(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 August 2009 (06.08.2009)

PCT

(10) International Publication Number
WO 2009/096590 A1

(51) International Patent Classification:
H01R 4/18 (2006.01)

(21) International Application Number:
PCT/JP2009/051826

(22) International Filing Date: 28 January 2009 (28.01.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2008-016604 28 January 2008 (28.01.2008) JP

(71) Applicant *(for all designated States except US)*: **YAZAKI CORPORATION** [JP/JP]; 4-28, Mita 1-chome, Minato-ku, Tokyo, 1088333 (JP).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **KUWAYAMA, Yasumichi**.

(74) Agents: **OGURI, Shohei** et al.; Eikoh Patent Firm, 7-13, Nishi-Shimbashi 1-chome, Minato-ku, Tokyo 1050003 (JP).

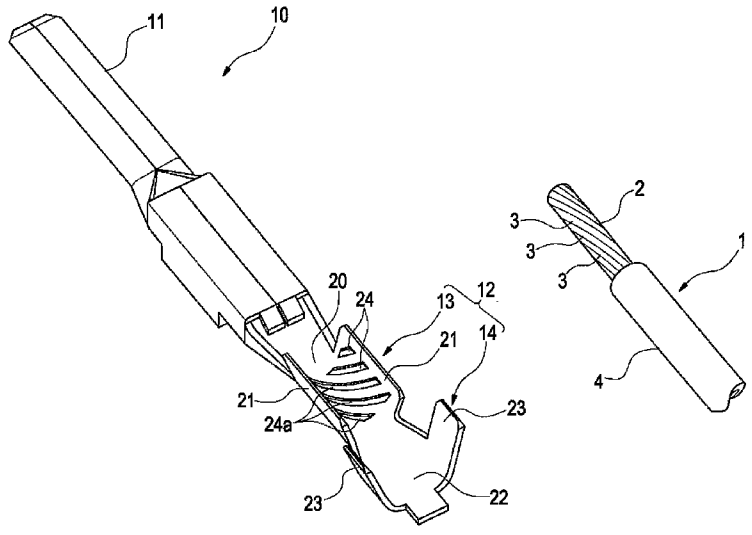
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, KE, KG, KM, KN, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, 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, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (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, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

(54) **Title:** CRIMP TERMINAL

Fig.1



(57) **Abstract:** A crimp terminal for press-clamping an aluminum wire having a conductive part which is configured by a plurality of wire elements formed of aluminum or aluminum alloy twisted together, includes a barrel part which press-fastens the conductive part. A coating film, having agglutinating function against the aluminum and aluminum alloy, is formed on a contact surface of the barrel so as to bring into contact with a crimp portion of the conductive part. A plurality of grooves, extending in parallel in a direction intersecting with an axial direction of the conductive part, is formed on the contact surface of the barrel. An inner side surface of each of the grooves is slanted so as to have an falling gradient toward a distal end side of the barrel part or a proximal end side of the barrel part in the axial direction of the conductive part.

WO 2009/096590 A1

DESCRIPTION

CRIMP TERMINAL

Technical Field

The present invention relates to a crimp terminal for an aluminum wire to be press-clamped to the aluminum wire having a conductive part which is configured by a plurality of wire elements formed of aluminum or aluminum alloy twisted together.

Background Art

Electric wires formed of copper are generally used in wire harnesses which are arranged in a vehicle such as an automobile. When the wire harnesses are connected to each other, or the wire harnesses are connected to an on-vehicle apparatus, terminals are attached to the copper wires of the wire harnesses. The terminals of this type are generally attached to the copper wires by press-clamping.

The terminal to be press-clamped to the copper wire is formed, for example, by stamping a sheet material having electrical conductivity such as copper alloy into a determined shape, and then, by subjecting it to folding work. This terminal has a barrel which is typically formed in a substantially U-shape in cross section. The barrel embraces a conductive part of the copper wire which is composed of a plurality of wire elements formed of copper and twisted together, and attached to the conductive part by crimping. In this manner, the

terminal is press-clamped to the copper wire.

By the way, in recent years, attention has been paid to use of an aluminum wire, considering weight reduction and easiness in recycling, in addition to shortage of copper resources. However, an oxidation layer formed on a surface is thicker in aluminum than in copper. For this reason, contact resistance between the conductive part of the aluminum wire and the barrel of the terminal tends to become relatively high.

In order to lower the contact resistance, a method of enhancing compression rate of the conductive part by tightly crimping the barrel to the conductive part has been known. According to this method, the oxidation layers of the wire elements which compose the conductive part are broken, and the contact resistance between the conductive part and the barrel is lowered. In this specification, the compression rate is defined as a ratio between a sectional area of the conductive part before press-clamping and the sectional area after the press-clamping.

However, as the compression rate is enhanced, stress exerted on the conductive part is also enhanced. Because aluminum has inferior mechanical strength as compared with copper, press-clamping strength between the conductive part and the barrel in the aluminum wire is remarkably deteriorated, in case where an excessive stress is exerted on the conductive part.

For the purpose of reducing the contact pressure and securing the

sufficient press-clamping strength, various methods concerning the press-clamping between the aluminum wire and the terminal have been heretofore proposed. For example, it is proposed to form a plurality of concave grooves on a contact surface of the barrel which is brought into contact with the conductive part (for example, see JP-A-2007-173215 and JP-A-2003-249284). In this case, the conductive part enters into the concave grooves, and the oxidation layers on the surfaces of the wire elements are broken, whereby the contact resistance is reduced. In addition, escape of the conductive part is prevented. It is also proposed to scatter powder which is softer than the conductive part on the contact surface of the barrel thereby to fix the conductive part to the contact surface of the barrel by agglutination (for example, JP-A-8-321330).

Disclosure of Invention

Technical Problem

In case of fixing the conductive part to the contact surface of the barrel by agglutination, it is also necessary to break the oxidation layers on the surfaces of the wire elements for enabling new surfaces of the wire elements to be exposed. Although it is possible to break the oxidation layers on the surfaces of the wire elements, by forming the concave grooves on the contact surface of the barrel, the oxidation layers cannot be sufficiently broken, because breaks of the oxidation layers occur mainly in edge parts of the concave grooves. Moreover, in order to sufficiently break the oxidation layers by an edge of the conventional barrel, it is necessary to enhance the compression rate of the conductive part. In this case, however, deterioration of the

press-clamping strength becomes a problem.

The invention has been made in view of the above described circumstances, and it is an object of the invention to provide a crimp terminal for an aluminum wire which can satisfy both decrease of contact resistance and securance of press-clamping strength between a conductive part of the aluminum wire and a barrel of the terminal.

Technical Solution

The above object is attained by the crimp terminal for an aluminum wire described in items (1) to (3) below.

(1) A crimp terminal for press-clamping an aluminum wire having a conductive part which is configured by a plurality of wire elements formed of aluminum or aluminum alloy twisted together, the crimp terminal comprising:

a barrel part which press-fastens the conductive part,

wherein a coating film, having agglutinating function against the aluminum and aluminum alloy, is formed on a contact surface of the barrel so as to bring into contact with a crimp portion of the conductive part;

wherein a plurality of grooves, extending in parallel in a direction intersecting with an axial direction of the conductive part, is formed on the contact surface of the barrel; and

wherein an inner side surface of each of the grooves is slanted so as to have an falling gradient toward a distal end side of the barrel part or a proximal end side of the barrel part in the axial direction of the conductive part.

(2) The crimp terminal according to item (1) above, wherein the plurality of grooves extend in parallel in a direction intersecting with an extending direction of the wire elements on an outer peripheral surface of the crimp portion of the conductive part.

(3) The crimp terminal according to item (1) above, wherein the coating film is a tin plated coating film.

According to the crimp terminal having the construction described in item (1) above, the conductive part which is compressed by the crimping of the barrel bites into the respective grooves, is extended mainly toward the distal end side or the proximal end side by using as starting points the portions which bit into the grooves, and slides toward the distal end side or the proximal end side on the slanted surfaces of the adjacent grooves. Further, due to the friction at the time of sliding on the slanted surfaces, the oxidized film on the surface of each wire element making up the conductive part is destroyed, and a newly generated surface is exposed on each wire element. Consequently, it is possible to sufficiently destroy the oxidized film on each wire element and cause a newly generated surface to be exposed thereon without excessively increasing the compression ratio of the conductive part. In addition, the film which exhibits adhesive action with respect to aluminum and an aluminum alloy is formed on the contact surface of the barrel, so that adhesion takes place between the film and the newly generated surface exposed on each wire element, thereby making it possible to obtain satisfactory contact resistance and

crimping strength.

According to the crimp terminal for an aluminum wire having the construction described in item (2) above, the twisted wire elements uniformly bite into the grooves and uniformly slide on the slanted surfaces of the grooves. As a result, it is possible to obtain more satisfactory contact resistance and crimping strength.

According to the crimp terminal for an aluminum wire having the construction described in item (3) above, the twined strands uniformly bite into the grooves and uniformly slide on the inclined surfaces of the grooves. As a result, it is possible to obtain more satisfactory contact resistance and crimping strength.

Advantageous Effects

According to the crimp terminal for an aluminum wire in accordance with the invention, the reduction of the contact resistance between the conductive part of the aluminum wire and the barrel of the terminal and the ensuring of the crimping strength therebetween can be made compatible.

Brief Description of Drawings

Fig. 1 is a perspective view of a first embodiment of a crimp terminal for an aluminum wire in accordance with the invention.

Fig. 2 is a cross-sectional view of the crimp terminal of Fig. 1 and illustrates a state in which the crimp terminal is crimped onto an aluminum wire.

Fig. 3 is a perspective view of a second embodiment of the crimp terminal for an aluminum wire in accordance with the invention.

Fig. 4 is a cross-sectional view of the crimp terminal of Fig. 3 and illustrates a state in which the crimp terminal is crimped onto an aluminum wire.

Best Mode for Carrying Out the Invention

Referring now to the accompanying drawings, a detailed description will be given of the preferred embodiments of a crimp terminal for an aluminum wire in accordance with the invention.

(First Embodiment)

As shown in Fig. 1, an aluminum wire 1 has a conductive part 2 in which a plurality of wire elements 3 made of aluminum or an aluminum alloy are twisted. The outer periphery of the conductive part 2 is covered by a sheath 4 formed of an insulating material. As for the aluminum wire 1, a predetermined length of the sheath 4 is removed at its terminal portion to expose the conductive part 2. A terminal 10 which is crimped onto the aluminum wire 1 is crimped onto this terminal portion. It should be noted that, as the aluminum alloy, it is possible to cite by way of example an alloy of aluminum and iron. As compared with an aluminum simple substance, an alloy of aluminum and iron excels in strength (particularly tensile strength) and is therefore preferable.

In the terminal 10, a connecting portion 11 for being connected to a mating terminal (not shown) is provided on its distal end side, and a barrel 12 which is crimped onto the aluminum wire 1 is provided on its proximal end side.

In the barrel 12, a wire barrel 13 which is crimped onto the conductive part 2 of the aluminum wire 1 is provided on its distal end side, and an insulation barrel 14 which is crimped onto the sheath 4 of the aluminum wire 1 is provided on its proximal end side.

The wire barrel 13 has a bottom plate portion 20 on which the conductive part 2 exposed at a terminal portion of the aluminum wire 1 is placed, as well as a pair of crimping pieces 21 which are provided continuously from the bottom plate portion 20 in such a manner as to clamp from both sides the conductive part 2 placed on the bottom plate portion 20. The wire barrel 13 is thus formed with a U-shaped cross section. The wire barrel 13 tucks the conductive part 2 of the terminal portion on its inner side and is crimped onto this conductive part 2.

The insulator barrel 14 has a bottom plate portion 22 on which the sheath 4 remaining at the terminal portion of the aluminum wire 1 is placed, as well as a pair of crimping pieces 23 which are provided continuously from the bottom plate portion 22 in such a manner as to clamp from both sides the sheath 4 placed on the bottom plate portion 22. Thus the insulator barrel 14 is similarly formed with a U-shaped cross section. The insulator barrel 14 tucks the sheath 4 of the terminal portion on its inner side and is crimped onto this sheath 4. It should be noted that the bottom plate portion 22 of the insulator barrel 14 is provided continuously from the bottom plate portion 20 of the wire barrel 13.

In addition, as for the terminal 10, the wire barrel 13 with the conductive part 2 of the terminal portion tucked therein is crimped onto this conductive part 2, and the insulator barrel 14 with the sheath 4 of the terminal portion tucked therein is crimped onto this sheath 4, thereby allowing the terminal 10 be crimped onto the aluminum wire 1.

A plurality of notched grooves 24, which extend in parallel in a direction intersecting the axial direction of the crimp portion of the conductive part 2 onto which the wire barrel 13 is crimped, are formed on the inner surface of the wire barrel 13, i.e., the contact surface of the wire barrel 13 which comes into contact with the conductive part 2.

Further, the plurality of grooves 24 extend in parallel in a direction intersecting the respective wire elements 3 which appear on the outer peripheral surface of the crimp portion of the conductive part 2. In other words, the respective wire elements 3 which appear on the outer peripheral surface of the crimp portion of the conductive part 2 are spiraled about the axis of the crimp portion of the conductive part 2, whereas the plurality of grooves 24 extend in parallel about the axis of the crimp portion of the conductive part 2 spirally in an opposite direction to that of these wire elements 3. Preferably, the respective grooves 24 extend in a direction perpendicularly intersecting the respective wire elements 3 which appear on the outer peripheral surface of the crimp portion of the conductive part 2.

Further, as shown in Fig. 2, inner side surfaces 24a of the grooves 24

facing the distal end side of the crimp portion of the conductive part 2 are formed as slanted surfaces which are downwardly sloped toward the distal end side. On the other hand, inner side surfaces of the grooves 24 facing the proximal end side are formed as vertical surfaces.

Further, a film which exhibits adhesive action with respect to aluminum and an aluminum alloy is formed on at least the contact surface of the wire barrel 13. Such a film is, for example, a film formed of a metal which is softer than aluminum or an aluminum alloy, and is preferably a tin plated coating film. The thickness of the film is preferably not less than 1.5 μm and not more than 4.0 μm.

The terminal 10 having the above-described construction is formed by subjecting a sheet material consisting of an electrically conductive material such as a copper alloy provided with tin plating on its surface to blanking into a predetermined shape, and by subjecting it to bending.

As shown in Fig. 2, as the wire barrel 13 is crimped onto the conductive part 2, the conductive part 2 is compressed, and the respective wire elements 3 constituting the conductive part 2 bite into the respective grooves 24 provided on the contact surface of the wire barrel 13. Then, the respective wire elements 3 are extended mainly toward the distal end side by using as starting points the portions which bit into the grooves 24.

Between each pair of the adjacent grooves 24, the portion of each wire

element 3 extended toward the distal end side enters the groove 24 on the distal end side, and at that time slides on the slanted surface 24a of the groove 24 on the distal end side. At that juncture, as for the portion of each wire element 3 which slides on the slanted surface 24a, the oxidized film on the surface is destroyed by friction between the same and the slanted surface 24a, and a newly generated surface, i.e., the base material of the aluminum or aluminum alloy, is exposed on that portion.

Then, friction is produced due to contact pressure between the film formed on the contact surface of the wire barrel 13 and the newly generated surface exposed on each wire element 13, and adhesion occurs therebetween. Owing to the adhesion, the film on the wire barrel 13 and the newly generated surface of the each wire element 13 are bonded to each other at the atomic level. Further, since the plurality of grooves 24 extend in parallel in the direction intersecting the respective wire elements 3 which appear on the outer peripheral surface of the crimp portion of the conductive part 2, the wire elements 3 uniformly bite into the grooves 24 and uniformly slide on the slanted surfaces 24a of the grooves 24. As a result, the destruction of the oxidized film and the adhesion with the film take place uniformly in the respective wire elements 3. Consequently, it is possible to obtain satisfactory contact resistance and bonding strength.

Thus, according to the crimp terminal 10 for an aluminum wire in accordance with the invention, the conductive part 2 which was compressed by the crimping of the wire barrel 13 bites into the respective grooves 24, is

extended mainly toward the distal end side by using as starting points the portions which bit into the grooves 24, and slides toward the distal end side on the slanted surfaces 24a of the adjacent grooves 24. Further, due to the friction at the time of sliding on the slanted surfaces, the oxidized film on the surface of each wire element 3 making up the conductive part 2 is destroyed, and a newly generated surface is exposed on each wire element 3. Consequently, it is possible to sufficiently destroy the oxidized film on each wire element 3 and cause a newly generated surface to be exposed thereon without excessively increasing the compression ratio of the conductive part 2. In addition, the film which exhibits adhesive action with respect to aluminum and an aluminum alloy is formed on the contact surface of the barrel, so that adhesion takes place between the film and the newly generated surface exposed on each wire element, thereby making it possible to obtain satisfactory contact resistance and crimping strength.

(Second Embodiment)

Fig. 3 is a perspective view of a second embodiment of the crimp terminal for an aluminum wire in accordance with the invention. Fig. 4 is a cross-sectional view of the crimp terminal of Fig. 3 and illustrates a state in which the crimp terminal is crimped onto an aluminum wire. It should be noted that the description of those elements which are common to those of the terminal 10 in accordance with the first embodiment will be omitted by denoting them by the same reference numerals in the drawings, or will be simplified.

As shown in Fig. 3, a plurality of notched grooves 24', which extend in

parallel in a direction intersecting the axial direction of the crimp portion of the conductive part 2 onto which the wire barrel 13 is crimped, are formed on the contact surface of the wire barrel 13 of a terminal 110. The plurality of these grooves 24' extend in parallel in a direction intersecting the respective wire elements 3 which appear on the outer peripheral surface of the crimp portion of the conductive part 2. Further, inner side surfaces 24b of the grooves 24' facing the proximal end side of the crimp portion of the conductive part 2 are formed as slanted surfaces which are downwardly sloped toward the proximal end side. On the other hand, inner side surfaces of the grooves 24' facing the distal end side are formed as vertical surfaces.

Further, a film which exhibits adhesive action with respect to aluminum and an aluminum alloy is formed on at least the contact surface of the wire barrel 13.

As shown in Fig. 4, as the wire barrel 13 is crimped onto the conductive part 2, the conductive part 2 is compressed, and the respective wire elements 3 constituting the conductive part 2 bite into the respective grooves 24' provided on the contact surface of the wire barrel 13. Then, the respective wire elements 3 are extended mainly toward the proximal end side by using as starting points the portions which bit into the grooves 24'.

Between each pair of the adjacent grooves 24', the portion of each wire element 3 extended toward the proximal end side enters the groove 24' on the proximal end side, and at that time slides on the slanted surface 24b of the

groove 24' on the proximal end side. At that juncture, as for the portion of each wire element 3 which slides on the slanted surface 24b, the oxidized film on the surface is destroyed by friction between the same and the slanted surface 24b, and a newly generated surface, i.e., the base material of the aluminum or aluminum alloy, is exposed on that portion.

Then, friction is produced due to contact pressure between the film formed on the contact surface of the wire barrel 13 and the newly generated surface exposed on each wire element 13, and adhesion occurs therebetween. Owing to the adhesion, the film on the wire barrel 13 and the newly generated surface of the each wire element 13 are bonded to each other at the atomic level. Further, since the plurality of grooves 24' extend in parallel in the direction intersecting the respective wire elements 3 which appear on the outer peripheral surface of the crimp portion of the conductive part 2, the wire elements 3 uniformly bite into the grooves 24' and uniformly slide on the slanted surfaces 24b of the grooves 24'. As a result, the destruction of the oxidized film and the adhesion with the film take place uniformly in the respective wire elements 3. Consequently, it is possible to obtain satisfactory contact resistance and bonding strength.

Thus, according to the crimp terminal 10 for an aluminum wire in accordance with the invention, the conductive part 2 which was compressed by the crimping of the wire barrel 13 bites into the respective grooves 24', is extended mainly toward the proximal end side by using as starting points the portions which bit into the grooves 24', and slides toward the proximal end side

on the slanted surfaces 24b of the adjacent grooves 24'. Further, due to the friction at the time of sliding on the slanted surfaces 24b, the oxidized film on the surface of each wire element 3 making up the conductive part 2 is destroyed, and a newly generated surface is exposed on each wire element 3. Consequently, it is possible to sufficiently destroy the oxidized film on each wire element 3 and cause a newly generated surface to be exposed thereon without excessively increasing the compression ratio of the conductive part 2. In addition, the film which exhibits adhesive action with respect to aluminum and an aluminum alloy is formed on the contact surface of the barrel, so that adhesion takes place between the film and the newly generated surface exposed on each wire element, thereby making it possible to obtain satisfactory contact resistance and crimping strength.

It should be noted that the invention is not limited to the above-described embodiments, and modifications, improvements, and the like are possible, as required. Furthermore, the shapes, sizes, numerical values, forms, the number, the places of disposition, and the like of the respective constituent elements in the above-described embodiments are arbitrary and are not limited insofar as the invention can be attained.

The present application is based on Japanese Patent Application No. 2008-016604 filed on January 28, 2008, the contents of which are incorporated herein for reference.

Industrial Applicability

The crimp terminal for an aluminum wire according to the invention can provide effects that the reduction of the contact resistance between the conductive part of the aluminum wire and the barrel of the terminal and the ensuring of the crimping strength therebetween can be made compatible.

CLAIMS

1. A crimp terminal for press-clamping an aluminum wire having a conductive part which is configured by a plurality of wire elements formed of aluminum or aluminum alloy twisted together, the crimp terminal comprising:

a barrel part which press-fastens the conductive part,

wherein a coating film, having agglutinating function against the aluminum and aluminum alloy, is formed on a contact surface of the barrel so as to bring into contact with a crimp portion of the conductive part;

wherein a plurality of grooves, extending in parallel in a direction intersecting with an axial direction of the conductive part, is formed on the contact surface of the barrel; and

wherein an inner side surface of each of the grooves is slanted so as to have an falling gradient toward a distal end side of the barrel part or a proximal end side of the barrel part in the axial direction of the conductive part.

2. The crimp terminal according to claim 1, wherein the plurality of grooves extend in parallel in a direction intersecting with an extending direction of the wire elements on an outer peripheral surface of the crimp portion of the conductive part.

3. The crimp terminal according to claim 1, wherein the coating film is a tin plated coating film.

Fig.1

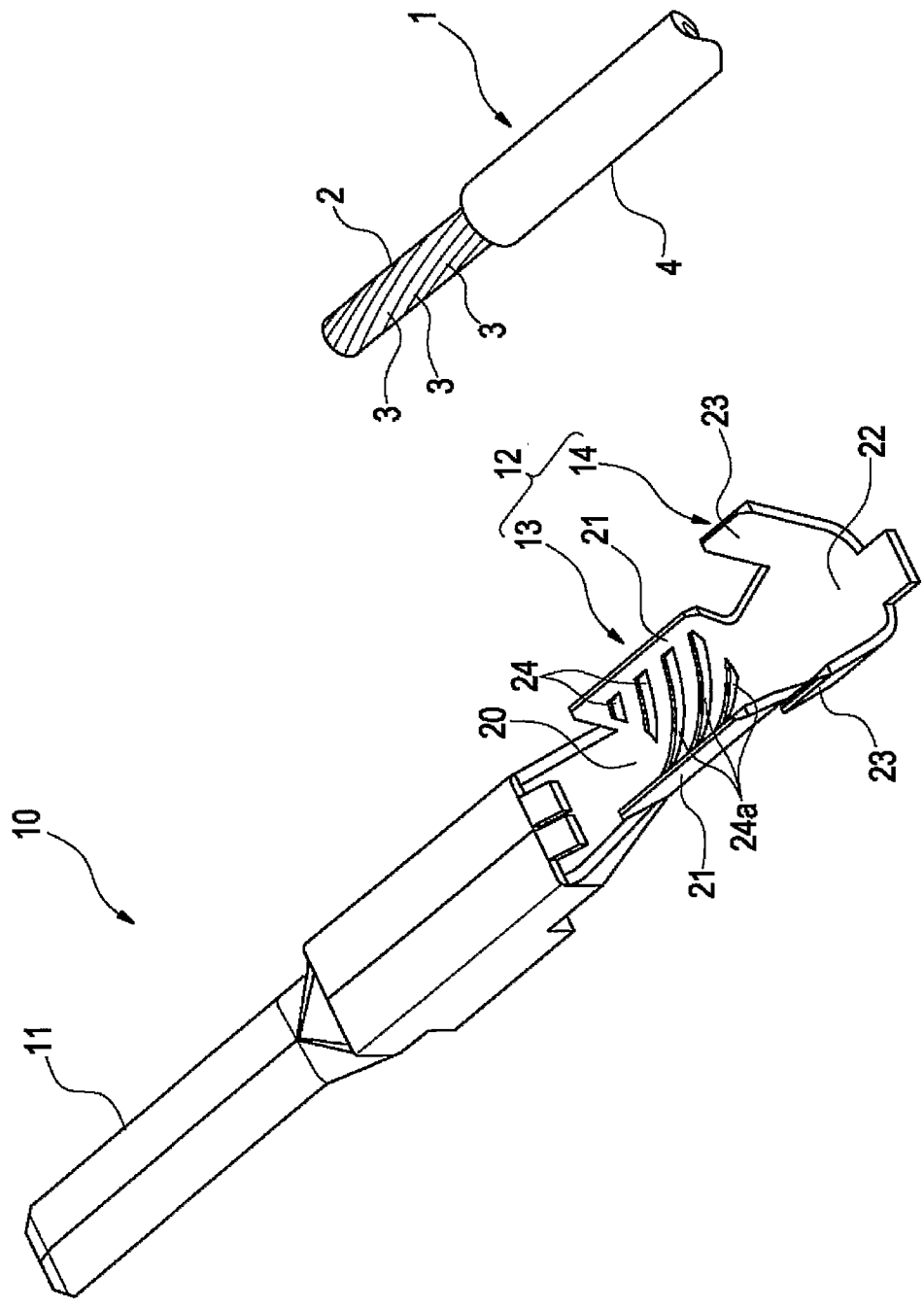


Fig.2

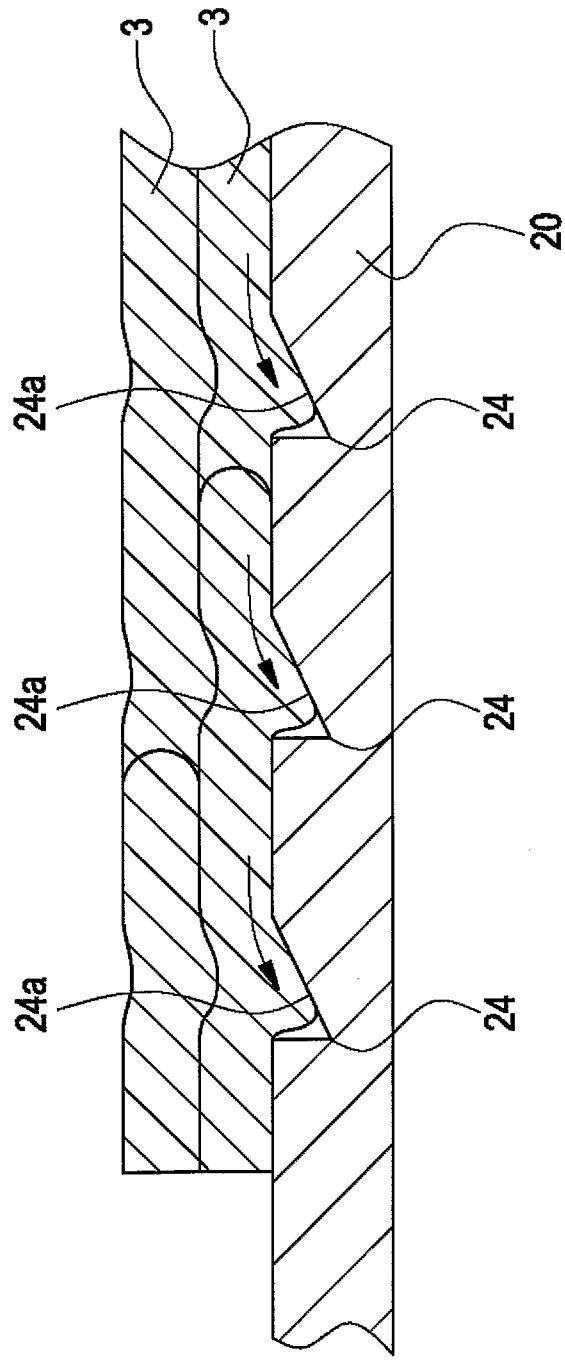


Fig.3

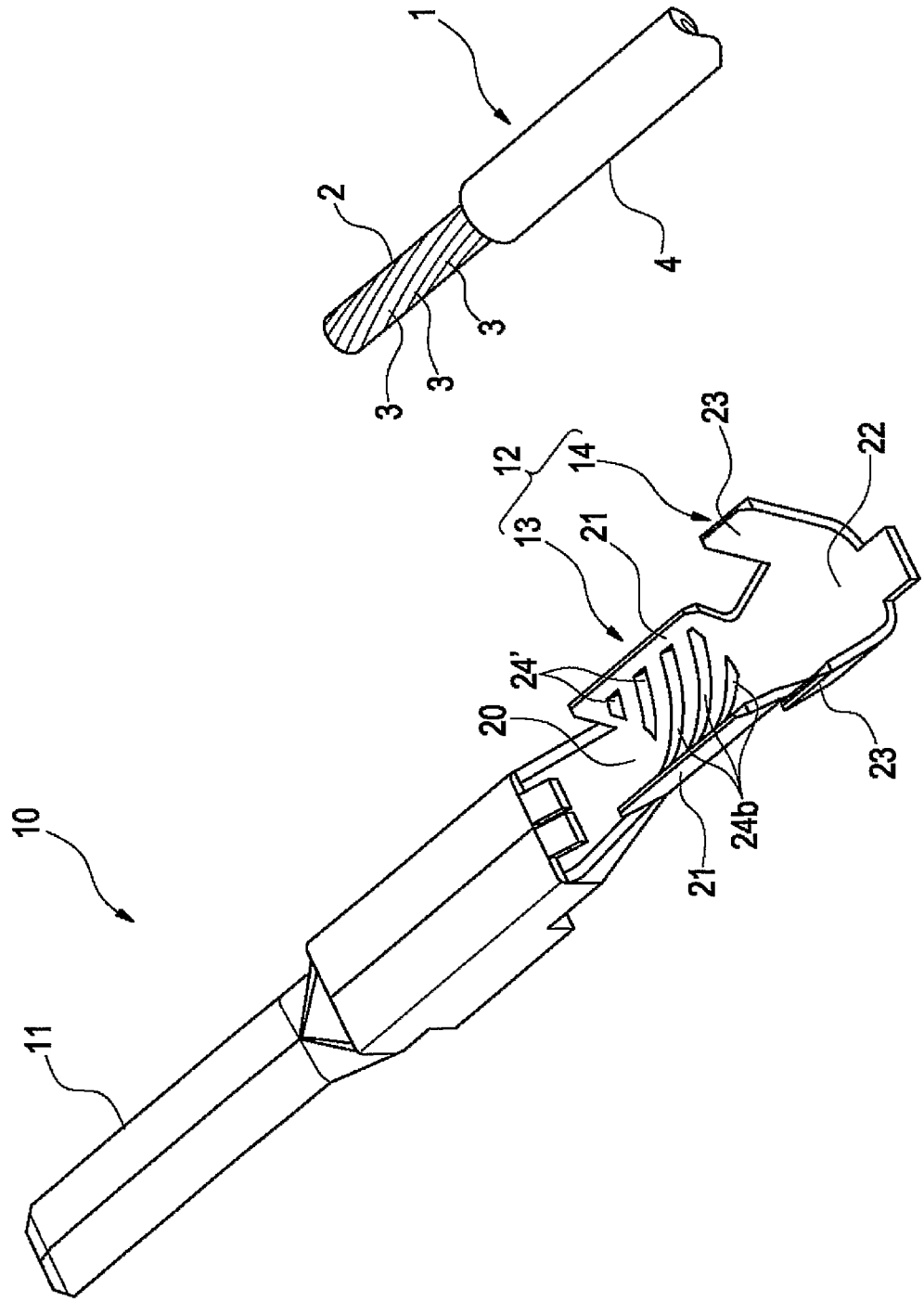
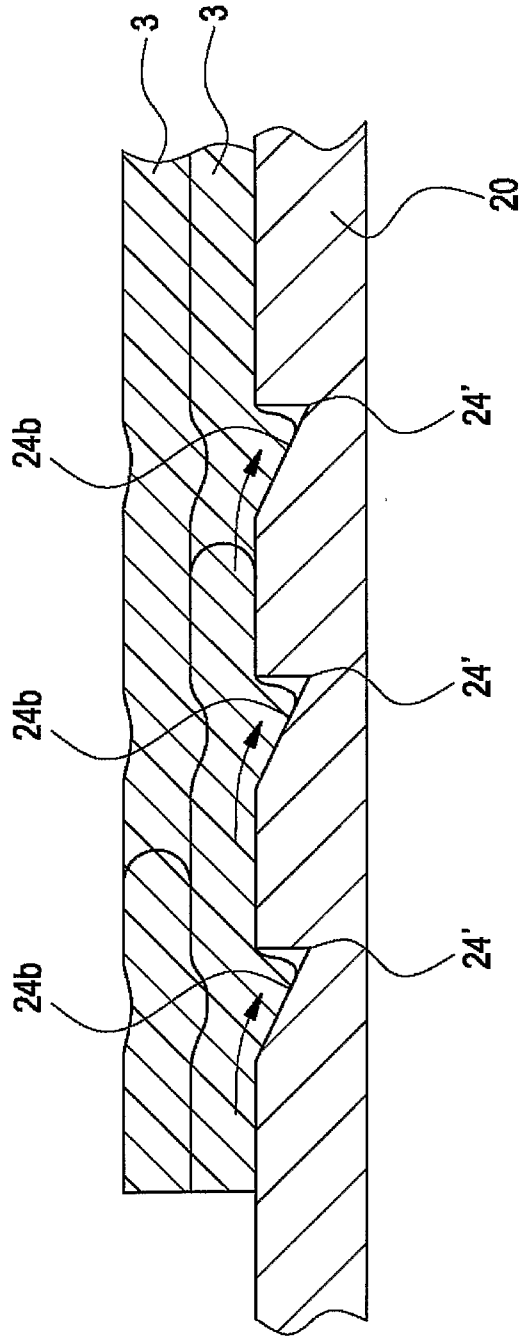


Fig.4



INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2009/051826

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R4/18

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)
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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2007/060953 A (FURUKAWA ELECTRIC CO LTD [JP]; SUSAI KYOTA [JP]; HASHIMOTO TOSHIYUKI [) 31 May 2007 (2007-05-31) the whole document & EP 1 965 464 A (FURUKAWA ELECTRIC CO LTD [JP]) 3 September 2008 (2008-09-03) paragraph [0010] - paragraph [0011] paragraph [0015]; figures 1a,1b	1-3
Y	US 3 533 055 A (ZAK ALFRED M) 6 October 1970 (1970-10-06) column 6, line 35 - line 67; figure 3	1-3
X	US 7 210 958 B1 (JACQUES RALPH E [US] ET AL) 1 May 2007 (2007-05-01) column 2, line 38 - column 3, line 21 column 3, line 57 - column 4, line 8; figures 1,4,7A	1-3

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 April 2009	17/04/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Fax: (+31–70) 340–3016	Criqui, Jean-Jacques

INTERNATIONAL SEARCH REPORT

International application No
PCT/JP2009/051826

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2003/111256 A1 (FUJIWARA HIDEMICHI [JP]) 19 June 2003 (2003-06-19) paragraph [0095] - paragraph [0102]; figure 2A	1-3
A	JP 2003 249284 A (AUTO NETWORK GIJUTSU KENKYUSHO; SUMITOMO WIRING SYSTEMS; SUMITOMO ELEC) 5 September 2003 (2003-09-05) cited in the application the whole document	1-3

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/JP2009/051826

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007060953 A	31-05-2007	EP 1965464 A1	03-09-2008
		JP 2007173215 A	05-07-2007
		US 2008230269 A1	25-09-2008
EP 1965464 A	03-09-2008	JP 2007173215 A	05-07-2007
		WO 2007060953 A1	31-05-2007
		US 2008230269 A1	25-09-2008
US 3533055 A	06-10-1970	NONE	
US 7210958 B1	01-05-2007	NONE	
US 2003111256 A1	19-06-2003	JP 3824809 B2	20-09-2006
		JP 2000357420 A	26-12-2000
JP 2003249284 A	05-09-2003	NONE	