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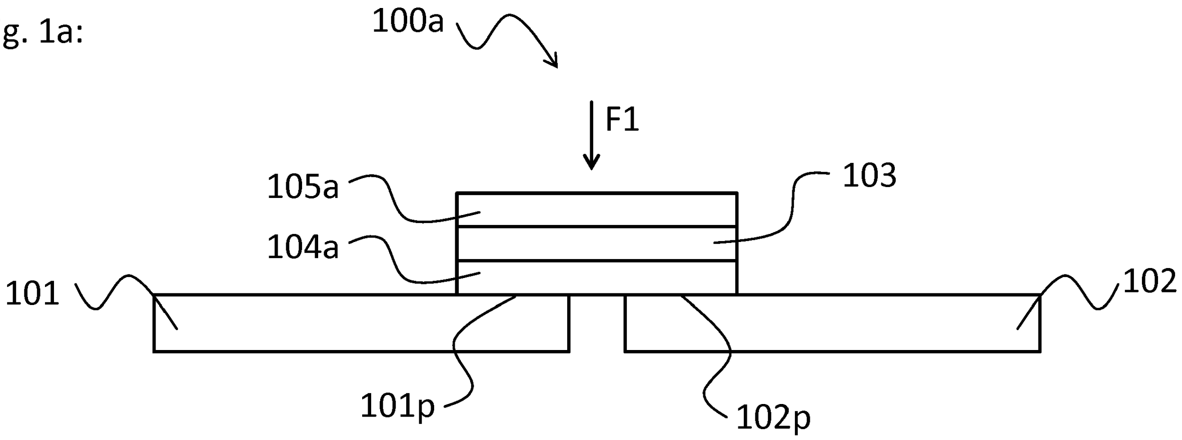
(54) **CONDUCTOR COUPLING APPARATUS**

(57) The invention provides a conductor coupling apparatus 100a. The conductor coupling apparatus 100a comprises a conductive coupling member 103 configured to cover a portion 101p of a first conductor 101 and a portion 102p of a second conductor 102. The conductive coupling member 103 is further configured to be separated from the first conductor 101 and/or the second conductor 102 by dielectric material 104a, wherein the conductive coupling member 103 is configured to provide a capacitive coupling between the first conductor 101 and the second conductor 102. The conductor coupling apparatus 100 further comprises at least one first support member 105a, configured to press the conductive coupling member 103 towards the first conductor 101 and/or the second conductor 102 whereby the conductive coupling member 103 is secured slidably against the first conductor 101 and the second conductor 102.

Fig. 1a:



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Description

TECHNICAL FIELD

[0001] The present invention is in the field of radio frequency (RF) systems and in particular provides a conductor coupling apparatus for enabling capacitive coupling between conductors of a RF system.

BACKGROUND

[0002] Common RF systems, e.g. antenna systems, include various RF system components, which in particular can be based on printed circuit boards (PCBs). In order to couple the various RF system components, conductors of the RF system components are often coupled by using soldered connections, which leads to longer manufacturing time and higher manufacturing costs. As common RF systems and RF system components are often exposed to temperature changes, for example due to environmental temperature changes, they need to reliably operate within a wide temperature range. In particular, due to the temperature changes and material characteristics of the RF system components, the RF system components are prone to thermal expansion and thermal contraction. This results in a relative movement of at least portions of the RF system components towards each other, which, in turn also leads to a relative movement at the conductors. In case of soldered connections, stress or heat can be caused at the soldered connections and the soldered connections can be damaged.

[0003] An alternative solution for coupling RF system components without soldering is mechanically fixing together RF system components by fastening elements, for example by screws or rivets.

[0004] Document WO 2012111938 A2 describes how to establish solderless coupling of two striplines. Coupling of the striplines is enabled by a coupling means that is screwed to both striplines to enable a conductive coupling. Since this solution requires mechanical fixation by screws and thick metal strips to ensure mechanical stability, it is on the one hand not suitable for use with thin PCBs. On the other hand, due to the rigid connection between the striplines and the coupling means, in the event of thermal expansion/contraction, the screw connection can also get damaged due to thermal deformation of the stripline and the screwed coupling member and may wear, which can lead to a decreasing coupling quality.

[0005] In order to provide an optimal coupling of RF system components, a reliable connection is required to avoid disadvantageous effects such as signal loss, signal damping or signal interference and in particular to avoid passive intermodulation (PIM). PIM refers to the disadvantageous effect of additional RF signals appearing when two or more different RF signals are processed in a RF system.

SUMMARY

[0006] In view of the above, embodiments of the present invention provide a coupling of conductors, suitable for use with PCBs and allows for an easy to implement, reliable, non-galvanic and solder-less coupling between the conductors, particularly in respect to thermal influences.

[0007] The above-mentioned object of the present invention is achieved by the solution provided in the independent claims. Advantageous implementations of the present invention are further defined in the respective dependent claims.

[0008] According to a first aspect, the invention provides a conductor coupling apparatus, comprising: a conductive coupling member configured to cover a portion of a first conductor and a portion of a second conductor, wherein the conductive coupling member is further configured to be separated from the first conductor and/or the second conductor by dielectric material and wherein the conductive coupling member is configured to provide a capacitive coupling between the first conductor and the second conductor, and at least one first support member, configured to press the conductive coupling member towards the first conductor and/or the second conductor whereby the conductive coupling member is secured slidably against the first conductor and the second conductor.

[0009] This ensures reliable capacitive coupling while allowing for relative movement (slidably) of the conductors and the conductive coupling member. As a result, the problem of thermal expansion is overcome. Additionally, as capacitive coupling of the conductors can be implemented by exclusively utilizing the conductive coupling member and the dielectric material complex manufacturing techniques such as soldering or screwing of the conductors can be avoided.

[0010] In this document the term "and/or" shall be understood as covering both alternatives an "and" combination and an "either or" combination.

[0011] According to a first implementation of the first aspect, the at least one first support member can be or can comprise at least one resilient means.

[0012] The resilient means ensures quality of capacitive coupling, as it avoids air gaps between the conductive coupling member, the dielectric material and the conductors, which can negatively affect coupling quality. The resilient means specifically enables to secure the conductive coupling member against the conductors by still allowing for movement of such.

[0013] According to a second implementation of the first aspect or any implementation thereof, the conductor coupling apparatus can further comprise at least one second support member configured to support the first conductor and/or the second conductor, wherein the at least one second support member preferably can be or can comprise at least one resilient means, and can be configured to press the conductive coupling member towards the first conductor and/or the second conductor.

[0014] The at least one second support member provides mechanical stability to protect the first conductor and/or the second conductor and/or the conductive coupling member from being damaged, when mechanical forces are applied. As the at least one second support member preferably can be or can comprise at least one resilient means, the conductive coupling member can additionally be pressed towards the first conductor and/or the second conductor by the at least one second support member, which improves mechanical stability and quality of capacitive coupling, as air gaps between the conductors and/or the dielectric material and/or the conductive coupling member can be further reduced. The resilient means further enables to stronger secure the conductive coupling member against the conductors by still allowing for movement of such.

[0015] According to a third implementation of the first aspect or any implementation thereof, the at least one first support member and the at least one second support member can preferably be configured to slidably secure together, and more preferably clamp together, the conductive coupling member and the first conductor and/or the second conductor, and/or the at least one resilient means can be configured to be electrically isolated from the conductive coupling member.

[0016] The slidable security in particular allows for a relative movement of the conductive coupling member against the first conductor and/or the second conductor, e.g. by sliding the conductive coupling member along the first conductor and/or the second conductor. Consequently, movement resulting from an expansion or contraction of the conductive coupling member, the first conductor and/or the second conductor, e.g. due to a thermal influence, can be compensated and does no longer lead to damage of the coupling or to connection loss. The slidable security also ensures that complex manufacturing techniques such as soldering or screwing can be avoided. Specifically, mechanical fastening means, e.g. screws, can be omitted. Electrically isolating the at least one resilient means from the conductive coupling member allows to ensure low-PIM operation

[0017] According to a fourth implementation of the first aspect or any implementation thereof, the conductive coupling member can be configured to be arranged adjacent to the at least one first support member and/or the at least one second support member and in particular can be configured to be affixed to and/or to be embedded in the at least one first support member and/or the at least one second support member.

[0018] Thus, an improved and more versatile way of arranging and manufacturing the components of the conductor coupling apparatus is provided.

[0019] According to a fifth implementation of the first aspect or any implementation thereof, the at least one first support member and/or the at least one second support member can be configured to be arranged on a first ground plane and/or a second ground plane and preferably between the first ground plane and the second ground plane, and the at least one resilient means can be configured to press against the first ground plane and/or the second ground plane.

[0020] This provides a way of mechanically supporting the at least one resilient means or the at least one first support member and/or the at least one second support member by the first ground plane and/or the second ground plane, which leads to increased overall mechanical stability of the conductor coupling apparatus. Additionally, the overall conductor coupling apparatus profits from being shielded by the first ground plane and/or the second ground plane. As ground planes can already be part of common RF systems, an advantageous way of integrating the conductor coupling apparatus into common RF systems is provided.

[0021] According to a sixth implementation of the first aspect or any implementation thereof, in the conductive coupling member and the portion of the first conductor and/or in the portion of the second conductor covered by the conductive coupling member, no mechanical fastening means can be provided, and/or the conductive coupling member and the first conductor and/or the second conductor can be slidably secured together only by a clamping force, in particular applied by the at least one first support member and/or the at least one second support member.

[0022] This ensures that movement resulting from an expansion or contraction of the conductive coupling member, the first conductor and/or the second conductor, e.g. due to a thermal influence, can be compensated and does no longer lead to damage of the coupling or to connection loss. The slidable security also ensures that complex manufacturing techniques such as soldering or screwing can be avoided. Specifically, mechanical fastening means, e.g. screws, can be omitted.

[0023] According to a seventh implementation of the first aspect or any implementation thereof, the slidable security can be configured to allow for a relative movement of the conductive coupling member against the first conductor and/or the second conductor, the movement in particular being a result of an expansion or contraction of the conductive coupling member, the first conductor and/or the second conductor, preferably due to a thermal influence.

[0024] Consequently, movement resulting from an expansion or contraction of the conductive coupling member, the first conductor and/or the second conductor, e.g. due to a thermal influence, can be further compensated and does no longer lead to damage of the coupling or to connection loss.

[0025] According to an eighth implementation of the first aspect or any implementation thereof, the first conductor and/or the second conductor and/or the conductive coupling member can be formed on a respective PCB and/or MID, and/or the at least one first support member and/or the at least one second support member can be formed from a non-conductive, preferably plastic, material, and/or the first conductor and/or the second conductor can be part of a stripline and/or a microstrip transmission line, and in particular can be a metal strip, and/or the first conductor and the second conductor can be spatially separated from each other.

[0026] Forming the first conductor and/or the second conductor and/or the conductive coupling member on a respective PCB and/or MID allows to provide a PCB or MID based conductor coupling apparatus that in particular can couple fine conductors which can be part of a stripline or a microstrip transmission line. In order to enable capacitive coupling of the first conductor and the second conductor, it is in particular necessary that no conductive connection is established between the first conductor and the second conductor. This is ensured since the first conductor and the second conductor can be spatially separated from each other. As the at least one first support member and/or the at least one second support member can be formed from a non-conductive, preferably plastic, material, quality of capacitive coupling can be improved.

[0027] According to a ninth implementation of the first aspect or any implementation thereof, the conductor coupling apparatus can further comprise first spacer elements, wherein the at least one first support member and the at least one second support member can be configured to be aligned with each other by the first spacer elements and can be configured to accommodate, between the at least one first support member and the at least one second support member, the conductive coupling member, the first conductor and/or the second conductor, and the dielectric material.

[0028] The alignment prevents the at least one first support member and the at least one second support member from accidental, undesirable movement, e.g. due to external forces, which may lead to a breakup of capacitive coupling.

[0029] According to a tenth implementation of the first aspect or any implementation thereof, the first spacer elements can be configured to secure the at least one first support member and the at least one second support member against parallel movement of the at least one first support member to the at least one second support member.

[0030] This even stronger prevents the at least one first support member and the at least one second support member from accidental, undesirable movement.

[0031] According to an eleventh implementation of the first aspect or any implementation thereof, the first spacer elements can be integrally formed on at least the at least one first support member and/or the at least one second support member, and/or can be configured to engage with at least the at least one first support member and/or the at least one second support member by form closure and/or force closure, preferably by a snap-fit coupling.

[0032] Forming the first spacer elements integrally with the at least one first support member and/or the at least one second support member reduces manufacturing steps when assembling the conductor coupling apparatus. Engaging the first spacer elements by form closure and/or force closure in particular allows to press the conductive coupling member towards the first conductor and/or the second conductor by the at least one first support member and the at least one second support member, thereby forming capacitive coupling.

[0033] According to a twelfth implementation of the first aspect or any implementation thereof, the conductor coupling apparatus can further comprise second spacer elements, wherein the at least one first support member and/or the at least one second support member can be configured to be distanced from the first ground plane and/or the second ground plane by the second spacer elements, and/or wherein the second spacer elements can be integrally formed with the at least one first support member, the at least one second support member, and/or the first spacer elements, and/or wherein the first spacer elements and/or the second spacer elements can be of elastic or resilient material.

[0034] Distancing the at least one first support member and/or the at least one second support member from the ground planes by the second spacer elements allows for a uniform distribution of mechanical forces and increases overall stability of the conductor coupling apparatus while it additionally enables more versatile arrangement manners of the used components. The distancing also facilitates flow of air, e.g. for heat exchange. Forming the second spacer elements integrally with the at least one first support member and/or the at least one second support member reduces manufacturing steps when assembling the conductor coupling apparatus. Forming the first spacer elements and/or the second spacer elements of elastic or resilient material facilitates generating forces to press together the at least one first support member and/or the at least one second support member. The elastic or resilient material also facilitates the process of establishing force closure and/or form closure of the at least one first support member and the at least one second support member, e.g. by a crimp connection.

[0035] According to a thirteenth implementation of the first aspect or any implementation thereof, the at least one first support member and/or the at least one second support member can comprise cavities configured to at least partially hold the first spacer elements and/or the second spacer elements, wherein the cavities can preferably be blind holes or through holes.

[0036] The cavities ensure that alignment of the at least one first support member and the at least one second support member can be implemented effectively. They further facilitate establishing force closure and/or form closure of the at least one first support member and the at least one second support member.

[0037] According to a second aspect, the invention provides a clamping mechanism, preferably for a conductor coupling apparatus, comprising at least one first support member and at least one second support member, and first spacer elements, wherein the at least one first support member and the at least one second support member are configured to be aligned with each other by the first spacer elements and are configured to accommodate, between the at least one first support member and the at least one second support member, a conductive coupling member, a first conductor and/or a second conductor, and dielectric material, wherein the at least one first support member and the at least one second support member are further configured to press the conductive coupling member towards the first conductor and/or the second conductor whereby the conductive coupling member is secured slidably against the first conductor and/or the second conductor when accommodated between the at least one first support member and the at least one second support member.

[0038] According to a first implementation of the second aspect, the first spacer elements can be configured to secure the at least one first support member and the at least one second support member against parallel movement of the at least one first support member to the at least one second support member.

[0039] According to a second implementation of the second aspect or any implementation thereof, the first spacer elements can be integrally formed on at least the at least one first support member and/or the at least one second support member, and/or can be configured to engage with at least the at least one first support member and/or the at least one second support member by form closure and/or force closure, preferably by a snap-fit coupling.

[0040] According to a third implementation of the second aspect or any implementation thereof, the clamping mechanism can further comprise second spacer elements, wherein the at least one first support member and/or the at least one second support member can be configured to be distanced from a first ground plane and/or a second ground plane by the second spacer elements, and/or wherein the second spacer elements can be integrally formed with the at least one first support member, the at least one second support member, and/or the first spacer elements, and/or wherein the first spacer elements and or the second spacer elements can be of elastic or resilient material.

[0041] According to a fourth implementation of the second aspect or any implementation thereof, the at least one first support member and/or the at least one second support member can comprise cavities configured to at least partially hold the first spacer elements and/or the second spacer elements, wherein the cavities preferably can be blind holes or through holes.

[0042] The clamping mechanism of the second aspect and its implementation forms additionally can comprise all features, functionality and advantages of the conductor coupling apparatus according to the first aspect as such and its implementation forms.

[0043] According to a third aspect, the invention provides a RF system, comprising a conductor coupling apparatus according to the first aspect as such or according to any implementation form of the first aspect.

[0044] This ensures that conventional RF systems can be equipped with the conductor coupling apparatus.

[0045] The system of the third aspect and its implementation forms achieve the same advantages as the conductor coupling apparatus of the first aspect and its implementation forms.

[0046] According to a fourth aspect, the invention provides a RF system, comprising a conductor coupling apparatus according to the first aspect as such or according to any implementation form of the first aspect and/or a clamping mechanism according to the second aspect as such or according to any implementation form of the second aspect.

[0047] This ensures that conventional RF systems can be equipped with the conductor coupling apparatus and/or the clamping mechanism.

[0048] The system of the fourth aspect and its implementation forms achieve the same advantages as the conductor coupling apparatus of the first aspect and its implementation forms and/or the clamping mechanism of the second aspect and its implementation forms, respectively.

BRIEF DESCRIPTION OF DRAWINGS

[0049] The above-described aspects and implementation forms of the present invention will be explained in the following description of specific embodiments in relation to the enclosed drawings, in which

Fig. 1a shows a schematic overview of a conductor coupling apparatus according to an embodiment of the present invention;

Fig. 1b shows a schematic overview of a conductor coupling apparatus according to an embodiment of the present invention;

Fig. 2 shows a schematic overview of a conductor coupling apparatus according to an embodiment of the present invention in detail;

Fig. 3 shows a cross-section of a conductor coupling apparatus according to an embodiment of the present invention;

Fig. 4 shows an implementation example of a conductive coupling member arrangement according to the present invention;

Fig. 5 shows an implementation example of a conductive coupling member arrangement according to the present invention;

Fig. 6 shows an implementation example of a conductor coupling apparatus according to the present invention;

Fig. 7 shows a perspective view of the implementation example of a conductor coupling apparatus according to the present invention;

Fig. 8 shows an implementation example of a conductor coupling apparatus according to the present invention;

Fig. 9 shows an implementation example of a conductor coupling apparatus according to the present invention in detail;

Fig. 10 shows an implementation example of a conductive coupling member according to the present invention;

Fig. 11 shows an implementation example of a conductor coupling apparatus according to the present invention;

Fig. 12 shows a schematic overview of a RF system according to an embodiment of the present invention.

DETAILED DESCRIPION OF EMBODIMENTS

[0050] Fig. 1a shows a schematic overview of a conductor coupling apparatus 100a for coupling at least two conductors 101, 102 according to an embodiment of the present invention. The conductor coupling apparatus 100a comprises a first conductor 101 and a second conductor 102. The first conductor 101 and/or the second conductor 102 are of electrically conductive material, in particular a wire or a metal strip, which can be part of a microstrip or a stripline transmission line. To enable capacitive coupling between the first conductor 101 and/or the second conductor 102, a conductive coupling member 103, made of electrically conductive material, is provided, which covers a portion 101p of the first conductor 101 and/or a portion 102p of the second conductor 102.

[0051] The conductive coupling member 103 is separated from the first conductor 101 and/or the second conductor 102 by at least a dielectric material 104a. The dielectric material 104a can be regarded as an electrical insulator that prevents flow of electric charges. The dielectric material 104a is preferably solid, but can also be a viscous liquid. Example dielectric materials 104a include crystals, glass, porcelain, plastics, polymer and oil. Hence, the transfer of signals from one conductor 101 to another conductor 102 is achieved by interaction of a mutual electric capacity of the conductors 101, 102 with the coupling member 103. The dielectric material 104a can cover the portion 101p, 102p in which the conductive coupling member 103 overlaps one of the conductors 101, 102 completely, or at least partly. To improve quality of coupling and to avoid disadvantageous effects, an even disposition of the dielectric material 104a between each of the conductors 101, 102 and the conductive coupling member 103 is desired.

[0052] In order to enable capacitive coupling of the first conductor 101 and the second conductor 102, it is in particular necessary that no direct conductive connection is established between the first conductor 101 and the second conductor 102. Therefore, the first conductor 101 and the second conductor 102 are spatially separated from each other.

[0053] It is further beneficial for a coupling quality to ensure contact of the conductors 101, 102, the conductive coupling member 103 and the dielectric material 104a, and to minimize air gaps between the conductors 101, 102 and the dielectric material 104a, respectively the dielectric material 104a and the conductive coupling member 103. Therefore, the conductor coupling apparatus 100a includes at least one first support member 105a which can press the conductive coupling member 103 towards the first conductor 101 and/or the second conductor 102. To avoid disadvantageous effects, the at least one first support member 105a can be made of non-conductive material, e.g. plastics.

[0054] To press the conductive coupling member 103 towards the first conductor 101 and/or the second conductor 102, the at least one first support member 105a can apply a force F1 to the conductive coupling member 103, the first conductor 101 and/or the second conductor 102. When applying the force F1, the at least one first support member 105a additionally allows to provide mechanical support to the conductors 101, 102 and the conductive coupling member 103, in order to protect them from being damaged. The force F1 is applied to minimize the air gaps and to secure the conductive coupling member 103 against the first conductor 101 and/or the second conductor 102. Additionally, the force F1 allows for an equal and uniform distribution of the dielectric material 104a between the conductors 101, 102 and the conductive coupling member 103, which improves the coupling quality. Even so the preferably predefined force F1 is applied, the first conductor 101, the second conductor 102 and the conductive coupling member 103 can still move against each other, at least in as far as the movement is caused by thermal influence, e.g. by at least partially sliding against each other, while being separated by the dielectric material 104a. In particular the force F1 is defined so that friction force at least partially caused by application of the force F1 at the conductive coupling member 103, the first conductor 101 and/or the second conductor 102 can be overcome by an expansion/contraction force caused in or at the conductive coupling member 103, the first conductor 101 and/or the second conductor 102 by thermal influence. This in particular allows to slidably secure the conductive coupling member 103 against the first conductor 101 and/or the second conductor 102. This slidable security also means that there generally is no movement in case no expansion/contraction force is caused.

[0055] The first conductor 101 and the second conductor 102 are spatially separated from each other to prevent a conductive connection between the first conductor 101 and the second conductor 102 thermally induced during movement (i.e. due to thermal expansion/contraction) of the first conductor 101 and/or the second conductor 102.

[0056] To prevent the dielectric material 104a from being displaced during movement of the first conductor 101, the second conductor 102 and/or the conductive coupling member 103, the dielectric material 104 can be fixed to the first conductor 101 and/or the second conductor 102 and/or the conductive coupling member 103, e.g. by an adhesive.

[0057] To secure the conductive coupling member 103 against the first conductor 101 and/or the second conductor 102 properly and to improve quality of coupling, the force F1 is applied essentially perpendicular to a longitudinal extension of the first conductor 101 and/or the second conductor 102, and presses the conductive coupling member 103 towards the first conductor 101 and/or the second conductor 102. It should be noted that within this description especially the longitudinal thermal expansion/contraction of the first conductor 101, the second conductor 102, and/or coupling member 103 is addressed. Of course, the thermal expansion/contraction of the first conductor 101, the second conductor 102, and/or coupling member 103 into other directions can be also compensated by adjustment of the force F1 and/or forming of e.g. the first support member 105a. This ensures reliable capacitive coupling while allowing for movement of the conductors 101, 102 and the conductive coupling member 103.

[0058] Fig. 1b shows another schematic overview of a conductor coupling apparatus 100b according to an embodiment of the present invention. The conductor coupling apparatus 100b includes all features and functionalities of the conductor coupling apparatus 100a as described above. While in Fig. 1a one portion of dielectric material 104a and one first support member 105a are shown, Fig. 1b includes two portions of dielectric material 104a, 104b and two first support members 105a, 105b. To press the conductive coupling member 103 towards the first conductor 101 and/or the second conductor 102, a first force F1a can be applied to/by one first support member 105a while a second force F1b can be applied to/by one other first support member 105b. Of course, the first force F1a and the second force F1b can correspond to force F1. Hence, the first support member 105a presses the conductive coupling member 103 towards the first conductor 101, which is separated from the conductive coupling member 103 by the portion of dielectric material 104a. In turn, the other first support member 105b presses the conductive coupling member 103 towards the second conductor 102, which is separated from the conductive coupling member 103 by the other portion of dielectric material 104b.

[0059] Although not shown in Fig. 1a and Fig. 1b, it is also possible to couple the first conductor 101 and the second conductor 102 by utilizing one first support member 105a, which applies the force F1 to the conductive coupling member 103 that is separated from the conductors 101, 102 by a portion of dielectric material 104a, 104b each. It is also possible to couple the first conductor 101 and the second conductor 102 by utilizing two first support members 105a, 105b which apply the forces F1a and F1b to the conductive coupling member 103 that is separated from the conductors 101, 102 by only one portion of dielectric material 104a.

[0060] This approach allows for a more versatile arrangement of the first conductor 101, the second conductor 102, the conductive coupling member 103, the portions of dielectric material 104a, 104b and the at least one first support members 105a, 105b, e.g. in order to comply with design requirements of RF system components.

[0061] Fig. 2 shows a schematic overview of a conductor coupling apparatus 200 according to an embodiment of the present invention in more detail. In Fig. 2 a first conductor 201, a second conductor 202, a conductive coupling member 203, dielectric material 204a, 204b and at least one first support member 205 are shown. The conductor coupling apparatus 200, the first conductor 201, the second conductor 202, the conductive coupling member 203, the dielectric material 204a, 204b and the at least one first support member 205, as described in view of Fig. 2, essentially show the features and functionalities of the respective components described in view of Fig. 1a and Fig. 1b.

[0062] To improve quality of the capacitive coupling, the first conductor 201, the second conductor 202, the conductive coupling member 203, the dielectric material 204a, 204b and the at least one first support member 205, as well as other components of the conductor coupling apparatus 200 described with reference to Fig. 2 below, can be arranged in a sandwich configuration. That means, that the components can be stacked and can overlap each other, in order to distribute mechanical forces equally to all components of the conductor coupling apparatus 200 and in particular to the portions 201p, 202p in which the conductive coupling member 203 covers the first conductor 201 and the second conductor 202. It should be noted that the conductors 201, 202 still have to remain spatially separated to avoid conductive contact. The sandwich configuration allows for the dielectric material 204a, 204b being disposed equally between the conductive coupling member 203 and the first conductor 201 and/or the second conductor 202, which improves quality of capacitive coupling. Furthermore, mechanical stability of the conductor coupling apparatus 200 is improved, as all included components are exposed to mechanical forces equally.

[0063] To illustrate the sandwich configuration, the features of the conductor coupling apparatus 200 are also shown in a cross-sectional view of Fig. 2 in Fig. 3. The conductor coupling apparatus 200 as shown in Fig. 3 is the same conductor coupling apparatus 200 as shown in Fig. 2. Elements of the conductor coupling apparatus 200 which are not shown in Fig. 3, but are present in Fig.

2 can also be part of Fig. 3.

[0064] Turning back to Fig. 2, at least one first resilient means 206, which is an optional part of the conductor coupling apparatus 200, is shown. The at least one first support member 205 can be or can comprise the at least one first resilient means 206. The first resilient means 206 can be an elastic element, such as a spring or plastics, or a mechanic, an electric, a pneumatic or a hydraulic means which is adapted to apply a force F2 to the conductors 201, 202 and/or the conductive coupling member 203 and/or the dielectric material 204a, 204b, and/or the at least one first support member 205. According to the present invention, the first resilient means 206 can in particular be configured to apply the force F2 to the at least one first support member 205.

[0065] Although only one first resilient means 206 is shown in Fig. 2, there can be an arbitrary number of first resilient means 206 to precisely adjust the force F2 to a predefined amount. It is further possible to combine several kinds of first resilient means 206 as described above. In an implementation example in which the conductor coupling apparatus 200 includes more than one first support member 205, each of the first support members can be or can include at least one first resilient means. In another specific implementation example it is possible to integrally form the at least one first support member 205 with the at least one first resilient means 206.

[0066] The first resilient means 206 ensures quality of capacitive coupling, as it avoids air gaps between the conductive coupling member 203, the dielectric material 204a, 204b and the conductors 201, 202, which can negatively affect coupling quality. The first resilient means 206 specifically enables to secure the conductive coupling member 203 against the conductors 201, 202 by still allowing for movement of such.

[0067] In order to avoid disadvantageous effects for capacitive coupling, the at least one first resilient means 206, especially when formed of a conductive material, can be electrically isolated from the conductive coupling member 203. This can in particular be achieved by the at least one first support member 205, which can be formed from a non-conductive, e.g. plastic, material which at least partially can surround the first resilient means 206 (which e.g. can be a metal spring). In case that the at least one first support member 205 is the first resilient means 206, the at least one first support member 205 can provide portions of non-conductive material to implement isolation, or can be completely made of non-conductive material.

[0068] As shown in Fig. 2, the first conductor 201 and/or the second conductor 202 can be supported by at least one second support member 207, which is optional. The at least one second support member 207 can directly support the first conductor 201 and/or the second conductor 202, e.g. by directly resting against them, or indirectly by being spatially separated from the first conductor 201 and/or the second conductor 202 by other components. The at least one second support member 207 provides mechanical stability to the first conductor 201 and/or the second conductor 202 and/or the conductive coupling member 203, when mechanical forces are applied. The mechanical stability in particular is provided in an area where the at least one first support member 205 presses against the first conductor 201 and/or the second conductor 202 and/or the conductive coupling member 203 and against the second support member 207. In order to improve quality of coupling and to avoid disadvantageous effects, the at least one second support member 207 can be made of non-conductive material, e.g. plastics.

[0069] In an implementation example of the conductor coupling apparatus 200 that includes several first support members it is possible to provide several second support members, wherein each of the several second support members corresponds to one of the several first support members. This allows for providing additional mechanical support when several first support members are required in the conductor coupling apparatus 200.

[0070] The at least one second support member 207 preferably can be or can comprises at least one second resilient means 208, which is optional. The at least one second resilient means 208 can be of the same kind as the at least one first resilient means 206 as described above. The second resilient means 208 can be configured to press the conductive coupling member 203 towards the first conductor 201 and/or the second conductor 202. This in particular is enabled by applying a second force F2-2 to the conductive coupling member 203 and the first conductor 201 and/or the second conductor 202. The second force F2-2 preferably acts essentially perpendicular to the longitudinal extension of the first conductor 201 and/or the second conductor 202. Thus, the conductive coupling member 203 can additionally be pressed towards the first conductor 201 and/or the second conductor 202 by the second force F2-2, which improves mechanical stability and quality of capacitive coupling, as air gaps between the conductors 201, 202 and/or the dielectric material 204a, 204b and/or the conductive coupling member 203 can be further reduced. The second resilient means 208 further enables to stronger secure the conductive coupling member 203 against the conductors 201, 202 by still allowing for some movement.

[0071] Although only one second resilient means 208 is shown in Fig. 2, there can be an arbitrary number of second resilient means 208 to precisely adjust the second force F2-2 to a predefined amount. It is further possible to combine several kinds of second resilient means 208 as described above. In an implementation example in which the conductor coupling apparatus 200 includes more than one second support member 207, each of the second support members 207 can be or can include at least one second resilient means 208. In another specific implementation example it is possible to integrally form the second support member 207 with the at least one second resilient means 208.

[0072] In order to avoid disadvantageous effects for capacitive coupling, the at least one second resilient means 208, especially when formed of a conductive material, can be electrically isolated from the conductive coupling member 203. This can in particular be achieved by the at least one second support member 207, which can be formed from a non-conductive, e.g. plastic, material, which at least partially can surround the second resilient means 208 (which e.g. can be a metal spring). In case that the at least one second support member 207 is the second resilient means 208, the at least one second support member 207 can provide portions of non-conductive material to implement isolation, or can be completely made of non-conductive material.

[0073] In an implementation example of the conductor coupling apparatus 200, the first conductor 201 and/or the second conductor 202 and the conductive coupling member 203 can be slidably secured together by the at least one first support member 205 and/or the at least one second support member 207. This is achieved by the at least one first support member 205 and/or the at least one second support member 207 which apply the force F2 and/or the second force F2-2 to an arrangement of the first and/or the second conductor 201, 202, the conductive coupling member 203 and the dielectric material 204a, 204b in order to provide capacitive coupling. In a more specific implementation example, the at least one first support member 205 and the at least one second support member 207 can further be configured to clamp together the conductive coupling member 203 and the first conductor 201 and/or the second conductor 202. This can for example be facilitated by at least one clamping mechanism, which is optional. The clamping mechanism can e.g. be realized by snap-hooks, which are integrally formed with the at least one first support member 205 and/or the at least one second support member 207. The force F2 and the second force F2-2 can be created by means of the snap-hooks (which e.g. can include or can be the first and second resilient means 206, 208), or by further resilient means 206, 208, which can be comprised by the at least one first support member 205 and/or the at least one second support member 207. The snap-hooks are not shown in Fig. 2. A more detailed description of a conductor coupling apparatus including the clamping mechanism is going to be provided with reference to Fig. 8 below.

[0074] In Fig. 2 an exemplary arrangement of the conductive coupling member 203 and the at least one first support member 205 is shown, in which the conductive coupling member 203 is arranged adjacent to the at least one first support member 205. That is, the at least one first support member 205 can rest against the conductive coupling member 203 when the force F2 is applied to the conductive coupling member 203. In another possible implementation, the conductive coupling member 203 can be arranged adjacent to the at least one second support member 207. That is, the at least one second support member 207 can rest against the conductive coupling member 203 when the force F2 is applied to the conductive coupling member 203. Thus, a more versatile way of arranging the components of the conductor coupling apparatus 200 is provided.

[0075] The conductor coupling apparatus 200 additionally can comprise a first ground plane 209 and/or a second ground plane 210, which are optional. The ground planes 209, 210 can in particular be used to shield the first conductor 201 and/or the second conductor 202 and/or the conductive coupling member 203. Together with the two ground planes 209, 210, the conductors 201 and 202 can form a stripline transmission line. To this end, the at least one first support member 205 and/or the at least one second support member 207 can be arranged next to, or on one of the first ground plane 209 and/or the second ground plane 210, or can be arranged between the first ground plane 209 and the second ground plane 210. The at least one first support member 205 and/or the at least one second support member 207 can also be fixed to the ground planes 209, 210, e.g. by a mechanical fastening means or an adhesive. An arrangement of the first conductor 201, the second conductor 202, the conductive coupling member 203 and the dielectric material 204a, 204b can in turn be positioned next to, on or between the at least one first support member 205 and/or the at least one second support member 207. Hence, the overall conductor coupling apparatus 200 profits from being shielded by the first ground plane 209 and/or the second ground plane 210.

[0076] The conductive coupling member 203 can also be fixed to and/or embedded in the at least one first support member 205 and/or the at least one second support member 207, as it is now described in view of Fig. 4. Fig. 4 shows an implementation example of a conductive coupling member 403 according to the present invention. In Fig. 4 the conductive coupling member 403 and at least one first support member 405 are shown. The conductive coupling member 403 and at least one first support member 405 as they are going to be described in view of Fig. 4 essentially comprise the features and functionalities of the respective components described in view of Fig. 1, 2 and Fig. 3. The conductive coupling member 403 and the at least one first support member 405 additionally comprise the features and functionalities as described in the following. It is to be noted, that all features and functionalities which are described in view of the at least one first support member 405 can also be conferred to at least one second support member. The at least one first support member 405 therefore also includes all features and functionalities of the at least one second support member 207 as described in view of Fig. 2 and Fig. 3.

[0077] In Fig. 4 a recess or groove is shown cutting into the at least one first support member 405. The conductive coupling member 403 can be held, fixed and/or to embedded at least partially in the groove in the at least one first support member 405. The conductive coupling member 403 can be an electrically conductive (e.g. metal) piece, and the at least one first support member 405 can be made of non-conductive material, e.g. plastic. The conductive coupling member 403 can be held on or in the at least one first support member 405, e.g. by an adhesive. In another example implementation, the conductive coupling member 403 can be a conductor on a PCB or a molded interconnect device (MID). In this case, the at least one first support member 405 can be the PCB or the MID. Fig. 4 additionally shows four round cavities in the first support member 405 which can be used to implement the clamping mechanism.

[0078] In a specific implementation example, the same conductive coupling member 403 can be fixed to and/or embedded in multiple first support members 405.

[0079] Combining the conductive coupling member 403 and the at least one first support member 405 in this way ensures that mechanical stability of the conductive coupling member 403 is increased, as the conductive coupling member 403 is less likely to be deformed.

[0080] In Fig. 2, at least one of the first and/or the second resilient means 206, 208 can press against one of the ground planes 209, 210. This provides additional mechanical stability when the force F2 and/or the second force F2-2 is generated by the at least one first and/or the at least one second resilient means 206, 208 and is applied to the at least one first support member 205 and/or the at least one second support member 207.

[0081] In an example implementation, the at least one first support member 205 and the at least one second support member 207 can be arranged between the first ground plane 209 and the second ground plane 210. An arrangement of the first conductor 201, the second conductor 202, the conductive coupling member 203 and the dielectric material 204a, 204b can be positioned between the at least one first support member 205 and the at least one second support member 207. In this example, the at least one first resilient means 206 and/or the at least one second resilient means 208 can press against the first ground plane 209 and/or the second ground plane 210 in order to apply the force F2 and/or the second force F2-2 to the at least one first support member 205 and/or the at least one second support member 207.

[0082] Fig. 2 additionally shows a first non-conductive plate 211 and a second non-conductive plate 212. The first non-conductive plate 211 and the second non-conductive plate 212 can e.g. be a PCB or a MID each. Although the first non-conductive plate 211 and the second non-conductive plate 212 are referred to as plates, an arbitrary three-dimensional shape of the first non-conductive plate 211 and/or the second non-conductive plate 212 is possible, in particular when the first non-conductive plate 211 or the second non-conductive plate 212 are MIDs.

[0083] In order to provide a PCB or MID based conductor coupling apparatus 200, the conductors 201, 202 can be formed on the non-conductive plates 211, 212. Specifically, the first conductor 201 can be formed on the first non-conductive plate 211, and the second conductor 202 can be formed on the second non-conductive plate 212. The non-conductive plates 211, 212 are arranged spatially separated from each other in order to prevent conductive link of the conductors 201, 202 and to provide space for movement of the first conductor 201, which is formed on the first non-conductive plate 211 and the second conductor 202, which is formed on the second non-conductive plate 212 (e.g. as a result of expansion or contraction of the conductors 201, 202 and/or the non-conductive plates 211, 212 due to thermal influence).

[0084] To improve manufacturing of RF systems, further RF system components, such as antenna feeding networks or antenna elements can be arranged on the non-conductive plates 211, 212 and can be electrically connected by means of the conductors 201, 202. In an example implementation of an RF system comprising the conductor coupling apparatus 200 it is possible to arrange an antenna feeding network on the first non-conductive plate 211 and to arrange an antenna element (e.g. an antenna radiator) on the second non-conductive plate 212. As a result, manufacturing of the whole RF system is facilitated as the first non-conductive plate 211 and the second non-conductive plate 212 can be easily capacitively coupled.

[0085] In a specific implementation example, the conductor coupling apparatus 200 additionally can include a third conductor and a fourth conductor, which can be part of stripline and/or microstrip transmission line, and in particular which can be a metal strips, and a second conductive coupling member as well as second dielectric material. The third conductor and the fourth conductor include all features and functionalities of the first conductor 201 and the second conductor 202 as described in view of Fig. 2. The second conductive coupling member and the second dielectric material both include the features and functionalities of the conductive coupling member 203 and the dielectric material 204a, 204b as described in view of Fig. 2.

[0086] In this example, the first conductor 201 is arranged on one side of the first non-conductive plate 211 and the third conductor is arranged on an opposite side of the first non-conductive plate 211. In turn, the second conductor 202 is arranged on one side of the second non-conductive plate 212 and the fourth conductor is arranged on an opposite side of the second non-conductive plate 212. It is possible to establish capacitive coupling of the first conductor 201 and the second conductor 202 by means of the conductive coupling member 203 that is separated from the first conductor 201 and the second conductor 202 by the dielectric material 204a, 204b. The conductive coupling member 203 therefore is pressed towards the conductors 201, 202 by the force F2 and/or the second force F2-2. It is possible to simultaneously establish capacitive coupling of the third conductor and the fourth conductor by means of the second conductive coupling member that is separated from the third conductor and the fourth conductor by the second dielectric material. The second conductive coupling member therefore is pressed towards the third conductor and the fourth conductor by the force F2 and/or the second force F2-2. This arrangement can be received between the at least one first support member 205 and/or the at least one second support member 207, which can generate the force F2 and the second force F2-2, e.g. by means of the first and/or second resilient means 206, 208.

[0087] Generally, characteristics of capacitive coupling can be controlled by the dimensions and in particular the thickness of the dielectric material 204a, 204b and by the size of each portion 201p, 202p in which the conductive coupling member 203 covers each conductor 201, 202.

[0088] To provide capacitive coupling, in each portion 201p, 202p in which the conductive coupling member 203 covers the first conductor 201 or the second conductor 202, the thickness d of the dielectric material 204a, 204b, the permittivity ε_r of the dielectric material 204a, 204b, the dielectric constant ε_0 of the dielectric material 204a, 204b, and the surface of the portion 201p, 202p *A* should satisfy the following inequation:

$$\frac{d}{2\pi f \varepsilon_r \varepsilon_0 A} \leq 1$$

[0089] The conductor coupling apparatus 200 according to the present invention also works with values which do not satisfy the above-mentioned inequation, if suitable matching structures are supplied.

[0090] Typically, the area used for capacitive coupling (i.e. the surface of the portion 201p, 202p) is of rectangular shape, wherein the length of the rectangle is defined by the length of the longitudinal extension of the portion 201p, 202p and the width of the rectangle is defined by the width of the conductor 101, 102. The rectangle preferably can have dimensions of approximately 1.5 mm of width and 5 mm of length. If the dimensions of the area used for capacitive coupling are smaller than the preferably used dimensions, a transition can be tuned by using appropriate matching structures. A matching structure can be e.g. a thin transmission line (respective to a 50 Ohm line) which has inductive behavior.

[0091] In particular, it is beneficial if the longitudinal extension of each portion 201p, 202p is shorter the than a quarter of the wavelength of a working frequency *f* of signals that are capacitively coupled by the conductor coupling apparatus 200.

[0092] It is to be noted that in case that the longitudinal extension of the portion 201p, 202p exceeds a quarter of the wavelength of the working frequency *f*, the portion 201p, 202p behaves like a coupled line section, e.g. two transmission lines which are arranged in close proximity. This effect can be used to implement directional coupling and/or filter structures. As a result, frequency selective behavior of capacitive coupling can be realized which enables to implement filters, e.g. high-pass, band-pass or low-ass filters, in the conductor coupling apparatus 200. In a specific implementation example the conductive coupling member 203 can be used to integrate frequency selective structures such as stubs or matching circuits in the conductive coupling member 203.

[0093] In an implementation example in which a dielectric constant of electrically conductive material that is used to form the conductive coupling member 203 is different from a dielectric constant of electrically conductive material that is used to form the first conductor 201 and/or the second conductor 202, this results in a wave impedance of the conductive coupling member 203 being different from a wave impedance of the first conductor 201 and/or the second conductor 202. Impedance matching structures can be connected in series with the first conductor 201 and/or the second conductor 202 and with the electrically conductive material that is used to implement the conductive coupling member 203 to compensate this effect. Impedance matching structures can be thin lines which are thinner compared to the dimensions of the conductors 201, 202 and the conductive coupling member 203.

[0094] As described in the above, the conductor coupling apparatus 200 provides strong and reliable means to enable capacitive coupling of the first conductor 201 and the second conductor 202 by securing the conductive coupling member 203 slidably to the first conductor 201 and/or the second conductor 202. Subsequently, no other mechanical fastening means need to be provided in the conductive coupling member 203, in the portion 201p in which the conductive coupling member 203 covers the first conductor 201 or the portion 202p in which the conductive coupling member 203 covers the second conductor 202. Specifically, mechanical fastening means, e.g. screws that extend through the portions 201p, 202p and/or through the conductive coupling member 203, can be omitted. The conductor coupling apparatus 200 allows to slidably secure together the conductive coupling member 203 and the first conductor 201 and/or the second conductor 202 only by a clamping force CF. The clamping force CF can be applied by the force F2 and/or the second force F2-2. The clamping force CF can in particular be applied by the at least one first support member 205 and/or the at least one second support member 207, e.g. by means of the first and/or second resilient means 206, 208. The clamping force CF can in particular be applied by the clamping mechanism.

[0095] The slidable security, which slidably secures the conductive coupling member 203 to at least the first conductor 201 and/or the second conductor 202, in particular allows for a relative movement of the conductive coupling member 203 against the first conductor 201 and/or the second conductor 202, e.g. due to material deformations of thermal expansion and/or contraction caused by thermal influences on the components of the coupling apparatus 200, which allows the components to slide, grind or work against each other. Consequently, movement resulting from an expansion or contraction of the conductive coupling member 203, the first conductor

201 and/or the second conductor 202, e.g. due to a thermal influence, can be compensated and does no longer lead to damage of the coupling or to connection loss.

[0096] With reference to Fig. 2 and Fig. 3, the conductor coupling apparatus 200 is described with the first conductor 201 and the second conductor 202 being arranged in a coplanar manner. In Fig. 2 and Fig. 3 the first conductor 201 and the second conductor 202 are arranged in a same plane. In case that the first conductor 201 is arranged on a first non-conductive plate 211 and the second conductor 202 is arranged on a second non-conductive plate 212, also the first non-conductive plate 211 and the second non-conductive plate 212 can be arranged in a coplanar manner. However, the present invention is not limited to a coplanar arrangement manner of the first conductor 201 and the second conductor 202. The first conductor 201 and the second conductor 202 can also be arranged angled towards each other, as it is going to be described in view of an exemplary implementation shown in Figs. 5, 6 and 7.

[0097] Fig. 5 shows an implementation example of a conductive coupling member 503 according to the present invention. In Fig. 5 the conductive coupling member 503 and at least one first support member 505 are shown. The conductive coupling member 503 and the at least one first support member 505 as they are going to be described in view of Fig. 5 essentially comprise the features and functionalities of the respective components described in view of Figs. 1, 2, 3 and 4. The conductive coupling member 503 and the at least one first support member 505 additionally show the features and functionalities described in the following. All features and functionalities which are described in view of the at least one first support member 505 can also be conferred to at least one second support member. The at least one first support member 505 therefore also includes all features and functionalities of the at least one second support member 207 as described in view of Figs. 2 and 3 respectively the at least one second support member 407 as described in view of Fig. 4.

[0098] To simultaneously cover the portions of two conductors, which are arranged angled towards each other, the conductive coupling member 503 is of angled shape. In Fig. 5, the conductive coupling member 503 is formed from an electrically conductive angled metal strip. The conductive coupling member 503 as shown in Fig. 5 includes two portions which are arranged at an angle of basically 90 degrees relative to one another. The conductive coupling member 503 therefore can be regarded as having an L-shape. Although this example shows the two portions being arranged at an angle of basically 90 degrees, various other angles in the range of 0 to 360 degrees are possible.

[0099] In Fig. 5, the shape of the at least one first support member 505 is adapted to the shape of the conductive coupling member 503. An elongate opening can be present in the at least one first support member 505 to affix the conductive coupling member 503 to and/or to embed the conductive coupling member 503 in the opening of the at least one first support member 505.

[0100] Fig. 6 shows a schematic overview of a conductor coupling apparatus 600 according to an embodiment of the present invention. In Fig. 6 a first conductor 601, a second conductor 602, the conductive coupling member 503, the at least one first support member 505, at least one second support member 607, a first non-conductive plate 611, and a second non-conductive plate 612 are shown. The conductive coupling member 503 and the at least one first support member 505 are the conductive coupling member 503 and the at least one first support member 505 as described with reference to Fig. 5. The conductor coupling apparatus 600, the first conductor 601, the second conductor 602, the at least one second support member 607, the first non-conductive plate 611 and the second non-conductive plate 612 as they are going to be described in view of Fig. 6 essentially comprise the features and functionalities of the respective components described in view of Figs. 1, 2, 3, 4 and 5. The conductor coupling apparatus 600 additionally comprises the features and functionalities as described in the following.

[0101] The first conductor 601 is arranged on the first non-conductive plate 611, while the second conductor 602 is arranged on the second non-conductive plate 612. In Fig. 6 the first conductor 601 and the first non-conductive plate 611 are arranged at an angle of basically 90 degrees towards the second conductor 602 and the second non-conductive plate 612. Although this example shows the conductors 601, 602 and the non-conductive plates 611, 612 being arranged at an angle of basically 90 degrees, various other angles in the range of 0 to 360 degrees are possible. The conductor coupling apparatus 600 can also establish capacitive coupling of conductors 601, 602 that are arranged angled towards each other without the need for non-conductive plates 611,612.

[0102] In order to establish capacitive coupling, the conductive coupling member 503 is pressed against the first conductor 601 and the second conductor 602 by a force F6, which can comprise force components Fx and Fy, applied by at least the one first support member 505. Since the first conductor 601 and the second conductor 602 are arranged angled towards each other, conductive coupling is in particular enabled by the angled shape of the conductive coupling member 503 and the at least one first support member 505. In Fig. 6, this is illustrated by the arrow labelled with F6 that points towards the first conductor 601 and the second conductor 602 and indicates the general direction of the force F6. The force components Fx and Fy of the force F6 simultaneously act essentially perpendicular to a longitudinal extension of the first conductor 601 and the second conductor 602, and presses the conductive coupling member 503 towards the first conductor 601 and the second conductor 602.

[0103] The conductive coupling member 503 can also be pressed against the first conductor 601 and/or the second conductor 602 by a second force F6-2 which can be applied by the at least one second support member 607. In this case, the force F6 and the second force F6-2 can also be regarded as a clamping force CF according to the operating principle as described above. In Fig. 6, the dielectric material that is present between the conductors 601, 602 and the conductive coupling member 503 is not shown.

[0104] To provide additional support, the first conductor 601, the second conductor 602 and the conductive coupling member 503 are arranged between the at least one first support member 505 and the at least one second support member 607. The at least one second support member 607 can be adapted to the shape of the at least one first support member 505 to improve stability and mechanical support. In a specific implementation example, the at least one second support member 607 can be secured to the at least one first support member 505 by first spacer elements 613. In case that the first spacer elements 613 are used to secure the at least one first support member 505 to the at least one second support member 607, the first spacer elements 613 are not present in the areas in which the coupling member 503 overlaps the first conductor 601 or the second conductor 602. The first spacer elements 613 however can protrude the first non-conductive plate 611 and/or the second non-conductive plate 612 for proper alignment of the non-conductive plates 611, 612. In this case, the openings in the non-conductive plates 611, 612 through which the first spacer elements 613 protrude can be of a dimension that still allows for movement of the non-conductive plates 611, 612 (i.e. the dimensions of the openings in the non-conductive plates 611, 612 are larger than the dimensions of the first spacer elements 613). The first spacer elements 613 are going to be described in more detail with reference to Fig. 8 below.

[0105] It is to be noted that in Fig. 6 enough distance is provided between the support members 505, 607 and the conductors 601, 602 as well as the non-conductive plates 611, 612 in order to enable movement of the conductors 601, 602 and/or the non-conductive plates 611, 612, e.g. due to thermal influence.

[0106] Fig. 7 shows an isometric perspective view of the implementation example of the conductor coupling apparatus 600 according to the present invention. In Fig. 7 the at least one second support member 607 and the second non-conductive plate 612 are shown. In particular, it is illustrated how the at least one second support member 607 provides additional support by pressing on one side of the second non-conductive plate 612, while the at least one first support member 505 presses the coupling member 503 towards the second conductor 602 that is arranged on an opposite side of the second non-conductive plate 612. The at least one first support member 505, the coupling member 503 and the second conductor 602 are not shown in Fig. 7.

[0107] Fig. 8 shows an implementation example of a conductor coupling apparatus 800 according to the present invention. In Fig. 8 a first conductor 801, a second conductor 802, a conductive coupling member 803, dielectric material 804, at least one first support member 805, at least one second support member 807 and first spacer elements 813 are shown. The conductor coupling apparatus 800, the first conductor 801, the second conductor 802, the conductive coupling member 803, the dielectric material 804, the at least one first support member 805, the at least one second support member 807 and the first spacer elements 813 as they are going to be described in view of Fig. 8 essentially comprise the features and functionalities of the respective components described in view of Figs. 1 to 7. The conductor coupling apparatus 800 additionally comprises the features and functionalities as described in the following.

[0108] As it is shown in Fig. 8, the at least one first support member 805 and the at least one second support member 807 can be aligned with each other by the first spacer elements 813. The alignment prevents the at least one first support member 805 and the at least one second support member 807 from accidental, undesirable movement, e.g. due to external forces, which may lead to a breakup of capacitive coupling.

[0109] While being aligned by the first spacer elements 813, the distance of the at least one first support member 805 and the at least one second support member 807 is determined by the dimensions of the conductive coupling member 803, the first conductor 801 and/or the second conductor 802, and the dielectric material 804, which can be accommodated between the at least one first support member 805 and the at least one second support member 807.

[0110] In general the alignment can be facilitated by the first spacer elements 813 extending from a predefined position of the at least one first support member 805 and establishing contact with a predefined position of the at least one second support member 807, or vice versa.

[0111] More specifically, the first spacer elements 813 can be of essentially conical and/or cylindrical shape and can extend essentially perpendicular from a surface of the at least one first support member 805 and/or from a surface of the at least one second support member 807. In order to align the at least one first support member 805 and the at least one second support member 807 with each other, the first spacer elements 813 can protrude, at least partially, through cavities 815 in the at least one first support member 805 and/or the at least one second support member 807. Specifically, the cavities 815 can receive and/or hold the first spacer elements 813, at least partially. More specifically, the cavities 815 can be blind holes or through holes. The blind holes typically can receive the first spacer elements 813 at least partly, while the through holes can completely receive the first spacer elements 813, i.e. the first spacer elements 813 can extend into or through the through holes.

[0112] As a consequence, the first spacer elements 813 in particular allow for a way to secure the at least one first support member 805 and the at least one second support member 807 against parallel movement of the at least one first support member 805 to the at least one second support member 807. Parallel movement of the at least one first support member 805 and the at least one second support member 807 in particular is avoided by means of form closure, established by the first spacer elements 813 that protrude at least partially through the cavities 815. Movement of the at least one first support member 805 and the at least one second support member 807 along the longitudinal extension of the first spacer elements 813 however is still possible. This ensures that the at least one first support member 805 and the at least one second support member 807 cannot leave their predefined position, e.g. due to parallel movement. However, this solution still allows for varying the distance of the at least one first support member 805 and the at least one second support member 807 along the longitudinal extension of the first spacer elements 813. This enables to react to a variation of the thickness (e.g. due to thermal influence) of the conductive coupling member 803, the first conductor 801 and/or the second conductor 802, and the dielectric material 804, which are accommodated between the at least one first support member 805 and the at least one second support member 807.

[0113] In order to improve ease of assembling the conductor coupling apparatus 800, the first spacer elements 813 can be integrally formed on at least the at least one first support member 805 and/or the at least one second support member 807.

[0114] The first spacer elements 813 further can engage with at least the at least one first support member 805 and/or the at least one second support member 807 by form closure and/or force closure.

[0115] In a specific implementation example, the first spacer elements 813 that are formed on the at least one first support member 805 can engage with the at least one second support member 807 by a snap-fit coupling. The snap-fit coupling in particular secures the first spacer elements 813 to the at least one second support member 807, e.g. by snap-hooks. It is also possible to integrally form the first spacer elements 813 with the at least one second support member 807 and to secure the first spacer elements 813 to the at least one first support member 805 by means of the snap-fit coupling. It is to be noted that the snap-fit coupling and the snap hooks are not shown in Fig. 8 to facilitate ease of illustration.

[0116] In another specific implementation example, the first spacer elements 813 are formed on the at least one first support member 805. The first spacer elements 813 extend from the surface of the at least one first support member 805 essentially perpendicular and are of conical shape. The first spacer elements 813 can be pressed into through holes in the at least one second support member 807. Since a maximum diameter of the conical shaped first support members 813 is larger than a diameter of the through holes in the at least one second support member 807, a crimp connection can be established to engage the first spacer elements 813 with the at least one second support member 807. This is in particular facilitated by the support members 805, 807 and/or the first spacer elements 813 being of resilient and/or elastic material. More specifically, the crimp connection benefits from a restoring force that is applied by the resilient and/or elastic material.

[0117] Engaging the first spacer elements 813 by form closure and/or force closure according the example implementations as described above (i.e. by means of a snap-fit coupling and/or by means of a crimp connection) in particular allows to generate a clamping force CF (i.e. a combination of a force F8 generated by the at least one first support member 805 and a second force F8-2 generated by the at least one second support member 807). The clamping force CF enables to press the conductive coupling member 803 towards the first conductor 801 and/or the second conductor 802 by the at least one first support member 805 and the at least one second support member 807. Generating the clamping force CF is also facilitated by the support members 805, 807 and/or the first spacer elements 813 being of resilient and/or elastic material. More specifically, the clamping force CF benefits from a restoring force that is applied by the resilient and/or elastic material.

[0118] Fig. 8 additionally shows the conductive coupling member 803 which is arranged on a non-conductive plate. The non-conductive plate can be a PCB or a MID. The non-conductive plate comprises openings which match the positions of the cavities 815 and the first spacer elements 813 on the at least one first support member 805 and/or at least one second support member 807. As the first spacer elements 813 can protrude through the openings in the non-conductive plate while the non-conductive plate is accommodated between the at least one first support member 805 and the at least one second support member 807, a way is provided to align and/or secure the non-conductive plate (and subsequently the conductive coupling member 803). To cope with expansion or contraction of the non-conductive plate, e.g. due to thermal influence, the dimensions of the openings in the non-conductive plate are larger than the dimensions of the first spacer elements 813.

[0119] Fig. 8 additionally shows the dielectric material 804. The dielectric material 804 comprises openings which match the positions of the cavities 815 and the first spacer elements 813 on the at least on first support member 805 and/or at least one second support member 807. As the first spacer elements 813 can protrude through the openings in the dielectric material 804 while the dielectric material 804 is accommodated between the at least one first support member 805 and the at least one second support member 807, a way is provided to align and/or secure the dielectric material 804. To cope with expansion or contraction of the dielectric material 804, e.g. due to thermal influence, the dimensions of the openings in the dielectric material 804 are larger than the dimensions of the first spacer elements 813.

[0120] The conductor coupling apparatus 800 also can include optional second spacer elements 814, which are going to be described in more detail with reference to Fig. 9 below.

[0121] Although it is not shown in Fig. 8, the first conductor 801 and/or the second conductor 802 can also be arranged on non-conductive plates, e.g. PCBs or MIDs.

[0122] With reference to Fig. 8 an operating principle of the conductor coupling apparatus 800 was described that allows clamping together the at least one first support member 805 and the at least one second support member 807, specifically by form closure and/or force closure, more specifically by a snap-fit coupling and/or a crimp connection. The conductor coupling apparatus 800 may therefore also be regarded as a clamping mechanism.

[0123] Fig. 9 shows an implementation example of a conductor coupling apparatus 900 according to the present invention. In Fig. 9 a first conductor 901, a second conductor 902, a conductive coupling member 903, dielectric material 904, at least one first support member 905, at least one first resilient means 906, at least one second support member 907, at least one second resilient means 908, a first ground plane 909, a second ground plane 910, first spacer elements 913, second spacer elements 914 and cavities 915 are shown. The first conductor 901, the second conductor 902, the conductive coupling member 903, the dielectric material 904, the at least one first support member 905, the at least one first resilient means 906, the at least one second support member 907, the at least one second resilient means 908, the first ground plane 909, the second ground plane 910, the first spacer elements 913, the second spacer elements 914 and the cavities 915 as they are going to be described in view of Fig. 9 essentially comprise the features and functionalities of the respective components described in view of Figs. 1 to 8. The conductor coupling apparatus 900 additionally comprises the features and functionalities as described in the following.

[0124] As it is shown in Fig. 9, the at least one first support member 905 and/or the at least one second support member 907 can be distanced from the first ground plane 909 and/or the second ground plane 910 by the second spacer elements 914. Distancing the at least one first support member 905 and/or the at least one second support member 907 from the ground planes 909, 910 by the second spacer elements 914 allows for a uniform distribution of mechanical forces and increases overall stability of the conductor coupling apparatus 900, while it additionally enables more versatile arrangement manners of the used components. The distancing also facilitates flow of air, e.g. for heat exchange.

[0125] In general the distancing can be facilitated by the second spacer elements 914 extending from a predefined position of the at least one first support member 905 and/or the at least one second support member 907 and establishing contact with a predefined position on at least one of the ground planes 909, 910. In a specific implementation example in which the conductor coupling apparatus 900 is part of a RF system, the second spacer elements 914 can be used to distance the conductor coupling apparatus from any other RF system component that is part of the RF system.

[0126] More specifically, the second spacer elements 914 can be of essentially conical or cylindrical shape and can extend essentially perpendicular from a surface of the at least one first support member 905 and/or from a surface of the at least one second support member 907.

[0127] The second spacer elements 914 are not limited to be used as spacers. In another implementation example not separately shown but indicated in Fig. 9, the second spacer elements 914 can alignment and/or fixation of the at least one first support member 905 and/or the at least one second support member 907 with at least one of the ground planes 909, 910. This can in particular be achieved by the second spacer elements 914 extending through respective openings, which can be blind holes and/or through holes, in at least one of the ground planes 909, 910, as indicated by the dotted circles. This allows for the at least one first support member 905 and/or the at least one second support member 907 to be aligned with at least one of the ground planes 909, 910 and/or to be fastened to the ground planes 909, 910, e.g. by establishing form and/or force closure of the second spacer elements 914 with the at least one ground plane 909, 910. This in particular prevents the second spacer elements 914 and consequently the at least one first support member 905 and/or the at least one second support member 907 from essentially parallel movement towards at least one of the ground planes 909, 910.

[0128] In order to improve ease of assembling the conductor coupling apparatus 900, the second spacer elements 914 can be integrally formed with the least the at least one first support member 905 and/or the at least one second support member 907. In particular, the second spacer elements 914 can be integrally formed with the first spacer elements 913.

[0129] The second spacer elements 914 can be held by the cavities 915 in the at least one first support member 905 and/or the at least one second support member 907, e.g. in order to assemble the conductor coupling apparatus 900. In case that the cavities 915 are blind holes, the second spacer elements 914 can be held at least partially in the cavities 915. In case that the cavities 915 are through holes, the second spacer elements 914 can extend into or through the through holes.

[0130] In a specific implementation example, in which a first spacer element 913 extends through a through hole in the at least one first support member 905 and/or the at least one second support member 907, and in which the first spacer element 913 simultaneously protrudes at both ends of the through hole, one protrusion of the first spacer element 913 may be regarded as a first spacer element 913, wherein the other protrusion may be regarded as a second spacer element 914 that is integrally formed with the first spacer element 913.

[0131] It is to be noted that the at least one first and/or second resilient means 906, 908, as shown in Fig. 9, are optional. In an implementation example where no first and/or second resilient means 906, 908 are included in the conductor coupling apparatus 900, a force F9 and a second force F9-2 that press the at least one first support member 905 and/or the at least one second support member 907 towards the first conductor 901 and/or the second conductor 902 and the conductive coupling member 903, can be generated by the second spacer elements 914. This is enabled by the second spacer elements 914 being of elastic and/or resilient material. The elastic and/or resilient material in particular is able to generate a restoring force.

[0132] Specifically, the second spacer elements 914 that are held by, or integrally formed with the at least one first support member 905, generate the force F9, while the second support members 914 that are held by, or integrally formed with the at least one second support member 907, generate the second force F9-2.

[0133] In another implementation example in which the conductor coupling apparatus 900 includes the at least one first resilient means 906 and/or the at least one second resilient means 908, both the first and/or second resilient means 906, 908 and the second spacer elements 914 can be used to simultaneously generate the force F9 and/or the second force F9-2.

[0134] In particular, the at least one first resilient means 906 and the second spacer elements 914 that are held by, or integrally formed with the at least one first support member 905, generate the force F9, while the at least one second resilient means 908 and the second spacer elements 914 that are held by, or integrally formed with the at least one second support member 907, generate the second force F9-2.

[0135] Additionally, in case that the at least one first and/or second resilient means 906, 908 and the second spacer elements 914 are simultaneously present in the conductor coupling apparatus 900, the second spacer elements 914 can ensure that a minimum distance between the at least one first support member 905 and the first ground plane 909 and/or the at least one second support member 907 and the second ground plane 910 is kept. This ensures that the first and/or second resilient means 906, 908 are protected from damage, e.g. when external forces impact on the ground planes 909, 910 while the first and/or second resilient means 906, 908 are arranged between the support members 905, 907 and the ground planes 909, 910.

[0136] Although it is not shown in Fig. 9, the first conductor 901 and/or the second conductor 902 can also be arranged on non-conductive plates, e.g. a PCB or a MID.

[0137] Fig. 10 shows an implementation example of a conductive coupling member 1003 according to the present invention. In Fig. 10 the conductive coupling member 1003, at least one first support member 1005, first spacer elements 1013, second spacer elements 1014 and cavities 1015 are shown. The conductive coupling member 1003, the at least one first support member 1005, the first spacer elements 1013, the second spacer elements 1014 and the cavities 1015 as they are going to be described in view of Fig. 10 essentially comprise the features and functionalities of the respective components described in view of Figs. 1 to 9 and additionally comprise the features and functionalities as described in the following. It is to be noted, that all features and functionalities which are described in view of the at least one first support member 1005 can also be conferred to at least one second support member. The at least one first support member 1005 therefore also includes all features and functionalities of the at least one second support member 807, 907 as described in view of Figs. 8 and 9.

[0138] In Fig. 10, the conductive coupling member 1003 is integrally formed with the at least one first support member 1005. That is, the conductive coupling member 1003 and the at least one first support member 1005 are formed by an MID structure, wherein the conductive coupling member 1003 can e.g. be implemented by conductive ink that is applied to the at least one first support member 1005, wherein the at least one first support member 1005 is made of plastics.

[0139] MID technology also allows to form the first spacer elements 1013 and the second spacer elements 1014 integrally with the at least one first support member 1005. The cavities 1015 can be manufactured by MID technology, too.

[0140] The conductive coupling member 1003 that is integrally formed with the at least one first support member 1005 as described in view of Fig. 10 can specifically be applied in the conductor coupling apparatus 800 or the conductor coupling apparatus 900.

[0141] As a result, MID technology allows to reduce the number of components and the number of manufacturing steps that are necessary to assemble the conductor coupling apparatus 800 or the conductor coupling apparatus 900.

[0142] Fig. 11 shows another implementation example of a conductor coupling apparatus 1100 according to the present invention. In Fig. 11 a first conductor 1101, a second conductor 1102, a conductive coupling member 1103, portions of dielectric material 1104a, 1104b, first support members 1105a, 1105b, at least one first resilient means 1106a, 1106b, second support members 1107a, 1107b and at least one second resilient means 1108a, 1108b are shown. The conductor coupling apparatus 1100, the first conductor 1101, the second conductor 1102, the conductive coupling member 1103, the portions of dielectric material 1104a, 1104b, the first support members 1105a, 1105b, the at least one first resilient means 1106a, 1106b, the second support members 1107a, 1107b and the at least one second resilient means 1108a, 1108b as they are going to be described in view of Fig. 11 essentially comprise the features and functionalities of the respective components described in view of Figs. 1 to 10. The conductor coupling apparatus 1100 additionally comprises the features and functionalities as described in the following.

[0143] In Fig. 11, the first conductor 1101 and the second conductor 1102 are capacitively coupled by means of the conductive coupling member 1103. The conductive coupling member 1103 overlaps a portion 1101p of the first conductor 1101 and a portion 1102p of the second conductor 1102. The portion of dielectric material 1104a is arranged between the conductive coupling member 1103 and the portion 1101p of the first conductor 1101, while the portion of dielectric material 1104b is arranged between the conductive coupling member 1103 and the portion 1102p of the second conductor 1102.

[0144] To press together the conductive coupling member 1103 and the first conductor 1101 respectively the conductive coupling member 1103 and the second conductor 1102, two separate first support elements 1105a, 1105b and two separate second support elements 1107a, 1107b are used.

[0145] The first support members 1105a, 1105b, and the second support members 1107a, 1107b specifically can comprise the features as described with reference to Fig. 8 and Fig. 9, in particular the first spacer elements 913, the second spacer elements 914 and the cavities 915. However, in Fig. 11 this is not indicated by means of reference signs to facilitate ease of illustration.

[0146] In order to press together the conductive coupling member 1103 and the first conductor 1101, a force F11a is applied by the first support member 1105a, while a second force F11a-2 is applied by the second support member 1107a. The force F11a can be generated by the at least one first resilient means 1106a and/or by first spacer elements and/or second spacer elements of the first support member 1105a. The force F11a can also be generated by the first support member 1105a itself, which is e.g. made of resilient and/or elastic material. The force F11a-2 can be generated by the at least one second resilient means 1108a and/or by first spacer elements and/or second spacer elements of the second support member 1107a. The force F11a-2 can also be generated by the second support member 1107a itself, which is e.g. made of resilient and/or elastic material.

[0147] In order to press together the conductive coupling member 1103 and the second conductor 1102, a force F11b is applied by the other first support member 1105b, while a second force F11b-2 is applied by the other second support member 1107b. The force F11b can be generated by the other at least one first resilient means 1106b and/or by first spacer elements and/or second spacer elements of the other first support member 1105b. The force F11b can also be generated by the other first support member 1105b itself, which is e.g. made of resilient and/or elastic material. The force F11b-2 can be generated by the other at least one second resilient means 1108b and/or by first spacer elements and/or second spacer elements of the other second support member 1107b. The force F11b-2 can also be generated by the other second support member 1107b itself, which is e.g. made of resilient and/or elastic material.

[0148] An arbitrary combination of the forces F11a, F11a-2, F11b and F11b-2 can also be regarded as a clamping force CF. The combination of the forces F11a, F11a-2, F11b and F11b-2 can in particular be regarded as the clamping force CF in an implementation example, where no first and/or second resilient means 1106a, 1106b, 1108a, 1108b are included in the conductor coupling apparatus 1100.

[0149] As a result, the present invention additionally provides a way in which several first support members 1105a, 1105b and several second support members 1107a, 1107b can be used to establish capacitive coupling in order to provide more versatile arrangement manners of the involved components and to enable more versatile operational scenarios of the conductor coupling apparatus 1100. In Fig. 11 it is in particular shown that the first support member 1105a and the second support member 1107a can be used to exclusively couple the first conductor 1101 with the conductive coupling member 1103, while the other first support member 1105b and the other second support member 1107b can be used to exclusively couple the second conductor 1102 with the conductive coupling member 1103.

[0150] In Fig. 12, a schematic overview of a RF system 1200 comprising a conductor coupling apparatus 100 according to an embodiment of the present invention is shown. The conductor coupling apparatus 100 as shown in Fig. 12 is the conductor coupling apparatus 100 according to Fig. 1. However, the RF system 1200 can also comprise a conductor coupling apparatus as described in view of any one of Figs. 2 to 11. The RF system 1200 can be any kind of system that is operated with radio frequency. The RF system 1200 can for example be an antenna system, an antenna feeding network, an antenna element, an antenna radiator or a phase shifter. The RF system 1200 can be operated with radio frequency of any bandwidth, preferably within a frequency range from 250 MHz to 70 GHz, more preferably within a frequency range from 300 MHz to 30 GHz. The conductor coupling apparatus 100 is used in the RF system 1200 to couple RF system components of the RF system 1200. The RF system 1200 can also comprise a various amount of conductor coupling apparatuses 100 in order to couple various RF system components.

[0151] The dimensions of the first conductor and/or the second conductor and/or the conductive coupling member as used herein can be adjusted to withstand the forces applied, e.g. force F1 and can be made of thick metal.

[0152] The invention has been described in conjunction with various embodiments herein. However, other variations to the enclosed embodiments can be understood and effected by those skilled in the art and practicing the claimed invention, from a study of the drawings, the disclosure and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. A single processor or other unit may fulfill the functions of several items recited in the claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. A computer program may be stored/distributed on a suitable medium, such as an optical storage medium or a solid-state medium supplied together with or as part of other hardware, but may also be distributed in other forms, such as via the internet or other wired or wireless telecommunication systems.

Claims

1. Conductor coupling apparatus (100a, 100b), comprising:

   - a conductive coupling member (103) configured to cover a portion (101p) of a first conductor (101) and a portion (102p) of a second conductor (102), wherein the conductive coupling member (103) is further configured to be separated from the first conductor (101) and/or the second conductor (102) by dielectric material (104a, 104b) and wherein the conductive coupling member (103) is configured to provide a capacitive coupling between the first conductor (101) and the second conductor (102), and
   - at least one first support member (105a, 105b), configured to press the conductive coupling member (103) towards the first conductor (101) and/or the second conductor (102) whereby the conductive coupling member (103) is secured slidably against the first conductor (101) and the second conductor (102).

2. Conductor coupling apparatus (200) according to claim 1, wherein the at least one first support member (205) is or comprises at least one resilient means (206).

3. Conductor coupling apparatus (200) according to claim 1 or 2, further comprising at least one second support member (207) configured to support the first conductor (201) and/or the second conductor (202), wherein the at least one second support member (207) preferably is or comprises at least one resilient means (208), and is configured to press the conductive coupling member (203) towards the first conductor (201) and/or the second conductor (202).

4. Conductor coupling apparatus (200) according to claim 2 or 3, wherein the at least one first support member (205) and the at least one second support member (207) are preferably configured to slidably secure together, and more preferably clamp together, the conductive coupling member (203) and the first conductor (201) and/or the second conductor (202), and/or wherein the at least one resilient means (206; 208) is configured to be electrically isolated from the conductive coupling member (203).

5. Conductor coupling apparatus (200) according to any one of the preceding claims, wherein the conductive coupling member (203) is configured to be arranged adjacent to the at least one first support member (205) and/or the at least one second support member (207) and in particular is configured to be affixed to and/or to be embedded in the at least one first support member (205) and/or the at least one second support member (207).

6. Conductor coupling apparatus (200) according to any one of the preceding claims, wherein the at least one first support member (205) and/or the at least one second support member (207) is configured to be arranged on a first ground plane (209) and/or a second ground plane (210) and preferably between the first ground plane (209) and the second ground plane (210), and wherein the at least one resilient means (206; 208) is configured to press against the first ground plane (209) and/or the second ground plane (210).

7. Conductor coupling apparatus (200) according to any one of the preceding claims, wherein in the conductive coupling member (203) and the portion (101p) of the first conductor (201) and/or in the portion (102p) of the second conductor (202) covered by the conductive coupling member (203), no mechanical fastening means is provided, and/or wherein the conductive coupling member (203) and the first conductor (201) and/or the second conductor (202) are slidably secured together only by a clamping force (CF), in particular applied by the at least one first support member (205) and/or the at least one second support member (207).

8. Conductor coupling apparatus (200) according to any one of the preceding claims, wherein the slidable security is configured to allow for a relative movement of the conductive coupling member (203) against the first conductor (201) and/or the second conductor (202), the movement in particular being a result of an expansion or contraction of the conductive coupling member (203), the first conductor (201) and/or the second conductor (202), preferably due to a thermal influence.

9. Conductor coupling apparatus (200) according to any one of the preceding claims, wherein the first conductor (201) and/or the second conductor (202) and/or the conductive coupling member (203) are formed on a respective PCB (211; 212) and/or MID (211; 212), and/or wherein the at least one first support member (205) and/or the at least one second support member (207) is formed from a non-conducting, preferably plastic, material, and/or wherein

the first conductor (201) and/or the second conductor (202) is part of a stripline or a microstrip, and in particular is a metal strip, and/or wherein the first conductor (201) and the second conductor (202) are spatially separated from each other.

10. Conductor coupling apparatus (800) according to any one of the preceding claims, further comprising first spacer elements (813), wherein
the at least one first support member (805) and the at least one second support member (807) are configured to be aligned with each other by the first spacer elements (813) and are configured to accommodate, between the at least one first support member (805) and the at least one second support member (807), the conductive coupling member (803), the first conductor (801) and/or the second conductor (802), and the dielectric material (804).

11. Conductor coupling apparatus (800) according to claim 10, wherein
the first spacer elements (813) are configured to secure the at least one first support member (805) and the at least one second support member (807) against parallel movement of the at least one first support member (805) to the at least one second support member (807).

12. Conductor coupling apparatus (800) according to claim 10 or 11, wherein
the first spacer elements (813) are integrally formed on at least the at least one first support member (805) and/or the at least one second support member (807), and/or are configured to engage with at least the at least one first support member (805) and/or the at least one second support member (807) by form closure and/or force closure, preferably by a snap-fit coupling.

13. Conductor coupling apparatus (900) according to claim 10 to 12, further comprising second spacer elements (914), wherein the at least one first support member (905) and/or the at least one second support member (907) are configured to be distanced from the first ground plane (909) and/or the second ground plane (910) by the second spacer elements (914), and/or wherein
the second spacer elements (914) are integrally formed with the at least one first support member (905), the at least one second support member (907), and/or the first spacer elements (913), and/or wherein
the first spacer elements (913) and/or the second spacer elements (914) are of elastic or resilient material.

14. Conductor coupling apparatus (900) according to claim 10 to 13, wherein the at least one first support member (905) and/or the at least one second support member (907) comprise cavities (915) configured to at least partially hold the first spacer elements (913) and/or the second spacer elements (914), wherein the cavities (915) preferably are blind holes or through holes.

15. RF system, comprising a conductor coupling apparatus (100) according to any one of the claims 1 to 14.

Fig. 1a:

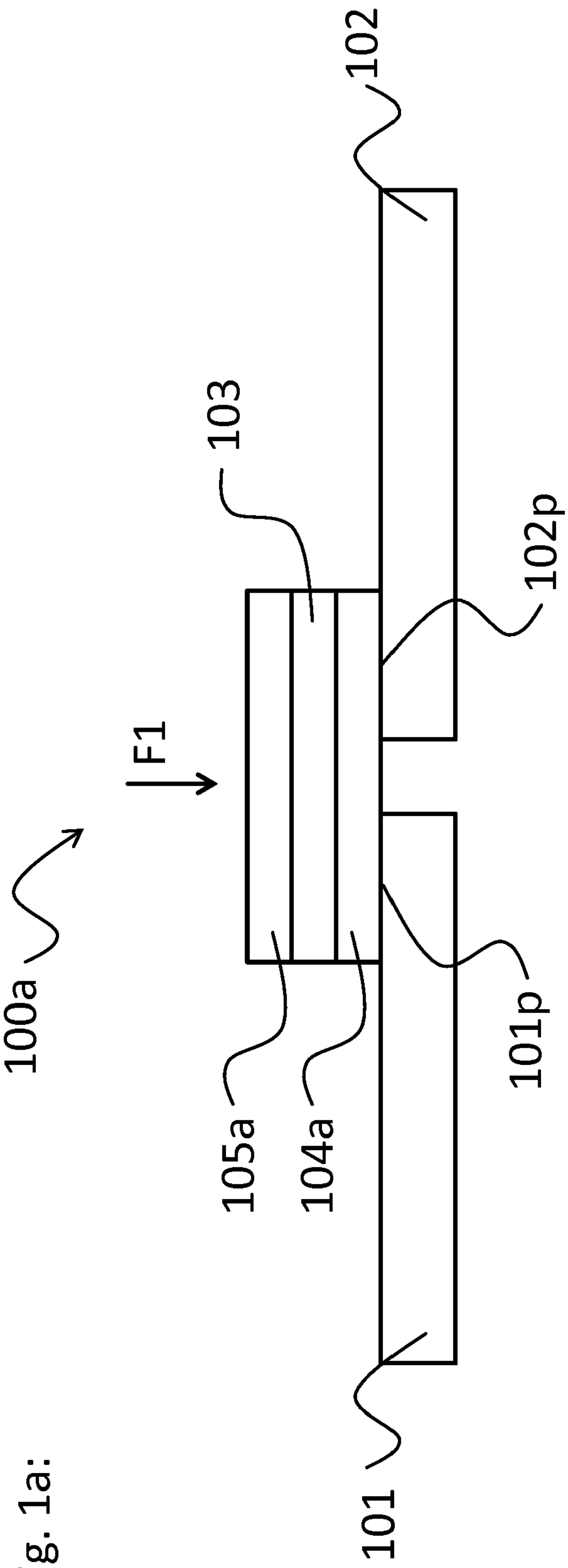
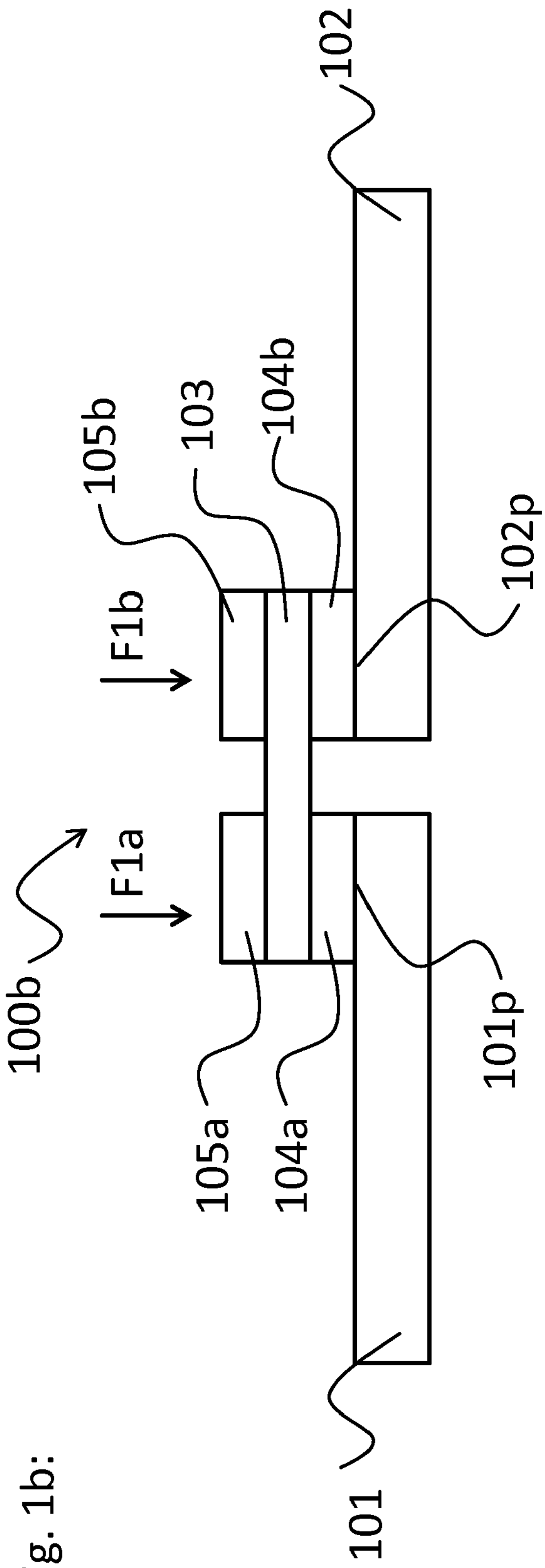

100a
F1
103
102
102p
101p
105a
104a
101

Fig. 1b:


100b
F1a
F1b
105b
103
104b
102
102p
101p
105a
104a
101

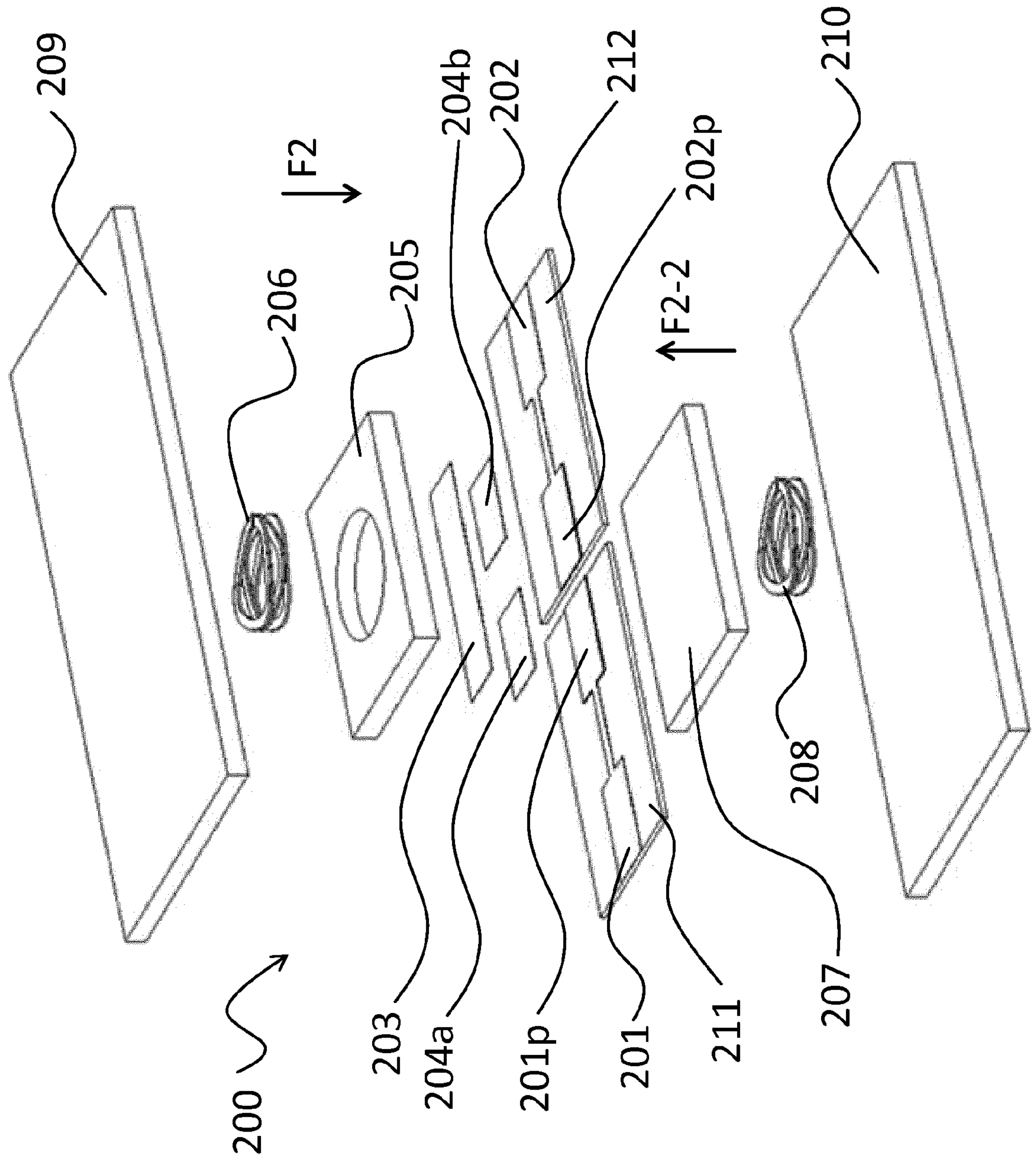

200
203
204a
201p
201
211
207
209
206
205
F2
204b
202
212
202p
F2-2
210
208

Fig. 2

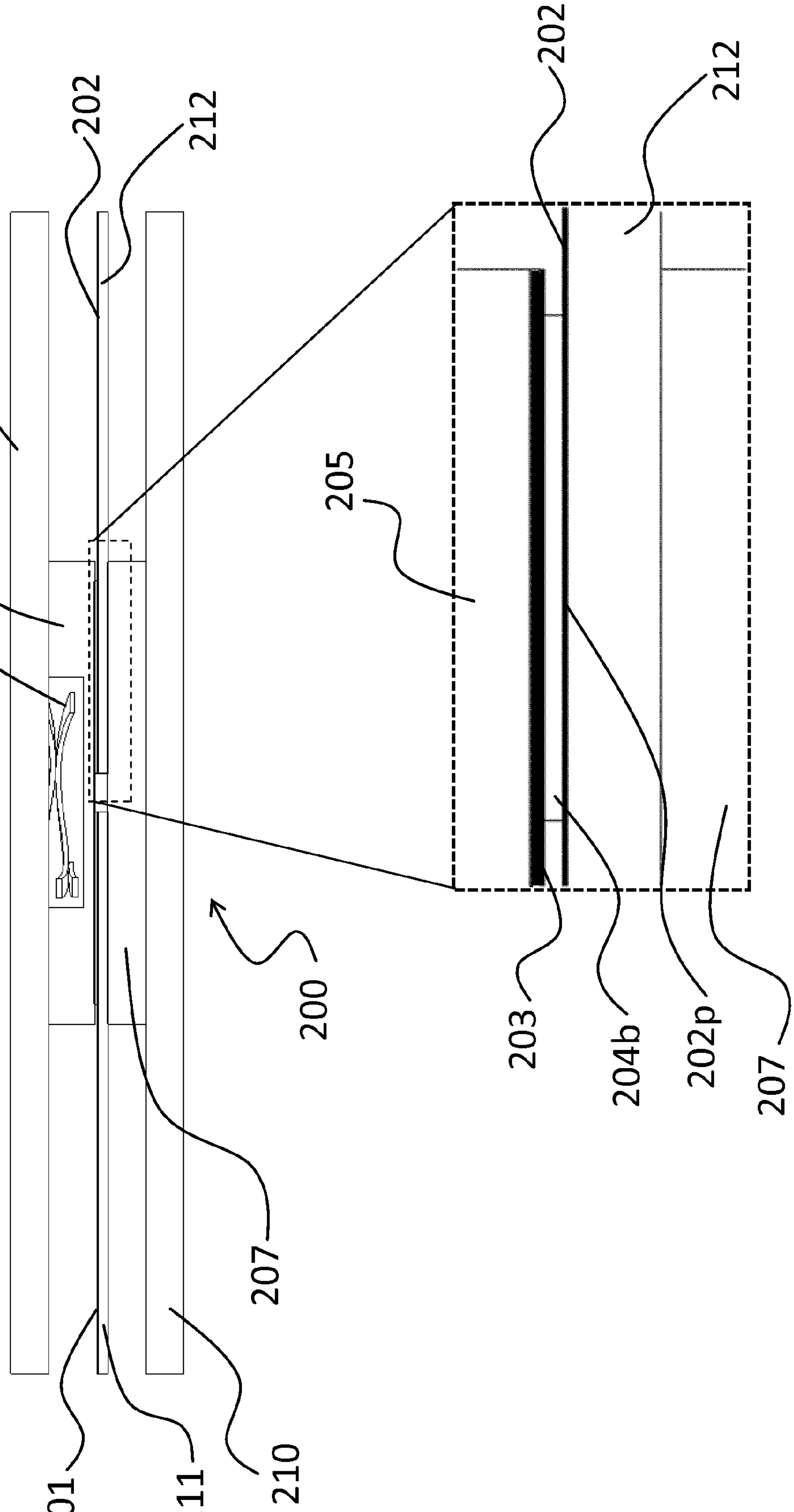

209
202
212
206
205
200
207
201
211
210
202
212
205
203
204b
202p
207

Fig. 3

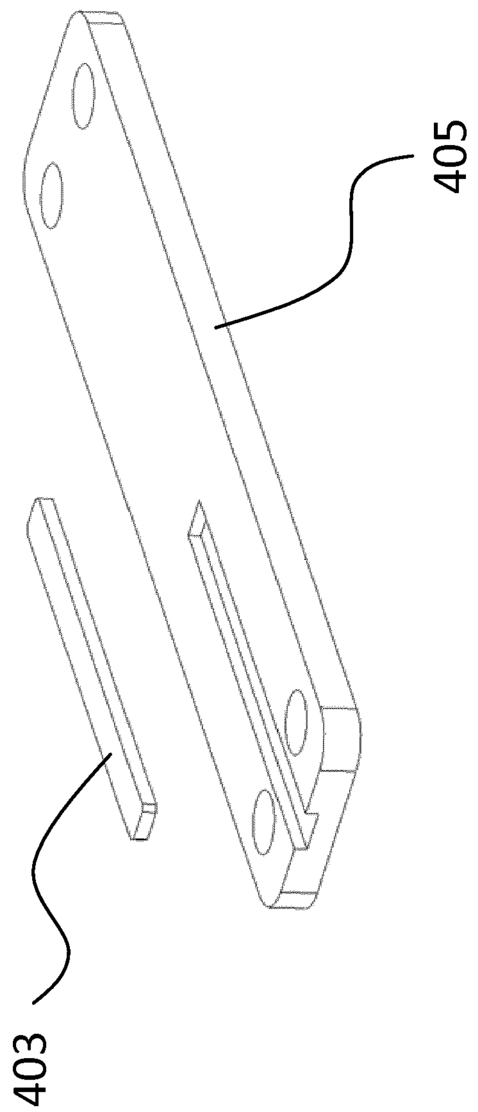


Fig. 4

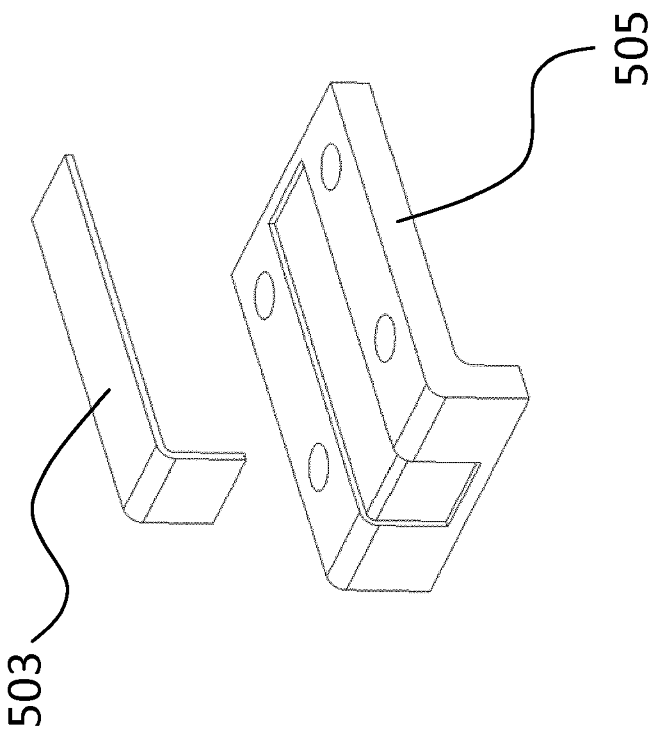


Fig. 5

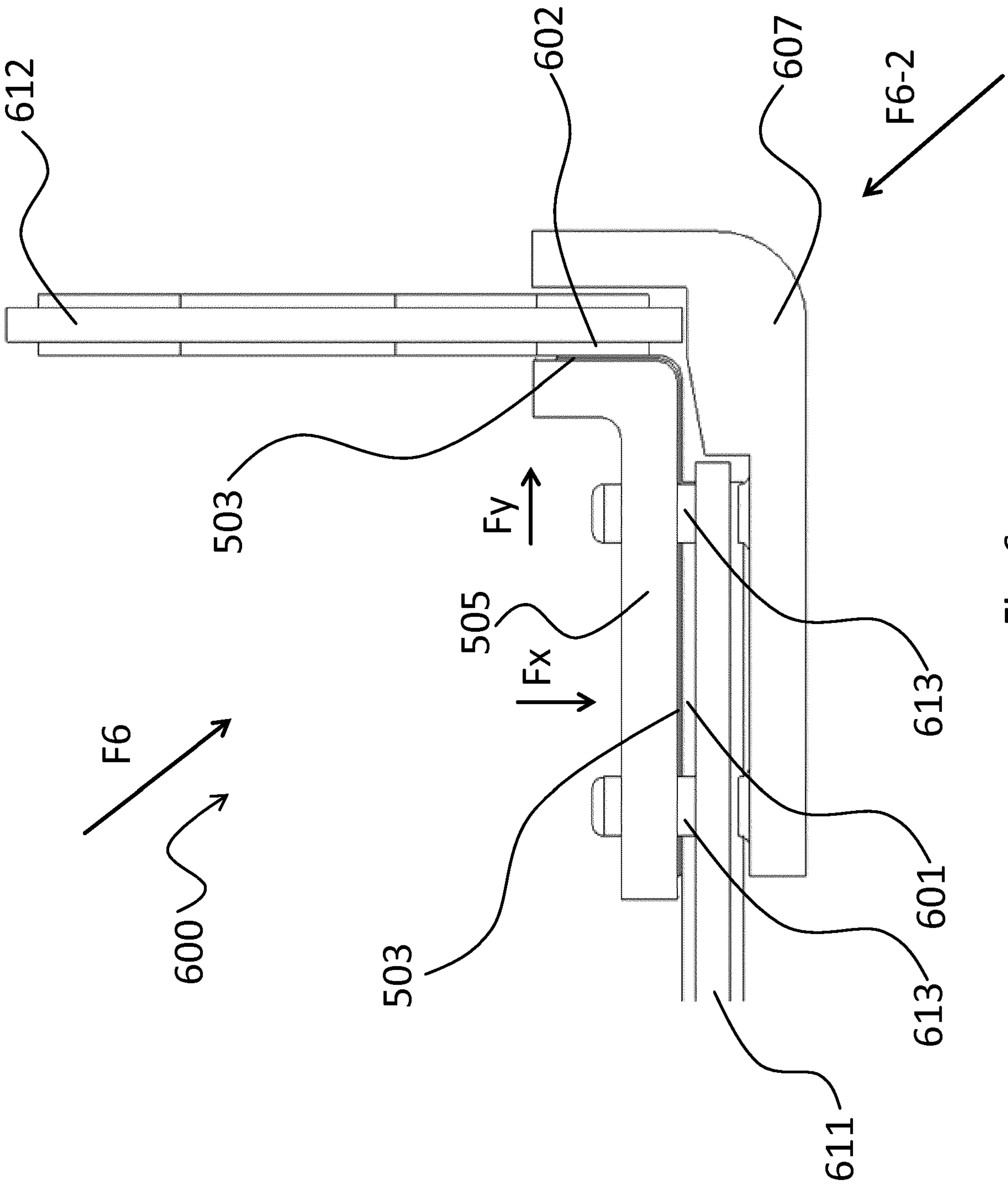


Fig. 6

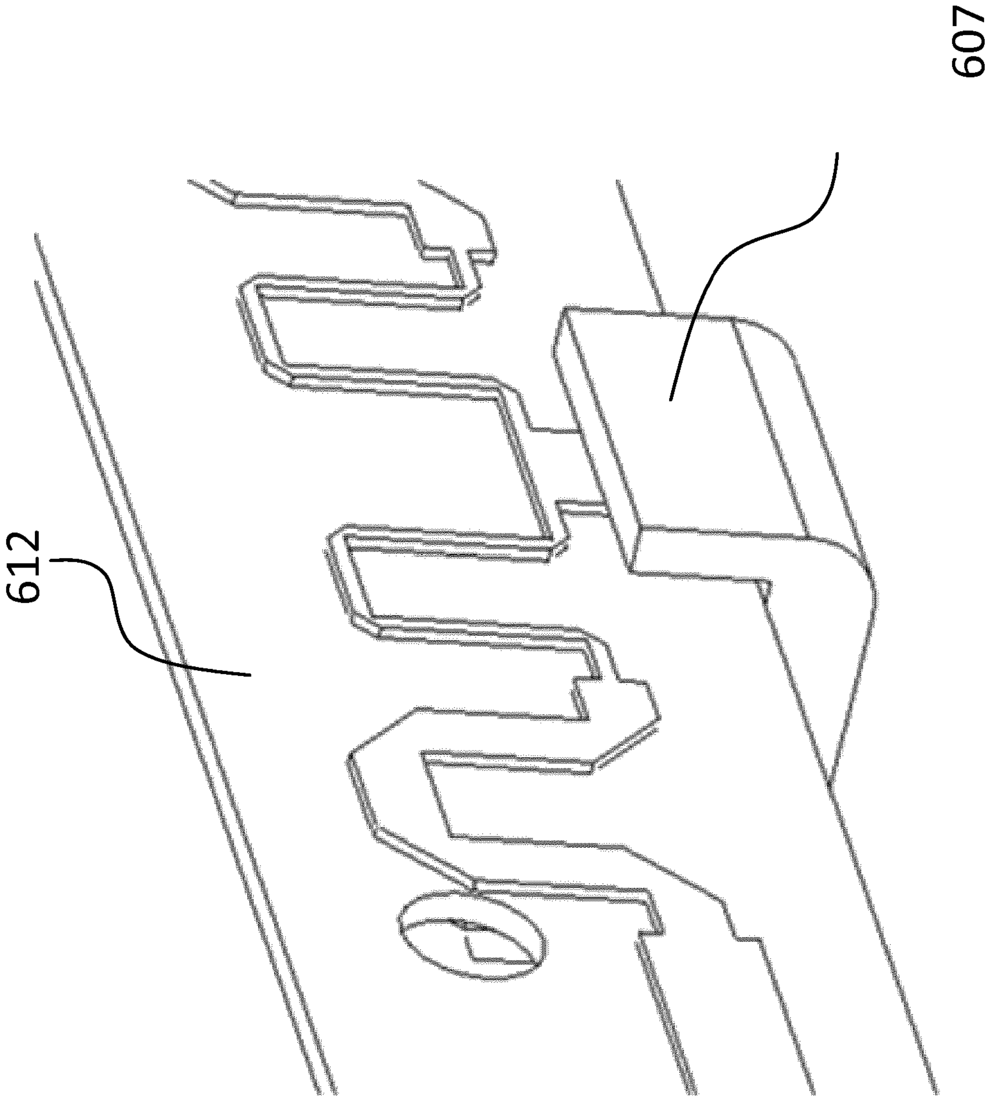


Fig. 7

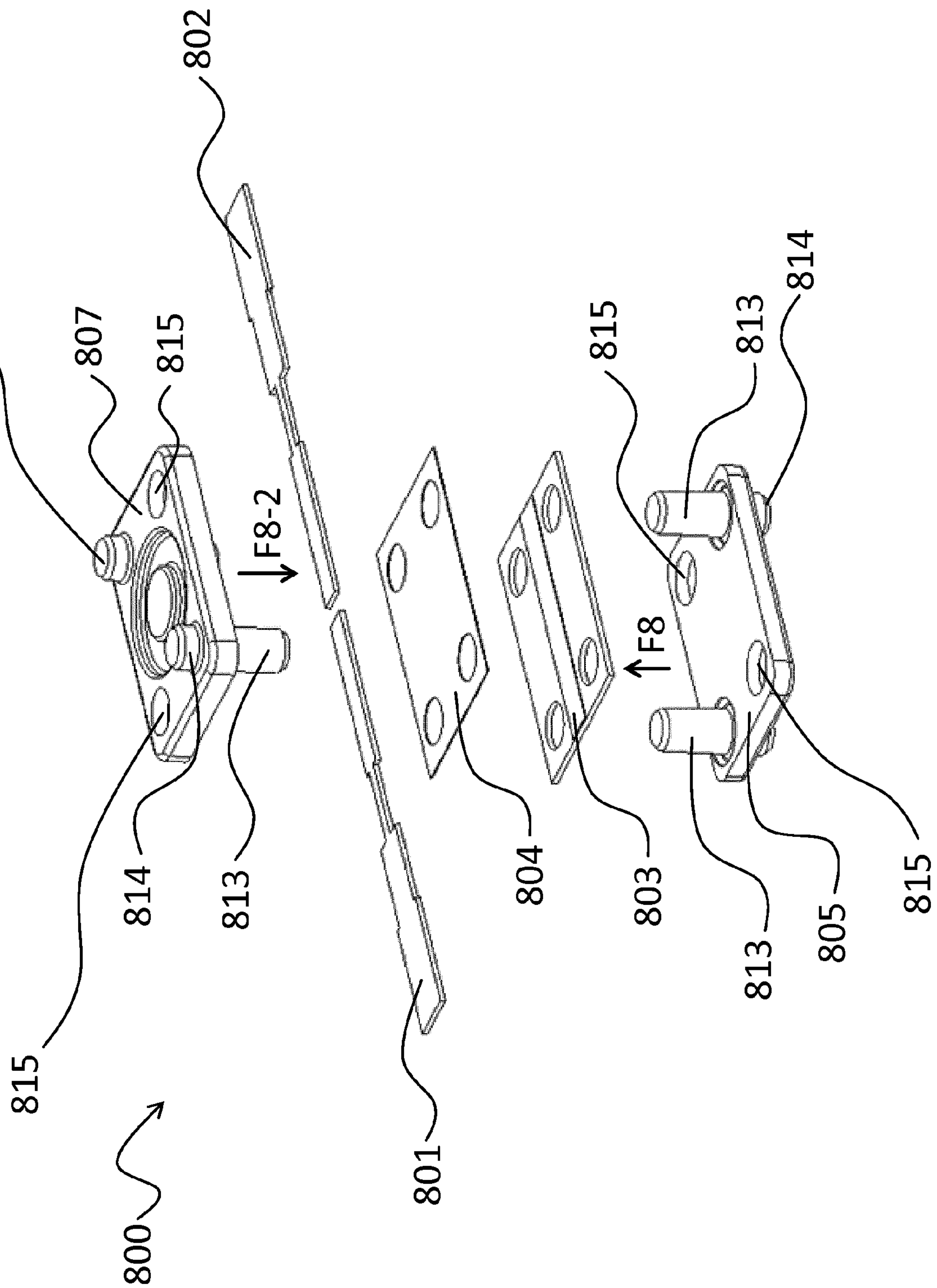

802
814
807
815
F8-2
815
813
814
F8
815
813
814
804
803
813
805
815
800
801

Fig. 8

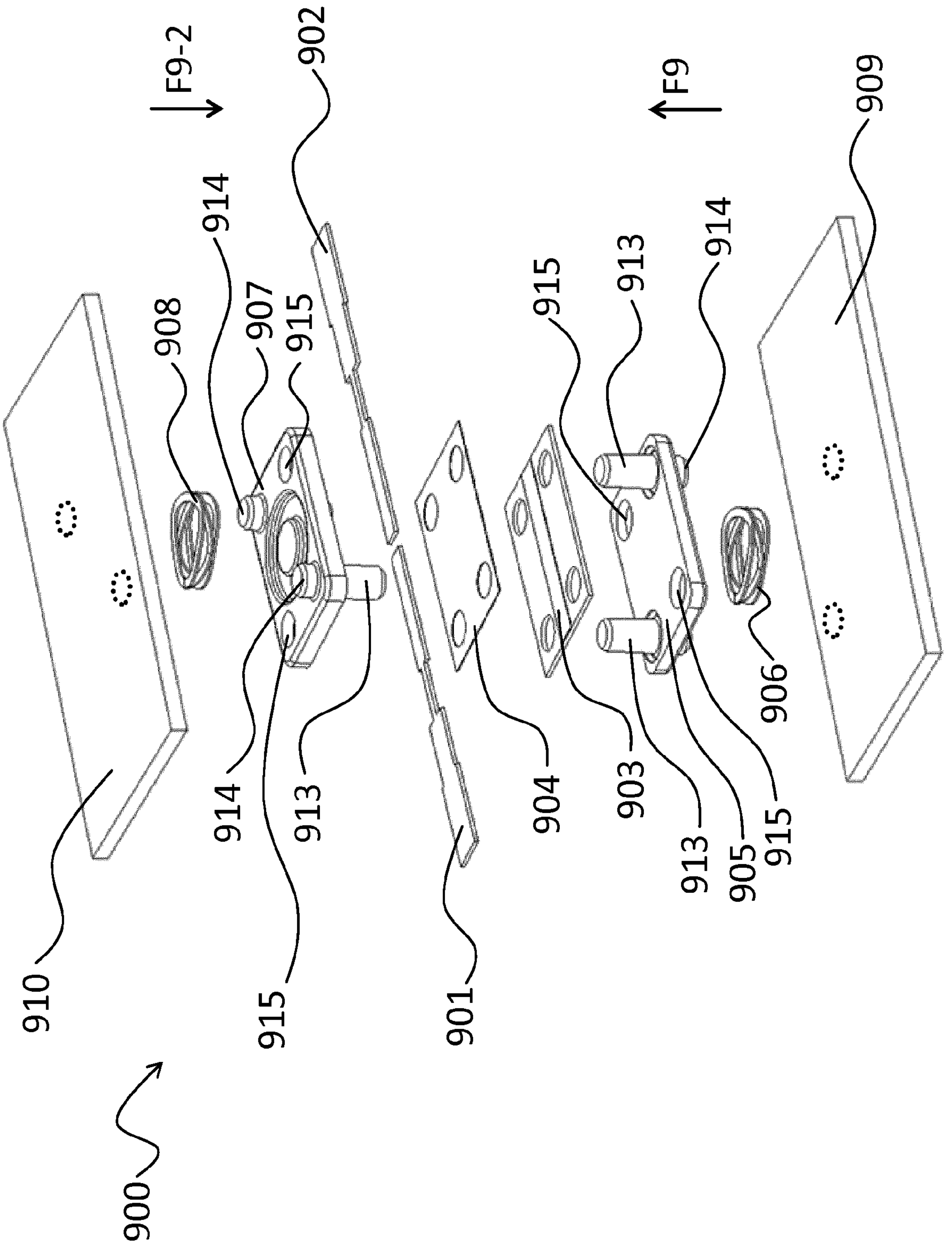


Fig. 9

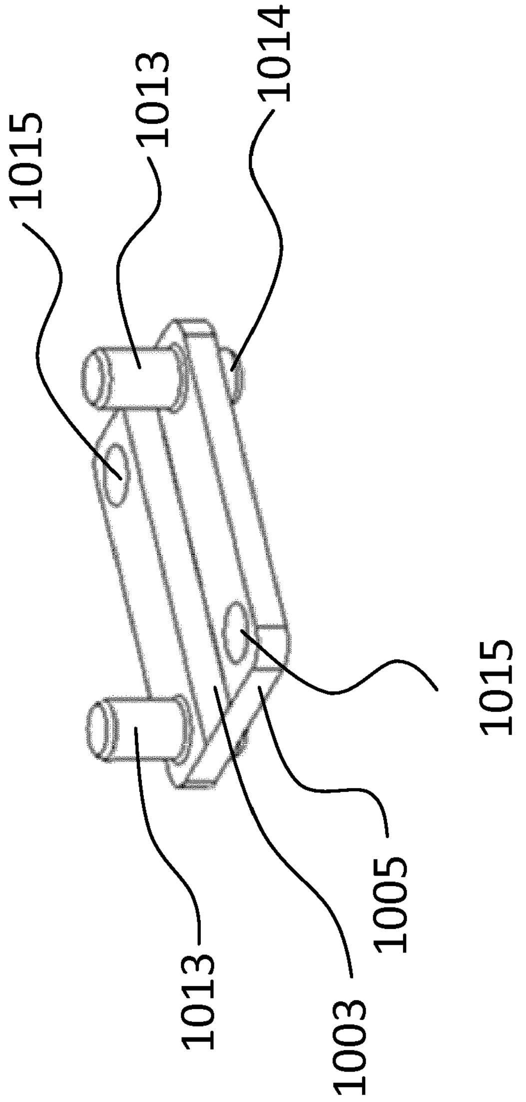
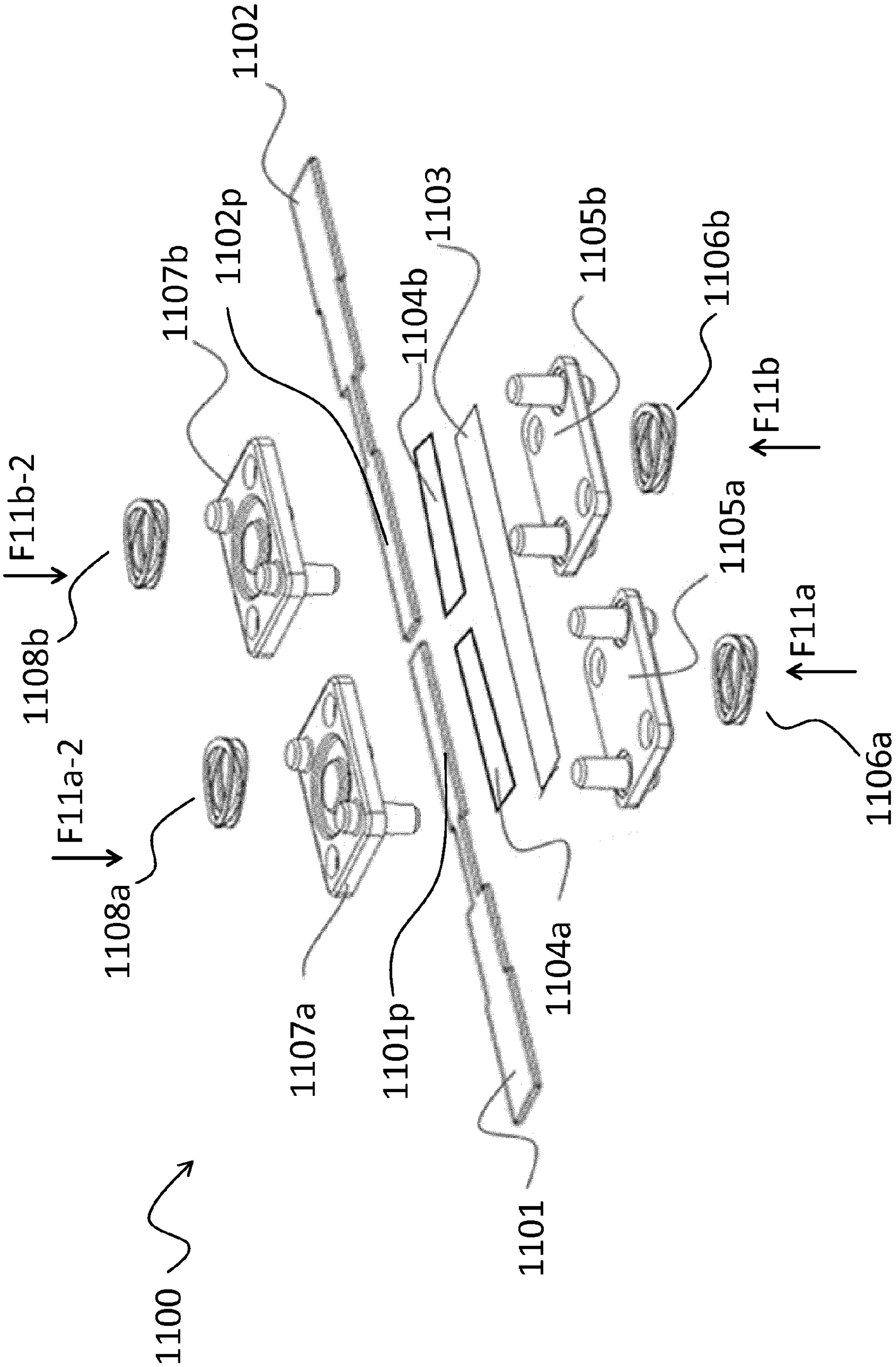


Fig. 10


1102
1102p
1107b
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1103
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1107a
1101p
1104a
1101
1100

Fig. 11

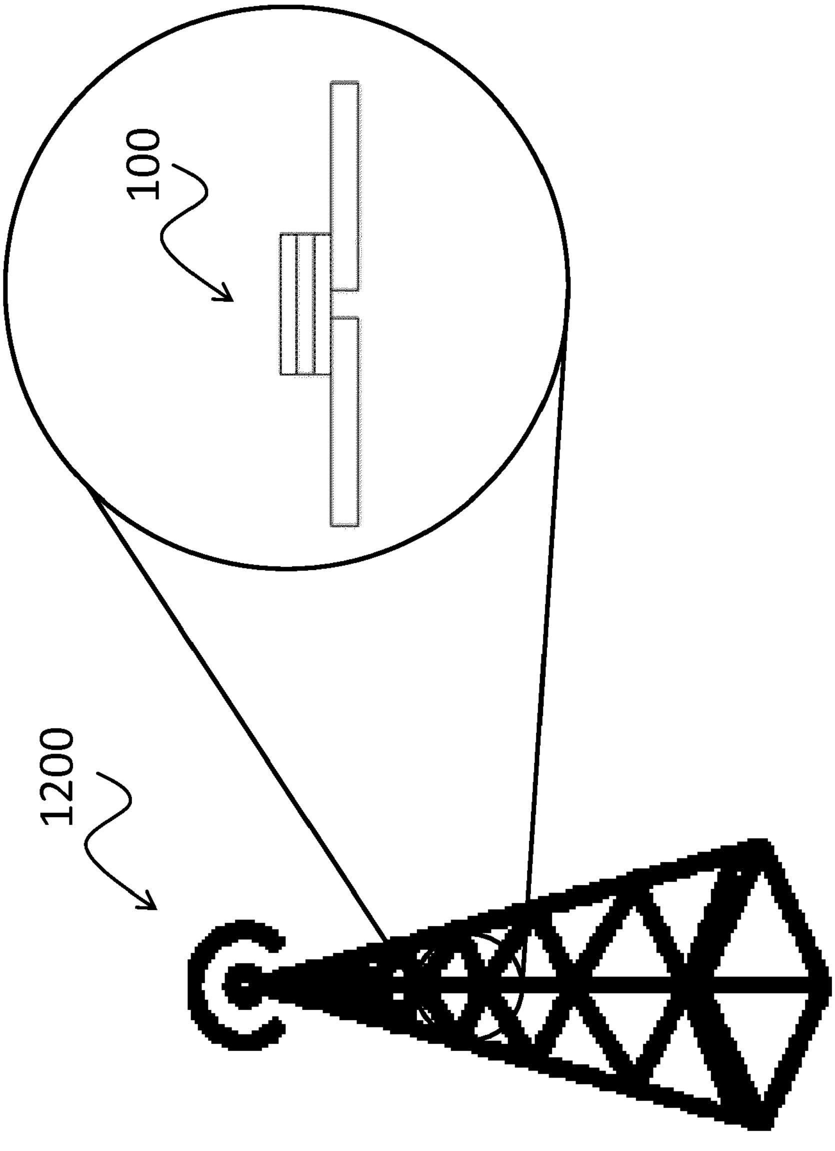

Fig. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 16 16 3690

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The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
The Hague	17 October 2016	Niemeijer, Reint

CATEGORY OF CITED DOCUMENTS

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