



- (51) **International Patent Classification:** Not classified
- (21) **International Application Number:** PCT/IN20 12/000686
- (22) **International Filing Date:** 17 October 2012 (17.10.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:** 2926/MUM/201 1 19 October 201 1 (19.10.201 1) IN
- (71) **Applicant: STERLITE TECHNOLOGIES LTD.** [IN/IN]; Thakur, Deepak, E1/E2/E3, MIDC, Waluj, Aurangabad 431136, Maharashtra (IN).
- (72) **Inventors; and**
- (71) **Applicants : MISHRA, Rajendra** [IN/IN]; K-302, Konark Indrayu Enclave, Phase-II, NIBM Road, Pune 411048, Maharashtra (IN). **MUNDHADA, Hitesh** [IN/IN]; C-4, 804, Kumar Prithvi, Achal Nagar, Kondhwa Khurd, Pune 411048, Maharashtra (IN).
- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP,

KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

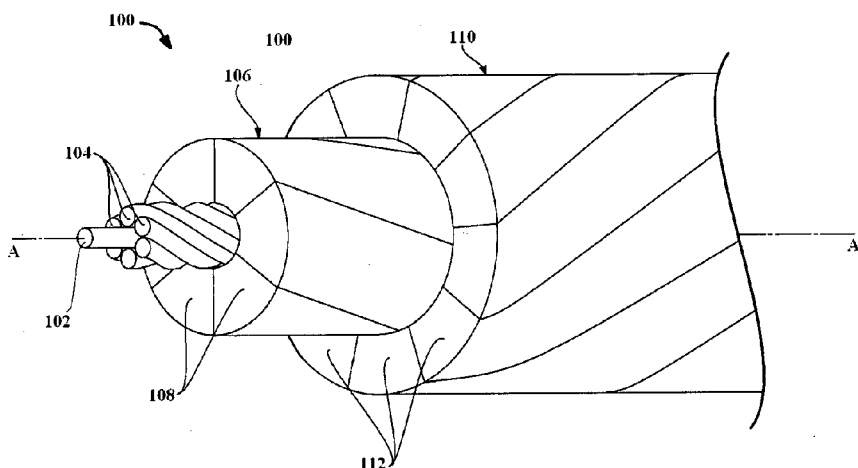
Declarations under Rule 4.17 :

- as to the identity of the inventor (Rule 4.1 7(i))
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.1 7(H))
- of inventorship (Rule 4.1 7(iv))

Published:

- without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) **Title:** ELECTRICAL POWER CONDUCTOR



(57) **Abstract:** An electrical power conductor having improved ampacity, robustness, reduced losses, and lesser sagging and aging effects is provided. The electric power conductor comprises of multiple strands for conducting electricity; wherein at least two of said multiple strands are made of an alloy selected from following: I. An Aluminum alloy comprising (in wt. %): a. Si: (0.30-0.40) and b. Mg: (0.30-0.40) II. An Aluminum alloy comprising (in wt. %): a. Cu: (0.15-0.25), b. Fe: (0.15-0.25), and c. Mg: (<0.07); cross-sectional shape of each of said at least two of said multiple strands is non-circular; and said at least two of said multiple strands are laid around longitudinal axis of the power conductor in a manner such that within a cross-section of the power conductor, cross-section of each of said at least two of said multiple strands does not lie in tangential contact with cross-section of at least one of the strands lying adjacent to it.

ELECTRICAL POWER CONDUCTOR

FIELD OF THE INVENTION

[0001] The present invention relates to the field of electrical power conductors. More specifically, the present invention relates to the field of electrical power conductors having improved compaction of conductor material, improved current carrying capacity (ampacity), improved robustness, reduced losses and lesser sagging and aging effects.

BACKGROUND OF THE INVENTION

[0002] Throughout the world transmission and distribution (T&D) of electric power is majorly done through bare overhead electric power conductors. For efficient use of energy and resources, reduction in (T&D) losses, reduction in losses caused due to aging, and improving robustness and usable life of electric power conductors still remain a challenge to be met on priority.

[0003] Resistive losses incurred during T&D of electricity through electric power conductors is a major factor contributing to T&D losses. A popular solution to reduce resistive losses incurred in electric power conductors is the use of high conductivity material (or a material having low electrical resistance). While selecting an electrical conductor material, apart from its conductivity, there are several other factors too which need careful analysis. These include economic viability, physical and chemical properties of the material, safe operating temperature range for continuous power transmission at specific range of load, modulus of elasticity, strength, coefficient of linear expansion, ultimate tensile strength (UTS), resistance to corrosion, etc.

[0004] While selecting an electrical conductor material for bare overhead power conductor, analysis of above mentioned properties are of particular importance. It is required that bare electrical power conductors should have high conductivity, lesser electrical resistance, greater current carrying capacity (ampacity), should have higher strength, should be robust, should have low sag, should have good resistance to corrosion and should have longer life of satisfactory performance.

[0005] Apart from using high conductivity material, resistive losses of power conductors can also be reduced by improving their structure, components and design. And, apart from

contributing to the reduction in resistive losses, the structure, components and design of overhead power conductor also play an important role in its overall performance such as ampacity, safe operating temperature for continuous power transmission at a specific range of load, robustness etc.

[0006] Though gradual improvements have been made over the time in electric power conductor technology, there still exists a need for further improvements which would provide greater ampacity, greater robustness, reduced power losses, and reduced aging and sagging effects in electric power conductors.

NEED OF THE INVENTION

[0007] Accordingly, there is a need to have electric power conductor having improved compaction of conductor material, improved current carrying capacity (ampacity), reduced losses, improved robustness, and lesser sagging and aging effects.

OBJECTS THE INVENTION

[0008] It is an object of the present invention is to provide a technically improved electrical power conductor.

[0009] Still another object of the present invention is to provide an electrical power conductor having improved compaction of conductor material.

[00010] Still another object of the present invention is to provide an electrical power conductor having enhanced current carrying capacity.

[00011] Still another object of the present invention is to provide an electrical power conductor having reduced electrical power losses.

[00012] Still another object of the present invention is to provide an electrical power conductor having enhanced robustness.

[00013] Still another object of the present invention is to provide an improved electrical power conductor for use in electrical power grids.

[00014] The other objects and advantages of the present invention will be apparent from the following description and selected embodiments of the invention provided therein in conjunction with the accompanying drawings which are incorporated for illustration of

selected embodiments of the present invention and are not intended to limit the scope thereof.

SUMMARY OF THE INVENTION

[00015] To achieve the above objectives, the present invention provides an electrical power conductor having following technical advancements:

- Improved compaction of conductor material within the available conductor space
- Improved current carrying capacity (ampacity)
- Reduced electrical power losses
- Improved robustness

[000 16] The electric power conductor of the present invention comprises of a longitudinal axis and further comprises of multiple compactly packed strands for conducting electricity, wherein the cross-sectional shape of each of at least two of said multiple strands is non-circular, and said at least two of said multiple strands are made of a metal alloy selected from following two alloy types:

I. An Aluminum alloy comprising of:

- a. 0.30-0.40 weight % of Si and
- b. 0.30-0.40 weight % of Mg

II. An Aluminum alloy comprising of:

- a. 0.15-0.25 weight % of Cu
- b. 0.15-0.25 weight % of Fe
- c. less than 0.07 weight % of Mg;

[00017] Note that the exact conductivity of the alloys mentioned above would depend on final composition of the alloy including other constituents also. However, conductivity of ~59% IACS (***International Annealed Copper Standard***) is achievable in Aluminum alloy comprising of 0.30-0.40 weight % of Si and 0.30-0.40 weight % of Mg.

[00018] Each of said at least two of said multiple strands are compactly laid around the longitudinal axis. The shape of non-circular cross-section of each of said at least two of said multiple strands is chosen such that it assists in better compaction of strands around the longitudinal axis. The cross-sectional shape of said at least two of said multiple strands

is non-circular; and said at least two of said multiple strands are laid around the longitudinal axis in a manner such that within a cross-section of the electrical power conductor, cross-section of each of said at least two of said multiple strands lies in contact with cross-section of at least one of the strands lying adjacent to it at more than one points (i.e. said at least two of said multiple strands are laid around the longitudinal axis in a manner such that within a cross-section of the electrical power conductor, cross-section of each of said at least two of said multiple strands does not lie in tangential contact with cross-section of at least one of the strands lying adjacent to it). It is ensured that a high level of material compaction is achieved within the electrical power conductor. The non-circular cross-sectional shape of each of said at least two of said multiple strands could include shapes such as triangular, trapezoidal, Quadrilateral (such as square, rectangular, parallelogram, etc.), pentagonal, hexagonal, heptagonal, octagonal etc.

[00019] When arranged and laid intelligently within an electrical power conductor, the non-circular cross-sectional shape of strands is useful in providing more conductor material per unit volume of the electrical power conductor. Hence, though the structural dimensions of the electrical power conductor remain the same, due to better compaction and availability of more conductor material, current carrying capacity i.e. ampacity of the electrical power conductor is increased. In a particular embodiment of the present invention, each of the non-circular cross-section strands are arranged within the conductor in a manner such that there is substantially little or no voids left in between said strand and strands which lie adjacent to it. Also, better compaction of strands also helps in enhancing the robustness and reduction of sagging of the power conductor when hung between pylons.

[00020] According to one embodiment of the present invention, the electrical power conductor comprises of a longitudinal axis, said electrical power conductor further comprises of:

multiple strands for conducting electricity, said multiple strands being laid around the longitudinal axis, wherein at least two of said multiple strands are made of a metal alloy selected from following two alloy types:

- I. An Aluminum alloy comprising of:

- a. 0.30-0.40 weight % of Si and
- b. 0.30-0.40 weight % of Mg
- II. An Aluminum alloy comprising of:
 - a. 0.15-0.25 weight % of Cu;
 - b. 0.15-0.25 weight % of Fe; and
 - c. less than 0.07 weight % of Mg;

cross-sectional shape of each of said at least two of said multiple strands is non-circular; and

said at least two of said multiple strands are laid around the longitudinal axis in a manner such that within a cross-section of the electrical power conductor, cross-section of each of said at least two of said multiple strands lies in contact with cross-section of at least one of the strands lying adjacent to it at more than one points (i.e. said at least two of said multiple strands are laid around the longitudinal axis in a manner such that within a cross-section of the electrical power conductor, cross-section of each of said at least two of said multiple strands does not lie in tangential contact with cross-section of at least one of the strands lying adjacent to it).

[00021] In another embodiment of the electric power conductor of the present invention, the electrical power conductor comprises of a longitudinal axis, said electrical power conductor further comprises of:

multiple strands for conducting electricity, said multiple strands being laid around the longitudinal axis, wherein each of said multiple strands are made of a metal alloy selected from following two alloy types:

- I. An Aluminum alloy comprising of:
 - a. 0.30-0.40 weight % of Si and
 - b. 0.30-0.40 weight % of Mg;
- II. An Aluminum alloy comprising of:
 - a. 0.15-0.25 weight % of Cu
 - b. 0.15-0.25 weight % of Fe and
 - c. less than 0.07 weight % of Mg;

cross-sectional shape of each of said multiple strands is non-circular; and

each of said multiple strands are laid around the longitudinal axis in a manner such that within a cross-section of the electrical power conductor, cross-section of each of said multiple strands lies in contact with cross-section of at least one of the strands lying adjacent to it at more than one points (i.e. each of said multiple strands are laid around the longitudinal axis in a manner such that within a cross-section of the electrical power conductor, cross-section of each of said multiple strands does not lie in tangential contact with cross-section of at least one of the strands lying adjacent to it).

[00022] The features of the present invention provide better compaction of conductor material within the electrical power conductor and hence result in enhanced overall ampacity of the electrical power conductor.

BRIEF DESCRIPTION OF THE ACCOMPANYING FIGURES

[00023] The objects and features of the present invention will become clear when read in conjunction with the accompanying figures, in which:

[00024] **Figure 1** shows a perspective view of an electrical power conductor in accordance with the first embodiment of the present invention.

[00025] **Figure 2** shows a cross-sectional view of the electrical power conductor in accordance with the first embodiment of the present invention.

[00026] **Figure 3** shows a perspective view of a conventional electrical power conductor (comprising only of circular cross-section strands and which is materially and diametrically similar to the electrical power conductor as provided by the first embodiment of the present invention).

[00027] **Figure 4** shows a cross-sectional view of conventional electrical power conductor of Figure 3.

[00028] **Figure 5** shows a perspective view of an electrical power conductor in accordance with the second embodiment of the present invention.

[00029] **Figure 6** shows a cross-sectional view of the electrical power conductor in accordance with the second embodiment of the present invention.

[00030] It should be understood that the drawings and the associated descriptions below are intended and provided to illustrate embodiments of the invention and not to limit the

scope of the invention. Also, it should be noted that the drawings are not necessarily drawn to scale.

DETAILED DESCRIPTION

[00031] Reference will now be made in detail to selected embodiments of the present invention, examples of which are illustrated in the accompanying drawings, which are not intended to limit scope of the present invention. Whenever possible, the same reference numerals will be used throughout the description to refer to the same or like parts of the invention.

[00032] **Figure 1** shows a perspective view of the first embodiment of the electrical power conductor in accordance with the present invention. **Figure 2** shows a cross-sectional view of the electrical power conductor in accordance with the first embodiment of the present invention.

[00033] As shown in **Figure 1**, the electrical power conductor **100** comprises of a longitudinal axis **AA'** and a central core **102**. The central core **102** has a circular cross-section. The central core **102** is made of a metal alloy selected from following two alloy types:

- I. An Aluminum alloy comprising of:
 - a. 0.30-0.40 weight % of Si and
 - b. 0.30-0.40 weight % of Mg
- II. An Aluminum alloy comprising of:
 - a. 0.15-0.25 weight % of Cu
 - b. 0.15-0.25 weight % of Fe and
 - c. less than 0.07 weight % of Mg;

and lies symmetrically around the longitudinal axis **AA'**. Electrical power conductor **100** further comprises of multiple circular cross-section strands **104** which are helically wound around the central core **102** and the longitudinal axis **AA'**. In this embodiment, circular cross-section strands **104** are also made of same metal alloy as that of central core **102**. Strands **104** are surrounded by an inner layer **106**. Layer **106** is formed of multiple compactly packed trapezoidal cross-section strands **108**. Strands **108** are also made of same metal alloy as that of central core **102**. In detail, layer **106** is formed by helically

winding multiple trapezoidal cross-section strands **108** around strands **104** and the axis **AA'** as shown in **Figure 1**. Within the inner layer **106**, strands **108** are laid in a manner such that there is substantially little or no voids left in between the adjacent strands. Inner layer **106** is further surrounded by an outer layer **110**. Outer layer **110** is formed of multiple compactly packed trapezoidal cross-section strands **112**. Strands **112** are also made of same metal alloy as that of central core **102**. In detail, layer **110** is formed by, helically winding multiple trapezoidal cross-section strands **112** around the inner layer **106** and the axis **AA'** in a manner as shown in **Figure 1**. In the outer layer **110**, strands **112** are laid around the inner layer **106** and the longitudinal axis **AA'** in a manner such that there is substantially little or no voids left in between the adjacent strands. Also, strands **112** are laid around the inner layer **106** in a manner such that the outer layer **110** compactly fits over the inner layer **106** and there is substantially little or no voids left between the two layers. In this embodiment, central core **102**, strands **104**, strands **108** and strands **112** are components of the electrical power conductor **100**.

[00034] Further, compact packing of strands **108** and **112** to form the inner layer **106** and outer layer **110** respectively is done in a in a manner such that: cross-section of each of the strands in the inner layer **106** touches (or is in contact with) the cross-section of any strand adjacent to it in the same layer at more than one points; and cross-section of each of the strands in the outer layer **110** touches (or is in contact with) the cross-section of any other strand lying adjacent to it in the same layer at more than one points.

[00035] In other words, compact packing of strands **108** and **112** to form the inner layer **106** and outer layer **110** is done in a in a manner such that: cross-section of each of the strands in the inner layer **106** does not lie in tangential contact (or single point contact) with the cross-section of any other strand adjacent to it in the same layer; and cross-section of each of the strands in the outer layer **110** does not lie in tangential contact (or single point contact) with the cross-section of any other strand lying adjacent to it in the same layer. The expression 'tangential contact' signifies a single point contact between two peripheries or shapes or figures (or cross-sections in this case), i.e. if two cross-sections are said to be in 'tangential contact', it is meant that they are in contact with each other (or touch each other) only at a single point.

[00036] In the cross-section view of the first embodiment, it is clearly shown in **Figure 2** that within both the inner layer **106** and the outer layer **110**, the cross-sections of any two adjacent strands belonging to a same layer, completely touch each other through at least one of the sides of their individual cross-section peripheries. Hence, the cross-sections of any two adjacent strands belonging to a same layer are in contact with each other at more than one points. In this embodiment, it is ensured that a high level of material compaction is achieved within the electrical power conductor **100**.

[00037] Experiments were conducted to collect the performance data of electric power conductor prepared according to the first embodiment of the invention. **Table 1** provides the count and dimensions of components of an electric power conductor shown in **Figure 1** and **2**. Basic performance data of electric power conductor prepared according to the first embodiment of the invention and having count and dimensions of components as provided in **Table 1** is provided in **Table 2**.

TABLE 1

S. No.	Item	Value
1	Diameter of central core 102	2.37 mm
2	Total count of strands 104	6
3	Diameter of a single strand among strands 104	2.37 mm
4	Total count of strands 108 in layer 106	6
5	Diameter of layer 106	13.42 mm
6	Total count of strands 112 in layer 110	10
7	Diameter of layer 110	20.50 mm

TABLE 2

S. No.	Parameter	Value
1	Ultimate Tensile Strength	67 KN
2	Maximum Continuous operating temperature	95°C
2	Current carrying capacity (Ampacity) at peak temperatures	At 85°C = 1194 Amps At 95°C = 1307 Amps
3	Maximum Continuous operating temperature	95°C
4	Linear mass per unit length	838 Kg/Km
5	DC resistance of the conductor at 20°C	0.0983
6	Modulus of elasticity	68 Gpa
7	Coefficient of linear expansion	$23 \times 10^{-6}/^{\circ}\text{C}$
8	Normal Operating Voltage Range	up to 400 KV

[00038] To establish an enhancement in performance, the performance of electric power conductor provided by the first embodiment of the present invention (having specifications as provided in **Table 1** and **Table 2**) was compared with a conventional electric power conductor (comprising only of circular cross-section strands) shown in **Figure 3**. The conventional electric power conductor of **Figure 3** comprises of all circular cross-section strands and each strand of the electrical power conductor is made of same aluminum alloy as the central core **102** of the first embodiment described above. As shown in **Figure 3**, the conventional electric power conductor **200** comprises of a longitudinal axis **BB'** and a central core **202**. The central core **202** has a circular cross-section. The central core **202** is made of same aluminum alloy as the central core **102** of the first embodiment described above and lies symmetrically around the longitudinal axis **BB'**. Electrical power conductor **200** further comprises of multiple circular cross-section strands **204** which are helically wound around the central core **202** and the longitudinal axis **BB'**. The circular cross-section strands **204** are also made of same aluminum alloy as the central core **102** of the first embodiment described above. Strands **204** are surrounded by an inner layer **206**. Layer **206** is formed of multiple compactly packed circular cross-section strands **208**. Strands **208** are also made of same aluminum alloy as the central core **102** of the first embodiment described above. In detail, layer **206** is formed by helically winding multiple circular cross-section strands **208** around strands **204** and the axis **BB'** as shown in **figure 3**. Within the inner layer **206**, strands **208** are laid in a manner to achieve better compaction. Inner layer **206** is further surrounded by an outer layer **210**. Outer layer **210** is formed of multiple compactly packed circular cross-section strands **212**. Strands **212** are also made of same aluminum alloy as the central core **102** of the first embodiment described above. In detail, layer **210** is formed by, helically winding multiple circular cross-section strands **212** around the inner layer **206** and the axis **BB'** as shown in **Figure 3**. In the outer layer **210**, strands **212** are laid around inner layer **206** and the longitudinal axis **BB'** in a manner to achieve better compaction. Also, strands **212** are laid around the inner layer **206** in a manner such that the outer layer **210** compactly fits over the inner layer **206**. As mentioned above, the central core **202**, strands **204**, strands **208** and strands **212** are components of the electrical power conductor **200** and are made of same aluminum alloy as the central core **102** of the first embodiment described above. It is

to be noted that in spite of compact packing of strands **204**, **208** and **212**, a lot of voids remain between them due to their circular cross-section. A cross-sectional view of the conventional electric power conductor of **Figure 3** is shown in **Figure 4**. Voids among the strands **204**, **208**, **212** of conventional electric power conductor are clearly visible in **Figure 4**. Due to these voids, the available space within the electric power conductor for conductor material is not fully utilized and less power conductor material is packed within the available space. Availability of lesser power conductor material in turn reduces the current carrying capacity and also affects overall performance of the electrical power conductor. The electrical power conductor of present invention provides an improved solution to this problem.

[00039] **Table 3** below provides the count and dimensions of components of the conventional electric power conductor shown in **Figure 3**. For comparing the performances of the electric power conductor provided by the first embodiment of the invention with the conventional electric power conductor shown in **Figure 3**, the diametric dimensions of the strands **202**, **204**, layer **210** and layer **206** of the conventional electric power conductor were kept same as diametric dimensions of strands **102**, **104**, layer **110** and layer **106** respectively of the electric power conductor provided by the first embodiment of the invention.

TABLE 3

S. No.	Item	Value
1	Diameter of central core 202	2.37 mm
2	Total count of strands 204	6
3	Diameter of a single strand among strands 204	2.37 mm
4	Total count of strands 208	10
5	Diameter of layer 206	13.42 mm
6	Total count of strands 212	15
7	Diameter of layer 210	20.50 mm

[00040] **Table. 4** below compares the performance of the electric power conductor as provided by the first embodiment of the invention with the conventional electric power conductor described above.

TABLE 4

S. NO.	PARAMETERS	PERFORMANCE SPECIFICATIONS	
		Electric power conductor [Figure 1]	Conventional Electric power conductor [Figure 3]
1	Ultimate Tensile Strength (UTS)	67 KN	62.5 KN
2	Maximum Continuous operating temperature	95°C	95°C
2	Current carrying capacity (Ampacity) at peak temperatures	At 85°C = 950 Amps At 95°C = 1008 Amps	At 85°C = 877 Amps At 95°C = 938 Amps
3	Maximum Continuous operating temperature	95°C	95°C
4	Linear mass per unit length	838 Kg/Km	707 Kg/Km
5	DC resistance of the conductor at 20°C	0.0983	0.1154
6	Modulus of elasticity	68 Gpa	68 Gpa
7	Coefficient of linear expansion	$23 \times 10^{-6}/^{\circ}\text{C}$	$23 \times 10^{-6}/^{\circ}\text{C}$
8	Normal Operating Voltage Range	132 KV	132 KV

[00041] It can be fairly concluded from **Table 4** that the electrical power conductor provided by the first embodiment of the present invention has lesser resistance, better UTS, better robustness and better Ampacity in comparison to a conventional all circular cross-section strands electric power conductor of similar dimensions and material composition. Hence the electric power conductor of the present also has reduced electrical power losses during transmission of electricity.

[00042] Electrical power conductor provided by the first embodiment of the present invention also achieves better conductor material compaction. It was found that the Electrical power conductor provided by the first embodiment of the present invention achieves about 20% more material compaction when compared to the conventional all

circular cross-section strands electric power conductor as described above. It was also found that electrical power conductor provided by the first embodiment of the present invention could achieve better compaction by filling up to 97.33 % of available space with conductor material. In other words, electrical power conductor provided by the first embodiment of the present invention could achieve better compaction by reducing voids within the electrical power conductor to just 2.67% of available conductor material space. It should be noted that, the set of count and dimensions of components of electrical power conductor of the first embodiment as described herein above (and its overall dimensions as described above) were chosen to prepare an exemplary working embodiment of the invention and these set of dimensions of electrical power conductor are not intended to limit the scope of the invention. Various other embodiments of the invention wherein the dimensions of the electrical power conductor are suitably chosen are fully covered by the scope of the invention.

[00043] Another embodiment of the invention which is fully covered by the scope of the invention is described below. It should be noted that the count and dimensions of components of the embodiments electrical power conductor provided below can also be suitably varied according to requirements.

[00044] Second embodiment of the present invention is shown in **Figures 5 and 6**. While **Figure 5** shows the perspective view of the second embodiment of the electrical power conductor in accordance with the present invention, **Figure 6** shows a cross-sectional view of the second embodiment of the electrical power conductor in accordance with the present invention.

[00045] As shown in **Figure 5**, electrical power conductor **300** comprises of a longitudinal axis **CC'** and a cylindrical central core **302** having a circular cross-section. The central core **302** is made of a metal alloy selected from following two alloy types:

- I. An Aluminum alloy comprising of: (a) 0.30-0.40 weight % of Si and (b) 0.30-0.40 weight % of Mg
- II. An Aluminum alloy comprising of: (a) 0.15-0.25 weight % of Cu, (b) 0.15-0.25 weight % of Fe and (c) less than 0.07 weight % of Mg;

[00046] The cylindrical central core **302** lies symmetrically around the longitudinal axis **CC** and is surrounded by an inner layer **304**.

[00047] Layer **304** is formed of multiple compactly packed trapezoidal cross-section strands **306** made of same metal alloy as that of central core **302**. In detail, layer **304** is formed by helically winding multiple trapezoidal cross-section strands **306** around the central core **302** and the axis **CC** as shown in **Figure 5**. In the layer **304**, strands **306** are laid around the central core **302** in a manner such that there are substantially little or no voids left in between the adjacent strands. Inner layer **304** is further surrounded by an outer layer **308**. Outer layer **308** is formed of multiple compactly packed trapezoidal cross-section strands **310** made of same metal alloy as that of central core **302**. In detail, layer **308** is formed by, helically winding multiple trapezoidal cross-section strands **310** around inner layer **304** and the axis **CC** as shown in **Figure 5**. In layer **308**, strands **310** are laid around inner layer **304** and longitudinal axis **CC** of the power conductor in a manner such that there is substantially little or no voids left in between the adjacent strands. Also, strands **310** are laid around the inner layer **304** in a manner such that the outer layer **308** compactly fits over the inner layer **304** and there is substantially little or no voids left among the two layers. In this embodiment, central core **302** strands **306**, strands **310** are components of the electrical power conductor **300**.

[00048] Further, compact packing of strands **306** and **310** to form the inner layer **304** and outer layer **308** is done in a in a manner such that: cross-section of each of the strands in the inner layer **304** touches (or is in contact with) the cross-section of any other strand lying adjacent to it in the same layer at more than one points and; cross-section of each of the strands **310** in the outer layer **308** touches (or is in contact with) the cross-section of any other strand lying adjacent to it in the same layer at more than one points.

[00049] In other words, compact packing of strands **306** and **310** to form the inner layer **304** and outer layer **308** is done in a in a manner such that: cross-section of each of the strands in the inner layer **304** does not lie in tangential contact with the cross-section of any other strand lying adjacent to it; and cross-section of each of the strands in the outer layer **308** does not lie in tangential contact with the cross-section of any other strand lying adjacent to it in the same layer. The expression 'Tangential contact' signifies a single point contact between two peripheries or shapes or figures (or cross-sections in this case),

i.e. if two cross-sections are said to be in 'tangential contact', it is meant that they touch each other only at a single point.

[00050] In the cross-section view of the second embodiment, it is clearly shown in **Figure 6** that within both the inner layer **304** and the outer layer **308**, the cross-sections of any two adjacent strands belonging to a same layer completely touch each other through at least one of the sides of their individual peripheries. Hence, the cross-sections of any two adjacent strands belonging to a same layer are in contact with each other at more than one points. In this embodiment, it is ensured that a high level of material compaction is achieved within the electrical power conductor **300**.

[00051] It is to be noted that since at least two of the electric power conductor provided by the present invention have non-circular cross-section, said strands include at least two sides.

[00052] It is to be noted that, instead of using strands having a cross-sectional shape including perfectly straight sides, strands having curved sides in their cross-sectional shape may also be used. It should also be noted that embodiments of the present invention which use strands having various other non-circular shapes such as triangular, quadrangular, trapezoidal, pentagonal, hexagonal, heptagonal, octagonal etc. are also fully covered within the scope of the invention. Also, it is to be noted that some embodiments of the present invention may use multiple strands having different non-circular cross-sectional shapes. Next, though the embodiments shown above in Figures 1 and 5 include a central core, it should be noted that various embodiments of the invention wherein the power conductor does not include a central core are also fully covered within the scope of the invention.

[00053] It should be noted that although the invention has been described in considerable detail in language specific to structural features, it is to be understood that the phraseology and terminology employed herein, as well as the abstract, are for the purpose of description and should not be regarded as limiting. And, although the invention has been described with selected embodiments, it should be understood that the invention as claimed should not be unduly limited to such specific embodiments. Indeed, various other embodiments of the claimed invention that are obvious to those skilled in the art are fully covered within the scope of the invention.

We claim:

1. An electrical power conductor having a longitudinal axis, said electrical power conductor comprising:
multiple strands for conducting electricity, said multiple strands being laid around the longitudinal axis, wherein
at least two of said multiple strands are made of a metal alloy selected from following two alloy types:
 - I. an Aluminum alloy comprising of: (a) 0.30-0.40 weight % of Si and (b) 0.30-0.40 weight % of Mg
 - II. an Aluminum alloy comprising of: (a) 0.15-0.25 weight % of Cu, (b) 0.15-0.25 weight % of Fe and (c) less than 0.07 weight % of Mg;
cross-sectional shape of each of said at least two of said multiple strands is non-circular; and said at least two of said multiple strands are laid around the longitudinal axis in a manner such that within a cross-section of the electrical power conductor, cross-section of each of said at least two of said multiple strands lies in contact with cross-section of at least one of the strands lying adjacent to it at more than one points.
2. An electrical power conductor having a longitudinal axis, said electrical power conductor comprising:
multiple strands for conducting electricity, said multiple strands being laid around the longitudinal axis, wherein
at least two of said multiple strands are made of a metal alloy selected from following two alloy types:
 - I. an Aluminum alloy comprising of: (a) 0.30-0.40 weight % of Si and (b) 0.30-0.40 weight % of Mg
 - II. an Aluminum alloy comprising of: (a) 0.15-0.25 weight % of Cu, (b) 0.15-0.25 weight % of Fe and (c) less than 0.07 weight % of Mg;
cross-sectional shape of each of said at least two of said multiple strands is non-circular; and said at least two of said multiple strands are laid around the longitudinal axis in a manner such that within a cross-section of the electrical power conductor, cross-section of each of said at least two of said multiple

- strands does not lie in tangential contact with cross-section of at least one of the strands lying adjacent to it.
3. An electrical power conductor having a longitudinal axis, said electrical power conductor comprising:
multiple strands for conducting electricity, said multiple strands being laid around the longitudinal axis, wherein
at least two of said multiple strands are made of an Aluminum alloy;
cross-sectional shape of each of said at least two of said multiple strands is non-circular; and
said at least two of said multiple strands are laid around the longitudinal axis in a manner such that within a cross-section of the electrical power conductor, cross-section of each of said at least two of said multiple strands lies in contact with cross-section of at least one of the strands lying adjacent to it at more than one points.
4. An electrical power conductor having a longitudinal axis, said electrical power conductor comprising:
multiple strands for conducting electricity, said multiple strands being laid around the longitudinal axis, wherein
at least two of said multiple strands are made of an Aluminum alloy;
cross-sectional shape of each of said at least two of said multiple strands is non-circular; and
said at least two of said multiple strands are laid around the longitudinal axis in a manner such that within a cross-section of the electrical power conductor, cross-section of each of said at least two of said multiple strands does not lie in tangential contact with cross-section of at least one of the strands lying adjacent to it.
5. An electrical power conductor having a longitudinal axis, said electrical power conductor comprising:
multiple strands for conducting electricity, said multiple strands being laid around the longitudinal axis, wherein
each of said multiple strands are made of an Aluminum alloy;

cross-sectional shape of each of said multiple strands is non-circular; and each of said multiple strands are laid around the longitudinal axis in a manner such that within a cross-section of the electrical power conductor, cross-section of each of said multiple strands lies in contact with cross-section of at least one of the strands lying adjacent to it at more than one points.

6. An electrical power conductor having a longitudinal axis, said electrical power conductor comprising:
multiple strands for conducting electricity, said multiple strands being laid around the longitudinal axis, wherein
each of said multiple strands are made of an Aluminum alloy;
cross-sectional shape of each of said multiple strands is non-circular; and
each of said multiple strands are laid around the longitudinal axis in a manner such that within a cross-section of the electrical power conductor, cross-section of each of said multiple strands does not lie in tangential contact with cross-section of at least one of the strands lying adjacent to it.
7. An electrical power conductor as claimed in claim 1 or claim 2 or claim 3 or claim 4 or claim 5 or claim 6 wherein said electrical power conductor further comprises of a central core, said central core lying symmetrically around the longitudinal axis.
8. An electrical power conductor as claimed in claim 1 or claim 2 or claim 3 or claim 4, wherein the cross-sectional shape of said at least two of said multiple strands includes at least two sides.
9. An electrical power conductor as claimed in claim 5 or claim 6, wherein the cross-sectional shape of each of said multiple strands is trapezoidal.

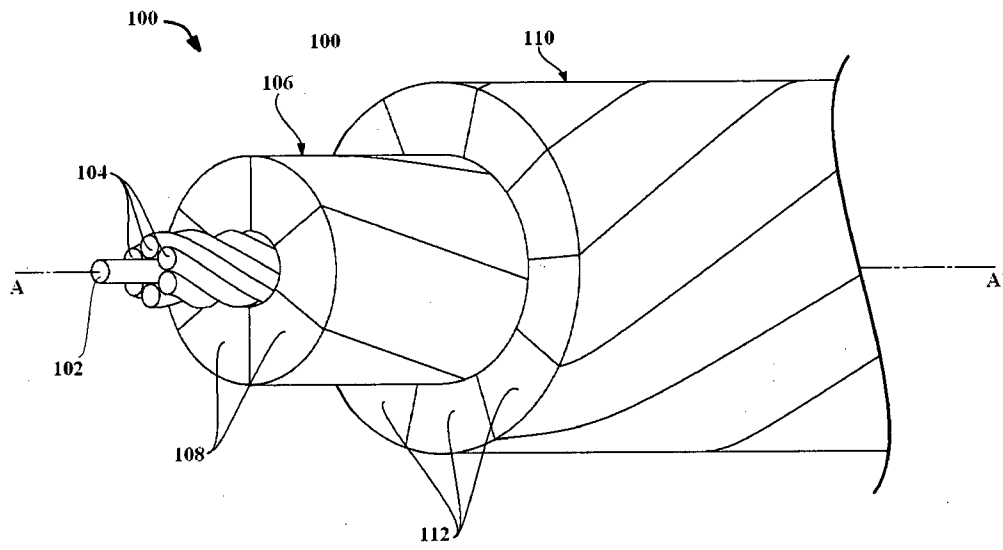


FIGURE 1

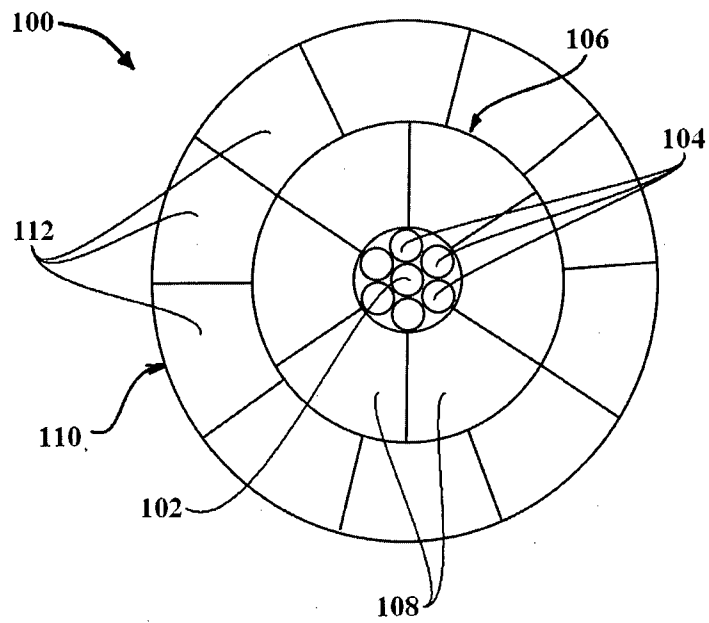
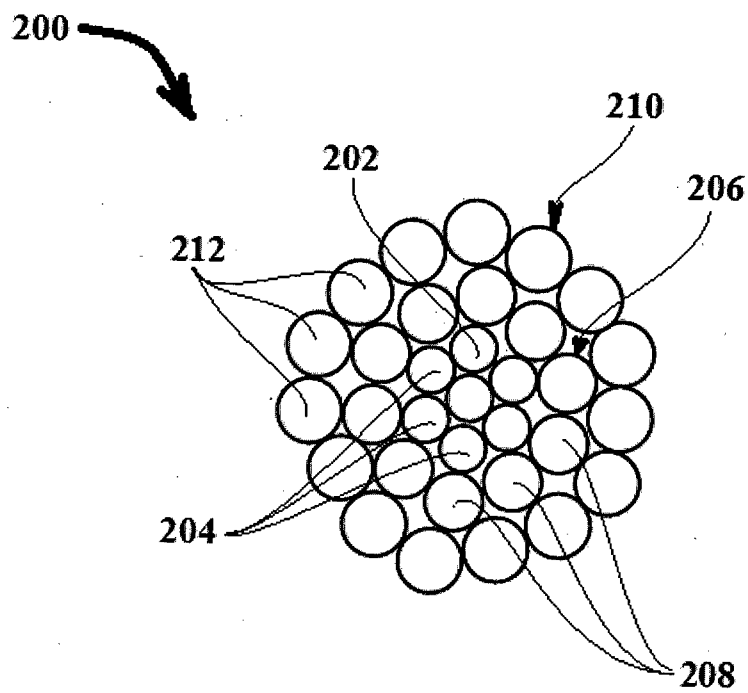
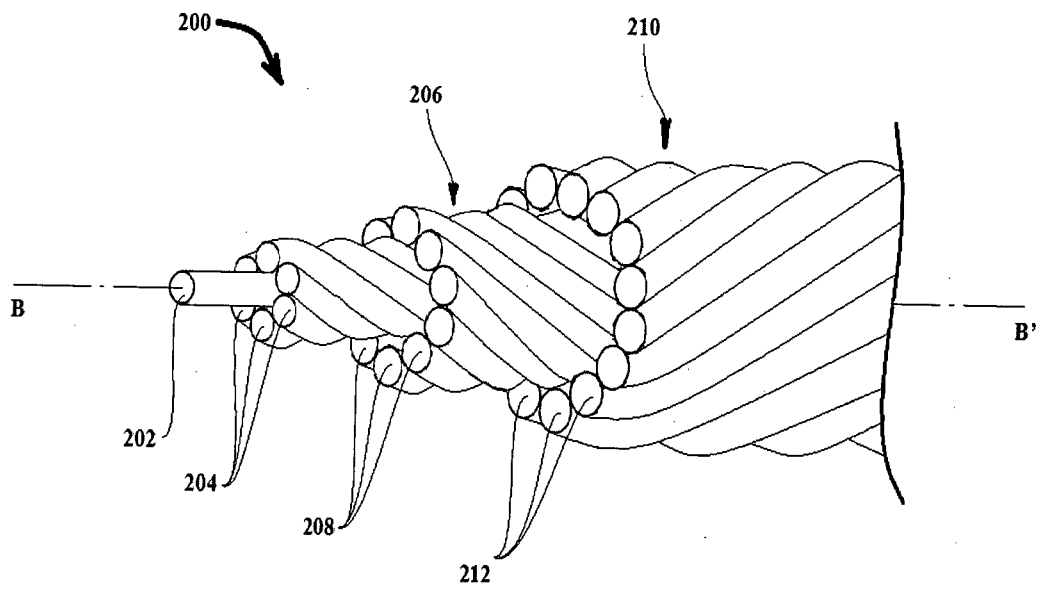


FIGURE 2



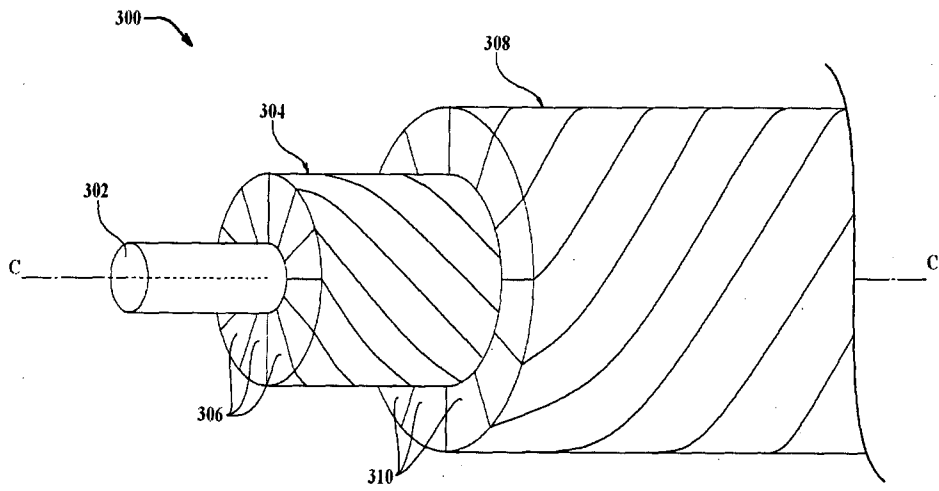


FIGURE 5

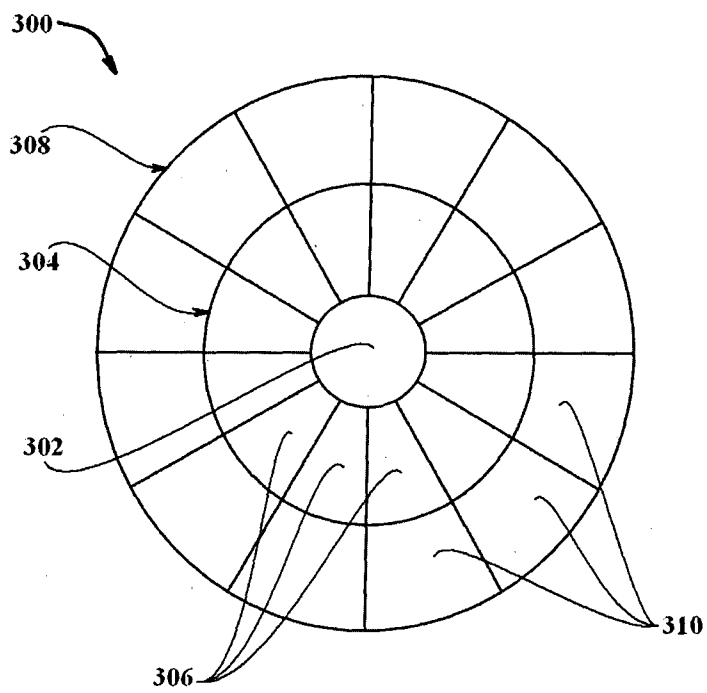


FIGURE 6