

TITLE OF INVENTION: MULTI-CORE GLASS SINTERED SHIELDING ELECTRICAL CONNECTOR ASSEMBLY

Technical Field

The present invention relates to the technical field of electrical connectors, and in particular, to a multi-core glass sintered shielding electrical connector assembly capable of operating under high-temperature and high-hydraulic pressure conditions.

Background Art

At present, with the continuous development of electrical connectors, the functions of the electrical connectors are constantly perfected. The functions of petroleum-based electrical connectors are particularly complicated. The connectors and assemblies thereof are required to not only resist high temperature and high pressure, but also have the capability of anti-electromagnetic interference, which is challenging for designers. Design of an electromagnetic shielding structure ensures the signal transmission stability in a shielding layer, and is particularly important to the electrical stability, thereby reducing noise interference, ensuring the signal transmission quality, and facilitating signal analysis of transmission data.

A petroleum exploitation apparatus is generally of a circular structure, and the petroleum-based electrical connectors are mainly designed in a circular structure. The circular structure has good pressure bearing capacity while making full use of the space of the petroleum exploitation apparatus. Generally, the shielding structures of the electrical connectors mainly employ metal housing shielding and metal shielding mesh shielding; and the technical effects are relatively limited, pressure bearing and high temperature resistance are poor, shielding is unstable. It is extremely urgent to design an electrical connector component having an excellent electromagnetic shielding effect.

Summary

The present invention overcomes the shortcomings of the prior art, and provides a multi-core glass sintered shielding electrical connector assembly, which solves the technical problems in the prior art of poor pressure bearing and high temperature resistance and unstable shielding of electrical connector assemblies.

To achieve the forgoing objective, the technical solution employed by the present invention is as follows: a multi-core glass sintered shielding electrical connector assembly, including a

sintered combination member, a dielectric body, a multi-core shielding wire, a first metal shielding casing, a second metal shielding casing, a rubber sleeve, and a heat shrinkable tube, where the sintered combination member includes an inner layer structure, a middle conductor, an outer layer structure, and a metal housing which are sequentially arranged from inside to outside; the inner layer structure includes three pins, and a first ceramic base, a first glass blank, and a second ceramic base which are sequentially arranged in an axial direction, and the three pins penetrate through the first ceramic base, the first glass blank, and the second ceramic base in the axial direction; the outer layer structure includes a third ceramic base, a second glass blank, and a fourth ceramic base which are sequentially arranged in the axial direction; the dielectric body is mounted in the middle conductor; the multi-core shielding wire is connected to the pins; the first metal shielding casing is connected to a shaft end part of the middle conductor, and the second metal shielding casing is connected to a shaft end part of the first metal shielding casing; a wire shielding layer of the multi-core shielding wire is partially provided in a cavity formed by the first metal shielding casing and the second metal shielding casing; a cavity formed by the middle conductor, the first metal shielding casing, the second metal shielding casing, and the wire shielding layer is filled with a colloid; the rubber sleeve is pressed into a cavity formed by the multi-core shielding wire and the second metal shielding casing; and the heat shrinkable tube is sleeved outside the middle conductor, the first metal shielding casing, the second metal shielding casing, and the multi-core shielding wire.

In a preferred embodiment of the present invention, the multi-core glass sintered shielding electrical connector assembly further includes: three first through holes evenly distributed in the circumferential direction are provided in the first ceramic base, three second through holes evenly distributed in the circumferential direction are provided in the first glass blank, three third through holes evenly distributed in the circumferential direction are provided in the second ceramic base, and the pins penetrate through the first through holes, the second through holes, and the third through holes.

In a preferred embodiment of the present invention, the multi-core glass sintered shielding electrical connector assembly further includes: a first step is provided on an outer wall of the first ceramic base, a second step and a third step are provided on an inner wall of the middle conductor, the second step is in contact fit with the first step, and the dielectric body is in contact fit with the third step.

In a preferred embodiment of the present invention, the multi-core glass sintered

shielding electrical connector assembly further includes: an outer diameter of the dielectric body is less than a diameter of a large-diameter hole of an inner wall of the middle conductor, one end of the dielectric body in contact fit with the third step is provided with a circular recess, a diameter of the circular recess is greater than an outer diameter of a small-diameter end of the first ceramic base, and the small-diameter end of the first ceramic base is partially provided in the circular recess.

In a preferred embodiment of the present invention, the multi-core glass sintered shielding electrical connector assembly further includes: bosses are provided in the middle of an outer wall of the middle conductor, a fourth step is provided on an inner wall of the third ceramic base, and a fifth step is provided on an outer wall of the third ceramic base; and the bosses are in contact fit with the fourth step, a positioning step is provided on an inner wall of the metal housing, and the positioning step is in contact fit with the fifth step.

In a preferred embodiment of the present invention, the multi-core glass sintered shielding electrical connector assembly further includes: a connecting section, a sealing groove, and a mounting thread are provided on the metal housing.

In a preferred embodiment of the present invention, the multi-core glass sintered shielding electrical connector assembly further includes: the pins are cylindrical, and welding holes are provided in two shaft ends of each of the pins.

In a preferred embodiment of the present invention, the multi-core glass sintered shielding electrical connector assembly further includes: the first metal shielding casing and the second metal shielding casing are both tubular, a sixth step and a seventh step are provided on an inner wall of the first metal shielding casing, an eighth step and a ninth step are provided on an outer wall of the first metal shielding casing, and a tenth step is provided on an inner wall of the second metal shielding casing.

In a preferred embodiment of the present invention, the multi-core glass sintered shielding electrical connector assembly further includes: the rubber sleeve is in interference fit with the multi-core shielding wire and the second metal shielding casing.

In a preferred embodiment of the present invention, the multi-core glass sintered shielding electrical connector assembly further includes: the first metal shielding casing is provided with a first solder injection hole, and the second metal shielding casing is provided with a second solder injection hole.

The present invention solves the defects in the background art. In the present invention, the three pins are evenly distributed at 120°, an insulating dielectric is formed by integrally sintering the first ceramic base, the first glass blank, the second ceramic base of the inner layer, and the third ceramic base, the second glass blank, and the fourth ceramic base of the outer layer, and the shielding layer of a connector is integrally sintered together with the connector, thereby ensuring the pressure bearing characteristic of the connector and also ensuring the shielding characteristics of the connector. The middle conductor, the first metal shielding casing, the second metal shielding casing, and the wire shielding layer are welded at two ends of the connector to form a full-shielding structure, and colloid filling ensures that the assembly has the characteristics of high temperature resistance and high hydraulic pressure resistance and shielding, so that anti-interference transmission of multi-core signals is realized, and the connector may operate in high-temperature and high-hydraulic pressure environments.

Brief Description of the Drawings

The present invention is further described below with the accompanying drawings and embodiments.

FIG. 1 is a schematic structural diagram of a preferred embodiment of the present invention;

FIG. 2 is a partial schematic structural diagram of a preferred embodiment of the present invention;

FIG. 3 is a schematic structural diagram of an electrical connector according to a preferred embodiment of the present invention;

FIG. 4 is a schematic structural diagram of a first ceramic base according to a preferred embodiment of the present invention;

FIG. 5 is a side view of a first ceramic base of a preferred embodiment of the present invention;

FIG. 6 is a schematic structural diagram of a first glass blank according to a preferred embodiment of the present invention;

FIG. 7 is a side view of a first glass blank according to a preferred embodiment of the present invention;

FIG. 8 is a schematic structural diagram of a second ceramic base according to a

preferred embodiment of the present invention;

FIG. 9 is a side view of a second ceramic base according to a preferred embodiment of the present invention;

FIG. 10 is a schematic structural diagram of a dielectric body according to a preferred embodiment of the present invention;

FIG. 11 is a side view of a dielectric body according to a preferred embodiment of the present invention;

FIG. 12 is a schematic structural diagram of a pin of a preferred embodiment of the present invention;

FIG. 13 is a schematic structural diagram of a middle conductor according to a preferred embodiment of the present invention;

FIG. 14 is a schematic structural diagram of a third ceramic base according to a preferred embodiment of the present invention;

FIG. 15 is a schematic structural diagram of a second glass blank according to a preferred embodiment of the present invention;

FIG. 16 is a schematic structural diagram of a fourth ceramic base according to a preferred embodiment of the present invention;

FIG. 17 is a schematic structural diagram of a metal housing according to a preferred embodiment of the present invention;

FIG. 18 is a schematic structural diagram of a first metal shield casing according to a preferred embodiment of the present invention;

FIG. 19 is a schematic structural diagram of a second metal shield casing according to a preferred embodiment of the present invention; and

FIG. 20 is a schematic structural diagram of a rubber sleeve according to a preferred embodiment of the present invention.

Detailed Description

The present invention is now explained in further detail in conjunction with the accompanying drawings and embodiments. These accompanying drawings are all simplified schematic diagrams, which merely illustrate the basic structure of the present invention

schematically, and so only show the structure relevant to the present invention.

As shown in FIG. 1 to FIG. 3, a multi-core glass sintered shielding electrical connector assembly includes: a sintered combination member 1, a dielectric body 2, a multi-core shielding wire 3, a first metal shielding casing 4, a second metal shielding casing 5, a rubber sleeve 6, and a heat shrinkable tube 7, where the sintered combination member 1 includes an inner layer structure, a middle conductor 101, an outer layer structure, and a metal housing 102 which are sequentially arranged from inside to outside; the inner layer structure includes three pins 103, and a first ceramic base 104, a first glass blank 105, and a second ceramic base 106 which are sequentially arranged in an axial direction, and the three pins 103 penetrate through the first ceramic base 104, the first glass blank 105, and the second ceramic base 106 in the axial direction; the outer layer structure includes a third ceramic base 107, a second glass blank 108, and a fourth ceramic base 109 which are sequentially arranged in the axial direction; the dielectric body 2 is mounted in the middle conductor 101; the multi-core shielding wire 3 is connected to the pins 103; the first metal shielding casing 4 is connected to a shaft end part of the middle conductor 101, and the second metal shielding casing 5 is connected to a shaft end part of the first metal shielding casing 4; a wire shielding layer 301 of the multi-core shielding wire 3 is partially provided in a cavity formed by the first metal shielding casing 4 and the second metal shielding casing 5; a cavity formed by the middle conductor 101, the first metal shielding casing 4, the second metal shielding casing 5, and the wire shielding layer 301 is filled with a colloid 8; the rubber sleeve 6 is pressed into a cavity formed by the multi-core shielding wire 3 and the second metal shielding casing 5; and the heat shrinkable tube 7 is sleeved outside the middle conductor 101, the first metal shielding casing 4, the second metal shielding casing 5, and the multi-core shielding wire 3. By means of the colloid 8, the pressure-bearing performance is improved, and welding points may be protected. The arrangement of the rubber sleeve 6 may realize the sealing between the second metal shielding casing 5 and the multi-core shielding wire 3, thereby avoiding flow-in of external liquid. The heat shrinkable tube 7 may protect the welding points. The wire shielding layer 301 is mesh-shaped so as to facilitate pouring of the colloid 8.

The sintered combination member 1 and the dielectric body 2 form an electrical connector 9. The electrical connector 9 is designed in a five-layer structure, which includes a three-layer metal structure and a two-layer insulating structure. The three-layer metal structure includes the inner layer structure having pins 103, a middle layer structure as the

middle conductor 101, and the outer layer structure as the metal housing 102. The two-layer insulating structure includes a first insulating structure consisting of the first ceramic base 104, the first glass blank 105, and the second ceramic base 106, and a second insulating structure consisting of the third ceramic base 107, the second glass blank 108, and the fourth ceramic base 109. Glass and ceramic are bonded under a high temperature condition to form an insulating dielectric layer. As shown in FIG. 4 to FIG. 9, according to the present invention, preferably, three first through holes 1041 evenly distributed in the circumferential direction are provided in the first ceramic base 104, three second through holes 1051 evenly distributed in the circumferential direction are provided in the first glass blank 105, three third through holes 1061 evenly distributed in the circumferential direction are provided in the second ceramic base 106, and the pins 103 penetrate through the first through holes 1041, the second through holes 1051, and the third through holes 1061. Further, preferably, diameters of circles where circle centers of the three first through holes 1041, the three second through holes 1051, and the three third through holes 1061 are located are the same.

As shown in FIG. 4, a first step 1042 is provided on an outer wall of the first ceramic base 104, and the first step 1042 is a slope step. As shown in FIG. 13, a second step 1011 and a third step 1012 are provided on an inner wall of the middle conductor 101, and the second step 1011 is in contact fit with the first step 1042, thereby realizing positioning of the first ceramic base 104, the first glass blank 105, and the second ceramic base 106. The dielectric body 2 is in contact fit with the third step 1012.

As shown in FIG. 10 and FIG. 11, three fourth through holes 201 evenly distributed in the circumferential direction are provided in the dielectric body 2, and diameters of circles where circle centers of the three fourth through holes 201 are located are the same as the diameters of circles where circle centers of the three first through holes 1041 are located. An outer diameter of the dielectric body 2 is less than a diameter of a large-diameter hole of an inner wall of the middle conductor 101, thereby facilitating colloid filling between the dielectric body 2 and the middle conductor 101. One end of the dielectric body 2 in contact fit with the third step 1012 is provided with a circular recess 202, a diameter of the circular recess 202 is greater than an outer diameter of a small-diameter end of the first ceramic base 104, and the small-diameter end of the first ceramic base 104 is partially provided in the circular recess 201. The dielectric body 2, the first ceramic base 104, the first glass blank 105, and the second ceramic base 106 are coaxially arranged.

As shown in FIG. 12, the pins 103 are cylindrical, and welding holes 1031 are provided in

two shaft ends of each of the pins 103. Each welding hole 1031 is communicated with a welding observation hole 1032. The diameters of the first through holes 1041, the second through holes 1051, the third through holes 1061, and the fourth through holes 201 are slightly greater than the diameters of the pins 103, thereby facilitating penetration of the pins 103. The pins 103 are designed in a symmetrical manner. When the product is sintered, the distance between the pins 103 and the metal housing 102 is controlled by means of a sintering mold.

As shown in FIG. 13 to FIG. 16, bosses 1013 are provided in the middle of an outer wall of the middle conductor 101. The third ceramic base 107 is of a tubular structure, a fourth step 1071 is provided on an inner wall of the third ceramic base 107, and a fifth step 1072 is provided on an outer wall of the third ceramic base 107. The bosses 1013 are in contact fit with the fourth step 1071. A positioning step 1021 is provided on an inner wall of the metal housing 102, and the positioning step 1021 is in contact fit with the fifth step 1072. Positioning of the third ceramic base 107, the second glass blank 108, and the fourth ceramic base 109 is realized. The second glass blank 108 is of a tubular structure, an outer diameter of the second glass blank 108 is less than an inner diameter of a large hole of an inner wall of the metal housing 102, and an inner diameter of the second glass blank 108 is less than outer diameters of the bosses 1013. The fourth ceramic base 109 is of a tubular structure, an outer diameter of the fourth ceramic base 109 is less than the inner diameter of the large hole of the inner wall of the metal housing 102, and an inner diameter of the fourth ceramic base 109 is greater than an outer diameter of a non-boss 1013 section of the middle conductor 101.

As shown in FIG. 17, a connecting section 1022, a sealing groove 1023, and a mounting thread 1024 are provided on the metal housing 102. The connecting section 1022 is configured to connect to an external tool. The sealing groove 1023 is configured to mount a sealing ring, so as to realize a sealing fit with an external device. The mounting thread 1024 is configured to be in thread fit with the external device. Preferably, the connecting section 1022 is a hexagonal connecting section.

As shown in FIG. 18 and FIG. 19, the first metal shielding casing 4 and the second metal shielding casing 5 are both tubular, a sixth step 401 and a seventh step 402 are provided on an inner wall of the first metal shielding casing 4, an eighth step 403 and a ninth step 404 are provided on an outer wall of the first metal shielding casing 4, and a tenth step 501 is provided on an inner wall of the second metal shielding casing 5. The

diameter of the sixth step 401 of the first metal shielding casing 4 is slightly greater than the outer diameters of the second ceramic base 107 and the dielectric body 2. The outer diameters of the second ceramic base 107 and the dielectric body 2 are the same. The outer diameter of the eighth step 403 is greater than the outer diameter of the ninth step 404. An end surface of the eighth step 403 and a large-diameter end of the inner wall of the second metal shielding casing 5 are in fit, and are subjected to weld sealing. The height difference between the eighth step 403 and the ninth step 404 is used to place the wire shielding layer 301, and to stack tin solders for sealing. The diameter of the large-diameter end of the inner wall of the second metal shielding casing 5 is greater than the diameter of a small-diameter end of the outer wall of the first metal shielding casing 4.

In the present invention, in order to facilitate welding, preferably, the first metal shielding casing 4 is provided with a first solder injection hole 405, and the second metal shielding casing 5 is provided with a second solder injection hole 502. The middle conductor 101, the first metal shielding casing 4, the second metal shielding casing 5, and the wire shielding layer 301 are welded to form a full-shielding structure. The full-shielding structure is of a symmetrical structure.

As shown in FIG. 20, the rubber sleeve 6 is tubular, an inner diameter of the rubber sleeve 6 is slightly less than an outer diameter of the multi-core shielding wire 3, and an outer diameter of the rubber sleeve 6 is slightly greater than the diameter of the small-diameter end of the inner wall of the second metal shielding casing 5. The rubber sleeve 6 is in interference fit with the multi-core shielding wire 3 and the second metal shielding casing 5. A top end of the rubber sleeve 6 is flush with a top end of the second metal shielding casing 5.

The multi-core glass sintered shielding electrical connector assembly of the present invention may be implemented by the following process steps:

step 1, assembling the first ceramic base 104, the first glass blank 105, the second ceramic base 106, the middle conductor 101, the third ceramic base 107, the second glass blank 108, the fourth ceramic base 109, the three pins 103, and the metal housing 102;

step 2, sintering the assembled parts to form the sintered combination member 1;

step 3, loading the dielectric body 2 from a tail portion of the middle conductor 101, pouring the colloid in a gap between the dielectric body 2 and the middle conductor 101, sealing and fixing the dielectric body 2 and the middle conductor 101, and electroplating the three pins 103, thereby forming the electrical connector 9;

step 4, welding and fixing the first metal shielding casing 4 and the middle conductor 101;

step 5, welding and fixing the multi-core shielding wire 3 and the pins 103;

step 6, welding and fixing the first metal shielding casing 4, the second metal shielding casing 5, and the wire shielding layer 301, where solders may be filled in the cavity formed by the first metal shielding casing 4 and the second metal shielding casing 5 as well as the wire shielding layer 301;

step 7, filling the colloid 8 in the cavity formed by the middle conductor 101, the first metal shielding casing 4, the second metal shielding casing 5, and the wire shielding layer 301, where the colloid 8 may be filled in a vacuum pouring manner, and an arrival position of the colloid 8 is controlled by controlling the amount of the colloid;

step 8, pressing the rubber sleeve 6 into the second metal shielding casing 5 from a tail end of the second metal shielding casing 5, so that the rubber sleeve 6 is in interference fit with the second metal shielding casing 5 and the multi-core shielding wire 3, and the rubber sleeve 6 is flush with a tail end of the second metal shielding casing 5; and

step 9, sleeving the heat shrinkable tube 7 outside the middle conductor 101, the first metal shielding casing 4, the second metal shielding casing 5, and the multi-core shielding wire 3, and performing thermal shrinkage.

The multi-core glass sintered shielding electrical connector assembly of the present invention has the characteristics of shielding and high temperature resistance and high hydraulic pressure resistance, and the full-shielding structure thereof is integrally connected by means of a metal welding method. The electrical connector included in the assembly have the characteristics of shielding and high temperature resistance and high hydraulic pressure resistance. In order to realize the pressure resistance and high temperature resistance of the assembly, the process of filling the full-shielding structure with the high temperature resistant colloid 8 is adopted, and sealing between the multi-core shielding wire 3, the first metal shielding casing 4, and the second metal shielding casing 5 are realized through interference of the rubber sleeve 6, so that the high hydraulic pressure resistance and high temperature resistance of the assembly are effectively ensured.

The above ideal embodiments according to the present invention serve to enlighten, and relevant persons would absolutely be able to make a variety of changes and amendments, based on the content of the above description, without departing from the scope of the technical thinking of the present invention. The technical scope of the present invention is not limited to the content presented herein, and must be determined according to the scope of the claims.

CLAIMS

1. A multi-core glass sintered shielding electrical connector assembly, comprising: a sintered combination member, a dielectric body, a multi-core shielding wire, a first metal shielding casing, a second metal shielding casing, a rubber sleeve, and a heat shrinkable tube, wherein the sintered combination member comprises an inner layer structure, a middle conductor, an outer layer structure, and a metal housing which are sequentially arranged from inside to outside; the inner layer structure comprises three pins, and a first ceramic base, a first glass blank, and a second ceramic base which are sequentially arranged in an axial direction, and the three pins penetrate through the first ceramic base, the first glass blank, and the second ceramic base in the axial direction; the outer layer structure comprises a third ceramic base, a second glass blank, and a fourth ceramic base which are sequentially arranged in the axial direction; the dielectric body is mounted in the middle conductor; the multi-core shielding wire is connected to the pins; the first metal shielding casing is connected to a shaft end part of the middle conductor, and the second metal shielding casing is connected to a shaft end part of the first metal shielding casing; a wire shielding layer of the multi-core shielding wire is partially provided in a cavity formed by the first metal shielding casing and the second metal shielding casing; a cavity formed by the middle conductor, the first metal shielding casing, the second metal shielding casing, and the wire shielding layer is filled with a colloid; the rubber sleeve is pressed into a cavity formed by the multi-core shielding wire and the second metal shielding casing; and the heat shrinkable tube is sleeved outside the middle conductor, the first metal shielding casing, the second metal shielding casing, and the multi-core shielding wire.

2. The multi-core glass sintered shielding electrical connector assembly according to claim 1, wherein three first through holes evenly distributed in the circumferential direction are provided in the first ceramic base, three second through holes evenly distributed in the circumferential direction are provided in the first glass blank, three third through holes evenly distributed in the circumferential direction are provided in the second ceramic base, and the pins penetrate through the first through holes, the second through holes, and the third through holes.

3. The multi-core glass sintered shielding electrical connector assembly according to claim 1, wherein a first step is provided on an outer wall of the first ceramic base, a second

step and a third step are provided on an inner wall of the middle conductor, the second step is in contact fit with the first step, and the dielectric body is in contact fit with the third step.

4. The multi-core glass sintered shielding electrical connector assembly according to claim 1, wherein an outer diameter of the dielectric body is less than a diameter of a large-diameter hole of an inner wall of the middle conductor, one end of the dielectric body in contact fit with the third step is provided with a circular recess, a diameter of the circular recess is greater than an outer diameter of a small-diameter end of the first ceramic base, and the small-diameter end of the first ceramic base is partially provided in the circular recess.

5. The multi-core glass sintered shielding electrical connector assembly according to claim 1, wherein bosses are provided in the middle of an outer wall of the middle conductor, a fourth step is provided on an inner wall of the third ceramic base, and a fifth step is provided on an outer wall of the third ceramic base; and the bosses are in contact fit with the fourth step, a positioning step is provided on an inner wall of the metal housing, and the positioning step is in contact fit with the fifth step.

6. The multi-core glass sintered shielding electrical connector assembly according to claim 1, wherein a connecting section, a sealing groove, and a mounting thread are provided on the metal housing.

7. The multi-core glass sintered shielding electrical connector assembly according to claim 1, wherein the pins are cylindrical, and welding holes are provided in two shaft ends of each of the pins.

8. The multi-core glass sintered shielding electrical connector assembly according to claim 1, wherein the first metal shielding casing and the second metal shielding casing are both tubular, a sixth step and a seventh step are provided on an inner wall of the first metal shielding casing, an eighth step and a ninth step are provided on an outer wall of the first metal shielding casing, and a tenth step is provided on an inner wall of the second metal shielding casing.

9. The multi-core glass sintered shielding electrical connector assembly according to claim 1, wherein the rubber sleeve is in interference fit with the multi-core shielding wire and the second metal shielding casing.

10. The multi-core glass sintered shielding electrical connector assembly according to claim 1, wherein the first metal shielding casing is provided with a first solder injection hole, and the second metal shielding casing is provided with a second solder injection hole.