



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.03.2013 Bulletin 2013/11

(51) Int Cl.:
H01F 27/30 (2006.01)

(21) Application number: **12182643.2**

(22) Date of filing: **31.08.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **TMC Italia S.p.A.**
21052 Busto Arsizio (VA) (IT)

(72) Inventor: **Colombo, Andrea**
21052 BUSTO ARSIZIO (VA) (IT)

(74) Representative: **Colombo, Stefano Paolo et al**
MARCHI & PARTNERS S.r.l.
Via G.B. Pirelli, 19
20124 Milano (IT)

(30) Priority: **08.09.2011 IT MI20111618**

(54) **Pressing device for a cast-resin dry-type electric transformer**

(57) A pressing device for a cast-resin dry-type electric transformer is described. The pressing device is configured to block a medium-voltage winding with respect to a yoke clamp. The pressing device comprises: a rack

and gear wheel mechanism; a pair of bases, wherein the rack and gear wheel mechanism is configured to move the two bases away from each other towards the yoke clamp and towards the winding; and a blocking device for blocking rotation of the gear wheel.

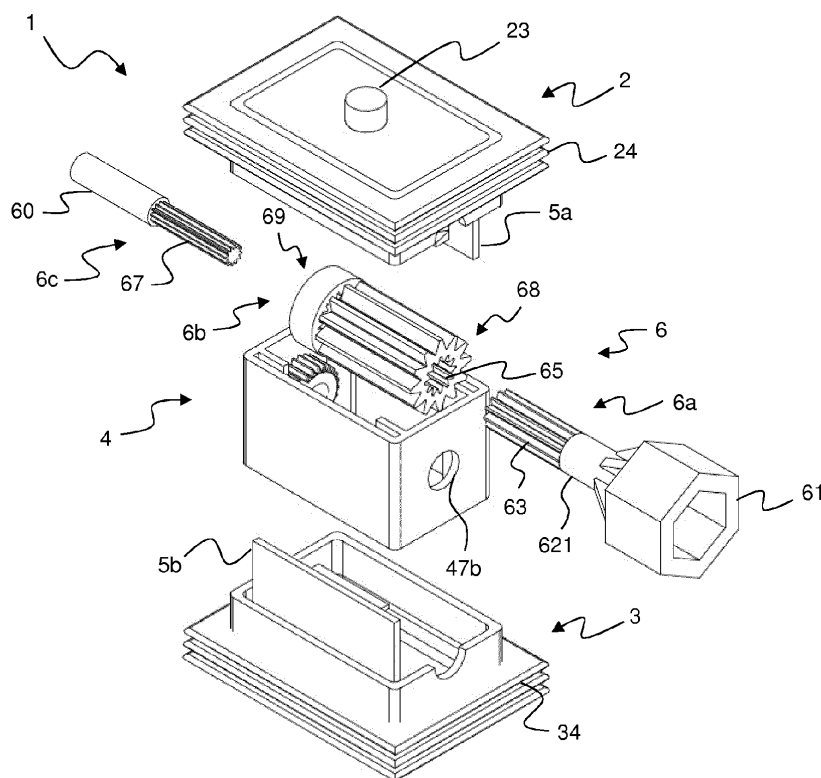


Figure 1

Description

[0001] The present invention relates to the sector of cast-resin dry-type electric transformers. In particular, the present invention relates to a pressing device for a medium to low voltage electric transformer.

[0002] The electricity network supplies users with electric energy in the form of an alternating voltage, generally called "low voltage". The amplitude of this low voltage typically is in the region of a few hundred volts. However, in the case of large users, such as factories, shopping centres or the like, the electric energy may be supplied in the form of "medium voltage", which typically has an amplitude in the region of several tens of thousands of volts. In this case, the user uses an electric transformer in order to convert the medium voltage supplied by the electricity network into low voltage.

[0003] As is known, a transformer is an electric machine able to convert an input voltage (and input current associated with it) into an output voltage (and output current associated with it).

[0004] Typically, a transformer comprises a primary winding and a secondary winding. The primary winding and secondary winding are electrically insulated from each other and are linked together by means of an magnetic circuit; for example, the primary and secondary windings may be wound concentrically onto a magnetic core.

[0005] An alternating input voltage applied to the terminals of the primary winding induces a magnetic flux in the magnetic core. In turn, this magnetic flux induces an alternating output voltage at the terminals of the secondary winding. As is known, the ratio between the amplitude of the output voltage and the amplitude of the input voltage is equal to the ratio between the number of turns of the secondary winding and the number of turns of the primary winding.

[0006] Since electric energy is generally provided in the form of three-phase voltage, the medium to low voltage transformers typically comprise three elements, commonly called "pillars". Each pillar comprises a magnetic core, a primary winding and a secondary winding, for converting a phase of the input medium voltage into a respective phase of the output low voltage.

[0007] The magnetic cores are typically formed by a plurality of laminations which are made of magnetic material (for example grain-oriented silicon) lined with an insulating material and are packed and clamped together. The magnetic cores of the pillars are not independent of each other, but are branches of a single three-branch magnetic circuit. The cores of the pillars are connected together at both their ends by means of straight yokes, also formed by the abovementioned laminations.

[0008] Moreover, typically, the magnetic core is pressed in the region of the yokes by means of a pair of horizontal members (made, for example, in the form of steel sections) commonly referred to as "yoke clamps", which are connected together by means of crosspieces.

The yoke clamps then have, fixed to them, pressing devices which are configured to press the pillars of the transformer, in particular the medium-voltage winding contained inside the casing.

[0009] In order to fix a known pressing device to a yoke clamp typically a screw is used, said screw being generally associated with two nuts which are in turn associated with respective lock nuts so as to prevent them from coming loose. In addition, typically, washers are used in order to improve locking of the nuts. The pressure exerted by the device on the medium-voltage winding of the transformer is adjusted by tightening the screw and the nuts.

[0010] The Applicant has noted that, in a disadvantageous manner, the known pressing device has a number of drawbacks.

[0011] In particular, the Applicant has noted that, in order to assemble the known device and fix it to the yoke clamp so that it presses correctly the medium-voltage winding of the transformer, screws, nuts, lock nuts and washers are required. This disadvantageously takes a long time and results in high assembly costs. In addition, screws and nuts tend to come loose and this means that, in order to maintain a suitable pressure on the winding, the tightness of the screw and the pulling force of the nuts of the pressing device must be continuously adjusted. Disadvantageously, therefore, it is difficult to adjust the pressure of the device.

[0012] Therefore, the object of the present invention is to provide a pressing device for an electric transformer which solves at least one of the abovementioned problems.

[0013] In particular, one object of the present invention is to provide a pressing device for an electric transformer which can be assembled and fitted more simply, for example without using screws, nuts, lock nuts and washers, in order to minimize the assembly time and costs. A further object of the present invention is to provide a pressing device for an electric transformer which allows adjustment of the pressure exerted by it on a winding of the transformer in advantageous manner.

[0014] According to a first aspect of the invention, a pressing device for a cast-resin dry-type electric transformer is provided, the pressing device being configured to block a medium-voltage winding with respect to a yoke clamp, the pressing device comprising:

- a rack and gear wheel mechanism;
- a pair of bases, wherein the rack and gear wheel mechanism is configured to move the two bases away from each other towards the yoke clamp and towards the winding; and
- a blocking device for blocking the rotation of the gear wheel. Preferably, the rack and gear wheel mechanism comprises a first rack, a second rack and a gear wheel configured to engage with the first rack and the second rack.

[0015] Preferably, the gear wheel comprises a central

element, a head element and a tail element coupled together so as to define a single longitudinal axis, wherein the central element comprises a toothing configured to engage with the first rack and the second rack.

[0016] Preferably, the head element comprises a head configured to be engaged by a tool for causing rotation of the gear wheel, wherein the head element comprises an external toothing configured to engage with an internal toothing of the central element.

[0017] Preferably, the tail element comprises an external toothing configured to engage with an internal toothing of the head element.

[0018] Preferably, the device further comprises a central portion for guiding the movement of the first rack and the second rack.

[0019] Preferably, the central portion comprises guiding projections for guiding the movement of the first rack and the second rack.

[0020] Preferably, the central portion comprises a pair of holes for axially supporting the gear wheel along two supporting portions.

[0021] Preferably, the blocking device comprises an internal toothing and a corresponding external toothing on an internal surface of the central portion.

[0022] Preferably, the device further comprises an upper portion and a lower portion. The upper portion and the lower portion are configured to abut against the pair of bases when they are moved away from each other towards the yoke clamp and towards the winding, respectively.

[0023] Preferably, the upper portion comprises, on a closing surface thereof, a pin configured to engage with an eyelet of the yoke clamp.

[0024] Preferably, the upper portion and the lower portion comprise at least one perimetral flange having a rounded external profile.

[0025] According to a second aspect of the invention, a cast-resin dry-type electric transformer comprising a pressing device as described above is provided.

[0026] The present invention will emerge more clearly from the following detailed description, provided by way of a non-limiting example, to be read with reference to the accompanying drawings in which:

- Figure 1 shows an exploded view of a pressing device according to an embodiment of the present invention;
- Figures 2a, 2b, 2c and 2d show, respectively, a first side view, a second side view, an axonometric view and a bottom plan view of the upper portion of the pressing device according to Figure 1;
- Figures 3a, 3b, 3c and 3d show, respectively, a top plan view, a first side view, a second side view and an axonometric view of the lower portion of the pressing device according to Figure 1;
- Figures 4a, 4b and 4c show, respectively, an axonometric view, a top plan view and a frontally sectioned view of the central portion of the pressing device ac-

cording to Figure 1;

- Figures 5a and 5b show, respectively, an axonometric view and a side view of a first rack of the pressing device according to Figure 1;
- Figures 6a, 6b and 6c show, respectively, an axonometric view, a front view and a top plan view of the gear wheel of the pressing device according to Figure 1;
- Figures 7a and 7b are, respectively, a top plan view and a cross-section along the plane A-A of the pressing device according to Figure 1, in the released configuration;
- Figures 8a and 8b are, respectively, a top plan view and a cross-section along the plane A'-A' of the pressing device according to Figure 1, in the blocked configuration; and
- Figures 9a and 9b show, respectively, an axonometric view of an electric transformer and a detail of said transformer.

[0027] The figures are not shown to scale.

[0028] In the remainder of the description and in the claims, the term "pitch" of a toothing of a gear wheel will be used to indicate the distance between two corresponding points of two adjacent teeth of the toothing, measured along the circumference along which the said teeth are arranged.

[0029] In the remainder of the description and the claims, the term "pitch" of a rack will be used to indicate the distance between two corresponding points of two adjacent teeth of the toothing, measured along the straight line along which the said teeth are arranged.

[0030] Moreover, the term "external circumference" of a toothing of a gear wheel will be used to indicate the circumference which defines the maximum dimension of the toothing itself.

[0031] Moreover, the expression "tooth of the external type" of a gear wheel will be used to indicate a toothing in which the teeth are radially directed towards the outside of the wheel, while the expression "tooth of the internal type" of a gear wheel will be used to indicate a toothing where the teeth are radially directed towards the centre of the wheel.

[0032] With reference to the figures, an embodiment of a pressing device 1 (referred to below simply as "device") for an electric transformer according to the present invention will now be described.

[0033] With reference to Figure 1, the device 1 comprises an upper portion 2, a lower portion 3, a central portion 4, a first rack 5a, a second rack 5b and a gear wheel 6.

[0034] Figures 2a, 2b, 2c and 2d show the upper portion 2. The upper portion 2 is preferably in the form of a hollow cylinder with a rectangular cross-section having an open end 21. More preferably, the cross-section of the upper portion 2 is substantially square-shaped.

[0035] Preferably, the upper portion 2 has rounded edges.

[0036] Preferably, the upper portion 2 comprises four side walls and a top closing wall 22. The closing wall 22 preferably comprises, on its outer surface, a pin 23. The pin 23 has the shape of a solid cylinder with a circular cross-section. The pin 23 is preferably positioned substantially in the centre of the outer surface of the closing wall 22.

[0037] The side walls of the upper portion 2 have, on their external surface, a number of perimetral flanges 24. Preferably, the number of perimetral flanges 24 is a whole number greater than 1. According to the embodiment shown in Figure 1 and in Figures 2a, 2b and 2c, the side walls of the upper portion 2 have three perimetral flanges 24. One of the perimetral flanges 24 shown in the figures surrounds externally the closing wall 22. Preferably, the perimetral flanges 24 are equally spaced from each other along the outer surface of the side walls of the upper portion 2. Moreover, preferably, the outer profiles of the perimetral flanges 24 are rounded.

[0038] Preferably, the end 21 has an edge 25. The edge 25 preferably comprises two recesses 26a, 26b. The recesses 26a, 26b are preferably positioned on the edge 25 along two opposite side walls of the upper portion 2. The recesses 26a, 26b preferably have a semicircular shape.

[0039] Figures 3a, 3b, 3c and 3d show the lower portion 3 of the device 1. The lower portion 3 is substantially similar to the upper portion 2 described above. Therefore, a detailed description of the lower portion 3 will not be repeated. In the description below and in the figures, the parts of the lower portion 3 corresponding to those of the upper portion 2 are denoted by corresponding reference numbers where the initial digit "2" has been replaced by the initial digit "3".

[0040] Unlike the upper portion 2, the bottom closing wall 32 of the lower portion 3 comprises a protrusion 37 in the form of a hollow cylinder with a rectangular or square shaped cross-section, which extends towards the outside of the lower portion 3. Preferably, the protrusion 37 is positioned substantially in the centre of the closing wall 32. Moreover, preferably, the area of the cross-section of the protrusion 37 is smaller than the area of the closing wall 32. The free edge of the protrusion 37 forms a pressing surface.

[0041] Figures 4a, 4b and 4c show the central portion 4 of the device 1. Preferably, the central portion 4 is in the form of a hollow cylinder with both ends open. Preferably, the shape and the dimensions of the cross-section of the central portion 4 correspond to the shape and the dimensions of the cross-section of the upper portion 2 and the lower portion 3 so that the ends of the central portion 4 may be inserted inside the upper portion 2 and the lower portion 3 during assembly of the device 1.

[0042] Preferably, the central portion 4 also has rounded edges.

[0043] The central portion has a first edge 40a and a second edge 40b at its open ends.

[0044] The central portion 4 comprises four side walls:

a first side wall 41, a second side wall 42, a third side wall 43, opposite to the first side wall 41, and a fourth side wall 44, opposite to the second side wall 42.

[0045] Preferably, two guides are provided inside the central portion for guiding the first and second racks 5a, 5b. The first guide preferably comprises two oppositely arranged longitudinal projections 45a. The oppositely arranged longitudinal projections 45a project from the inner faces of the first and third side walls 41, 43, in the vicinity of the inside corners formed between the first and second side walls 41, 42 and between the second and third side walls 42, 43.

[0046] The second guide also preferably comprises two oppositely arranged longitudinal projections 45b. The oppositely arranged longitudinal projections 45b project from the inner faces of the first and third side walls 41, 43, in the vicinity of the inside corners formed between the first and fourth side walls 41, 44 and between the fourth and third side walls 44, 43.

[0047] Moreover, preferably, the first side wall 41 and the third side wall 43 comprise a first hole 47a and a second hole 47b in oppositely arranged positions. The first hole 47a and the second hole 47b are situated substantially in the centre of the first side wall 41 and the third side wall 43, respectively.

[0048] The first side wall 41 further preferably comprises, on its inner surface, around the first hole 47a, a toothed rim 48. Preferably, the toothed rim 48 has a toothing of the external type. In particular, the toothed rim 48 preferably comprises a plurality of teeth 481 arranged along a circumference which surrounds the first hole 47a. Preferably the teeth 481 are equally spaced from each other. Preferably, the pitch of the teeth 481 is between 2 and 6 mm. Preferably, the pitch of the teeth 481 is equal to about 3.4 mm.

[0049] Figures 5a and 5b show the first rack 5a of the device 1. The first rack 5a preferably comprises a base 51 and a vertical wall 52 arranged at right angles with respect to each other. Preferably, the base 51 of the first rack 5a has a shape and dimensions corresponding to the shape and the dimensions of the cross-section of the central portion 4. Moreover, the base 51 has a shape and dimensions such that it may be housed inside the upper portion 2, as will be described in greater detail below.

[0050] Preferably, the vertical wall 52 is connected to the base 51 in the vicinity of its edge 51a and projects perpendicularly with respect to the base 51. More preferably, the distance between the vertical wall 52 and the edge 51a of the base 51 is slightly greater than the thickness of the second side wall 42 of the central portion 4 of the device 1. Preferably, the vertical wall 52 comprises a plurality of teeth 53 directed as shown in Figure 5b. In the embodiment shown in Figures 5a and 5b, the number of teeth 53 is equal to six. The teeth 53 are positioned on the vertical wall 52, extending from its free end over at least part of the length of the vertical wall 52. Preferably, the teeth 53 are equally spaced from each other. Preferably, the pitch of the teeth 53 is between 2 and 6

mm. Preferably, the pitch of the teeth 53 is equal to about 3.4 mm.

[0051] Moreover, preferably the rack 5 comprises a stiffening element 54. The stiffening element 54 rests against the base 51 and against the vertical wall 52, in particular against the portion of the vertical wall 52 not occupied by the teeth 53, in the vicinity of the base 51.

[0052] The second rack 5b is substantially similar to the first rack 5a. Therefore, a detailed description of the second rack 5b will not be repeated.

[0053] Figures 6a, 6b and 6c show an embodiment of the gear wheel 6 of the device 1. The gear wheel 6 preferably comprises a head element 6a, a central element 6b and a tail element 6c. The head element 6a preferably comprises a head 61 and a shank 62 which are aligned along a longitudinal axis X. The head 61 has preferably a cross-section with a substantially polygonal (for example hexagonal) shape. The head 61 is preferably configured to engage with a tool such as a spanner, for example a hexagonal spanner.

[0054] The shank 62 is substantially in the form of a circular cylinder and is at least partially hollow. It comprises a supporting portion 621, with a smooth outer surface, and an end portion which has on its outer surface a first toothing 63 and, on its inner surface, a second toothing (Figure 7b). The first toothing 63 is arranged circumferentially on the outer surface of the toothed portion of the shank 62 and is of the external type. The first toothing 63 comprises a plurality of teeth 631 which are equally spaced from each other. Preferably the shape, size and pitch of the teeth 631 is such that they engage with the teeth of a second toothing 65 of the central element 6b, as will be explained in greater detail below.

[0055] The second toothing of the shank 62 is arranged circumferentially on its inner surface and is of the internal type. The second toothing also comprises a number of teeth which are equally spaced from each other. Preferably the shape, size and pitch of the teeth is such that they engage with the teeth 671 of the tail element 6c, as will be explained in greater detail below.

[0056] The central element 6b comprises a toothed body 68 and a ring 69, each having the shape substantially of a hollow circular cylinder. The toothed body 68 and the ring 69 are preferably formed as a single body. The outer surface of the toothed body 68 comprises a first pressing toothing 64. The first toothing 64 is of the external type. In particular, it comprises a plurality of teeth 641 arranged circumferentially on the outer surface of the toothed body 68 and equally spaced from each other. The number of teeth 641 of the first toothing 64 is, for example, twelve. Preferably the shape, size and pitch of the teeth 641 is such that they engage with the teeth 53 of the first rack 5a and the second rack 5b, as will be explained in greater detail below.

[0057] The inner surface of the toothed body 68 comprises a second toothing 65 (Figure 1). The second toothing 65 is arranged circumferentially on the inner surface of the toothed body 68. The second toothing 65 is of the

internal type and comprises a plurality of teeth 651 which are equally spaced from each other. Preferably the diameter of the external circumference of the second toothing 65 is substantially equal to the diameter of the external circumference of the first toothing 63 of the head element 6a. Preferably the shape, size and pitch of the teeth 651 is such that they engage with the teeth 631 of first toothing 63 of the head element 6a, as will be explained in greater detail below.

10 The ring 69 preferably comprises, on its inner surface, a third blocking toothing 66. The third blocking toothing 66 is also preferably of the internal type. The third toothing 66 comprises a plurality of teeth 661, the shape, size and pitch of which are such that they engage with the teeth 481 of the toothed rim 48, as will be explained in greater detail below.

15 **[0058]** The tail element 6c preferably has the shape of a solid cylinder and comprises a supporting portion 60 and a toothed portion comprising a toothing 67. This toothing 67 comprises a plurality of teeth 671. Preferably the shape, size and pitch of the teeth 671 is such that they engage with the teeth of second toothing of the head element 6a, as will be explained in greater detail below.

20 **[0059]** The entire pressing device may be made of any material, but preferably it is made of a plastic material such as polyethylene, polyethylene terephthalate, (polyamide) nylon 6 with a 50% filler consisting of glass or a similar material.

25 **[0060]** Below, with reference to Figure 1 and Figures 7a and 7b, the procedure for assembly of the device 1 will be described in detail.

30 **[0061]** In order to assemble the device 1, the central element 6b of the gear wheel 6 is housed inside the central portion 4. In particular, the central element 6b is arranged coaxially with the first hole 47a and the second hole 47b of the central portion 4, along the longitudinal axis X. At this point, the shank 62 of the head element 6a is inserted, through the second hole 47b, into the toothed body 68, so that the toothed portion of the shank 62 is inserted into the toothed body 68 of the central element 6b and the supporting portion 621 engages with the second hole 47b. In this way, the first toothing 63 of the head element 6a meshes with the second toothing 65 of the toothed body 68.

35 **[0062]** Moreover, the tail element 6c is inserted, through the first hole 47a, into the central element 6b via the ring 69 so that the toothed portion of the tail element 6c engages with the toothed portion of the shank 62 and the toothed portion 60 engages with the first hole 47a. In this way, the toothing 67 meshes with the second toothing of the head element 6a. Once in position, the shank 62 of the head element 6a and the tail element 6c form a shaft around which the central element 6b may rotate.

40 **[0063]** Furthermore, the vertical wall 52 of the first rack 5a is inserted into the first guide (defined by the projections 45a) so that the base 51 is substantially flush with the first edge 40a on the outside thereof. In this way, moreover, the teeth 53 of the first rack 5a are directed

towards the inside of the central portion 4. Then the vertical wall 52 of the second rack 5b is inserted into the second guide (defined by the projections 45b) so that the base 51 is substantially flush with the second edge 40b on the outside thereof. In this way, moreover, the teeth 53 of the second rack 5b are directed towards the inside of the central portion 4. When the first rack 5a and the second rack 5b are in position, the first toothing 64 of the central element 6b of the gear wheel 6 meshes with the first rack 5a and with the second rack 5b.

[0064] At this point, the device 1 is completed with the upper portion 2 and the lower portion 3.

[0065] In particular, the upper portion 2 is fitted onto the central portion 4, opposite the base 51 of the first rack 5a. In this way the recesses 26a, 26b are aligned along an axis parallel to the longitudinal axis X. Furthermore, the base 51 of the first rack 5a bears against the inner surface of the closing wall 22 of the upper portion 2.

[0066] Furthermore, the lower portion 3 is fitted onto the central portion 4, opposite the base 51 of the second rack 5b. In this way the recesses 36a, 36b are aligned along an axis parallel to the longitudinal axis X. Furthermore, the base 51 of the second rack 5b bears against the inner surface of the closing wall 32 of the lower portion 3.

[0067] Figures 9a and 9b show a cast-resin dry-type electric transformer 100 comprising a pressing device 1 according to the present invention. In particular, the electric transformer 100 is a three-phase transformer suitable for converting each of the phases of the medium voltage supplied by the electricity network into a respective phase of the low voltage useful for the user.

[0068] The transformer 100 comprises three pillars 101 arranged in parallel, each one for each phase of the voltage. Each pillar 101 comprises in turn a magnetic core (not shown in the figures). The magnetic cores of the pillars 101 are connected together at both their ends by one or two straight yokes 102.

[0069] Each pillar further comprises a low-voltage winding 103 wound around the magnetic core. The low-voltage winding 103 has a pair of low-voltage terminals 103a. Each pillar further comprises a respective casing 104 which surrounds the low-voltage winding 103 and which is substantially in the form of a hollow cylinder. Turns of a respective medium-voltage winding (not shown in the figures) are embedded in the thickness of each casing 104. The turns of each low-voltage winding are connected to a pair of medium-voltage terminals 104a to which a phase of the corresponding input medium voltage is applied. The corresponding phase of the output low voltage is taken from the low-voltage terminals 103a.

[0070] The transformer 100 also comprises, at each of the top and bottom ends of the pillars 101, a pair of yoke clamps 106 which are connected together by means of crosspieces. Each yoke clamp 106 may be in the form of C-shaped section directed outwards. Eyelets 106b are provided on at least one of the flanges 106a of the C-shaped section.

[0071] In order to fix the pressing device 1 to the yoke clamp 106 so that it presses the casing 104, the pressing device 1 is positioned in the space situated between the flange 106a and the edge of the casing 104 so that the pin 23 passes through the eyelet 106b.

[0072] A resilient element 107 may be advantageously positioned on the edge of the casing 104, in a position corresponding to that of the device 1. The resilient element 107 may be for example a rubber disc or collar. The element 107 is able to compensate for any expansion of the casing 104 at the operating temperatures of the transformer 100. A height adapter 108 may be provided between the element 107 and the device 1. The adapter 108 is preferably made of plastic.

[0073] Once the pressing device 1 is in position between the flange 106a and the casing 104, the pressure exerted by it on the casing 104 may be regulated (Figure 7b) by adjusting the head element 6a of the gear wheel 6 which advantageously may be easily accessed by an operator. In particular, an operator may use a spanner to engage the head 61 of the element 6a and therefore cause rotation of the shank 62, for example in the clockwise direction. In this way, the teeth 631 of the first toothing 63 of the shank 62 engage with the teeth of the second toothing 65 of the toothed body 68 so that it is consequently made to rotate. At this point, the teeth 641 of the first toothing 64 of the toothed body 68 which engage with the teeth 53 of the first rack 5a and the second rack 5b convert the rotary movement of the toothed body 68 into a translatory linear movement of the first rack 5a and the second rack 5b. In particular, the first rack 5a and the second rack 5b move in opposite directions. During the movement, the base 51 of the first rack 5a pushes the upper portion 2 against the flange 106a. On the other hand, the base 51 of the second rack 5b pushes the lower portion 3 against the adapter 108. The thrust exerted by the base 51 of the second rack 5b is therefore transmitted to the resilient element 107 and to the horizontal edge of the casing 104.

[0074] Once the desired pressure has been obtained, the operator may block the gear wheel 6 in position. Blocking is obtained by displacing horizontally the gear wheel 6 along the longitudinal axis X in the direction indicated by the arrow marked with the letter "B" in Figure 7b. In this way, as shown in Figure 8b, the third toothing 66 and the toothed rim 48 mesh. In this way, advantageously, the gear wheel 6 is blocked firmly in the position which ensures the desired pressure.

[0075] Advantageously, by means of the pressing device 1 described above it is possible to press effectively the medium-voltage winding contained inside the casing 104 of the pillars of the transformer 100. Advantageously, in order to fix firmly the pressing device to the yoke clamp, it is not required to use screws, nuts, lock nuts and washers. In fact, the thrust exerted by the device 1 on the casing and on the yoke clamp ensures that the device 1 stably maintains its position. This results in a considerable reduction in the time required to mount the device 1

in the transformer and the associated costs. Moreover, adjustment of the pressure exerted by the device is advantageously rapid and easy since the gear wheel can be easily accessed from the outside by means of a spanner. In addition, advantageously, the wheel may be stably locked in the position which ensures the desired pressure which may therefore be maintained without the need for continuous adjustment.

[0076] Moreover, advantageously, the pressing device 1 according to the present invention, owing to the presence of the perimetral flanges 24, 34 present on the outer surface of the upper portion 2 and the lower portion 3, is able to increase the distance between the casing, which contains the medium-voltage winding which typically has a voltage of a several tens of thousands of volts, and the yoke clamp, which is instead at earth potential. Consequently, advantageously, with the pressing device according to present invention it is possible to reduce the likelihood of a surface discharge occurring between the medium-voltage winding and the yoke clamp.

[0077] Finally, the fact that the edges of the upper portion 2, the lower portion 3 and the central portion 4 as well as the outer profiles of the flanges 24, 34 are rounded advantageously avoids magnetic field concentrations which would favour the partial discharge effects.

Claims

1. A pressing device (1) for a cast-resin dry-type electric transformer (100), said pressing device (1) being configured to block a medium-voltage winding (104) with respect to a yoke clamp (106), said pressing device (1) comprising:
 - a rack (5a, 5b) and gear wheel (6) mechanism;
 - a pair of bases (51), wherein said rack (5a, 5b) and gear wheel (6) mechanism is configured to move the two bases (51) away from each other towards the yoke clamp (106) and towards the winding (104); and
 - a blocking device (48, 66) for blocking the rotation of said gear wheel (6).
2. The device (1) according to claim 1, wherein said rack (5a, 5b) and gear wheel (6) mechanism comprises a first rack (5a), a second rack (5b) and a gear wheel (6) configured to engage with said first rack (5a) and said second rack (5b).
3. The device (1) according to claim 2, wherein said gear wheel (6) comprises a central element (6b), a head element (6a) and a tail element (6c) coupled together so as to define a single longitudinal axis (X), wherein said central element (6b) comprises a toothing (64) configured to engage with said first rack (5a) and said second rack (5b).

4. The device (1) according to claim 3, wherein said head element (6a) comprises a head (61) configured to be engaged by a tool for causing rotation of the gear wheel (6), wherein said head element (6a) comprises an external toothing (63) configured to engage with an internal toothing (65) of said central element (6b).
5. The device (1) according to claim 4, wherein said tail element (6c) comprises an external toothing (67) configured to engage with an internal toothing of said head element (6a).
6. The device (1) according to any one of the preceding claims, further comprising a central portion (4) for guiding the movement of said first rack (5a) and said second rack (5b).
7. The device (1) according to claim 6, wherein said central portion (4) comprises guiding projections (45a, 45b) for guiding the movement of said first rack (5a) and said second rack (5b).
8. The device (1) according to claim 6 or 7, wherein said central portion (4) comprises a pair of holes (47a, 47b) for axially supporting said gear wheel (6) along two supporting portions (62, 60).
9. The device (1) according to any one of claims 6-8, wherein said blocking device (48, 66) comprises an internal toothing (66) and a corresponding external toothing (48) on an internal surface of said central portion (4).
10. The device (1) according to any one of the preceding claims, further comprising an upper portion (2) and a lower portion (3), said upper portion (2) and said lower portion (3) being configured to abut against said pair of bases (51) when they are moved away from each other towards the yoke clamp (106) and towards the winding (104), respectively.
11. The device (1) according to claim 10, wherein said upper portion (2) comprises, on a closing surface thereof (22), a pin (23) configured to engage with an eyelet (106b) of said yoke clamp (106).
12. The device (1) according to claim 10 or 11, wherein said upper portion (2) and said lower portion (3) comprise at least one perimetral flange (24, 34) having a rounded external profile.
13. A cast-resin dry-type electric transformer (100) comprising a pressing device (1) according to any one of the preceding claims.

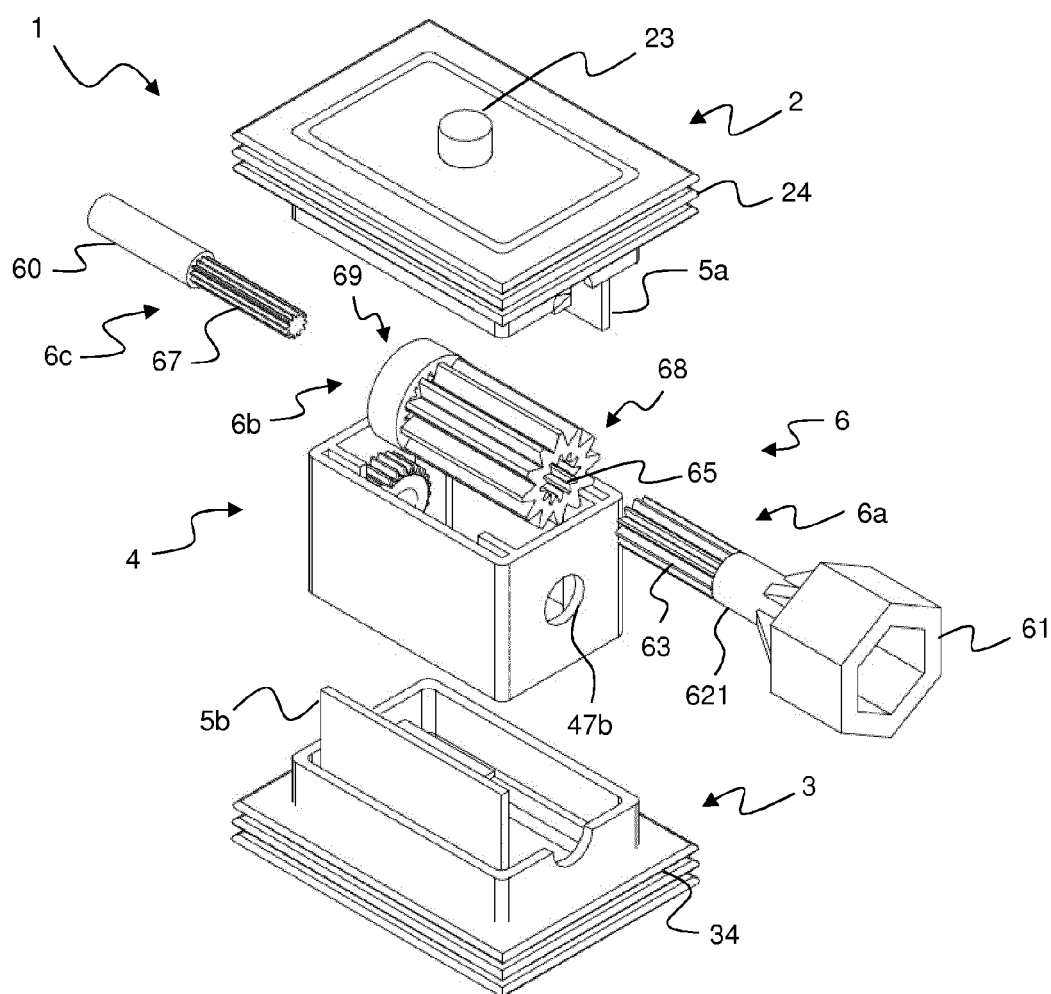


Figure 1

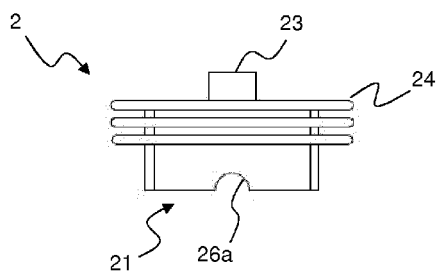


Figure 2a

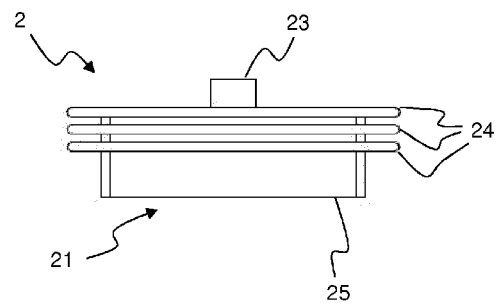


Figure 2b

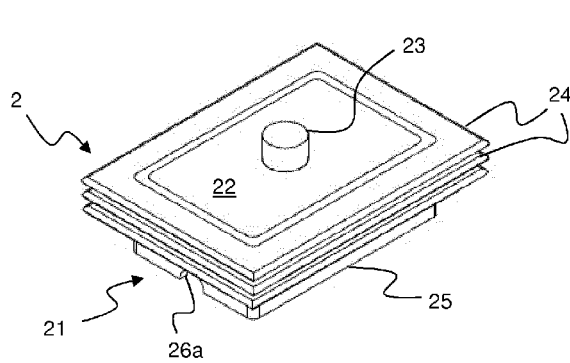


Figure 2c

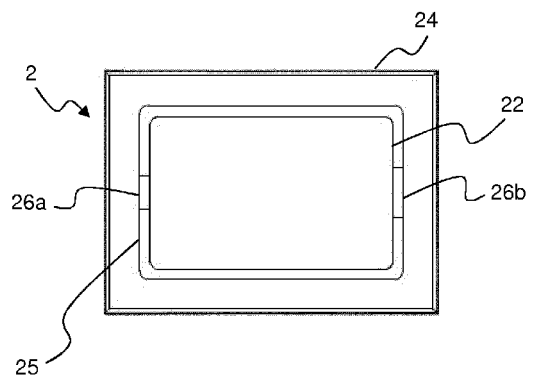


Figure 2d

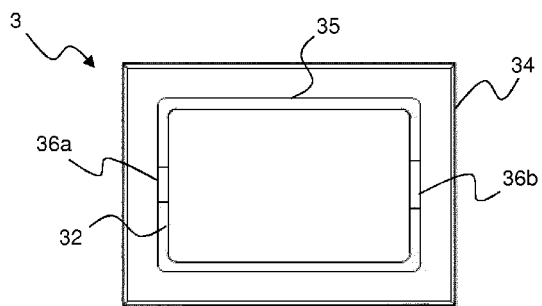


Figure 3a

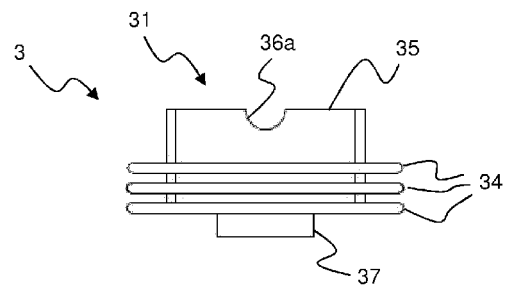


Figure 3b

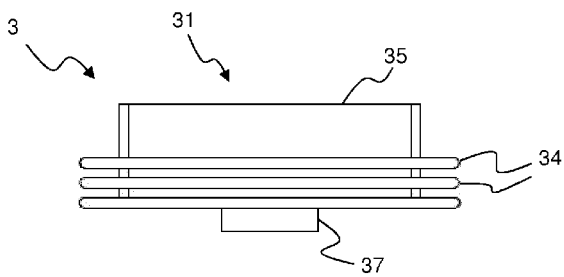


Figure 3c

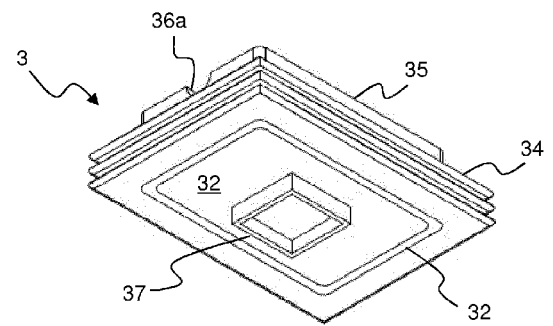


Figure 3d

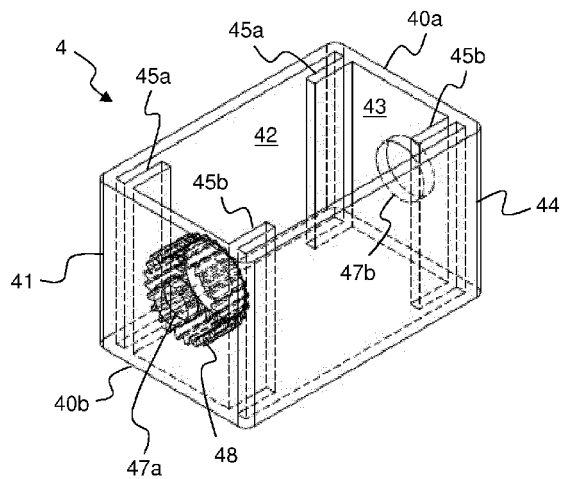


Figure 4a

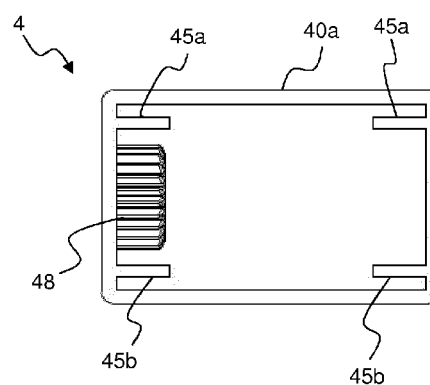


Figure 4b

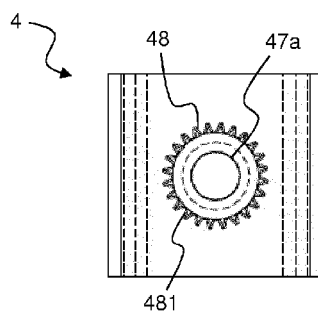


Figure 4c

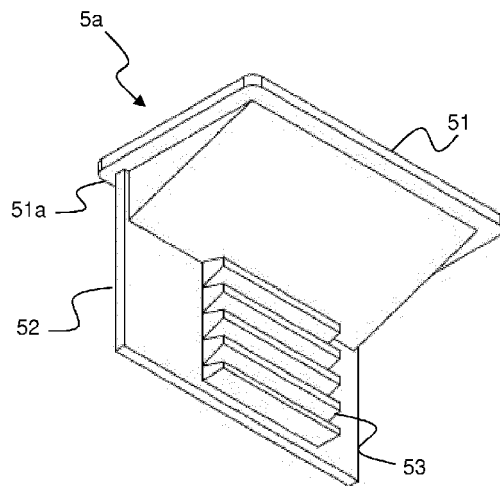


Figure 5a

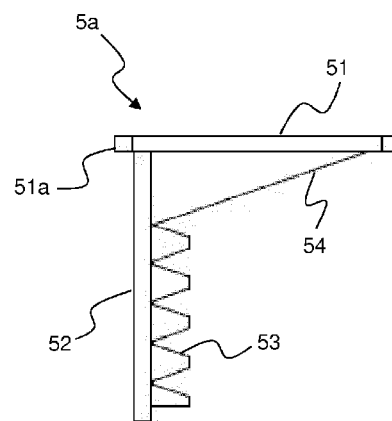
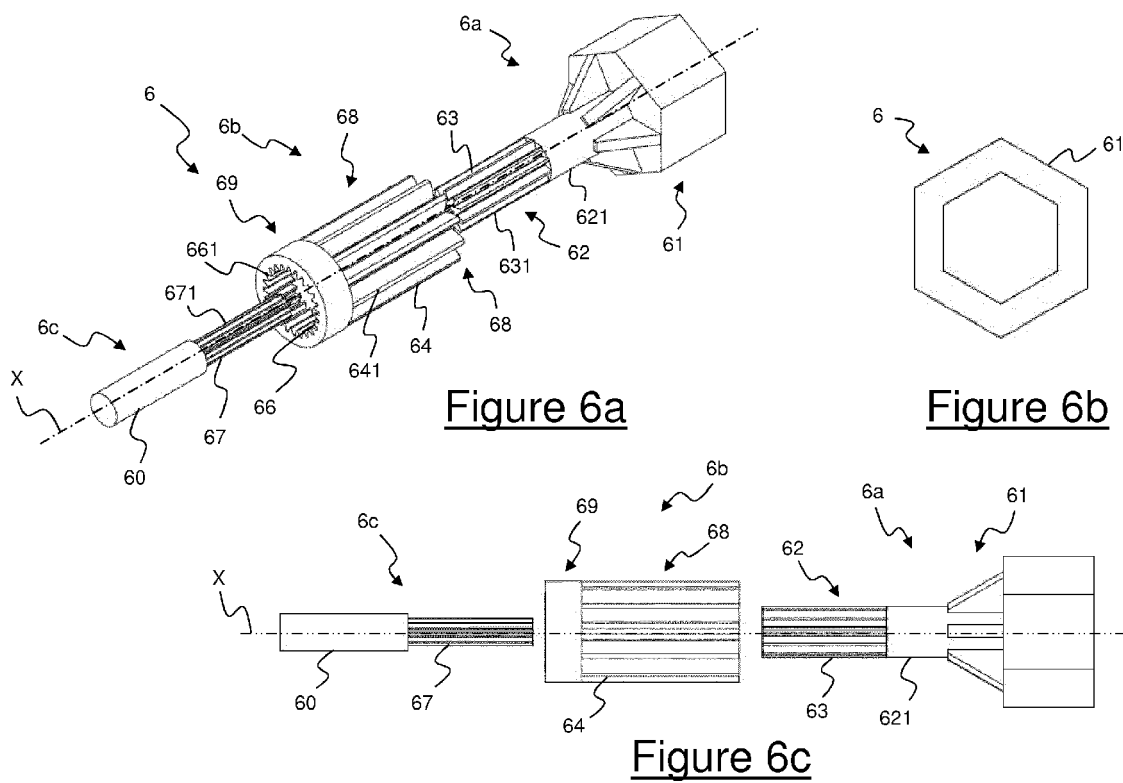


Figure 5b



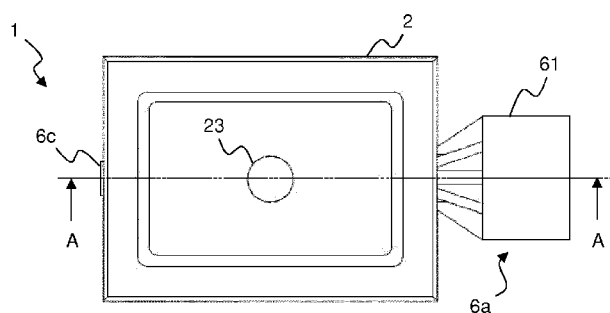


Figure 7a

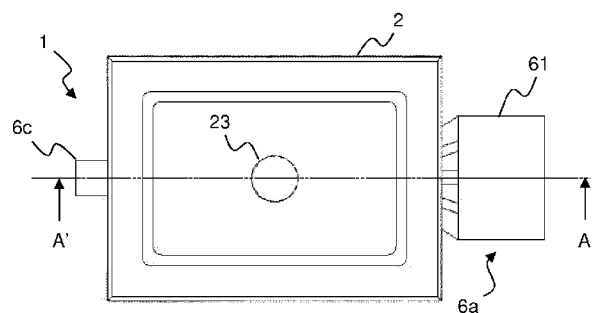


Figure 8a

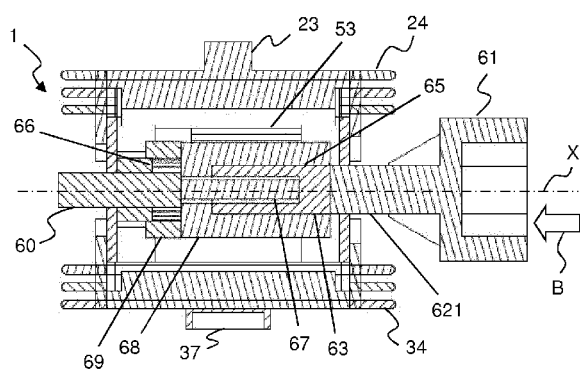


Figure 7b

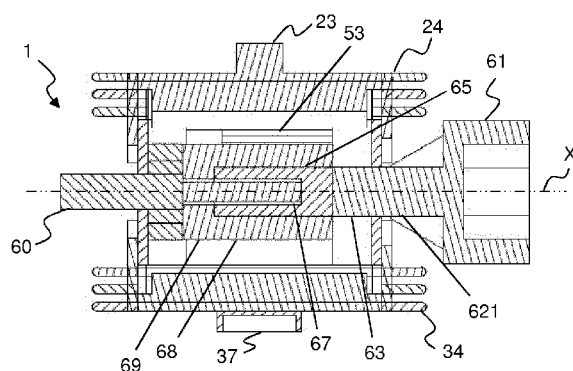


Figure 8b

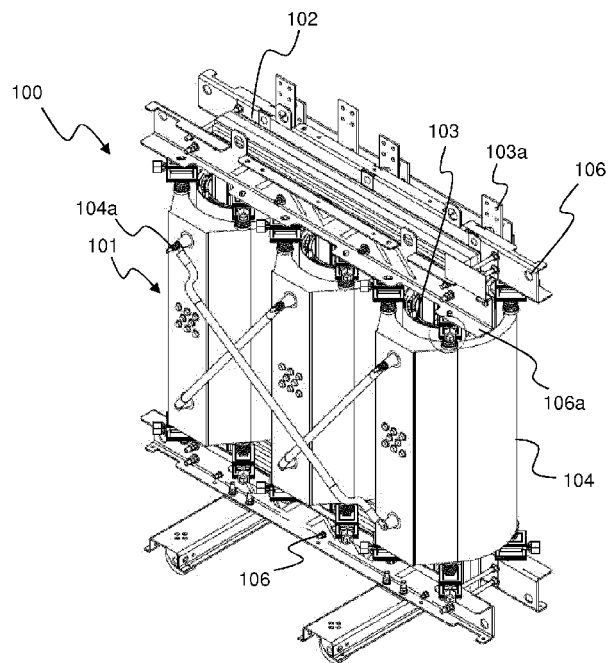


Figure 9a

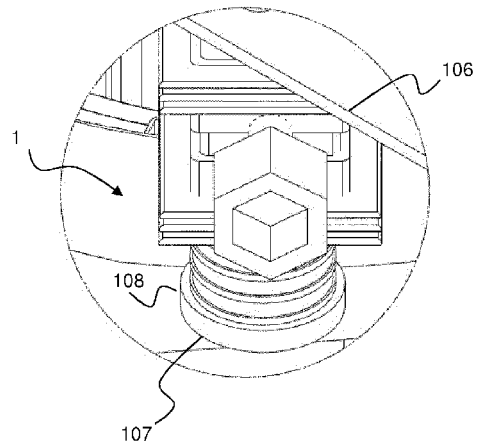


Figure 9b



EUROPEAN SEARCH REPORT

Application Number
EP 12 18 2643

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US H 906 H (BAGGETT FRANKLIN E [US] ET AL) 2 April 1991 (1991-04-02) * abstract * * column 2, lines 7-36 * * figures 1-3 * -----	1-13	INV. H01F27/30
A	EP 1 298 681 A1 (PIOCH SA [FR]) 2 April 2003 (2003-04-02) * abstract * * paragraphs [0037] - [0041] * * figures 1-6 * -----	1-13	
A	EP 2 117 019 A1 (ELETTROMECCANICA DI MARNATE S [IT]) 11 November 2009 (2009-11-11) * abstract * * paragraph [0053] * * figure 13 * -----	1-13	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC) H01F
2	Place of search Munich	Date of completion of the search 12 December 2012	Examiner Winkelmann, André
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	

EPO FORM 1503 03.82 (P04C01)

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

EP 12 18 2643

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

12-12-2012

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US H906	H	02-04-1991	NONE	

EP 1298681	A1	02-04-2003	EP 1298681 A1	02-04-2003
			FR 2830369 A1	04-04-2003

EP 2117019	A1	11-11-2009	NONE	
