(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 480 244 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
22.04.2015 Bulletin 2015/17

(51) Int Cl.:
H01F 27/30 *(2006.01)* ***H01F 38/30*** *(2006.01)*
H01H 83/14 *(2006.01)* *H01H 83/04* *(2006.01)*

(21) Application number: **04076452.4**

(22) Date of filing: **18.05.2004**

(54) **A device for containing current-sensor means**

Vorrichtung zur Aufnahme eines Stromsensors

Dispositif servant à contenir un capteur de courant

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PL PT RO SE SI SK TR

(30) Priority: **20.05.2003 IT BG20030034**

(43) Date of publication of application:
24.11.2004 Bulletin 2004/48

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Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a structure for containing current-sensor means to be used in protection apparatuses for electrical networks, which may be, for example, bipolar or quadripolar circuit breakers or residual-current units appropriately coupled to a circuit-breaking unit.

[0002] It is known that, in low-voltage electrical systems, apparatuses such as the ones mentioned above are widely used to interrupt the current flow in the electrical circuit in which they are employed when a residual current higher than a pre-set threshold value occurs. The purpose of such apparatuses is principally that of guaranteeing an adequate protection of the electrical system and of the loads applied thereto against the small dispersions that usually precede short-circuits. A further, and even more important, purpose is to protect persons from the so-called direct contacts, i.e., accidental contacts with a conductor carrying electric current, specifically with a phase of the circuit, which may be a stripped wire, a broken socket, etc., but also from indirect contacts, i.e., contacts with a conductive body that is normally insulated, such as the casing of an electrical household appliance, which, on account of a fault or failure or a random event, happens to come into contact with a phase of the circuit and is hence at a dangerous voltage.

[0003] Almost all the devices currently employed for said purpose envisage the use of a residual-current sensor, which is constituted in its essential parts, illustrated in Figure 1, by a residual-current transformer having a toroidal core 10, a primary winding, and a secondary winding 15.

[0004] The toroidal core is generally made of mild ferromagnetic material and is usually inserted inside appropriate protection and insulation covers 11. The primary winding is usually formed by conductors 12, referred to as primary conductors, which are typically made of copper and are equal in number to the conductors of the circuit that carries the current to the various loads and appliances. The primary conductors are usually arranged so as to pass within the toroidal core and are electrically connected to the conductors of the electrical circuit.

[0005] The secondary winding is, instead, usually made of a conductor wound around the toroidal core, having its terminals operatively connected to the actuation means of the protection device, which are represented, for example, by a relay designed to actuate a kinematic chain which brings about opening of the electrical circuit and hence interruption of the current flow. These sensor means often comprise also a third winding 70 wound around the toroidal core and used for obtaining an electrical circuit designed to enable the testing of the device.

[0006] At present, residual-current sensors of the above sort, albeit quite satisfactory from the standpoint of operation, present a number of drawbacks linked to industrialization and, in particular, to assembly of the sensors themselves with the other parts constituting the protection apparatus. Optimization of the assembly operations, as is known, represents a particularly important aspect of production since it has a considerable inpact on the final production costs. For this reason, the obvious tendency, also in this sector, is to mechanize and robotize the production lines to the maximum, reducing as much as possible the costs linked to human intervention.

[0007] It is known that the use of automatic machines, such as robots, requires precise and fixed references to enable the correct and reliable repeatability of the operations and hence guarantee proper operation of the end product as well as a high standard of quality thereof.

[0008] However, currently, during insertion of the sensor means in said protection apparatuses, said references become almost completely absent, frequently rendering manual intervention by operators still necessary to ensure proper execution of important operations, such as the welds necessary for connection of the terminals of the secondary winding to the terminals of the relay.

[0009] Usually, in fact, the toroidal cores and the corresponding windings are simply positioned inside the apparatus, usually on the bottom of the containment box thereof, without there being defined, in this way, precise and constant references, for example, on the position of the terminals of the primary winding or of the terminals of the primary conductors. In such conditions, the use of an automatic machine becomes somewhat difficult if not, indeed, even useless.

[0010] The situation is then further complicated in the presence of the aforesaid third winding, which also requires welds that guarantee its connection to the testing circuit. In particular, it should be emphasized how, at present, also positioning of other components of the testing circuit, for example, electrical resistors, frequently proves rather complicated, thus limiting possible automation of the assembly line.

[0011] Another disadvantage of the current system for positioning the sensor means inside the protection apparatuses is linked to the possible movement of the toroidal core with respect to the rest of the apparatus, as a result of the absence of appropriate arrest means which prevent motion thereof. This situation can arise above all in the event of the apparatus itself being turned upside down once the assembly operation is concluded, or else during installation thereof on a vertical wall. Movements of this type are in any case to be avoided in so far as they can lead, for example, to damage of the connections referred to above made on the terminals of the windings.

[0012] **Document** DE4111236 **discloses a known example of containment structure for containing current-sensor means.**

[0013] On the basis of the above considerations, the main task of the present invention is to provide a containment structure for current-sensor means to be used in the production of protection apparatuses for electrical networks which will enable to overcome the drawbacks mentioned above linked to the automation of the opera-

tions of assembly of said sensor means with the other components of the apparatus.

[0014] In the context of the above task, the main purpose of the present invention is to provide a containment structure for current-sensor means which will provide precise references for execution of the connections of the terminals of the various windings used to the parts constituting the protection apparatus.

[0015] A further purpose of the present invention is to provide a containment structure for current-sensor means formed by a small number of components that can be easily assembled together. Another purpose of the present invention is to provide a containment structure for current-sensor means which will enable a secure positioning of the sensor means within the apparatus in such a way as to prevent any relative movement between the parts.

[0016] Not the least important purpose of the present invention is to provide a containment structure for current-sensor means that will present high reliability, relative ease of manufacture and competitive costs.

[0017] The aforesaid tasks, as well as the above and other related purposes that will appear more clearly from what follows, are achieved by a containment structure for current-sensor means to be used for protection apparatuses for electrical networks**, according to the following claim 1.**

[0018] The possibility of stably containing the sensor means in a closed containment structure represents the main advantage of the invention so far as it enables precise and constant references to be obtained for positioning the structure itself inside the apparatus and for execution of the operations of welding of the terminals of the windings with the other parts forming the apparatus.

[0019] Further characteristics and advantages of the invention will emerge more clearly from the description of preferred but non-exclusive embodiments of the containment structure according to the invention, illustrated by way of indicative and non-limiting example in the attached drawings, in which:

- Figure 1 is a perspective view representing current-sensor means according to an embodiment of a traditional type;
- Figures 2a and 2b provide a first perspective view of the two elements constituting a containment structure according to the invention prior to its assembly;
- Figures 3a and 3b provide a second perspective view of the two elements constituting a containment structure according to the invention prior to its assembly;
- Figures 4a and 4b provide perspective views of the union of the two elements constituting a containment structure according to the invention;
- Figure 5 is a perspective view of a containment structure according to the invention to be used for making a bipolar protection apparatus; and
- Figure 6 is a perspective view of a containment structure according to the invention to be used for making a quadripolar protection apparatus.

[0020] With reference to the aforesaid figures, the containment structure 1 according to the invention comprises, within it, current-sensor means 3 formed by a toroidal core 10, a primary winding, and a secondary winding 15.

[0021] The toroidal core 10 is generally made of mild ferromagnetic material and is usually enveloped in appropriate protection covers 11, which ensure a perfect insulation thereof. The primary winding is formed by two primary conductors 12, which are preferably made of copper and are arranged so as to pass within the toroidal core 10, as illustrated in Figure 1. The secondary winding 15 is wound, instead, on the outside of the protection covers 11 of the toroidal core 10.

[0022] The containment structure 1 is obtained with a first containment element 40, which is coupled, via appropriate coupling means, to a second containment element 50 in order to contain the aforesaid current-sensor means 3. Also provided in the two containment elements 40 and 50 are first openings 41 and second openings 42, which enable terminals of the primary conductors 12 and terminals of the secondary winding 15, respectively, to come out.

[0023] Figures 2a, 2b, 3a, and 3b are perspective views of an embodiment of the two containment elements 40 and 50 provided by the invention. In particular, from Figure 3a it may be noted how the first containment element 40 has a substantially prismatic shape, defined externally by a bottom resting surface 43 (not visible in the figures), a front surface 45, a first side wall 47 and a second side wall 48, a top surface 44 substantially opposite to the bottom surface 43, and, finally, a rear surface 49 substantially opposite to the front surface 45. The side surfaces, as appears evident from Figures 2a and 3a, can be advantageously radiused in order to limit any sharp edges of the structure 1 and in order to meet the possible requirements linked to the operations of construction of the first containment component 40. For constructional reasons similar to the ones just mentioned also the bottom surface 43 has an enlarged and reinforced surface so as to enable ease of resting and at the same time guarantee a greater solidity for the structure 1.

[0024] With reference in particular to Figure 2a, the top surface 49 comprises a third opening, which enables insertion of the current-sensor means 3 in an internal cavity 38 made in the first element 40. Advantageously, the internal cavity 38 develops in a direction substantially orthogonal to the front surface 45 and has a configuration such as to enable containment of the toroidal core 10 in such a way that its axis will be substantially orthogonal to the front surface 45.

[0025] With reference to Figures 2b and 3b, the second containment element 50 has, instead, a prevalently flat configuration, basically comprising a front surface 51 and a rear surface 52 substantially opposed to the former.

[0026] Figures 4a and 4b show the union of the two containment elements 40 and 50, according to a pre-

ferred embodiment of the invention. In particular, it may be noted how the rear surface 49 of the first containment element 40 is fitted to the front surface 51 of the second containment element 50. In this way, the second containment element 50 acts, in practice, as lid, enabling the toroidal core to be completely contained within the internal cavity 38 of the first containment element 40.

[0027] With reference, instead, to Figures 2a and 3b, the coupling means which enable union of the two containment elements 40 and 50 can be represented, for example by pins 61 and by geometrically conjugated seats 62 made, respectively, on the rear surface 49 of the first containment element 40 and/or on the front surface 51 of the second containment element 50.

[0028] From Figures 3a and 3b, it is also possible to note the arrangement of the first and second openings 41 and 42 referred to above, according to a preferred embodiment of the invention. In particular, the first openings 41 are made on the front surface 45 of the first element 40 and on the front surface 51 of the second containment element 50, whilst the second openings 42 are made on at least one of the side surfaces 47 and 48. The arrangement of the first openings 41 referred to above is such as to enable the primary conductors 12 of the primary winding to maintain a position substantially concentric to the toroidal core 10 so as to guarantee correct operation of the sensor means 3. In the same way, also the second openings 42 provide a useful and constant reference on the position of the terminals 17 of the secondary winding 15 on the outside of said containment elements 40 and 50 for the automatic machines used for assembly.

[0029] According to the invention, the two containment elements 40 and 50 advantageously comprise also fourth openings that can be used to enable the terminals of a possible third winding 70 to come out, said third winding being used, for example, for providing a testing circuit dedicated to verification of operation of the electrical-protection apparatuses for which there is envisaged the use of sensor means 3. With reference to Figure 3, these fourth openings are preferably made through recesses 105 provided on the rear surface 49 of the first containment element 40.

[0030] In order to provide the aforementioned testing circuit, also other components are normally used, such as electrical resistors designed to simulate a voltage drop, which, in the case of correct operation of the protection circuit, is immediately detected by the sensor means 3. According to the invention, the containment structure 1 conveniently comprises also first means for housing these components, which may be obtained through shaped seats 77 made on the first element 40 and/or on the parts referred to above that jut out therefrom.

[0031] With reference to Figures 3a and 3b, the containment structure 1 advantageously comprises first means for guiding and mutual insulation of the primary conductors 12, which constitute the winding, within the containment elements 40 and 50. These first guide means have, in fact, the purpose of guaranteeing correct operation of the current-sensor means 3, for which the primary conductors 12 are required to be mutually insulated from one another in order to prevent any undesired interaction, as well as being appropriately guided and supported in the stretch of their length that traverses the toroidal core 10 on the inside.

[0032] According to a preferred embodiment of the invention, the above first guiding and mutual-insulation means comprise first internal ends 81, which project from the front surface 45 of the first containment element 40 and from the front surface 51 of the second containment element 50.

[0033] With reference to Figure 3a, the containment structure 1 according to the invention comprises also second guiding and insulation means for the primary conductors 12, on the outside of the two containment elements 40 and 50. These second means can be made, for example, via shapings 82 projecting outwards from the front surface of the first containment element 40 and/or from the rear surface of the second containment element 50. This solution is particularly effective in so far as it enables prevention of any contact between the primary conductors 12 and enables the terminals 13 thereof to reach a well-defined and constant position by means of a simple operation of bending. In this way, said terminals 13 of the primary conductors 12 can be easily connected to the other parts of the protection apparatus in which the structure 1 is inserted.

[0034] Again with the purpose of ensuring correct operation of the current-sensor means 3, the containment structure 1 according to the invention comprises supporting means and/or spacers designed to maintain the toroidal core 10 in the position assumed in the step of its insertion within the containment elements 40 and 50. Said latter supporting means, in fact, enable prevention of any relative displacement of the toroidal core 10 with respect to the cavity 38 in which it is inserted, in the case where said core 10 has an axial thickness of dimensions considerably smaller than the depth of said cavity 38. According to a preferred embodiment, the supporting means comprise second internal ends projecting from the front surface 51 of the second containment element 50. Said second ends (not visible in the figures) develop in a direction substantially orthogonal to said front surface 51 and rest their free ends on the toroidal core, thus preventing axial displacement thereof.

[0035] In order to favour the assembly operations, the containment structure 1 according to the invention comprises means for anchoring said structure, as well as further positioning means designed to simplify and optimize automatic conveyance. The anchoring means can be used, for example, in the assembly step, which envisages the bending of the primary conductors 12 that was referred to previously and will be described in greater detail hereinafter. With reference to Figures 4a and 4b, according to a preferred embodiment of the invention, said an-

choring means comprise anchoring seats 90 made on the front surface 45 of the first containment element 40 and on the rear surface 52 of the second containment element 50.

[0036] The positioning means referred to above, again according to a preferred embodiment of the invention, comprise, instead, centring holes 96 made on the bottom resting surface 43 of the first containment element 40.

[0037] Figure 5 shows a containment structure 1, according to the invention, particularly suited for the construction of bipolar protection apparatuses, whilst Figure 6 regards, instead, a containment structure to be used in quadripolar protection apparatuses. As may be noted, both of the embodiments of the structure 1 comprise second means for housing interface elements 110, which can be advantageously used to provide a rigid outlet in a fixed position for the terminals 17 of the secondary winding 15, in order to enable ease of connection of said terminals 17 to the elements for actuation of the protection apparatus, such as, for example, a relay. These second housing means may preferably be made via a housing pocket 115, positioned outside the first containment element 40 and having a first part 116 projecting from the first containment element 40. Said housing pocket, as may be noted also from Figure 4a, comprises first grooves 120 for insertion of the aforementioned interface elements 110 according to a direction substantially parallel to the one in which the first containment element 40 develops.

[0038] Figure 6 indicates also the presence of a service pocket 130 designed, according to the invention, for housing said interface elements 110 during the step of assembly in which the terminals 17 of the secondary winding 15 are welded to said interface elements 110 and, at the same time, during which the terminals of the third winding 70 are welded to the testing circuit. In particular, said service pocket is made through a second part projecting from the first containment element 40 and has second grooves 140 for insertion of the interface elements 110 in a direction that enables the aforesaid welds to be made on substantially the same plane. A solution of this type leads to considerable advantages in so far as it enables all the connections to be made with just a single operation.

[0039] Again with reference to Figure 6, both containment elements 40 and 50, according to the invention, may comprise also cantilever parts 99, which, as has already been mentioned above, may be used, for example, for housing the components forming the testing circuit. It should be emphasized how said cantilever parts 99 provide a further advantage in so far as they enable positioning of the containment structure 1 inside protection apparatuses of various sizes, in such a way that the interface elements can in any case maintain the same position with respect to the other parts of the apparatus, with evident advantages for the automation of the assembly line.

[0040] The operations of assembly of the containment structure 1 according to the invention may be completely automated. The first operation, in particular, consists in positioning the toroidal core 10 inside the cavity 38 present in the first containment element 40. Subsequently, the interface elements 110 and the components 81 of the circuit are positioned in the corresponding first and second housing means. The terminals 17 of the secondary winding 15 and the terminals 74 of the third winding, through the second openings 42 and the fourth openings 72, are welded, respectively, to the interface elements 110 and to the testing circuit, possibly using the service pocket 130 referred to above. The subsequent operations consist in fitting together the two containment elements 40 and 50 and in the subsequent insertion of the primary conductors 12 inside the elements themselves, by using the first guiding and mutual-insulation means. After anchoring the containment structure 1 using the corresponding anchoring means, there follows the operation of bending of said primary conductors 12, exploiting the action of the second guiding and mutual-insulation means. Finally, the containment structure is then inserted inside the box for containing electrical-protection apparatuses, possibly through the action of the centring holes used for automated conveyance to enable a more stable positioning.

[0041] The technical solutions adopted for the containment structure enable the pre-set tasks and purposes to be fully achieved. In particular, the containment structure is extremely simple and compact and is made up of a reduced number of components. The sensor means are stably contained inside the corresponding containment elements, and the structure itself can be stably inserted inside the electrical-protection device in which it is to be used.

[0042] Assembly of the containment structure is completely automated, as likewise are the operations of conveyance, of insertion of said structure in the protection apparatus, and of connection thereto, owing to the precise and constant references offered by the technical solutions adopted.

Claims

1. A containment structure (1) for containing current-sensor means to be used in protection apparatuses for electrical networks, said sensor means comprising at least:

   - a substantially toroidal core (10), enveloped by corresponding protection covers (11);
   - a primary winding, comprising two or more primary conductors (12) passing inside the toroidal core (10); and
   - a secondary winding (15), wound on the outside of said protection covers (11) of said toroidal core (10);

said containment structure comprising at least a first containment element (40), coupled to a second containment element (50) via corresponding coupling means (60); said containment elements (40, 50) comprising inside them said sensor means and comprising first openings (41) and second openings (42) for enabling terminals (12) of said primary conductors (12) and terminals (17) of said secondary winding (15), respectively, to come out, **characterized in that said first containment element (40) comprises externally a bottom resting surface (43), a front surface (45), a first side wall (47) and a second side wall (48), a top surface (44) opposite to said bottom surface (43), and a rear surface (49) opposite to said front surface (45), said second openings (42) being made on at least one of said side surfaces (47, 48) belonging to said first containment element (40).**

2. The containment structure (1) according to Claim 1, **characterized in that** said toroidal core (10) is completely contained inside said first containment element (40).

3. The containment structure (1) according to Claim 1 or Claim 2, **characterized in that** said first containment element (40) has a substantially prismatic shape with an internal cavity (38) designed to contain said sensor means, said rear surface (49) comprising a third opening for insertion of said sensor means within said internal cavity (38).

4. The containment structure (1) according to Claim 3, **characterized in that** said internal cavity (38) develops in a direction substantially orthogonal to said front surface (45), said internal cavity (38) containing said toroidal core (10) in such a way that its axis will be substantially orthogonal to said front surface (45).

5. The containment structure (1) according to one or more of the preceding claims, **characterized in that** said second containment element (50) has a prevalently flat configuration, comprising a front surface (51) and a rear surface (52) opposed to the former.

6. The containment structure (1) according to one or more of the preceding claims, **characterized in that** said rear surface (49) of said first containment element (40) is coupled to said front surface (51) of said second containment element (50).

7. The containment structure (1) according to Claim 6, **characterized in that** said coupling means (60) comprise pins (61) and geometrically conjugated seats (62) made, respectively, on said rear surface (46) of said first containment element (40) and/or on said front surface (51) of said second containment element (50).

8. The containment structure (1) according to one or more of the preceding claims, **characterized in that** it comprises cantilever parts (99) projecting from said first containment element (40) and/or from said second containment element (50).

9. The containment structure (1) according to Claim 1, **characterized in that** said first openings (41) are made on the front surface (45) of said first element (40) and on the front surface (51) of said second containment element (50),

10. The containment structure (1) according to one or more of the preceding claims, **characterized in that** said containment elements (40, 50) comprise fourth openings for enabling the terminals (74) of a third winding (70) of said toroidal core (10) to come out, said third winding (70) being used for providing a testing circuit (71) for verifying correct operation of said protection apparatus.

11. The containment structure (1) according to Claim 10, **characterized in that** said fourth openings are preferably made through recesses (105) made on said rear surface (46) of said first containment element (40).

12. The containment structure (1) according to Claim 10 or Claim 11, **characterized in that** it comprises first means for housing the components used for providing said testing circuit (71).

13. The containment structure (1) according to Claim 12, **characterized in that** said first housing means comprise said shaped seats (77) made on said first containment element (40) and/or on said cantilever parts (99) projecting from said first containment element (40).

14. The containment structure (1) according to one or more of the preceding claims, **characterized in that** it comprises first means for guiding and mutual insulation of said primary conductors (12) within said containment elements (40, 50).

15. The containment structure (1) according Claim to 14, **characterized in that** said first guiding and mutual-insulation means comprise first internal ends (81), which project from said front surface (45) of said first containment element (40) and from said front surface (51) of said second containment element (50), said first internal ends (81) developing in a direction substantially orthogonal to said front surface (45) and to said front surface (51).

16. The containment structure (1) according to one or more of the preceding claims, **characterized in that** it comprises second guiding and mutual-insulation

means for said conductors on the outside of said containment elements (40, 50).

17. The containment structure (1) according to Claim 16, **characterized in that** said second guiding and mutual-insulation means are made via shapings (82) projecting outwards from the front surface (45) of said first containment element (40) and/or from said rear surface (52) of said second containment element (50).

18. The containment structure (1) according to one or more of the preceding claims, **characterized in that** it comprises means for anchorage of said structure (1).

19. The containment structure (1) according to Claim 18, **characterized in that** said anchoring means comprise anchoring seats (90) made on said front surface (45) of said first containment element (40) and on said rear surface (52) of said second containment element (50).

20. The containment structure (1) according to one or more of the preceding claims, **characterized in that** it comprises supporting means and/or spacers for said toroidal core (10).

21. The containment structure (1) according to Claim 20, **characterized in that** said supporting means and/or spacers comprise second internal ends projecting from said front surface (51) of said second element (50), said second internal ends developing in a direction substantially orthogonal to said front surface (51) and resting their free ends on said toroidal core (10).

22. The containment structure (1) according to one or more of the preceding claims, **characterized in that** it comprises positioning means designed to simplify and optimize automated conveyance during the step of assembly of said protection apparatuses.

23. The containment structure (1) according to Claim 22, **characterized in that** said positioning means comprise centring holes (96) made on said bottom resting surface (43) of said first containment element (40).

24. The containment structure (1) according to Claim 1, **characterized in that** it comprises second means for housing interface elements (110) designed to provide a rigid outlet in a fixed position for said terminals (17) of said secondary winding (15).

25. The containment structure (1) according to Claim 24, **characterized in that** said second housing means comprise at least one housing pocket (115), made on the outside of the first containment element (40), said housing pocket (115) being made through a first part (116) projecting from said first containment element (40) and having first grooves (120) for insertion of said interface elements (110) in a direction substantially parallel to that in which said first containment element (40) develops.

26. The containment structure (1) according to one or more of the preceding claims, **characterized in that** it comprises a service pocket (130) designed for housing said interface elements (110) during the step of welding of said terminals (17) of said second winding (15) to said interface elements (110) and of said terminals of said third winding (74) to said testing circuit, said service pocket (130) being made through a second part projecting from said first containment element (40) and having second grooves (140) for insertion of said interface elements (110) in a direction that enables the aforesaid welds to be made on substantially the same plane.

Patentansprüche

1. Aufnahmestruktur (1) zum Aufnehmen eines Stromsensors zur Verwendung in Schutzvoruchtungen für elektrische Netzwerke, wobei der Sensor mindestens aufweist:

- einen von entsprechenden Schutzabdeckungen (11) umhüllten, im Wesentlichen ringförmigen Kern (10);
- eine Primärwicklung, die zwei oder mehr Primärleiter (12) aufweist, die innerhalb des ringförmigen Kerns (10) verlaufen; und
- eine an der Außenseite der Schutzabdeckungen (11) des ringförmigen Kerns (10) gewickelte Sekundärwicklung (15);

wobei die Aufnahmestruktur mindestens ein erstes Aufnahmeelement (40) aufweist, das über eine entsprechende Kopplungseinrichtung (60) mit einem zweiten Aufnahmeelement (50) gekoppelt ist;
wobei die Aufnahmeelemente (40, 50) in ihrem Inneren den Sensor aufweisen und erste Öffnungen (41) und zweite Öffnungen (42) aufweisen, um den Austritt der Anschlüsse (12) der Primärleiter (12) bzw. der Anschlüsse (17) der Sekundärwicklung (15) zu ermöglichen, **dadurch gekennzeichnet, dass** das erste Aufnahmeelement (40) außen eine untere Auflagefläche (43), eine vordere Fläche (45), eine erste Seitenwand (47) und eine zweite Seitenwand (48), eine gegenüber der unteren Fläche (43) angeordnete obere Fläche (44) und eine gegenüber der vorderen Fläche (45) angeordnete hintere Fläche (49) aufweist, wobei die zweiten Öffnungen (42) an mindestens einer der Seitenflächen (47, 48) gebildet sind, die zu dem ersten Aufnahmeelement (40)

gehören.

2. Aufnahmestruktur (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** der ringförmige Kern (10) vollständig in dem ersten Aufnahmeelement (40) aufgenommen ist.

3. Aufnahmestruktur (1) nach Anspruch 1 oder Anspruch 2, **dadurch gekennzeichnet, dass** das erste Aufnahmeelement (40) im Wesentlichen die Form eines Prismas hat und eine Innenausnehmung (38) aufweist, die dafür ausgelegt ist, den Sensor aufzunehmen, wobei die hinteren Fläche (49) eine dritte Öffnung zum Einfügen des Sensors in die Innenausnehmung (38) aufweist.

4. Aufnahmestruktur (1) nach Anspruch 3, **dadurch gekennzeichnet, dass** sich die Innenausnehmung (38) in eine zu der vorderen Fläche (45) im Wesentlichen orthogonale Richtung erstreckt, wobei die Innenausnehmung (38) den ringförmigen Kern (10) derart aufnimmt, dass dessen Achse im Wesentlichen orthogonal zu der vorderen Fläche (45) verläuft.

5. Aufnahmestruktur (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das zweite Aufnahmeelement (50) eine vorwiegend flache Konfiguration hat und eine vordere Fläche (51) und eine dieser gegenüberliegende hintere Fläche (52) aufweist.

6. Aufnahmestruktur (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die hintere Fläche (49) des ersten Aufnahmeelements (40) mit der vorderen Fläche (51) des zweiten Aufnahmeelements (50) gekoppelt ist.

7. Aufnahmestruktur (1) nach Anspruch 6, **dadurch gekennzeichnet, dass** die Kopplungseinrichtung (60) Stifte (61) und geometrisch konjugierte Sitze (62) aufweist, die an der hinteren Fläche (46) des ersten Aufnahmeelements (40) und/oder an der vorderen Fläche (51) des zweiten Aufnahmeelements (50) gebildet sind.

8. Aufnahmestruktur (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie Auskragungsteile (99) aufweist, die von dem ersten Aufnahmeelement (40) und/oder dem zweiten Aufnahmeelement (50) hervorragen.

9. Aufnahmestruktur (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die ersten Öffnungen (41) an der vorderen Fläche (45) des ersten Elements (40) und an der vorderen Fläche (51) des zweiten Aufnahmeelements (50) gebildet sind.

10. Aufnahmestruktur (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Aufnahmeelemente (40, 50) vierte Öffnungen aufweisen, um den Austritt der Anschlüsse (74) einer dritten Wicklung (70) des ringförmigen Kerns (10) zu ermöglichen, wobei die dritte Wicklung (70) zur Schaffung einer Testschaltung (71) zum Überprüfen des korrekten Betriebs der Schutzvorrichtung verwendet wird.

11. Aufnahmestruktur (1) nach Anspruch 10, **dadurch gekennzeichnet, dass** die vierten Öffnungen vorzugsweise durch Vertiefungen (105) gebildet sind, die an der hinteren Fläche (46) des ersten Aufnahmeelements (40) gebildet sind.

12. Aufnahmestruktur (1) nach Anspruch 10 oder Anspruch 11, **dadurch gekennzeichnet, dass** sie eine erste Gehäuseeinrichtung für die Komponenten aufweist, die zur Schaffung der Testschaltung (71) verwendet werden.

13. Aufnahmestruktur (1) nach Anspruch 12, **dadurch gekennzeichnet, dass** die erste Gehäuseeinrichtung geformte Sitze (77) aufweist, die an dem ersten Aufnahmeelement (40) und/oder an den von dem ersten Aufnahmeelement (40) hervorragenden Auskragungsteilen (99) gebildet sind.

14. Aufnahmestruktur (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine erste Einrichtung zum Führen und gegenseitigen Isolieren der Primärleiter (12) innerhalb der Aufnahmeelemente (40, 50) aufweist.

15. Aufnahmestruktur (1) nach Anspruch 14, **dadurch gekennzeichnet, dass** die erste Einrichtung zum Führen und gegenseitigen Isolieren erste innere Enden (81) aufweist, die von der vorderen Fläche (45) des ersten Aufnahmeelements (40) und von der vorderen Fläche (51) des zweiten Aufnahmeelements (50) hemorragen, wobei die ersten inneren Enden (81) sich in eine Richtung erstrecken, die im Wesentlichen orthogonal zu der vorderen Fläche (45) und der vorderen Fläche (51) verläuft.

16. Aufnahmestruktur (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine zweite Einrichtung zum Führen und gegenseitigen Isolieren für die Leiter auf der Außenseite der Aufnahmeelemente (40, 50) aufweist.

17. Aufnahmestruktur (1) nach Anspruch 16, **dadurch gekennzeichnet, dass** die zweite Einrichtung zum Führen und gegenseitigen Isolieren durch Formungen (82) gebildet ist, die von der vorderen Fläche (45) des ersten Aufnahmeelements (40) und/oder

von der hinteren Fläche (52) des zweiten Aufnahmeelements (50) nach außen hervorragen.

18. Aufnahmestruktur (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine Einrichtung zur Verankerung der Struktur (1) aufweist.

19. Aufnahmestruktur (1) nach Anspruch 18, **dadurch gekennzeichnet, dass** die Verankerungseinrichtung an der vorderen Fläche (45) des ersten Aufnahmeelements (40) und an der hinteren Fläche (52) des zweiten Aufnahmeelements (50) gebildete Verankerungssitze (90) aufweist.

20. Aufnahmestruktur (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine Trägereinrichtung und/oder Abstandshalter für den ringförmigen Kern (10) aufweist.

21. Aufnahmestruktur (1) nach Anspruch 20, **dadurch gekennzeichnet, dass** die Trägereinrichtung und/oder die Abstandshalter zweite innere Enden aufweisen, die von der vorderen Fläche (51) des zweiten Elements (50) hervorragen, wobei sich die zweiten inneren Enden in einer zu der vorderen Fläche (51) im Wesentlichen orthogonalen Richtung erstrecken und mit ihren freien Enden auf dem ringförmigen Kern (10) aufliegen.

22. Aufnahmestruktur (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine Positionierungseinrichtung aufweist, die dafür ausgelegt ist, den automatisierten Transport während des Schrittes der Montage der Schutzvorrichtungen zu vereinfachen und zu optimieren.

23. Aufnahmestruktur (1) nach Anspruch 22, **dadurch gekennzeichnet, dass** die Positionierungseinrichtung an der unteren Auflagefläche (43) des ersten Aufnahmeelements (40) gebildete Zentrierbohrungen (96) aufweist.

24. Aufnahmestruktur (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** sie eine zweite Gehäuseeinrichtung für Schnittstellenelemente (110) aufweist, die dafür ausgelegt ist, einen starren Auslass in einer fixierten Position für die Anschlüsse (17) der Sekundärwicklung (15) zu schaffen.

25. Aufnahmestruktur (1) nach Anspruch 24, **dadurch gekennzeichnet, dass** die zweite Gehäuseeinrichtung mindestens eine Gehäusetasche (115) aufweist, die an der Außenseite des ersten Aufnahmeelements (40) gebildet ist, wobei die Gehäusetasche (115) durch einen ersten Teil (116) gebildet ist, der von dem ersten Aufnahmeelement (40) hervorragt und erste Ausnehmungen (120) zum Einfügen der Schnittstellenelemente (110) in eine Richtung hat, die zu derjenigen, in die sich das erste Aufnahmeelement (40) erstreckt, im Wesentlichen parallel verläuft.

26. Aufnahmestruktur (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine Montagetasche (130) aufweist, die dafür ausgelegt ist, die Schnittstellenelemente (110) während des Schrittes des Schweißens der Anschlüsse (17) der zweiten Wicklung (15) an die Schnittstellenelemente (110) und der Anschlüsse der dritten Wicklung (74) an die Testschaltung aufzunehmen, wobei die Montagetasche (130) durch einen zweiten Teil gebildet ist, der von dem ersten Aufnahmeelement (40) hemorragt und zweite Ausnehmungen (140) zum Einfügen der Schnittstellenelemente (110) in einer Richtung hat, die es ermöglicht, dass die oben genannten Schweißungen im Wesentlichen in der gleichen Ebene erfolgen.

Revendications

1. Structure de confinement (1) pour contenir des moyens formant capteur de courant à utiliser dans des appareils de protection pour des réseaux électriques, lesdits moyens formant capteur comprenant au moins:

- un noyau sensiblement toroïdal (10), enveloppé par des capots de protection (11) correspondants;
- un enroulement primaires, comprenant deux conducteurs primaires (12) ou plus passant à l'intérieur du noyau toroïdal (10); et
- un enroulement secondaire (15), enroulé sur l'extérieur desdits capots de protection (11) dudit noyau toroïdal (10);

ladite structure de confinement comprenant au moins un premier élément de confinement (40), accouplé à un deuxième élément de confinement (50) par l'intermédiaire de moyens d'accouplement (60) correspondants;
lesdits éléments de confinement (40, 50) comprenant, à l'intérieur de ceux-ci, lesdits moyens formant capteur et comprenant des premières ouvertures (41) et des deuxièmes ouvertures (42) pour permettre la sortie des bornes (12) desdits conducteurs primaires (12) et des bornes (17) dudit enroulement secondaire (15), respectivement, **caractérisée en ce que** ledit premier élément de confinement (40) comprend, extérieurement, une surface d'appui inférieure (43), une surface avant (45), une première paroi latérale (47) et une deuxième paroi latérale

(48), une surface supérieure (44) opposée à ladite surface inférieure (43), et une surface arrière (49) opposée à ladite surface avant (45), lesdites deuxièmes ouvertures (42) étant réalisées sur au moins l'une desdites surfaces latérales (47, 48) appartenant au dit premier élément de confinement (40).

2. Structure de confinement (1) selon la revendication 1, **caractérisée en ce que** ledit noyau toroïdal (10) est complètement contenu à l'intérieur dudit premier élément de confinement (40).

3. Structure de confinement (1) selon la revendication 1 ou la revendication 2, **caractérisée en ce que** ledit premier élément de confinement (40) a une forme sensiblement prismatique avec une cavité interne (38) conçue pour contenir lesdits moyens formant capteur, ladite surface arrière (49) comprenant une troisième ouverture pour l'insertion desdits moyens formant capteur dans ladite cavité interne (38).

4. Structure de confinement (1) selon la revendication 3, **caractérisée en ce que** ladite cavité interne (38) se développe dans une direction sensiblement orthogonale à ladite surface avant (45), ladite cavité interne (38) contenant ledit noyau toroïdal (10) de manière à ce que son axe soit sensiblement orthogonal à ladite surface avant (45).

5. Structure de confinement (1) selon une ou plusieurs des revendications précédentes, **caractérisée en ce que** ledit deuxième élément de confinement (50) a une configuration principalement plate, comprenant une surface avant (51) et une surface arrière (52) opposée à la première.

6. Structure de confinement (1) selon une ou plusieurs des revendications précédentes, **caractérisée en ce que** ladite surface arrière (49) dudit premier élément de confinement (40) est accouplée à ladite surface avant (51) dudit deuxième élément de confinement (50).

7. Structure de confinement (1) selon la revendication 6, **caractérisée en ce que** lesdits moyens d'accouplement (60) comprennent des broches (61) et des sièges géométriquement conjugués (62) réalisés, respectivement, sur ladite surface arrière (46) dudit premier élément de confinement (40) et/ou sur ladite surface avant (51) dudit deuxième élément de confinement (50).

8. Structure de confinement (1) selon une ou plusieurs des revendications précédentes, **caractérisée en ce qu'**elle comprend des parties en porte-à-faux (99) faisant saillie dudit premier élément de confinement (40) et/ou dudit deuxième élément de confinement (50).

9. Structure de confinement (1) selon la revendication 1, **caractérisée en ce que** lesdites premières ouvertures (41) sont réalisées sur la surface avant (45) dudit premier élément (40) et sur la surface avant (51) dudit deuxième élément de confinement (50).

10. Structure de confinement (1) selon une ou plusieurs des revendications précédentes, **caractérisée en ce que** lesdits éléments de confinement (40, 50) comprennent des quatrièmes ouvertures pour permettre la sortie des bornes (74) d'un troisième enroulement (70) dudit noyau toroïdal (10), ledit troisième enroulement (70) étant utilisé pour réaliser un circuit de test (71) pour vérifier le fonctionnement correct dudit appareil de protection.

11. Structure de confinement (1) selon la revendication 10, **caractérisée en ce que** lesdites quatrièmes ouvertures sont de préférence réalisées à travers des évidements (105) réalisés sur ladite surface arrière (46) dudit premier élément de confinement (40).

12. Structure de confinement (1) selon la revendication 10 ou la revendication 11, **caractérisée en ce qu'**elle comprend des premiers moyens pour recevoir les composants utilisés pour réaliser ledit circuit de test (71).

13. Structure de confinement (1) selon la revendication 12, **caractérisée en ce que** lesdits premiers moyens de logement comprennent lesdits sièges formés (77) réalisés sur ledit premier élément de confinement (40) et/ou sur lesdites parties en porte-à-faux (99) faisant saillie dudit premier élément de confinement (40).

14. Structure de confinement (1) selon une ou plusieurs des revendications précédentes, **caractérisée en ce qu'**elle comprend des premiers moyens pour le guidage et l'isolement mutuel desdits conducteurs primaires (12) dans lesdits éléments de confinement (40, 50).

15. Structure de confinement (1) selon la revendication 14, **caractérisée en ce que** lesdits premiers moyens de guidage et d'isolement mutuel comprennent des premières extrémités internes (81), qui font saillie de ladite surface avant (45) dudit premier élément de confinement (40) et de ladite surface avant (51) dudit deuxième élément de confinement (50), lesdites premières extrémités internes (81) se développant dans une direction sensiblement orthogonale à ladite surface avant (45) et à ladite surface avant (51).

16. Structure de confinement (1) selon une ou plusieurs des revendications précédentes, **caractérisée en ce qu'**elle comprend des deuxièmes moyens de guidage et d'isolement mutuel pour lesdits conducteurs

à l'extérieur desdits éléments de confinement (40, 50).

17. Structure de confinement (1) selon la revendication 16, **caractérisée en ce que** lesdits deuxièmes moyens de guidage et d'isolement mutuel sont réalisés par l'intermédiaire de profils (82) faisant saillie à l'extérieur de la surface avant (45) dudit premier élément de confinement (40) et/ou de ladite surface arrière (52) dudit deuxième élément de confinement (50).

18. Structure de confinement (1) selon une ou plusieurs des revendications précédentes, **caractérisée en ce qu'**elle comprend des moyens pour l'ancrage de ladite structure (1).

19. Structure de confinement (1) selon la revendication 18, **caractérisée en ce que** lesdits moyens d'ancrage comprennent des sièges d'ancrage (90) réalisés sur ladite surface avant (45) dudit premier élément de confinement (40) et sur ladite surface arrière (52) dudit deuxième élément de confinement (50).

20. Structure de confinement (1) selon une ou plusieurs des revendications précédentes, **caractérisée en ce qu'**elle comprend des moyens de support et/ou des éléments d'espacement pour ledit noyau toroïdal (10).

21. Structure de confinement (1) selon la revendication 20, **caractérisée en ce que** lesdits moyens de support et/ou lesdits éléments d'espacement comprennent des deuxièmes extrémités internes faisant saillie de ladite surface avant (51) dudit deuxième élément (50), lesdites deuxièmes extrémités internes se développant dans une direction sensiblement orthogonale à ladite surface avant (51) et appuyant leurs extrémités libres sur ledit noyau toroïdal (10).

22. Structure de confinement (1) selon une ou plusieurs des revendications précédentes, **caractérisée en ce qu'**elle comprend des moyens de positionnement conçus pour simplifier et optimiser le transport automatisé pendant l'étape d'assemblage desdits appareils de protection.

23. Structure de confinement (1) selon la revendication 22, **caractérisée en ce que** lesdits moyens de positionnement comprennent des trous de centrage (96) réalisés sur ladite surface d'appui inférieure (43) dudit premier élément de confinement (40).

24. Structure de confinement (1) selon la revendication 1, **caractérisée en ce qu'**elle comprend des deuxièmes moyens pour recevoir des éléments d'interface (110) conçus pour réaliser une sortie rigide dans une position fixe pour lesdites bornes (17) dudit enroulement secondaire (15).

25. Structure de confinement (1) selon la revendication 24, **caractérisée en ce que** lesdits deuxièmes moyens de logement comprennent au moins une poche de logement (115), réalisée sur l'extérieur du premier élément de confinement (40), ladite poche de logement (115) étant réalisée à travers une première partie (116) faisant saillie dudit premier élément de confinement (40) et comportant des premières rainures (120) pour l'insertion desdits éléments d'interface (110) dans une direction sensiblement parallèle à celle dans laquelle ledit premier élément de confinement (40) se développe.

26. Structure de confinement (1) selon une ou plusieurs des revendications précédentes, **caractérisée en ce qu'**elle comprend une poche de service (130) conçue pour recevoir lesdits éléments d'interface (110) pendant l'étape de soudage desdites bornes (17) dudit deuxième enroulement (15) aux dits éléments d'interface (110) et desdites bornes dudit troisième enroulement (74) au dit circuit de test, ladite poche de service (130) étant réalisée à travers une deuxième partie faisant saillie dudit premier élément de confinement (40) et comportant des deuxièmes rainures (140) pour l'insertion desdits éléments d'interface (110) dans une direction qui permet la réalisation des soudures susmentionnées sensiblement dans le même plan.

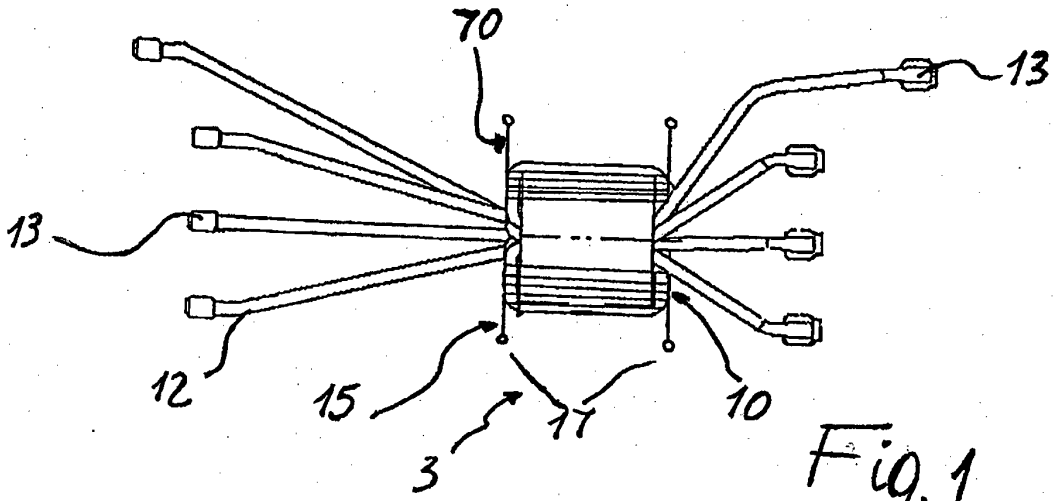


Fig. 1

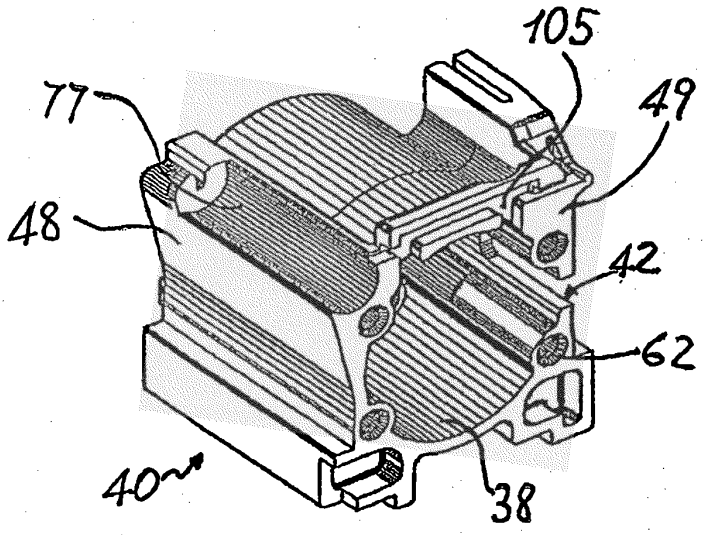


Fig. 2a

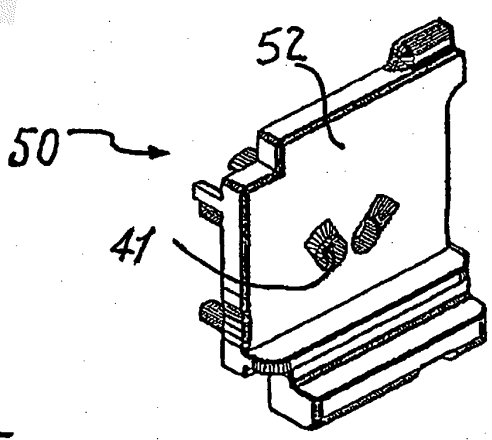


Fig. 2b

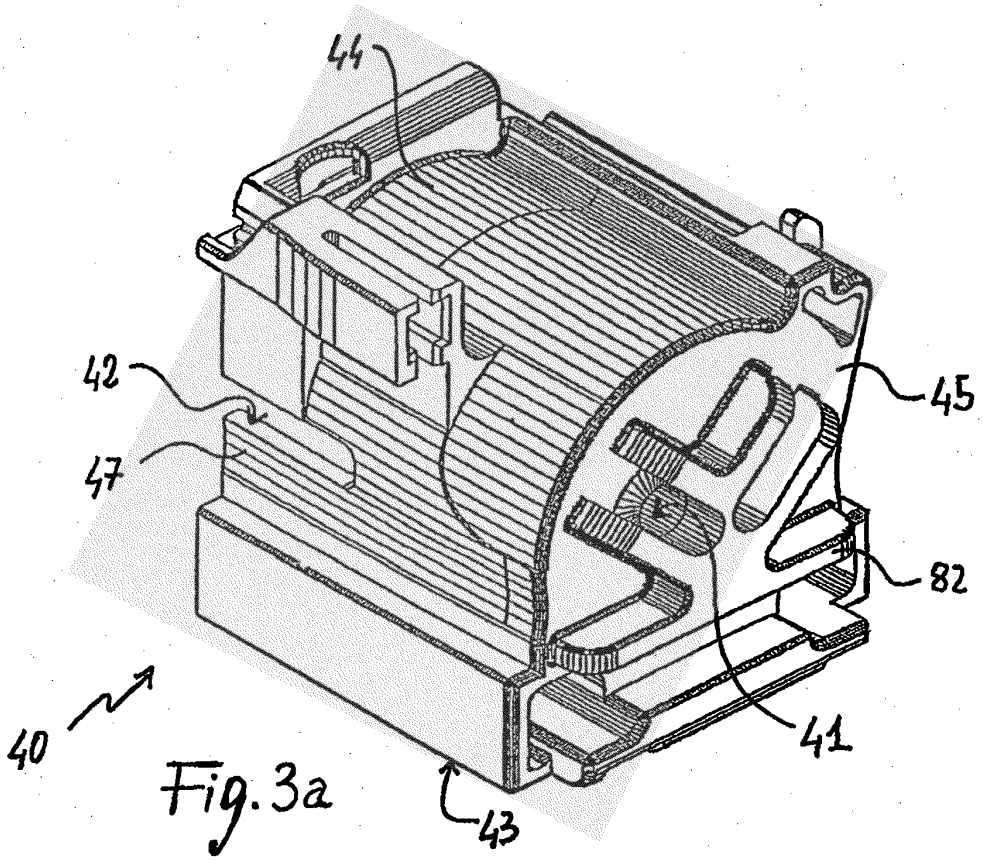


Fig.3a

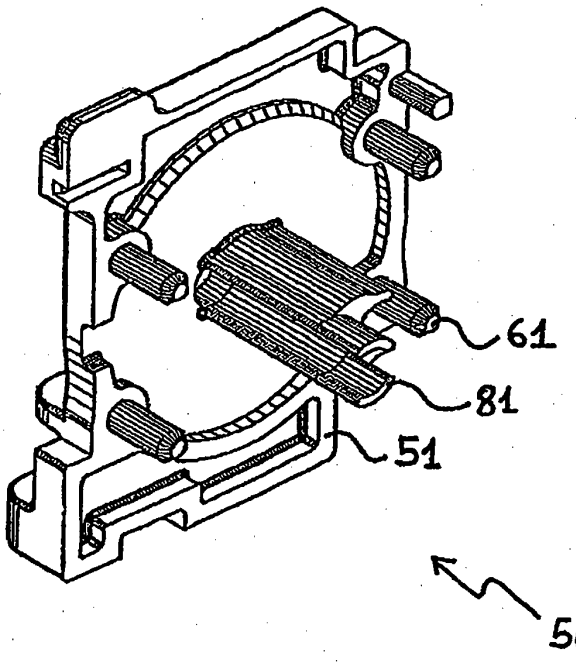


Fig.3b

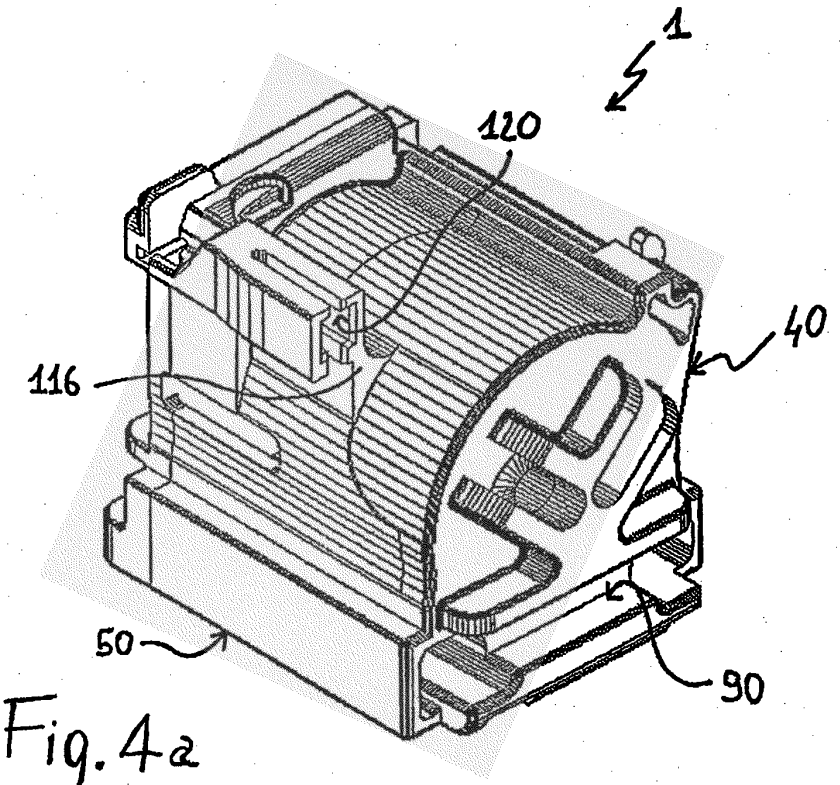


Fig. 4a

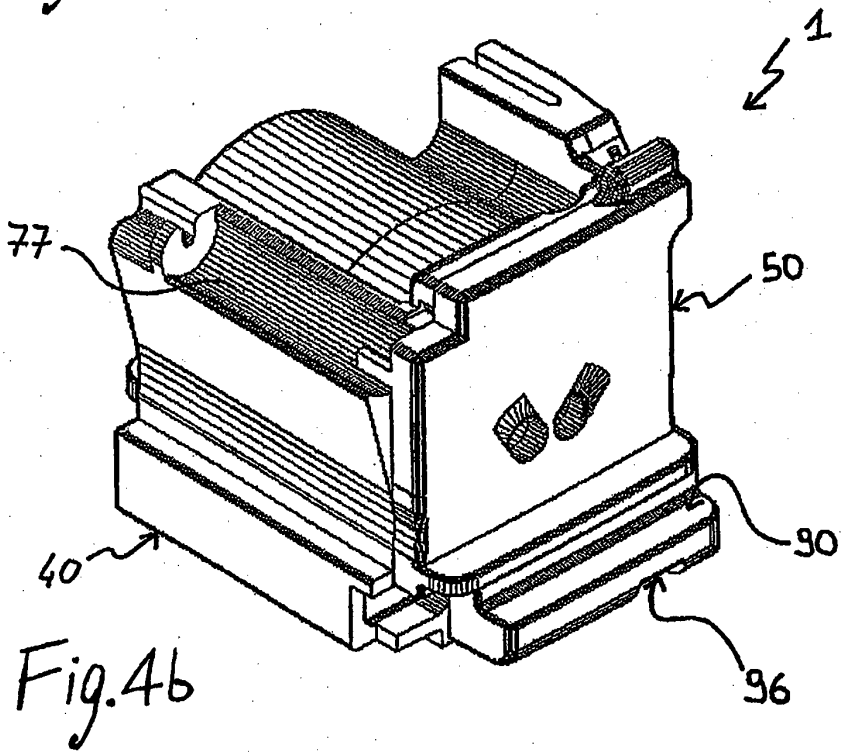


Fig. 4b

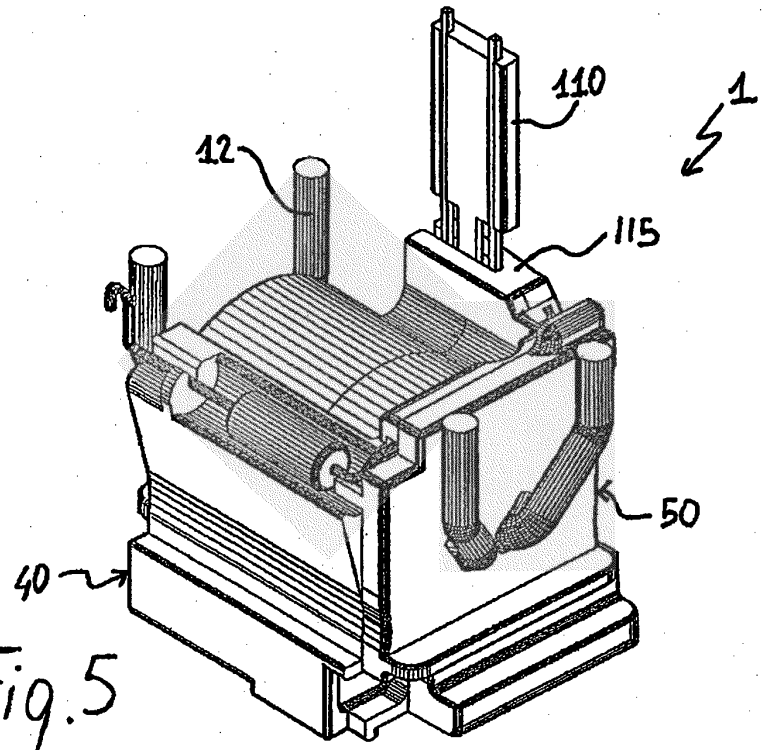


Fig.5

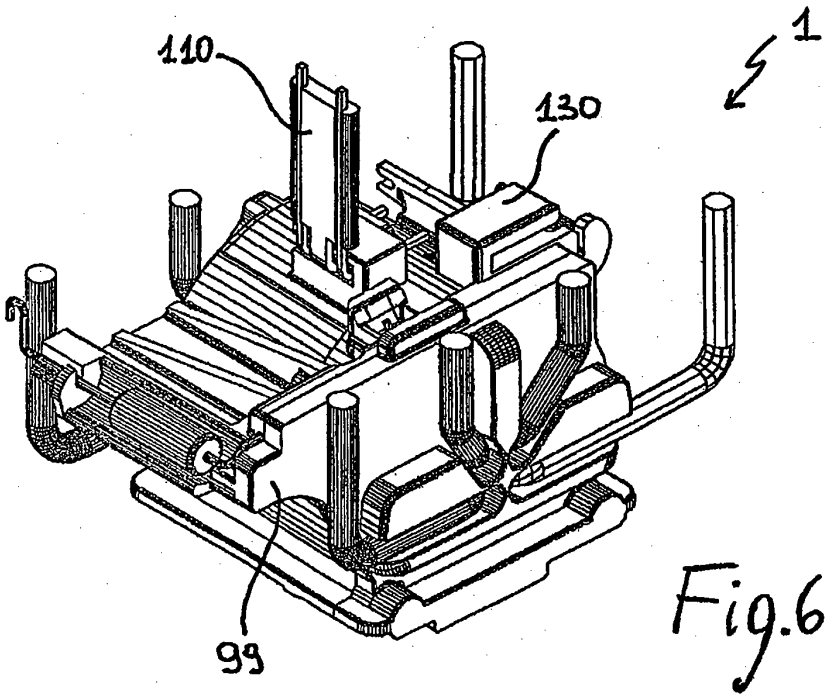


Fig.6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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