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(54) A DISHWASHER COMPRISING A DEHUMIDIFYING UNIT

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LAVE-VAISSELLE COMPRENANT UNE UNITÉ DE DÉSHUMIDIFICATION

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EP 2 637 547 B1

Description

[0001] The present invention relates to a dishwasher comprising a dehumidifying unit that provides the dehumidification process to be performed effectively.

[0002] In dishwasher programs, the dehumidification step is started after the washing and rinsing steps. In the dehumidifying step, it is aimed to remove the water remaining on the dishes and also to prevent the moisture in the tub from leaving stains on the dishes getting cold by condensing after the rinsing step. The last rinsing step is performed with hot water in order to remove the water remaining on the dishes in an easier way in the dehumidifying step. This requires a great amount of energy to be consumed for heating the water. In the dehumidification step after the hot rinsing step, humid air in the tub is delivered into the air channel disposed between the outer cabinet and the tub by means of a fan. This air is directly discharged outside by means of an opening. In some dishwashers, an additional air channel that delivers the humid air received from the tub by condensing it thereon is disposed near this line. However, moisture in the tub cannot be completely discharged and causes stains on the dishes by condensing. Moreover, when the user opens the cover of the dishwasher just after the program is completed, air mass with high temperature remaining in the tub at once exits to the outer environment and can cause the user to be exposed to hot vapor.

[0003] In order to eliminate the said problem, dehumidifying elements comprising reversible type moisture adsorbent materials are used. Adsorbent materials can adsorb moisture upto the saturation point and at that moment emit heat to their surroundings. In the state of the art, zeolite is used as moisture adsorbent. Humid air received from the tub by means of the fan into the air channel is sent to the zeolite-comprising container and after heating up and leaving its moisture therein, the said air is again directed into the tub. By means of this process, an efficient dehumidification process is realized by evaporating the water on the dishes. At the same time, zeolite that fills its moisture adsorption capacity is regenerated at the next washing step by being heated up to high temperatures by means of a heater placed therein or thereabout and can be used in the next dehumidification step.

[0004] Since zeolite regeneration is realized at very high temperatures, a heater outside the chamber cannot provide an effective regeneration. In cases where the heater is disposed inside the chamber, since zeolite particles directly contacting the heater are subject to high amount of heat, they burn and lose their desiccation characteristic after some time. In this case, the dishwasher cannot perform an effective dehumidifying in the course of time and the user thinks that the machine is broken down. And this causes customer dissatisfaction and increase in maintenance and repair rate.

[0005] In state of the art International Patent Application No. WO2006061287, positioning of the heater in the flow direction of the air, just before the inlet of the chamber comprising reversible desiccant material is explained.

[0006] In the state of the art European Patent Document No. EP358279, a dishwasher is described, comprising a zeolite container positioned around a pipe-type water heater. In this embodiment, the zeolite particles contact the heater directly. The residual heat occurring around the heater is used during the water heating process for zeolite regeneration.

[0007] In the state of the art European Patent Document No. EP1674030, a dishwasher is described, comprising a chamber having desiccant material therein between the outer cabinet and the tub. In this embodiment, at least one heater is disposed between the desiccant materials arranged as plates so as to make thermal contact with the particles. A dishwasher according to the preamble of claim 1 is known for example from DE 10 2008040789 A1.

[0008] The aim of the present invention is the realization of a dishwasher comprising a dehumidifying unit the desiccation performance of which is improved.

[0009] In the dishwasher realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, a dehumidifying unit having a desiccant material, a heater and fins disposed on the heater and an air channel providing the connection between the dehumidifying unit and the tub are disposed.

[0010] In the dishwasher of the present invention, the fins prevent the desiccant material particles from contacting the heater by forming a barrier between the desiccant material and the heater.

[0011] In an embodiment of the present invention, the distance between the consecutive two fins of the heater is smaller than the length of the desiccant material particle. Thus, the desiccant material particles are prevented from entering between the heater fins.

[0012] In another embodiment of the present invention, the heater is placed perpendicular to the air flow, in the chamber at a region near the area where the air enters the chamber.

[0013] In another embodiment of the present invention, the heater is in pipe form and the fin in circular ring form. The fins are arranged parallel to each other along the heater.

[0014] In another embodiment of the present invention, the fin is in helical form. In this embodiment, the fin extends along the pipe-shaped heater as a single piece.

[0015] In another embodiment of the present invention, the fins are in needle form. In this embodiment, the lengths of the needles and the gaps therebetween are chosen such that the desiccant material does not slip between the needles.

[0016] In another embodiment of the present invention, the heater is in curved configuration. The heater is formed as an M by being bent preferably at three points (Figure 3). Thus, the heater sweeps the vertical cross-section of the chamber and provides a homogeneous heat distribution.

[0017] The desiccant material has reversible feature.

Preferably zeolite is used as the desiccant material.

[0018] By means of the present invention, the desiccant material particles are prevented from burning and losing their desiccation characteristic during the regeneration of the desiccant material. Thus, dehumidifying efficiency of the dishwasher is prevented from decreasing in long term. Furthermore, since a homogeneous heat distribution is provided in the chamber, almost all of the desiccant material particles are provided to be regenerated. Thus, total dehumidification capacity in the next dehumidifying step increases and hence a more efficient dehumidifying is provided.

[0019] The elements illustrated in the figures are numbered as follows:

1. Dishwasher
2. Outer cabinet
3. Tub
4. Outlet
5. Air channel
6. Fan
7. Dehumidifying unit
8. Chamber
9. Desiccant material
10. Heater
11. Fin
12. Inlet

[0020] A dishwasher 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 the dishwasher of the present invention.
Figure 2 - is the schematic view of the dehumidifying unit.
Figure 3 - is the schematic view of the heater.

[0021] The dishwasher (1) comprises

- an outer cabinet (2),
- a tub (3) wherein the washing process is performed, disposed into the outer cabinet (2) such that a gap remains therebetween,
- an air channel (5) both ends of which are connected to the tub (3),
- a dehumidifying unit (7) having a desiccant material (9) disposed on the air channel (5), at least one heater (10) used for regenerating the desiccant material (9), a chamber (8) wherein the desiccant material (9) and the heater (10) are placed and at least one fin (11) disposed on the heater (10),
- an outlet (4) enabling air transfer from the inside of the tub (3) into the air channel (5),
- at least one fan (6) that is disposed on the air channel (5) and that sucks and delivers the humid air in the tub (3) towards the dehumidifying unit (7) and
- an inlet (12) that provides the dehumidified and heated air leaving the dehumidifying unit (7) to be sent back to the tub (3) through the air channel (5) (Figure 1).

[0022] In the washing program of the dishwasher (1), after the rinsing step is completed, the dehumidification step is started by operating the fan (6) on the air channel (5). In this step, firstly the air sucked by the fan (6) is received into the air channel (5) by means of the outlet (4) on the tub (3) surface. Afterwards, the humid air received into the air channel (5) is sent to the dehumidifying unit (7) disposed under the tub (3) in the direction of the rotational axis of the preferably radial fan (6). The humid air leaves its moisture while moving through the desiccant material (9) disposed in the dehumidifying unit (7) and leaves the dehumidifying unit (7) and returns to the tub (3) by means of the inlet (12). The desiccant material (9) emanates heat due to its thermophysical feature as it retains moisture and transfers this heat to the process air passing therethrough. As the process air passing through the dehumidifying unit (7) heats up, the internal temperature of the tub (3) increases and thus the water accumulated on the dishes are provided to be evaporated. The vapor forming passes over again the desiccant material (9) in the dehumidifying unit (7) in the closed cycle and received into the tub (3). After a while, the humid air forming as a result of the water on the dishes and the vaporization of the water is discharged from the tub (3). The heater (10) is not operated at all during the dehumidification step.

[0023] Since the desiccant material (9) reaching its saturation point by retaining the moisture of the process air in the dehumidification step is of reversible feature, it is regenerated and regains its desiccant characteristic. This process is realized between the cold washing and the hot washing steps of the next washing program. The temperature of the desiccant material (9) is increased to almost 350°C by operating the heater (10) in the chamber (8) and the desiccant material (9) is provided to be regenerated.

[0024] In the dishwasher (1) of the present invention, the fins (11) prevent the desiccant material (9) particles from contacting the heater (10) by forming a barrier between the desiccant material (9) and the heater (10). Thus, while the heater (10) is operating, the desiccant material (9) particles are prevented from being subjected to high temperatures by contacting the heater (10) and from losing their desiccation characteristic by being burnt.

[0025] In an embodiment of the present invention, the distance between the consecutive two fins (11) of the heater (10) is smaller than the length of the desiccant material (9) particle (Figure 2, Figure 3). Thus, the desiccant material (9) particles are prevented from entering between the heater (10) fins (11). Thus, the surface area of the desiccant material (9) particles contacting the heater (10) is decreased and the particles in contact with the heater (10) are prevented from burning by being subject-

ed to high temperatures and from losing their desiccation characteristic. Consequently, this eliminates a possible situation of user dissatisfaction since it prevents the dehumidification performance from decreasing in long term.

[0026] In another embodiment of the present invention, the heater (10) is placed perpendicular to the air flow, in the chamber (8) at a region near the area where the air enters the chamber (8) (Figure 2, Figure 3). In the regeneration process, the fan (6) is operated at the same time with the heater (10). While heat transfer to regions near the heater (10) is realized by conduction and heat transfer to regions away from the heater (10) is realized by convection by means of the fan (6) blowing the air coming from tub (3) into the dehumidifying unit (7). Thus, a homogeneous heat distribution is provided in the chamber (8). By means of the homogeneous heat distribution, almost whole desiccant material (9) in the chamber (8) is regenerated and the desiccation capacity thereof is provided to be higher in the next dehumidification step.

[0027] In another embodiment of the present invention, the heater (10) is in pipe form and the fin (11) in circular ring form. The fins (11) are arranged parallel to each other along the heater (10).

[0028] In another embodiment of the present invention, the fin (11) is in helical form. In this embodiment, the fin (11) extends along the pipe-shaped heater (10) as a single piece.

[0029] In another embodiment of the present invention, the fins (11) are in needle form. In this embodiment, the lengths of the needles and the gaps therebetween are chosen such that the desiccant material (9) does not slip between the needles.

[0030] In another embodiment of the present invention, the heater (10) is in curved configuration. The heater (10) is formed as an M by being bent preferably at three points (Figure 3). Thus, the heater (10) sweeps the vertical cross-section of the chamber (8) and provides a homogeneous heat distribution.

[0031] The desiccant material (9) has reversible feature. Preferably zeolite is used as the desiccant material (9).

[0032] By means of the present invention, the desiccant material (9) particles are prevented from burning and losing their desiccation characteristic during the regeneration of the desiccant material (9). Thus, dehumidifying efficiency of the dishwasher (1) is prevented from decreasing in long term. Furthermore, since a homogeneous heat distribution is provided in the chamber (8), almost all of the desiccant material (9) particles are provided to be regenerated. Thus, total dehumidification capacity in the next dehumidifying step increases and hence a more efficient dehumidifying is provided.

[0033] It is to be understood that the present invention is not limited to the embodiments disclosed above and a person skilled in the art can easily introduce different embodiments. These should be considered within the scope of the protection postulated by the claims of the present invention.

Claims

1. A dishwasher (1) comprising

- an outer cabinet (2),
- a tub (3) wherein the washing process is performed, disposed into the outer cabinet (2) such that a gap remains therebetween,
- an air channel (5) both ends of which are connected to the tub (3),
- a dehumidifying unit (7) having at least one desiccant material (9) disposed on the air channel (5), at least one heater (10) used for regenerating the desiccant material (9), a chamber (8) wherein the desiccant material (9) and the heater (10) are placed and at least one fin (11) disposed on the heater (10),
- an outlet (4) enabling air transfer from the inside of the tub (3) into the air channel (5),
- at least one fan (6) that is disposed on the air channel (5) and that sucks and delivers the humid air in the tub (3) towards the dehumidifying unit (7) and
- an inlet (12) that provides the dehumidified and heated air leaving the dehumidifying unit (7) to be sent back to the tub (3) through the air channel (5) **characterized by** the at least one fin (11) of the dehumidifying unit (7) preventing the desiccant material (9) particles from contacting the heater (10) by forming a barrier between the desiccant material (9) and the heater (10).

2. A dishwasher (1) as in Claim 1, **characterized by** the heater (10) the distance between the consecutive two fins (11) of which is smaller than the length of the desiccant material (9) particle.

3. A dishwasher (1) as in Claim 1 or 2, **characterized by** the heater (10) placed perpendicular to the air flow, in the chamber (8) at a region near the area where the air enters the chamber (8).

4. A dishwasher (1) as in any one of the above claims, **characterized by** the heater (10) in pipe form.

5. A dishwasher (1) as in any one of the above claims, **characterized by** the fin (11) in circular plate form.

6. A dishwasher (1) as in any one of the Claims 1 to 4, **characterized by** the fin (11) in helical form.

7. A dishwasher (1) as in any one of the Claims 1 to 4, **characterized by** the fin (11) in needle form.

8. A dishwasher (1) as in any one of the above claims, **characterized by** the heater (10) in curved configuration.

Patentansprüche

1. Geschirrspüler (1), umfassend:

   • einen äußeren Schrank (2)
   • einen Spülbehälter (3), in dem der Spülvorgang ausgeführt wird und der im äußeren Schrank (2) unter Einhaltung eines Abstands zu diesem angeordnet ist,
   • einen Luftkanal (5), dessen beide Enden mit dem Spülbehälter (3) verbunden sind,
   • eine Entfeuchtungseinheit (7) mit wenigstens einem Entfeuchtungsmaterial (9), die am Luftkanal (5) angeordnet ist, wenigstens eine Heizeimichtung (10), die zum Regenerieren des Entfeuchtungsmaterials (9) dient, eine Kammer (8), in der das Entfeuchtungsmateual (9) und die Heizeinrichtung (10) angeordnet sind, und wenigstens eine Lamelle (11), die an der Heizeimichtung (10) angeordnet ist,
   • eine Auslass (4), der einen Lufttransfer vom Inneren des Spülbehälters (3) in den Luftkanal (5) ermöglicht,
   • wenigstens ein Gebläse (6), das am Luftkanal (5) angeordnet ist und das die feuchte Luft im Spülbehälter (3) ansaugt und zur Entfeuchtungseinheit (7) leitet, und
   • einen Einlass (12), der dafür sorgt, dass die entfeuchtete und erwärmte Luft, die die Entfeuchtungseinheit (7) verlässt, durch den Luftkanal (5) zurück an den Spülbehälter (3) geleitet wird,

   dadurch gekennzeichnet, dass die wenigstens eine Lamelle (11) der Entfeuchtungseinheit (7) verhindert, dass Partikel des Entfeuchtungsmaterials (9) in Kontakt mit der Heizeinrichtung (10) gelangen, indem sie eine Barriere zwischen dem Entfeuchtungsmateual (9) und der Heizeinrichtung (10) bildet.

2. Geschirrspüler (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** bei der Heizeinrichtung (10) der Abstand zwischen den aufeinanderfolgenden zwei Lamellen (11) kleiner als die Länge des Partikels des Entfeuchtungsmaterials (9) ist.

3. Geschirrspüler (1) nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Heizeinrichtung (10) senkrecht zum Luftstrom in einer Region in der Nähe eines Bereichs, in dem die Luft in die Kammer (8) gelangt, in der Kammer (8) angeordnet ist.

4. Geschirrspüler (1) nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Heizeimichtung (10) rohrförmig ist.

5. Geschirrspüler (1) nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Heizeimichtung (11) rund und scheibenförmig ist.

6. Geschirrspüler (1) nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** die Lamelle (11) spiralförmig ist.

7. Geschirrspüler (1) nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** die Lamelle (11) nadelförmig ist.

8. Geschirrspüler (1) nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Heizeinrichtung (10) eine gekrümmte Konfiguration aufweist.

Revendications

1. Un lave-vaisselle (1) comprenant

   • une armoire externe (2),
   • une cuve (3) dans laquelle le processus de lavage est réalisé et qui est disposée dans l'armoire externe (2) de telle sorte qu'un vide reste entre celles-ci,
   • un canal d'air (5) dont les deux extrémités sont reliées à la cuve (3),
   • une unité de déshumidification (7) qui présente au moins un matériau dessicatif (9) disposé sur le canal d'air (5), au moins un dispositif de chauffage (10) utilisé pour la régénération du matériau dessicatif (9), une chambre (8) où le matériau dessicatif (9) et le dispositif de chauffage (10) sont placés et au moins une ailette (11) disposée sur le dispositif de chauffage (10),
   • une sortie (4) qui permet le transfert d'air à partir de l'intérieur de la cuve (3) dans le canal d'air (5),
   • au moins un ventilateur (6) qui est disposé sur le canal d'air (5) et qui aspire et délivre l'air humide présent dans la cuve (3) vers l'unité de déshumidification (7) et
   • une entrée (12) qui permet à l'air déshumidifié et chauffé sortant de l'unité de déshumidification (7) d'être renvoyé à la cuve (3) à travers le canal d'air (5),

   caractérisé par l'au moins une ailette (11) de l'unité de déshumidification (7) qui empêche les particules du matériau dessicatif (9) de contacter le dispositif de chauffage (10) en formant une barrière entre le matériau dessicatif (9) et le dispositif de chauffage (10).

2. Un lave-vaisselle (1) selon la Revendication 1, **caractérisé par** le dispositif de chauffage (10) la distance entre les deux ailettes consécutives (11) duquel est plus petite que la longueur de la particule

du matériau dessicatif (9).

3. Un lave-vaisselle (1) selon la Revendication 1 ou 2, **caractérisé par** le dispositif de chauffage (10) qui est placé perpendiculairement à l'écoulement d'air dans la chambre (8) à une région proche de la zone où l'air entre dans la chambre (8).

4. Un lave-vaisselle (1) selon l'une quelconque des revendications précédentes, **caractérisé par** le dispositif de chauffage (10) en forme de tuyau.

5. Un lave-vaisselle (1) selon l'une quelconque des revendications précédentes, **caractérisé par** l'ailette (11) en forme de plaque circulaire.

6. Un lave-vaisselle (1) selon l'une quelconque des revendications de 1 à 4, **caractérisé par** l'ailette (11) en forme d'hélice.

7. Un lave-vaisselle (1) selon l'une quelconque des revendications de 1 à 4, **caractérisé par** l'ailette (11) en forme d'aiguille.

8. Un lave-vaisselle (1) selon l'une quelconque des revendications précédentes, **caractérisé par** le dispositif de chauffage (10) dans la configuration incurvée.

Figure 1

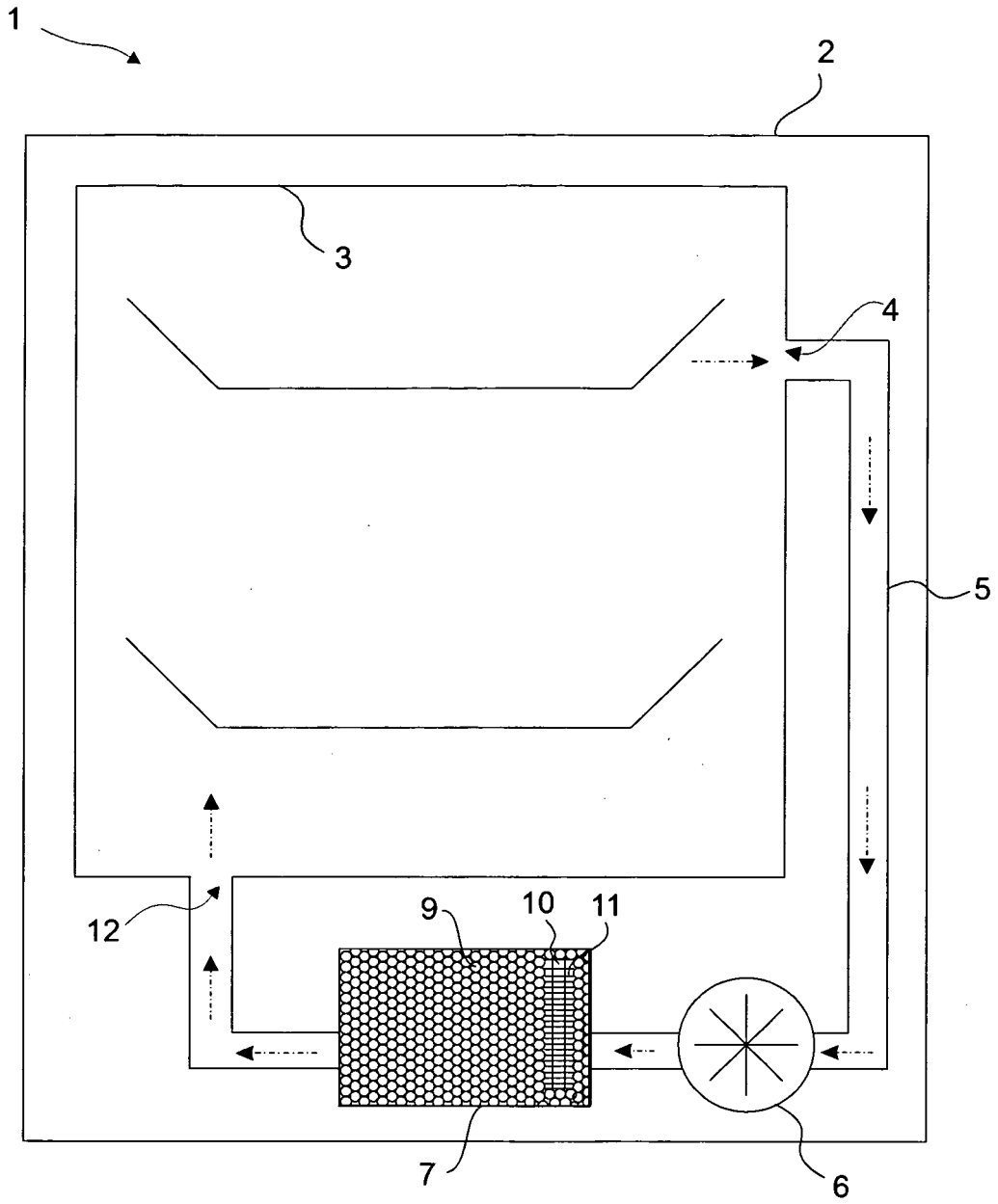


Figure 2

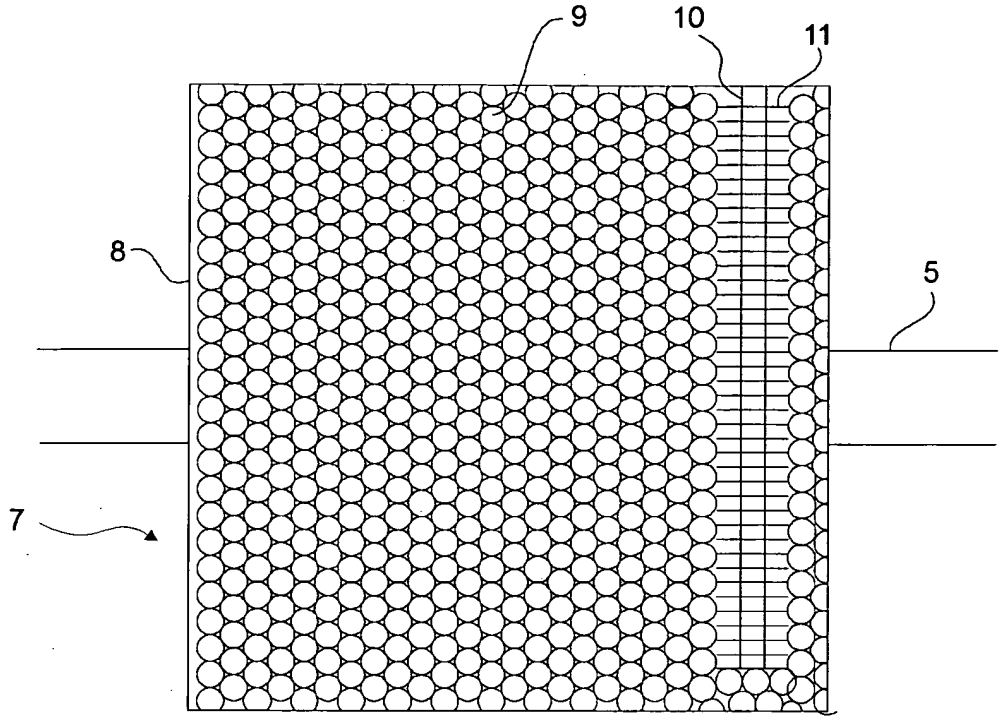
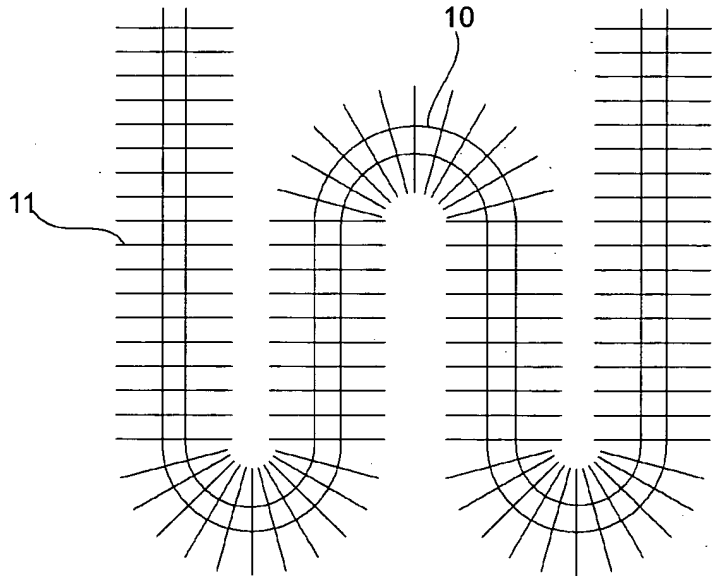


Figure 3



REFERENCES CITED IN THE DESCRIPTION

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