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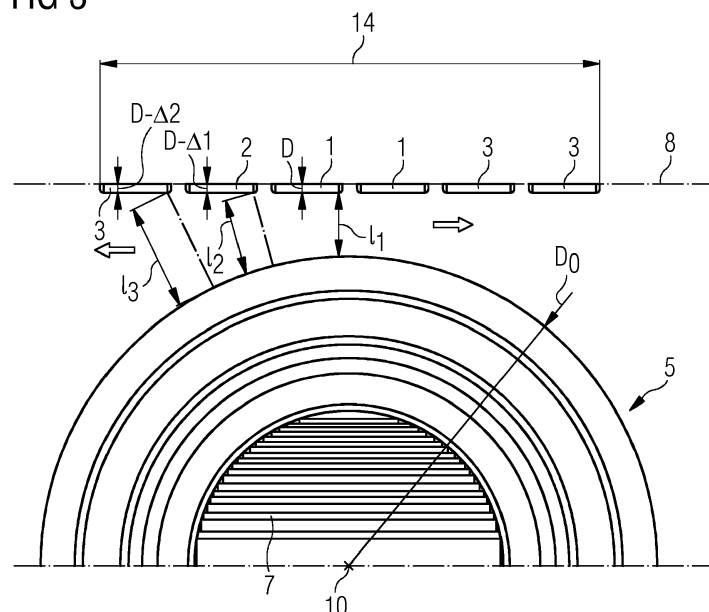
(54) **ELECTRIC TRANSFORMER OR SHUNT REACTOR WITH MAGNETIC SHUNTS**

(57) The invention relates to an electric transformer or shunt reactor comprising at least one winding block (5) within a tank, the tank having at least one tank wall (8) which is parallel to the axis (10) of the winding block, magnetic shunts (1-4) between the winding block (5) and the tank wall (8), whereas the shunts (1-4) are mounted parallel to a tank wall (8), whereas the shunts (1-4) are oriented parallel to the axis (10) of the winding block,

whereas each shunt (1-4) has a constant thickness (D, D-Δ1, D-Δ2), measured in a direction perpendicular to the tank wall (8) .

To reduce the weight of the transformer or shunt reactor the thickness (D) of a first shunt (1) is greater than the thickness (D-Δ1) of a second shunt (2), especially a second shunt (2) mounted adjacent to the first shunt (1), which second shunt (2) is situated at a greater distance (L2) from the axis (10) of the same winding block (5) than the first shunt (1).

FIG 3



Description

Field of the invention

[0001] The invention relates to an electric transformer or shunt reactor comprising at least one winding block within a tank, the tank having at least one tank wall which is parallel to the axis of the winding block, magnetic shunts between the winding block and the tank wall, whereas the shunts are mounted parallel to a tank wall, whereas the shunts are oriented parallel to the axis of the winding block, whereas each shunt has a constant thickness, measured in a direction perpendicular to the tank wall.

[0002] One winding block can contain one, two or even more windings, whereas two or more windings are arranged concentrically. One winding block can contain a primary and a secondary winding to realize a transformer. A shunt reactor will have one or more windings. The tank can contain one or more winding blocks, e.g. one winding block for every phase of an electric power transmission grid, for example three winding blocks for the three phases of an electric power transmission grid.

Background art

[0003] In large power devices such as power transformers or shunt reactors the existence of a stray magnetic flux is usually inevitable and cannot be entirely prevented just by careful and thorough design of the transformer or reactor. On the other hand, stray magnetic flux helps power transformers to limit short circuit current in the grid. In case of large power transformers the stray loss can be 20 to 30% or even higher than the transformer load losses. Stray losses produced are due to eddy and circulating currents in constructional metal parts of the transformer or shunt reactor, such as in the tank and especially in the tank walls.

[0004] Stray magnetic field lines are always closed through the path with the least magnetic resistance. Since transformer oil and insulation have relative magnetic permeability equal to 1 (just like vacuum or air), stray magnetic flux tends to choose the path through the - usually - silicon steel core or the - usually - magnetic steel tank whose relative magnetic permeability is several hundred or several thousand times greater than 1. This causes splitting of the stray magnetic flux to a part which closes itself through the core and a part which closes itself outside the core. The amount of stray flux on either of these paths depends on the distance to the core, distance to the tank, i.e. the tank walls, or existence of silicon steel tank shields. These shields are also called magnetic shunts, in the following also just shunts.

[0005] So magnetic shielding is employed to protect the tank wall(s) from the stray magnetic fields of the windings. Magnetic shielding is achieved by using magnetic shunts that comprise magnetically highly permeable ma-

terials with anisotropically low electric conductivity. Magnetic shunts reduce losses of the transformer and prevent local overheating of tank walls.

[0006] Usually a magnetic shunt is a rectangular or oblong plate with a constant thickness. For a certain tank wall usually - if there are no other constraints - several identical shunts, i.e. with the same length and width and thickness, are mounted parallel to each other, the length parallel to the axis of the windings of the winding block. The length of the shunt is often greater than the height or length of the respective winding. If an orthographic projection onto the tank wall is applied to a certain winding block then several shunts usually cover an area of 60 to 80% of the outer diameter of the winding block.

[0007] For example, to protect a tank wall of a power transformer (or shunt reactor) from a stray magnetic field, the magnetic shunts are typically arranged in a row and placed parallel to the tank wall. At the same time the axes (lengths) of the magnetic shunts run parallel to the estimated direction of the expected stray magnetic field to reduce the losses due to eddy currents induced in the tank wall. The shunts are mounted closer to the tank wall than to the outer diameter of the winding block.

[0008] The thickness of the shunt is dimensioned according to the minimum distance from the winding block outside diameter to the tank wall. Again, when applying an orthographic projection of the winding block to the tank wall, this minimum distance is at the place of the axis of the winding block. Shunt coverage, i.e. how much of the winding block outside diameter in the orthographic projection is covered with shunts, and the thickness of the shunts are calculated based on magnetic field simulation or on empiric formula. The thus calculated shunt thickness is uniformly applied throughout the coverage area in front (and on the back, based on similar calculation as above) of the winding blocks at every phase. Normally, for every phase there is a pair of windings which are arranged concentrically in a winding block. As the shape of a single magnetic shunt is assumed to be standardized it is possible to define an entire magnetic shunt arrangement/system as a combination of a given number of standardized magnetic shunts at given positions.

[0009] However, magnetic field intensity H at the tank wall is inversely proportional to the distance l of the tank wall from the winding(s) or winding block(s), respectively: the greater the distance l the smaller the magnetic field intensity H . The typical geometry of the windings or winding block(s), respectively, in cross section is circular whereas the tank's cross section is rectangular. This means when the required shunt thickness is calculated (e.g. for a flux density < 1.6 T) based on the minimum distance between tank wall and winding block outer diameter this will result in an over-dimensioning for those shunts which are not mounted exactly in front of the phase, i.e. which are not mounted exactly in front of the axis of the winding block. So the magnetic flux density in shunts mounted farther away from the axis of the winding will be lower as compared to shunts which are

mounted in close vicinity of the phase or winding center.

[0010] Since the shunts contribute to the mass of the electric transformer or reactor, the transformer or reactor is heavier than necessary.

Object of the invention

[0011] It is therefore an object of the invention to present a magnetically shielded electric transformer or shunt reactor with a reduced weight compared to electric transformers or shunt reactors with standardized magnetic shunts.

Description of the invention

[0012] The object of the invention is achieved by an electric transformer or shunt reactor according to claim 1. According to claim 1 the thickness of a first shunt is greater than the thickness of a second shunt, especially a second shunt mounted adjacent to the first shunt, which second shunt is situated at a greater distance from the axis of the same winding block than the first shunt. In other words the thickness of the shunts decreases with the distance of the shunt to the nearest winding block.

[0013] Of course the thickness of each shunt is still constant over its length and width but first and second shunt do have different thicknesses. Due to the fact that the second shunt has a lower thickness it also has a lower weight than the first shunt, provided that the second shunt is made of a material with the same or less specific weight than the first shunt and provided that length and width of the second shunt are equal to or less than for the first shunt.

[0014] According to the invention the thickness of every shunt is calculated based on magnetic field simulation or on empiric formula.

[0015] Again, when applying an orthographic projection of the winding block to the tank wall, a single first shunt will normally be mounted at the place of the axis of the winding block, e.g. symmetric to the axis of the winding block. The same applies for the central first shunt of an odd number of first shunts. If there are two first shunts then one first shunt can be arranged on one side of the axis of the winding block and the other first shunt on the other side of the axis of the winding block. The same applies for the two central first shunts of an even number of first shunts. There can be arranged one or more second shunts on both sides of the first shunt(s).

[0016] Those surfaces of all shunts of one tank wall which are oriented towards the tank wall normally are arranged in the same plane. Since the second shunt according to the invention is thinner than the first shunt, the second shunt will be farther away from the axis of the winding block than a standardized shunt having the same thickness as the first shunt.

[0017] In a preferred embodiment of the invention a shunt arranged beside a second shunt can still be thinner than the second shunt. Accordingly, the thickness of a

second shunt is greater than the thickness of a third shunt, especially a third shunt mounted adjacent to the second shunt, which third shunt is situated at a greater distance from the axis of the same winding block than the second shunt. This takes into account that shunts which are more distant to the center of the winding block than a second shunt do experience a weaker stray magnetic field than the second shunt.

[0018] Similarly, a shunt arranged beside a third shunt can still be thinner than the third shunt. So in another preferred embodiment of the invention the thickness of a third shunt is greater than the thickness of a fourth shunt, especially a fourth shunt mounted adjacent to the third shunt, which fourth shunt is situated at a greater distance from the axis of the same winding block than the third shunt.

[0019] Basically a certain tank wall can have an arbitrary number of first and second shunts for one winding block. However, to keep the mounting effort for mounting the shunts to the tank wall low, there normally is either one first shunt or there are two first shunts.

[0020] So one embodiment of the invention provides that for a certain winding block and a certain tank wall there are provided two first shunts and two second shunts, whereas the first shunts are situated between and adjacent to the two second shunts. Referring to the orthographic projection of the winding block to the tank wall, the first shunts will be mounted left and right of the axis of the winding block.

[0021] An alternative embodiment of the invention provides that for a certain winding block and a certain tank wall there are provided one first shunt and two second shunts, whereas the first shunt is situated between and adjacent to the two second shunts. Referring to the orthographic projection of the winding block to the tank wall, the first shunt will be mounted on the axis of the winding block. At each side of the first shunt there will be at least one second shunt. There could, however, be provided more than one second shunt.

[0022] No matter how many first and second shunts are provided, a further embodiment of the invention consists in that for the same winding block two third shunts are provided, each third shunt adjacent to a second shunt. Starting from that, a still further embodiment of the invention consists in that for the same winding block two fourth shunts are provided, each fourth shunt adjacent to a third shunt. There could, however, be provided more than one third and/or fourth shunt.

[0023] An additional measure to take into account that the magnetic flux density in shunts mounted farther away from the axis of the winding is smaller, consists in that a second shunt is made of a material with less magnetic permeability than the material of the first shunt. It shall be noted that the principle that a second shunt is made of a material with less magnetic permeability than the material of a first shunt, can also be applied to prior art shunts, that is, to shunts all having the same thickness. Such materials with less magnetic permeability are

in general cheaper so that the costs of the transformer can be reduced without reducing the magnetic shielding effect.

[0024] Accordingly, a further embodiment of the invention consists in that a third shunt is made of a material with less magnetic permeability than the material of the first and/or the second shunt. Again, this principle also can be applied to first, second and third shunts all having the same thickness, or to first and second shunts having the same thickness and third shunts having another thickness, or to second and third shunts having the same thickness which is smaller than the thickness of a first shunt.

[0025] A still further embodiment of the invention consists in that a fourth shunt is made of a material with less magnetic permeability than the material of the first and/or the second and/or the third shunt. Again, this principle also can be applied to first, second, third and fourth shunts if the thicknesses between these four groups of shunts are not or only partly different.

[0026] So for example a first shunt can be largely made of cold-rolled grain-oriented steel, whereas a second shunt and/or third shunt, where applicable (i.e. for the case a third shunt is provided), and/or fourth shunt, where applicable (i.e. for the case a fourth shunt is provided), is largely made of cold rolled non-grain-oriented steel. That is, if there are only first and second shunts, (i.e. if there are shunts with two different thicknesses) then the first shunts could largely consist of or could completely be made of cold-rolled grain-oriented steel, whereas the second shunts can largely consist of or could completely be made of cold rolled non-grain-oriented steel. If there additionally are third shunts (i.e. if there are shunts with three different thicknesses), then there basically are two options: According to option one the second shunts and the third shunts are (largely) made of cold rolled non-grain-oriented steel. According to option two the second shunts are (largely) made of cold rolled grain-oriented steel, like the first shunt(s), and only the third shunts are made of cold rolled non-grain-oriented steel.

[0027] The same applies if there additionally are fourth shunts (i.e. if there are shunts with four different thicknesses): According to option one the second, third and fourth shunts are (largely) made of cold rolled non-grain-oriented steel. According to option two only third and fourth shunts are (largely) made of cold rolled non-grain-oriented steel, whereas first and second shunts are (largely) made of cold rolled grain-oriented steel, like the first shunt(s). According to option three the second and third shunts are (largely) made of cold rolled grain-oriented steel, like the first shunt(s), and only the fourth shunts are made of cold rolled non-grain-oriented steel.

[0028] Of course there generally could be fifth shunts, sixth shunts, ..., n-th shunts, (n+1)th shunts, whereas basically the thickness of a n-th shunt is greater than the thickness of a (n+1)th shunt, which (n+1)th shunt is situated at a greater distance from the axis of the same winding block than the n-th shunt, n being a positive in-

teger. Additionally or alternatively, it can be provided for that a (n+1)th shunt is made of a material with less magnetic permeability than the material of the first and/or the second and/or the third shunt ... and or the n-th shunt.

[0029] If there is more than one winding block in the tank, then there will be at least one first shunt and at least two second shunts per each orthogonal projection of a winding block onto a certain tank wall. So if e.g. there are three winding blocks in a row, the two tank walls in longitudinal direction of the tank will each have three orthogonal projections of a winding block, whereas the two tank walls in width direction of the tank will only have one orthogonal projection of a winding block.

15 Brief description of the drawings

[0030] In what follows the invention is described further with regard to example embodiments. The drawings are, however, only exemplary and are not meant to restrict the scope of the invention as described above.

Fig. 1 shows the side view of a winding block of a transformer between two tank walls equipped with magnetic shunts, in longitudinal section

Fig. 2 shows the stray magnetic field of the winding block of Fig. 1

Fig. 3 shows the top view of a winding block and shunts according to a first embodiment the invention

Fig. 4 shows the side view of a transformer with shunts according to a second embodiment the invention.

35 Ways of carrying out the invention

[0031] Fig. 1 shows a scheme of one winding package 5 of a transformer, the winding package 5 here containing three concentric windings 11. The winding package 5 is situated between two tank walls 8. Each tank wall 8 is inside equipped with magnetic shunts 1. The tank further comprises a bottom 12 and a cover 13.

[0032] Electrical power transformers usually feature a laminated transformer core. Windings of a particular phase are arranged on one core column 7 of this core. In order to form a closed magnetic circuit, the ends of said core columns 7 are connected by yokes of the laminated core; upper ends of the core columns 7 are connected to each other by an upper yoke 6 whereas lower ends of the core columns 7 are connected to each other by a lower yoke 9.

[0033] The length of the shunts 1 is greater than the height of the single windings 11 of the winding block 5, but lower than the height of the transformer core 6,7,9. The shunts 1 normally end where the upper yoke 6 and the lower yoke 9 begin, or the shunts 1 can reach until

the middle of upper yoke 6 and lower yoke 9.

[0034] In Fig. 2 one can see the magnetic field lines of the stray magnetic field which go through the first shunts 1. Apart from that Fig. 2 shows the same technical features as Fig. 1.

[0035] According to prior art all shunts on the tank walls 8 would have the same thickness as the first shunt 1 situated on or near the axis 10 of the winding block 5 in an orthographic projection of the winding block 5 to the tank wall 8. The axis 10 of a winding block 5 is the axis of rotational symmetry.

[0036] Now according to the invention, see Fig. 3, magnetic shunts 1-3 are arranged between the winding block 5 and the tank wall 8. The shunts 1-3 are mounted parallel to the tank wall 8 and are oriented parallel to the axis 10 of the winding block 5. Each shunt 1-3 has a constant thickness, measured in a direction perpendicular to the tank wall 8. The thickness D of the two first shunts 1 is greater than the thickness D-Δ1 of the two second shunts 2, which each are mounted adjacent to a first shunt 1. Each second shunt 2 is situated at a greater distance L2 from the axis 10 of the same winding block than the first shunt 1, which is mounted in a distance L1 from the axis 10. Adjacent to each second shunt 2 is situated a third shunt 3 which has a greater distance L3 from the axis 10 of the same winding block 5 than the second shunt 2. The thickness D-Δ2 of the two third shunts 3 is smaller than the thickness D-Δ1 of the two second shunts 2. The two arrows each indicate the direction into which the thickness of the shunts 1-3 decreases.

[0037] The six shunts 1-3 cover an area 14 on the tank wall 8 of about 0.6 to 0.8 of the winding block outside diameter D_o. The first shunts 1 are arranged to the left and to the right of the orthographic projection of the axis 10 to the tank wall 8. The distance between two adjacent shunts 1-3 is normally of the same order than the thickness D of the first shunt 1.

[0038] The decrease in thickness from the first shunt 1 to the second shunt 2 is typically in the range of 10-30%, the decrease in thickness from the second shunt 2 to the third shunt 3 is typically also in the range of 10-30%.

[0039] Fig. 4 shows another embodiment of the invention with a different sequence of shunts 1-4. The transformer has three winding blocks 5 which are arranged on a 3/2 type core, i.e. there is one core column 7 for each winding block 5 and one core column on each end of the transformer which carries no windings. So the core consists of three main core columns and two return limbs. For each winding block 5 in this example there are seven shunts 1-4 on one tank wall 8, the tank walls 8 in Fig. 4 are oriented parallel to the plane of projection. Per winding block 5 and per tank wall 8 there is only one first shunt 1, followed by a second shunt 2 on each side, each second shunt 2 followed by a third shunt 3, each third shunt 3 followed by a fourth shunt 4. The first shunt 1 is positioned symmetrically to the axis 10, as orthographically projected onto the tank wall 8. The second, third and fourth shunts 2-4 are also arranged symmetrically to the

(projected) axis 10 and to the first shunt 1, respectively.

[0040] In Fig. 4 the shunts 1-4 only for the left winding block 5 are depicted in different shades of grey, according to their thicknesses D, D-Δ1, D-Δ2 (see Fig. 3). For the central winding block 5 and for the left winding block 5 only the contours of the shunts 1-4 are given. And only the shunts 1-4 on the tank wall 8 facing to the front are depicted. The same sequence of shunts 1-4 is arranged on the tank wall 8 on the back. So to every winding block 5 there are assigned seven shunts 1-4 on the long front tank wall 8 and on the long back tank wall 8, when the distance between winding blocks 5 and the long back tank wall 8 (in fact the place of the shunts 1-4 mounted there) is the same as between winding blocks 5 and the long front tank wall 8 (in fact the place of the shunts 1-4 mounted there). Another distance between winding blocks 5 and tank walls 8 (in fact the place of the shunts 1-4 mounted there) would e.g. result in another thickness of the shunts 1-4, and/or another number of the shunts 1-4, and/or another coverage.

[0041] In this case there are no shunts 1-4 on the short tank walls since there are empty core columns 7, acting as return limbs, between left and right winding block 5 and short tank wall. In other cases, like for a 3/0 type core (no return limbs) there could be shunts on the short tank walls, too. Then also on the short tank walls there could be graded shunts (i.e. shunts with different thicknesses) according to the invention.

[0042] In Fig. 3 and 4, first shunt (s) 1 could be made of cold-rolled grain-oriented steel (e.g. M150-30S), whereas second, third and - in Fig. 4 - fourth shunts 2-4 could be made of cold rolled non-grain-oriented steel. As cold rolled non-grain-oriented steel e.g. several sheets - according to the required thickness of the shunt - of CRN-GO 0.5 mm M530-50A could be used. Another possibility would be to make first and second shunts 1,2 of cold-rolled grain-oriented steel and third and - where present - fourth shunts 3,4 of cold rolled non-grain-oriented steel.

[0043] Typical thicknesses of first shunts 1 are between 10 mm and 100 mm.

Reference signs

[0044]

- | | |
|---|---------------|
| 1 | first shunt |
| 2 | second shunt |
| 3 | third shunt |
| 4 | fourth shunt |
| 5 | winding block |
| 6 | upper yoke |
| 7 | core column |

8	tank wall			fourth shunt (4), especially a fourth shunt (4) mounted adjacent to the third shunt (3), which fourth shunt (4) is situated at a greater distance (L3) from the axis (10) of the same winding block (5) than the third shunt (3).
9	lower yoke			
10	axis of a winding block 5	5		
11	windings		4.	Electric transformer or shunt reactor according to any of the claims 1 to 3, characterised in that for a certain winding block (5) and a certain tank wall (8) there are provided two first shunts (1) and two second shunts (2), whereas the first shunts (1) are situated between and adjacent to the two second shunts (2).
12	bottom of the tank		10	
13	cover of the tank			
14	area on the tank wall			
D	thickness of first shunt	15	5.	Electric transformer or shunt reactor according to any of the claims 1 to 3, characterised in that for a certain winding block (5) and a certain tank wall (8) there are provided one first shunt (1) and two second shunts (2), whereas the first shunt (1) is situated between and adjacent to the two second shunts (2).
D-Δ1	thickness of second shunt			
D-Δ2	thickness of third shunt			
Do	winding block outside diameter			
L1	distance of first shunt 1 from the axis 10			
L2	distance of second shunt 2 from the axis 10	20		
L3	distance of third shunt 3 from the axis 10			

Claims

1. Electric transformer or shunt reactor comprising at least one winding block (5) within a tank, the tank having at least one tank wall (8) which is parallel to the axis (10) of the winding block, magnetic shunts (1-4) between the winding block (5) and the tank wall (8),
whereas the shunts (1-4) are mounted parallel to a tank wall (8),
whereas the shunts (1-4) are oriented parallel to the axis (10) of the winding block,
whereas each shunt (1-4) has a constant thickness (D, D-Δ1, D-Δ2), measured in a direction perpendicular to the tank wall (8),
characterized in that the thickness (D) of a first shunt (1) is greater than the thickness (D-Δ1) of a second shunt (2), especially a second shunt (2) mounted adjacent to the first shunt (1), which second shunt (2) is situated at a greater distance (L2) from the axis (10) of the same winding block (5) than the first shunt (1).
2. Electric transformer or shunt reactor according to claim 1, **characterized in that** the thickness (D-Δ1) of a second shunt (2) is greater than the thickness (D-Δ2) of a third shunt (3), especially a third shunt (3) mounted adjacent to the second shunt (2), which third shunt (3) is situated at a greater distance (L3) from the axis (10) of the same winding block (5) than the second shunt (2).
3. Electric transformer or shunt reactor according to claim 2, **characterized in that** the thickness (D-Δ2) of a third shunt (3) is greater than the thickness of a
4. Electric transformer or shunt reactor according to any of the claims 1 to 3, **characterised in that** for a certain winding block (5) and a certain tank wall (8) there are provided two first shunts (1) and two second shunts (2), whereas the first shunts (1) are situated between and adjacent to the two second shunts (2).
5. Electric transformer or shunt reactor according to any of the claims 1 to 3, **characterised in that** for a certain winding block (5) and a certain tank wall (8) there are provided one first shunt (1) and two second shunts (2), whereas the first shunt (1) is situated between and adjacent to the two second shunts (2).
6. Electric transformer or shunt reactor according to claim 4 or 5, **characterised in that** for the same winding block (5) two third shunts (3) are provided, each third shunt (3) adjacent to a second shunt (2).
7. Electric transformer or shunt reactor according to claim 6, **characterised in that** for the same winding block (5) two fourth shunts (4) are provided, each fourth shunt (4) adjacent to a third shunt (3).
8. Electric transformer or shunt reactor according to any of the claims 1 to 7, **characterised in that** a second shunt (2) is made of a material with less magnetic permeability than the material of the first shunt (1).
9. Electric transformer or shunt reactor according to claim 2, **characterised in that** a third shunt (3) is made of a material with less magnetic permeability than the material of the first (1) and/or the second shunt (2).
10. Electric transformer or shunt reactor according to claim 3, **characterised in that** a fourth shunt (4) is made of a material with less magnetic permeability than the material of the first (1) and/or the second (2) and/or the third shunt (3).
11. Electric transformer or shunt reactor according to any of the claims 1 to 10, **characterised in that** a first shunt (1) is largely made of cold-rolled grain-oriented steel, whereas a second shunt (2) and/or third shunt (3), where applicable, and/or fourth shunt (4), where applicable, is largely made of cold rolled non-grain-oriented steel.

FIG 1

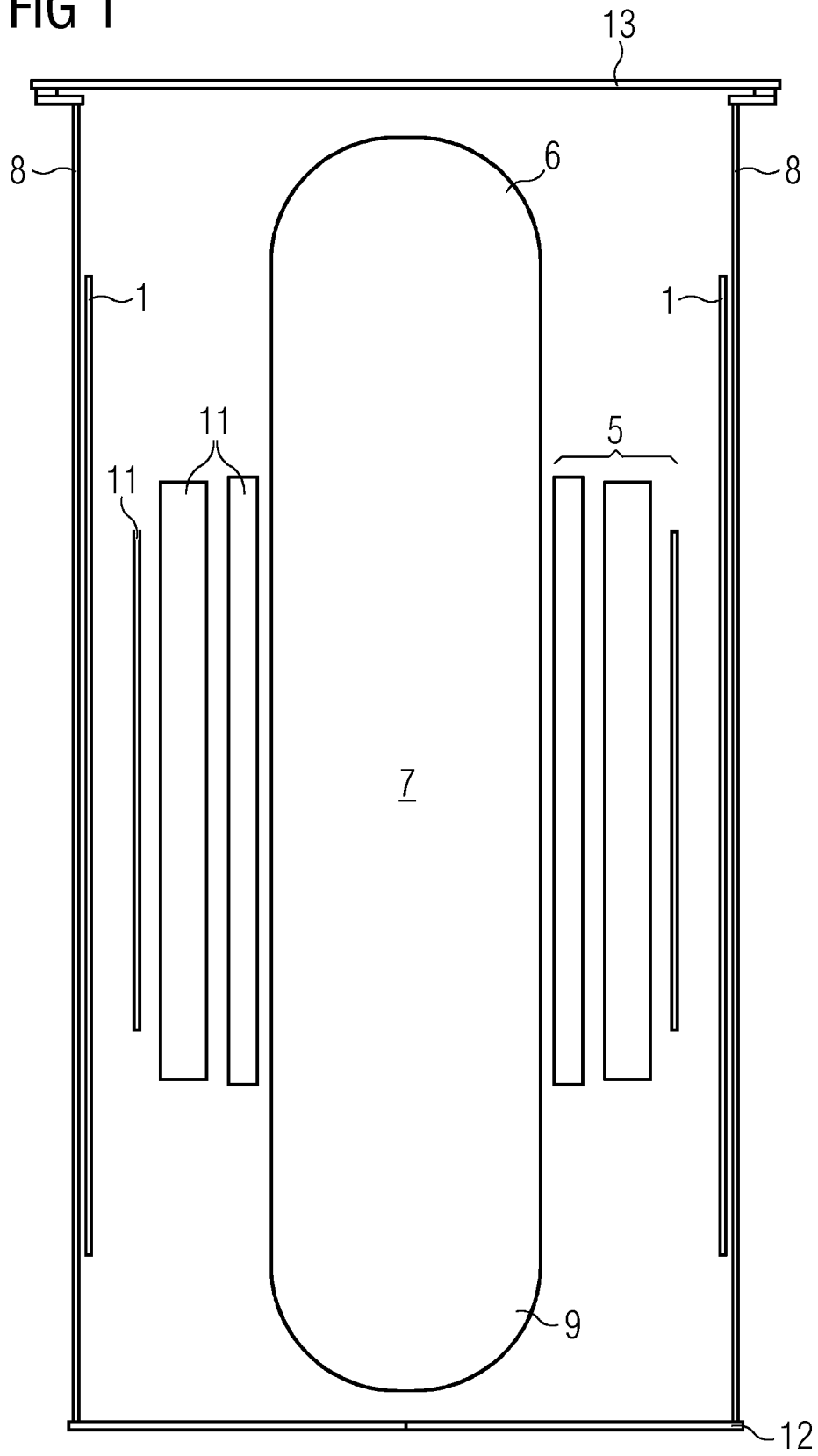


FIG 2

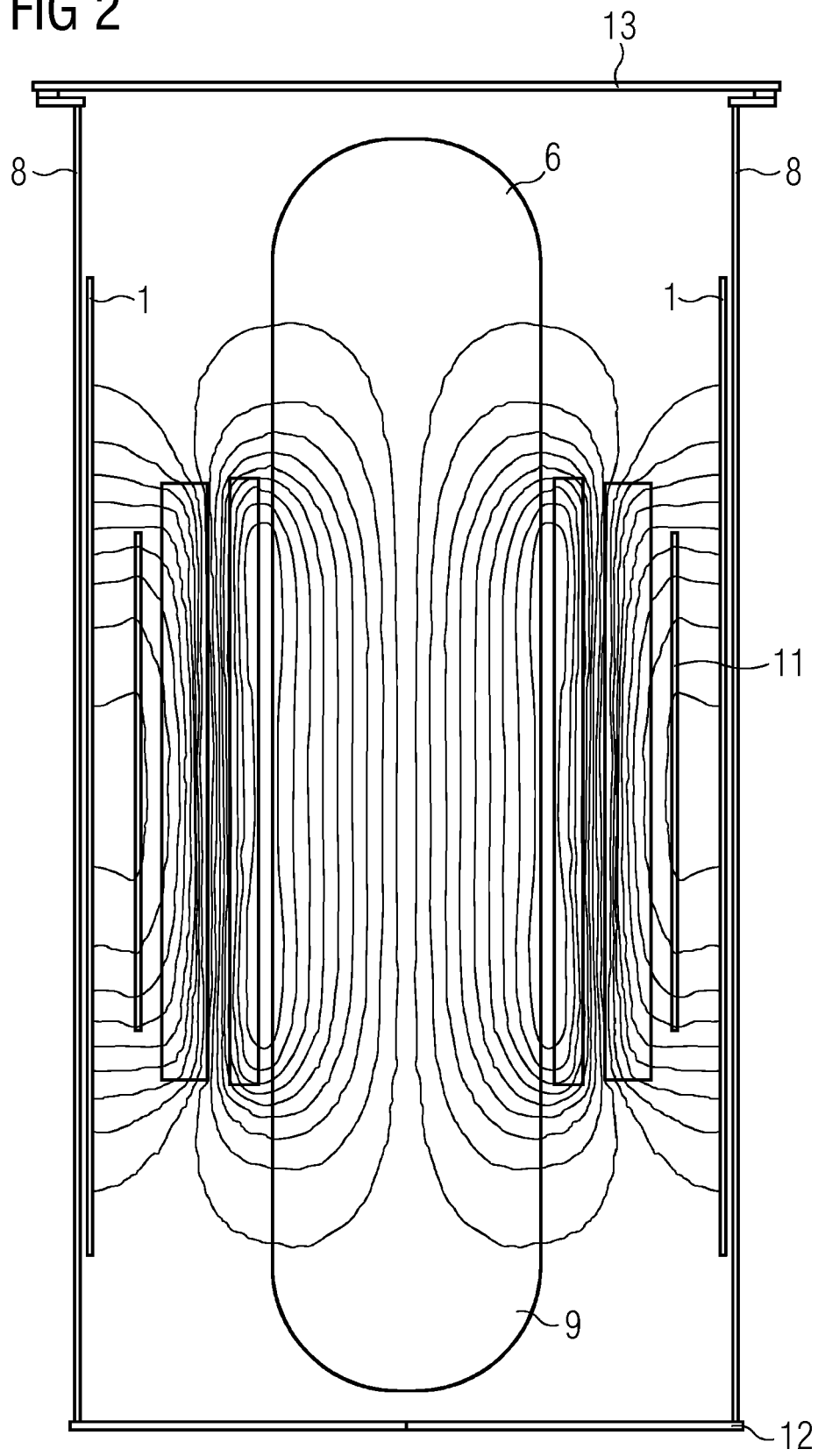


FIG 3

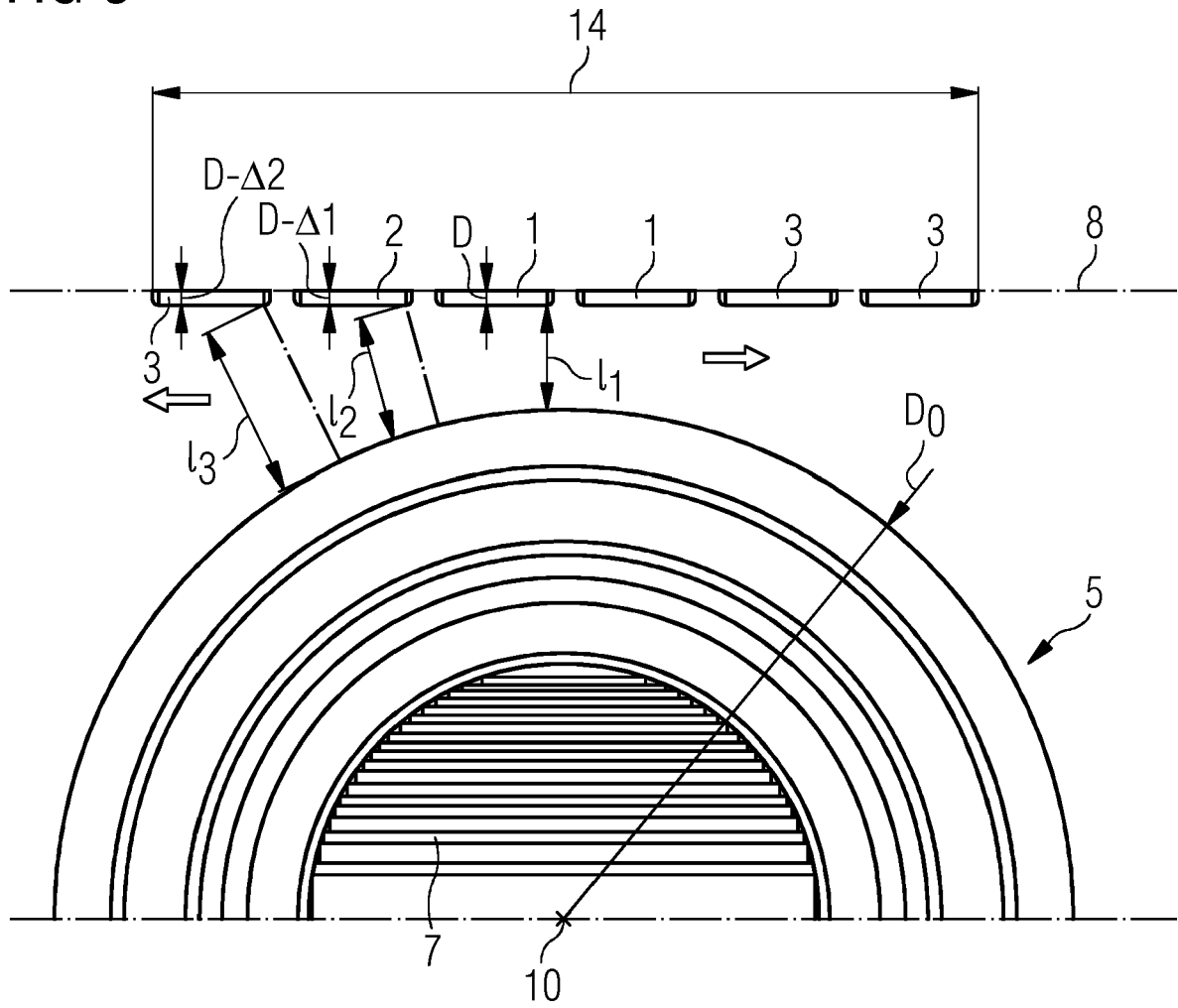
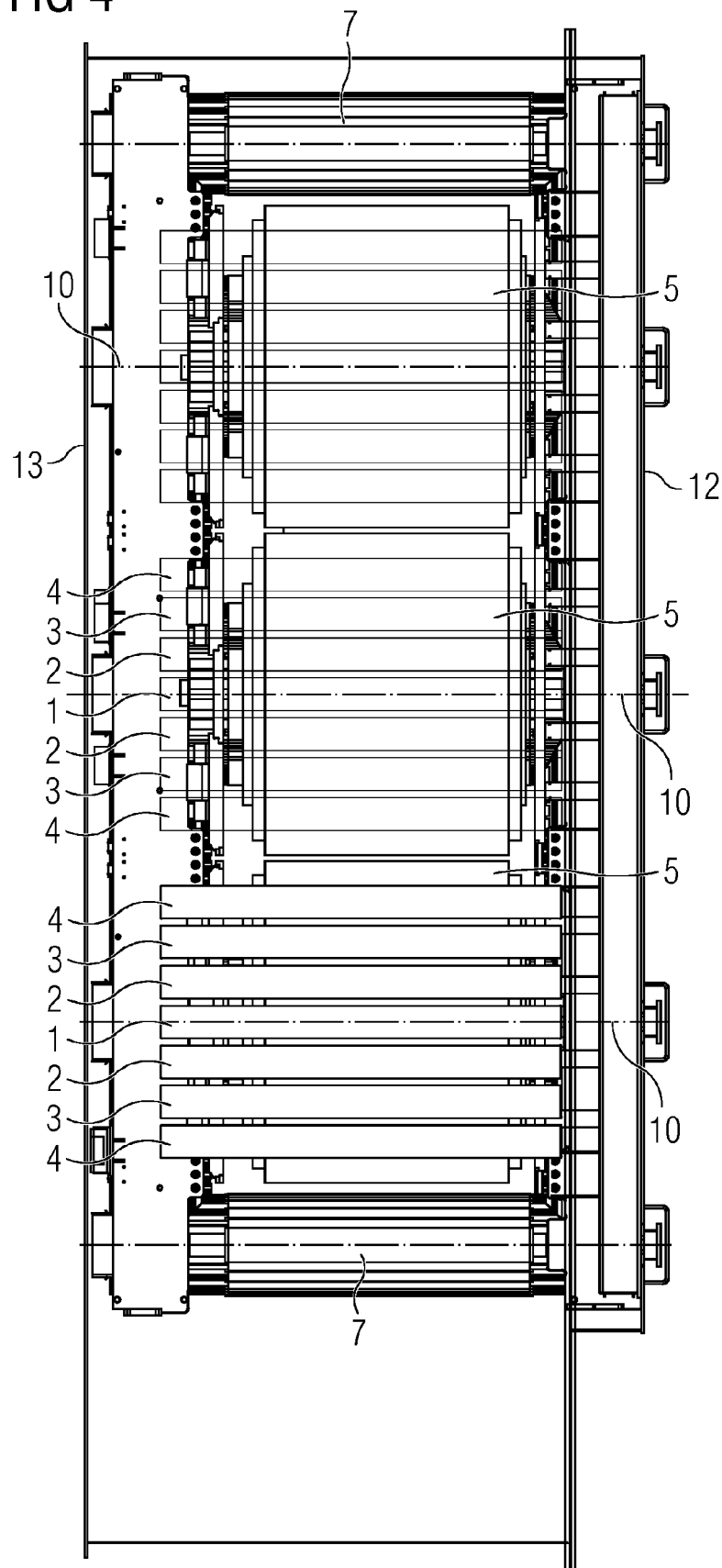


FIG 4





EUROPEAN SEARCH REPORT

Application Number
EP 19 17 0075

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	* the whole document *	8-11	H01F3/10 H01F3/12
Y	JP S61 125007 A (HITACHI LTD) 12 June 1986 (1986-06-12) * abstract; figures 1,2 *	8-11	ADD. H01F30/12
			TECHNICAL FIELDS SEARCHED (IPC)
			H01F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 1 October 2019	Examiner Warneck, Nicolas
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 17 0075

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82