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(54) **BASE ELEMENT TO CARRY AN INSULATING COLUMN AND A HEAD OF A CURRENT TRANSFORMER**

(57) The invention relates to a base element (4) for a current transformer (1), to carry an extremity of an insulating column (3) of the transformer which carries a head (2) of the transformer (1), this base element (4) comprising:

- a plurality of electric epoxy resin bushings (21) carrying each a corresponding secondary lead (18) comprising each a portion extending out of the base and a portion extending in the base ;

- a plurality of outer plugs (14) comprising each a portion extending out of the base and a portion extending in the base ;

- a plurality of wires extending in the base, each wire connecting a secondary lead to a corresponding plug ;

According to the invention, the portion of the secondary leads extending in the base, the portions of the plugs extending in the base and the wires are embedded in a block of cast material.

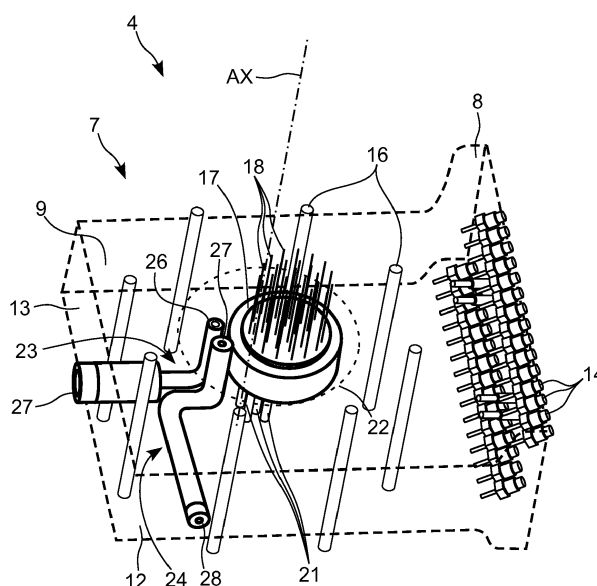


FIG. 4

Description

TECHNICAL FILED

[0001] The invention relates to a current transformer also called instrument transformer, which is used for the purpose of measuring an alternating electric current of an electric line transferring current having high intensity, and under high voltage, such as for example a power line conveying the electric current of a power plant to a town.

STATE OF PRIOR ART

[0002] The alternating main current traversing the head of the transformer generates an orthoradial magnetic field in its surrounding. This alternating magnetic field which extends along circular field lines into the toroidal core generates in the winding wrapped around this toroidal core, the current which is output by the transformer.

[0003] When wanting to measure electric currents having an intensity of several hundreds of amperes, it is not possible to install a current sensor directly to the line, since common current sensors are not able to sustain such high levels of intensity.

[0004] For this reason, a current transformer is used to convert linearly at fixed rate the main current carried by the line into an output current having a lower intensity. The conversion rate can be for example 400/5, converting a main current of 400 amperes to 5 amperes, which means that if the effective main current present in the line is of for example 200 amperes, the output of the transformer will be 2.5 amperes.

[0005] A current sensors connected to the output of the transformer can be used to determine the intensity of the current output by the transformer, and to deduce the intensity of the current of the power line.

[0006] Concretely, such current transformer comprises a head which is traversed by the current of the power line, and a hollow insulating column which carries this head, this hollow insulating column being carried by a base element. The head comprises a toroidal magnetic core which surrounds the path of the current of the line, and a winding is rolled onto this magnetic core, this winding is connected to electrical conductors which extend in the hollow insulating column, from the head to the base element. The current sensor is connected to corresponding connectors, at the base of the transformer.

[0007] To ensure electrical insulation of the inner electrical parts, the head and the hollow insulating column of the transformer are filed with oil. A diaphragm secured to the top of the head allows thermal expansion of this oil to ensure that the pressure of the oil does not increase when temperature is raising.

[0008] The base element of the transformer carries the full load of the head, the hollow insulating column with the components and the oil filled therein, with additional weight resulting from wind and from the mechanical

stress of the cables of the main line secured to the head. Moreover this base element has to be designed to sustain seismic situations.

[0009] Practically, this base element comprises a base plate, pedestals, multiple epoxy resin cast bushings with corresponding independent oil sealings to allow electrical conductors connected to the wirings of the head to pass from the inner space filled with oil to the external region of the transformer.

[0010] Since such a current transformer can comprise several magnetic cores with several windings each, the number of resin bushings can be important, resulting in a complex arrangement to be carried by this base element into a relatively small space.

PRESENTATION OF THE INVENTION

[0011] The invention relates to a base element for a current transformer, to carry a lower extremity of an insulating column of the transformer secured to this base element, this insulating column carrying a head of the transformer at its opposite extremity, this base element comprising:

- a plurality of plugs comprising each a portion extending out of a face of the base element ;
- a plurality of electric epoxy resin bushings carrying each a corresponding secondary lead, each secondary lead comprising a portion extending out of a face of the base element to be electrically connected in the insulating column ;
- a plurality of wires connecting each a secondary lead to a corresponding plug ;
- a plurality of securing means such as studs or bolts comprising each a portion extending out of a face of the base element for securing the insulating column to the base element,

characterized in that it comprises a block of cast material, the secondary leads, the plugs and the securing means, comprising each a portion which is embedded into this block of cast material, the wires connecting each a secondary lead to a corresponding plug being embedded in this block of cast material.

[0012] With this solution, the base element can be obtained in a simple manufacturing process since it is not necessary to produce a metallic structure made of several parts machined and assembled together. The production cost is greatly reduced.

[0013] The invention also relates to a base element as defined above, wherein the cast material, is a polymer resin or a polymer concrete material or an epoxy resin.

[0014] The invention also relates to a base element as defined above, comprising an oil drain which is embedded in the block of cast material.

[0015] The invention also relates to a base element as defined above, comprising a capacitance tap which is embedded in the block of cast material.

[0016] The invention also relates to a base element as defined above, wherein the means for securing the insulating column to the base element are studs extending each through the thickness of the block of cast material of this base element.

[0017] The invention also relates to a current transformer comprising a base element as defined above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

Figure 1 is a general view of a current transformer comprising a base element according to the invention;

Figure 2 is a perspective view showing front face of the base element of the current transformer according to the invention;

Figure 3 is a perspective view showing the side of base element of the current transformer according to the invention;

Figure 4 is a perspective view showing the arrangement of the inner components of the base element of the transformer according to the invention.

DETAILED PRESENTATION OF PARTICULAR EMBODIMENTS

[0019] As seen in figure 1, the current transformer marked as 1 comprising a base element according to the invention, extends along a main vertical direction noted AX. It comprises a head 2 at its top carried by a hollow insulating column 3 extending along the AX direction, which is carried by a base element 4, this base element 4 being secured onto a channel connector 6.

[0020] This transformer comprises an inner space extending from the housing of its head 2 to the hollow insulating column 3 which communicate together. The head 2 encloses, in its external metallic housing, six toroidal magnetic cores comprising each five windings which are not visible in the drawings. A central conductor crossing the housing of the head is arranged to extend through these magnetic cores, this central conductor is to be connected to the main electrical current line to be traversed by the main electrical current, in order to induce corresponding currents in the windings of the toroidal magnetic cores.

[0021] Each of the windings of the toroidal cores are located in the head, and are connected to the base element 4 of the transformer by corresponding wires which extend into the hollow insulating column 3 along all of the length of this column.

[0022] To ensure proper electrical insulation of these inner components, a main insulator, which is not visible on the drawings, made of a significant thickness of wrapped paper surrounds the magnetic cores of the head and the wires extending in the hollow column. The portion of the main insulator which extends in the hollow column

corresponds to an electrical capacitive bushing. Additionally, all the inner space of the transformer is filled with electrical insulating oil.

[0023] At the level of the bottom of the insulating column 3, the inner electrical wires connected to the wirings of the magnetic cores cross the frontier of the inner space filled with oil, to reach the outer space of the transformer in order to be connected to the corresponding measuring instruments or devices. This frontier corresponds to the junction of the lower extremity of the hollow column 3 with the upper face of the base element 4 to which this lower extremity is secured.

[0024] As seen more clearly in figures 2 and 3, the base element 4 comprises a main portion 7 having an outer parallelepiped shape and a front panel 8 generally rectangular. The main portion 7 is delimited by an upper face 9, a lower face 11, two lateral face one of which being visible and marked as 12, a back face 13 and a front face. The front panel 8 has greater dimensions than the front face of the main portion 7, and it has the same orientation as the front face, i.e. parallel to the back face 13.

[0025] As seen in figure 2, the front panel comprises at its front face a series of thirty electrical plugs marked as 14 extending each out of a main face 15 of the front panel 8. Each of these electrical plugs 14 is connected to one of the windings of the magnetic toroidal cores of the head of the transformer. At site, depending on the measures which are to be achieved on the main electrical current, several of these plugs are connected to corresponding electrical measurement devices.

[0026] The lower extremity of the hollow column 3 which is applied against the upper face 9 of the main portion 7 is secured to the base element 4 by means of a series of eight studs or bolts or the like, marked as 16, which extend through the thickness of the main portion 7, i.e. from its upper face to its lower face.

[0027] As seen on the figures, these studs 16 extend perpendicular to the faces 9 and 11 of the base element 4, i.e. parallel to the AX direction, and they are uniformly distributed around the central direction AX which corresponds to the axis of revolution of the hollow column 3 when the whole system is assembled. The studs 16 have each an extremity extending out of the base element through the upper face of the main portion 7 and another extremity extending out of the base element through the lower face of this main portion, and they are cast into the main portion 7 to be firmly secured to it.

[0028] The base element 4 according to the invention is not made of metallic material components machined, adjusted and secured together, it is contrarily made of cast polymer resin material or the like in which all of the internal components housed by this base element are embedded. In the example of the drawings, the main portion 7 and the front panel 4 are part of a single block of resin polymer which is the main part of the base element, and in which all the components are embedded.

[0029] As seen on figure 4, these components com-

prise a central element 17 embedded in the upper face 9 of the main portion and carrying thirty secondary leads 18 at its upper face and comprising electrical epoxy resin bushings 19 in its thickness, an oil drain 21 and a capacitance tap 22.

[0030] The thirty secondary leads 18 extend parallel to the AX axis and are each carried by a corresponding epoxy resin bushing 21 which pass through the thickness of the central element 17, the central element 17 carrying these bushings 21. Every secondary lead is connected to a corresponding plug 14 by means of a corresponding wire not represented and extending into the main portion 7, i.e. cast into the block of polymer resin forming the base element 4.

[0031] The upper extremities of these secondary leads 18, i.e. the extremities which extend over the upper face 9 of the main portion 7, connect each to a corresponding wire extending in the hollow column 3 to a corresponding wiring of the head 2.

[0032] Thanks to the single central element 17 carrying the bushings 21 which carry the secondary leads 18, these secondary leads 18 cross the frontier between the inner space of the transformer filled with oil, and the body of the base element 4.

[0033] As visible in figure 4, the central element is located inside the footprint 22 of the inner space of the hollow insulating column. Moreover, the base element 4 comprise an oil drain 23 and a capacitance tap 24 each of which having a first extremity 26, 27, located in the upper face 7, into the area of the footprint 22.

[0034] The oil drain is a tube extending from its first extremity 26 in the upper face 7, to its second extremity 27, in the rear face 13. This second extremity 27 is a mechanical connector and valve adapted to receive a corresponding tube or the like, in order to empty the oil of the current transformer during a maintenance operation, for example prior to filling the transformer with new oil.

[0035] The capacitance tap 24 extends from its first extremity 27 located in the upper face 9, to a second extremity 28 which is located in the lateral face 12 of the main portion 7. This capacitance tap is mainly an electrical conductor of large diameter in order to sustain high current intensities. This capacitance tap is used during a test performed after assembling the current transformer to check that the actual electrical insulation level of the inner insulator of this transformer is satisfactory. Practically, this capacitance tap corresponds to one of the electrodes which are put under electrical tension during the test, and since a high current can flow during the test, this capacitance tap has a significant section area, as seen from the drawings.

[0036] Thanks to the idea of casting all the components of the base element into a single block of polymer resin, the invention allows to reduce the assembly time and the cost of material required to build the base element of a current transformer. It results in a very compact base element, having a production cost which is significantly

reduced since all the components are integrated into a single block.

[0037] The block of polymer resin is rigid and strong enough to withstand the mechanical load of the hollow column carrying the head of the transformer, even in case seismic stress.

[0038] The invention replaces the base element known of the prior art which was composed of several machined elements assembled adjusted and tightened in a complex structure with multiple oil sealing, by one single block component which is mainly parallelepiped. This single block of the base element according to the invention withstands the mechanical stress of the transformer, and functionally comprises all the appropriate electrical connections without risk of oil leakage.

[0039] In the embodiment exemplified in the previous description, the block of the base element is made of a polymer resin, but it can also be chosen to be another material such as for example a polymer concrete.

Claims

1. A base element (4) for a current transformer (1), to carry a lower extremity of an insulating column (3) of the transformer secured to this base element (4), this insulating column carrying a head (2) of the transformer (1) at its opposite extremity, this base element (4) comprising:

- a plurality of plugs (14) comprising each a portion extending out of a face of the base element (4) ;
- a plurality of electric epoxy resin bushings (21) carrying each a corresponding secondary lead (18), each secondary lead (18) comprising a portion extending out of a face (9) of the base element (4) to be electrically connected in the insulating column (3) ;
- a plurality of wires connecting each a secondary lead (18) to a corresponding plug (14) ;
- a plurality of securing means such as studs (16) or bolts comprising each a portion extending out of a face of the base element (4) for securing the insulating column (3) to the base element (4),

characterized in that it comprises a block (7, 8) of cast material, the secondary leads (18), the plugs (16) and the securing means (16), comprising each a portion which is embedded into this block (7, 8) of cast material, the wires connecting each a secondary lead (18) to a corresponding plug (14) being embedded in this block (7, 8) of cast material.

2. Base element according to claim 1, wherein the cast material, is a polymer resin or a polymer concrete material or an epoxy resin.

3. Base element according to any of the previous claims, comprising an oil drain (23) which is embedded in the block (7, 8) of cast material.
4. Base element according to any of the previous claims, comprising a capacitance tap (24) which is embedded in the block (7, 8) of cast material. 5
5. Base element according to any of the previous claims, wherein the means for securing the insulating column (4) to the base element are studs (16) extending each through the thickness of the block (7, 8) of cast material of this base element (4). 10
6. Current transformer comprising a base element according to any of the previous claims. 15

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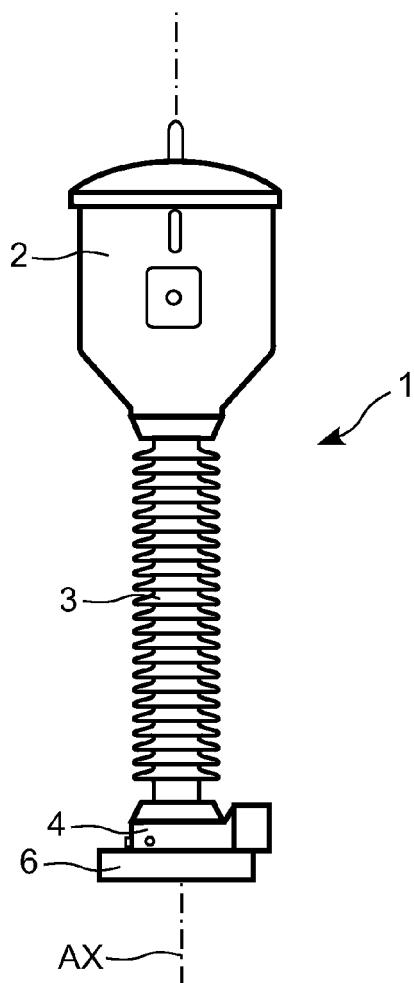


FIG. 1

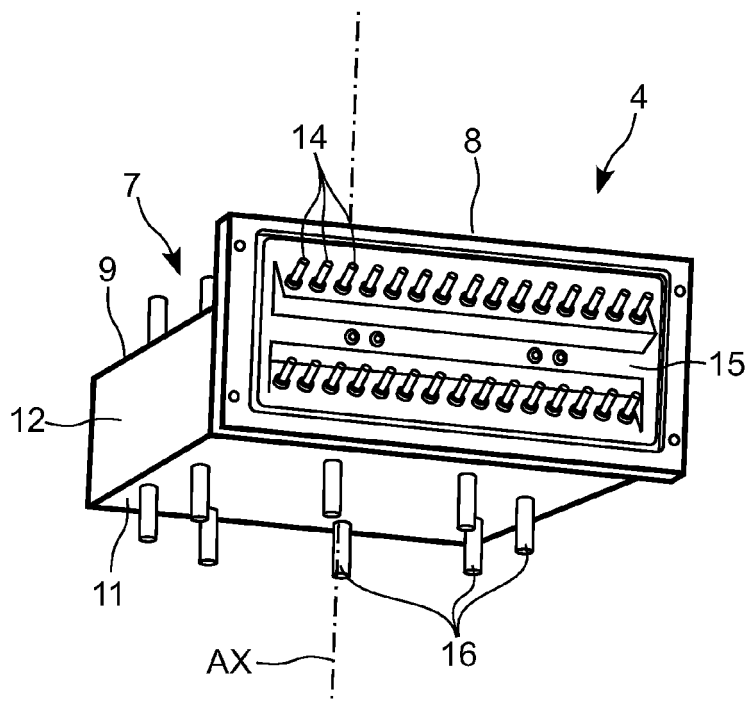


FIG. 2

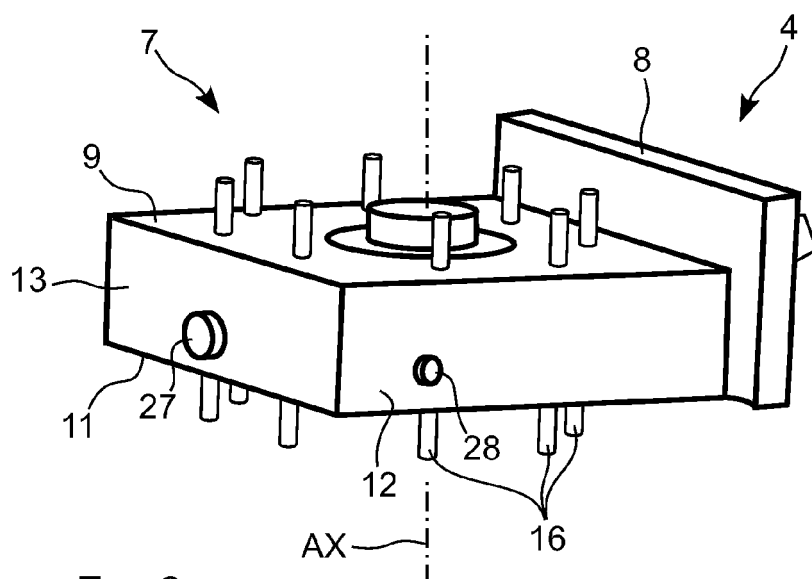


FIG. 3

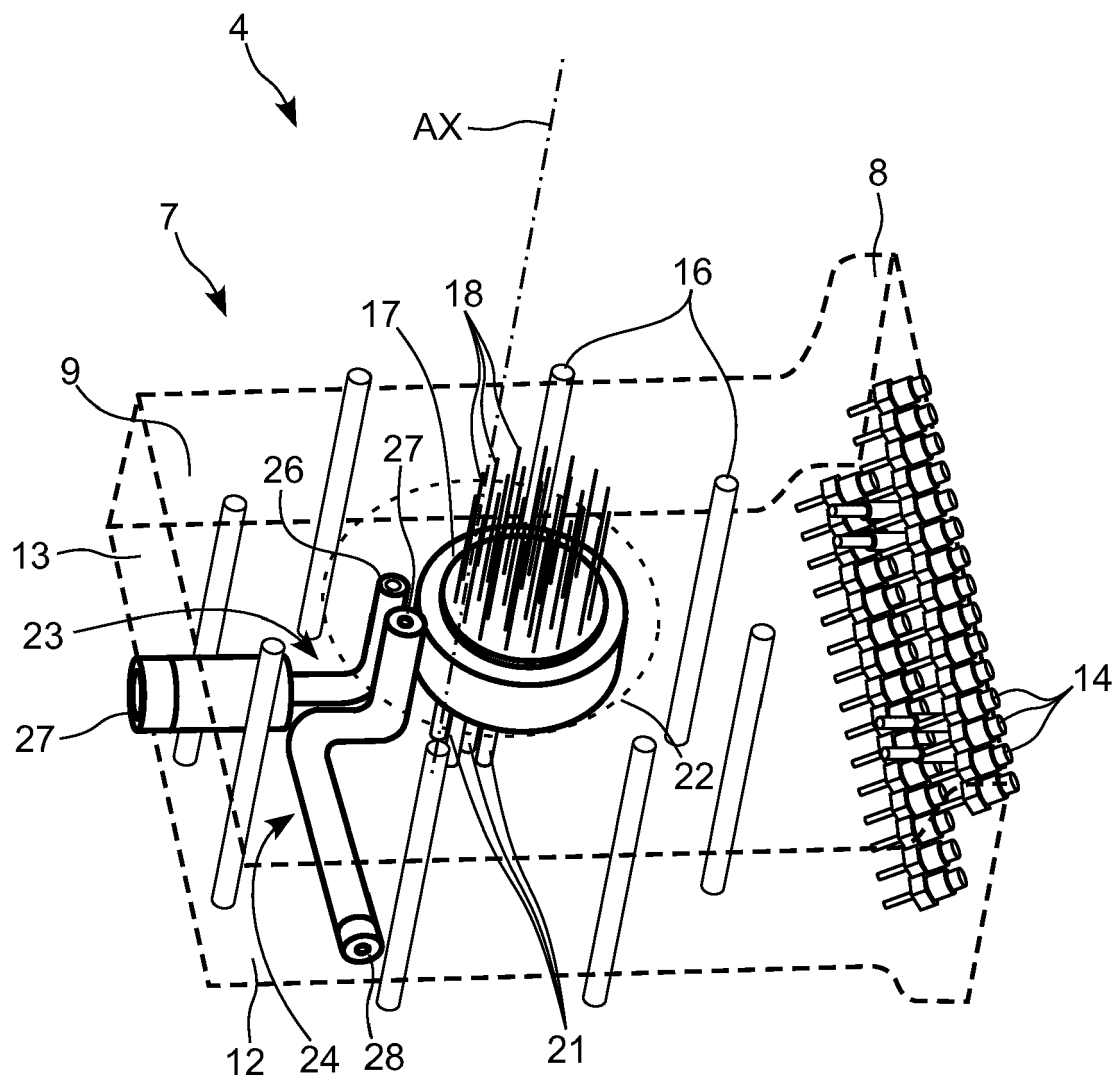


FIG. 4



EUROPEAN SEARCH REPORT

 Application Number
 EP 16 15 6181

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 August 2016	Examiner Warneck, Nicolas
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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