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(54) **A method for assembling a laundry dryer including a heat pump system with a closed refrigerant circuit and a heat pump laundry dryer with a closed refrigerant circuit**

Verfahren zur Montage eines Wäschetrockners mit Wärmepumpensystem mit geschlossenem Kältekreislauf und Wärmepumpenwäschetrockner mit einem geschlossenen Kältekreislauf

Procédé d'assemblage d'un sèche-linge comprenant un système de pompe à chaleur avec un circuit de réfrigérant fermé et sèche-linge à pompe à chaleur avec un circuit de réfrigérant fermé

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Description

[0001] The present invention relates to a method for assembling a laundry dryer including a heat pump system with a closed refrigerant circuit. Further, the present invention relates to a laundry dryer including a heat pump system with a closed refrigerant circuit. Moreover, the present invention relates to a heat pump system with a closed refrigerant circuit for a laundry dryer.

[0002] Some laundry dryers comprise a heat pump system in order to dry wet clothes. The heat pump system allows that heat energy can be moved from one environment to another, and in either direction. This allows the heat pump system to bring heat into an occupied space, or to take it out of said space. The heat pump system uses an intermediate fluid called refrigerant. Said refrigerant absorbs heat as it vaporizes and releases the heat as it is condensed. In the laundry dryer the moist air coming from the laundry drum passes through the heat exchangers, namely a condenser and an evaporator, and releases the moisture accumulated, wherein the moisture condenses.

[0003] The heat exchangers are composed of very thin metal plates, in particular aluminium plates. Usually, said aluminium plates are arranged in parallel and equally spaced. The metal plates have high heat conductivity. During the drying process the moist air touches the metal plates of the heat pump evaporator and moisture is condensed. The moisture is then driven to a drain pump and finally stored in a tank for being expelled. Laundry drying air further passes through the heat pump condenser for being heated up before being delivered to the drum chamber containing laundry to be dried. The refrigerant flows through special pipes, which crisscross the heat exchangers in order to have the maximum contact with the metal plates of the heat exchangers as well as the moist air. The metal for the refrigerant pipes should be chosen as a good compromise between the costs and the heat conductivity. For this reason welding between pipes of different materials, such as copper and aluminium, are often used.

[0004] Actually the welding process consists basically in inserting a pipe into another pipe and then pouring between them a welding material. This process is easy to perform, but imprecise. In fact, due to a loose space between the pipes to be coupled, there is no guarantee that the pipes themselves remain coaxial. In addition, the temporary insertion of the one pipe end in the other pipe end may be released even by a simple vibration. This could lead to an incomplete welding or avoids the welding, so that refrigerant leakages and losses in the performance of the heat pump system may occur.

[0005] A method for assembling a laundry dryer including a heat pump with a pipe joint according to the above is disclosed in JP 2008 005898 A.

[0006] US 6 654 995 B1 discloses a method for making a sound circumferential weld at the overlapped joining region of a metal tube-receiving member with an inserted

tube. Such method is for forming a hydrostatic pressure-tight connection in an assembled tubular structure intended to undergo subsequent hydroforming. This document discloses to perform welding by inducing fusion of pipe portions through passage of an electric current.

[0007] JP 2007 187413 A discloses a heat exchanger for a heat pump system wherein a pipe joint is provided. At least one of the joined pipes has an enlarged portion or a radially reduced portion.

[0008] US 3,347,728 discloses forming joints in tubes for refrigerant condensers where two end portions of different diameter are inserted in one another and a powdered material assisting soldering is inserted into the cylindrical gap between the tube ends.

[0009] It is an object of the present invention to provide a method for assembling a laundry dryer with a heat pump system and a corresponding laundry dryer, which overcomes the problems relating to the connection of the refrigerant pipes of the refrigerant circuit.

[0010] The object of the present invention is achieved by the method according to claim 1, by the laundry dryer of claim 6 and the heat pump system of claim 11, respectively.

[0011] The present invention relates to a method for assembling a laundry dryer including a heat pump system with a closed refrigerant circuit, said method comprises the steps of:

- providing components for the refrigerant circuit, wherein at least two components are coupleable by interconnecting a first end piece and a second end piece of refrigerant pipes,
- enlarging the first end piece of the refrigerant pipe, so that the inner diameter of the first end piece is marginally bigger than the outer diameter of the second end piece,
- deforming the enlarged portion of the first end piece from the outer side, so that the second end piece is coaxially insertable into the first end piece,
- inserting the second end piece into the first end piece, and
- welding together the first end piece and the second end piece.

[0012] The first end piece and the second end piece are welded together by pouring the welding material between a circumferential inner side of the enlarged portion of the first end piece and a circumferential outer side of the second end piece.

[0013] Deforming the enlarged portion of the first end piece from its outer side comprises forming one or more elements which protrude inwardly from the inner surface of the enlarged portion of said first end piece. Further features are defined in claim 1.

[0014] The pipe joint between the first end piece and the second end piece avoids refrigerant leakages due to wrong alignment, i.e. centering, between the refrigerant pipes to be connected. Said pipe joint avoids accidental

release of the temporary coupled end pieces before welding them together. Further, the pipe joint between the first end piece and the second end piece increases the mechanical strength. These pipe joints improve the efficiency of the heat pump system. The inventive pipe joint between the first end piece and the second end piece does not require any special tools for keeping the enlarged first end piece and the second end piece in position during their connection operation.

[0015] In particular, the elements protruding inwardly from the inner surface of the enlarged portion of the first end piece comprise a plurality of dots arranged along at least one circumference of the enlarged portion of the first end piece.

[0016] Optionally, at least one predetermined portion of the first end piece is prevented from being enlarged, so that at least this portion remains at its initial diameter.

[0017] Alternatively or additionally, at least one circumferential groove is formed on the outer surface of the enlarged portion of the first end piece, so that the inserted second end piece is firmly kept inside the enlarged portion of the first end piece.

[0018] Preferably, the first end piece and the second end piece are welded together by pouring a welding material between said first end piece and second end piece.

[0019] The present invention relates to a laundry dryer including a heat pump system with a closed refrigerant circuit, wherein:

- the refrigerant circuit comprises a number of components, wherein at least two components are coupled by interconnecting a first end piece and a second end piece of refrigerant pipes,
- the first end piece of the refrigerant pipe is enlarged, so that the inner diameter of the first end piece is marginally bigger than the outer diameter of the second end piece,
- the enlarged portion of the first end piece is deformed from the outer side, so that the second end piece is coaxially inserted into the first end piece, and
- the first end piece and the second end piece are welded together.

[0020] The first end piece and the second end piece are welded together by pouring the welding material between a circumferential inner side of the enlarged portion of the first end piece and a circumferential outer side of the second end piece.

[0021] The enlarged portion of the first end piece comprises one or more elements which protrude inwardly from the inner surface of the enlarged portion of said first end piece.

[0022] Preferably, the elements protruding inwardly from the inner surface of the enlarged portion of said first end piece comprise a plurality of dots arranged along at least one circumference of the enlarged portion of the first end piece.

[0023] As an option, at least one predetermined portion

of the first end piece is remained at its initial diameter.

[0024] Alternatively or additionally, at least one circumferential groove is formed on the outer surface of the enlarged portion of the first end piece, so that the inserted second end piece is firmly kept inside the enlarged portion of the first end piece.

[0025] Preferably, the first end piece and the second end piece are welded together, wherein a welding material has been poured between said first end piece and second end piece.

[0026] At last the present invention relates to a heat pump system with a closed refrigerant circuit for a laundry dryer, wherein the heat pump system is provided for a laundry dryer mentioned above.

[0027] Novel and inventive features believed to be the characteristic of the present invention are set forth in the appended claims.

[0028] The invention will be described in further detail with reference to the drawings, in which

FIG 1 illustrates a perspective view of a basement portion for a laundry dryer according to a preferred embodiment of the present invention,

FIG 2 illustrates a perspective view of a heat pump system for the laundry dryer according to the preferred embodiment of the present invention,

FIG 2 illustrates a perspective view of a heat pump system for the laundry dryer according to the preferred embodiment of the present invention,

FIG 3 illustrates an exploded perspective view of the basement portion for the laundry dryer according to the preferred embodiment of the present invention,

FIG 4 illustrates a detailed perspective view of a pipe joint of the heat pump system for the laundry dryer according to the preferred embodiment of the present invention,

FIG 5 illustrates a detailed perspective view of the pipe joint of the heat pump system for the laundry dryer according to the preferred embodiment of the present invention,

FIG 6 illustrates a front view and a sectional top view of the pipe joint of the heat pump system for the laundry dryer according to the preferred embodiment of the present invention,

FIG 7 illustrates an enhanced sectional top view of the pipe joint of the heat pump system for the laundry dryer according to the preferred embodiment of the present invention,

FIG 8 illustrates a perspective view of the laundry dry-

er according to the preferred embodiment of the present invention, and

FIG 9 illustrates a detailed perspective view of a lower part of the laundry dryer according to the preferred embodiment of the present invention.

[0029] FIG 1 illustrates a perspective view of a basement portion 10 for a laundry dryer according to a preferred embodiment of the present invention. A heat pump system is arranged in said basement portion 10.

[0030] The heat pump system includes a compressor 12, a first heat exchanger 14, i.e. a refrigerant evaporator, a second heat exchanger 18, i.e. a refrigerant condenser, and an expansion device 16 arranged in the refrigerant pipe line leading the refrigerant from the condenser 18 to the evaporator 14. The first heat exchanger 14 and second heat exchanger 18 are air-to-refrigerant heat exchangers. In FIG 1 the first heat exchanger 14 and the second heat exchanger 18 are covered by a basement casing 20. Such casing 20 forms a portion of a laundry drying air path that conveys air towards a rotatable drum chamber where laundry to be dried is contained.

[0031] FIG 2 illustrates a perspective view of the heat pump system for the laundry dryer according to the preferred embodiment of the present invention. The compressor 12, the first heat exchanger 14, the expansion device 16 and the second heat exchanger 18 form a refrigerant circuit. The refrigerant circuit includes a plurality of refrigerant pipes 22. The refrigerant pipes 22 are provided for connecting the compressor 12, the first heat exchanger 14, the expansion device 16 and the second heat exchanger 18.

[0032] Further, the first heat exchanger 14 and the second heat exchanger 18 include at least one refrigerant pipe 22 in each case, wherein at least a part of said refrigerant pipe 22 has a serpentine form. Moreover, the first heat exchanger 14 and the second heat exchanger 18 include a plurality of metal plates in each case. Said metal plates are very thin. In particular, the metal plates are made of aluminium. Preferably, the metal plates are arranged in parallel and equally spaced. The metal plates have high heat conductivity. Metal plates are arranged so as to be passed through by laundry drying air.

[0033] FIG 3 illustrates an exploded perspective view of the basement portion 10 for the laundry dryer according to the preferred embodiment of the present invention. FIG 3 clarifies the arrangement of the components of the heat pump system.

[0034] The compressor 12 compresses a refrigerant, so that the pressure and temperature of the refrigerant become much higher. For example, the compression is an adiabatic compression. The first heat exchanger 14, commonly referred as evaporator, cools down the drying air stream arriving from a revolving laundry drum 35 (see FIG 9), in order to condense the surplus moisture in said drying air stream. Said laundry drum 35 is arranged above the basement portion 10. At the same time, the

first heat exchanger 14 heats up the refrigerant. In the expansion device 16 the refrigerant is released and cooled down. The second heat exchanger 18, commonly referred as condenser, cools down the refrigerant. At the same time, the second heat exchanger 18 heats up again the drying air stream arriving from the first heat exchanger 14. The drying air stream is then directed back to the revolving laundry drum 35. The temperature of the drying air stream re-entering into the laundry drum again is higher than or equal to that of the drying air stream flowing out of the laundry drum.

[0035] FIG 4 illustrates a detailed perspective view of a pipe joint 24 of the heat pump system for the laundry dryer according to the preferred embodiment of the present invention. The pipe joint 24 interconnects two neighboured end pieces of refrigerant pipes 22. FIG 4 shows the pipe joint 24 in a connected state.

[0036] The pipe joint 24 is obtained by inserting a narrow end piece 28 of one refrigerant pipe 22 into an enlarged end piece 26 of another refrigerant pipe 22. The one end piece 26 is enlarged before connecting the neighboured refrigerant pipes 22. The enlarged end piece 26 includes a number of dots 30.

[0037] FIG 5 illustrates a detailed perspective view of the pipe joint 24 of the heat pump system for the laundry dryer according to the preferred embodiment of the present invention. In FIG 5, the pipe joint 24 is in a disconnected state. FIG 5 clarifies that the number of dots 30 are formed in the enlarged end piece 26.

[0038] FIG 6 illustrates a front view and a sectional top view of the pipe joint 24 of the heat pump system for the laundry dryer according to the preferred embodiment of the present invention. FIG 6 clarifies the geometric properties of the pipe joint 24, the enlarged end piece 26 and the narrow end piece 28. The number of dots 30 is formed in the enlarged end piece 26.

[0039] FIG 7 illustrates an enhanced sectional top view of the pipe joint 24 of the heat pump system for the laundry dryer according to the preferred embodiment of the present invention. FIG 7 is the enhanced view of the sectional top view in FIG 6. FIG 7 clarifies the structure of the dots 30. The enlarged end piece 26 and the narrow end piece 28 have a common symmetry axis 36.

[0040] In FIG 7 the enlarged end piece 26 includes a number of dots 30. The dots 30 are mechanically formed on the outer surface of said enlarged end piece 26. The dots 30 have the effect that the inner diameter of the enlarged end piece 26 is locally smaller than in the remaining enlarged end piece 26. At the dots 30 the inner diameter of the enlarged end piece 26 substantially corresponds to the outer diameter of the neighboured narrow end piece 28. FIG 7 illustrates a detailed view of the dots 30 formed on the outer surface of said enlarged end piece 26.

[0041] The dots 30 are preferably formed by a punching and/or buckling operation on the outer surface of the enlarged end piece 26. Dots 30 are preferably arranged along at least a circumference of the enlarged end piece

26. The dots 30 deform radially and inwardly the enlarged end piece 26 so as to protrude from the inner surface 25 of the enlarged end piece 26 towards the axis 36 of both the enlarged end piece 26 and the narrow end piece. As an option, while enlarging the end piece 26, a portion of said end piece 26 may be prevented from being enlarged, so that this portion remains at its initial diameter. The initial diameter corresponds to the outer diameter of the narrow end piece 28.

[0042] Instead of the dots 30 or additionally, an annular groove or a partially annular groove, may be formed on the cylindrical outer surface of the enlarged end piece 26. Such groove protrudes inwardly from the inner surface 25 of the enlarged end piece 26 towards the axis 36 of both the enlarged end piece 26 and the narrow end piece. Once the narrow end piece 28 has been inserted into the enlarged end piece 26, the narrow end piece 28 and the elements protruding inwardly from the inner surface 25 of the enlarged end piece 26 interfere each other such that the narrow end piece 28 is firmly kept in the enlarged end piece 26 ensuring that coupled pipe ends remain coaxial. In this way, when the welding material is poured between the two neighbored pipes 22 it distributes regularly between them. This guarantees a perfect sealing and high mechanical strength.

[0043] The pipe joint 24 mentioned above avoids refrigerant leakages due to wrong alignment between the refrigerant pipes 22 to be connected. The above pipe joint 24 avoids accidental release of temporary coupled end pieces 26 and 28 before welding them together. Further, the above pipe joint 24 increases the mechanical strength. The above pipe joints 24 improve the efficiency of the heat pump system and simplify its assembling procedure. The inventive pipe joint 24 does not require any special tools for keeping the enlarged end piece 26 and the narrow end piece 28 in position during connecting them.

[0044] The pipe joint 24 made according to the invention is preferably provided for connecting the compressor 12 inlet pipe end with the end of the pipe draining refrigerant fluid from the evaporator 14 and for connecting the compressor 12 outlet pipe end with the end of the pipe leading refrigerant fluid to the condenser 18.

[0045] FIG 8 illustrates a perspective view of the laundry dryer 32 according to the preferred embodiment of the present invention. The laundry dryer 32 comprises a front portion including a front door 34. The laundry drum 35 is arranged behind said front door 34. The basement portion 10 is arranged below the laundry drum 35.

[0046] FIG 9 illustrates a detailed perspective view of a lower part of the laundry dryer 32 according to the preferred embodiment of the present invention. FIG 9 clarifies the position of the heat pump system inside the basement portion 10.

[0047] Although illustrative embodiments of the present invention have been described herein with reference to the accompanying drawings, it is to be understood that the present invention is not limited to those

precise embodiments, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope of the invention as claimed. All such changes and modifications are intended to be included within the scope of the invention as defined by the appended claims.

List of reference numerals

10 [0048]

- 10 basement portion
- 12 compressor
- 14 first heat exchanger
- 15 16 expansion device
- 18 second heat exchanger
- 20 basement casing
- 22 refrigerant pipe
- 24 pipe joint
- 20 25 inner surface
- 26 enlarged end piece
- 28 narrow end piece
- 30 dot
- 32 laundry dryer
- 25 34 front door
- 35 laundry drum
- 36 symmetry axis

30 Claims

1. A method for assembling a laundry dryer (32) including a heat pump system with a closed refrigerant circuit, said method comprises the steps of:

providing components (12, 14, 16, 18) for the refrigerant circuit, wherein at least two components (12, 14, 16, 18) are coupleable by interconnecting a first end piece (26) and a second end piece (28) of refrigerant pipes (22), enlarging the first end piece (26) of the refrigerant pipe (22), so that the inner diameter of the first end piece (26) is marginally bigger than the outer diameter of the second end piece (28), the method being **characterized by** locally deforming the enlarged portion of the first end piece (26) from the outer side, wherein deforming the enlarged portion of the first end piece (26) from the outer side comprises forming one or more dots (30), an annular groove and/or a partially annular groove on the outer surface of the enlarged portion of the first end piece (26) which protrude inwardly from the inner surface of the enlarged portion of said first end piece (26), so that the second end piece (28) is coaxially insertable into the first end piece (28), inserting the second end piece (28) into the first end piece (28), and

welding together the first end piece (26) and the second end piece (28) by pouring a welding material between said first end piece (26) and second end piece (28).

2. The method according to claim 1, **characterized in that** a plurality of dots (30) is arranged along at least one circumference of the enlarged portion of the first end piece (26).
3. The method according to any one of the preceding claims, **characterized in that** at least one predetermined portion of the first end piece (26) is prevented from being enlarged, so that at least this portion remains at its initial diameter.
4. The method according to any one of the preceding claims, **characterized in that** at least one circumferential groove is formed on the outer surface of the enlarged portion of the first end piece (26), so that the inserted second end piece (28) is firmly kept inside the enlarged portion of the first end piece (26).
5. The method according to any preceding claim, **characterized in that** the first end piece (26) and the second end piece (28) are welded together by pouring the welding material between a circumferential inner side of the enlarged portion of the first end piece (26) and a circumferential outer side of the second end piece (28).
6. A laundry dryer (32) including a heat pump system with a closed refrigerant circuit, wherein:

the refrigerant circuit comprises a number of components (12, 14, 16, 18), wherein at least two components (12, 14, 16, 18) are coupled by interconnecting a first end piece (26) and a second end piece (28) of refrigerant pipes (22), the first end piece (26) of the refrigerant pipe (22) is enlarged, so that the inner diameter of the first end piece (26) is marginally bigger than the outer diameter of the second end piece (28), the laundry dryer being **characterised in that** the enlarged portion of the first end piece (26) is locally deformed from the outer side, wherein the enlarged portion of the first end piece (26) comprises one or more dots (30), an annular groove and/or a partially annular groove on the outer surface of the enlarged portion of the first end piece (26) which protrude inwardly from the inner surface of the enlarged portion of said first end piece (26), so that the second end piece (28) is coaxially inserted into the first end piece (28), and the first end piece (26) and the second end piece (28) are welded together by a welding material poured between said first end piece (26) and

second end piece (28).

7. The laundry dryer according to claim 6, **characterized in that** a plurality of dots (30) are arranged along at least one circumference of the enlarged portion of the first end piece (26).
8. The laundry dryer according to claim 6 or 7, **characterized in that** at least one predetermined portion of the first end piece (26) is remained at its initial diameter.
9. The laundry dryer according to any one of the claims 6 to 8, **characterized in that** at least one circumferential groove is formed on the outer surface of the enlarged portion of the first end piece (26), so that the inserted second end piece (28) is firmly kept inside the enlarged portion of the first end piece (26).
10. The laundry dryer according to any one of the claims 6 to 9, **characterized in that** the first end piece (26) and the second end piece (28) are welded together by pouring the welding material between a circumferential inner side of the enlarged portion of the first end piece (26) and a circumferential outer side of the second end piece (28).
11. A heat pump system with a closed refrigerant circuit for a laundry dryer, the refrigerant circuit including a plurality of refrigerant pipes (22), two neighbored end pieces (26, 28) of refrigerant pipes (22) being interconnected by a pipe joint (24) wherein a first end piece (26) of the refrigerant pipe (22) is enlarged, so that the inner diameter of the first end piece (26) is marginally bigger than the outer diameter of the second end piece (28), the heat pump system being **characterized in that** the enlarged portion of the first end piece (26) is locally deformed from the outer side, wherein the enlarged portion of the first end piece (26) comprises one or more dots (30), an annular groove and/or a partially annular groove on the outer surface of the enlarged portion of the first end piece (26) which protrude inwardly from the inner surface of the enlarged portion of said first end piece (26), so that the second end piece (28) is coaxially inserted into the first end piece (28), and the first end piece (26) and the second end piece (28) are welded together by a welding material poured between said first end piece (26) and second end piece (28).

Patentansprüche

1. Verfahren zur Montage eines Wäschetrockners (32) mit einem Wärmepumpensystem mit einem geschlossenen Kältekreislauf, wobei das Verfahren die

Schritte aufweist:

- Bereitstellen von Komponenten (12, 14, 16, 18) für den Kältekreislauf, wobei zumindest zwei Komponenten (12, 14, 16, 18) durch Zwischenverbinden eines ersten Endstücks (26) und eines zweiten Endstücks (28) von Kälterohren (22) koppelbar sind, 5
- Vergroßern des ersten Endstücks (26) des Kälterohrs (22), sodass der Innendurchmesser des ersten Endstücks (26) marginal größer ist als der Außendurchmesser des zweiten Endstücks (28), wobei das Verfahren **gekennzeichnet ist durch** 10
- lokales Verformen des vergrößerten Abschnitts des ersten Endstücks (26) von der Außenseite, wobei das Verformen des vergrößerten Abschnitts des ersten Endstücks (26) von der Außenseite ein Bilden eines oder mehrerer Punkte (30), einer ringförmigen Kerbe und/oder einer teilweise ringförmigen Kerbe an der Außenfläche des vergrößerten Abschnitts des ersten Endstücks (26) aufweist, die von der Innenfläche des vergrößerten Abschnitts des ersten Endstücks (26) nach innen ragen, sodass das zweite Endstück (28) coaxial in das erste Endstück (28) einfügbar ist, 20
- Einfügen des zweiten Endstücks (28) in das erste Endstück (28), und 25
- Zusammenschweißen des ersten Endstücks (26) und des zweiten Endstücks (28) **durch** Gießen eines Schweißmaterials zwischen das erste Endstück (26) und zweite Endstück (28). 30
2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** mehrere Punkte (30) entlang zumindest eines Umfangs des vergrößerten Abschnitts des ersten Endstücks (26) angeordnet sind. 35
3. Verfahren nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** zumindest ein vorbestimmter Abschnitt des ersten Endstücks (26) davon abgehalten ist, vergrößert zu werden, sodass zumindest dieser Abschnitt bei seinem Anfangsdurchmesser bleibt. 40
4. Verfahren nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** zumindest eine umgebende Kerbe an der Außenfläche des vergrößerten Abschnitts des ersten Endstücks (26) gebildet ist, sodass das eingefügte zweite Endstück (28) fest innerhalb des vergrößerten Abschnitts des ersten Endstücks (26) gehalten ist. 50
5. Verfahren nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** das erste Endstück (26) und das zweite Endstück (28) durch Gießen des Schweißmaterials zwischen eine umgebende Innenseite des vergrößerten Abschnitts des ersten Endstücks (26) und eine umgebende Außenseite des zweiten Endstücks (28) zusammengeschweißt sind. 55
6. Wäschetrockner (32) mit einem Wärmepumpensystem mit einem geschlossenen Kältekreislauf, wobei: 60
- der Kältekreislauf eine Zahl von Komponenten (12, 14, 16, 18) aufweist, wobei zumindest zwei Komponenten (12, 14, 16, 18) durch Zwischenverbinden eines ersten Endstücks (26) und eines zweiten Endstücks (28) von Kälterohren (22) gekoppelt sind, 65
- das erste Endstück (26) des Kälterohrs (22) vergrößert ist, sodass der Innendurchmesser des ersten Endstücks (26) marginal größer ist als der Außendurchmesser des zweiten Endstücks (28), 70
- der Wäschetrockner **dadurch gekennzeichnet ist, dass**
- der vergrößerte Abschnitt des ersten Endstücks (26) lokal von der Außenseite aus verformt ist, wobei der vergrößerte Abschnitt des ersten Endstücks (26) einen oder mehrere Punkte (30), eine ringförmige Kerbe und/oder eine teilweise ringförmige Kerbe an der Außenfläche des vergrößerten Abschnitts des ersten Endstücks (26) aufweist, die von der Innenfläche des vergrößerten Abschnitts des ersten Endstücks (26) nach innen ragen, sodass das zweite Endstück (28) coaxial in das erste Endstück (28) eingefügt ist, und 75
- das erste Endstück (26) und das zweite Endstück (28) durch ein Schweißmaterial, das zwischen das erste Endstück (26) und zweite Endstück (28) gegossen ist, zusammengeschweißt sind. 80
7. Wäschetrockner nach Anspruch 6, **dadurch gekennzeichnet, dass** mehrere Punkte (30) entlang zumindest eines Umfangs des vergrößerten Abschnitts des ersten Endstücks (26) angeordnet sind. 85
8. Wäschetrockner nach Anspruch 6 oder 7, **dadurch gekennzeichnet, dass** zumindest ein vorbestimmter Abschnitt des ersten Endstücks (26) bei seinem Anfangsdurchmesser bleibt. 90
9. Wäschetrockner nach einem der Ansprüche 6 bis 8, **dadurch gekennzeichnet, dass** zumindest eine umgebende Kerbe an der Außenfläche des vergrößerten Abschnitts des ersten Endstücks (26) gebildet ist, sodass das eingefügte zweite Endstück (28) fest im vergrößerten Abschnitt des ersten Endstücks (26) gehalten ist. 95
10. Wäschetrockner nach einem der Ansprüche 6 bis 9,

dadurch gekennzeichnet, dass das erste Endstück (26) und das zweite Endstück (28) durch Gießen des Schweißmaterials zwischen eine umgebende Innenseite des vergrößerten Abschnitts des ersten Endstücks (26) und eine umgebende Außenseite des zweiten Endstücks (28) zusammengeschweißt sind.

11. Wärmepumpensystem mit einem geschlossenen Kältekreislauf für einen Wäschetrockner, wobei der Kältekreislauf mehrere Kälterohre (22) enthält, wobei zwei benachbarte Endstücke (26, 28) von Kälterohren (22) durch ein Rohrverbindungsstück (24) zwischenverbunden sind, wobei ein erstes Endstück (26) des Kälterohrs (22) vergrößert ist, sodass der Innendurchmesser des ersten Endstücks (26) marginal größer ist als der Außendurchmesser des zweiten Endstücks (28), wobei das Wärmepumpensystem **dadurch gekennzeichnet ist, dass** der vergrößerte Abschnitt des ersten Endstücks (26) lokal von der Außenseite aus verformt ist, wobei der vergrößerte Abschnitt des ersten Endstücks (26) einen oder mehr Punkte (30), eine ringförmige Kerbe und/oder eine teilweise ringförmige Kerbe an der Außenfläche des vergrößerten Abschnitts des ersten Endstücks (26) aufweist, die von der Innenfläche des vergrößerten Abschnitts des ersten Endstücks (26) nach innen ragen, sodass das zweite Endstück (28) koaxial in das erste Endstück (28) eingefügt ist, und das erste Endstück (26) und das zweite Endstück (28) durch ein Schweißmaterial, das zwischen das erste Endstück (26) und zweite Endstück (28) gegossen ist, zusammengeschweißt sind.

Revendications

1. Procédé d'assemblage d'un sèche-linge (32) comprenant un système de pompe à chaleur avec un circuit de réfrigérant fermé, ledit procédé comprenant les étapes suivantes:

procurer des composants (12, 14, 16, 18) pour le circuit de réfrigérant, dans lequel au moins deux composants (12, 14, 16, 18) peuvent être couplés en interconnectant une première pièce d'extrémité (26) et une deuxième pièce d'extrémité (28) de tubes de réfrigérant (22), agrandir la première pièce d'extrémité (26) du tube de réfrigérant (22), de telle manière que le diamètre intérieur de la première pièce d'extrémité (26) soit marginalement plus grand que le diamètre extérieur de la deuxième pièce d'extrémité (28), le procédé étant **caractérisé en ce que** on déforme localement la partie agrandie de la première pièce d'extrémité (26) à partir du côté

extérieur, dans lequel la déformation de la partie agrandie de la première pièce d'extrémité (26) à partir du côté extérieur comprend la formation d'un ou de plusieurs points (30), d'une rainure annulaire et/ou d'une rainure partiellement annulaire sur la surface extérieure de la partie agrandie de la première pièce d'extrémité (26), qui font saillie intérieurement à partir de la surface intérieure de la partie agrandie de ladite première pièce d'extrémité (26), de telle manière que la deuxième pièce d'extrémité (28) puisse être insérée coaxialement dans la première pièce d'extrémité (28), insérer la deuxième pièce d'extrémité (28) dans la première pièce d'extrémité (28), et souder l'une à l'autre la première pièce d'extrémité (26) et la deuxième pièce d'extrémité (28) en versant une matière de soudage entre ladite première pièce d'extrémité (26) et ladite deuxième pièce d'extrémité (28).

2. Procédé selon la revendication 1, **caractérisé en ce qu'**une multiplicité de points (30) sont arrangés le long d'au moins une circonférence de la partie agrandie de la première pièce d'extrémité (26).
3. Procédé selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**au moins une partie prédéterminée de la première pièce d'extrémité (26) est empêchée d'être agrandie, de telle manière qu'au moins cette partie reste à son diamètre initial.
4. Procédé selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**au moins une rainure circonférentielle est formée sur la surface extérieure de la partie agrandie de la première pièce d'extrémité (26), de telle manière que la deuxième pièce d'extrémité (28) soit maintenue fermement à l'intérieur de la partie agrandie de la première pièce d'extrémité (26).
5. Procédé selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la première pièce d'extrémité (26) et la deuxième pièce d'extrémité (28) sont soudées l'une à l'autre en versant la matière de soudage entre un côté circonférentiel intérieur de la partie agrandie de la première pièce d'extrémité (26) et un côté circonférentiel extérieur de la deuxième pièce d'extrémité (28).
6. Sèche-linge (32) comprenant un système de pompe à chaleur avec un circuit de réfrigérant fermé, dans lequel:

le circuit de réfrigérant comprend un certain nombre de composants (12, 14, 16, 18), dans lequel au moins deux composants (12, 14, 16,

- 18) sont couplés en interconnectant une première pièce d'extrémité (26) et une deuxième pièce d'extrémité (28) de tubes de réfrigérant (22), la première pièce d'extrémité (26) du tube de réfrigérant (22) est agrandie, de telle manière que le diamètre intérieur de la première pièce d'extrémité (26) soit marginalement plus grand que le diamètre extérieur de la deuxième pièce d'extrémité (28), le sèche-linge étant **caractérisé en ce que** la partie agrandie de la première pièce d'extrémité (26) est localement déformée à partir du côté extérieur, dans lequel la partie agrandie de la première pièce d'extrémité (26) comprend un ou plusieurs points (30), une rainure annulaire et/ou une rainure partiellement annulaire sur la surface extérieure de la partie agrandie de la première pièce d'extrémité (26), qui font saillie vers l'intérieur à partir de la surface intérieure de la partie agrandie de ladite première pièce d'extrémité (26), de telle manière que la deuxième pièce d'extrémité (28) soit insérée coaxialement dans la première pièce d'extrémité (28), et la première pièce d'extrémité (26) et la deuxième pièce d'extrémité (28) sont soudées l'une à l'autre par une matière de soudage versée entre ladite première pièce d'extrémité (26) et ladite deuxième pièce d'extrémité (28).
7. Sèche-linge selon la revendication 6, **caractérisé en ce qu'**une multiplicité de points (30) sont arrangés le long d'au moins une circonférence de la partie agrandie de la première pièce d'extrémité (26).
8. Sèche-linge selon la revendication 6 ou 7, **caractérisé en ce qu'**au moins une partie déterminée de la première pièce d'extrémité (26) est restée à son diamètre initial.
9. Sèche-linge selon l'une quelconque des revendications 6 à 8, **caractérisé en ce qu'**au moins une rainure circonférentielle est formée sur la surface extérieure de la partie agrandie de la première pièce d'extrémité (26), de telle manière que la deuxième pièce d'extrémité insérée (28) soit maintenue fermement à l'intérieur de la partie agrandie de la première pièce d'extrémité (26).
10. Sèche-linge selon l'une quelconque des revendications 6 à 9, **caractérisé en ce que** la première pièce d'extrémité (26) et la deuxième pièce d'extrémité (28) sont soudées l'une à l'autre en versant la matière de soudage entre un côté circonférentiel intérieur de la partie agrandie de la première pièce d'extrémité (26) et un côté circonférentiel extérieur de la deuxième pièce d'extrémité (28).
11. Système de pompe à chaleur avec un circuit de ré-

frigérant fermé pour un sèche-linge, le circuit de réfrigérant comprenant une multiplicité de tubes de réfrigérant (22), deux pièces d'extrémité voisines (26, 28) de tubes de réfrigérant (22) étant interconnectées par une jonction de tubes (24) dans laquelle une première pièce d'extrémité (26) du tube de réfrigérant (22) est agrandie, de telle manière que le diamètre intérieur de la première pièce d'extrémité (26) soit marginalement plus grand que le diamètre extérieur de la deuxième pièce d'extrémité (28), le système de pompe à chaleur étant **caractérisé en ce que** la partie agrandie de la première pièce d'extrémité (26) est localement déformée à partir du côté extérieur, dans lequel la partie agrandie de la première pièce d'extrémité (26) comprend un ou plusieurs points (30), une rainure annulaire et/ou une rainure partiellement annulaire sur la surface extérieure de la partie agrandie de la première pièce d'extrémité (26), qui font saillie vers l'intérieur à partir de la surface intérieure de la partie agrandie de ladite première pièce d'extrémité (26), de telle manière que la deuxième pièce d'extrémité (28) soit insérée coaxialement dans la première pièce d'extrémité (28), et la première pièce d'extrémité (26) et la deuxième pièce d'extrémité (28) sont soudées l'une à l'autre par une matière de soudage versée entre ladite première pièce d'extrémité (26) et ladite deuxième pièce d'extrémité (28).

FIG 1

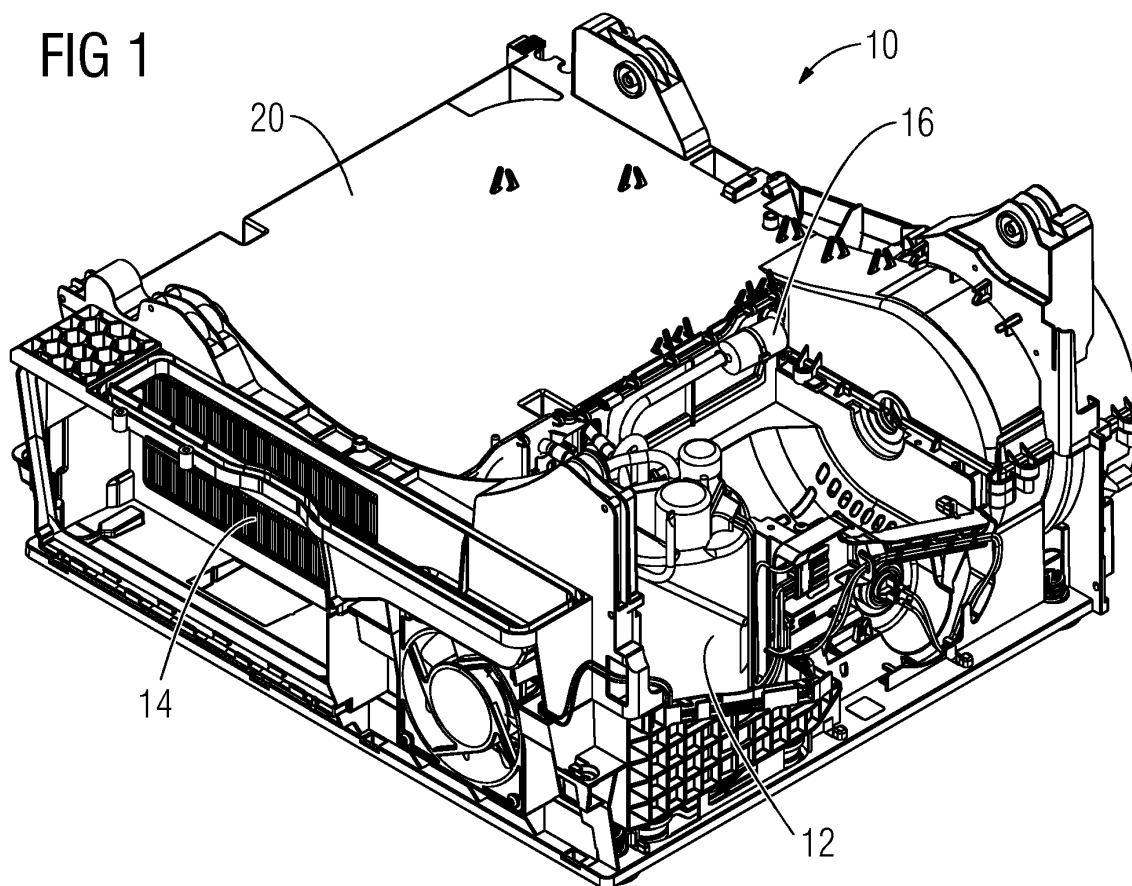


FIG 2

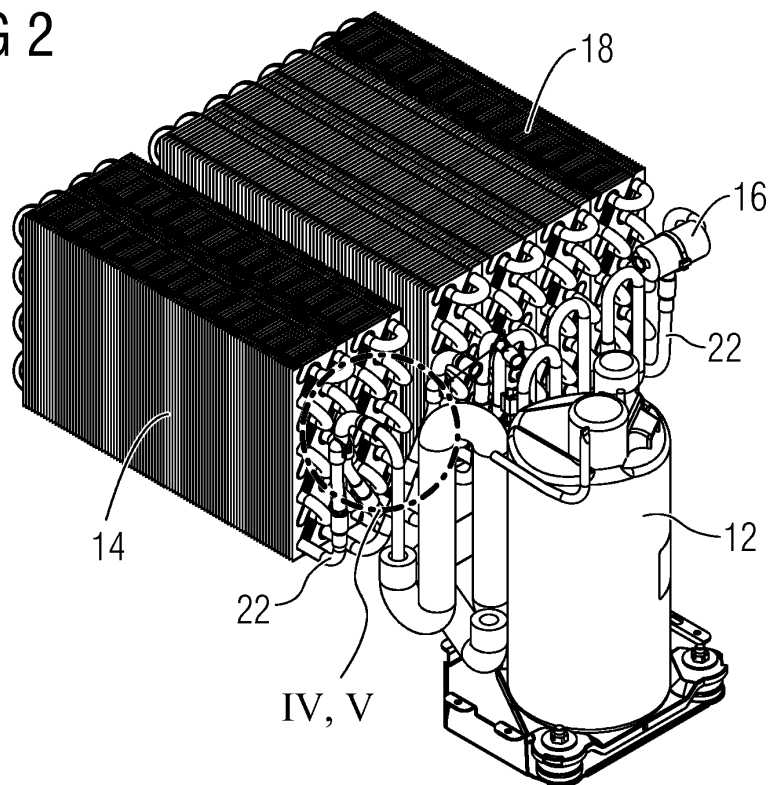


FIG 3

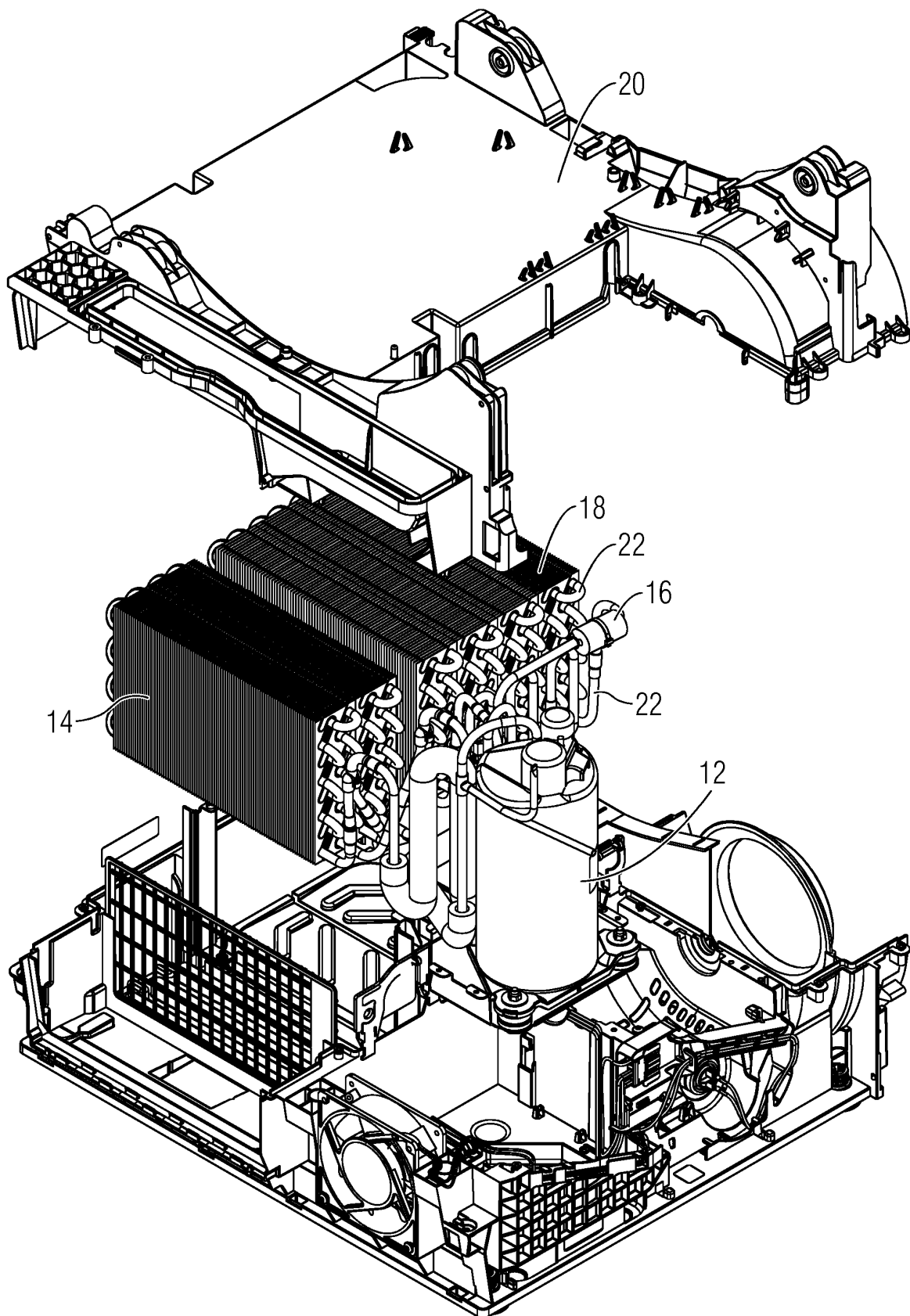


FIG 4

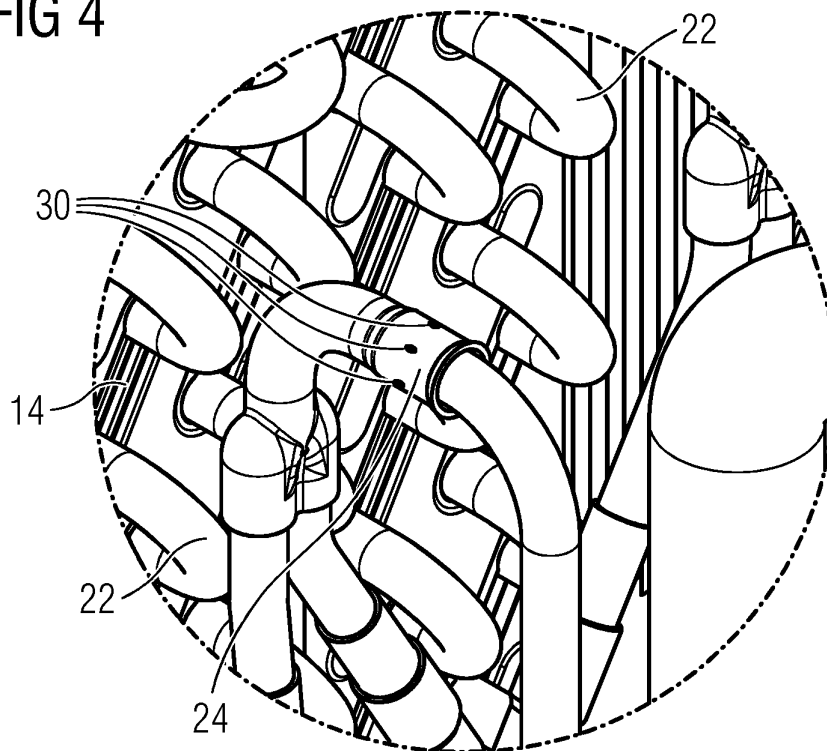


FIG 5

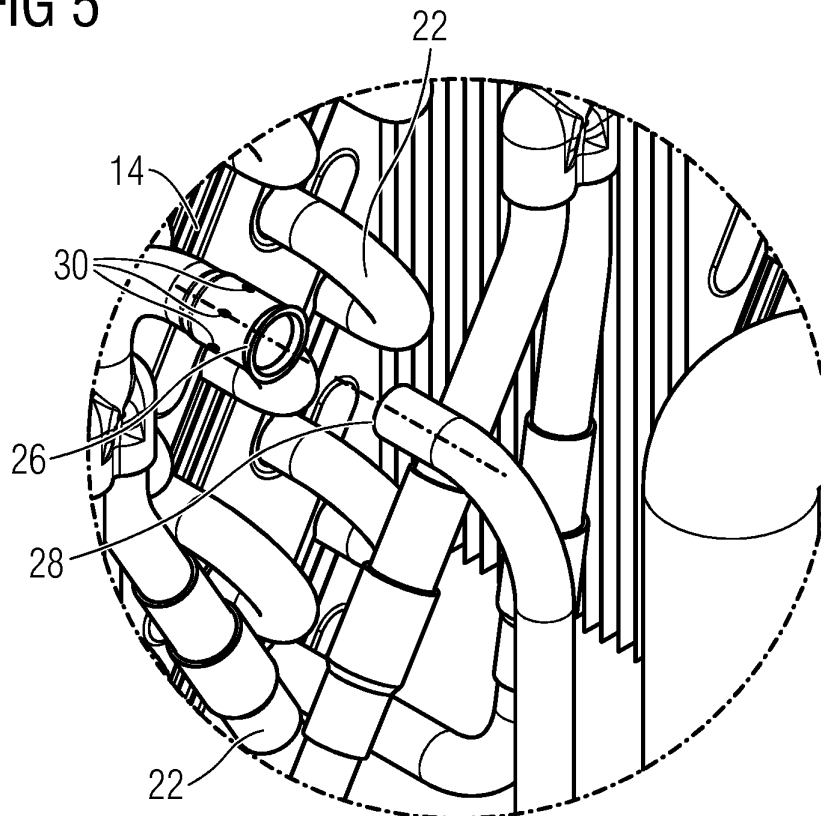


FIG 6

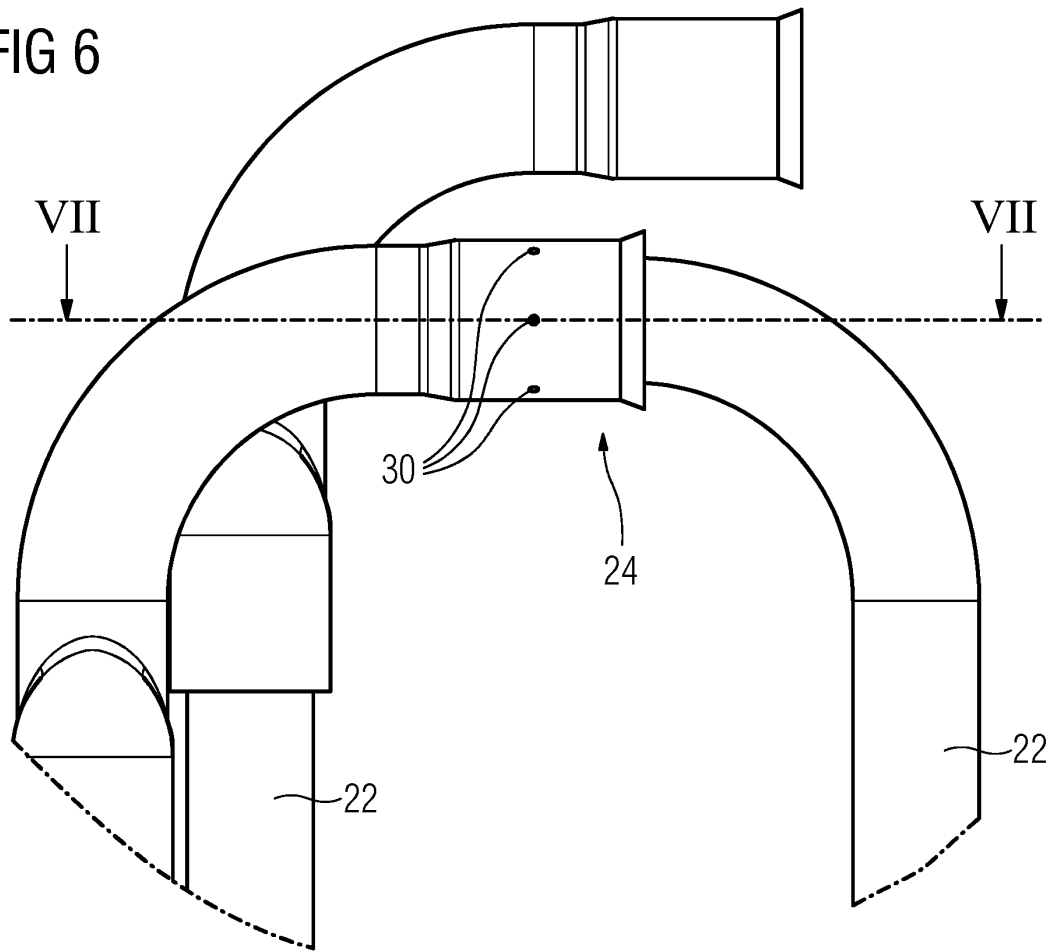


FIG 7

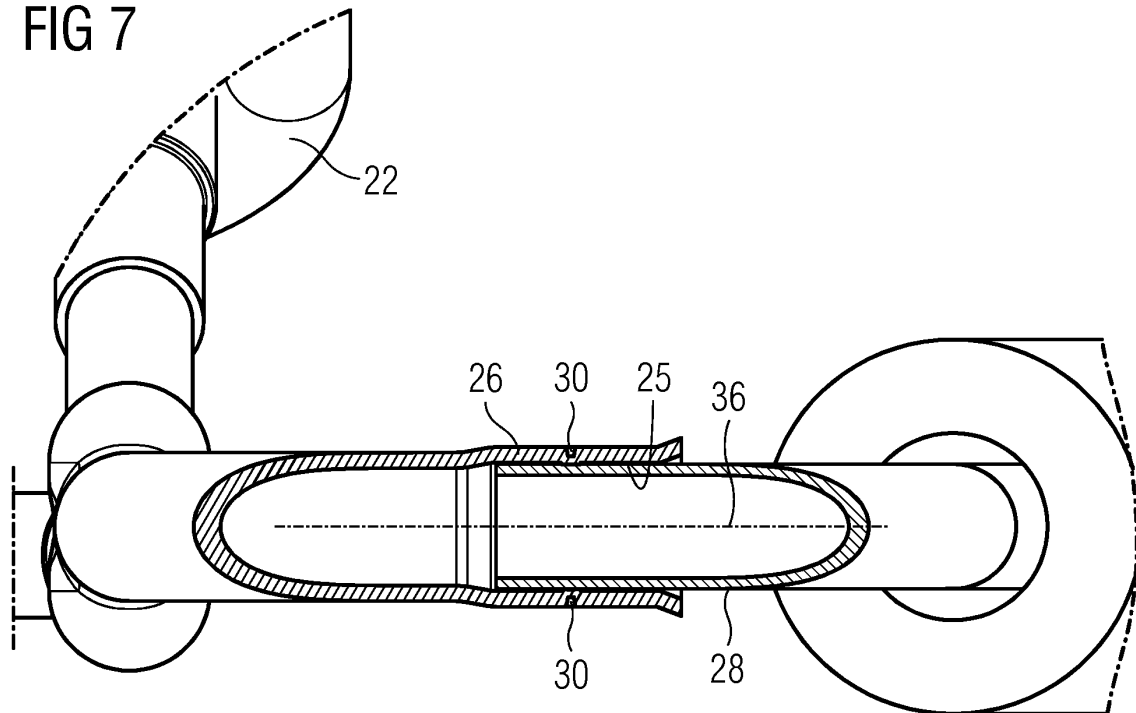


FIG 8

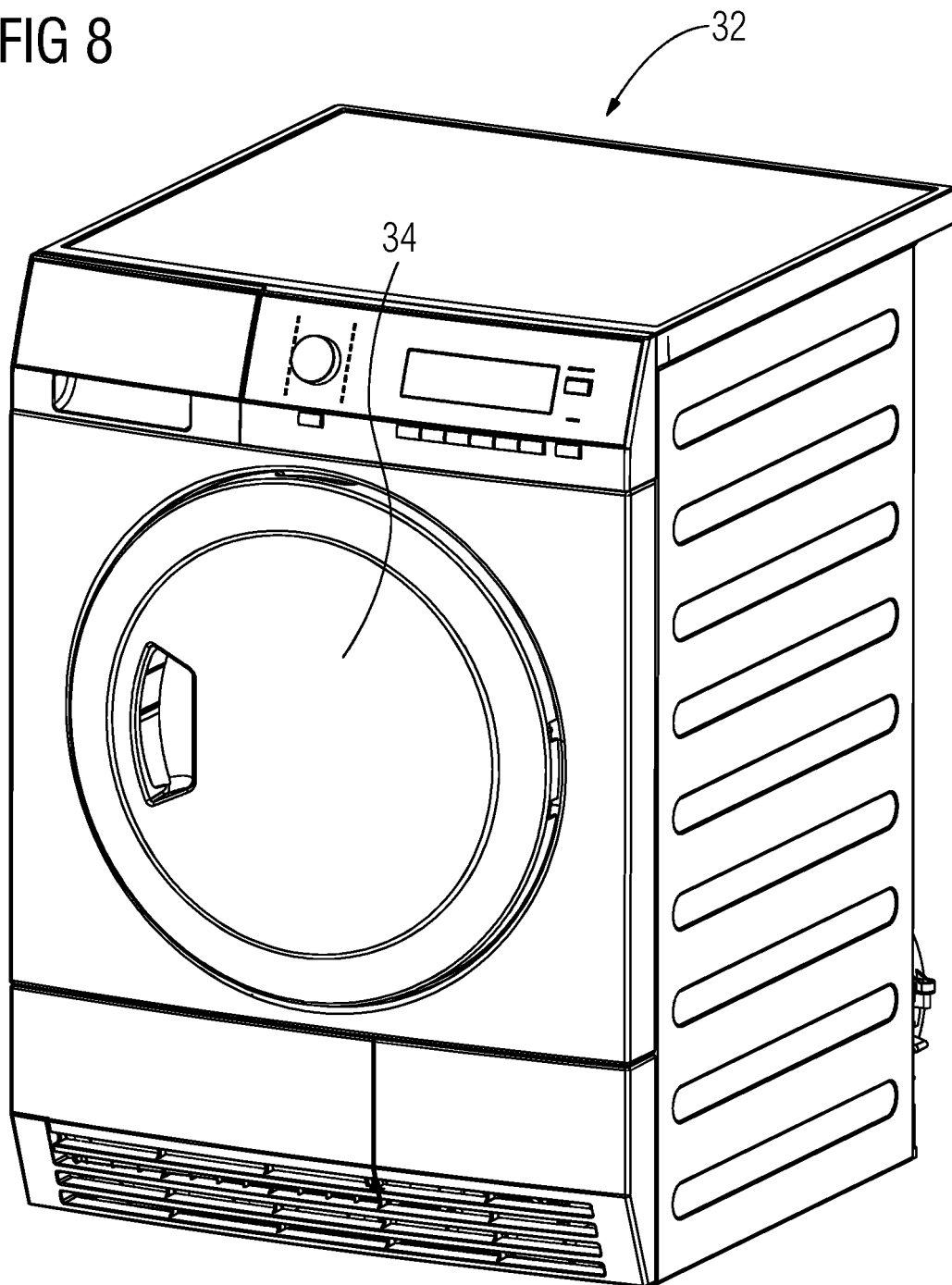
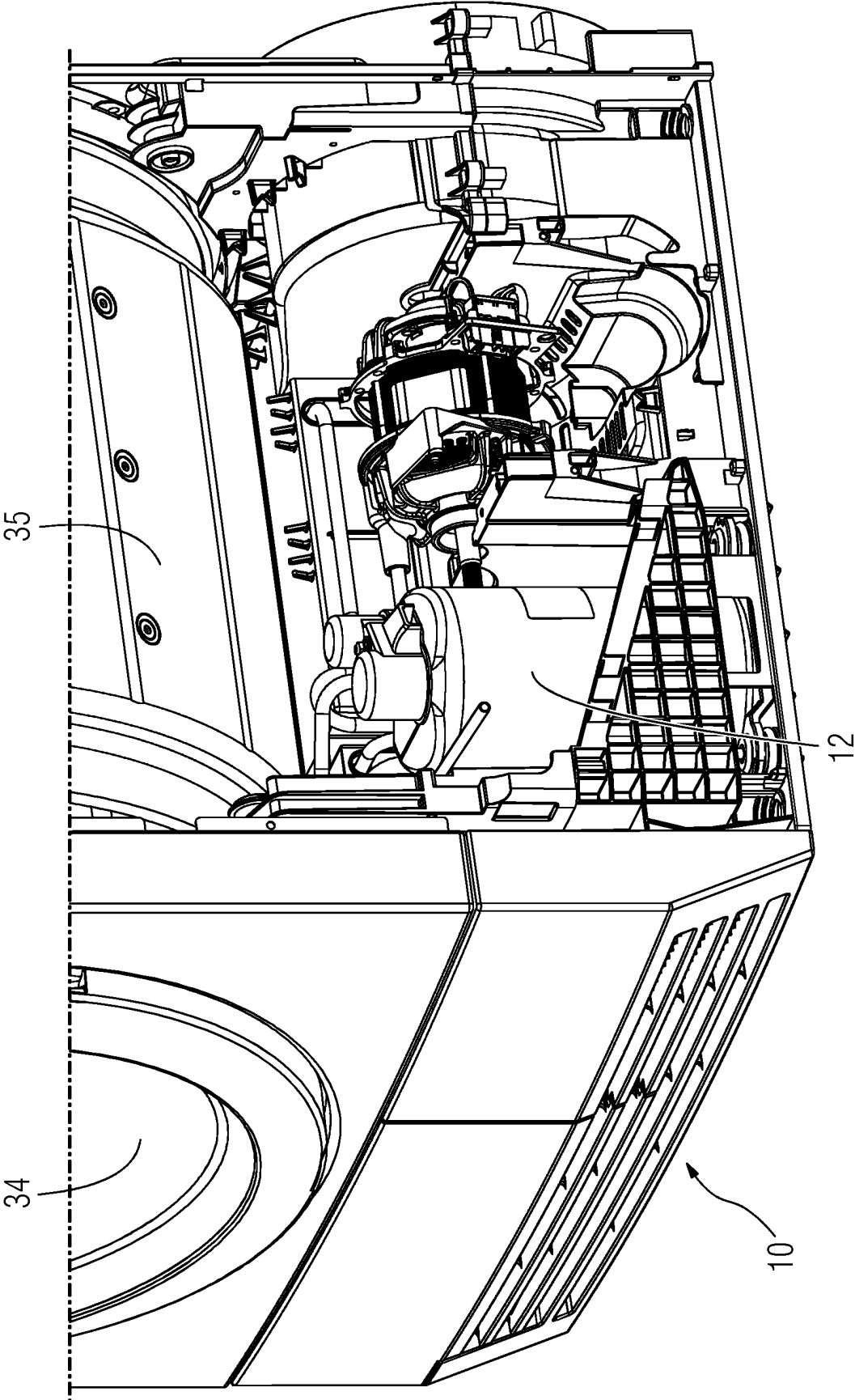


FIG 9



REFERENCES CITED IN THE DESCRIPTION

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