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(54) **A LAUNDRY DRYER**
EIN WÄSCHETROCKNER
UN SÉCHOIR À LINGE

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Description

[0001] The present invention relates to a heat pump or conventional laundry dryer.

[0002] In conventional laundry dryers wherein the drying air is circulated through a closed cycle, the drying air moved by a fan is passed over the laundry inside the drum to be dehumidified and the water vapor in the air is condensed in the condenser. The drying air dehumidified in the condenser is then heated by being passed over the heater, and thus hot and dry air is delivered onto the laundry. In heat pump laundry dryers, the heat pump used for drying the laundry is composed of flow pipes wherein the refrigerant fluid flows, a compressor which provides the circulation of the refrigerant by pressurizing the same, an evaporator and a condenser. In the drying process, the drying air moved by the process fan is passed over the laundry. The condenser located in the heat pump functions as a heater and the evaporator as a condenser. The drying air is heated while passing over the condenser, delivered onto the laundry as heated and after dehumidifying the laundry, is condensed while passing over the evaporator.

[0003] In conventional and heat pump laundry dryers, a single motor is used for moving the drum and operating the fan which provides the air circulation. In this case during the operation of the motor the drum rotates clockwise or counterclockwise depending on the direction of the motor, and since the process fan is driven by the same motor, the process fan similarly rotates in both directions and provides air flow.

[0004] In heat pump or conventional laundry dryers, sufficient air flow is required for the systems, which perform the heating and dehumidification processes, to operate so as to carry out the drying process. In case of insufficient air flow, the heater in conventional laundry dryers and the compressor in heat pump laundry dryers are turned off and deactivated for security reasons, which in turn prolongs the drying process.

[0005] Since in laundry dryers the fan, which provides the air circulation, and the drum are driven by the same motor, the drum also has to rotate continuously while providing air flow. This causes the noise to increase and the delicate laundry to be worn down due to the mechanical effect caused by the rotation of the drum.

[0006] In the Patent Application No. US2017254014 (A1), in a laundry dryer two fans, one at the inlet of the drum and one at the outlet thereof, are provided so as to increase the flow rate of the air.

[0007] The aim of the present invention is the realization of a laundry dryer wherein the delicate laundry is prevented from being worn down and the drying process duration is shortened.

[0008] In the state of the art, European Patent Application No. EP2765235 discloses a laundry dryer comprising a control unit.

[0009] In the state of the art, German Patent Application No. DE2429078 discloses an automatic clothes drier

comprises a horizontal-axis rotary perforated drum surrounded at a distance by a stationary casing, and a condenser for removing humidity from the drying air.

[0010] The above stated problem is solved by a laundry dryer as defined in claim 1 and by a conventional laundry dryer as defined in claim 7.

[0011] Preferred embodiments are defined in the dependent claims respectively.

[0012] The laundry dryer realized in order to attain the aim of the present invention comprises a heat pump system composed of an air circulation duct which enables the process air to be passed over the laundry in the drum, a first fan which moves the process air, a compressor which provides the circulation of the refrigerant, an evaporator and a condenser, or in the conventional type, a heater and a heat exchanger. In both types of laundry dryers, a main motor operates the drum and the first fan together. In the embodiment of the present invention, by means of a second fan disposed in the air circulation duct, the process air is continued to be circulated when the drum and the first fan are deactivated. The second fan is positioned at the outlet of the condenser in the heat pump laundry dryer, and at the outlet of the heater in the conventional laundry dryer.

[0013] The laundry dryer realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

Figure 1 - is the schematic view of a heat pump laundry dryer.

Figure 2 - is the schematic view of a conventional laundry dryer.

[0014] The elements illustrated in the figures are numbered as follows:

1. Laundry dryer
2. Drum
3. Air circulation duct
4. First fan
5. Compressor
6. Evaporator
7. Condenser
8. Main motor
9. Auxiliary motor
10. Second fan
11. Control unit
12. Conventional laundry dryer
13. Heater
14. Heat exchanger

[0015] The laundry dryer (1) comprises a body; a drum (2) wherein the laundry to be dried is placed; a heat pump system having an air circulation duct (3) which enables the process air to be passed over the laundry in the drum (2), a first fan (4) which is disposed in the air circulation duct (3) and which moves the process air, a compressor (5) which performs the refrigerant cycle, an evaporator

(6) which enables the process air to be dehumidified and a condenser (7) which enables the process air to be heated; a main motor (8) which operates the drum (2) and the first fan (4) at the same time, thus rotating the drum (2) during the drying process while providing the circulation of the process air by means of the first fan (4); and a control unit (11) which regulates the drying process.

[0016] The laundry dryer (1) of the present invention comprises a second fan (10) which is disposed in the air circulation duct (3), which provides the continuity of the circulation of the process air in the drum (2) via the air circulation duct (3) when the drum (2) and the first fan (4) are deactivated during the drying process, and which is operated by an auxiliary motor (9) independently of the main motor (8).

[0017] In an embodiment of the present invention, the second fan (10) is positioned in the air circulation duct (3) at the outlet of the condenser (7) where the humidity of the process air is at the lowest level and the temperature of the process air is at the highest level. Moreover, the outlet of the condenser (7) is the point which least affects the flow rate of the process air. Thus, the adverse effect on the energy efficiency of the system when the second fan (10) is deactivated is minimized.

[0018] In the laundry dryer (1), the humid process air leaving the drum (2) passes through the evaporator (6) and the condenser (7) and then is directed to the drum (2) via the air circulation duct (3) by the first fan (4). The drum (2) and the fan (4) which enables the process air to be circulated in the air circulation duct (3) and the drum (2) are driven by the main motor (8). Therefore, when the drum (2) stops the first fan (4) also stops, and when the drum (2) rotates in the opposite direction, the first fan (4) also rotates in the opposite direction. Particularly in delicate textile programs and quiet drying programs, the drum (2) is required to be stopped at intervals in order to reduce the movement thereof. In the embodiment of the present invention, when the drum (2) and the first fan (4) are stopped, the second fan (10) is activated by the auxiliary fan (9), thus resuming the process air flow. The second fan (10) moves the air with high temperature and low humidity at the outlet of the condenser (7), thus improving the drying performance. The delicate laundry is prevented from being worn down and is enabled to be quickly dried.

[0019] In an embodiment of the present invention, the control unit (11) executes a drying program wherein the second fan (10) is operated only when the drum (2) and the first fan (4) are stopped intermittently. Said drying program is used to prevent the laundry affected by the mechanical movement from being worn down and/or to consume less energy.

[0020] In an embodiment of the present invention, the control unit (11) executes a drying program wherein the second fan (10) is continuously operated and the drum (2) and the first fan (4) are stopped intermittently. Said drying program is used to air the laundry and remove odors and to decrease the formation of lint and the me-

chanical damage caused by the continuous rotation of the dry laundry with the drum (2).

[0021] In an embodiment of the present invention, the control unit (11) executes a drying program wherein the second fan (10) is continuously operated and the drum (2) and the first fan (4) are completely stopped. In this program, the air at high temperature and low flow rate is enabled to flow, and delicate laundry, which is excessively affected by the mechanical movement, is prevented from being worn down. In hygiene programs, only the second fan (10) is operated, thus performing the drying process at low flow rate.

[0022] In an embodiment of the present invention, the control unit (11) executes a drying program wherein the drum (2), the first fan (4) and the second fan (10) are continuously operated. This drying program is used to decrease the total drying time by increasing the flow rate of the process air and to quickly air the laundry and remove odors.

[0023] In another embodiment of the present invention, a conventional laundry dryer (12) comprises a drum (2) wherein the laundry to be dried is placed; an air circulation duct (3) which enables the process air to be passed over the laundry in the drum (2); a first fan (4) which is disposed in the air circulation duct (3) and which moves the process air; a heater (13) which heats the process air; a heat exchanger (14) which dehumidifies the process air; a main motor (8) which operates the drum (2) and the first fan (4) at the same time, thus rotating the drum (2) during the drying process while providing the circulation of the process air by means of the first fan (4); and a second fan (10) which is disposed in the air circulation duct (3), which is operated by an auxiliary motor (9) independently of the main motor (8), and which provides the continuity of the circulation of the process air in the drum (2) via the air circulation duct (3) when the drum (2) and the first fan (4) are deactivated.

[0024] In the conventional laundry dryer (12), the second fan (10) is disposed in the air circulation duct (3) at the outlet of the heater (13).

[0025] In the laundry dryer (1) of the present invention, the second fan (10) which is disposed in the air circulation duct (3) at the outlet of the condenser (7) enables the drying process to be carried out with minimum mechanical effect while not moving or barely moving the drum (2) during the drying of the delicate laundry. Thus, the laundry is prevented from being worn down. Energy consumption, total drying time and noises caused by the rotation of the drum (2) are decreased.

Claims

1. A laundry dryer (1) comprising a drum (2) wherein the laundry to be dried is placed, an air circulation duct (3) which enables the process air to be passed over the laundry in the drum (2), a first fan (4) which is disposed in the air circulation duct (3) and which

moves the process air, a compressor (5) which performs the refrigerant cycle, an evaporator (6), a condenser (7), a main motor (8) which operates the drum (2) and the first fan (4), and a control unit (11),

- **characterized by** a second fan (10) which is disposed in the air circulation duct (3), which provides the continuity of the circulation of the process air in the drum (2) via the air circulation duct (3) when the drum (2) and the first fan (4) are deactivated during the drying process, and which is operated by an auxiliary motor (9) independently of the main motor (8). 5
- 2. A laundry dryer (1) as in Claim 1, **characterized by** the second fan (10) which is disposed in the air circulation duct (3) at the outlet of the condenser (7). 10
- 3. A laundry dryer (1) as in Claim 1 or 2, **characterized by** the control unit (11) which executes a drying program wherein the second fan (10) is operated only when the drum (2) and the first fan (4) are stopped intermittently. 20
- 4. A laundry dryer (1) as in Claim 1 or 2, **characterized by** the control unit (11) which executes a drying program wherein the second fan (10) is continuously operated and the drum (2) and the first fan (4) are stopped intermittently. 25
- 5. A laundry dryer (1) as in Claim 1 or 2, **characterized by** the control unit (11) which executes a drying program wherein the second fan (10) is continuously operated and the drum (2) and the first fan (4) are completely stopped. 30
- 6. A laundry dryer (1) as in Claim 1 or 2, **characterized by** the control unit (11) which executes a drying program wherein the drum (2), the first fan (4) and the second fan (10) are continuously operated. 35
- 7. A conventional laundry dryer (1) comprising a drum (2), an air circulation duct (3), a first fan (4), a main motor (8) which operates the drum (2) and the first fan (4) at the same time, a heater (13) which heats the process air, a heat exchanger (14) which dehumidifies the process air, **characterized by** a second fan (10) which is disposed in the air circulation duct (3), which provides the continuity of the circulation of the process air in the drum (2) via the air circulation duct (3) when the drum (2) and the first fan (4) are deactivated and which is operated by an auxiliary motor (9) independently of the main motor (8). 40
- 8. A conventional laundry dryer (12) as in Claim 7, **characterized by** the second fan (10) which is disposed in the air circulation duct (3) at the outlet of the heater (13). 45

Patentansprüche

- 1. - Ein Wäschetrockner (1) umfasst eine Trommel (2), in der die zu trocknende Wäsche platziert wird, einen Luftumwälzkanal (3), der es ermöglicht, die Prozessluft über die Wäsche in der Trommel (2) zu leiten, einen ersten Ventilator (4), der im Luftumwälzkanal (3) angeordnet ist und die Prozessluft bewegt, einen Kompressor (5), der den Kältekreislauf durchführt, einen Verdampfer (6), einen Kondensator (7), einen Hauptmotor (8), der die Trommel (2) und den ersten Ventilator (4) betreibt, und eine Steuereinheit (11),
- **gekennzeichnet ist es dadurch**, dass ein zweiter Ventilator (10), das im Luftumwälzkanal (3) angeordnet ist, dass die Kontinuität der Zirkulation der Prozessluft in der Trommel (2) über den Luftumwälzkanal (3) sicherstellt, wenn die Trommel (2) und das erste Ventilator (4) während des Trocknungsprozesses ausgeschaltet sind, und das von einem Hilfsmotor (9) unabhängig vom Hauptmotor (8) betrieben wird. 5
- 2. - Ein Wäschetrockner (1), wie in Anspruch 1 aufgeführt, **ist dadurch gekennzeichnet**, dass der zweite Ventilator (10) im Luftumwälzkanal (3) am Ausgang des Kondensators (7) angeordnet ist. 10
- 3. - Ein Wäschetrockner (1), wie in Anspruch 1 oder 2 aufgeführt, **ist dadurch gekennzeichnet**, dass die Steuereinheit (11) ein Trocknungsprogramm ausführt, bei dem der zweite Ventilator (10) nur dann betrieben wird, wenn die Trommel (2) und der erste Ventilator (4) zeitweise gestoppt sind. 20
- 4. - Ein Wäschetrockner (1), wie in Anspruch 1 oder 2 aufgeführt, **ist dadurch gekennzeichnet**, dass die Steuereinheit (11) ein Trocknungsprogramm ausführt, bei dem der zweite Ventilator (10) kontinuierlich betrieben wird und die Trommel (2) und der erste Ventilator (4) intermittierend gestoppt werden. 25
- 5. - Ein Wäschetrockner (1), wie in Anspruch 1 oder 2 aufgeführt, **ist dadurch gekennzeichnet**, dass die Steuereinheit (11) ein Trocknungsprogramm ausführt, bei dem der zweite Ventilator (10) kontinuierlich betrieben wird und die Trommel (2) und der erste Ventilator (4) vollständig gestoppt werden. 30
- 6. - Ein Wäschetrockner (1), wie in Anspruch 1 oder 2 aufgeführt, **ist dadurch gekennzeichnet**, dass die Steuereinheit (11) ein Trocknungsprogramm ausführt, bei dem die Trommel (2), der erste Ventilator (4) und der zweite Ventilator (10) kontinuierlich betrieben werden. 35
- 7. - Ein herkömmlicher Wäschetrockner (1) umfasst eine Trommel (2), einen Luftumwälzkanal (3), ein ers-

tes Ventilator (4), einen Hauptmotor (8), der die Trommel (2) und das erste Ventilator (4) gleichzeitig betreibt, eine Heizung (13), die die Prozessluft erwärmt, einen Wärmetauscher (14), der die Prozessluft entfeuchtet, **gekennzeichnet ist es dadurch**, dass ein zweites Ventilator (10), das im Luftumwälzkanal (3) angeordnet ist, die Kontinuität der Zirkulation der Prozessluft in der Trommel (2) über den Luftumwälzkanal (3) sicherstellt, wenn die Trommel (2) und das erste Ventilator (4) deaktiviert sind, und das von einem Hilfsmotor (9) unabhängig vom Hauptmotor (8) betrieben wird.

8. - Ein herkömmlicher Wäschetrockner (1), wie in Anspruch 7 aufgeführt, **ist dadurch gekennzeichnet**, dass der zweite Ventilator (10) im Luftumwälzkanal (3) am Auslass der Heizung (13) angeordnet ist.

Revendications

1. - Un sèche-linge (1) **comportant** un tambour (2) dans lequel est placé le linge à sécher, un conduit de circulation d'air (3) qui permet de faire passer l'air de traitement sur le linge dans le tambour (2), un premier ventilateur (4) placé dans le conduit de circulation d'air (3) et qui déplace l'air de traitement, un compresseur (5) qui effectue le cycle frigorifique, un évaporateur (6), un condenseur (7), un moteur principal (8) qui actionne le tambour (2) et le premier ventilateur (4), et une unité de commande (11),
 - **caractérisé par** un second ventilateur (10) disposé dans le conduit de circulation d'air (3), qui assure la continuité de la circulation de l'air de traitement dans le tambour (2) via le conduit de circulation d'air (3) lorsque le tambour (2) et le premier ventilateur (4) sont désactivés pendant le processus de séchage, et qui est actionné par un moteur auxiliaire (9) indépendamment du moteur principal (8).
2. - Un sèche-linge (1) selon la déclaration 1, **caractérisé par** le second ventilateur (10) qui est disposé dans le conduit de circulation d'air (3) à la sortie du condenseur (7).
3. - Un sèche-linge (1) selon la déclaration 1 ou 2, **caractérisé par** l'unité de commande (11) qui exécute un programme de séchage dans lequel le second ventilateur (10) ne fonctionne que lorsque le tambour (2) et le premier ventilateur (4) sont arrêtés de manière intermittente.
4. - Un sèche-linge (1) selon la déclaration 1 ou 2, **caractérisé par** l'unité de commande (11) qui exécute un programme de séchage dans lequel le second ventilateur (10) fonctionne en continu et le tambour

(2) et le premier ventilateur (4) sont arrêtés par intermittence.

5. - Un sèche-linge (1) selon la déclaration 1 ou 2, **caractérisé par** l'unité de commande (11) qui exécute un programme de séchage dans lequel le second ventilateur (10) fonctionne en continu et le tambour (2) et le premier ventilateur (4) sont complètement arrêtés.
6. - Un sèche-linge (1) selon la déclaration 1 ou 2, **caractérisé par** l'unité de commande (11) qui exécute un programme de séchage dans lequel le tambour (2), le premier ventilateur (4) et le second ventilateur (10) fonctionnent en continu.
7. - Un sèche-linge conventionnel (1) comprenant un tambour (2), un conduit de circulation d'air (3), un premier ventilateur (4), un moteur principal (8) qui fait fonctionner le tambour (2) et le premier ventilateur (4) en même temps, un réchauffeur (13) qui chauffe l'air de traitement, un échangeur de chaleur (14) qui déshumidifie l'air de traitement, **caractérisé par** un second ventilateur (10) placé dans le conduit de circulation d'air (3), qui assure la continuité de la circulation de l'air de traitement dans le tambour (2) via le conduit de circulation d'air (3) lorsque le tambour (2) et le premier ventilateur (4) sont désactivés et qui est actionné par un moteur auxiliaire (9) indépendamment du moteur principal (8).
8. - Un sèche-linge conventionnel (12) selon la déclaration 7, **caractérisé par** le second ventilateur (10) qui est disposé dans le conduit de circulation d'air (3) à la sortie de l'appareil de chauffage (13).

Figure 1

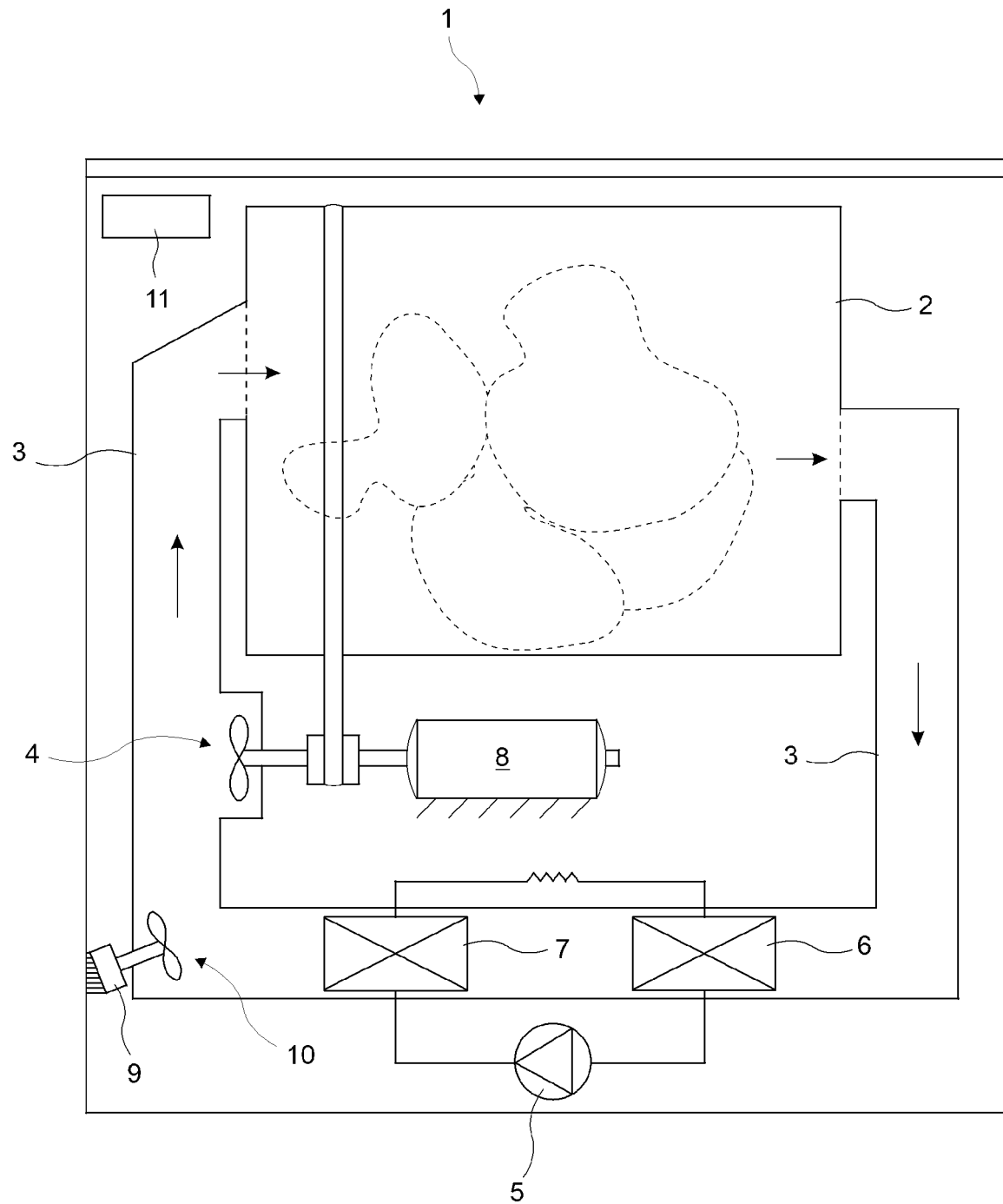
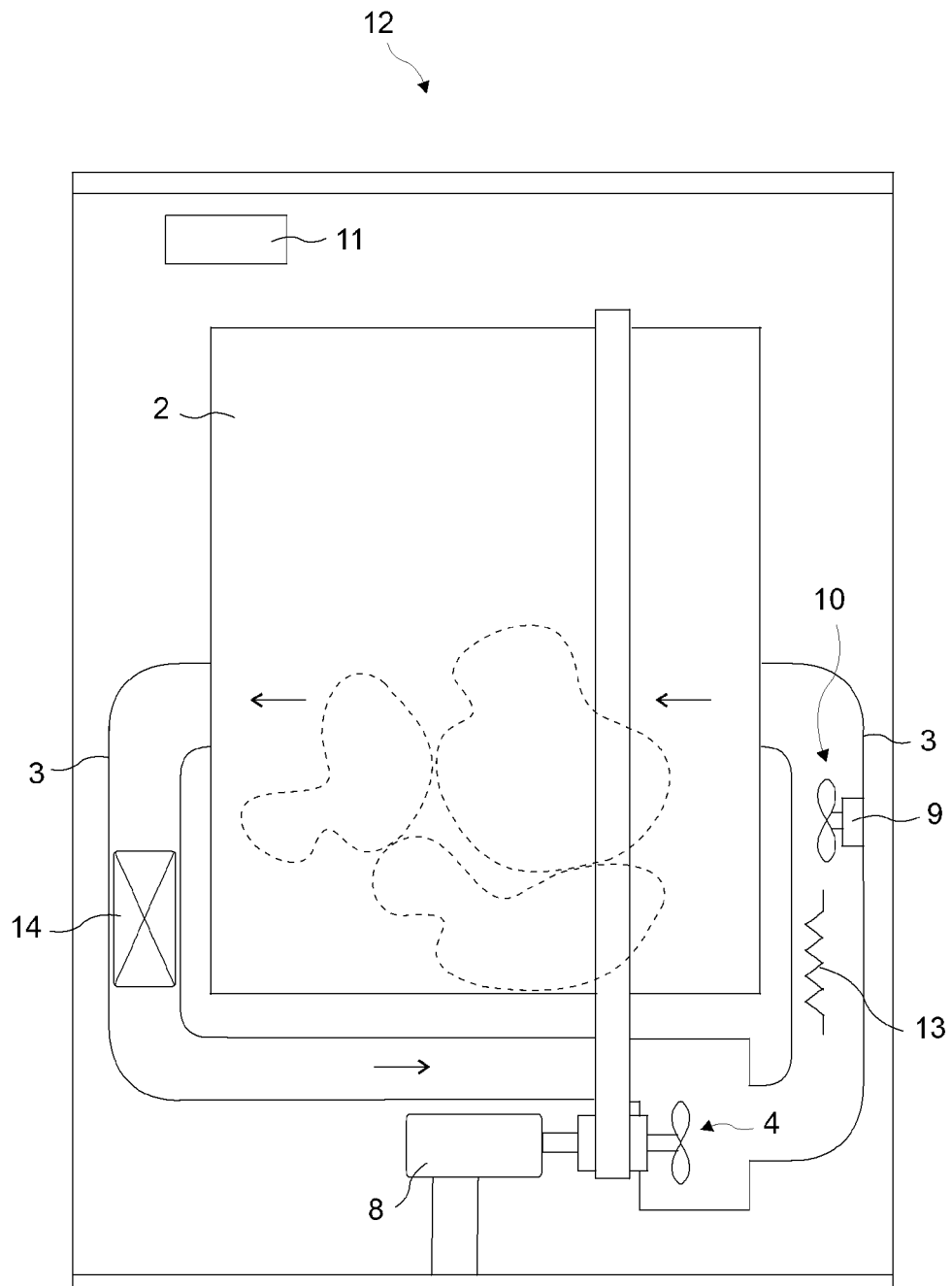


Figure 2



REFERENCES CITED IN THE DESCRIPTION

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