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(54) **A COOLING DEVICE**

KÜHLVORRICHTUNG

DISPOSITIF DE REFROIDISSEMENT

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Description

[0001] The present invention relates to a cooling device wherein noise caused by the bend at the welding point of the capillary and evaporator tubes is prevented.

[0002] Acoustic behavior of products is an important design criterion in the white goods industry. Since cooling devices, especially refrigerators, operate during the whole day unlike other white goods products, possible sound problems are found more disturbing by users. One of the main noise sources in the cooling devices is the movement of the refrigerant fluid. Changes in diameter, slope and angle in the path that the refrigerant fluid follows cause turbulent motion of the refrigerant fluid, an increase in its kinetic energy and the generation of noise due to this energy. An example of this situation is the increase in noise due to the bends in the tube and to the change in diameter at the welding point of the capillary and evaporator tubes in the freezing compartment of the cooling device.

[0003] The diameters of the capillary and evaporator tubes in the freezing compartment are different from each other. The refrigerant fluid moves from the narrow diameter capillary tube to the evaporator tube with a relatively larger diameter. This sudden change in diameter affects the movement of the refrigerant fluid, which is converted into sound energy. Moreover, when welding the capillary and evaporator tubes, assembly-induced bends in the tubes are a common problem. During the welding of the capillary and evaporator tubes, undesirable bending angles and, accordingly, noise occur. In addition to the diameter change, welding the pipes at the wrong angle causes the noise of the refrigerant fluid to increase to a disturbing level. Increasing sound power level also adversely affects the perception of quality.

[0004] The state of the art South Korean Patent Application No. KR101586540 discloses the prevention of the deformation of the tube by providing a structural improvement by means of a tube connection.

[0005] In another state of the art Korean Patent Application No. KR20090128123, a cooling device is disclosed, comprising an intermediate member which is used to prevent the refrigerant fluid from leaking at the welding point.

[0006] In another state of the art Korean Patent Application No. KR101130849, a cooling device is disclosed, comprising an intermediate member which is manufactured from a material different from that of the tubes used for preventing the deformation at the welding point of the tubes.

[0007] In the state of the art Korean Patent No. KR100860820, a cooling device or an air conditioner is disclosed, comprising an intermediate member having a filler used at the connection points of the tubes through which the refrigerant fluid flows.

[0008] In the state of the art Korean Patent No. KR20060067161, a refrigerator is disclosed, comprising a noise reduction rubber allows the straight connection

of the capillary tube and the refrigerant pipe without any angle therebetween.

[0009] The aim of the present invention is the realization of a cooling device wherein the noise at the connection points of the tubes is absorbed by welding the capillary and evaporator tubes to each other at the correct angle.

[0010] The cooling device realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises an intermediate member providing the welding of the capillary tube and the evaporator tube to each other at a certain angle and having an inner part which is arranged at the connection point of the capillary tube and the evaporator tube in the cooling system and which has a first channel receiving the capillary tube and a second channel receiving the evaporator tube, and an outer part which completely surrounds the inner part and which is composed of two interlocking half pieces.

[0011] By means of the present invention, it is ensured that the noise caused by the connection angle between the capillary tube and the evaporator tube is minimized.

[0012] In the embodiment of the present invention, in the region where the capillary tube and the evaporator tube are welded to each other, the capillary tube is seated into the first channel, and the evaporator tube in the second channel, in the inner part. In this case, the region where the capillary tube and the evaporator tube are attached to each other is completely surrounded by the inner part. Afterwards, the two half pieces forming the outer part are interlocked with the inner part remaining therebetween. Thus, the inner part is completely surrounded by the outer part. In the embodiment of the present invention, having a certain angle, the outer part acts as a mold for the inner part and the connection point of the capillary tube and the evaporator tube surrounded by the inner part, and enables the capillary tube and the evaporator tube to be bent with a certain connection angle. Thus, the capillary tube and the evaporator tube are bent in a controlled manner, and the risk of the capillary tube and the evaporator tube being bent in an uncontrolled, undesirable way and at an angle, and causing noise in this region is minimized. Especially in the freezing compartment of the cooling device, by ensuring that the capillary tube and the evaporator tube are welded to each other at the correct connection angle, the noise level is reduced, the sound quality is increased, and the vibration damping is provided thanks to the weight created by the intermediate member on the capillary tube and the evaporator tube.

[0013] In the preferred embodiment of the present invention, the connection angle between the capillary tube and the evaporator tube is desired to be between 120° and 160°. In the preferred embodiment of the present invention, the intermediate member ensures that the connection angle between the capillary tube and the evaporator tube is 135°.

[0014] In an embodiment of the present invention, the

inner part is in a monolithic or segmented structure and is manufactured from elastic material. In this embodiment of the present invention, the inner part is preferably manufactured from silicone material and the outer part from plastic material.

[0015] The first and second channels in the embodiment of the present invention guide the assembly operator so as to ensure that the capillary tube and the evaporator tube are connected to each other at the correct connection angle. Moreover, by means of the additional weight of the inner part manufactured from silicone acting on the connection point where the capillary tube and the evaporator tube are joined, the resulting vibrations in this region are absorbed.

[0016] In the present invention, the intermediate member comprises an outer part composed of two half pieces along its longitudinal section. In this embodiment of the present invention, the intermediate member comprises at least one locking member which enables the two half pieces to be locked together. The locking member comprises at least one female locking member in one half piece and at least one male locking member in the other half piece which engages with this female locking member. When the two half pieces are brought together such that the inner part surrounding the capillary tube and the evaporator tube remains therebetween, the female and male locking members are engaged with each other and interlocked. Thus, the outer part surrounding the inner part is completely closed. Moreover, if the capillary tube and the evaporator tube are not correctly placed in the inner part, the outer part cannot be closed since the locking members on the outer part do not fully engage with each other. This informs the operator about whether a correct installation has been made or not.

[0017] In another embodiment of the present invention, the intermediate member comprises an outer part composed of two half pieces along its transversal section. In this embodiment of the invention, the intermediate member comprises a joint which connects the two half pieces. By means of this articulated structure, the capillary tube and the evaporator tube can be connected to each other at different connection angles. In this embodiment of the present invention, the capillary tube is placed in the first channel, and the evaporator tube in the second channel, in the inner part. Then, the outer part, which is composed of two half pieces, is fitted over the inner part. The two half pieces forming the outer part are adjusted to the desired connection angle by means of the joint therebetween, and thus the capillary tube and the evaporator tube are bent at the desired connection angle. The correct connection angle depends on the capacity of the compressor in the cooling device, the amount of refrigerant fluid and the diameter of the capillary tube. In this embodiment of the present invention, the connection angle can be adjusted by means of the joint. In this embodiment of the present invention, the intermediate member comprises a lock to keep the outer part at the desired connection angle by means of the joint. Since the two half

pieces are adjusted to the desired connection angle by means of the joint, the lock is activated and the outer part remains fixed in this connection angle unless there is an outside intervention.

[0018] By means of the present invention, undesirable slope and angle changes between the capillary and the evaporator tube are prevented. By means of the intermediate member of the present invention designed in accordance with the connection point of the capillary tube and the evaporator tube, the correct bending angle is provided, thus improving the sound power level, and the sound waves are absorbed by means of the intermediate member of the present invention.

[0019] A cooling device realized in order to attain the aim the object of the present invention is illustrated in the attached figures, where:

Figure 1 - is the detailed view of the intermediate member of the present invention in a cooling device.

Figure 2 - is the perspective view of a intermediate member.

Figure 3 - is the cross-sectional view of the intermediate member.

Figure 4 - is the exploded view of the intermediate member.

Figure 5 - is the detailed view of the intermediate member in a cooling device in another embodiment of the present invention.

Figure 6 - is the detailed view of the intermediate member at an angled position in the cooling device in another embodiment of the present invention.

Figure 7 - is the perspective view of the intermediate member in another embodiment of the present invention.

Figure 8 - is the perspective view of the intermediate member at an angled position in another embodiment of the present invention.

Figure 9 - is the cross-sectional view of the intermediate member in another embodiment of the present invention.

[0020] The elements illustrated in the figures are numbered as follows:

1. Cooling device

2. Evaporator tube

3. Capillary tube

- 4. Intermediate member
- 5. Inner part
- 6. Outer part
- 7. First channel
- 8. Second channel
- 9. Locking member
- 10. Joint
- A - Connection angle

[0021] The cooling device (1) comprises an evaporator tube (2); a capillary tube (3); and an intermediate member (4) providing the welding of the capillary tube (3) and the evaporator tube (2) to each other at a certain angle and having an inner part (5) which is arranged at the connection point of the capillary tube (3) and the evaporator tube (2) and which has a first channel (7) receiving the capillary tube (3) and a second channel (8) receiving the evaporator tube (2), and an outer part (6) which completely surrounds the inner part (5) and which is composed of two interlocking half pieces.

[0022] By means of the present invention, it is ensured that the noise caused by the connection angle (A) between the capillary tube (3) and the evaporator tube (2) is minimized.

[0023] In the embodiment of the present invention, in the region where the capillary tube (3) and the evaporator tube (2) are welded to each other, the capillary tube (3) is seated into the first channel (7), and the evaporator tube (2) in the second channel (8), in the inner part (5). In this case, the region where the capillary tube (3) and the evaporator tube (2) are attached to each other is completely surrounded by the inner part (5). Afterwards, the two half pieces forming the outer part (6) are interlocked with the inner part (5) remaining therebetween. Thus, the inner part (5) is completely surrounded by the outer part (6). In the embodiment of the present invention, having a bending angle, the outer part (6) acts as a mold for the inner part (5) and the connection point of the capillary tube (3) and the evaporator tube (2) surrounded by the inner part (5), and enables the capillary tube (3) and the evaporator tube (2) to be bent with a certain connection angle (A). Thus, the capillary tube (3) and the evaporator tube (2) are bent in a controlled manner, and the risk of the capillary tube (3) and the evaporator tube (2) being bent in an uncontrolled, undesirable way and at an angle, and causing noise in this region is minimized. Especially in the freezing compartment of the cooling device (1), by ensuring that the capillary tube (3) and the evaporator tube (2) are welded to each other at the correct connection angle (A), the noise level is reduced, the sound quality is increased, and the vibration damping is provided

thanks to the weight created by the intermediate member (4) on the capillary tube (3) and the evaporator tube (2).

[0024] In the preferred embodiment of the present invention, the connection angle (A) between the capillary tube (3) and the evaporator tube (2) is desired to be between 120° and 160°. In the preferred embodiment of the present invention, the intermediate member (4) ensures that the connection angle (A) between the capillary tube (3) and the evaporator tube (2) is 135°.

[0025] In an embodiment of the present invention, the inner tube (5) is manufactured from elastic material. In an embodiment of the present invention, the inner part (5) is in a monolithic or segmented structure and is manufactured from silicone. In this embodiment of the present invention, the outer tube (6) is manufactured from plastic material.

[0026] The first and second channels (7 and 8) in the embodiment of the present invention guide the assembly operator so as to ensure that the capillary tube (3) and the evaporator tube (2) are connected to each other at the correct connection angle (A). Moreover, by means of the additional weight of the inner part (5) manufactured from silicone acting on the connection point where the capillary tube (3) and the evaporator tube (2) are joined, the resulting vibrations in this region are absorbed.

[0027] In the present invention, the intermediate member (4) comprises an outer part (6) composed of two half pieces along its longitudinal section. In this embodiment of the present invention, the intermediate member (4) comprises at least one locking member (9) which enables the two half pieces to be locked together. The locking member (9) comprises at least one female locking member in one half piece and at least one male locking member in the other half piece which engages with this female locking member. When the two half pieces are brought together such that the inner part (5) surrounding the capillary tube (3) and the evaporator tube (2) remains therebetween, the female and male locking members are engaged with each other and interlocked. Thus, the outer part (6) surrounding the inner part (5) is completely closed. Moreover, if the capillary tube (3) and the evaporator tube (2) are not correctly placed in the inner part (5), the outer part (6) cannot be closed since the locking members (9) on the outer part (6) do not fully engage with each other. This informs the operator about whether a correct installation has been made or not (Figure 1, Figure 2, Figure 3 and Figure 4).

[0028] In another embodiment of the present invention, the intermediate member (4) comprises an outer part (6) composed of two half pieces along its transversal section. In this embodiment of the invention, the intermediate member (4) comprises a joint (10) which connects the two half pieces. By means of said joint (10), the two half pieces are interlocked and the capillary tube (3) and the evaporator tube (2) can be connected to each other at different connection angles (A). In this embodiment of the present invention, the capillary tube (3) is placed in the first channel (7), and the evaporator tube (2) in the

second channel (8), in the inner part (5). Then, the outer part (6), which is composed of two half pieces, is fitted over the inner part (5). The two half pieces forming the outer part (6) are adjusted to the desired connection angle (A) by means of the joint (10) therebetween, and thus the capillary tube (3) and the evaporator tube (2) are bent at the desired connection angle (A). The correct connection angle (A) depends on the capacity of the compressor in the cooling device (1), the amount of refrigerant fluid and the diameter of the capillary tube (3). In this embodiment of the present invention, the connection angle (A) can be adjusted by means of the joint (10). In this embodiment of the present invention, the intermediate member (4) comprises a lock to keep the outer part (6) at the desired connection angle (A) by means of the joint (10). Since the two half pieces are adjusted to the desired connection angle (A) by means of the joint (10), the lock is activated and the outer part (6) remains fixed in this connection angle (A) unless there is an outside intervention (Figure 5, Figure 6, Figure 7, Figure 8 and Figure 9).

[0029] By means of the present invention, the capillary tube (3) and the evaporator tube (2) are welded at a right angle, thus reducing the sound power level. By providing a uniform connection angle (A), the sound power level variation between products is minimized. Vibration absorption is provided by means of the weight of the intermediate member (4) of the present invention acting on the capillary tube (3) and the evaporator tube (2). Breakages caused by incorrect and rigid bends on the capillary tube (3) and the evaporator tube (2) are prevented and the possibility of refrigerant fluid leakage is eliminated.

Claims

1. A cooling device (1) **comprising** an evaporator tube (2) and a capillary tube (3), an intermediate member (4) providing the welding of the capillary tube (3) and the evaporator tube (2) to each other at a certain angle and having an inner part (5) which is arranged at the connection point of the capillary tube (3) and the evaporator (2) tube and which has a first channel (7) receiving the capillary tube (3) and a second channel (8) receiving the evaporator tube (2), and an outer part (6) which is attached onto the inner part (5) so as to completely surround the inner part (5) and which is composed of two interlocking half pieces, **characterized by** an articulated joint (10) which connects the two half pieces and the intermediate member (4) comprising a lock to keep the outer part (6) at the desired connection angle (A) by means of the joint (10).
2. A cooling device (1) as in Claim 1, **characterized by** the inner part (5) which is manufactured from elastic material.
3. A cooling device (1) as in Claim 1, **characterized**

by the outer part (6) which is manufactured from plastic material.

4. A cooling device (1) as in Claim 1, **characterized by** an outer part (6) composed of two half pieces along its longitudinal section.
5. A cooling device (1) as in any one of the above claims, **characterized in that** the connection angle (A) between the capillary tube (3) and the evaporator tube (2) is between 120° and 160°.
6. A cooling device (1) as in Claim 5, **characterized in that** the connection angle (A) between the capillary tube (3) and the evaporator tube (2) is 135°.

Patentansprüche

1. Eine Kühlvorrichtung (1) **umfasst** ein Verdampferrohr (2) und ein Kapillarrohr (3), ein Zwischenelement (4), das die Verschweißung des Kapillarrohrs (3) und des Verdampferrohrs (2) miteinander in einem bestimmten Winkel gewährleistet und ein Innenteil (5) aufweist, das an der Verbindungsstelle des Kapillarrohrs (3) und des Verdampferrohrs (2) angeordnet ist und das einen ersten Kanal (7) zur Aufnahme des Kapillarrohrs (3) und einen zweiten Kanal (8) zur Aufnahme des Verdampferrohrs (2) aufweist, und ein äußeres Teil (6), das an dem inneren Teil (5) so angebracht ist, dass es das innere Teil (5) vollständig umgibt, und das aus zwei ineinandergreifenden Halbschalen besteht, **gekennzeichnet ist sie durch** ein Gelenk (10), das die beiden Halbschalen verbindet, und das Zwischenelement (4), das eine Sperre umfasst, um das äußere Teil (6) mittels des Gelenks (10) in dem gewünschten Verbindungswinkel (A) zu halten.
2. Eine Kühlvorrichtung (1), wie in Anspruch 1 aufgeführt, **ist dadurch gekennzeichnet, dass** das Innenteil (5) aus elastischem Material hergestellt ist.
3. Eine Kühlvorrichtung (1), wie in Anspruch 1 aufgeführt, **ist dadurch gekennzeichnet, dass** das Außenteil (6) aus Kunststoff hergestellt ist.
4. Eine Kühlvorrichtung (1), wie in Anspruch 1 aufgeführt, **ist dadurch gekennzeichnet, dass** das Außenteil (6) im Längsschnitt aus zwei Halbschalen besteht.
5. Eine Kühlvorrichtung (1), wie in einem der vorherigen Ansprüche aufgeführt, **ist dadurch gekennzeichnet, dass** der Verbindungswinkel (A) zwischen dem Kapillarrohr (3) und dem Verdampferrohr (2) zwischen 120° und 160° beträgt.

6. Eine Kühlvorrichtung (1), wie in Anspruch 5 aufgeführt, **ist dadurch gekennzeichnet, dass** der Verbindungswinkel (A) zwischen dem Kapillarrohr (3) und dem Verdampferrohr (2) 135° beträgt.

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Revendications

1. Un dispositif de refroidissement (1) **comprenant** un tube évaporateur (2) et un tube capillaire (3), un élément intermédiaire (4) qui assure la soudure du tube capillaire (3) et du tube évaporateur (2) l'un à l'autre à un certain angle et qui comporte une partie intérieure (5) disposée au point de raccordement du tube capillaire (3) et du tube évaporateur (2), et présentant un premier canal (7) recevant le tube capillaire (3) et un deuxième canal (8) recevant le tube évaporateur (2), et une partie extérieure (6) fixée sur la partie intérieure (5) de manière à entourer complètement la partie intérieure (5) et qui est composée de deux demi-pièces qui s'emboîtent l'une dans l'autre, **caractérisé par** une articulation (10) qui relie les deux demi-pièces et l'élément intermédiaire (4) comprenant un verrou pour maintenir la partie extérieure (6) à l'angle de connexion souhaité (A) au moyen de l'articulation (10). 10
2. Un dispositif de refroidissement (1) selon la Revendication 1, **caractérisé par** la partie intérieure (5) qui est fabriquée en matériau élastique. 15
3. Un dispositif de refroidissement (1) selon la Revendication 1, **caractérisé par** la partie extérieure (6) qui est fabriquée en matériau plastique. 20
4. Un dispositif de refroidissement (1) selon la Revendication 1, **caractérisé par** une partie extérieure (6) composée de deux demi-pièces le long de sa section longitudinale. 25
5. Un dispositif de refroidissement (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'angle de connexion (A) entre le tube capillaire (3) et le tube évaporateur (2) est compris entre 120° et 160°. 30
6. Un dispositif de refroidissement (1) selon la Revendication 5, **caractérisé en ce que** l'angle de connexion (A) entre le tube capillaire (3) et le tube évaporateur (2) est de 135°. 35

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Figure 1

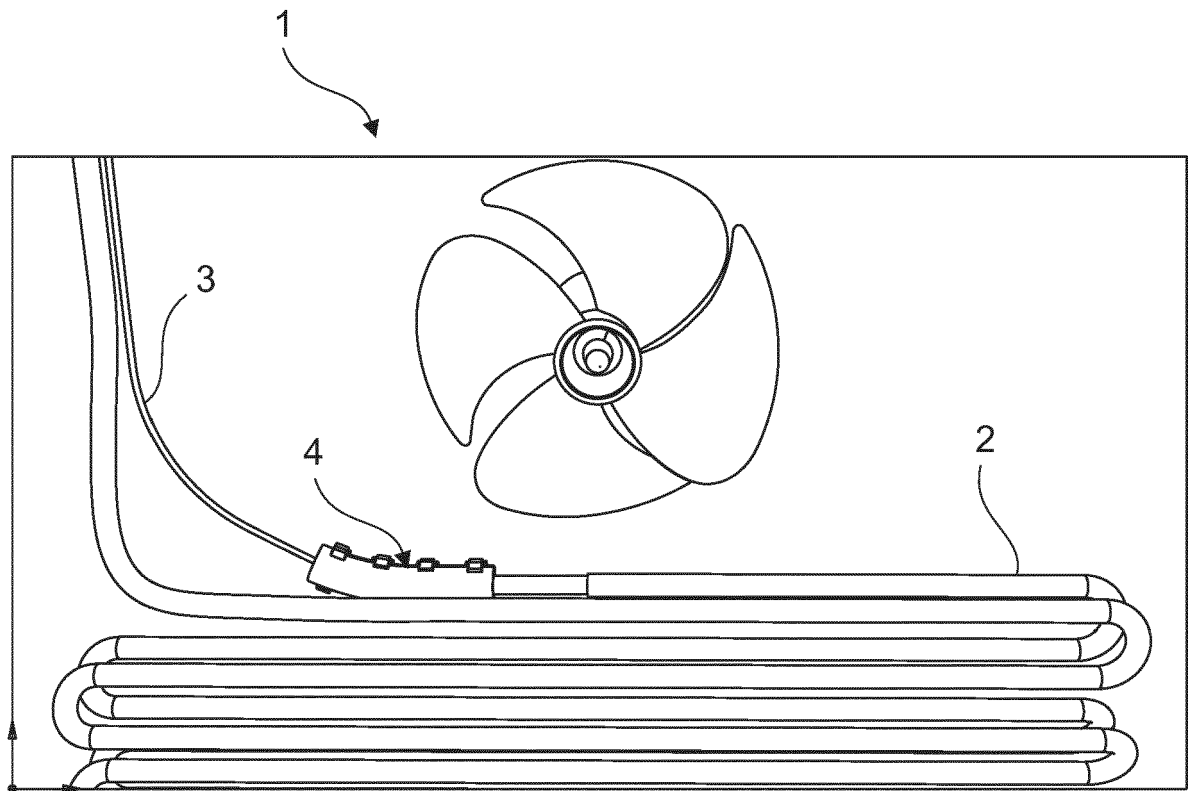


Figure 2

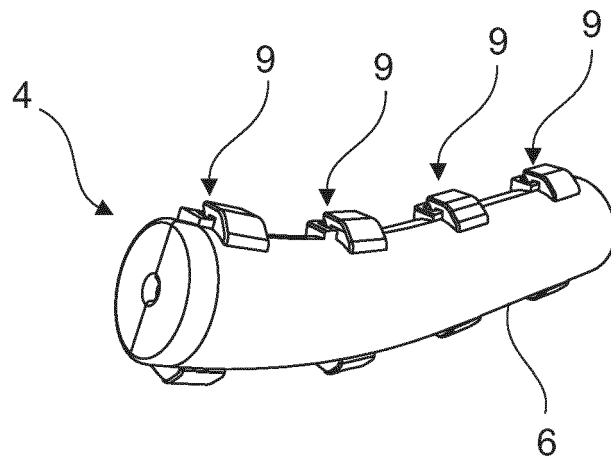


Figure 3

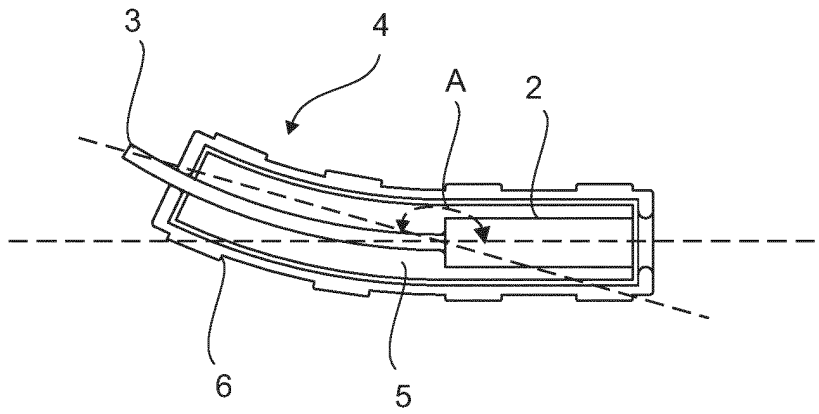


Figure 4

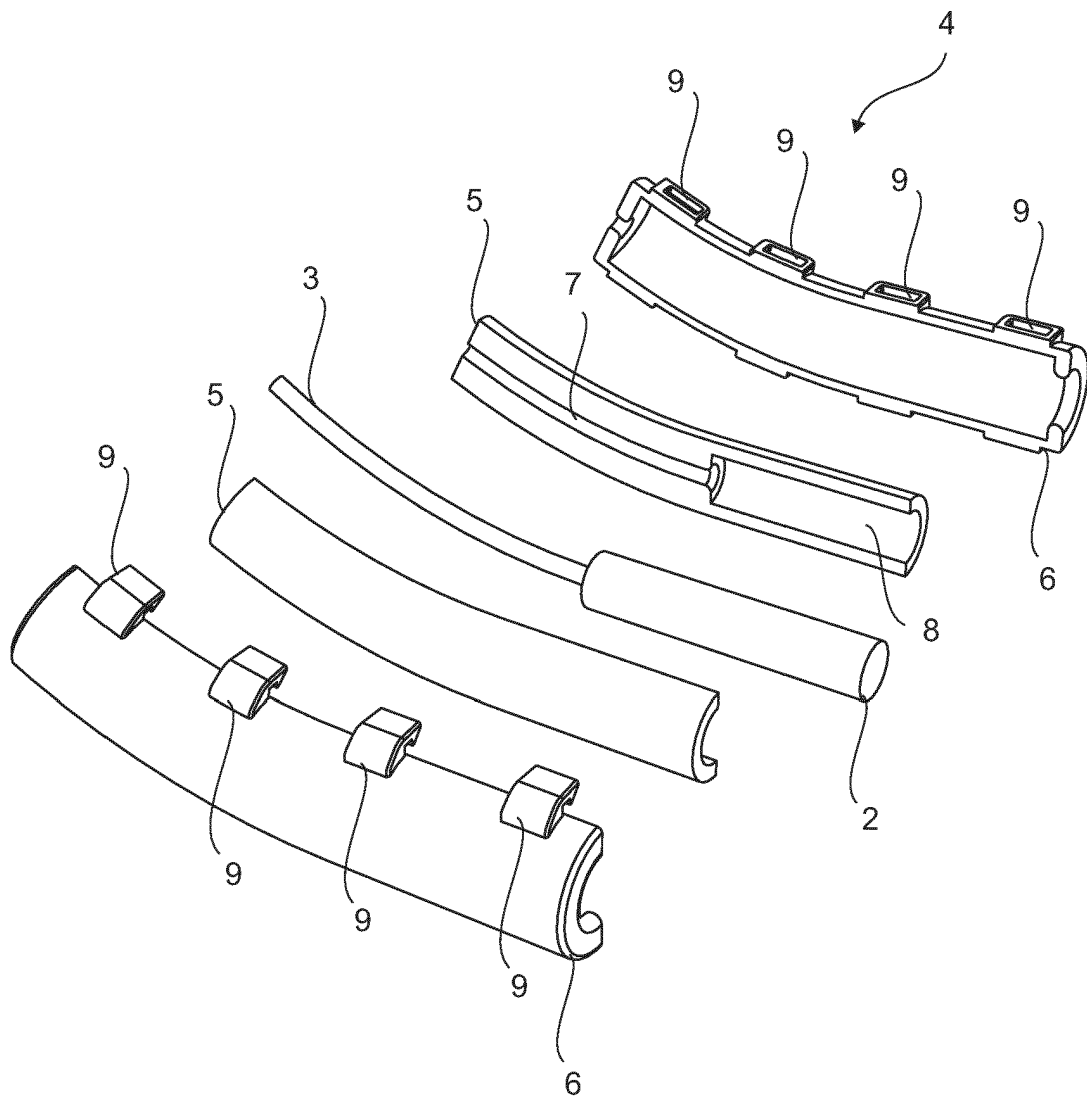


Figure 5

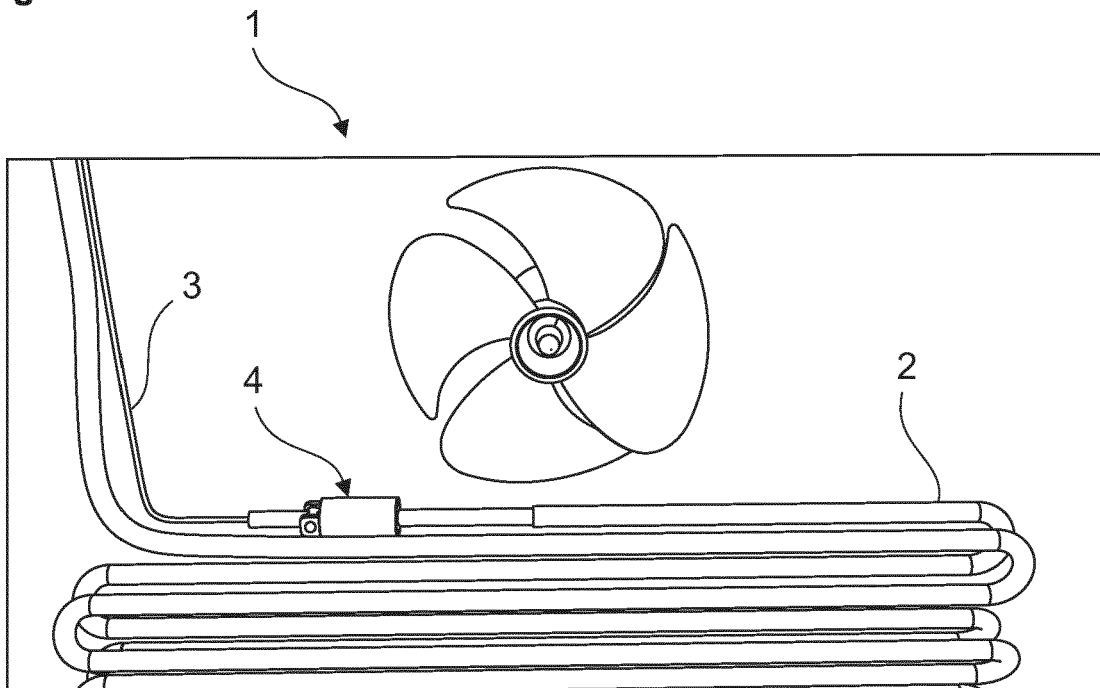


Figure 6

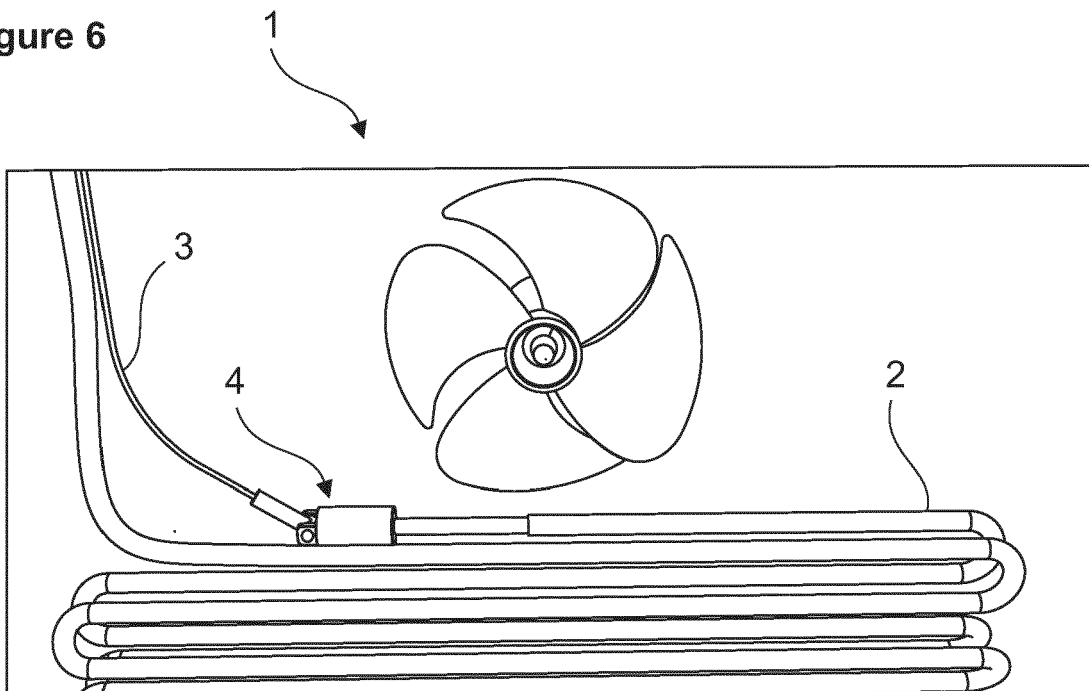


Figure 7

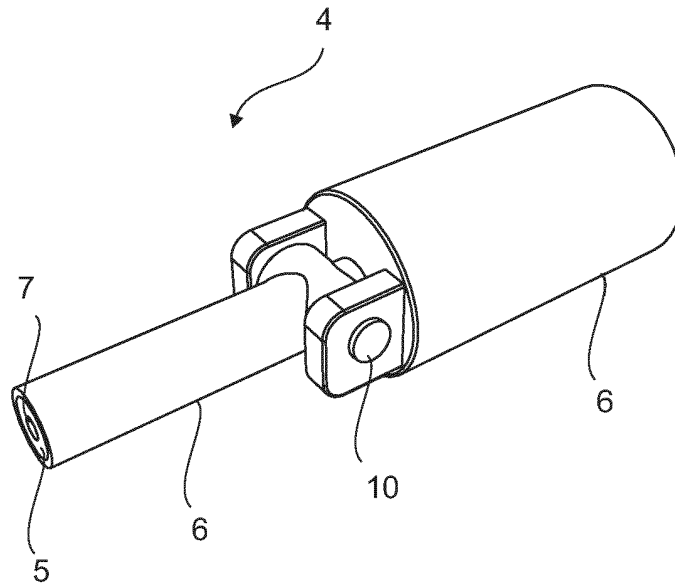


Figure 8

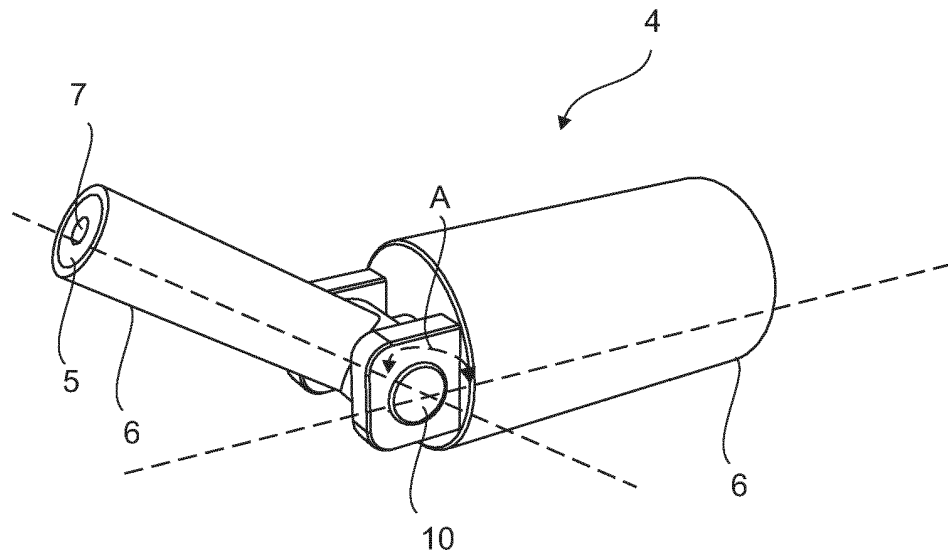
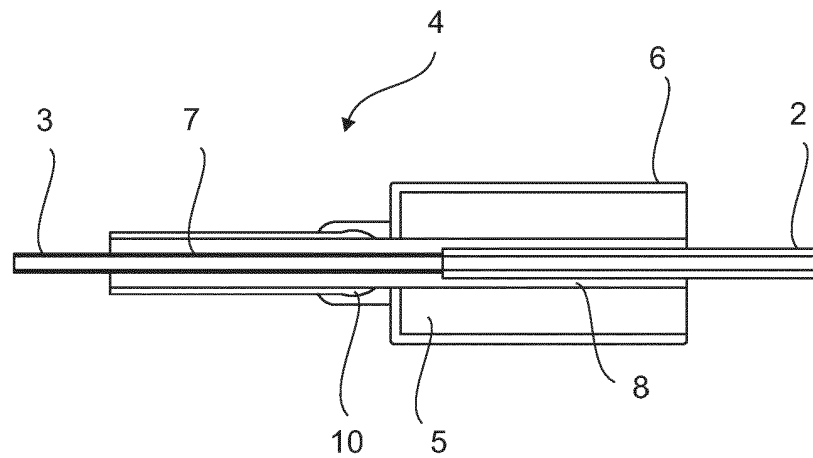


Figure 9



REFERENCES CITED IN THE DESCRIPTION

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