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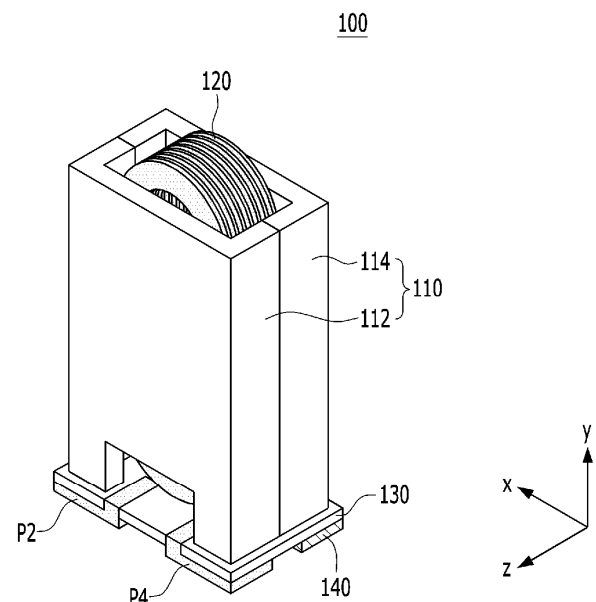
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(54) **MAGNETIC COMPONENT**

(57) A magnetic component according to an embodiment includes: a substrate including an upper surface and a lower surface, and a first side surface and a second side surface disposed between the upper surface and the lower surface and facing each other in a first horizontal direction; a core unit disposed on the upper surface of the substrate and including a first core and a second core spaced apart from each other in the first horizontal direction; and a coil unit disposed between the first core and the second core. The substrate includes a concave portion that is concave toward the second side surface from the first side surface.

【FIG. 1B】



Description

[Technical Field]

[0001] Embodiments relate to a magnetic component.

[Background Art]

[0002] In general, a magnetic component may include an inductor and a printed circuit board, and the inductor, as one of electronic components mounted on the printed circuit board, may be applied to a resonant circuit, a filter circuit, a power circuit, and the like due to electromagnetic characteristics thereof.

[0003] For example, if an inductor is disposed on a circuit board in a dual inline package (DIP) form, the volume of the magnetic component may increase. Therefore, research has been conducted to address this issue.

[Disclosure]

[Technical Problem]

[0004] Embodiments provide a compact magnetic component.

[Technical Solution]

[0005] A magnetic component according to an embodiment may include a substrate including an upper surface and a lower surface and including a first side surface and a second side surface disposed between the upper surface and the lower surface and facing each other in a first horizontal direction, a core unit disposed on the upper surface of the substrate, the core unit including a first core and a second core spaced apart from each other in the first horizontal direction, and a coil unit disposed between the first core and the second core. The substrate may include a concave portion recessed in the first side surface toward the second side surface.

[0006] In an example, the concave portion may include first and second concave portions spaced apart from each other in a second horizontal direction, and the second horizontal direction may be orthogonal to the first horizontal direction.

[0007] In an example, each of the first core and the second core may include first and second outer legs spaced apart from each other in the second horizontal direction and a center leg disposed between the first and second outer legs. Each of the first and second outer legs may have a greater length in a vertical direction than the center leg, and the first and second outer legs may be in contact with the upper surface of the substrate.

[0008] In an example, the coil unit may include one end portion and the other end portion. One end portion of the coil unit may include a first portion disposed in the first concave portion and a second portion bent and extending from the first portion toward a region below the lower

surface of the substrate in the second horizontal direction, and the other end portion of the coil unit may include a third portion disposed in the second concave portion and a fourth portion bent and extending from the third portion toward a region below the lower surface of the substrate in a direction opposite the second horizontal direction in which the second portion extends.

[0009] In an example, the substrate may include a third side surface disposed between the first side surface and the second side surface and a fourth side surface positioned opposite the third side surface in the second horizontal direction. The second portion may extend to the third side surface, and the fourth portion may extend to the fourth side surface.

[0010] In an example, the second portion and the first outer leg may overlap each other in the vertical direction with the substrate interposed therebetween, and the fourth portion and the second outer leg may overlap each other in the vertical direction with the substrate interposed therebetween.

[0011] In an example, each of the second and fourth portions may be disposed in a pad form on the lower surface of the substrate.

[0012] In an example, the magnetic component may further include a dummy member disposed on the lower surface of the substrate and spaced apart from each of the second and fourth portions.

[0013] In an example, a first thickness of the dummy member and a second thickness of each of the second and fourth portions may be equal to each other.

[0014] In an example, each of the first core and the second core may include a third concave portion recessed in the vertical direction. The third concave portion may be positioned between the first outer leg and the second outer leg. The third concave portion may overlap the coil unit in the first horizontal direction.

[0015] A magnetic component according to another embodiment may include a substrate, a core unit including an upper core and a lower core disposed to face the upper core in a first direction, and a coil unit at least partially accommodated between the upper core and the lower core. The substrate may include a first through-hole formed to allow one end portion of the coil unit to pass through the substrate and a second through-hole formed to allow the other end portion of the coil unit to pass through the substrate.

[0016] In an example, the substrate may include first and second side surfaces positioned opposite each other in the first direction, and both the first and second through-holes may be disposed on any one of the first and second side surfaces.

[0017] In an example, each of the upper core and the lower core may include first and second outer legs spaced apart from each other in a second direction intersecting the first direction and extending in a third direction intersecting each of the first and second directions and a center leg disposed between the first and second outer legs. Both surfaces of each of the first and

second outer legs may be positioned opposite each other in the third direction, and among both surfaces of each of the first and second outer legs, a surface adjacent to one end portion and the other end portion of the coil unit may be disposed in contact with a top surface of the substrate.

[0018] In an example, one end portion of the coil unit may include a first portion disposed in the first through-hole and a second portion bent and extending from the first portion toward a region below a bottom surface of the substrate in the second direction, and the other end portion of the coil unit may include a third portion disposed in the second through-hole and a second portion bent and extending from the third portion toward a region below the bottom surface of the substrate in a direction opposite the second direction.

[0019] In an example, the substrate may include a third side surface disposed between the first side surface and the second side surface and a fourth side surface positioned opposite the third side surface in the second direction. The second portion may extend to the third side surface, and the fourth portion may extend to the fourth side surface.

[0020] In an example, the second portion and the first outer leg may overlap each other in the third direction with the substrate interposed therebetween, and the fourth portion and the first outer leg may overlap each other in the third direction with the substrate interposed therebetween.

[0021] In an example, each of the second and fourth portions may be disposed in a pad form on the bottom surface of the substrate.

[0022] In an example, the magnetic component may further include a dummy member disposed on the bottom surface of the substrate and spaced apart from each of the second and fourth portions.

[0023] In an example, a first thickness of the dummy member and a second thickness of each of the second and fourth portions may be equal to each other.

[0024] In an example, a difference between the first thickness of the dummy member and the second thickness of each of the second and fourth portions may fall within a predetermined range.

[0025] In an example, the first thickness of the dummy member and the second thickness of each of the second and fourth portions may range from 0.8 mm to 1.2 mm.

[Advantageous Effects]

[0026] The magnetic component according to the embodiment may improve supportability of an inductor by a substrate, and may have a compact size through mounting of the inductor on the substrate in an SMD type to minimize loss of available space and enhance efficiency.

[Description of Drawings]

[0027]

FIG. 1A is a partially exploded perspective view of a magnetic component according to an embodiment. FIG. 1B is a coupled perspective view of the magnetic component shown in FIG. 1A.

FIG. 1C is a bottom view of the magnetic component shown in FIG. 1A.

FIG. 1D is a right-side view of the magnetic component shown in FIG. 1A.

FIG. 1E is a partial front view of the magnetic component shown in FIG. 1A.

FIG. 2A is an exploded perspective view of an embodiment of the inductor shown in FIGs. 1A to 1E.

FIG. 2B is an assembled perspective view of the inductor shown in FIG. 2A.

FIG. 3 is a bottom view of the substrate shown in FIGs. 1A to 1E.

[Best Mode]

[0028] The present disclosure will now be described more fully hereinafter with reference to the accompanying drawings, in which various embodiments are shown. The examples, however, may be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein. It is to be understood that the present disclosure covers all modifications, equivalents, and alternatives falling within the scope and spirit of the present disclosure.

[0029] While ordinal numbers including "second," "first," etc. may be used to describe various components, they are not intended to limit the components. These expressions are used only to distinguish one component from another component. For example, a second element could be termed a first element, and, similarly, a first element could be termed a second element, without departing from the scope of the present disclosure. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[0030] It will be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled to the other element, or intervening elements may be present. In contrast, when an element is referred to as being "directly connected" or "directly coupled" to another element, there are no intervening elements present.

[0031] In the description of the embodiments, it will be understood that when an element, such as a layer (film), a region, a pattern or a structure, is referred to as being "on" or "under" another element, such as a substrate, a layer (film), a region, a pad or a pattern, the term "on" or "under" means that the element is "directly" on or under another element or is "indirectly" formed such that an intervening element may also be present. It will also be understood that criteria of on or under is on the basis of the drawing. In addition, the thickness or size of a layer (film), a region, a pattern or a structure shown in the drawings may be exaggerated, omitted or schematically drawn for the clarity and convenience of explanation, and may not

accurately reflect the actual size.

[0032] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of exemplary embodiments of the disclosure. As used herein, the singular forms are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the term "include" or "have", when used herein, specifies the presence of stated features, integers, steps, operations, elements, components, or combinations thereof, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, or combinations thereof.

[0033] Unless otherwise defined, all terms used herein, which include technical or scientific terms, have the same meanings as those generally appreciated by those skilled in the art. The terms, such as ones defined in common dictionaries, should be interpreted as having the same meanings as terms in the context of pertinent technology, and should not be interpreted as having ideal or excessively formal meanings unless clearly defined in the specification.

[0034] Hereinafter, embodiments will be described in detail with reference to the accompanying drawings. The same or equivalent elements are denoted by the same reference numerals even when they are depicted in different drawings, and redundant descriptions thereof will be omitted.

[0035] In addition, some embodiments will be described using the Cartesian coordinate system (x-axis, y-axis, z-axis). In the Cartesian coordinate system, the x-axis, the y-axis, and the z-axis shown in each drawing are perpendicular to each other, but the embodiments are not limited thereto. The x-axis, the y-axis, and the z-axis may intersect each other obliquely.

[0036] Hereinafter, a magnetic component according to an embodiment will be described with reference to the accompanying drawings.

[0037] FIG. 1A is a partially exploded perspective view of a magnetic component 100 according to an embodiment, FIG. 1B is a coupled perspective view of the magnetic component 100 shown in FIG. 1A, FIG. 1C is a bottom view of the magnetic component 100 shown in FIG. 1A, FIG. 1D is a right-side view of the magnetic component 100 shown in FIG. 1A, and FIG. 1E is a partial front view of the magnetic component 100 shown in FIG. 1A.

[0038] The magnetic component 100 according to the embodiment may include an inductor (or a transformer) and a substrate 130. In addition, the magnetic component 100 may further include a dummy member 140 or may not include the dummy member 140.

[0039] Hereinafter, the magnetic component 100 according to the embodiment will be described with reference to a case in which the inductor is disposed on the substrate 130. However, the following description may also be applied to a case in which a transformer is

disposed on the substrate 130.

[0040] The inductor may include a core unit 110 and a coil unit 120.

[0041] FIG. 2A is an exploded perspective view of an embodiment of the inductor shown in FIGs. 1A to 1E, and FIG. 2B is an assembled perspective view of the inductor shown in FIG. 2A.

[0042] The inductor included in the magnetic component 100 according to the embodiment will be described with reference to FIGs. 2A and 2B. However, the embodiments are not limited to any specific form of the inductor included in the magnetic component 100.

[0043] The core unit 110 may have characteristics of a magnetic circuit and may serve as a path for magnetic flux. The core unit 110 may include a first core (hereinafter referred to as an "upper core") 112 and a second core (hereinafter referred to as a "lower core") 114.

[0044] The lower core 114 may be disposed to face the upper core 112 in a first direction (i.e., a z-axis direction) (or a first horizontal direction) and may be coupled to the upper core 112. The two cores 112 and 114 may be formed to be symmetrical or asymmetrical with each other in a vertical direction. However, for convenience of explanation, the following description is provided based on the assumption that the two cores are vertically symmetrical. That is, the lower core 114 and the upper core 112 are disposed to be spaced apart from each other in the first horizontal direction.

[0045] Each of the upper core 112 and the lower core 114 may include a body portion having a flat plate shape and a plurality of leg portions protruding from the body portion in the z-axis direction, which is the first direction, and extending in a third direction (e.g., a y-axis direction). The plurality of leg portions may include two outer legs OL1 and OL2 spaced apart from each other in one axis direction (e.g., an x-axis direction, which is a second direction) (or a second horizontal direction) and extending in another axis direction (e.g., the y-axis direction, which is the third direction) in a plan view and one center leg CL disposed between the two outer legs OL1 and OL2.

[0046] Each of the first and second outer legs OL1 and OL2 may have a greater length in the vertical direction than the center leg CL.

[0047] When the upper core 112 and the lower core 114 are coupled to each other in the vertical direction, the outer legs and the center leg of the upper core 112 face the outer legs and the center leg of the lower core 114, respectively. In this case, a gap of a predetermined distance (e.g., 10 μm to 200 μm , without being necessarily limited thereto) may be defined between at least one pair among the pairs of outer legs and the pair of center legs, which face each other. FIGs. 1A, 1B, 1D, 1E, and 2B illustrate a configuration in which the gap is 0. However, the embodiments are not limited to any specific size of the gap.

[0048] In addition, each of the upper core 112 and the lower core 114 may include a magnetic material, for

example, iron or ferrite. However, the disclosure is not necessarily limited thereto.

[0049] As described above, each of the upper core 112 and the lower core 114 may include the first and second outer legs OL1 and OL2 and the center leg CL. The first and second outer legs OL1 and OL2 may be disposed to be spaced apart from each other in the x-axis direction, which is the second direction intersecting the first direction, and the center leg CL may be disposed between the first and second outer legs OL1 and OL2.

[0050] Each of the upper core 112 and the lower core 114 includes a third concave portion (hereinafter referred to as a "recess") recessed in the vertical direction, and the third concave portion is positioned between the first outer leg OL1 and the second outer leg OL2. In addition, the third concave portion may overlap the coil unit 120 in the first horizontal direction.

[0051] For example, the drawings illustrate a configuration in which a recess H1 is formed in one side portion CS1 of the upper core 112, no recess is formed in the opposite side portion CS2 of the upper core 112, a recess H2 is formed in one side portion CS1 of the lower core 114, and no recess is formed in the opposite side portion CS2 of the lower core 114. However, the recesses H1 and H2 may also be formed in the opposite side portion CS2 or may be formed in neither the side portion CS1 nor the opposite side portion CS2.

[0052] The coil unit 120 may be at least partially accommodated between the upper core 112 and the lower core 114. As shown, the coil unit 120 may include a single coil. Unlike what is shown, the coil unit 120 may include a plurality of coils stacked in the z-axis direction, which is the first direction.

[0053] As described above, when the coil unit 120 includes a plurality of coils rather than only a single coil, an allowable current level may be increased, and this configuration may be advantageous in terms of current density of the coils.

[0054] The coil unit 120 may include a winding portion WP and both end portions E1 and E2. The winding portion WP is a portion wound to surround the center leg CL, and may be at least partially disposed between the upper core 112 and the lower core 114 of the core unit 110.

[0055] Both end portions E1 and E2 may protrude from the winding portion WP in the third direction and may correspond to a start point and an end point of the coil unit 120. In this case, the third direction is a direction intersecting each of the first direction and the second direction, and may be the y-axis direction. For example, as shown in FIGs. 2A and 2B, one end portion E1 and the other end portion E2 of both end portions may protrude in the same direction, which is a -y-axis direction, and may correspond to an end point and a start point of the coil unit 120. Alternatively, unlike what is shown, one end portion E1 and the other end portion E2 of both end portions may protrude in the same direction, which is a +y-axis direction.

[0056] The substrate 130 may be disposed under the inductor, and may be a printed circuit board (PCB) assembly (e.g., FR4).

[0057] FIG. 3 is a bottom view of the substrate 130 shown in FIGs. 1A to 1E.

[0058] Referring to FIGs. 1A and 3, the substrate 130 may include first to fourth side surfaces SS1 to SS4, an upper surface (hereinafter referred to as a "top surface") TS, and a lower surface (hereinafter referred to as a "bottom surface") BS.

[0059] The first side surface SS1 and the second side surface SS2 are disposed between the top surface TS and the bottom surface BS and face each other in the z-axis direction, which is the first direction. In this manner, the first side surface SS1 and the second side surface SS2 are positioned opposite each other in the first horizontal direction. The third side surface SS3 may be disposed between the first side surface SS1 and the second side surface SS2, and the fourth side surface SS4 may be positioned opposite the third side surface SS3 in the x-axis direction (or the second horizontal direction), which is the second direction intersecting the first direction. The top surface TS and the bottom surface BS may be positioned opposite each other in the y-axis direction, which is the third direction.

[0060] The core unit 110 may be disposed on the top surface TS of the substrate 130, and the first and second outer legs OL1 and OL2 may be disposed in contact with the top surface TS of the substrate 130.

[0061] The substrate 130 may include a concave portion (hereinafter referred to as a "through-hole") that is recessed in the first side surface SS1 toward the second side surface SS2. The through-hole may include first and second through-holes TH1 and TH2 spaced apart from each other in the second horizontal direction, which is the x-axis direction. The second horizontal direction is orthogonal to the first horizontal direction.

[0062] The first through-hole TH1 may be formed to allow one end portion E1 of the coil unit 120 to pass therethrough, and the second through-hole TH2 may be formed to allow the other end portion E2 of the coil unit 120 to pass therethrough.

[0063] According to the embodiment, the first through-hole TH1 and the second through-hole TH2 may be disposed on any one of the first to fourth side surfaces SS1 to SS4 of the substrate 130. For example, as shown, the first through-hole TH1 and the second through-hole TH2 may be disposed adjacent to each other on the first side surface SS1 of the substrate 130.

[0064] In the core unit 110 described above, both surfaces OS1 and OS2 of each of the first and second outer legs OL1 and OL2 may be positioned opposite each other in the y-axis direction, which is the third direction. Both end portions E1 and E2 of the coil unit 120 may be disposed adjacent to one of both surfaces OS1 and OS2. For example, both end portions E1 and E2 of the coil unit 120 may be disposed adjacent to a first surface OS1 (a cross-hatched portion in FIG. 2B), rather than a

second surface OS2, among both surfaces OS1 and OS2 of each of the first and second outer legs OL1 and OL2.

[0065] According to the embodiment, among both surfaces OS1 and OS2 of each of the first and second outer legs OL1 and OL2 positioned opposite each other in the third direction, a surface that is adjacent to both one end portion E1 and the other end portion E2 of the coil unit 120 may be disposed in contact with the top surface TS of the substrate 130. For example, when both end portions E1 and E2 of the coil unit 120 are disposed adjacent to the first surface OS1, the first surface OS1 may be disposed in contact with the top surface TS of the substrate 130.

[0066] In addition, referring to FIGs. 1A, 1B, and 1E, one end portion E1 of the coil unit 120 may include first and second portions P1 and P2, and the other end portion E2 of the coil unit 120 may include third and fourth portions P3 and P4.

[0067] The first portion P1 is a portion that is disposed in the first through-hole TH1, and the second portion P2 is a portion that is bent and extends from the first portion P1 toward a region below the bottom surface BS of the substrate 130 in the second direction (e.g., in a +x-axis direction). For example, the second portion P2 may extend to the third side surface SS3.

[0068] The third portion P3 is a portion that is disposed in the second through-hole TH2, and the fourth portion P4 is a portion that is bent and extends from the third portion P3 toward a region below the bottom surface BS of the substrate 130 in a direction opposite the second direction (e.g., in a - x-axis direction). For example, the fourth portion P4 may extend to the fourth side surface SS4.

[0069] In addition, as shown, the coil unit 120 may have a rectangular wire form. Unlike what is shown, the coil unit 120 may have a wire form. Regardless of the form of the coil unit 120, the first portion P1 and the third portion P3 of both end portions E1 and E2 of the coil unit 120 having the rectangular wire form or the wire form may be inserted into the first and second through-holes TH1 and TH2, respectively, and may then be bent to form the second and fourth portions P2 and P4.

[0070] In this case, each of the second and fourth portions P2 and P4 may be pressed to be disposed in a pad form on the bottom surface BS of the substrate 130.

[0071] According to the embodiment, the second portion P2 and the first outer leg OL1 may overlap each other in the y-axis direction (or the vertical direction), which is the third direction intersecting each of the first and second directions, with the substrate 130 interposed therebetween, and the fourth portion P4 and the second outer leg OL2 may overlap each other in the third direction with the substrate 130 interposed therebetween.

[0072] Meanwhile, the dummy member 140 may be spaced apart from each of the second portion P2 and the fourth portion P4 in the z-axis direction, which is the first direction, and may be disposed on the bottom surface BS of the substrate 140.

[0073] Referring to FIG. 3, the bottom surface BS of the substrate 140 may include first to third regions A1, A2,

and A3. The first region A1 may be a region in which the second portion P2 is disposed, the second region A2 may be a region in which the fourth portion P4 is disposed, and the third region A3 may be a region in which the dummy member 140 is disposed.

[0074] Referring to FIGs. 1D and 1E, a first thickness T1 of the dummy member 140 may be equal to a second thickness T21 of the second portion P2 and a second thickness T22 of the fourth portion P4, or a difference between the first thickness T1 and the second thicknesses T21 and T22 may fall within a predetermined range. For example, each of the first thickness T1 and the second thicknesses T21 and T22 may range from 0.8 mm to 1.2 mm. However, the embodiments are not limited thereto.

[0075] Hereinafter, a magnetic component according to a comparative example and the magnetic component according to the embodiment will be described with reference to the accompanying drawings.

[0076] In the case of an inductor or a transformer according to the comparative example, pin terminals connected to a coil are inserted into and disposed in a circuit board in a dual inline package (DIP) type. In such a DIP type, holes need to be present in regions of the board into which the pin terminals of the coil are inserted. Therefore, when the magnetic component according to the comparative example is applied to a power supply unit (PSU), loss of available space in the PSU may occur.

[0077] In contrast, in the magnetic component 100 according to the embodiment, since one of both surfaces OS1 and OS2 of each of the outer legs OL1 and OL2 is disposed in contact with the top surface TS of the substrate 130, supportability of the inductor by the substrate 130 may be improved.

[0078] In addition, the second portion P2 of one end portion E1 and the fourth portion P4 of the other end portion E2 of the coil unit 120 may be pressed against the bottom surface BS of the substrate 130 such that the second portion P2 and the fourth portion P4 perform a function of pads.

[0079] In addition, flatness of a state in which the core unit 110 is disposed on the substrate 130 may be improved using the dummy member 140. In this manner, according to the embodiment, an inductor or a transformer is mounted on the substrate 130 in a surface mounting device (SMD) type to minimize loss of available space and enhance efficiency, thereby enabling the magnetic component 100 to be implemented in a compact form.

[0080] While the present disclosure has been particularly shown and described with reference to exemplary embodiments thereof, these embodiments are only proposed for illustrative purposes, and do not restrict the present disclosure, and it will be apparent to those skilled in the art that various changes in form and detail may be made without departing from the essential characteristics of the embodiments set forth herein. For example, respective configurations set forth in the embodiments may be modified and applied. Further, differences in such

modifications and applications should be construed as falling within the scope of the present disclosure as defined by the appended claims.

[Mode for Disclosure]

[0081] Various embodiments have been described in the best mode for carrying out the disclosure.

[Industrial Applicability]

[0082] The magnetic component according to the embodiment may be applied to an instrument transformer, an alternating-current meter panel, a direct-current to direct-current converter (DC-DC converter), a boost converter, a buck converter, and the like.

Claims

1. A magnetic component, comprising:

a substrate including an upper surface and a lower surface and including a first side surface and a second side surface disposed between the upper surface and the lower surface and facing each other in a first horizontal direction; a core unit disposed on the upper surface of the substrate, the core unit including a first core and a second core spaced apart from each other in the first horizontal direction; and a coil unit disposed between the first core and the second core, wherein the substrate includes a concave portion recessed in the first side surface toward the second side surface.

2. The magnetic component according to claim 1, wherein the concave portion includes first and second concave portions spaced apart from each other in a second horizontal direction, and wherein the second horizontal direction is orthogonal to the first horizontal direction.

3. The magnetic component according to claim 2, wherein each of the first core and the second core includes:

first and second outer legs spaced apart from each other in the second horizontal direction; and a center leg disposed between the first and second outer legs, wherein each of the first and second outer legs has a greater length in a vertical direction than the center leg, and wherein the first and second outer legs are in contact with the upper surface of the substrate.

4. The magnetic component according to claim 3, wherein the coil unit includes one end portion and another end portion, wherein the one end portion of the coil unit includes:

a first portion disposed in the first concave portion; and a second portion bent and extending from the first portion toward a region below the lower surface of the substrate in the second horizontal direction, and wherein the other end portion of the coil unit includes: a third portion disposed in the second concave portion; and a fourth portion bent and extending from the third portion toward a region below the lower surface of the substrate in a direction opposite the second horizontal direction, the second horizontal direction being an extension direction of the second portion.

5. The magnetic component according to claim 4, wherein the substrate includes:

a third side surface disposed between the first side surface and the second side surface; and a fourth side surface positioned opposite the third side surface in the second horizontal direction, wherein the second portion extends to the third side surface, and wherein the fourth portion extends to the fourth side surface.

6. The magnetic component according to claim 5, wherein the second portion and the first outer leg overlap each other in the vertical direction with the substrate interposed therebetween, and wherein the fourth portion and the second outer leg overlap each other in the vertical direction with the substrate interposed therebetween.

7. The magnetic component according to claim 4, wherein each of the second and fourth portions is disposed in a pad form on the lower surface of the substrate.

8. The magnetic component according to claim 7, further comprising a dummy member disposed on the lower surface of the substrate and spaced apart from each of the second and fourth portions.

9. The magnetic component according to claim 8, wherein a first thickness of the dummy member and a second thickness of each of the second and fourth portions are equal to each other.

10. The magnetic component according to claim 3, wherein each of the first core and the second core includes a third concave portion recessed in the vertical direction,

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wherein the third concave portion is positioned between the first outer leg and the second outer leg, and

wherein the third concave portion overlaps the coil unit in the first horizontal direction.

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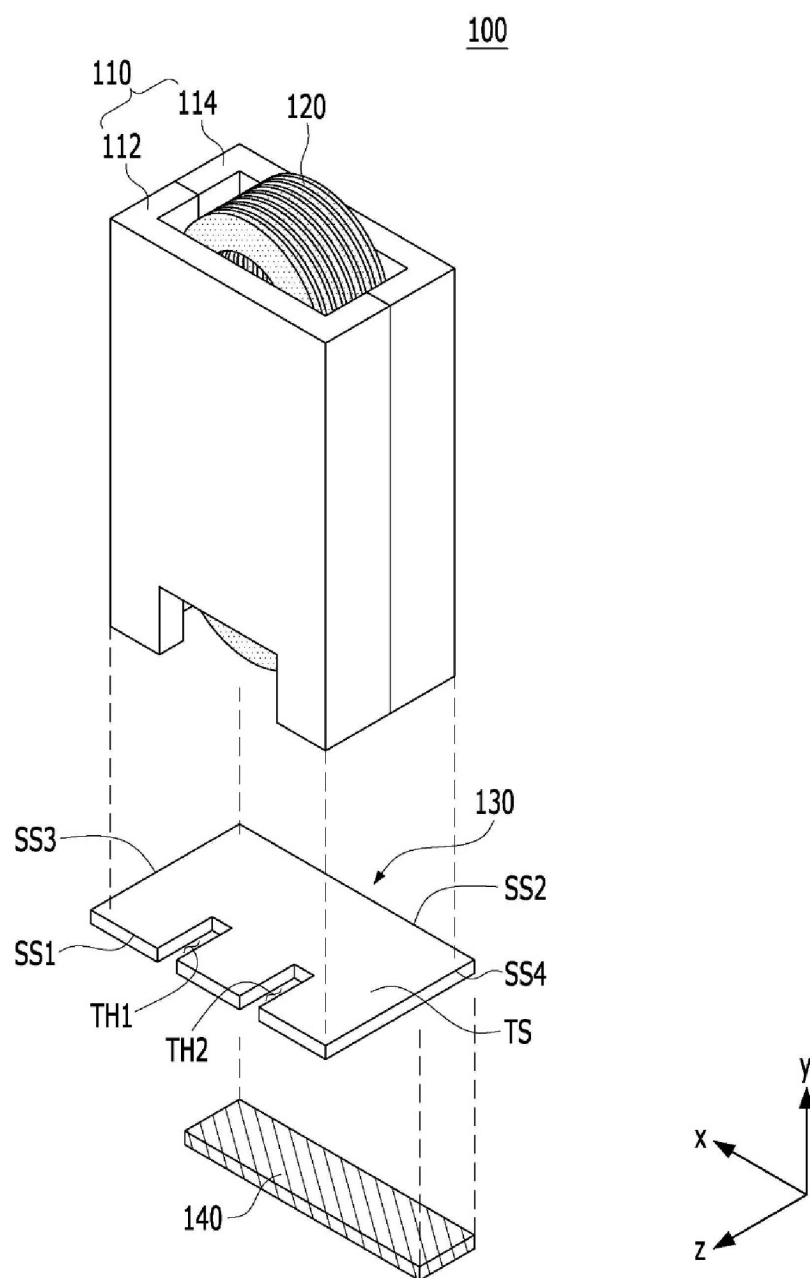
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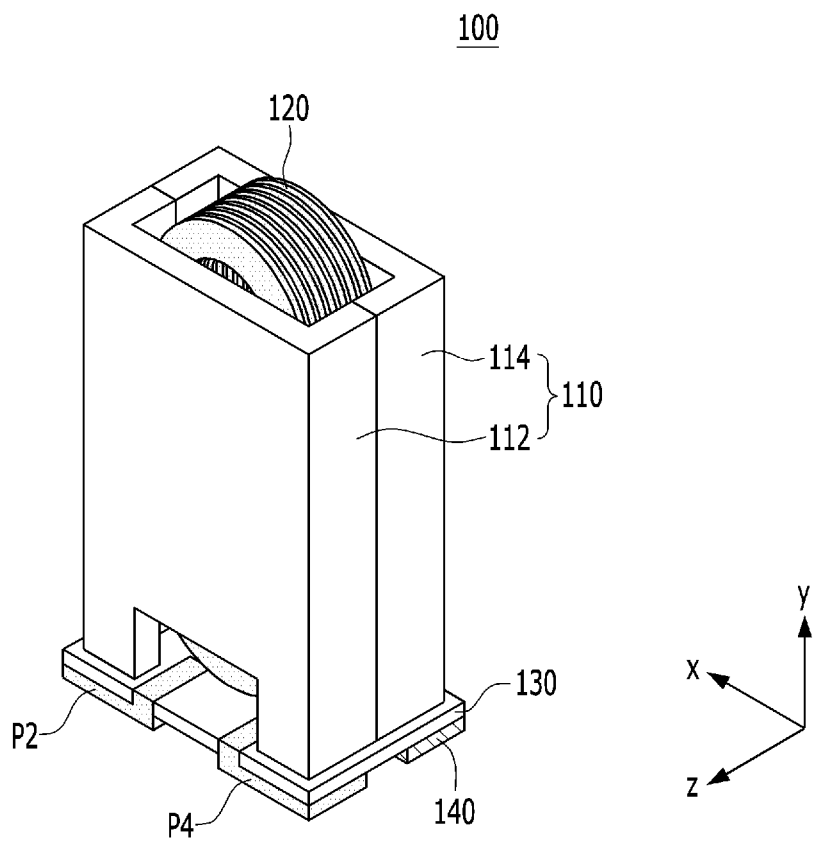
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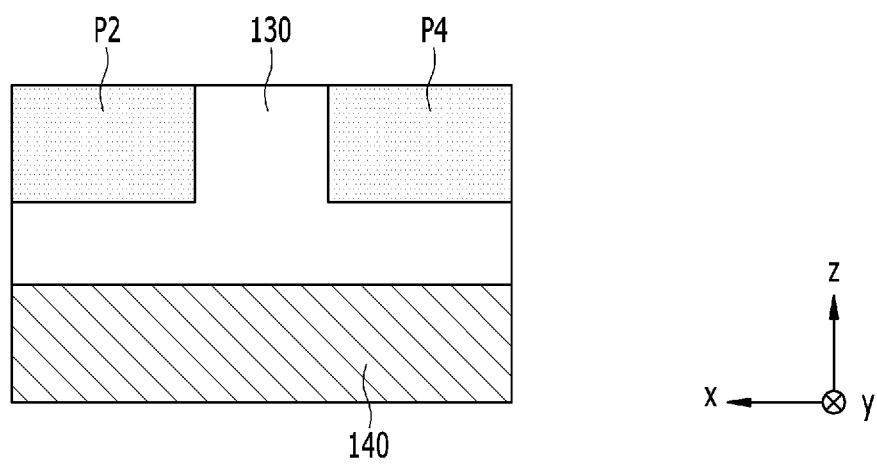
【FIG. 1A】



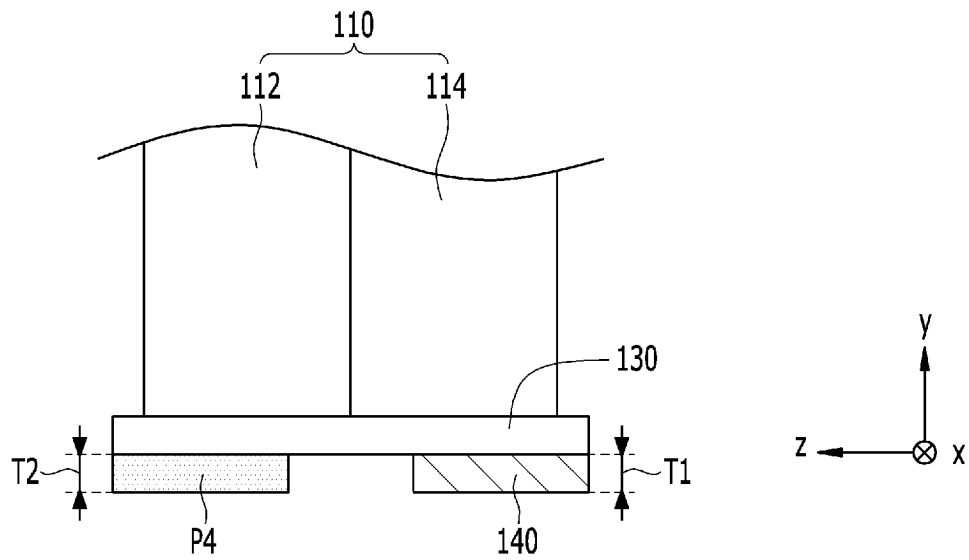
【FIG. 1B】



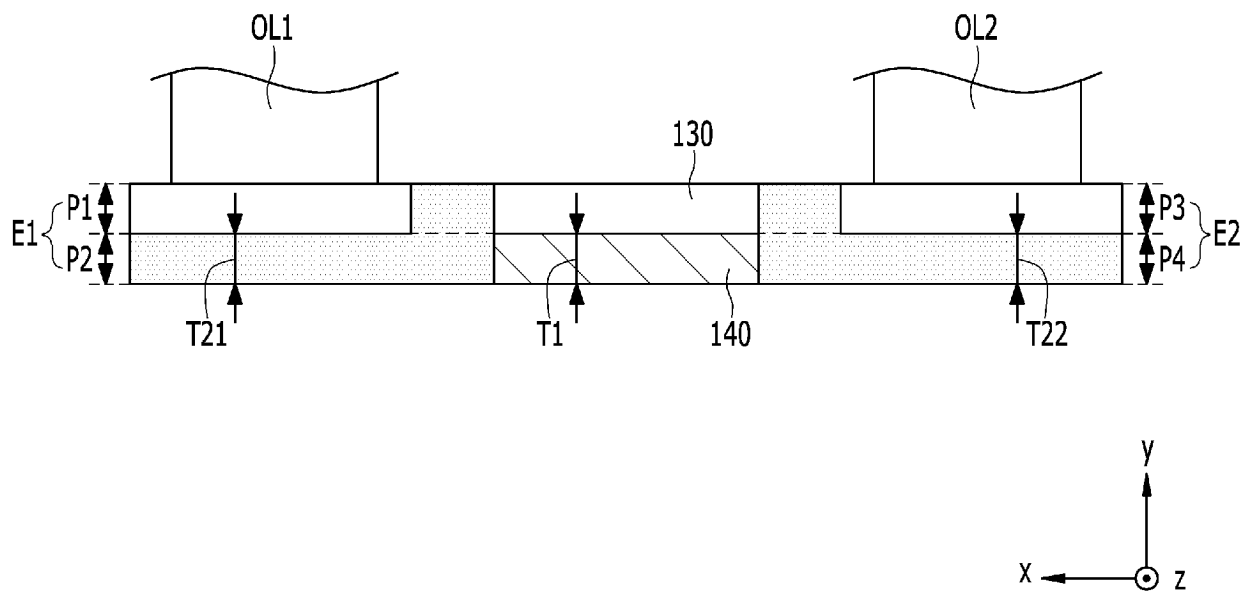
【FIG. 1C】



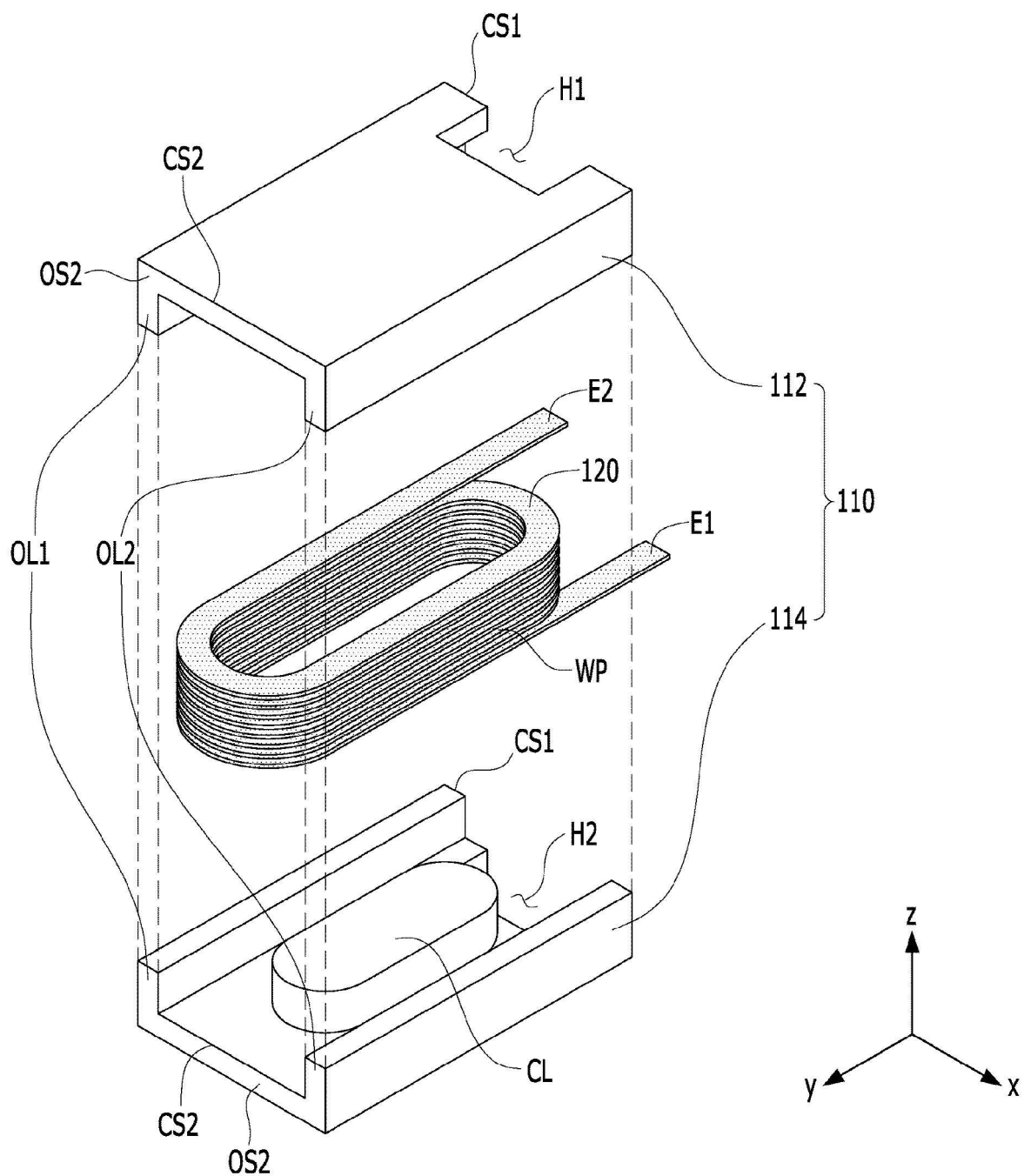
【FIG. 1D】



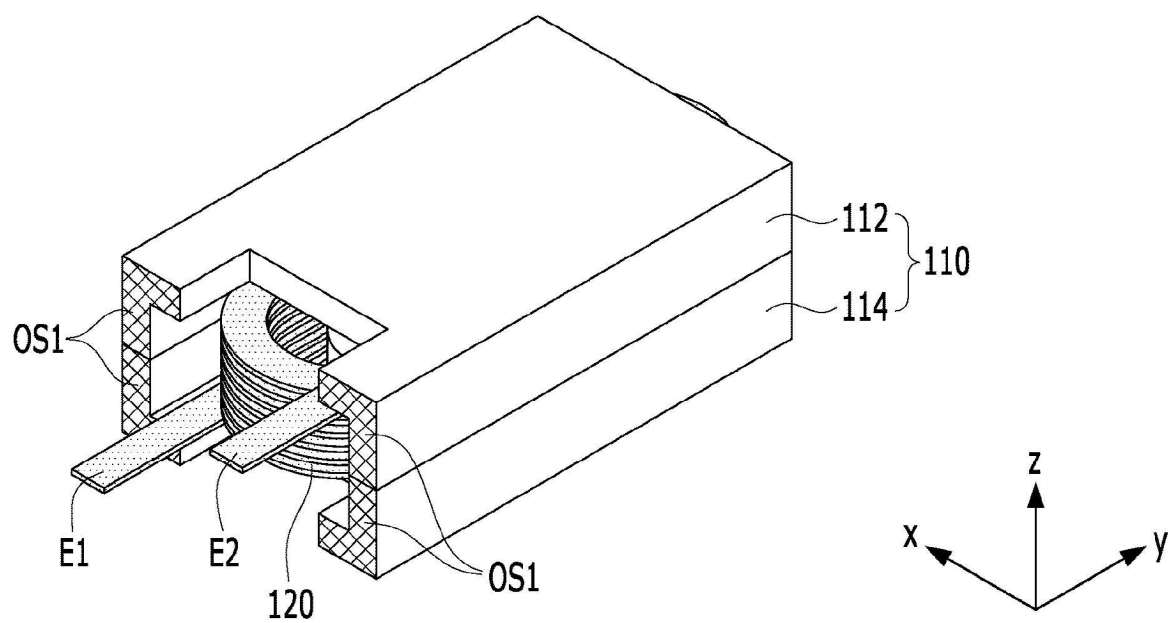
【FIG. 1E】



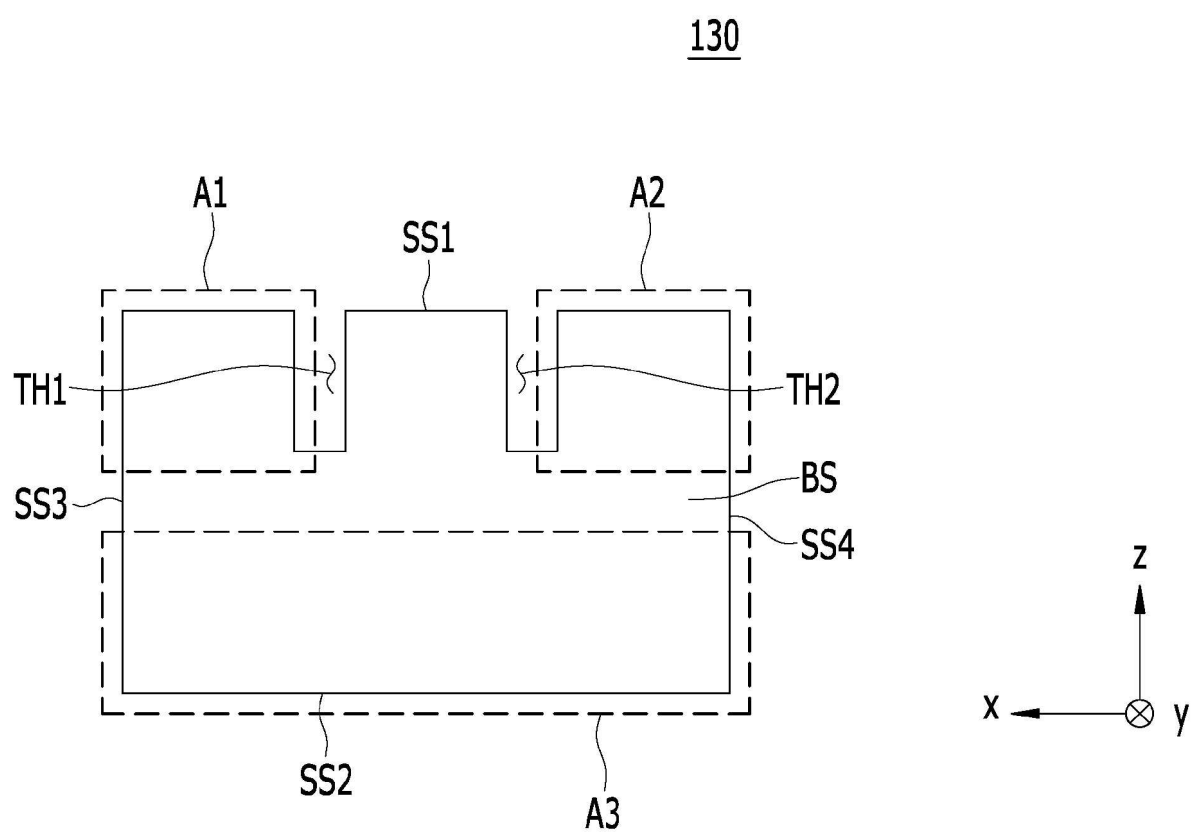
【FIG. 2A】



【FIG. 2B】



【FIG. 3】



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2024/012881

A. CLASSIFICATION OF SUBJECT MATTER**H01F 27/06**(2006.01)i; **H01F 17/04**(2006.01)i; **H01F 27/24**(2006.01)i; **H01F 3/00**(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01F 27/06(2006.01); H01F 17/04(2006.01); H01F 27/26(2006.01); H01F 27/28(2006.01); H01F 27/29(2006.01);
H01F 27/30(2006.01); H01F 41/04(2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models: IPC as above

Japanese utility models and applications for utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & keywords: 자성 부품(magnetic component), 코일(coil), 코어(core), 오목부(concave part)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2020-0117478 A (LG INNOTEK CO., LTD.) 14 October 2020 (2020-10-14) See paragraphs [0029]-[0060] and figures 2a-9.	1-3
Y		4-10
Y	JP 3232254 U (ITG ELECTRONICS INC.) 03 June 2021 (2021-06-03) See paragraph [0011] and figures 1-4.	4-9
Y	KR 10-2022-0031617 A (VISHAY DALE ELECTRONICS, LLC) 11 March 2022 (2022-03-11) See figures 3a-3b and 8a-8b.	10
A	JP 11-054335 A (HITACHI FERRITE ELECTRONICS LTD.) 26 February 1999 (1999-02-26) See paragraphs [0012]-[0023] and figures 1-7.	1-10
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☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

02 December 2024

Date of mailing of the international search report

02 December 2024

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2024/012881

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