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(54) **THERMAL DEFORMATION MANAGEMENT IN A SCROLL PLATE OF A SCROLL COMPRESSOR**

(57) A scroll plate, for use in a scroll compressor, comprises a base plate (200) having a first side (205) and a second side (210), wherein the second side opposes the first side, and a spiral wrap (270) formed on the first side of the base plate, wherein the base plate comprises one or more recesses (220) and wherein an insulating material (260) is located in at least one of the one or more recesses. A scroll compressor having a corresponding scroll plate is described.

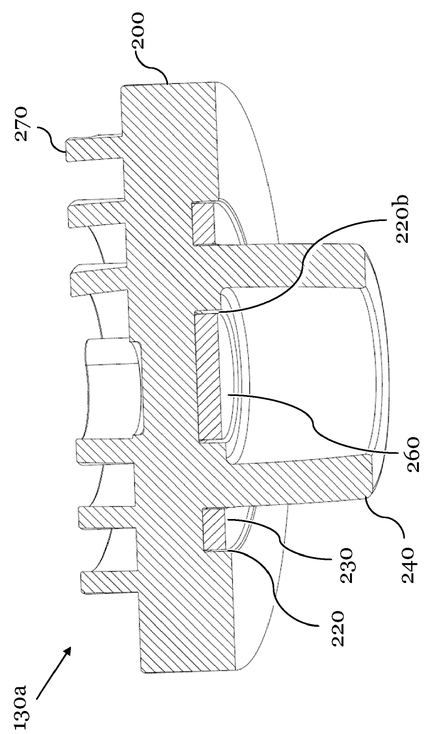

Fig. 4a

EP 4 108 922 A1

Description

[0001] The current application relates to a scroll plate for use in a scroll compressor, wherein such compressor could be used, for example, in refrigeration systems.

[0002] A compressor is an apparatus, which reduces the volume of a fluid by increasing the pressure of the fluid.

[0003] Compressors are used, for example, in refrigeration systems. In a common refrigeration system, a refrigerant is circulated through a refrigeration cycle. Upon circulation, the refrigerant undergoes changes in thermodynamic properties in different parts of the refrigeration system and transports heat from one part of the refrigeration system to another part of the refrigeration system. The refrigerant is a fluid, i.e. a liquid or a vapour or gas. Examples of refrigerants may be artificial refrigerants like fluorocarbons. However, in recent applications, the use of carbon dioxide, CO_2, which is a non-artificial refrigerant, has become more and more important, because it is non-hazardous to the environment.

[0004] A compressor comprises at least a suction port, a discharge port, and a means for compressing. At the suction port, the compressor receives the fluid, which is to be compressed. In case the compressor is used in a refrigeration system, the fluid is a refrigerant. At the suction port, the fluid usually is in a gaseous or vapour state. The means for compressing is used for compressing the fluid from an initial pressure, for example the pressure the fluid has at the suction port, to a desired discharge pressure. For example, the means for compressing may form at least one compression chamber. A compression chamber is a closed volume, in which a portion of the refrigerant will be compressed. Afterwards, the compressed fluid is discharged at the discharge port. In a scroll compressor, the means for compressing comprises two scroll plates, which form the at least one compression chamber. One of these scroll plates is a stationary scroll plate and the other scroll plate is an orbiting scroll plate, which is moved in an orbiting motion relatively to the stationary scroll plate. Both scroll plates usually comprise corresponding spiral wraps, which are interleaved, when the elements of the scroll compressor are assembled. The interleaved spiral wraps and the base plates form the at least one compression chamber. Due to the orbiting motion of the orbiting scroll plate, fluid is drawn into a pocket formed between the spiral wraps. Said pocket forms a compression chamber and is transported from the outermost locations of the interleaved spiral wraps to the innermost locations of the interleaved spiral wraps. Thereby, the fluid within the pocket is moved to the innermost locations of the interleaved spiral wraps. During this process, the fluid will be compressed because the size of the pocket, i.e. the size of the compression chamber, will be reduced. At the innermost location of the interleaved spiral wraps, the compressed fluid will be ejected from the compression chamber into a discharge chamber of the compressor, from where the compressed fluid will be discharged from the compressor at the discharge port. The person skilled in the art will appreciate that during operation of a scroll compressor, while one compression chamber, which is formed by a pocket between the interleaved spiral wraps and the base plates of the scroll plates, is moved to the innermost location, one or more additional compression chambers may be formed subsequently upon further relative motion of the scroll plates.

[0005] During the compression of the fluid within the compression chambers, the fluid's pressure and temperature increase. This increase in temperature of the fluid also increases the temperature of the scroll plates, which form the one or more compression chambers, due to the contact between the scroll plates and the fluid. Additionally, friction losses caused by the motion of the orbiting scroll plate also increase the temperature of the scroll plates. However, only one side of each scroll plate is directly affected by the temperature increase within the at least one compression chamber, namely the side of the scroll plate, which comprises the spiral wrap and which faces the respective other scroll plate. For purposes of this invention disclosure, said side is referred to as frontside of the scroll plate, whereas the side of each scroll plate, which opposes its frontside is referred to as backside of the scroll plate. Accordingly, a substantial temperature difference may develop between the backside of the scroll plate and the frontside, which comprises the spiral wrap.

[0006] In the art, different scroll compressor configurations are known, which operate at different pressure ranges and temperatures. For example, one configuration comprises a low-pressure side and a high-pressure side. The low-pressure side may comprise a suction port, a motor and a crankshaft for operating the scroll compressor as well as a lubricant supply, whereas the high-pressure side comprises the discharge port. According to said definition, the scroll set is neither part of the low-pressure side nor part of the high-pressure side, but instead forms a transition area between both sides. Additionally, the stationary scroll plate may at least partially be in contact to the high-pressure side and/or the orbiting scroll plate may at least partially be in contact to the low-pressure side. In said low-pressure side and high-pressure side configuration, the fluid is received at a suction port at the low-pressure side, will be compressed in the at least one compression chamber formed by the scroll plates and will then be provided to the high-pressure side. The person skilled in the art will appreciate that deviations from said definition of the low-pressure side high-pressure side configuration maybe possible without deviating from the scope of the current application.

[0007] At the low-pressure side, the temperature of the fluid and the surrounding components is rather low. For example, the temperature may be similar to the temperature the fluid has, when it is received at the suction port. The temperature of the fluid received at the suction port may be referred to as fluid intake temperature. However, it is also possible that the temperature at the low-pressure side is higher than the temperature of the fluid received at the suction port, for example, because of the operation of the motor and the friction between the motor, crankshaft and the orbiting scroll plate. Therefore, the temperature of the fluid at the low-pressure side may be referred to as suction side temperature, because it refers to the temperature at the side of the compressor, which comprises the suction port. The suction side temperature may be similar to the fluid intake temperature or in case of, for example, heat generation by the operation of the motor and friction losses, the suction side temperature may be higher than the fluid intake temperature. The person skilled in the art will be aware that the suction side temperature does not represent a particular temperature value, but instead may represent a temperature interval. Said temperature interval may have the fluid intake temperature as a lower end, while its upper end depends on the operation of the compressor and the heat, which may be generated by the motor and the friction caused by movement of the crankshaft and the scroll plates. Typically, the upper end is less than or equal to the temperature at which the fluid will be discharged from the compressor at the discharge port.

[0008] Due to the temperature increase during the compression process, the temperature of the fluid and of the components of the high-pressure side is higher than the temperature at the low-pressure side, i.e. the suction side temperature. Since this higher temperature relates to the temperature at which the compressed fluid will be discharged from the discharge port, this higher temperature may be referred to as discharge temperature.

[0009] Consequently, the temperature of the fluid in the at least one compression chamber is in a range between the low temperature referred to as suction side temperature and the high temperature referred to as discharge temperature. The temperature within the at least one compression chamber is referred to as compression chamber temperature. Since the at least one compression chamber receives the fluid from the low-pressure side with the suction side temperature and because the temperature increases during compression, the compression chamber temperature represents an interval, which may have a range from the suction side temperature to the discharge temperature. In scroll compressor having a low-pressure side and a high-pressure side configuration, there are therefore different temperature areas. The exemplary temperature areas of such a scroll compressor configuration are described in more detail below with respect to figure 2.

[0010] In such a low-pressure side and high-pressure side configuration, the backside of the orbiting scroll plate may be in contact to the low temperature area operating at the suction side temperature, whereas the frontside of the orbiting scroll plate is in contact to the compression chambers and experiences the compression chamber temperature, which is higher than the suction side temperature in at least some locations within the interleaved scroll plates. In this case, there is a temperature difference between the frontside and the backside, wherein the temperature difference is a temperature difference of the suction side temperature and the compression chamber temperature. As the person skilled in the art will appreciate, the temperature distribution at the frontside of the orbiting scroll plate may be inhomogeneous, because the compressed refrigerant in the innermost locations of the spiral wrap has a higher temperature than the refrigerant in the outermost locations of the spiral wrap, which essentially has the temperature of the refrigerant received from the low-pressure side. Also, the temperature distribution at the backside of the orbiting scroll plate may be inhomogeneous, because some portions of the backside may be supported by a frame or a thrust plate and may experience friction, which also may increase the temperature locally, while other portions may be affected by lubricant. These effects may contribute to the temperature difference between the frontside of the orbiting scroll plate and the backside of the orbiting scroll plate.

[0011] For the stationary scroll plate, the temperature difference is different. As the person skilled in the art will appreciate, there are different ways in which the stationary scroll plate may be placed within the scroll compressor. In some examples, the backside of the stationary scroll plate may be in direct contact with the high-pressure side and may experience the discharge temperature, while in other examples another component or a portion of the case may provide a boundary between the stationary scroll plate and the high-pressure side, so that the temperature at the backside of the stationary scroll plate may be substantially lower than the discharge temperature. However, in most applications, the backside of the stationary scroll plate experiences a temperature which is higher than the suction side temperature - for example caused by heat transfer from the high-pressure side.

[0012] In contrast, the frontside of the stationary scroll plate experiences the compression chamber temperature, or in other words, the temperature of the fluid within the compression chamber. As mentioned above, the compression chamber temperature represents a temperature range between the suction side temperature and the discharge temperature. As the person skilled in the art will appreciate, in the innermost section of the spiral wraps from where the compressed fluid will be ejected into the discharge chamber, the compressed fluid has a temperature which may be similar to the discharge temperature, or in other words, the high temperature that the stationary scroll plate experiences at its backside. At the outer portions of the interleaved spiral wraps, i.e. the positions where the compression of the fluid is starting, the temperature maybe similar to the suction side temperature. This may make the temperature distribution at the frontside inhomogeneous. Therefore, for the stationary scroll plate, there is a substantial temperature difference between the discharge temperature at the backside and the compression chamber temperature at the frontside, which increases from the suction side temperature at the outermost locations of the spiral wraps to the higher temperature of the compressed refrigerant at the innermost locations of the spiral wraps.

[0013] In another configuration, which is referred to as high-side configuration, both scroll plates are surrounded by the very high temperature discharge fluid. In such a case, the stationary scroll plate as well as the orbiting scroll plate each at least locally experience a temperature difference between the discharge temperature and the at least locally lower compression chamber temperature.

[0014] In any configuration, the temperature difference leads to differences in thermal expansion and therefore stress and deformation induced onto the scroll plates. Such effects may lead to leakage or decreased efficiency of the scroll compressor.

[0015] Hence, there is a need in the art for reducing thermal deformation of scroll plates in a scroll compressor.

[0016] The above-mentioned need is fulfilled by a scroll plate according to the current invention. The scroll plate according to the current invention may be for use in a scroll compressor. As the person skilled in the art will appreciate, the principles of the current invention can be applied either to an orbiting scroll plate or a stationary scroll plate.

[0017] A scroll plate in the sense of the current invention comprises a base plate. The base plate has a first side and a second side, wherein the second side opposes the first side. The first side may be referred to as frontside of the scroll plate, whereas the second side may be referred to as backside of the scroll plate. A spiral wrap is formed on the first side of the base plate. The spiral wrap is for being interleaved with a corresponding spiral wrap of another scroll plate. Between the spiral wraps and the base plates of both scroll plates, the compression chambers may be formed by orbiting motion of at least one of the scroll plates when the spiral wraps are interleaved and the compressor is operated.

[0018] According to the current invention, the base plate comprises one or more recesses. The one or more recesses may be located at the second side of the base plate or the one or more recesses may be located between the first side and the second side of the base plate. An insulating material is located in at least one of the one or more recesses. The insulating material reduces the thermal stress and deformation induced by the temperature difference between the opposing sides of the scroll plate.

[0019] Depending on the location of the insulating material, the insulating material may, for example, reduce heat transfer between the opposing sides of the scroll plate and/or the insulating material may isolate one side of the scroll plate from the temperature area that it surrounds. For example, in a preferred embodiment, at least one of the one or more recesses may be located at a surface of the second side of the base plate, which allows to isolate the base plate from its surroundings. The insulating material located in the recess may shield the corresponding side of the scroll plate from its surroundings and may thereby reduce the influence that the surrounding temperature has on the side of the scroll plate. In such a case, the temperature of both sides of the scroll plate maybe more similar, such that the temperature difference is reduced. In case of a low-pressure side and high-pressure side configuration, the surroundings may for example refer to the low-pressure side of the scroll compressor when the scroll plate is an orbiting scroll plate, or the surroundings may refer to the high-pressure side of the scroll compressor when the scroll plate is a stationary scroll plate. Similarly, the surroundings may be the high-pressure side in case that the scroll compressor has a high-side configuration.

[0020] In a preferred embodiment, at least one of the one or more recesses is located at a surface of the second side of the base plate. Locating a recess at the surface of the second side and placing the insulating material in said recess at the surface allows to isolate the base plate from its surrounding and thereby shielding the base plate from either lower or higher temperatures and their effects on the temperature difference in the base plate.

[0021] In some preferred embodiments, the scroll plate may be configured as an orbiting scroll plate. In an orbiting scroll plate, the second side of the base plate may comprise a reception configured to receive a portion of a crankshaft of the compressor. When the crankshaft is operated, placement of a portion of the crankshaft in a reception allows to transfer motion from the crankshaft to the orbiting scroll plate. The reception may have the form of a protrusion, preferably in form of a ring, so that a pin of the crankshaft can be placed in the annular protrusion. However, the reception may also be an aperture in the base plate. In an orbiting scroll plate, at least one recess of the one or more recesses preferably maybe located within the reception. Usually, the crankshaft is lubricated by a lubricant, which generally has a temperature, which is lower than the temperature of the fluid within the compression chambers; for example, the lubricant may have the suction side temperature. The pin of the crankshaft that is received by the reception of the orbiting scroll plate may also be lubricated in order to reduce wear between the pin and the reception. Consequently, the surface of the reception will experience the rather low temperature of the lubricant, e.g. the suction side temperature, while the opposing side of the base plate at the location corresponding to the reception may experience a much higher temperature of the compressed fluid up to the discharge temperature. Therefore, providing a recess with insulating material in the reception is preferred because it efficiently reduces the heat transfer.

[0022] Additionally or alternatively to placing a recess and insulating material within the reception for the crankshaft, at least one recess of the one or more recesses may be located outside of the reception, meaning that the recess at least partially surrounds the reception. Thereby, the temperature difference of the sides of the base plate may be reduced by isolating the backside of the orbiting scroll plate from its surroundings, e.g. a thrust surface, which may be used to support the orbiting scroll plate. Preferably, the at least one recess, which is located outside of the reception, may form a closed ring around the reception, which reduces the temperature difference homogeneously around the reception. Further, at least two recesses may form rings around the reception. These rings may be concentric and may improve management of the temperature difference over a larger portion of the orbiting scroll plate and lead to more homogenously reduced temperature difference.

[0023] In another preferred embodiment, at least one recess of the one or more recesses may be located beneath the surface of the second side of the base plate. Thereby, the at least one recess beneath the surface of the second side may be formed as a sealed chamber within the base plate. The insulating material located in the recess beneath the surface of the second side may be a fluid. In particular, the fluid may be a gas, for example refrigerant vapor, or the fluid may be a liquid, for example a lubricant. However, also a solid non-metal material may be used as insulating material. Using a recess beneath the surface of the second side improves management of temperature differences between the first side and the second side of the scroll plate by reducing heat transfer from one side to the other side and thereby also reducing temperature induced stress and deformation.

[0024] In any of the abovementioned preferred embodiments, the insulating material may generally have a low thermal conductivity. Accordingly, non-metal material may preferably be used as insulating material. Examples of such materials may be synthetic polymers preferably composed of polyamides, such as nylon, polytetrafluoroethylene (PTFE), polyether ether ketone (PEEK) or ceramic materials.

[0025] The abovementioned need may also be fulfilled by a scroll compressor comprising a first scroll plate in the sense of the disclosure above. Such a scroll compressor preferably comprises in addition a second scroll plate, which also comprises features for improving temperature difference and reducing heat-induced stress and deformation. Said second scroll plate may comprise similar features as the first scroll plate or any of the abovementioned embodiments. If the second scroll plate is a stationary scroll plate, the second scroll plate may however also comprise additional features for reducing thermal deformation, as will be described below.

[0026] Such a second scroll plate, which is a stationary scroll plate, comprises a second base plate. The second base plate has a frontside and a backside, wherein the backside opposes the frontside. A second spiral wrap is formed at the frontside of the second base plate. The spiral wrap is adapted to interact with a corresponding spiral wrap of the first (i.e. orbiting) scroll plate. Between the spiral wraps and the base plates of both scroll plates, at least one compression chamber may be formed. By orbiting motion of at least the orbiting scroll plate relatively to the stationary scroll plate, the fluid in the compression chamber is compressed.

[0027] The second scroll plate also comprises an injection channel, which is formed within the second base plate. The injection channel provides an injection path for injection of fluid into the at least one compression chamber formed between the spiral wraps of the scroll plates. The person skilled in the art will be aware that the location of the at least one compression chamber formed between the spiral wraps may change during the orbiting motion of the orbiting scroll plate. Hence, it is sufficient that the injection path is configured to inject fluid into the at least one compression chamber at least at a particular point in time during the operation of the compressor.

[0028] At the end of the injection channel, an opening may be located, which may be used to connect the injection channel with an injection line of a refrigeration cycle. The injection channel can be used to inject fluid - e.g. taken from a refrigeration cycle - into the at least one compression chamber formed between the corresponding spiral wraps. The fluid maybe injected at intermediate pressure. In this regard, the intermediate pressure refers to a pressure higher than the pressure of the fluid at the suction port, but lower than the pressure of the fluid at the discharge port. The temperature of the injected fluid may be lower than the discharge temperature. Preferably, the temperature of the injected fluid maybe an intermediate temperature, i.e. a temperature higher than the suction side temperature, but lower than the discharge temperature. However, in other preferred embodiments, it may also be possible that the temperature of the injected fluid is even lower than the suction side temperature.

[0029] Further, the second scroll plate comprises a recess, which is referred to as second recess in order to distinguish from the one or more recesses of the first scroll plate, which comprise an insulating material, as mentioned above, which are referred to as first recesses for the purpose of this embodiment example. The second recess is located at the second side of the second scroll plate. Also, the second scroll plate comprises an insert. The insert is placed within the second recess at the second side of the second base plate of the second scroll plate. Thereby, the insert forms a cooling chamber within the second recess or, in other words, the insert separates a portion of the volume within the second recess of the second scroll plate. The second scroll plate further comprises an inlet channel and an outlet channel. Via the inlet channel, the cooling chamber is connected to the injection channel and via the outlet channel, the cooling chamber is connected to the inside of the second spiral wrap. The connection of the cooling chamber with the inlet channel may be achieved by one or more first openings of the cooling chamber and the connection of the cooling chamber with the outlet channel may be achieved by one or more second openings of the cooling chamber.

Accordingly, the cooling chamber is configured to receive a portion of the fluid from the injection channel via the inlet channel and - after the received fluid passed through the cooling chamber - the cooling chamber provides the fluid to the at least one compression chamber formed between the interleaved spiral wraps, via the outlet channel.

[0030] As mentioned earlier, the fluid in the injection channel may have an intermediate temperature, which is lower than the discharge temperature. Therefore, during operation the cooling chamber will have a lower temperature than the backside of the stationary scroll plate. Accordingly, areas located in close proximity to the cooling chamber will be cooled by the intermediate temperature fluid. Preferably, the location of the second recess of the second scroll plate and thereby the location of the cooling chamber is selected in a way that large areas of the second scroll plate can be cooled. This reduces stress and thermal deformation induced by the temperature difference and heat transfer between the backside and the frontside of the second scroll plate.

[0031] In a preferred embodiment of the second scroll plate, the second recess located at the backside of the second scroll plate may have an annular shape. Further preferred, the center of the annular recess may be concentric with the center of the second base plate. As further explained below, the second recess of the second scroll plate provides an intermediate pressure cavity, which can be used to push the stationary scroll plate towards the orbiting scroll plate and improve the fit between the interleaved spiral wraps.

[0032] In case of an annular second recess, the second scroll plate is pushed towards the first scroll plate uniformly. In case of an annular second recess, the insert placed within the second recess may form the cooling chamber in at least a portion of the annular second recess. Preferably, the insert may also have an annular shape and may form the cooling chamber over the entire annular recess. In such a configuration, the injected fluid may flow through the entire annular chamber and provide cooling to a large range of the second base plate.

[0033] Further, the remaining volume of the second recess of the second scroll plate, i.e. the volume that does not form the cooling chamber, may be used to provide an intermediate pressure cavity. When assembled in a scroll compressor, such an intermediate pressure cavity may be formed between the remainder of the second recess of the second scroll plate and a portion of the case of the compressor, e.g. a plate to which the second scroll plate is fixed. The intermediate pressure cavity may be connected to the at least one compression chamber formed between the spiral wraps of the scroll plates by ease of a so-called bleed hole. Thereby, pressure is built within the intermediate pressure cavity located at the backside of the second scroll plate, which presses the second scroll plate towards the first scroll plate and improves the fit between the scroll plates. Furthermore, the intermediate pressure cavity and the bleed hole improve pressure balancing of the compression chambers. Additionally or alternatively, the intermediate pressure cavity may be connected, via a passage, to the at least one compression chamber.

[0034] In some preferred embodiments of the second scroll plate, the cooling chamber, the inlet channel and the outlet channel may define a cooling path configured to guide fluid received from the injection channel to the inside of the second spiral wrap. This may be achieved by providing the first and second openings of the cooling chamber, that are used to connect the cooling chamber to the inlet and outlet channels, at opposing ends of the chamber. Further, the insert may form the cooling chamber in a way that the chamber provides a cooling path arranged in a predetermined way through the base plate. For example, in case of an annular shape of the insert and the cooling chamber, the first and second openings that connect the cooling chamber to the inlet and outlet channels may be provided at opposing sides of the annular chamber. The person skilled in the art will appreciate that in some embodiments of the second scroll plate, fluid may flow from the injection channel via the inlet channel to the cooling chamber and then via the outlet channel directly to the inside of the spiral wrap, whereas in other embodiments, the fluids may flow from the cooling chamber via the outlet channel back to the injection channel and then to the inside of the spiral wrap. In the latter embodiment examples, the inlet channel may be connected to the injection channel at a first location and the outlet channel maybe connected to the injection channel at a second location, wherein the first and second locations are different from one another and the first location is located upstream of the second location (i.e. closer to the injection line of the refrigerant cycle from where the fluid is received).

[0035] In some preferred embodiments of the second scroll plate, the second recess of the second scroll plate may comprise a bottom and two side walls and a sealed contact may be established between the insert and both side walls. The sealed contact separates the cooling chamber from the intermediate pressure cavity. Further, the insert may comprise at least one protruding element, which contacts the bottom of the second recess of the second scroll plate. The at least one protruding element may define a height of the cooling chamber. By changing the dimensions of the at least one protruding element, the volume within the cooling chamber may be adjusted. Additionally or alternatively, the insert may comprise legs, which establish the sealed connection with the side walls. For example, the insert may have a cross-section which is essentially U-shaped. That means the insert has two legs, i.e. the upward facing legs of the U, which are connected to the walls of the second recess of the second scroll plate. Opposite of the upward facing legs, the U-shaped insert may comprise at least one protruding element for defining the height of the cooling chamber. Alternatively, the U-shaped insert may be turned upside down so that the upwards facing legs of the U face towards the bottom of the second recess of the second scroll plate. Thereby, the legs may define the height of the cooling chamber.

[0036] In some preferred embodiments of the second scroll plate, the insert may be made of the same material as the second scroll plate or a material, which has a similar thermal expansion characteristic as the material of the second scroll plate. For example, suitable materials may be steel or cast iron. However, also non-metal materials may be possible in case that their thermal expansion characteristic is similar to the material of the second scroll plate. Furthermore, in some embodiment examples, it may be possible to place a seal between the insert and walls of the second recess of the second scroll plate.

[0037] In some preferred embodiments, an insulation layer may be added to the insert. The insulation layer may improve heat insulation between the cooling chamber and the intermediate pressure cavity. The insulating material may generally have a low thermal conductivity. Accordingly, non-metal material may preferably be used as insulating material. Examples of such materials may be synthetic polymers preferably composed of polyamides, such as nylon, polytetrafluoroethylene (PTFE), polyether ether ketone (PEEK) or ceramic materials. Alternatively, the insert may be coated with an insulating material. Preferably, the insulation layer is added to the insert at the side of the insert, which faces the intermediate pressure cavity. This would prevent heat transfer from the intermediate pressure cavity to the cooling chamber.

[0038] The following description and the annexed drawings set forth in detail certain illustrative aspects of the apparatus and the method described above. These aspects are indicative, however, of but a few of the various ways in which the principles of various embodiments can be employed and the described embodiments are intended to include all such aspects and their equivalent. In particular it needs to be highlighted that - although the following drawings only show embodiment examples of scroll compressors - the invention may be applied to any type of compressor.

[0039] In the drawings, like reference characters generally refer to the same parts throughout the different drawings. The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention.

[0040] In the following description, various embodiments of the invention are described with reference to the following drawings, in which:

FIG. 1	shows a cross-sectional view of an embodiment of a scroll compressor with an orbiting scroll plate according to the current invention, wherein the scroll compressor has a low-pressure and high-pressure configuration.
FIG. 2	shows a highlighted portion of the upper portion of the scroll compressor of figure 1 and illustrates the temperature areas within the scroll compressor.
FIGs. 3a - 3d	show cross-sectional views of some embodiments of a scroll plate according to the current invention.
FIGs. 4a - 4c	show embodiment examples of orbiting scroll plates according to the current invention, wherein (a) is a perspective view of an embodiment example of an orbiting scroll plate cut in half and (b), (c) are top views of the backside of orbiting scroll plates with different designs of insulating material.
FIGs. 5a, 5b	show another embodiment example of an orbiting scroll plate according to the current invention, wherein the base plate consists of two separate parts, wherein the first part comprises the first side and the second part comprises the second side and wherein the insulating material is placed between the first part and the second part. (a) is a perspective view of said embodiment example of an orbiting scroll plate cut in half and (b) is an exploded view of the orbiting scroll plate according to said embodiment.
FIGs. 6a - 6c	show other embodiments of a scroll compressor in which the current invention can be used, wherein the scroll compressor has a so-called high-side compressor configuration, (a) shows a cross-sectional view of a scroll compressor with thermal deformation management features added to the orbiting scroll plate, (b) shows a highlighted portion of the upper portion of the scroll compressor of (a) and illustrates the temperature areas within the scroll compressor, and (c) shows a cross-sectional view of a scroll compressor with thermal deformation management features added to the stationary scroll plate.
FIG. 7	shows a cross-sectional view of an embodiment example of a stationary scroll plate that may be used additionally to the scroll plate according to the current invention.
FIGs. 8a, 8b	show (a) a cross-sectional detail view of a preferred embodiment of an insert placed within a second recess of the

stationary scroll plate illustrated in figure 7 and (b) different views of the preferred embodiment of the insert.

FIGs. 9a, 9b show two exemplary types of cooling chambers formed within the second recess of the stationary scroll plate of figure 7 by the insert illustrated in figure 8.

[0041] The following detailed description refers to the accompanying drawings that show, by way of illustration, specific details and embodiments in which the invention may be practiced.

[0042] The word "exemplary" is used herein to mean "serving as an example, instance, or illustration". Any embodiment or design described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments or designs.

[0043] Figure 1 shows a cross-sectional view of an embodiment of a scroll compressor with an orbiting scroll plate according to the current invention. At 100, a scroll compressor is depicted. The scroll compressor comprises a case 110, a suction port 140, a discharge port 150, a stationary scroll plate 120 and an orbiting scroll plate 130. Further, the scroll compressor 100 comprises a motor 160, which is connected to a crankshaft 170 and the crankshaft 170 is connected to the orbiting scroll plate 130. Thereby, the motor drives the crankshaft 170 and causes a rotary motion of the crankshaft 170. Because the crankshaft is connected to the orbiting scroll plate 130, the rotary motion is transferred to an orbiting motion of the orbiting scroll plate 130. Further, the scroll compressor 100 comprises a lubricant supply 180, which may provide lubricant to the crankshaft 170, the orbiting scroll plate 130 and the stationary scroll plate 120.

[0044] The scroll compressor 100 has a low-pressure side and high-pressure side configuration. In this configuration, the low-pressure side comprises a lubricant supply 180, the motor 160, the crankshaft 170 and the suction port 140, whereas the high-pressure side comprises the discharge port 150. The stationary scroll plate 120 and the orbiting scroll plate 130 form a transition area from the low-pressure side to the high-pressure side.

[0045] Figure 2 shows a highlighted area of the upper portion of the scroll compressor of figure 1 and illustrates the temperature areas within the scroll compressor.

[0046] At the low-pressure side, the fluid is received at the suction port. Since the fluid received at the suction port has a rather low pressure and temperature, the temperature at the low-pressure side is also rather low. In figure 2, the temperature of the low-pressure side is denoted as suction side temperature T_S. Although the low-pressure side is characterized by a single temperature T_S in figure 2, the person skilled in the art will appreciate that the temperature distribution at the low-pressure side is not necessarily homogenous.

[0047] Similarly, at the high-pressure side, the compressed fluid has the highest temperature, which is denoted discharge temperature T_d. Again, the person skilled in the art will appreciate that deviations from the discharge temperature may occur and that the temperature distribution at the high-pressure side is not necessarily homogenous.

[0048] Further, the temperature in the compression chambers formed between the orbiting scroll plate and the stationary plate is higher than or equal to the suction side temperature T_S and lower than or equal to the discharge temperature T_d. During the compression procedure, the temperature in the compression chamber is increased from the suction side temperature T_S to the discharge temperature T_d. The temperature in the compression chambers is denoted T_c. Again, the person skilled in the art will appreciate that the temperature distribution in the compression chambers is not homogenous as has been described before.

[0049] The compressor configuration depicted in figure 2 further has a so-called intermediate pressure cavity, which is located between the stationary scroll plate and a portion of the supporting frame to which the stationary scroll plate is attached. The intermediate pressure cavity is connected to the compression chambers for at least a portion of time via a so-called bleed hole, which relates the pressure inside the compression chambers to the pressure inside the intermediate pressure cavity. Further, the intermediate pressure cavity is used for pressing the stationary scroll plate against the orbiting scroll plate, thereby improving the sealing between the scroll plates. As is depicted in figure 2, the temperature of the fluid within the intermediate pressure cavity denoted is T_i, which is a temperature higher than the suction side temperature T_S but lower than the discharge temperature T_d.

[0050] As the person skilled in the art will appreciate, the temperature areas depicted in figure 2 are simplifications and used for illustrative purposes only. As mentioned earlier, the temperature areas do not need to be homogeneous. Instead, they may represent temperature intervals. This is particularly important for the compression chamber temperature T_c, which ranges from values similar to the suction side temperature T_S at locations on the left and right hand side of figure 2 to values similar to the discharge temperature T_d at the center of the interleaved scroll plates.

[0051] The frontside of the stationary scroll plate faces the compression chambers and has a temperature similar to temperature T_c. The backside of the stationary scroll plate is in contact to the intermediate pressure cavity having temperature T_i and in close contact to the high-pressure side having temperature T_d. Therefore, the temperature at the backside of the stationary scroll plate is higher than the temperature T_c of the frontside and may be close to the discharge temperate T_d.

[0052] Similarly, the frontside of the orbiting scroll plate faces the compression chambers and also has a temperature similar to temperature T_c. The backside of the orbiting scroll plate is in contact to the low-pressure side having the suction side temperature T_s. Therefore, the temperature at the backside of the orbiting scroll plate is similar to the suction side temperature T_s.

[0053] Figures 3a to 3d show cross-sectional views of some embodiments of a scroll plate according to the current invention. In the first embodiment of a scroll plate 130a depicted in figure 3a, the scroll plate 130a comprises a base plate 200 having a first side 205 and a second side 210. The first side comprises a spiral wrap 270 and may also be referred to as frontside. The second side comprises a recess 220 located at the surface of the second side, which has an annular shape, such that it occurs on the left and right image sides of the surface. Said recess 220 may be referred to as first recess, as has been described before. A more detailed example of an annular recess will be described below with respect to figures 4a to 4c. Within the recess, an insulation material (not shown) can be placed, as will be shown in more detail below with respect to figures 4a to 4c.

[0054] The scroll plate 130a depicted in figure 3a may be either a stationary scroll plate or an orbiting scroll plate. However, the scroll plate 130a is illustrated as an orbiting scroll, which can be identified by the annular protrusion 240, which forms a reception for a crankshaft, as will also be described in more detail below with respect to figures 4a to 4c.

[0055] Figure 3b illustrates a variation 130b of the embodiment example of the scroll plate 130a depicted in figure 3a. Here, a portion of the recess 220a extends into a portion of the annular protrusion 240, thereby allowing the placement of the insulating material not only at the second side of the base plate 200, but also around the annular protrusion 240. This may limit thermal deformation of the annular protrusion 240.

[0056] Additionally to the features of scroll plate 130a or 130b depicted in figures 3a, 3b, the scroll plate 130c depicted in figure 3c comprises an additional recess 220b, which is located in the reception formed by the annular shaped protrusion 240. The person skilled in the art will appreciate that the recess 220b can be used additionally to the recess 220 as is depicted in figure 3c or alternatively to recess 220 even though this is not explicitly shown in a separate drawing.

[0057] Whereas the recesses 220, 220b depicted in figures 3a to 3c are located at the surface of the second side 210 of the base plate 200, the scroll plate 130d depicted in figure 3d comprises recesses 225, 225b, which are located beneath the surface of the second side 210. Although the recesses 225, 225b in figure 3d are shown at lateral positions (with respect to the surface of the second side) corresponding to the recesses 220, 220b of the embodiment example depicted in figure 3c, the person skilled in the art will appreciate that other shapes are also possible. For example, a single recess may extend in a plane parallel to the surface of the base plate 200, may be annular and may have a diameter up to the extend of the base plate.

[0058] In the embodiment examples of orbiting scroll plates depicted in figures 3a to 3d, the recesses and the insulating material are placed at the locations near the location of the protrusion for receiving a portion of the crankshaft. Although other locations for the recess are possible and are encompassed by the scope of the current application, the exemplary locations depicted in the drawings represent preferred examples. In case of a low-pressure side and high-pressure side scroll compressor configuration, these preferred examples account for temperature differences between the first side, which experiences a temperature similar to the discharge temperature in the center of the spiral wrap 270, and the second side, which experiences the substantially lower side temperature at the annular protrusion 240 caused by lubrication of the crankshaft with a lubricant and additionally contact with vapor at the suction side received from the suction port.

[0059] Figures 4a to 4c show embodiment examples of orbiting scroll plates according to the current invention, wherein (a) is a perspective view of an embodiment example of an orbiting scroll plate cut in half and (b), (c) are top views of the backside of two orbiting scroll plates having different shapes of insulating materials. The embodiment examples depicted in figures 4a to 4c correspond to the illustration depicted in figure 3c. In these figures 4a to 4c the insulating materials 230 and 260 located in recess 220 and 220b respectively are shown. Further, because of the perspective view, the annular shape of recess 220 and the circular shape of recess 220b as well as the annular shape of the protrusion 240 can be more clearly identified compared to the cross-sectional views depicted in figure 3c.

[0060] In figures 4a and 4b, the insulating materials 230, 230a are represented by a ring made of insulating material being located in an annular recess 220, while the insulating material 260 is represented by a circle or disc made of insulating material located in a circular recess 220b. In contrast to insulating material 230a in figure 4b, the insulating material 230b in figure 4c does not form a closed ring. This allows the insulating material to increase or decrease its size caused by thermal effects within the insulating material. As the person skilled in the art will appreciate, this benefit may also be achieved by providing multiple portions of insulating material, which are placed in sections of the annular recess.

[0061] Figures 5a, 5b show another embodiment example of an orbiting scroll plate 130b according to the current invention, wherein the base plate consists of two parts, wherein the first part comprises the first side and the second part comprises the second side and wherein the insulating material is placed between the first part and the second part.

[0062] In this embodiment example, the base plate of scroll plate 130b is formed by a first portion 310, a second portion 320 and an insulating layer 330 placed in a recess between the first portion 310 and the second portion 320. As such, a recess in the sense of the current invention may also be interpreted as separation of the base plate into two portions 310 and 320. This embodiment example isolates the first portion 310 from the second portion 320 by ease of the insulating layer 330, which reduces heat transfer between both portions of the base plate of the scroll plate.

[0063] Figures 6a to 6c show another embodiment of a scroll compressor in which the current invention can be used, wherein the scroll compressor has a so-called high-side compressor configuration. (a) shows a cross-sectional view of the scroll compressor with thermal deformation management features added to the orbiting scroll plate, (b) shows a highlighted portion of the upper portion of the scroll compressor of (a) and illustrates the temperature areas within the scroll compressor, and (c) shows a cross-sectional view of the scroll compressor with thermal deformation management features added to the stationary scroll plate. Similarly to scroll compressor 100 depicted in figure 1, the scroll compressor 400a depicted in figure 6a comprises a case 410, a motor 460, a crankshaft 470, and a lubricant supply 480. These components all may have similar features as the corresponding features of scroll compressor 100.

[0064] Further, scroll compressor 400a comprises a scroll set, which forms one or more compression chambers during operation of the scroll compressor 400a. The scroll set is formed by a stationary scroll plate 420 and an orbiting scroll plate 430. Both scroll plates 420, 430 comprise spiral wraps, which form one or more compression chambers between them. Contrary to the scroll plates 120, 130 of scroll compressor 100, scroll plates 420, 430 of scroll compressor 400a are located at the high-pressure side. The scroll compressor 400a comprises a suction port 440 for receiving fluid and a discharge port (not shown) for discharging fluid from the compressor. Contrary to scroll compressor 100, the suction port 440 does not lead the received fluid to a low-pressure side, but instead feeds the fluid directly to the one or more compression chambers formed between the orbiting scroll plate 430 and the stationary scroll plate 420. The discharge port of scroll compressor 400a may be similar to discharge port 150 of scroll compressor 100.

[0065] Since both scroll plates 420, 430 are located at the high-pressure side, the back sides of both scroll plates 420, 430 experience a higher temperature than the temperature T_c. As is illustrated in figure 6b, the stationary scroll plate 420 is surrounded by fluid ejected from the one or more compression chambers at the center of the stationary scroll plate 420, so that the stationary scroll plate is surrounded by fluid having the discharge temperature T_d. Within the spiral wraps of the scroll plates 420, 430 the scroll plate experience different temperatures. The one or more compression chambers receive the fluid directly form the suction port, thereby at least partially experiencing the suction port temperature T_{sp}. Since the fluid is compressed and thereby its temperature is increasing, the scroll plates at the locations of the interleaved spiral wraps experience the compression chamber temperature T_c, which increases from T_{sp} to T_d.

[0066] In the embodiment example depicted in figure 6a, the orbiting scroll plate 430 comprises an insulation layer 510 located at its backside. This insulation layer 510 improves the thermal deformation behavior of the orbiting scroll plate similarly to what has been described with respect to the insulating material placed in recesses for the scroll plates of the high-pressure side and low-pressure side scroll compressor embodiments.

[0067] Scroll compressor 400b depicted in figure 6c is also a high-side scroll compressor and has similar features as scroll compressor 400a depicted in figure 6a. Also, its temperature areas are similar to the temperature areas depicted in figure 6b. However, in contrast to the scroll compressor 400a depicted in figure 6a, scroll compressor 400b depicted in figure 6c comprises thermal deformation management features applied to the stationary scroll plate. For example, stationary scroll plate 420 may comprise a recess with an insulating material at the side, which opposes the side with the spiral wrap. Alternatively, as is illustrated in figure 6c, an insulating layer 520 may cover the stationary scroll plate 420 and shield it from the high temperature T_d. The insulating layer 520 may be made of the same material as the insulating material discussed above.

[0068] The following description relates to the case in which the scroll plate having one or more recesses with insulating material is an orbiting scroll plate. The one or more recesses of the orbiting scroll plate in which the insulating material is placed as has been described above may be referred to as one or more first recesses. In such an embodiment example, thermal deformation management may additionally be improved by adding thermal deformation management features to the stationary scroll plate. Preferably, the thermal deformation management features added to the stationary scroll plate may comprise an insert, which is placed in a second recess of the stationary scroll plate in a way that a cooling chamber is formed between the insert and the stationary scroll plate, said second recess being connected to a fluid injection line. Figures 7 to 9 illustrate such a stationary scroll plate and a corresponding insert for forming a cooling chamber.

[0069] Figure 7 shows a cross-sectional view of an embodiment example of a stationary scroll plate 120a. Compared to the stationary scroll plate 120 of compressor 100, the stationary scroll plate 120a depicted in figure 7 comprises an insert 650 placed within a second recess 630 on a second side 610 of a base plate 600 of the stationary scroll plate 120a. The insert 650 forms a cooling chamber 640 within the second recess 630, which represents a volume within the second recess 630, which is separated from the remaining volume.

[0070] In order to provide a sealed separation from the remaining volume within the second recess 630, side portions of the insert 650 are connected to side walls 630a, 630b of the second recess 630. The side portions may be formed by legs 655a, 655b as will be illustrated in more detail with respect to figure 8a.

[0071] Another portion of the insert 650, which may be formed by one or more protrusions 660, keeps the insert 650 in a particular distance from the bottom 630c of the second recess 630. As is illustrated in figure 7, the protrusion 660 may define the height of the cooling chamber 640. In the embodiment example depicted in figure 7, the second recess 630 and the insert 650 have annular shapes.

[0072] The fluid that may for example be received from an injection line of a refrigeration cycle flows through the injection channel 680 within the base plate 600. Through an inlet channel 645a, a portion of the fluid flows into the cooling chamber 640. After passing through the cooling chamber 640, the fluid flows through the outlet channel 645b into the compression chamber formed between the interleaved spiral wraps 670. The person skilled in the art will be aware that there are various ways of how the inlet channel 645a may be formed. An example of such an inlet channel is depicted in figure 7, whereas figure 8a depicts a slightly different configuration.

[0073] Figures 8a, 8b show (a) a cross-sectional detail view of a preferred embodiment of an insert placed within a second recess of a stationary scroll plate and (b) a perspective view of the preferred embodiment of the insert.

[0074] The insert 650 depicted in figure 8a essentially has a U-shaped cross-section with two legs 655a and 655b. These legs 655a, 655b can be used to connect the insert 650 to the side walls 630a, 630b of the second recess 630. The connection may preferably be a sealed connection, so that the cooling chamber 640 is sealed from the intermediate pressure cavity formed in the remaining part of the second recess 630. The sealing may for example be achieved by interference fit or usage of a sealing element.

[0075] Further, the insert 650 comprises at least one protrusion 660. The at least one protrusion 660 lies on the bottom 630c of the second recess. Hence, the length of the protrusion 660 defines the height of the cooling chamber 640. In the embodiment example depicted in figure 8a, the insert 650 comprises two protrusions 660, which are located at the edges of the insert 650, or in other words at locations opposing the legs 655a, 655b. The two protrusions 660 allow the forming of the cooling chamber 640 between them and the bottom of the second recess. Alternatively but not shown, the insert may comprise a single protrusion located centrally (similar to what is shown in figure 7), so that the cooling chamber is formed on either sides of the protrusion.

[0076] In another example, which is not depicted in the figures, the legs 655a, 655b of the insert 650 may face toward the bottom 630c of the second recess 630. In this case, no protrusion is necessary because the height of the chamber 640 is defined by the length of the legs 655a, 655b.

[0077] Further as is already shown in figures 7 and 8a, the connection between the insert 650 and the wall of the second recess may be sealed by one or more seals 665. These seals may be sealing elements (e.g. O-rings) or may be established by interference fit.

[0078] Figure 8b shows three views of the insert 650 of figure 8a without the surrounding stationary scroll plate. The first image is a perspective view of the insert 650, while the second image is a perspective view of a cross-section of the insert 650 and the third image is a cross-sectional view of the insert 650. The insert 650 comprises first and second legs 655a, 655b for being connected to side walls of a second recess in a stationary scroll plate and two protrusions 660, which are used for defining the height of the cooling chamber. As can be seen in figure 8b, the insert has an annular shape and is configured for being placed in an annular recess in a stationary scroll plate.

[0079] Figures 9a and 9b show two exemplary types of cooling chambers formed within the second recess by the insert. Figures 9a, 9b illustrate a top view of the arrangement of the cooling chamber 640 formed by the insert 650 in the second recess 630.

[0080] In the first example, which is depicted in figure 9a, the second recess 630 has an annular shape and extends around the aperture 620. The cooling chamber 640a formed by the insert 650 within the second recess also has an annular shape. The openings of the cooling chamber 640a to inlet and outlet channels, respectively, are not illustrated in the figure but may preferably be located at opposing sides of the annular ring, e.g. at locations corresponding to 12 o'clock and 6 o'clock in the figure 9 or any other opposing locations. In this way, the fluid received from the injection channel 680 via the first opening may distribute to two paths within the cooling chamber 640a and be guided to the second opening.

[0081] In the second example, which is depicted in figure 9b, the second recess 630 again has an annular shape and extends around the aperture 620. The cooling chamber 640b formed by the insert 650 within the second recess comprises a path, which is essentially formed by two concentric rings, which are connected. This way, the fluid can enter cooling chamber 640b via the inlet channel that ends in a first opening 710 and is guided through the cooling chamber 640b for almost an entire outer ring of the second recess 630, experiences a turn and is then guided within the inner ring towards the second opening 720 from where it is provided outlet channel.

[0082] The person skilled in the art will appreciate that various kinds of other cooling chamber arrangements are also possible and achieve the same or similar effects as the examples, which are explicitly shown in the figures. In particular any arrangement, in which the cooling chamber only covers a portion of the annular recess 230 is also encompassed by the scope of current invention even though such examples are not explicitly shown.

[0083] Further, the person skilled in the art will appreciate that multiple first openings, which connect the cooling chamber with the inlet channel within the base plate, and multiple second openings, which connect the cooling chamber with the outlet channel are also possible, even though this is not explicitly shown. Thereby, curved cooling chambers and several branches can be designed.

[0084] The at least one protrusion of the insert may be used to define the course of the cooling chamber in order to achieve the aforementioned designs.

[0085] What has been described above includes examples of one or more embodiments. It is, of course, not possible to describe every conceivable combination of components or methodologies for purposes of describing the aforementioned embodiments, but one of ordinary skill in the art may recognize that many further combinations and permutations of various embodiments are possible. Accordingly, the described embodiments are intended to embrace all such alterations, modifications and variations that fall within the scope of the appended claims.

Claims

1. A scroll plate for use in a scroll compressor (100, 400a, 400b), the scroll plate comprising:

    a base plate (200) having a first side (205) and a second side (210), wherein the second side (210) opposes the first side (205); and
    a spiral wrap (270) formed on the first side (205) of the base plate (200);
    wherein the base plate (200) comprises one or more recesses (220, 220a, 2200b, 225, 225b) and wherein an insulating material (230, 260, 230a, 230b) is located in at least one of the one or more recesses (220, 220a, 2200b, 225, 225b).

2. The scroll plate according to claim 1, wherein at least one of the one or more recesses (220, 220a, 2200b, 225, 225b) is located at a surface of the second side (210) of the base plate (200).

3. The scroll plate according to any of claims 1 or 2, wherein the second side (210) of the base plate (200) further comprises a reception configured to receive a portion of a crankshaft of the compressor.

4. The scroll plate according to claim 3, wherein at least one recess (220b) of the one or more recesses (220, 220a, 2200b, 225, 225b) is located within the reception.

5. The scroll plate according to any of claims 3 or 4, wherein at least one recess (220) of the one or more recesses (220, 220a, 2200b, 225, 225b) is located outside of the reception.

6. The scroll plate according to claim 5, wherein the at least one recess (220), which is located outside of the reception, forms a ring around the reception.

7. The scroll plate according to claim 6, wherein at least two recesses form concentric rings around the reception.

8. The scroll plate according to claim 1, wherein at least one recess (225, 225b) of the one or more recesses (220, 220a, 2200b, 225, 225b) is located beneath the surface of the second side (210) of the base plate (200).

9. The scroll plate according to claim 8, wherein the at least one recess (225, 225b) beneath the surface of the second side (210) is formed as a sealed chamber within the base plate (200).

10. The scroll plate according to claim 9, wherein the insulating material located in the recess beneath the surface of the second side (210) is a fluid.

11. The scroll plate according to claim 1, wherein the insulating material (230, 260, 230a, 230b) forms a layer (330) located between the first side (205) and the second side (210) of the base plate (200).

12. The scroll plate according to any of claims 1 to 9 and 11, wherein the insulating material (230, 260, 230a, 230b) is a non-metal material having a low thermal conductivity.

13. A scroll compressor (100, 400a, 400b) comprising a scroll plate (130) according to any of the aforementioned claims.

14. The scroll compressor (100, 400a, 400b) according to claim 13, wherein the scroll plate is an orbiting scroll plate (130) and wherein the one or more recesses (220, 220a, 2200b, 225, 225b) of the base plate (200) of the orbiting scroll plate (130) are referred to as one or more first recesses (220, 220a, 2200b, 225, 225b), the scroll compressor further comprising a second scroll plate (120a, 120b), wherein the second scroll plate (120, 120b) comprises:

    a second base plate (600) having a frontside (605) and a backside (610), wherein the backside (610) opposes the frontside (605);
    a second spiral wrap (670) formed at the frontside (605) of the second base plate (600), wherein the second spiral wrap (670) is adapted to interact with the spiral wrap (270) of the orbiting scroll plate (130) to form at least one compression chamber;
    an injection channel (680) formed within the second base plate (600), the injection channel (680) providing an injection path for injection of fluid into the at least one compression chamber;
    a second recess (630) located at the backside

(610) of the second base plate (600);
an insert (650) placed within the second recess (630), wherein the insert (650) forms a cooling chamber (640, 640a, 640b) within the second recess (630),
an inlet channel (645a) via which the cooling chamber (640, 640a, 640b) is connected to the injection channel (680); and
an outlet channel (645b) via which the cooling chamber (640, 640a, 640b) is connected to the inside of the second spiral wrap (670).

15. The scroll compressor (100, 400a, 400b) according to claim 14, wherein the cooling chamber (640, 640a, 640b), the inlet channel and the outlet channel define a cooling path configured to guide fluid from the injection channel (680) to the inside of the spiral wrap (670).

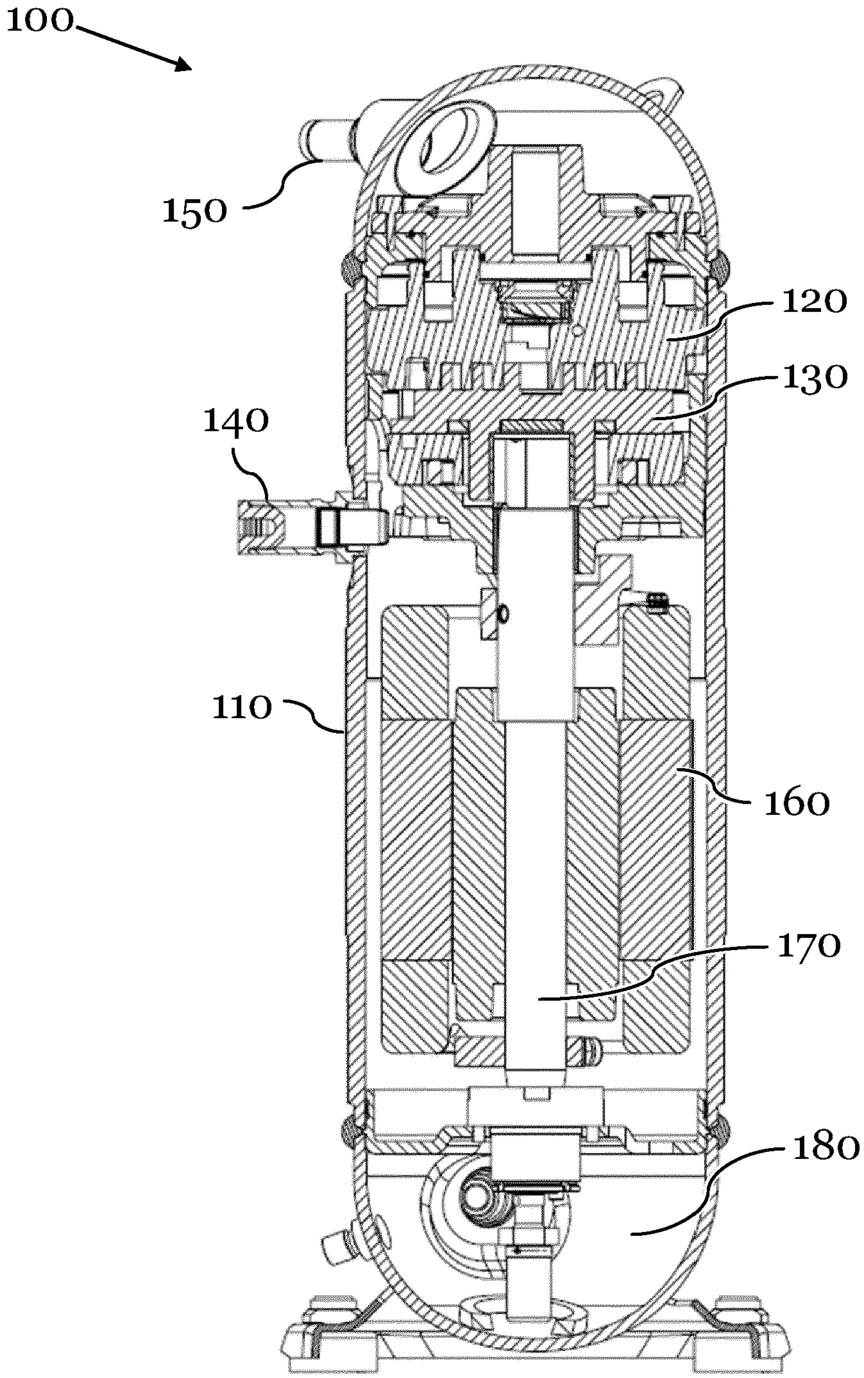

Fig. 1

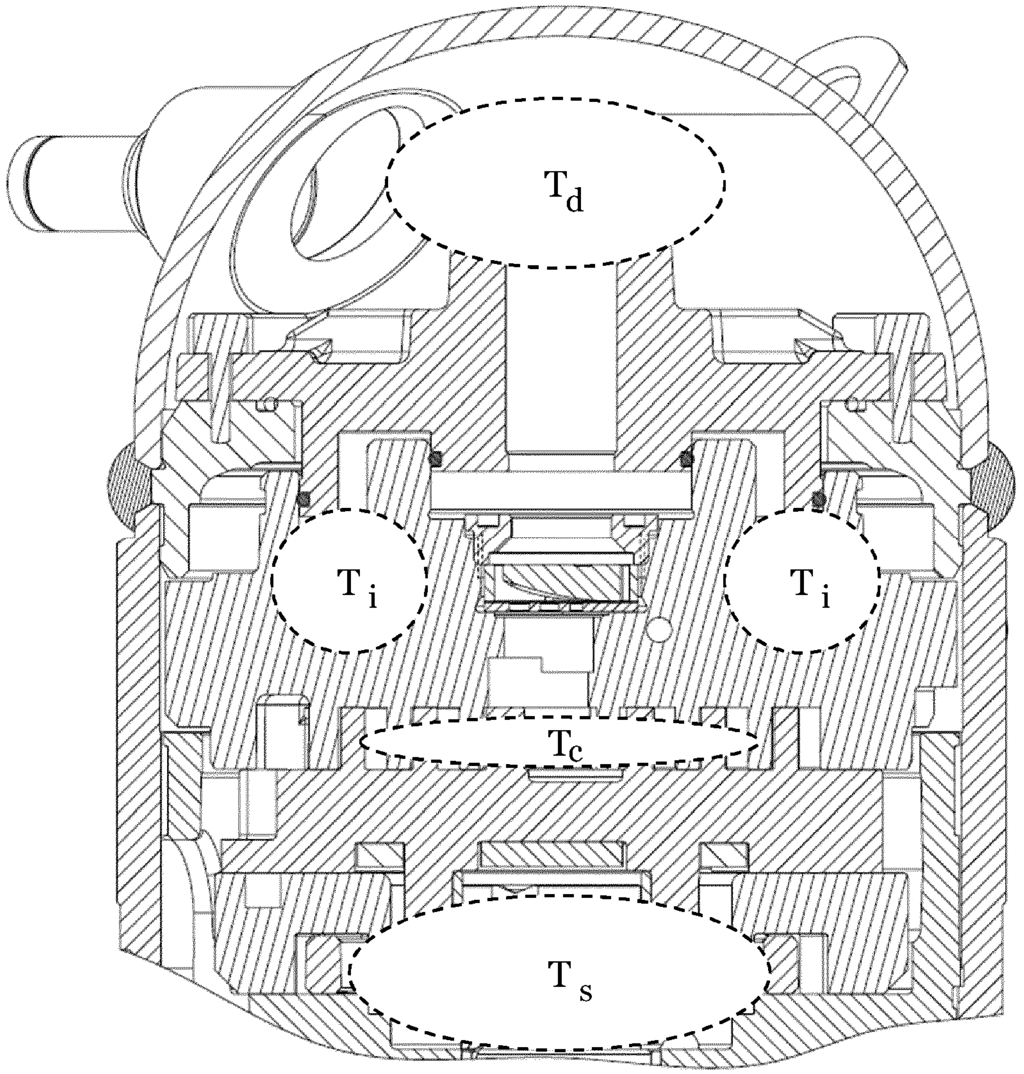

Fig. 2

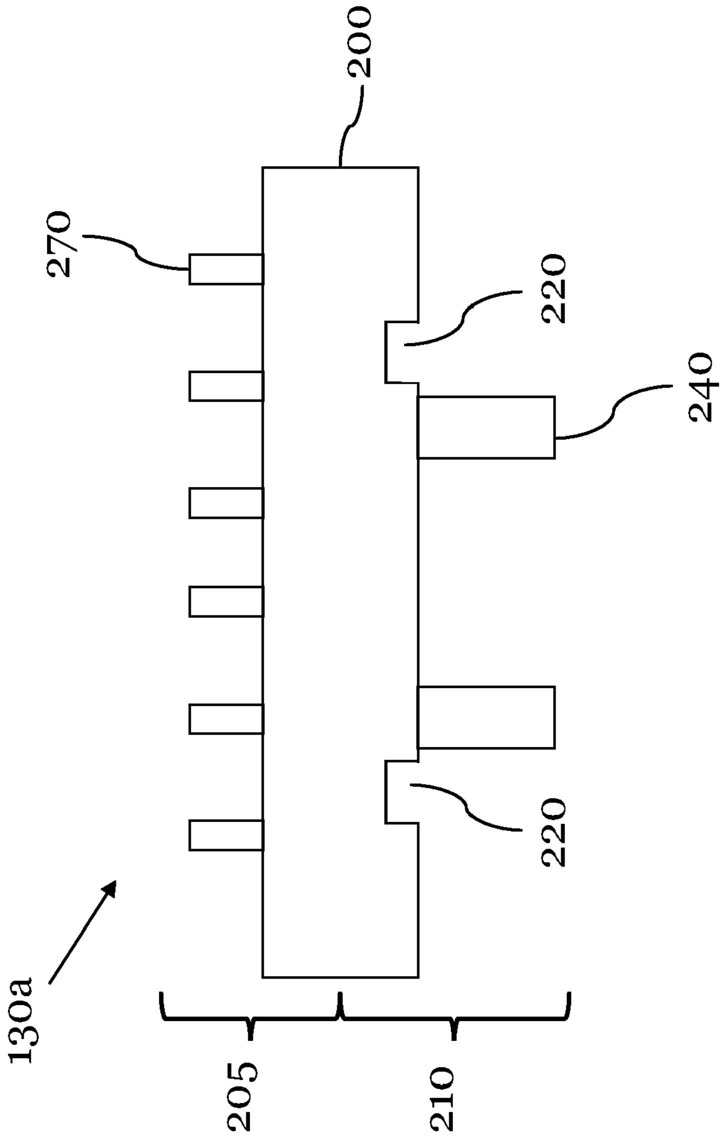

Fig. 3a

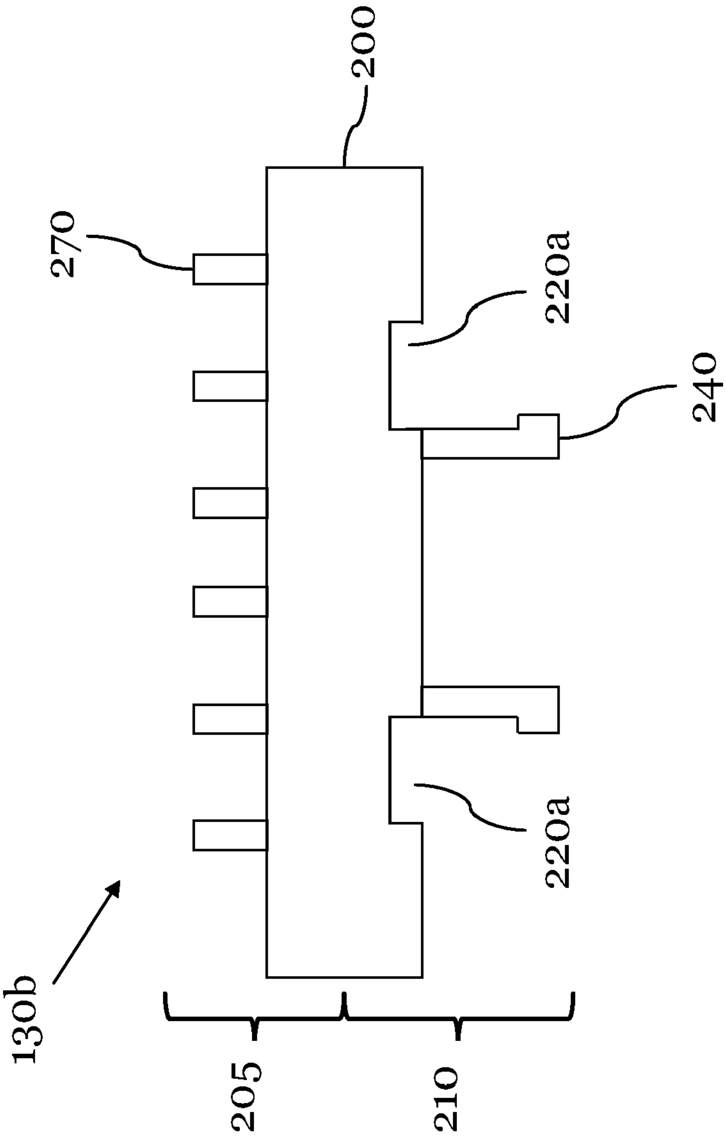

Fig. 3b

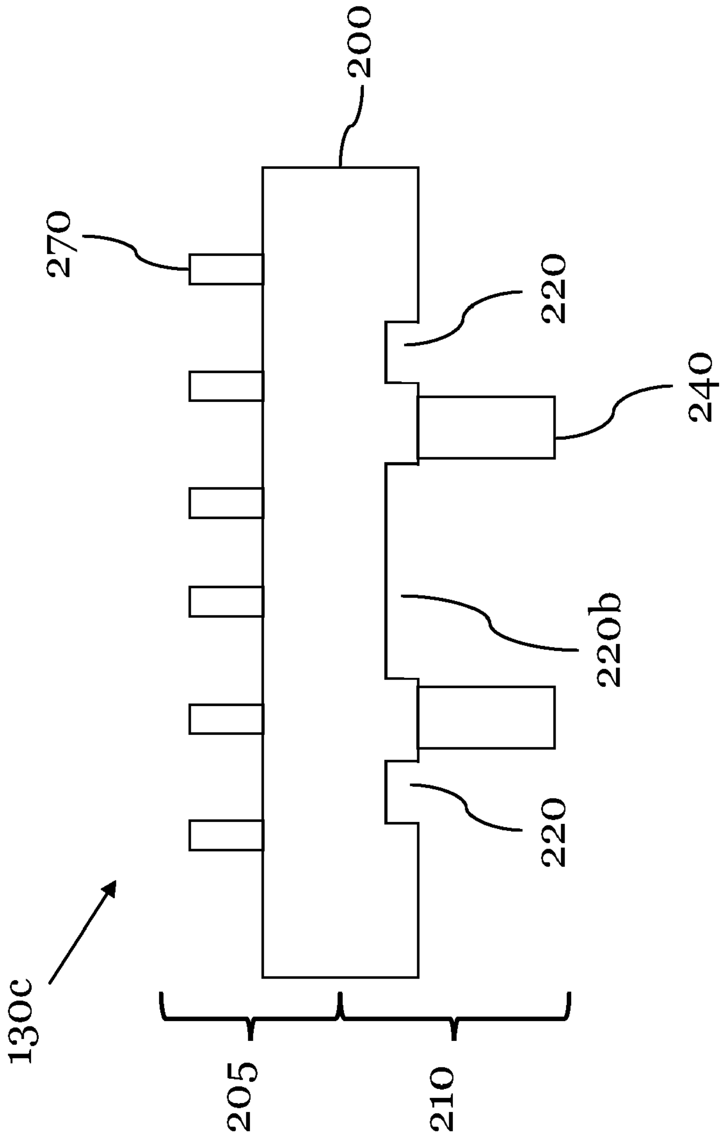

Fig. 3c

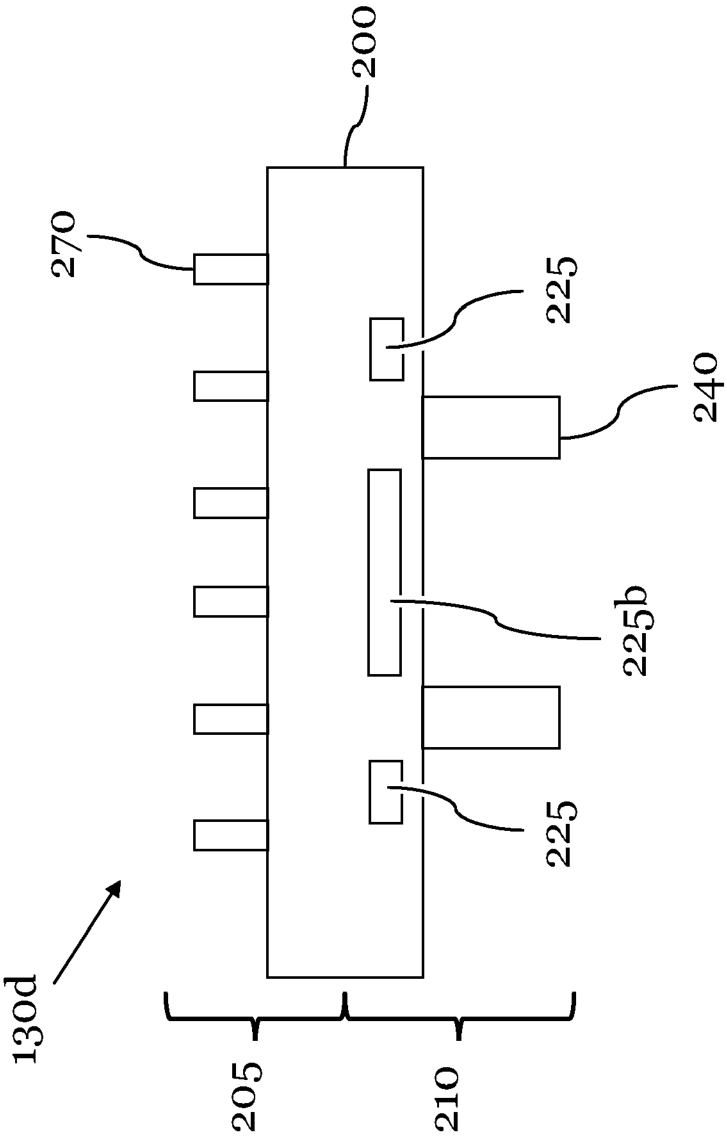

Fig. 3d

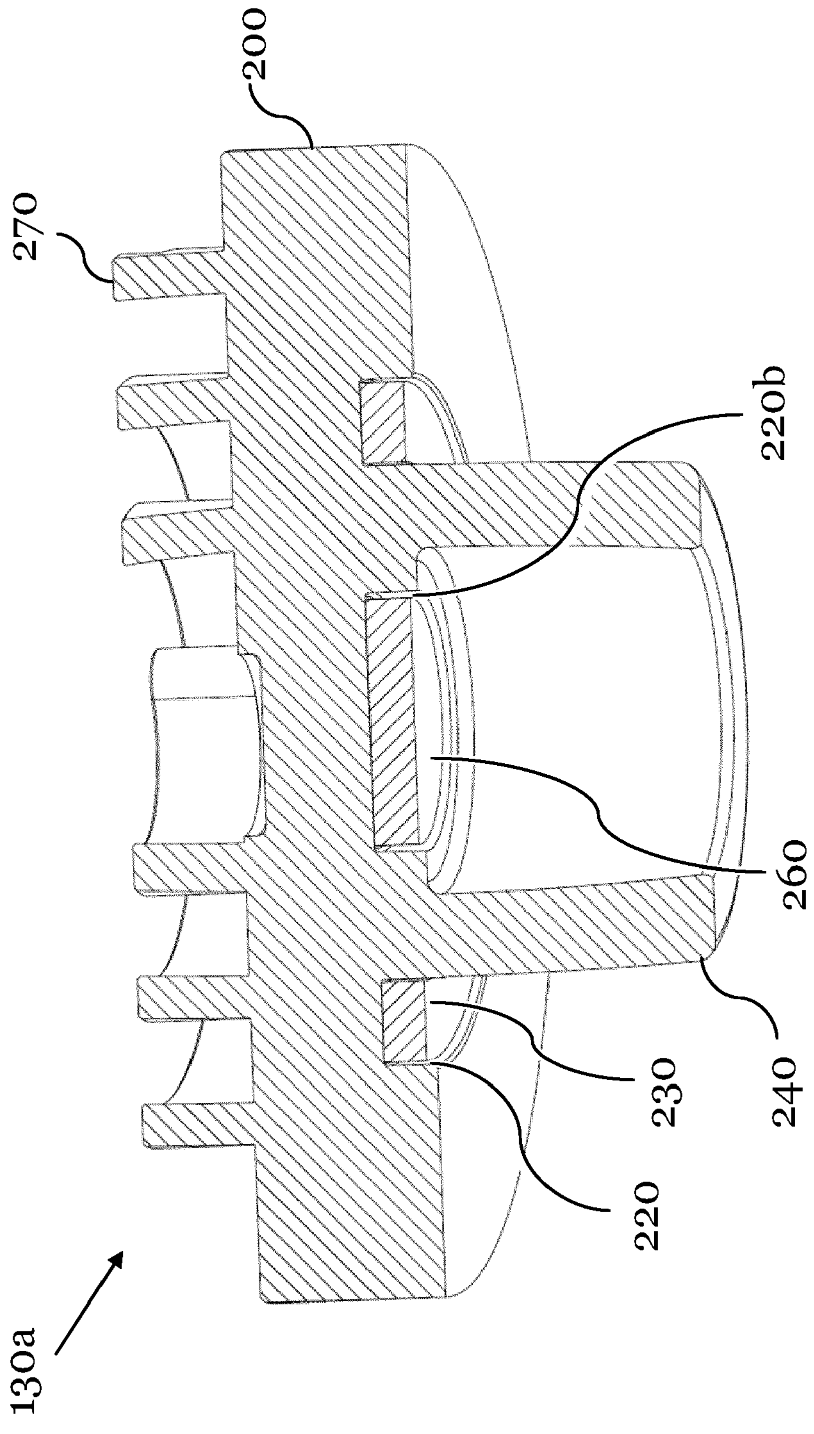

Fig. 4a

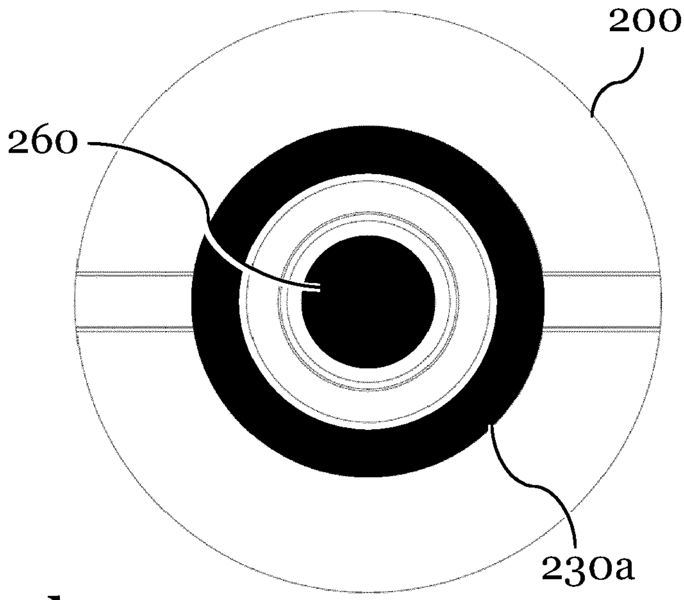

Fig. 4b

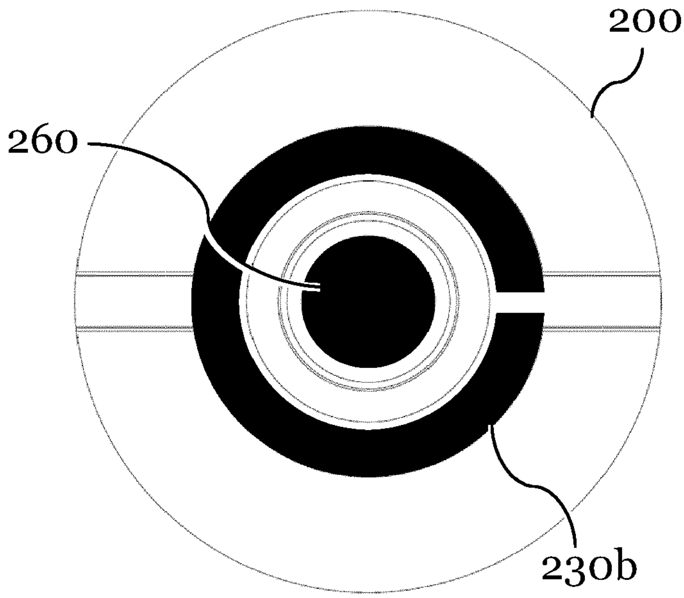

Fig. 4c

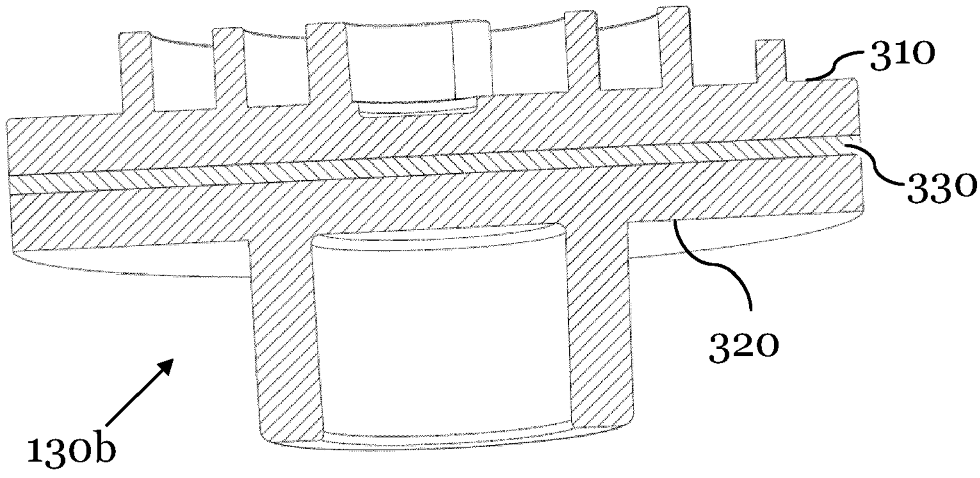

Fig. 5a

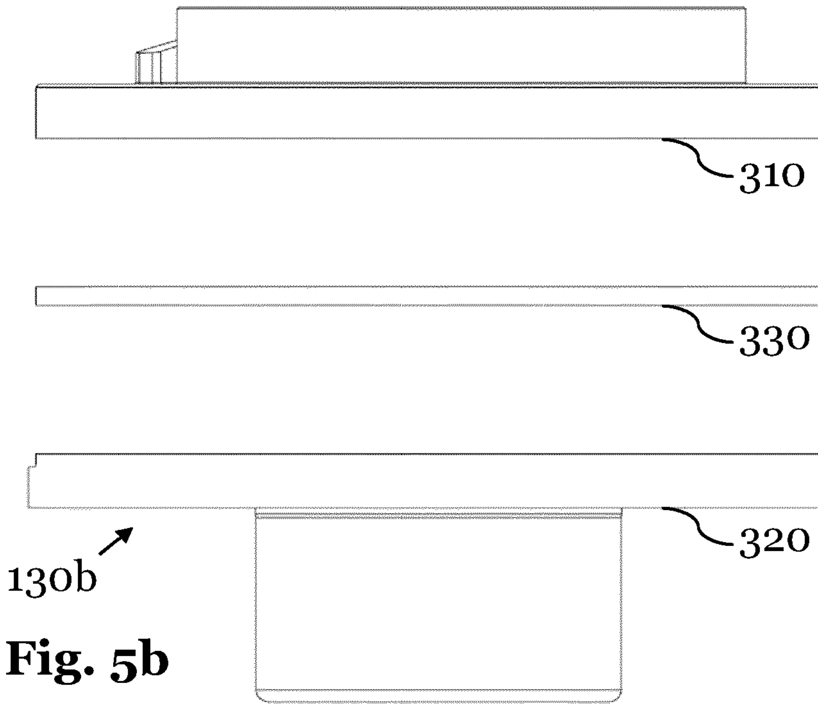

Fig. 5b

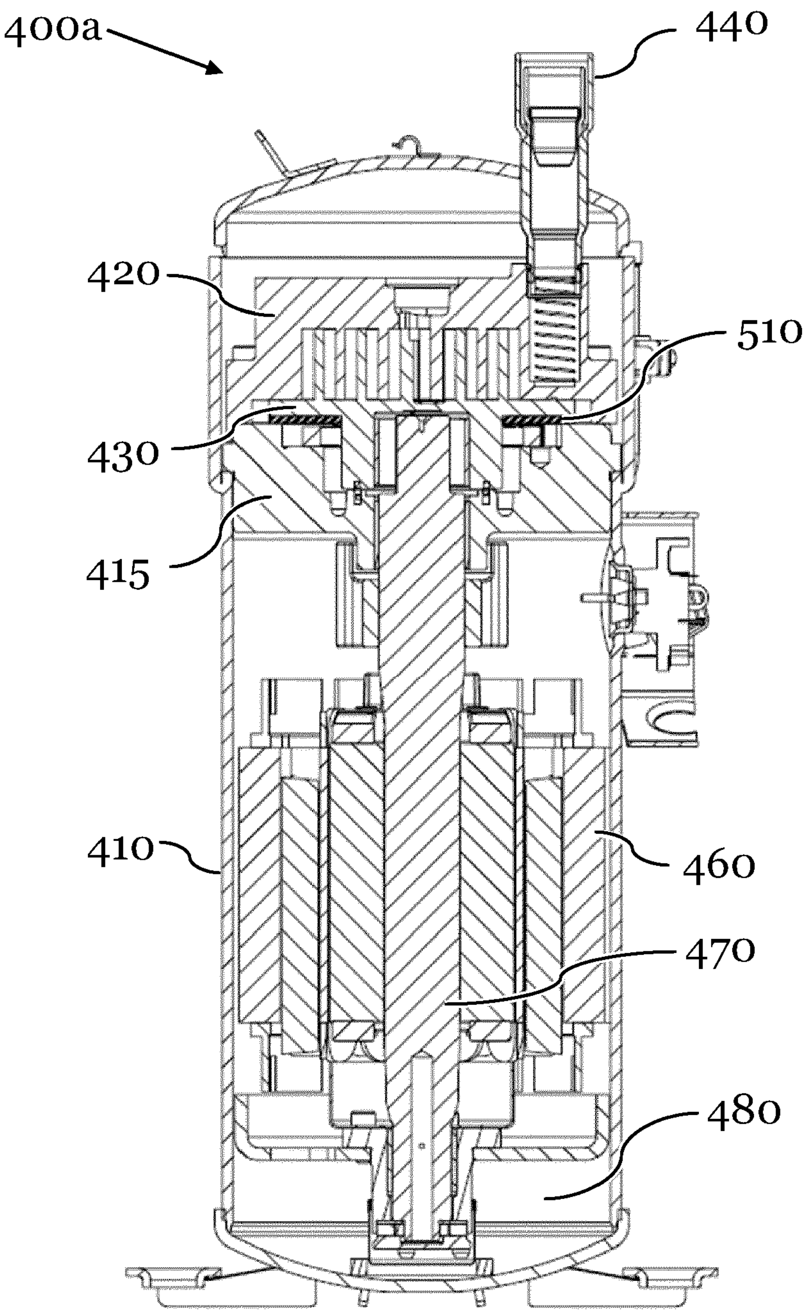

Fig. 6a

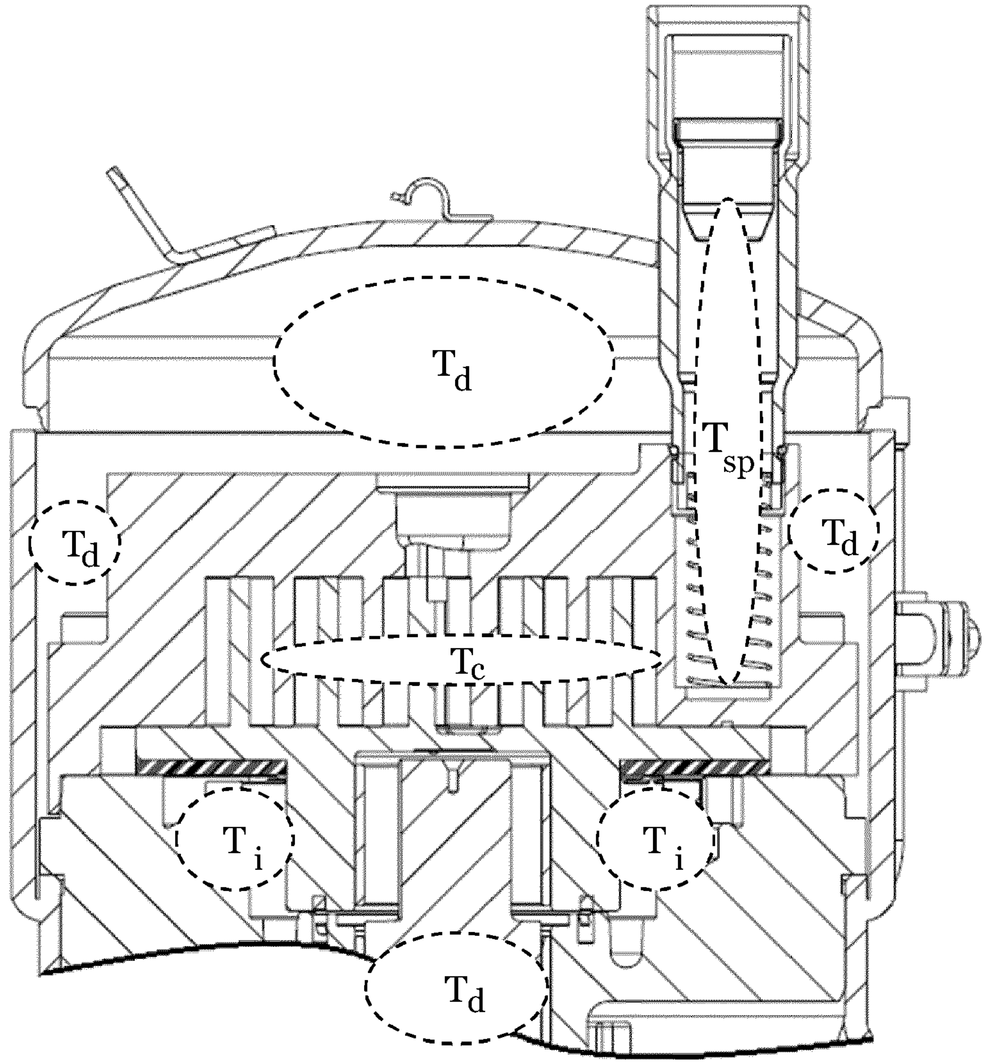

Fig. 6b

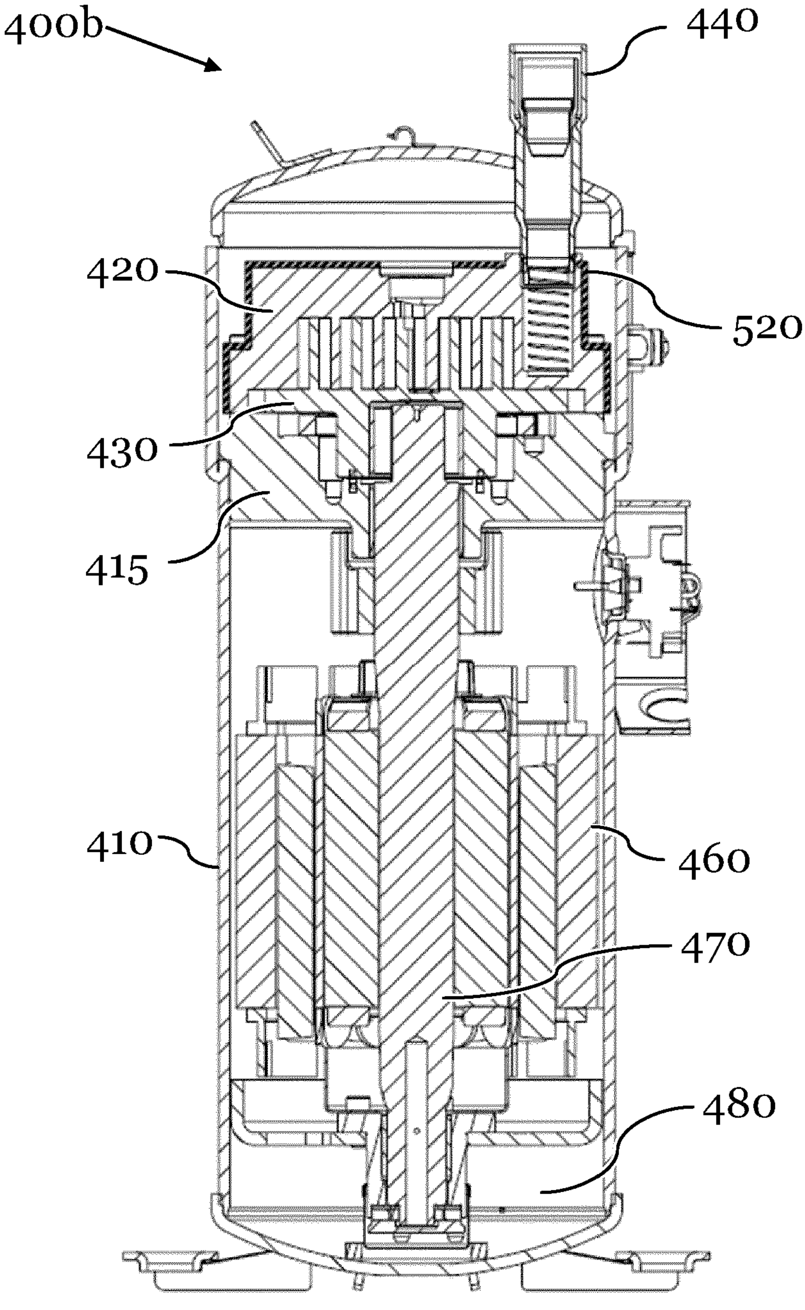

Fig. 6c

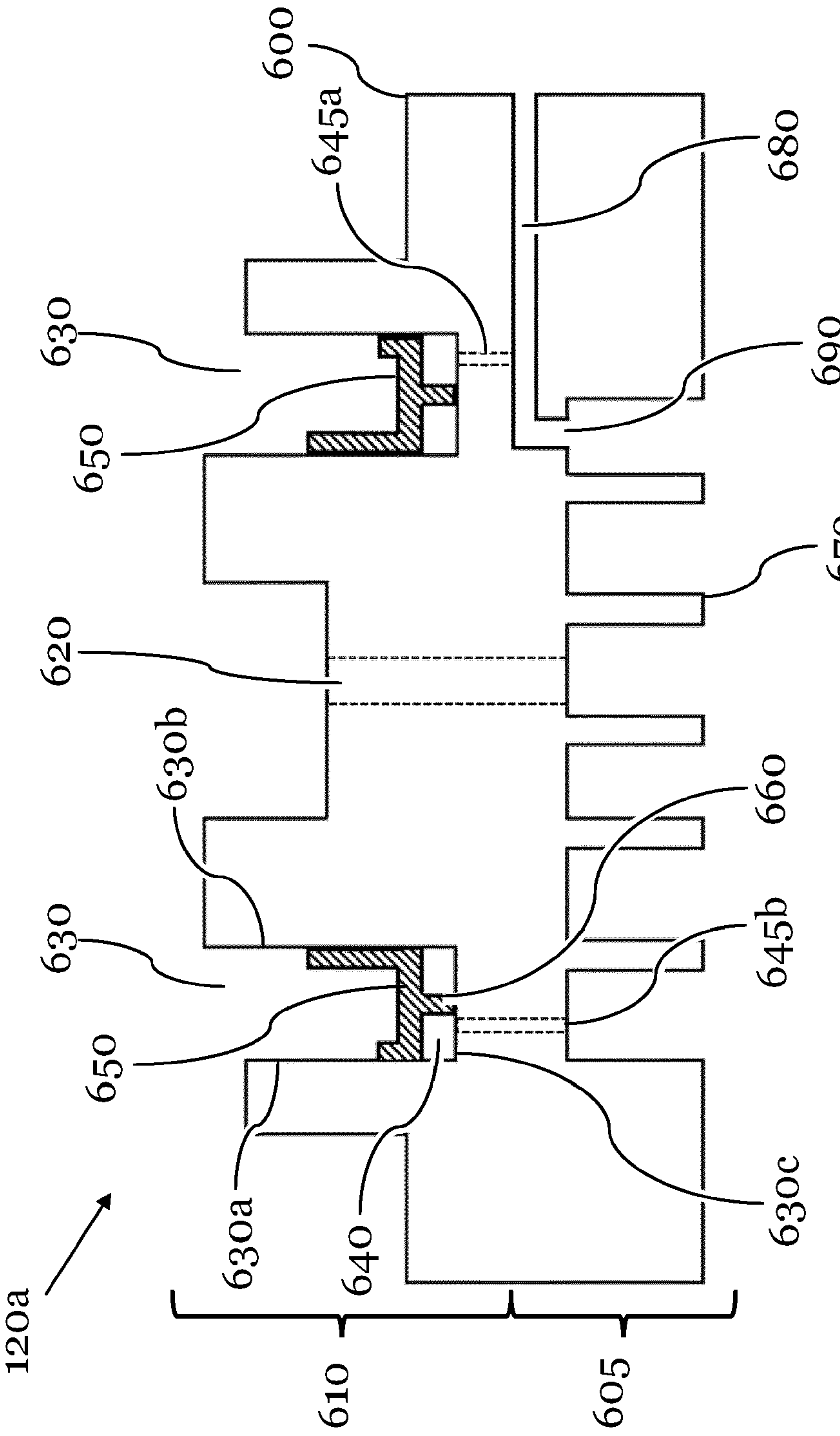
600
645a
680
630
690
650
670
620
630b
660
630
645b
650
630c
630a
640
120a
610
605

Fig. 7

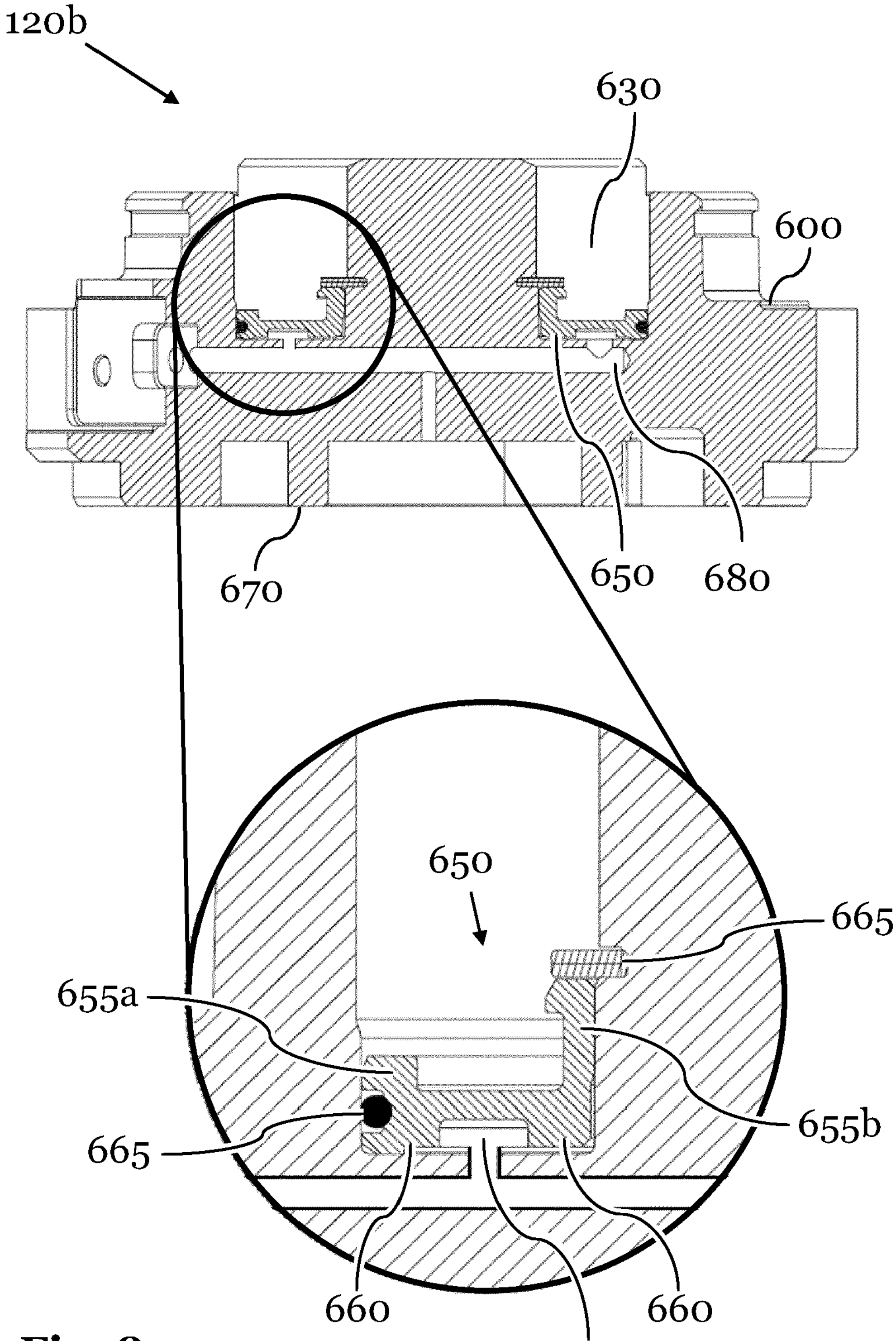

Fig. 8a

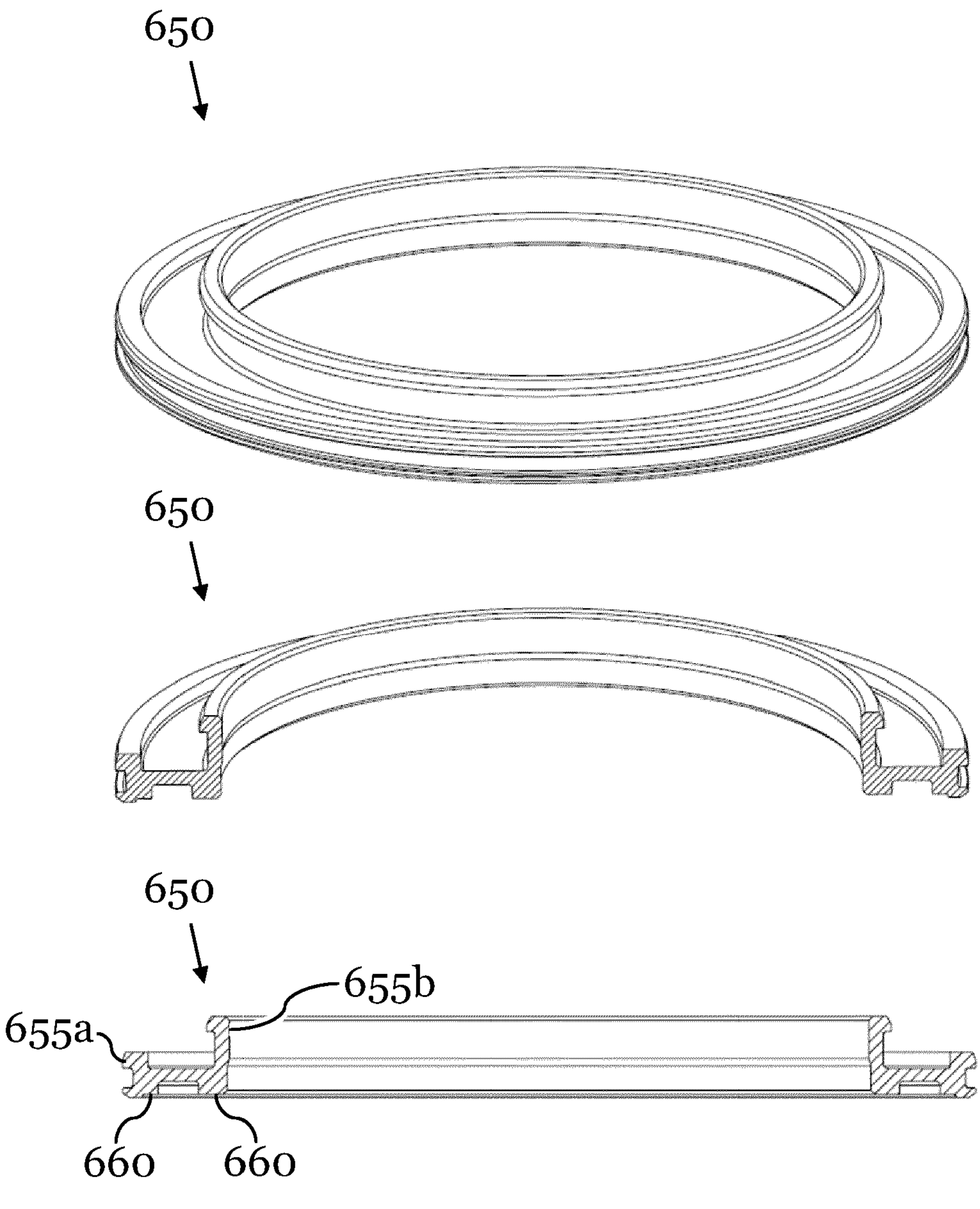

Fig. 8b

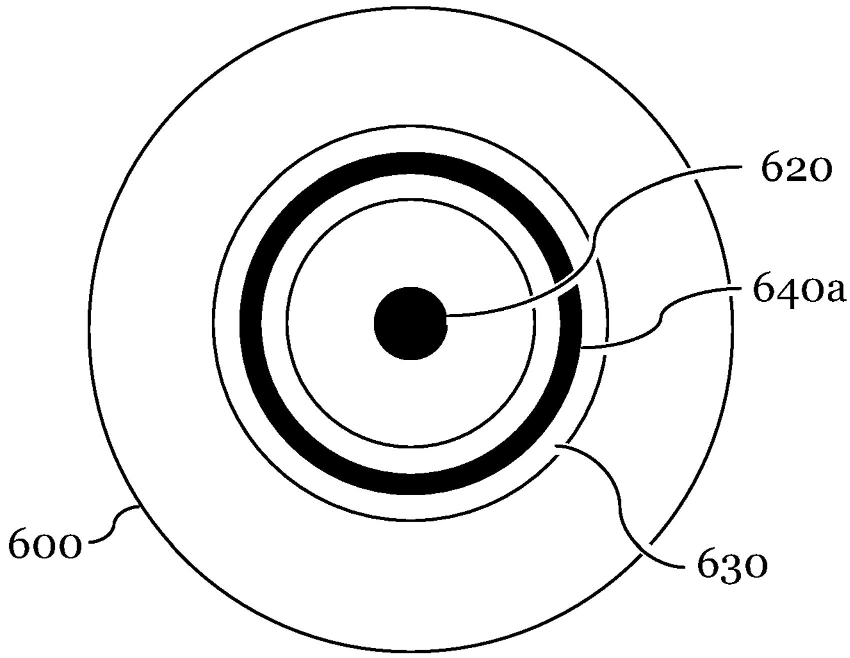

Fig. 9a

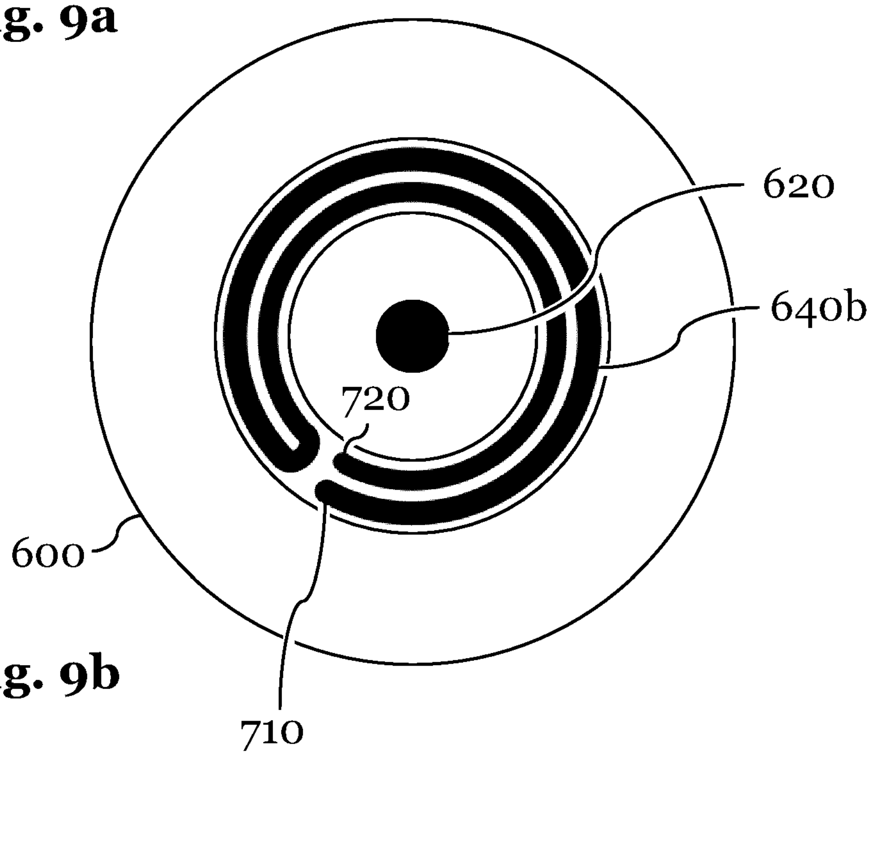

Fig. 9b

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EUROPEAN SEARCH REPORT

Application Number
EP 21 18 1137

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Place of search	Date of completion of the search	Examiner
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