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(54) Title: OUTLET BAR FOR TRANSFORMER COIL AND TRANSFORMER WITH SUCH OUTLET BAR

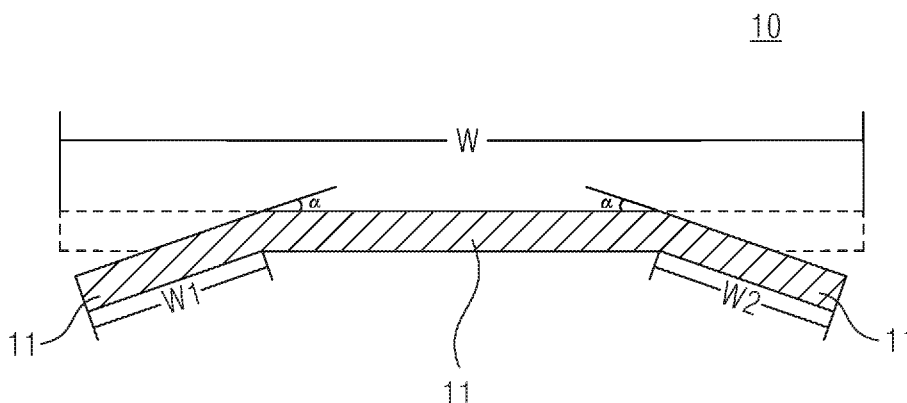


Fig. 2

(57) Abstract: The application provides an outlet bar for a transformer coil and a transformer with such an outlet bar. The outlet bar is characterized by including at least two flat sections, when being observed in a cross section of the outlet bar, each flat section is continuously arranged in a manner of fitting with a circumference of the transformer coil, and an angle α is formed between two adjacent flat sections. According to the application, the outlet bar, when being welded to the coil along an axial direction of the coil, can fit well with an arc surface of the coil to meet coil winding requirements, so that the problem that a coil winding dimension cannot be ensured in a production process of a low-voltage/high-current low-voltage coil is solved, the overall dimension of the transformer is small, the production cost is reduced, an insulation distance is ensured, the passing rate is increased, and the quality of the transformer is improved.



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Outlet bar for transformer coil and transformer with such outlet bar

Technical Field

The application relates to the technical field of power devices, and more particularly to an outlet bar for a transformer coil and a transformer with such an outlet bar.

Background

In this field, for especially wide copper/aluminum outlet bars, in practice, it is difficult to ensure a gap between inner and outer outlet bars during winding due to a tension limit of a device, and as a result, a practical position of the outer outlet bar is quite beyond a position of a coil. If a main air gap is not so large, an insulation distance is always not enough, an insulator mounting gap is large, and if there is a side outgoing line, mounting of the side outgoing line may also be influenced. At present, there is yet no good method for solving these problems, and a winding deviation of the outlet bar may be compensated only by enlarging the main air gap.

Fig. 1 is a schematic cross section view illustrating a structure of a winding for a transformer according to the prior art.

Referring to Fig. 1, the winding includes a coil 1 and inner and outer outlet bars 2. The coil 1 is formed by coaxially winding a plurality of insulating layers and conductive copper/aluminum coil layers at intervals. The inner and outer outlet bars 2 are welded to the coil 1 along an axial direction of the coil 1.

In addition, it can be seen clearly from Fig. 1 that the inner and outer outlet bars 2 are flat. Therefore, when the inner and outer outlet bars 2 are welded to the coil 1 along the axial direction Y of the coil 1, the inner and outer outlet bars 2 cannot fit with an arc surface of the coil 1. Consequently, a coil winding dimension cannot be ensured in a production process, the overall dimension of the transformer is large, and the production cost is increased. Moreover, for especially wide copper/aluminum outlet bars, it is difficult to ensure a gap between inner and outer outlet bars during winding due to a tension limit of a device. As a result, an insulation distance is not enough, the passing rate is reduced, and the quality of the transformer is deteriorated.

Therefore, there is an urgent need in this field for an outlet bar for a transformer

coil and a transformer, which can solve or at least alleviate the foregoing problems.

Summary

An objective of the application is to provide an outlet bar for a transformer coil. The outlet bar, when being welded to the coil along an axial direction of the coil, can fit well with an arc surface of the coil to meet coil winding requirements, so that the problem that a coil winding dimension cannot be ensured in a production process of a low-voltage/high-current low-voltage coil is solved, the overall dimension of a transformer is small, the production cost is reduced, an insulation distance can be ensured, the passing rate is increased, and the quality of the transformer is improved.

According to an exemplary embodiment of the application, an outlet bar for a transformer coil is provided, which is characterized by including at least two flat sections, wherein, when being observed in a cross section of the outlet bar, each flat section is continuously arranged in a manner of fitting with an arc surface of the transformer coil, and an angle α is formed between two adjacent flat sections.

In such a manner, the outlet bar, when being welded to the coil along an axial direction of the coil, can fit well with the arc surface of the coil to meet coil winding requirements, so that the overall dimension of a transformer is small, the production cost is reduced, an insulation distance is ensured, the passing rate is increased, and the quality of the transformer is improved.

According to the exemplary embodiment of the application, the angle α ranges from 15 degrees to 30 degrees.

In such a manner, the angle α is determined according to dimensions of the coil and an iron core, so that the outlet bar can fit well with the arc surface of the coil to ensure that a position of an outer outlet bar is in a tolerance range during practical winding and the insulation distance can meet requirements.

According to the exemplary embodiment of the application, the angle α is formed by bending the outlet bar through a bender.

In such a manner, the outlet bar is bent through the bender to fit well with the arc surface of the coil, so that the outlet bar is easier and more convenient to machine.

According to the exemplary embodiment of the application, the outlet bar is a hard copper/aluminum bar with integrated upper and lower parts.

In such a manner, the outlet bar is more convenient and easier to machine, the productivity is improved, and the production cost is reduced.

According to the exemplary embodiment of the application, the outlet bar can be used as an inner outlet bar or an outer outlet bar.

In such a manner, it is ensured that the position of the outer outlet bar is in the tolerance range during practical winding, so that the insulation distance is ensured, the passing rate is increased, and the quality of the transformer is improved.

According to the exemplary embodiment of the application, the transformer coil is a low-voltage coil.

In such a manner, the problem that a coil winding dimension cannot be ensured in a production process of a low-voltage/high-current low-voltage coil is solved, the overall dimension of the transformer is small, and the production cost is reduced.

According to the exemplary embodiment of the application, both ends of the outlet bar are bent by the angle α respectively such that the outlet bar includes three flat sections.

In such a manner, the outlet bar is bent to the three flat sections, so that the outlet bar can fit well with the arc surface of the coil to ensure that the position of the outer outlet bar is in the tolerance range during practical winding and the insulation distance can meet requirements.

According to the exemplary embodiment of the application, when being observed in the cross section of the outlet bar, a total width of the unbent outlet bar is W , and widths of the bent flat sections at both ends of the outlet bar are W_1 and W_2 respectively, $W_1+W_2=(40\%\sim 60\%)\times W$.

In such a manner, the outlet bar can fit well with the arc surface of the coil to ensure that the position of the outer outlet bar is in the tolerance range during practical winding and the insulation distance can meet requirements.

Another objective of the application is to provide a transformer. The transformer includes an outlet bar for a transformer coil according to the application. The outlet bar, when being welded to the coil along an axial direction of the coil, can fit well with an arc surface of the coil to meet coil winding requirements, so that the problem that a coil winding dimension cannot be ensured in a production process of a low-voltage/high-current low-voltage coil is solved, the overall dimension of the transformer is small, the production cost is reduced, an insulation distance is ensured, the passing rate is increased, and the quality of the transformer is improved.

Brief Description of the Drawings

The drawings described here are adopted to provide a further understanding to the application and form a part of the application. Schematic embodiments of the application and descriptions thereof are adopted to explain the application and not intended to form improper limits to the application. In the drawings:

Fig. 1 is a schematic cross section view illustrating a structure of a winding for a transformer according to the prior art; and

Fig. 2 is a schematic cross section view of an outlet bar for a transformer coil according to a preferred embodiment of the application.

Detailed Description of the Embodiments

In order to make those skilled in the art understand the solutions of the application better, the technical solutions in the embodiments of the application will be clearly and completely described below in combination with the drawings in the embodiments of the application. It is apparent that the described embodiments are not all embodiments but only a part of the embodiments of the application. All other embodiments obtained by those of ordinary skill in the art based on the embodiments in the application without creative work shall fall within the scope of protection of the application.

It is to be noted that terms "first", "second" and the like in the specification, claims and drawings of the application are adopted not to describe a specific sequence or order but to distinguish similar objects. It is to be understood that data used like this may be exchanged under a proper condition for implementation of the embodiments of the application described here in sequences besides those shown or described herein. Moreover, terms like "include" and "have" and any transformation thereof of them are intended to cover nonexclusive inclusions. For example, a process, method, system, product or device including a series of steps or modules or units is not limited to those clearly listed steps or modules or units, but may include other steps or modules or units which are not clearly listed or inherent in the process, the method, the system, the product or the device.

For solving or at least alleviating the foregoing problems in the conventional art, an objective of the application is to provide an outlet bar for a transformer coil, which is characterized by including at least two flat sections. When being observed in a cross section of the outlet bar, each flat section is continuously arranged in a manner

of fitting with an arc surface of the transformer coil, and an angle α is formed between two adjacent flat sections.

In such a manner, the outlet bar, when being welded to the coil along an axial direction of the coil, can fit well with an arc surface of the coil to meet coil winding requirements, so that the problem that a coil winding dimension cannot be ensured in a production process of a low-voltage/high-current low-voltage coil is solved, the overall dimension of a transformer is small, the production cost is reduced, an insulation distance can be ensured, the passing rate is increased, and the quality of the transformer is improved.

Furthermore, the angle α ranges from 15 degrees to 30 degrees. Moreover, the angle α is determined according to dimensions of the coil and an iron core, so that the outlet bar can fit well with the arc surface of the coil to ensure that a position of an outer outlet bar is in a tolerance range during practical winding and the insulation distance can meet requirements.

Furthermore, the angle α is formed by bending the outlet bar through a bender. The outlet bar is bent through the bender to fit well with the arc surface of the coil, so that the outlet bar is easier and more convenient to machine.

Furthermore, the outlet bar is a hard copper/aluminum bar with integrated upper and lower parts. Therefore, the outlet bar is more convenient and easier to machine, the productivity is improved, and the production cost is reduced.

Furthermore, the outlet bar can be used as an inner outlet bar or an outer outlet bar. In such a manner, it is ensured that the position of the outer outlet bar is in the tolerance range during practical winding, so that the insulation distance is ensured, the passing rate is increased, and the quality of the transformer is improved.

Furthermore, the transformer coil is a low-voltage coil. Therefore, the problem that a coil winding dimension cannot be ensured in a production process of a low-voltage/high-current low-voltage coil is solved, the overall dimension of the transformer is small, and the production cost is reduced.

For better understanding, refer to Fig. 2. Fig. 2 is a schematic cross section view of an outlet bar for a transformer coil according to a preferred embodiment of the application.

An unbent outlet bar is shown with the dashed line in Fig. 2. In addition, the solid lines in Fig. 2 show that both ends of the outlet bar 10 are bent by the angle α respectively such that the outlet bar 10 includes three flat sections 11.

In such a manner, the outlet bar is bent to the three flat sections, so that, when the outlet bar is welded to the coil along the axial direction of the coil, the outlet bar can fit well with the arc surface of the coil to ensure that the position of the outer outlet bar is in the tolerance range during practical winding and the insulation distance can meet requirements.

In addition, it can be seen from Fig. 2 that a total width of the unbent outlet bar is W and widths of the bent flat sections 11 at both ends of the outlet bar 10 are $W1$ and $W2$ respectively.

Furthermore, $W1+W2=(40\%\sim 60\%)\times W$.

In such a manner, the outlet bar can fit well with the arc surface of the coil to ensure that the position of the outer outlet bar is in the tolerance range during practical winding and the insulation distance can meet requirements.

Another objective of the application is to provide a transformer. The transformer includes an outlet bar for a transformer coil according to the application. The outlet bar, when being welded to the coil along an axial direction of the coil, can fit well with an arc surface of the coil to meet coil winding requirements, so that the problem that a coil winding dimension cannot be ensured in a production process of a low-voltage/high-current low-voltage coil is solved, the overall dimension of the transformer is small, the production cost is reduced, an insulation distance is ensured, the passing rate is increased, and the quality of the transformer is improved.

For ease of description, spatial relative terms such as "over", "above", "on an upper surface" and "upper" may be used herein for describing a spatial position relation between a device or feature and other devices or features shown in the drawings. It will be appreciated that the spatial relative terms aim to contain different orientations in usage or operation besides the orientations of the devices described in the drawings. For example, if the devices in the drawings are inverted, devices described as "above other devices or structures" or "over other devices or structures" will be located as "below other devices or structures" or "under other devices or structures". Thus, an exemplar term "above" may include two orientations namely "above" and "below". The device may be located in other different modes (rotated by 90 degrees or located in other orientations), and spatial relative descriptions used herein are correspondingly explained.

In addition, it is also to be noted that "an embodiment", "another embodiment", "embodiment" and the like mentioned in the specification refer to inclusion of a

specific feature, structure or characteristic described in combination with the embodiment in at least one embodiment generally described in the application. The same expression appearing at different places in the specification does not always refer to the same embodiment. Furthermore, when a specific feature, structure or characteristic is described in combination with any embodiment, it is claimed that achievement of the feature, the structure or the characteristic in combination with another embodiment also falls in the scope of the disclosure.

In the embodiments, the descriptions of the embodiments focus on different aspects. The part which is not described in a certain embodiment in detail may refer to the related description of the other embodiments.

The above is only the preferred embodiment of the disclosure and not intended to limit the disclosure. For those skilled in the art, the disclosure may have various modifications and variations. Any modifications, equivalent replacements, improvements and the like made within the spirit and principle of the disclosure shall fall within the scope of protection of the disclosure.

What is claimed is:

1. An outlet bar (10) for a transformer coil, characterized in that the outlet bar (10) comprises at least two flat sections (11), when being observed in a cross section of the outlet bar (10), each flat section (11) is continuously arranged in a manner of fitting with an arc surface of the transformer coil, and an angle (α) is formed between two adjacent flat sections (11).
2. The outlet bar (10) for the transformer coil as claimed in claim 1, wherein the angle (α) ranges from 15 degrees to 30 degrees.
3. The outlet bar (10) for the transformer coil as claimed in claim 1 or 2, characterized in that the angle (α) is formed by bending the outlet bar (10) through a bender.
4. The outlet bar (10) for the transformer coil as claimed in claim 1 or 2, characterized in that the outlet bar (10) is a hard copper/aluminum bar with integrated upper and lower parts.
5. The outlet bar (10) for the transformer coil as claimed in claim 1 or 2, characterized in that the outlet bar (10) is used as an inner outlet bar or an outer outlet bar.
6. The outlet bar (10) for the transformer coil as claimed in claim 1 or 2, characterized in that the transformer coil is a low-voltage coil.
7. The outlet bar (10) for the transformer coil as claimed in claim 1 or 2, characterized in that both ends of the outlet bar (10) are bent by the angle (α) respectively such that the outlet bar (10) comprises three flat sections (11).
8. The outlet bar (10) for the transformer coil as claimed in claim 7, characterized in that, when being observed in the cross section of the outlet bar, a total width of the unbent outlet bar (10) is W, and widths of the bent flat sections (11) at both ends of the outlet bar (10) are W1 and W2 respectively, $W1+W2=(40\%\sim 60\%)\times W$.
9. A transformer, comprising the outlet bar (10) as claimed in any one of claims 1-8.

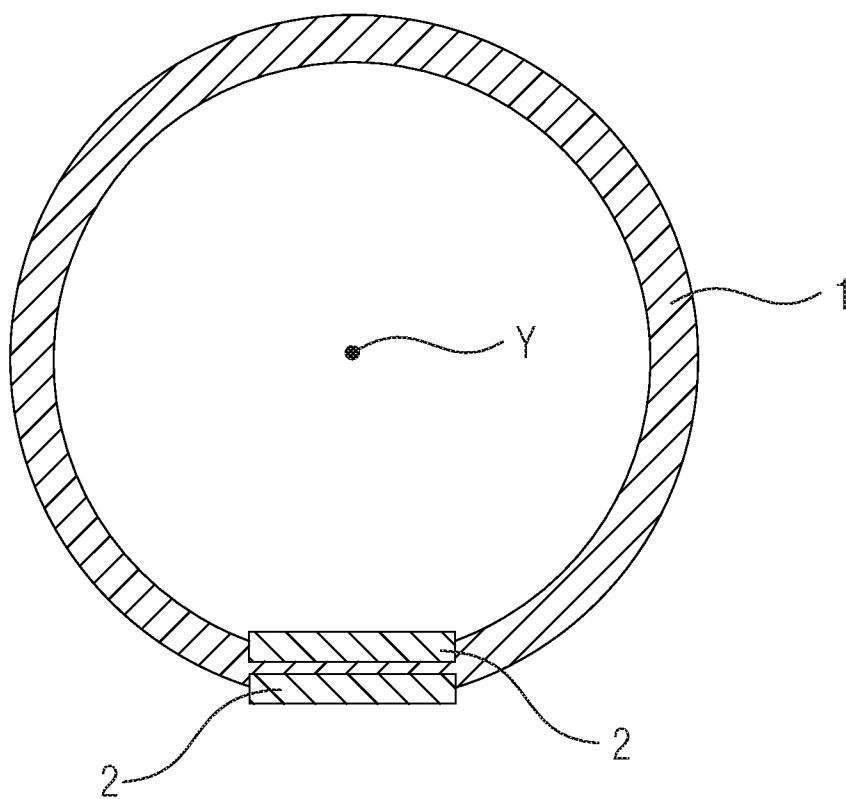


Fig. 1

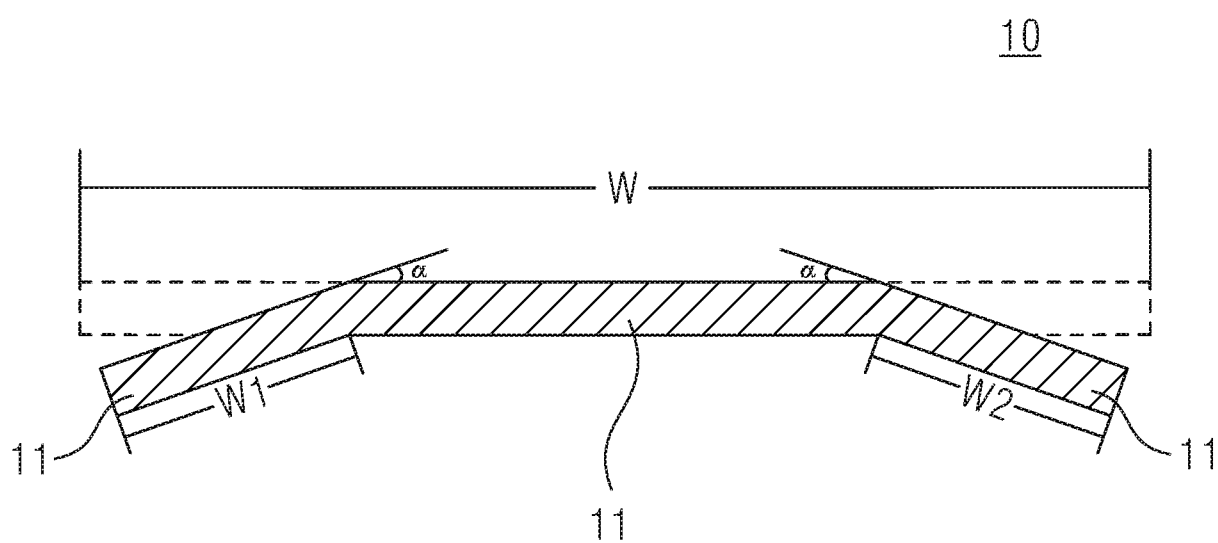


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/117202

A. CLASSIFICATION OF SUBJECT MATTER

H01F 27/28(2006.01)i; H01F 27/29(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01F,H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT,CNKI,WPI,EPODOC: transformer, coil, outlet, bar, flat, angle, low, voltage, bend, bent, polygon, trapezium, buckling

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 201369220 Y (WUHAN ZHENYUAN ELECTRIC POWER EQUIPMENT CO., LTD.) 23 December 2009 (2009-12-23) description, pages 1-2 and figures 1-2	1-9
X	CN 201266537 Y (GUANGDONG HAIHONG TRANSFORMER CO., LTD.) 01 July 2009 (2009-07-01) description, page 1 and figures 1-2	1-9
X	CN 203386586 U (ZHENJIANG TIANLI TRANSFORMER CO., LTD.) 08 January 2014 (2014-01-08) description, pages 5-24 and figures 5-6	1-9
X	CN 103996502 A (KUNSHAN YOUXIANG ELECTRONIC TECHNOLOGY CO., LTD.) 20 August 2014 (2014-08-20) description, pages 2-25 and figures 1-2	1-3, 5-9
A	KR 20040024950 A (CQICE INC.) 24 March 2004 (2004-03-24) the whole document	1-9



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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“&” document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2020/117202

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN	201369220	Y	23 December 2009	None	
CN	201266537	Y	01 July 2009	None	
CN	203386586	U	08 January 2014	None	
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KR	20040024950	A	24 March 2004	None	