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(72) Inventors:
• **Weglinski, Bogumil**
53-405 Wroclaw (PL)
• **Juchim, Sebastian**
50-620 Gryfow Slaski (PL)
• **Haber, Leszek**
53-312 Wroclaw (PL)

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(71) Applicant: **POLITECHNIKA WROCLAWSKA**
50-370 Wroclaw (PL)

(54) **Powder composite magnetic core and method of manufacturing the same**

(57) Method comprises the die being filled with magnetic powder composite, with conductive element (2) being placed within the die during pouring of the powder, following which procedure magnetic powder composites are being bounded with conductive elements (2)

through compacting.

Magnetic core manufactured as an element made of compacted magnetic powder composite, with at least one conductive element (2) being inserted into the magnetic powder composite (1) element.

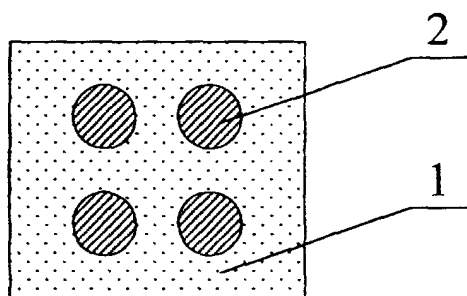


Fig. 1

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Description

[0001] The invention concerns method for manufacturing powder composite magnetic core and powder composite magnetic core designed use in electrotechnical appliances, and especially in electrical machines.

[0002] Inductive element and method for producing the same are already known from international patent application WO02/101763. Said powder composite is produced by mixing a ferromagnetic amorphous or nanocrystalline alloy powder with a ferromagnetic dielectric powder and a thermoplastic or duroplastic polymer, with dielectric ferromagnetic powder alloy equaling more than 55% by volume. Inductive element produced of dielectric ferromagnetic powder is characteristic in that in the mixture of powders, ribbons of ferromagnetic alloy are placed in the mixture of powders.

[0003] Known from their employment are powder composite magnetic cores manufactured as components from homogenous mass of compressed magnetic powder composite, wherein the compacted magnetic cores are annealed or sintered following their compacting.

[0004] According to the invention the method comprises the die being filled with magnetic powder composite, inside of which conductive elements are being placed, and following this procedure magnetic powder composite is bound with inductive elements through compacting. As conductive elements, conductive wires or conductive bars are located in the die. Conductive elements of the magnetic core can also be manufactured of conductive powder. To obtain them, the die is being filled with conductive powder and magnetic powder composite.

[0005] Favourably, the die is simultaneously being filled with conductive powder and magnetic powder composite.

[0006] What is also favourable is the die at least once being filled with conductive powder, then at least once with magnetic powder composite or the conductive sheet being placed in the die and then magnetic powder composite is poured over it, and eventually another electrical steel sheet is also placed within the die.

[0007] The essence of the invention concerns inserting at least one conductive element into the compacted magnetic powder composite. A conductive wire or a conductive bar is the conducting element.

[0008] Favourably, on both sides of the compacted powder composite material the conducting layers is placed.

[0009] Within the compacted magnetic powder composites are conductive layers, favourably conducting sheet element or compacted conductive powder.

[0010] Favourably, the magnetic core is of layered arrangement with at least one layer of magnetic powder composite, and at least one layer of conductive powder.

[0011] Conductive elements are placed on the circumference of the magnetic core or along the magnetic

core.

[0012] The advantage of this new method for manufacturing powder composite magnetic cores is the possibility of simultaneous obtaining of both the electrical and the magnetic circuit in a waste-free compacting process, what reduces the duration of technological process. Powder composite magnetic core, according to the invention, creates the possibility of producing rotors of electrical machines, rotors of small-power electrical machines, and these of special machines as uniform electromagnetic system. Furthermore, it enables simple change of configuration of conducting elements in order to control the electromagnetic parameters of the circuit already in the process of manufacture.

[0013] Embodiment of the invention is presented in the drawing, in which Fig. 1 illustrates hybrid magnetic core made of magnetic powder composites with four conductive wires, Fig. 2 - hybrid magnetic core made of magnetic powder composites with four conductive bars, Fig. 3 - hybrid magnetic core made of magnetic powder composites with conductive bars made of conductive powder, Fig. 4 - layered hybrid magnetic core with one magnetic powder composite layer, Fig. 5 - layered hybrid magnetic core made of magnetic powder composites with one conductive powder layer, Fig. 6 - layered hybrid magnetic core made of magnetic powder composites with three conductive elements made of conductive sheet, Fig. 7 - hybrid magnetic core made of magnetic powder composites with one conductive bar and two conductive wires, Fig. 8 - hybrid magnetic core made of magnetic powder composites with eight conductive wires, Fig. 9 - layered hybrid magnetic core made of magnetic powder composites with two conductive elements made of conductive sheet on both sides of the compacted magnetic powder composite, Fig. 10 - layered hybrid magnetic core made of powder composites with two conductive elements made of compacted conductive powders embedded in compacted magnetic powder composite, Fig. 11 - layered hybrid magnetic core made of powder composites with compacted magnetic powder composite embedded between two conductive steels, Fig. 12 - layered hybrid magnetic core made of powder composites with one magnetic powder composite layer being placed between two layers of compacted conductive powder, Fig. 13 - hybrid magnetic core made powder composites with two conductive wires and three conductive bars, and Fig - 14 - hybrid magnetic core made of powder composites with compacted magnetic powder composite embedded in the compacted conductive powder.

Example 1.

[0014] Method for manufacturing powder composite hybrid magnetic core comprises the cuboid die being filled with magnetic powder composite 1, with four conductive elements in the form of conductive wires being inserted into the die during powder pouring. Subse-

quently, powder composite material 1 is being bounded with conductive elements 2 through the process of compaction.

Example 2.

[0015] Method for manufacturing powder composite magnetic core proceeds as in example 1, the difference being that four conductive bars of rectangular cross-section are inserted into cuboid die as conductive elements 2.

Example 3

[0016] Method for manufacturing powder composite magnetic core proceeds as in example 1, the difference being that the die is simultaneously being filled with magnetic powder composite 1 and conductive powder 2. Composite magnetic core manufactured this way has four conductive beams each of which is situated along the magnetic core's lateral side.

Example 4.

[0017] Method for manufacturing powder composite magnetic core proceeds as in example 1, the difference being that the die is being filled with conductive powder 3, then with magnetic powder composite 1, and finally once again with conductive powder 3. Composite powder magnetic core manufactured this way is a layered magnetic core with one compacted magnetic composite layer 1 placed between two layers of compacted conductive powder 3.

Example 5.

[0018] Method for manufacturing powder composite magnetic core proceeds as in example 4, the difference being that the die is being with magnetic powder composite 1, then with conductive powder 3, and once again with magnetic powder composite 1. Composite powder magnetic core manufactured this way is a layered magnetic core with one compacted conductive powder layer 3 placed between two layers of compacted magnetic powder 1.

Example 6.

[0019] Method for manufacturing powder composite magnetic core proceeds as in example 1, the difference being that a conductive sheet 2 is inserted into the die which is then filled with magnetic powder composite 1, and finally another conductive steel 2 is also inserted into the die. Composite powder magnetic core manufactured this way is a layered magnetic core with two compacted magnetic powder composite layers 1 placed between three conductive sheets elements 2.

Example 7.

[0020] Powder composite magnetic core is manufactured of compacted magnetic powder composite 1 and has three conductive elements 2 - two in the form of conductive bars of circular cross-section and one conductive bar of rectangular cross-section - within the element of compacted magnetic powder composite 1.

Example 8.

[0021] Powder composite magnetic core manufactured as in example 7, the difference being that this type of core has six conductive elements 2 in the form conductive wires.

Example 9.

[0022] Powder composite magnetic core manufactured as in example 7, the difference being that is layered hybrid magnetic core in which conductive layers 3 are placed on both sides of the compacted magnetic powder composite 1.

Example 10.

[0023] Powder composite magnetic core manufactured as in example 7, the difference being that is a layered hybrid magnetic core of powder composites with two conductive layers 3 made from compacted conductive powders embedded in compacted magnetic powder composite 1. The first conductive layer 3 is located along lateral side of the magnetic core, and the second layer 3 is located on its diagonal between the first conductive layer 3 and the opposite side of the magnetic core.

Example 11.

[0024] Powder composite magnetic core manufactured as in example 9, the difference being that the conductive layers 3 are conductive sheet elements.

Example 12.

[0025] Powder composite magnetic core manufactured as in example 11, the difference being that the conductive layer 3 is a layer made of compacted conductive powders.

Example 13.

[0026] Powder composite magnetic core manufactured as in example 7, the difference being that it has five conductive elements 2 are placed on the circumference and along the magnetic core, with two conductive elements 2 being wires and three - conductive bars of rectangular cross-section.

Example 14.

[0027] Powder composite magnetic core manufactured as in example 9, the difference being that the compacted magnetic powder composite 1 is embedded in the compacted conductive powder 3.

[0028] New method of manufacturing magnetic powder composite allows the manufacture of a magnetic core of any configuration of both the conductive layers 2 and of conductive elements 3 embedded in compacted magnetic powder composite 1. The configuration depends on both the requirements and the parameters of the magnetic core which is to be used in electromagnetic system, and because of that the embodiments of the invention show only exemplary hybrid magnetic cores.

Claims

1. Method for manufacturing powder composite magnetic core comprising magnetic powder composites bounded through compacting, wherein the die is being filled with magnetic powder composite, with conductive elements (2) being placed within the magnetic powder composite, following which procedure magnetic powder composite is being bounded with conductive elements (2) through compacting. 20
2. Method as claimed in Claim 1, wherein conductive wires are placed as conductive elements (2). 30
3. Method as claimed in Claim 1, wherein conductive bars are placed as conductive elements (2).
4. Method as claimed in Claim 1, wherein the die is being filled with conductive powder and with magnetic powder composite. 35
5. Method as claimed in Claim 4, wherein the die is simultaneously being filled with conductive powder and with magnetic powder composite. 40
6. Method as claimed in Claim 4, wherein the die is being filled at least once with conductive powder and at least once with magnetic powder composite. 45
7. Method as claimed in Claim 1, wherein a conductive sheet (2) is inserted into the die which is then filled with magnetic powder composite, and finally another conductive sheet (2) is also inserted into the die. 50
8. Magnetic core manufactured as an element made of compacted magnetic powder composite, wherein at least one conductive element (2) is embedded in magnetic powder composite element (1). 55
9. Magnetic core as claimed in Claim 8, wherein conductive bar is the conductive element (2).
10. Magnetic core as claimed in Claim 8, wherein conductive wire is the conductive element (2).
11. Magnetic core as claimed in Claim 8, wherein it is a layered arrangement with at least one layer of compacted magnetic powder composite (1) and at least one conductive layer (3).
12. Magnetic core as claimed in Claim 8, wherein at least one conductive layer (3) is located within the element made of compacted magnetic powder composite (1).
13. Magnetic core as claimed in Claim 8, wherein a conductive sheet element is the conductive layer (3).
14. Magnetic core as claimed in Claim 8, wherein compacted conductive powder is the conductive layer (3).
15. Magnetic core as claimed in Claim 8, wherein conductive elements (2) are located on the circumference of the magnetic core.
16. Magnetic core as claimed in Claim 8, wherein conductive elements (2) are located along the magnetic core.

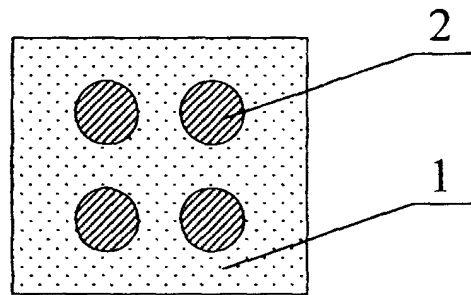


Fig. 1

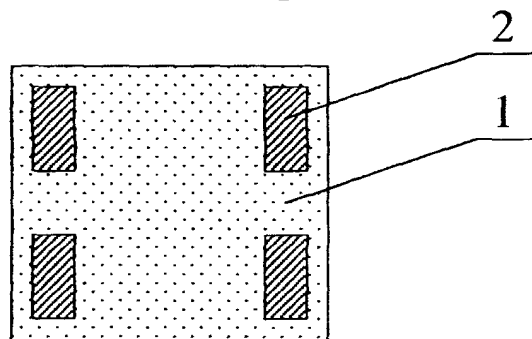


Fig. 2

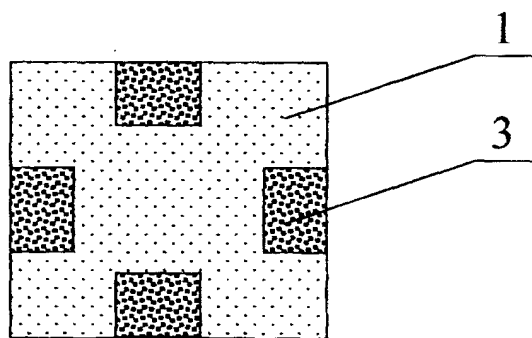


Fig.3

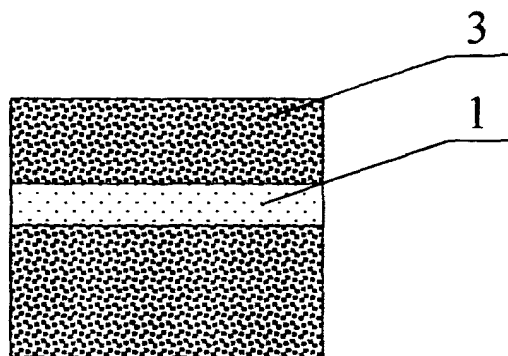


Fig. 4

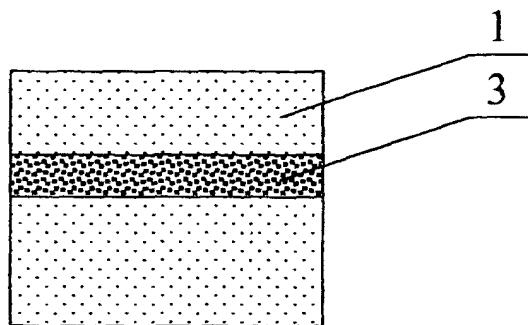


Fig. 5

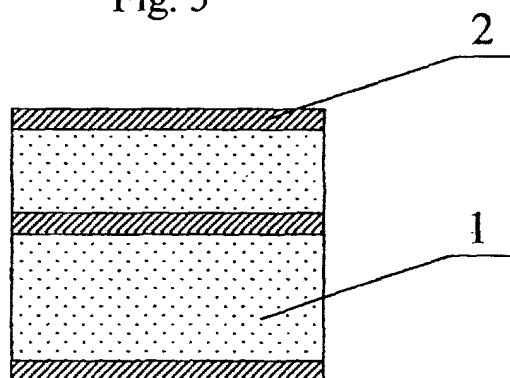


Fig. 6

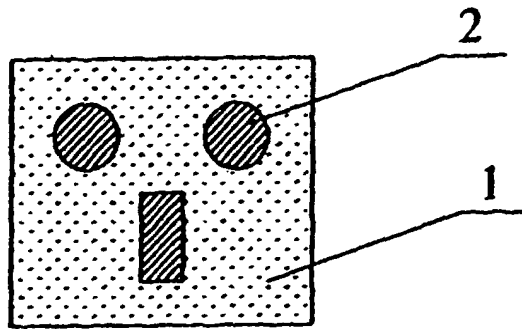


Fig. 7

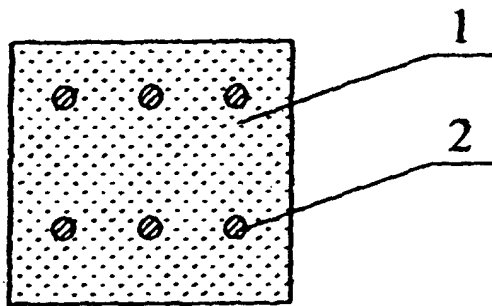


Fig. 8

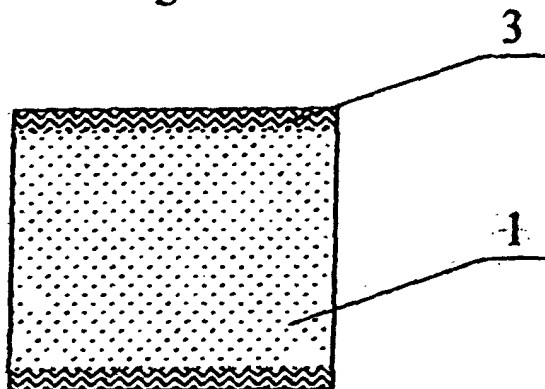


Fig. 9



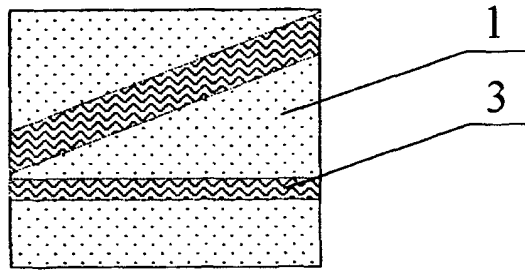


Fig. 10

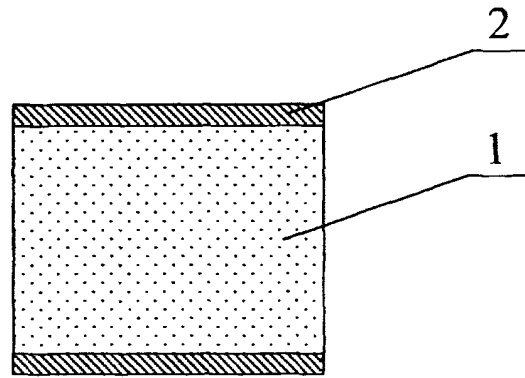


Fig. 11

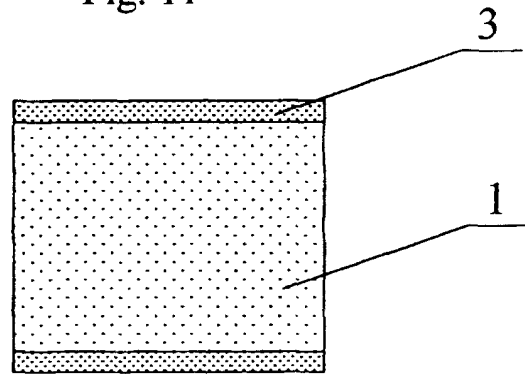


Fig. 12

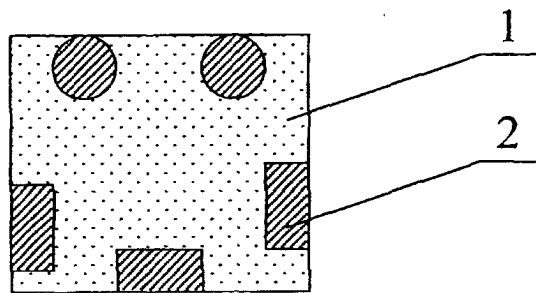


Fig. 14

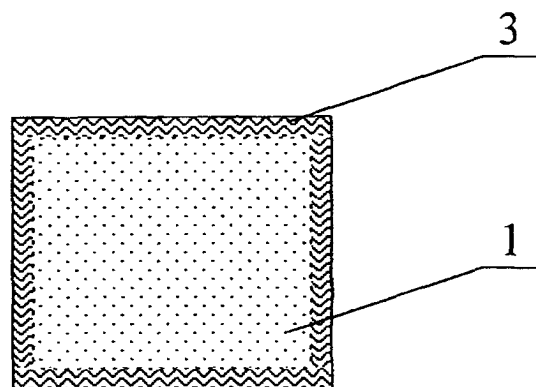


Fig. 15