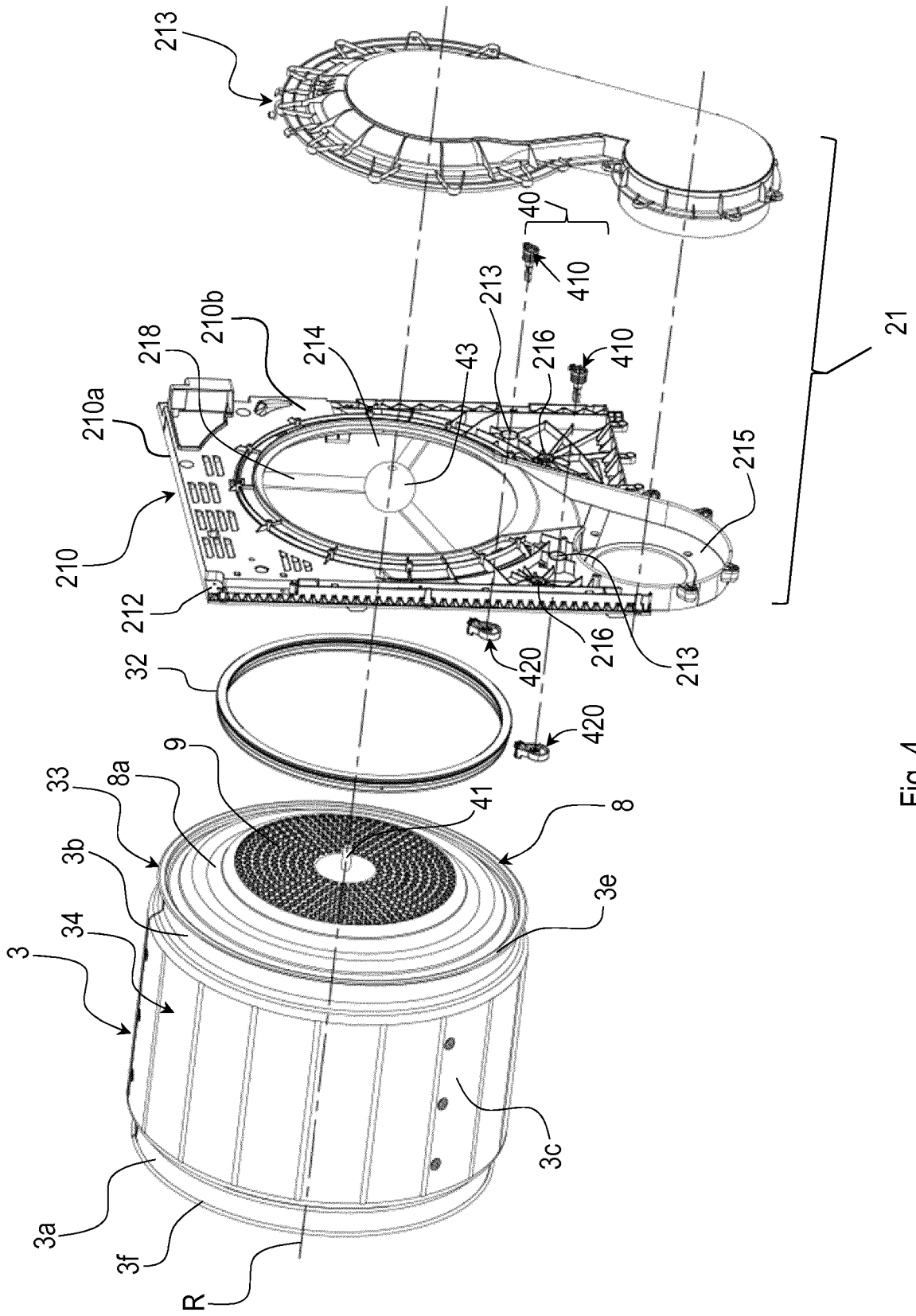
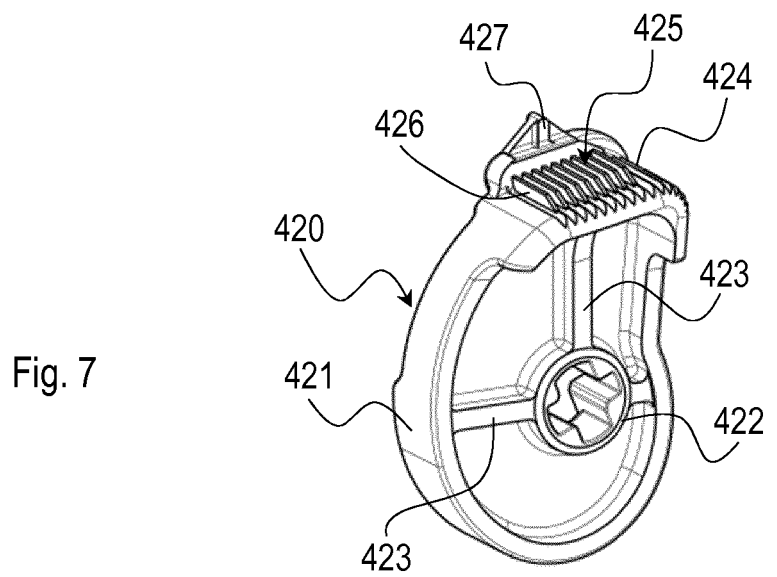
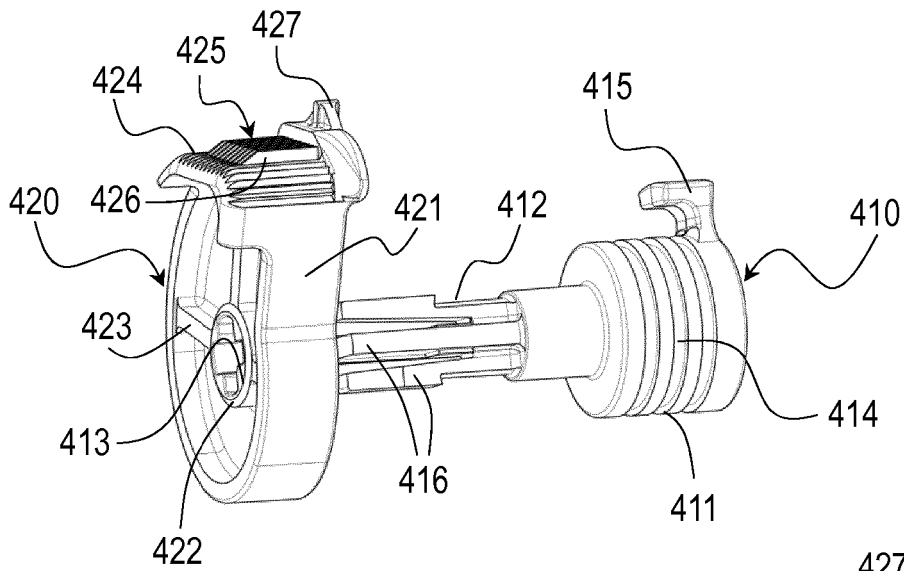
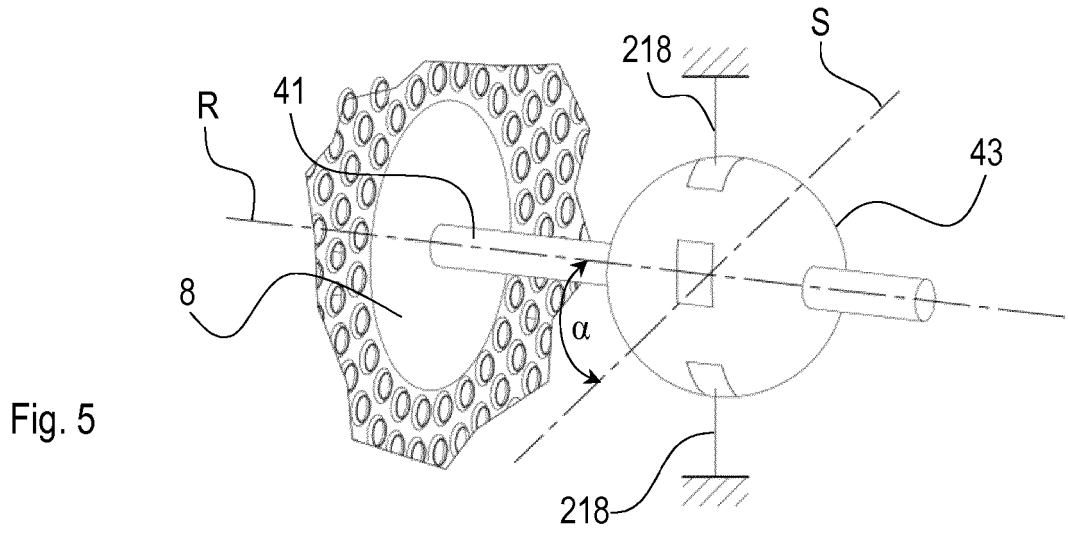


Fig. 4



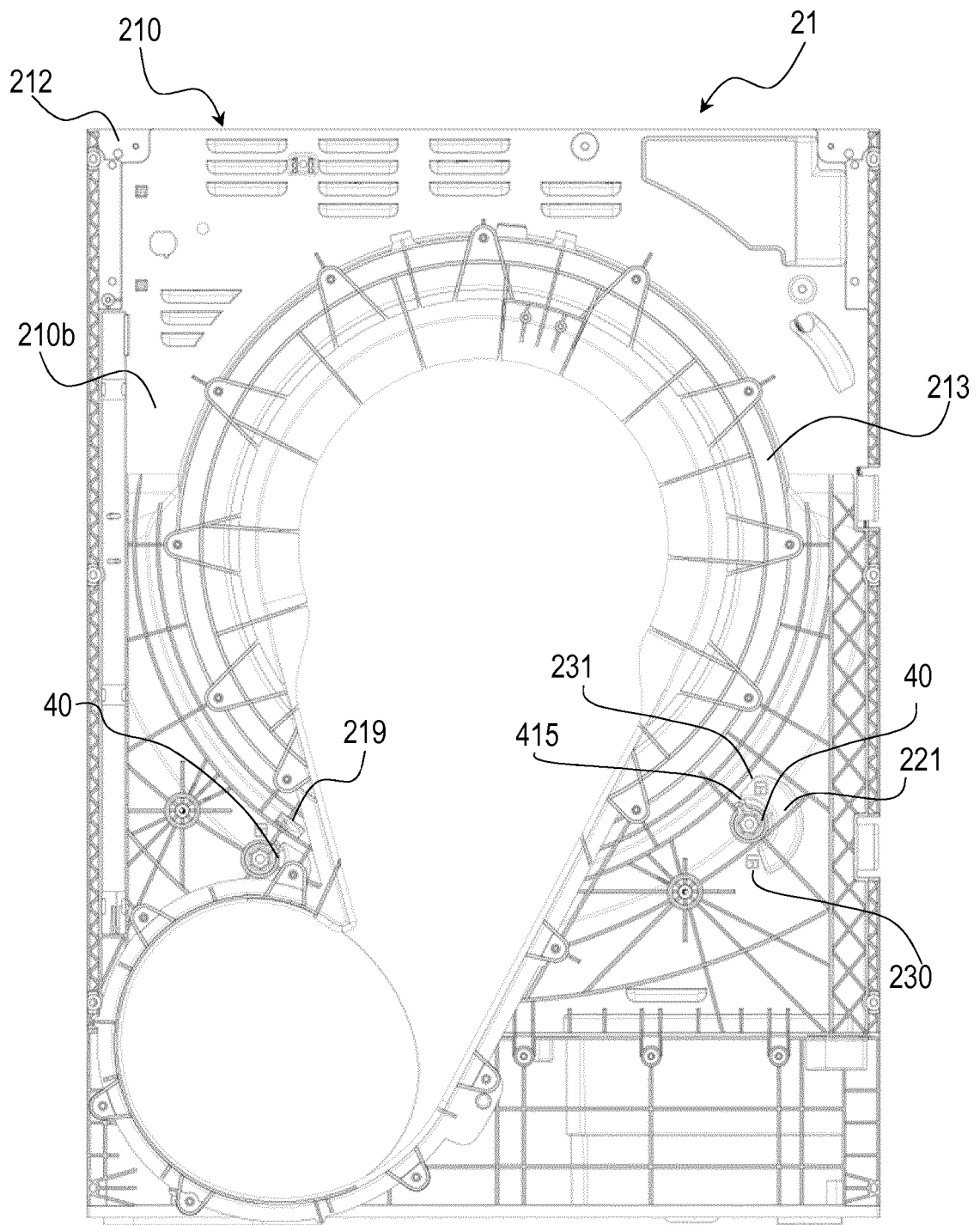


Fig. 8

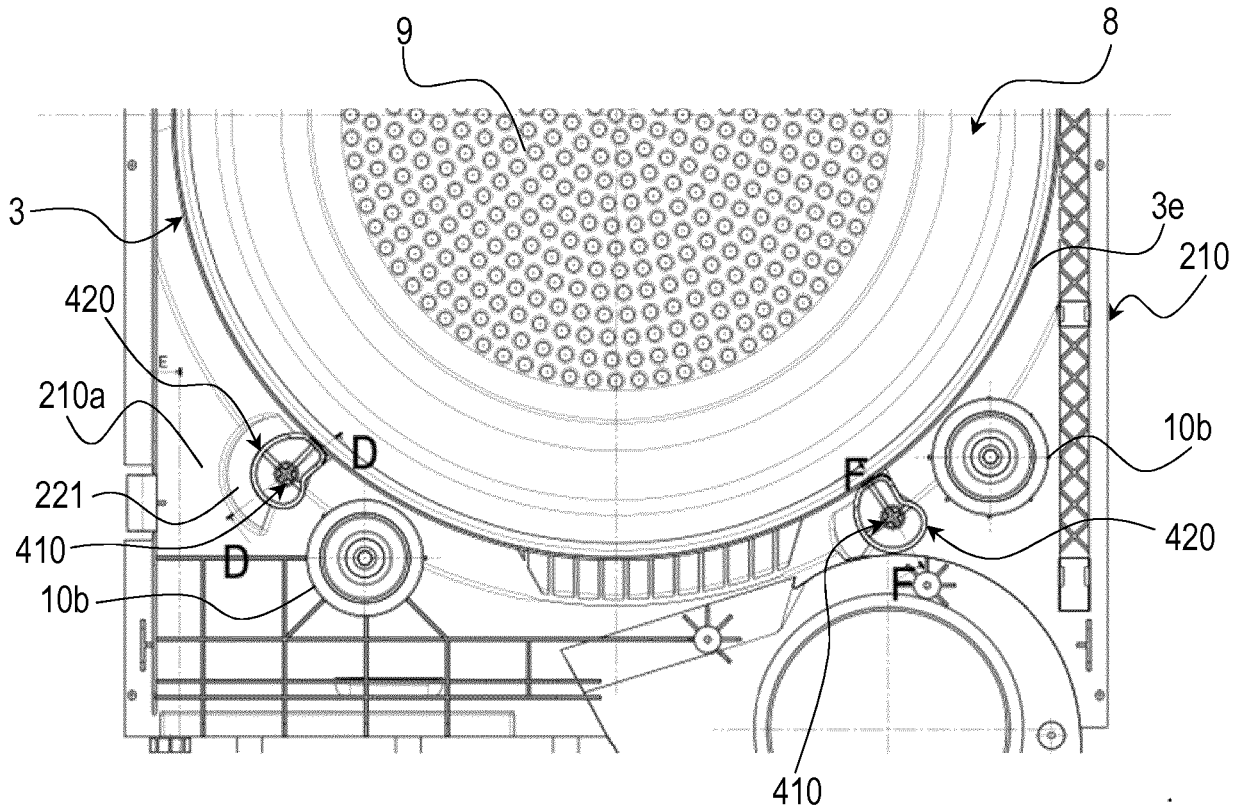


Fig. 9

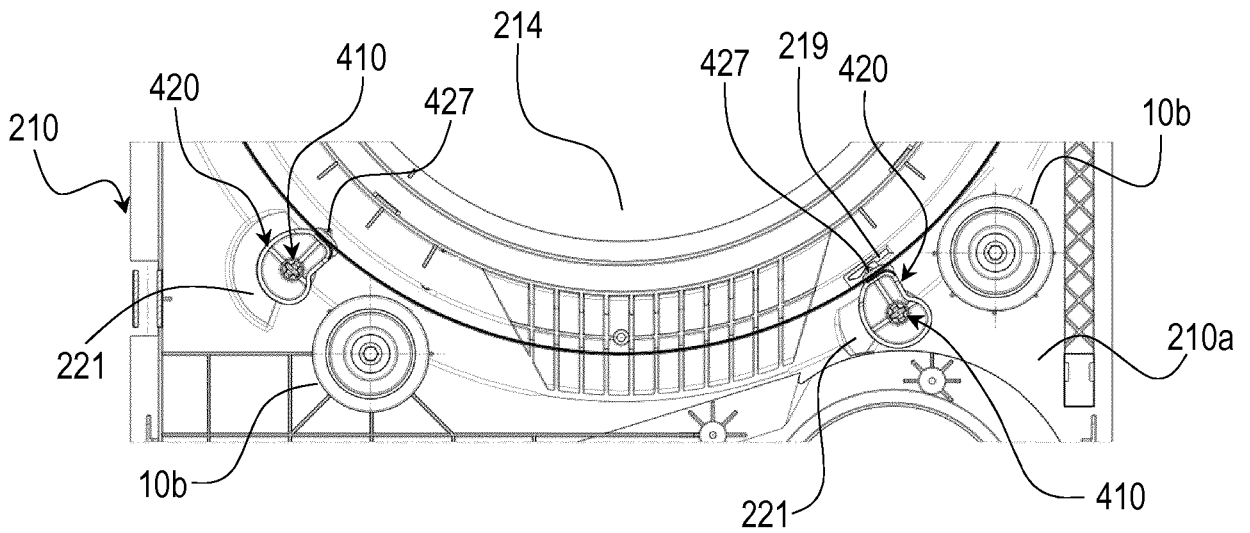


Fig. 10

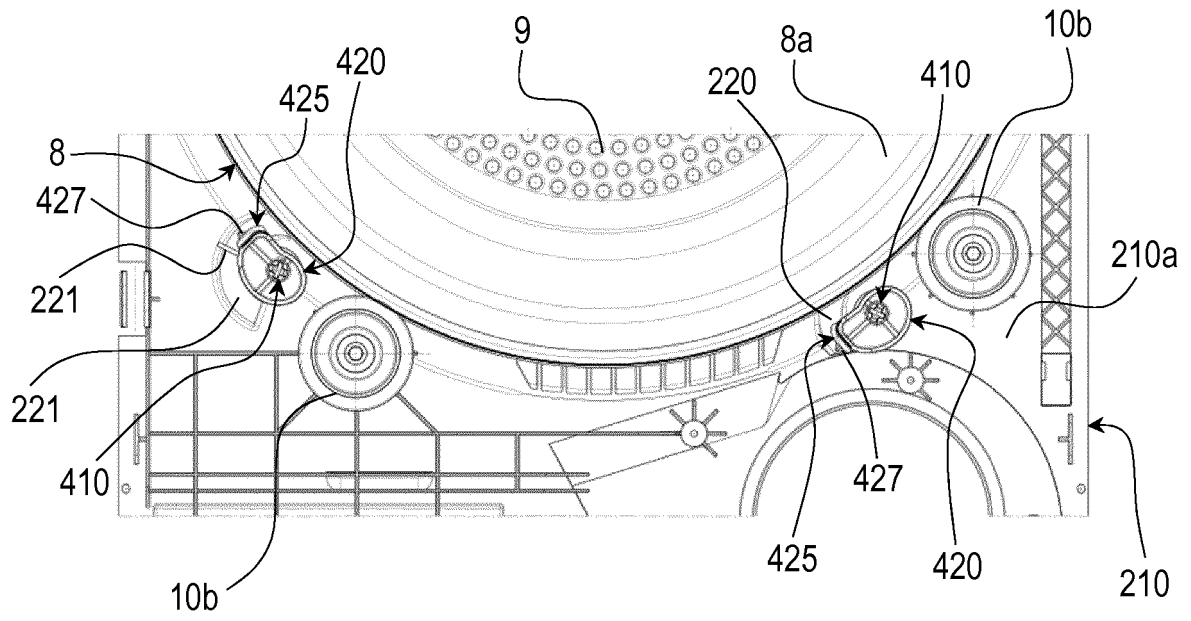


Fig. 11

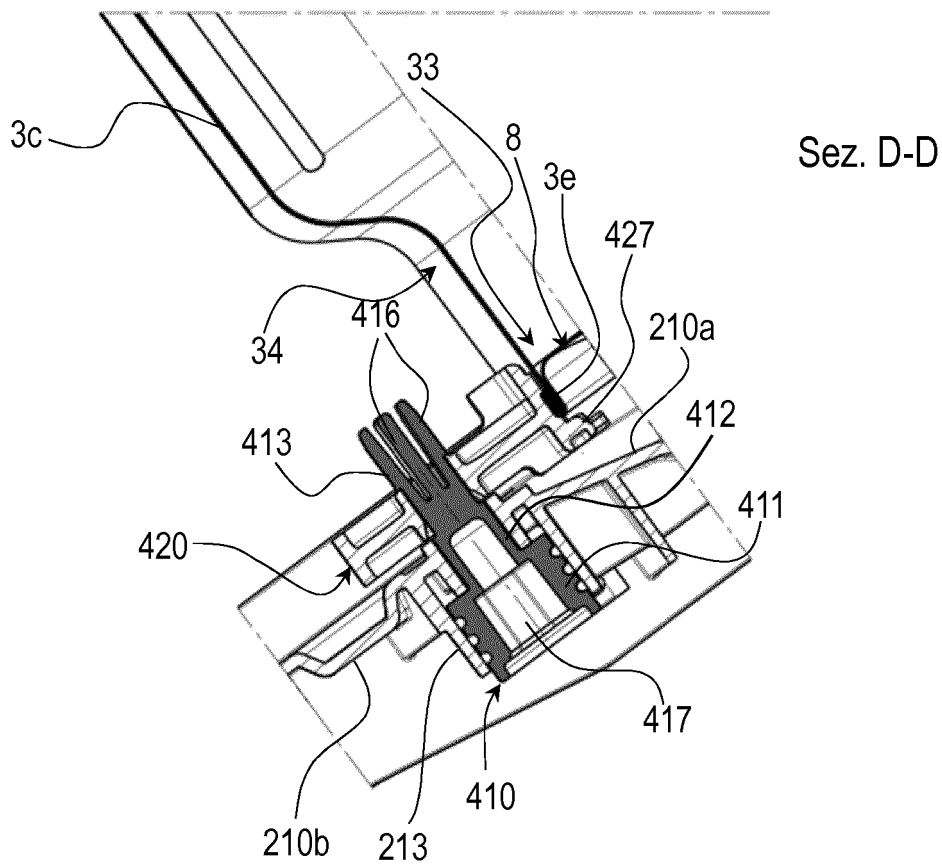


Fig. 12

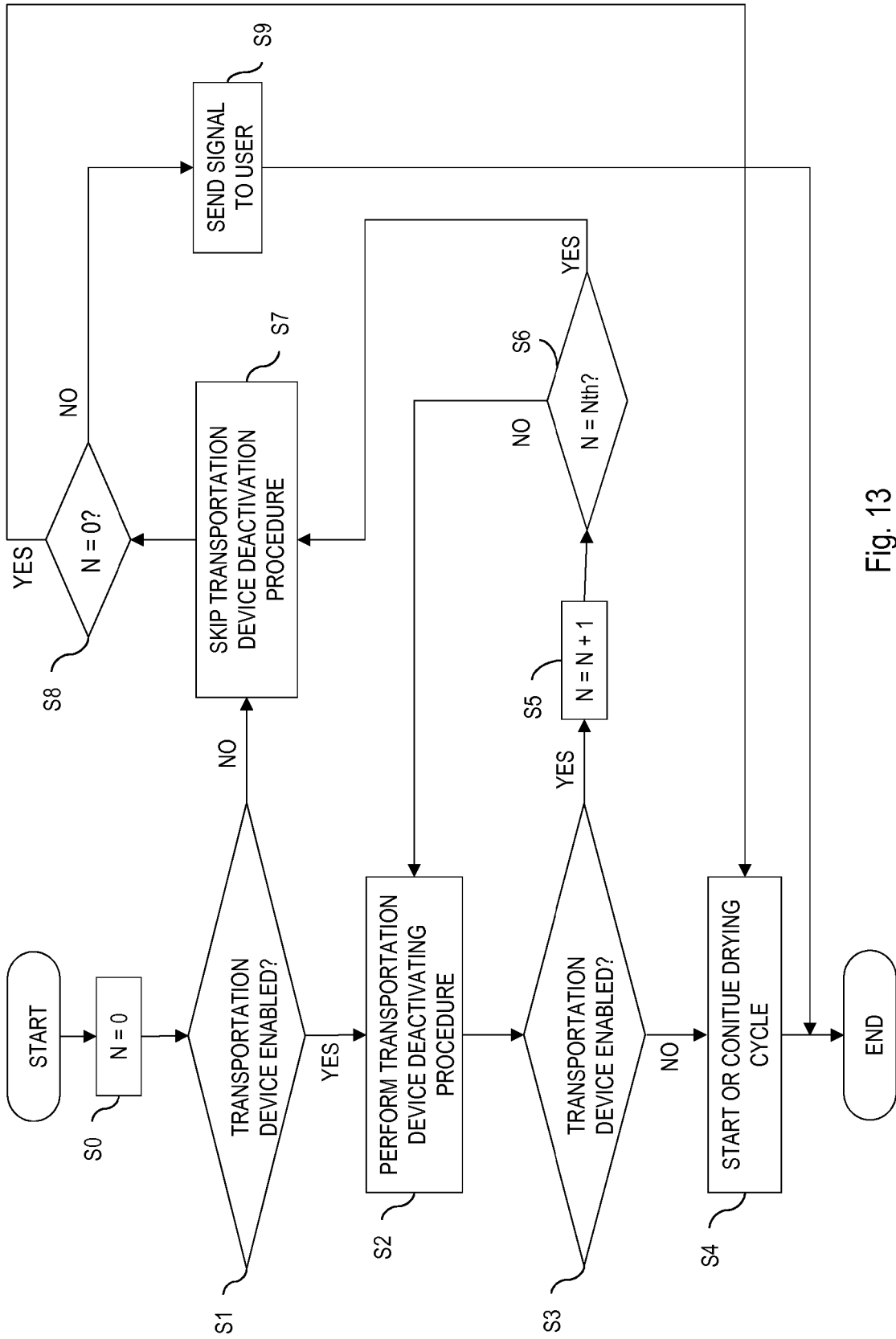


Fig. 13

REFERENCES CITED IN THE DESCRIPTION

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