United States Patent

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[54] **INTRINSICALLY STABLE SUPERCONDUCTIVE CONDUCTOR**

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[58] **Field of Search**..174/15 R, 15 C, DIG. 6, 126 R, 174/126 CP, 128, 113 R, 27; 335/216; 29/599

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[57] **ABSTRACT**

Intrinsically stable superconductive conductor enabling a tube made of stabilizing metal to be dispensed with, comprising filaments composed of several strands 10 to 50 microns in diameter, each of the said filaments being covered by a very fine layer of metal, the unit formed by seven of these filaments constituting a strand, said strands being coated by extrusion with a cover made of aluminum having high mechanical resistance.

8 Claims, 4 Drawing Figures

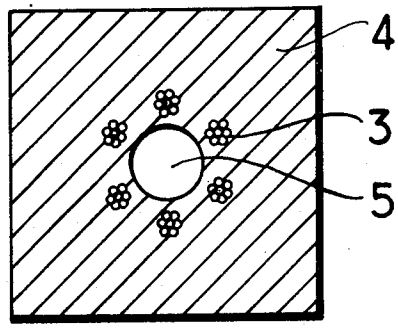


FIG. 1

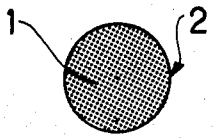


FIG. 2

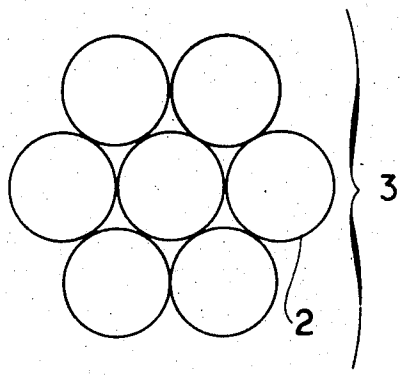


FIG. 3

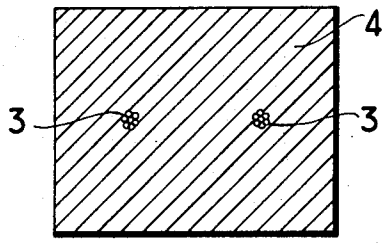
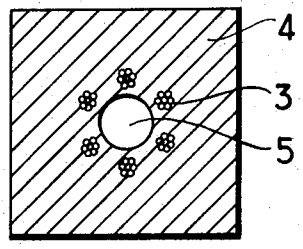


FIG. 4



INTRINSICALLY STABLE SUPERCONDUCTIVE CONDUCTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention concerns the covering of a superconductive conductor formed by several strands arranged next to one another having a small diameter and having the particularity of being intrinsically stable.

2. Description of the Prior Art

A superconductive conductor in which the superconductive wires are surrounded by an aluminum tube having a high degree of purity so as to ensure the stabilization of the conductor when it operates in the superconductive state, is known. Conventional superconductor wires give rise to flux jumps which locally make the material pass from the superconductive state towards the normal state.

In order to limit the scope of this phenomenon, a metal which is a good conductor is arranged in parallel with the superconductive material, this enabling the latter to be stabilized by shunting a part of the electric current through the conductive metal tube. Around this tube made of metal having a high degree of purity it is known to arrange a casing made of material having high mechanical resistance which confers good mechanical properties to the conductor. The latter properties must be sufficient for resisting tensile and compression stresses, thermal contractions resulting from the freezing fluid and electromagnetic stresses due to very great electromotive forces which may be applied in the large superconductive windings.

The producing of such a conductor having a tube made of aluminum having a high degree of purity and a casing made of metal having high mechanical resistance should be performed in two phases by the drawing method. In the first phase, the conductor is passed through a cylindrical drawing frame which makes it possible to cover it with a stabilizing tube having a circular cross-section. In the second phase, the conductor with its stabilizing tube is passed into a press having a parallelepipedical draw frame so as to cover it with a casing having a square cross-section. It is therefore long and expensive to implement the old production method.

SUMMARY OF THE INVENTION

The aim of the present invention is a superconductive conductor not having the above-mentioned disadvantages. Indeed, in the latter, it is possible to produce a conductor by means of a single drawing operation.

The present invention has for its object a superconductive conductor comprising wires made of superconductive material covered by a metal matrix, characterized in that the wires consist of strands comprising several threads, and that the wires are covered directly with a casing made of material having high mechanical resistance.

With reference to the diagrammatic FIGS. 1 to 4 enclosed herewith, an example for implementing the present invention will be described herebelow, this example being given only by way of illustration and having no limiting character. The same parts illustrated in several of these figures bear, in all the latter, the same references.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 and 2 show very much enlarged sectional views of superconductive filaments. FIGS. 3 and 4 show two embodiments of a superconductive conductor along transversal sections.

DESCRIPTION OF PREFERRED EMBODIMENTS

FIG. 1 shows several threads 1 consisting of a superconductive material such as niobium-titanium. Each of these threads has a diameter which can range from 10 to 50 microns. The threads 1 embedded in a cover 2 made of copper which is not very thick constitute a filament. The diameter of the filament can be 400 microns. That filament constitutes an intrinsically stable superconductive conductor, for, due to the fact of the small diameter of the threads, forming the filament, no flux jumps occur inside the superconductive material.

FIG. 2 shows a strand 3 consisting of seven filaments each having a diameter of 400 microns. The filaments are arranged in a circle around a central filament. This strand, seen with the naked eye, looks like a wire having a thickness of about 1.2 mm.

FIG. 3 shows that the wires of the strands 3 are covered by a casing 4 having a rectangular cross-section.

FIG. 3 illustrates a solid conductor. This conductor, when it is in service, can be dipped, on one or several surfaces, in liquid helium. The casing 4 is drawn around the two wires. The metal used is aluminum alloy subjected to structural hardening, known by the trade name of A.S.G. (aluminum, silicon and magnesium alloy) or of AZ5G (aluminum, zinc and magnesium alloy).

These alloys confer great mechanical resistance on the conductor. The mechanical rupture strength of ASG is 35 kg/sq. mm at ambient temperature, and that of AZ5G is 40 kg/sq. mm in the same conditions.

It should be noted that the wires formed by the strands 3 are not surrounded by a refined aluminum tube having high purity as was the practice in prior art.

FIG. 4 shows a varied version of an embodiment of the superconductive conductor. This time, there is, in the middle of the casing 4, a cooling duct 5 having a circular cross-section. This duct is used for making the freezing fluid flow, and it is surrounded by six strands 3 arranged in star formation.

The casing 4 is also obtained by drawing, and the metal used has the same characteristics as those described with respect to FIG. 3.

The conductor which is the object of the invention enables a superconductor having high mechanical resistance and not having flux jump phenomena to be made available.

Particularly interesting applications could be used for superconductive windings.

What is claimed is:

1. In a superconductive conductor comprising wires made of superconductive material covered in a metal matrix, the improvement wherein said wires consist of strands comprising several filaments themselves composed of several threads, with said wires being directly covered with a cover made of material having high mechanical resistance.

2. The superconductive conductor according to claim 1, wherein said threads have a diameter of less than 50 microns.

3. The superconductive conductor according to claim 1, wherein said filaments are surrounded by a stabilizing layer of copper.

4. The superconductive conductor according to claim 1, wherein said casing directly covering the superconductive wires is made of an aluminum alloy comprising at least one metal of the group consisting of silicon, magnesium, zinc.

5. The superconductive conductor according to claim 2, wherein the thickness of said stabilizing layer is between 50 and 100 microns.

6. The superconductive conductor according to claim 3, wherein the thickness of said stabilizing layer is between 50 and 100 microns.

7. The superconductive conductor according to claim 3, wherein said casing directly covering the superconductive wires is made of an aluminum alloy comprising at least one metal of the group consisting of silicon, magnesium, zinc.

8. The superconductive conductor according to claim 5, wherein said casing directly covering the superconductive wires is made of an aluminum alloy comprising at least one metal of the group consisting of silicon, magnesium, zinc.

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