



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
10.03.2010 Bulletin 2010/10

(51) Int Cl.:
H01R 4/70 (2006.01)

(21) Application number: **07830727.9**

(86) International application number:
PCT/JP2007/070993

(22) Date of filing: **29.10.2007**

(87) International publication number:
WO 2008/155865 (24.12.2008 Gazette 2008/52)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR

Designated Extension States:
AL BA HR MK RS

(30) Priority: **21.06.2007 JP 2007164198**

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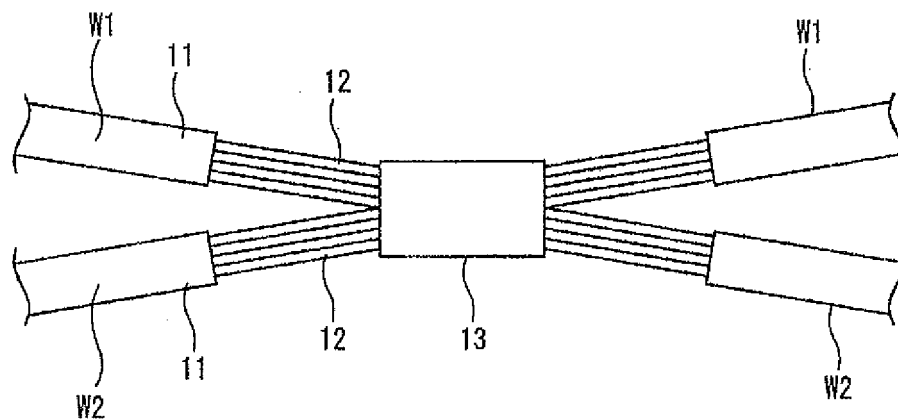
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(54) **METHOD OF WATERPROOFING SPLICE AREA AND WIRING STRUCTURE FOR AUTOMOBILE WIRE HARNESS WITH SPLICE AREA**

(57) A foamed sheet is disposed on a central area of an inner surface of a wide pressure sensitive adhesive tape. The foamed sheet is coated with a waterproofing agent made of silicone. A spliced portion of wires is mounted on the foamed sheet. The foamed sheet together with the wide pressure sensitive adhesive tape is wound around the spliced portion. Core wire exposed

portions of the wires continued to the opposite sides of the spliced portion are covered with the foamed sheet containing the waterproofing agent. Insulation covers of the wires continued to the core wire exposed portions are covered with the wide pressure sensitive adhesive tape. An outer periphery of the wide pressure sensitive adhesive tape is wound by another narrow pressure sensitive adhesive tape by a half wrap winding manner.

FIG. 2



Description

FIELD OF THE INVENTION

[0001] This invention relates to a method for waterproofing a spliced portion of wire harnesses for a motor vehicle and a structure for arranging the wire harnesses with the spliced portion, and more particularly relates to a method and a structure for maintaining a performance in waterproofing in a spliced portion of wire harnesses to be arranged in a motor vehicle even if the spliced portion is disposed on a bent arrangement path in the motor vehicle.

BACKGROUND OF THE INVENTION

[0002] Heretofore, in the case where wires in a plurality of wire harnesses to be arranged in a motor vehicle are connected to one another, the wires are stripped off insulation covers to expose core wires, and core wire exposed portions are connected to one another by means of welding, soldering, or press-contact terminals to form a spliced portion. If water adheres to the spliced portion, the core wires and press-contact terminals will be subject to corrosion. Accordingly, in the wire harnesses to be arranged in an engine compartment that is likely to receive water, the splice portion is waterproofed.

[0003] The present applicant has proposed a structure for waterproofing a spliced portion of wires constituting wire harnesses in WO 2005-104302 A. The waterproofing structure is shown in Figure 6. A foamed sheet 3 containing a silicone 2 and a pressure sensitive adhesive tape 4 are wound around a spliced portion 1 of wires so that the silicone 2 is filled in clearances between spliced core wires, thereby effecting a waterproofing function.

[0004] When wire harnesses provided with the spliced portion protected by the waterproofing structure are arranged in a motor vehicle, there is a case where the wire harnesses must be bent at an area including the spliced portion in some arrangement paths. In this case, usually, an arrangement of wire harnesses is designed so that the spliced portion is not bent as much as possible and the opposite sides of the spliced portion can be bent. However, as described above, since the foamed sheet 3 and pressure sensitive adhesive tape 4 are merely wound around the spliced portion 1 in an axial direction of the wires, a stiffness of the spliced portion will not be high. Consequently, when the area including the spliced portion 1 is bent, the spliced portion 1 is likely to be bent. Also, if a force for winding the foamed sheet 3 and pressure sensitive adhesive tape 4 is low before the silicone 2 is solidified, a force for pressing the silicone 2 into the clearances in the spliced portion 1 will become low. Consequently, the silicone 2 is not filled into the clearances and there is a possibility that a performance in waterproofing will be lowered.

[0005] Patent Document 1: WO 2005-104302 A

SUMMARY OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0006] In view of the above problems, an object of the present invention is to surely waterproof and protect a spliced portion of wire harnesses, to enhance a stiffness of the spliced portion, and to bend the opposite sides of the spliced portion so as to prevent the spliced portion from being bent even if a section including the spliced portion is disposed in a bent arrangement path.

MEANS FOR SOLVING THE PROBLEM

[0007] In order to achieve the above object, a first invention is directed to a waterproofing method of a spliced portion comprising the steps of: disposing a foamed sheet on a central area of an inner surface of a wide pressure sensitive adhesive tape, the foamed sheet being coated with a waterproofing agent made of silicone; mounting a spliced portion of wires on the foamed sheet; winding the foamed sheet together with the wide pressure sensitive adhesive tape around the spliced portion; covering core wire exposed portions of the wires continued to the opposite sides of the spliced portion with the foamed sheet containing the waterproofing agent; covering insulation covers of the wires continued to the core wire exposed portions with the wide pressure sensitive adhesive tape; and winding an outer periphery of the wide pressure sensitive adhesive tape by another narrow pressure sensitive adhesive tape by a half wrap winding manner.

[0008] As described above, in the waterproofing method of the spliced portion, after the foamed sheet coated with the waterproofing agent and the wide pressure sensitive adhesive tape are wound around the spliced portion to cover the spliced portion, the narrow pressure sensitive adhesive tape is wound around the outer periphery of the wide pressure sensitive adhesive tape by the spiral half wrap winding. If the narrow pressure sensitive adhesive tape is strongly wound around the wide pressure sensitive adhesive tape upon the spiral half wrap winding, it is possible to press the formed sheet and wide pressure sensitive adhesive tape onto the spliced portion to bring into close contact with the spliced portion and it is possible to surely press the waterproofing agent into the clearances between the core wires, thereby enhancing a performance in waterproofing.

It is also possible to suppress the waterproofed part from increasing its diameter due to an elastic force of the foamed sheet and to restrain the waterproofing agent from being absorbed in the foamed sheet, thereby facilitating to maintain the waterproofing agent in the clearances between the core wires.

In addition, since the narrow pressure sensitive adhesive tape is wound around the outer periphery of the wide pressure sensitive adhesive tape by the spiral half wrap winding manner, the stiffness of the spliced portion is

increased, thereby rendering the spliced portion hard to bend. In result, the spliced portion can keep its straight position and the opposite sides of the spliced portion can be bent, even if the section including the spliced portion is disposed on a curved arrangement path in the motor vehicle.

[0009] In order to achieve the above object, a second invention is directed to an arranging structure of a wire harness for a motor vehicle with a spliced portion, wherein wire harnesses are disposed on a bent arrangement path in a motor vehicle; the wires are provided with spliced portion on the bent arrangement path; the spliced portion is waterproofed by the above method; opposite sides of the spliced portion are bent in the bent arrangement path; and the spliced portion is rendered in a straight position.

[0010] Since the spliced portion of the wires is waterproofed by the above waterproofing method and the stiffness of the spliced portion is enhanced by half-wrap-winding the narrow pressure sensitive adhesive tape around the outer periphery of the spliced portion, even if the spliced portion is disposed on the curved arrangement path, the spliced portion is hard to bend and can maintain a straight position, so that the opposite sides of the spliced portion are bent. Even if the spliced portion should be bent a little, it is possible to maintain the close contact between the splice portion and the foamed sheet and wide pressure sensitive adhesive tape without delaminating the sheet and tape from the spliced portion, since the narrow pressure sensitive adhesive tape is wound around the outer periphery of the spliced portion. Accordingly, it is possible to prevent the performance in waterproofing from being lowered.

EFFECTS OF THE INVENTION

[0011] As described above, according to the waterproofing method of the present invention, since the foamed sheet and wide pressure sensitive adhesive tape are wound around the spliced portion and another narrow pressure sensitive adhesive tape is further wound around the sheet and tape by the spiral half wrap winding manner, it is possible to fill the waterproofing agent into the clearances between the core wires without causing any voids, thereby enhancing a performance in waterproofing.

[0012] Furthermore, since the narrow pressure sensitive adhesive tape is wound around the outer periphery of the spliced portion by the spiral half wrap winding manner, the stiffness of the spliced portion is enhanced and the spliced portion is hard to bend. Accordingly, the spliced portion is not bent and can maintain the straight position, even if the section including the spliced portion of the wires is disposed on the curved arrangement path in the motor vehicle. Since the opposite sides of the spliced portion are bent, it is possible to prevent the spliced portion from lowering the performance in waterproofing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

[Fig. 1] Figure 1A is a front elevation view of an embodiment of a spliced portion of wires for a motor vehicle in accordance with the present invention. Figure 1B is a cross section view of the spliced portion taken along lines A-A in Figure 1A.

[Fig. 2] Figure 2 is a plan view of the spliced portion shown in Figure 1A.

[Fig. 3] Figure 3 is a plan view of a wide pressure sensitive adhesive tape on which a foamed sheet is mounted.

[Fig. 4] Figure 4 is a plan view of the wide pressure sensitive adhesive tape similar to Figure 3, illustrating the foamed sheet on which the spliced portion of the wires is mounted.

[Fig. 5] Figures 5A and 5B are a sectional view of the foamed sheet and wide pressure sensitive adhesive tape wound around the spliced portion.

[Fig. 6] Figure 6 is an explanatory view of a conventional method for waterproofing a spliced portion of the wires.

EXPLANATION OF SIGNS

[0014]

10	waterproofed, spliced section
11	insulation covers
12	core wire exposed portions
13	spliced portion
14	silicone
15	foamed sheet
16	wide pressure sensitive adhesive tape
17	narrow pressure sensitive adhesive tape
W1, W2	wires

DETAILED DESCRIPTION OF THE INVENTION

[0015] Referring now to the drawings, embodiments of the present invention will be described below.

Figure 1A to Figure 5B show the embodiments of the present invention.

Wires W1 and W2 are stripped off insulation covers 11 at intermediate areas of the wires in a longitudinal direction to expose core wires 12. The exposed core wires 12, 12 are welded by means of ultrasonic welding to form a spliced portion 13.

The exposed core wires 12 disposed at the opposite sides of the spliced portion 13 are embedded in a silicone 14. A foamed sheet 15 and a wide pressure sensitive adhesive tape 16 are wound around the silicon-embedded portion of the core wires 12 and a narrow pressure sensitive adhesive tape 17 is further wound around the outer periphery of the wide pressure sensitive adhesive tape 16 by a spiral half wrap winding manner to form a

waterproofed, spliced section 10.

[0016] Each of the wide and narrow pressure sensitive adhesive tapes 16 and 17 is made of a vinyl chloride tape of which one side is coated with an adhesive. The vinyl chloride tape is commonly used to bind wires.

The narrow pressure sensitive adhesive tape 17 is made of a pressure sensitive adhesive tape that is wound around the wires W1 and W2 to bind them. The narrow pressure sensitive adhesive tape 17 may be continuously wound around them from other portion to the spliced portion.

[0017] Before the wide pressure sensitive adhesive tape 16 and foamed sheet 15 are wound around the spliced portion 13, they are formed into rectangular shapes shown in Figure 3. The foamed sheet 15 is smaller in size than the adhesive tape 16. A length L2 of the foamed sheet 15 in a longitudinal direction X of the wire harness is set to be less than 80 % of a length L1 of the wide pressure sensitive adhesive tape 16 in the longitudinal direction X. In the present embodiment, the length L1 is 65 mm and the length L2 is 30 mm (46 % of L1).

[0018] The foamed sheet 15 is adhered to the wide pressure sensitive adhesive tape 16 in parallel with the tape 16 and at a central position of the tape 16 in the longitudinal direction X of the wire harness. An adhesive is applied to an adhesive surface 16a of the wide pressure sensitive adhesive tape 16. The adhesive surface 16a is exposed at the opposite end sides of the foamed sheet 15 in the longitudinal direction X of the wire harness so that the insulation covers 11 of the wires W1 and W2 can be adhered to the exposed adhesive surface 16a.

A length of the foamed sheet 15 in a winding direction Y is set to be longer than an outer peripheral length of the piled wires W1 and W2 so that the foamed sheet 15 can be wound around the outer periphery of the piled wires W1 and W2 by at least one turn.

[0019] Next, a waterproofing method of the spliced portion 13 will be described below.

Firstly, as shown in Figure 2, the insulation covers 11 are stripped from the wires W1 and W2 at intermediate positions to be spliced. Then, the core wires of the wires W1 and W2 are exposed to form core wire exposed portions 12. The core wire exposed portions 12 are welded by means of ultrasonic welding to form the spliced portion 13 so that the wires W1 and W2 are connected to each other at their intermediate positions.

[0020] Secondly, as shown in Figure 3, the foamed sheet 15 is mounted on and adhered to the adhesive surface 16a of the wide pressure sensitive adhesive tape 16 at a central position in the longitudinal direction X and at a side end in the winding direction (width direction) Y. The other side end of the wide pressure sensitive adhesive tape 16 extends in the winding direction Y.

Thirdly, a predetermined amount of the silicone 14 is applied to the central area on the foamed sheet 15. A part of the applied silicone 14 penetrates into the foamed sheet 15 and the other part of the applied silicone 14 remains on a surface of the foamed sheet 15.

Fourthly, as shown in Figure 4, the spliced portion 13 of the wires W1, W2, the core wire exposed portions 12 continued to the opposite sides of the spliced portion 13, and the insulation covers 11a of the wires continued to the core wire exposed portions 12 are mounted on the central area of the foamed sheet 15 to which the silicone 14 is applied. Further, insulation covers 11b continued to the insulation covers 11a are mounted on the wide pressure sensitive adhesive tape 16 that extends over the foamed sheet 15.

[0021] Fifthly, as shown in Figure 5A, while the foamed sheet 15 is laminated on the wide pressure sensitive adhesive tape 16, the wide pressure sensitive adhesive tape 16 and foamed sheet 15 are turned to the winding direction Y from the opposite lateral sides of the spliced portion 13 to enclose the spliced portion 13 so that the opposite lateral ends of the foamed sheet 15 are superimposed on each other and the opposed adhesive surfaces 16a of the wide pressure sensitive adhesive tape 16 are adhered to each other. Under this condition, the other side end of the wide pressure sensitive adhesive tape 16 is not wound. Thus, the foamed sheet 15 is closely contacted to the spliced portion 13, the core wire exposed portions 12, and the insulation covers 11a continued to the core wire exposed portions 12. At the same time, the wide pressure sensitive adhesive tape 16 is adhered to the insulation cover 11b. Thus, the silicone 14 on the foamed sheet 15 is pressed onto the spliced portion 13, core wire exposed portions 12, and insulation covers 11 so that the silicone 14 is filled into clearances among them.

[0022] Sixthly, as shown in Figure 5B, the other side end of the wide pressure sensitive adhesive tape 16 is strongly wound around the outer periphery of the one side end of the wide pressure sensitive adhesive tape 16 that is previously wound around the spliced portion 13. Furthermore, the other side end of the wide pressure sensitive adhesive tape 16 presses the foamed sheet 15 so that the foamed sheet 15 is closely contacted with the spliced portion 13. Consequently, the silicone 14 penetrated in the foamed sheet 15 is squeezed and filled into the clearances between the spliced portion 13 and the foamed sheet 15.

[0023] Finally, as shown in Figures 1A and 1B, the narrow pressure sensitive adhesive tape 17 is wound around the outer periphery of the wide pressure sensitive adhesive tape 16 along the longitudinal direction X of the wires W1 and W2 by a spiral half wrap winding manner. Since the narrow pressure sensitive adhesive tape 17 further presses the foamed sheet 15 when the narrow pressure sensitive adhesive tape 17 is strongly wound around the foamed sheet by the spiral half wrap winding manner, the silicone 14 is squeezed from the foamed sheet 15 onto the spliced portion 13 and filled into the clearances between the splice portion 13 and the foamed sheet 15. Under this condition, a little amount of the penetrated silicone 14 remains in the foamed sheet 15 and a great amount of the applied silicone 14 is filled into the clear-

ances among the spliced portion 13 and the core wire exposed portions 12.

[0024] According to the waterproofing method of the present invention, the silicone 14 is filled into the clear-
ances among the core wires in the waterproofed, spliced
section 10 without leaking the silicone 14, the foamed
sheet 15 is closely contacted with the outer periphery of
the spliced portion 13, and the outer periphery of the
foamed sheet 15 is enclosed by the wide pressure sen-
sitive adhesive tape 16. Consequently, it is possible to
enhance a performance in waterproofing. Furthermore,
since the narrow pressure sensitive adhesive tape 17
covers the outer periphery of the wide pressure sensitive
adhesive tape 16 by the half wrap winding manner, it is
possible to enhance stiffness of the waterproofed, spliced
section 10.

[0025] Even if the waterproofed, spliced section 10 is
disposed on a bent area when the wire harness is ar-
ranged in the motor vehicle, the waterproofed, spliced
section 10 is not bent and the opposite side ends of the
core wire portions adjacent the waterproofed, spliced
section are bent. Consequently, the wires can be dis-
posed along a desired bent arrangement path in the mo-
tor vehicle, as a whole.

Thus, since the waterproofed, spliced section 10 is not
bent but keeps its straight position, it is possible to pre-
vent the foamed sheet 15 and wide pressure sensitive
adhesive tape 16 in the waterproofed, spliced section 10
from being cracked or delaminated and to enhance per-
formance in waterproofing.

[0026] Although two wires are stripped off insulation
covers at the intermediate areas in the above embodi-
ment, the waterproofing method of the present invention
can be preferably applied to the case where more than
three wires are spliced. Means for splicing the core wires
is not limited to the welding method. The splicing means
may be soldering means or press-contact terminals in
order to form the spliced portion.

Claims

1. A waterproofing method of a spliced portion, com-
prising the steps of:

disposing a foamed sheet on a central area of
an inner surface of a wide pressure sensitive
adhesive tape, said foamed sheet being coated
with a waterproofing agent made of silicone;

mounting a spliced portion of wires on said
foamed sheet;

winding said foamed sheet together with said
wide pressure sensitive adhesive tape around
said spliced portion;

covering core wire exposed portions of said
wires continued to the opposite sides of said
spliced portion with said foamed sheet contain-
ing said waterproofing agent;

covering insulation covers of said wires contin-
ued to said core wire exposed portions with said
wide pressure sensitive adhesive tape; and
winding an outer periphery of said wide pressure
sensitive adhesive tape by another narrow pres-
sure sensitive adhesive tape by a half wrap
winding manner.

2. An arranging structure of a wire harness for a motor
vehicle with a spliced portion,

wires being disposed on a bent arrangement
path in a motor vehicle;
said wires being provided with spliced portion
on said bent arrangement path;
said spliced portion being waterproofed by the
method according to Claim 1;
opposite sides of said spliced portion being bent
in said bent arrangement path; and
said spliced portion being rendered in a straight
position.

FIG. 1A

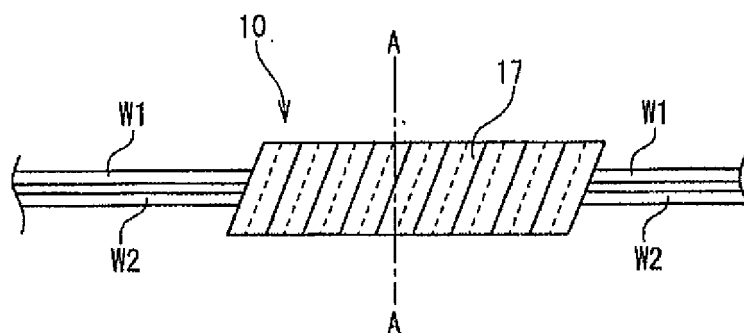


FIG. 1B

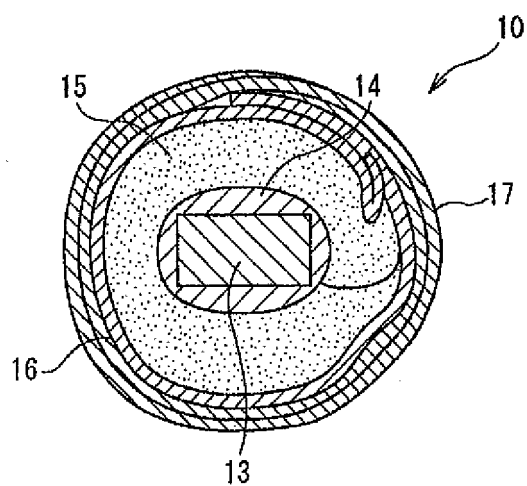


FIG. 2

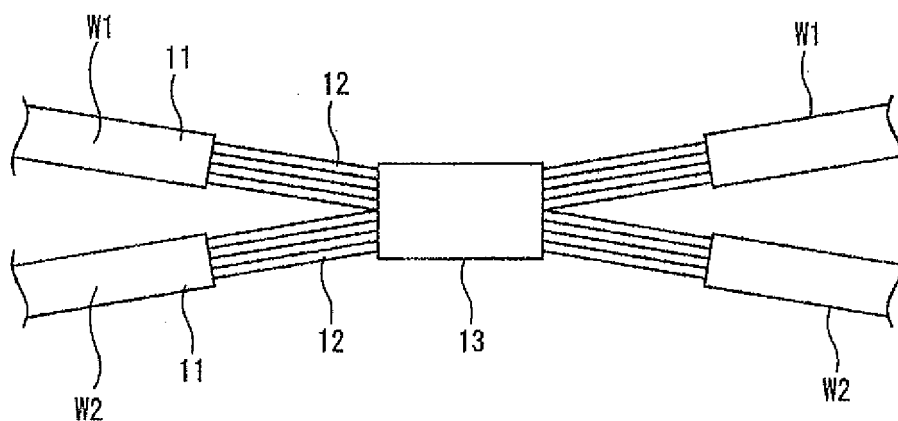


FIG. 3

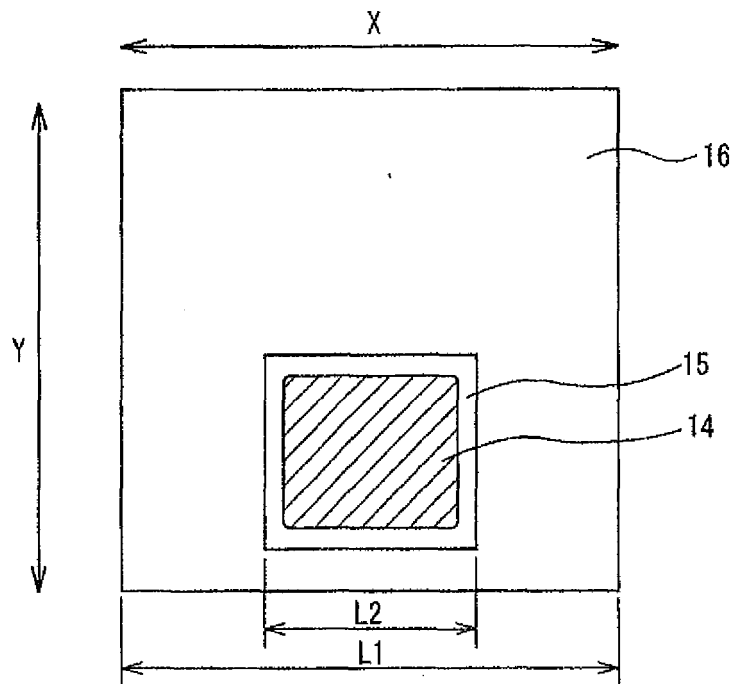


FIG. 4

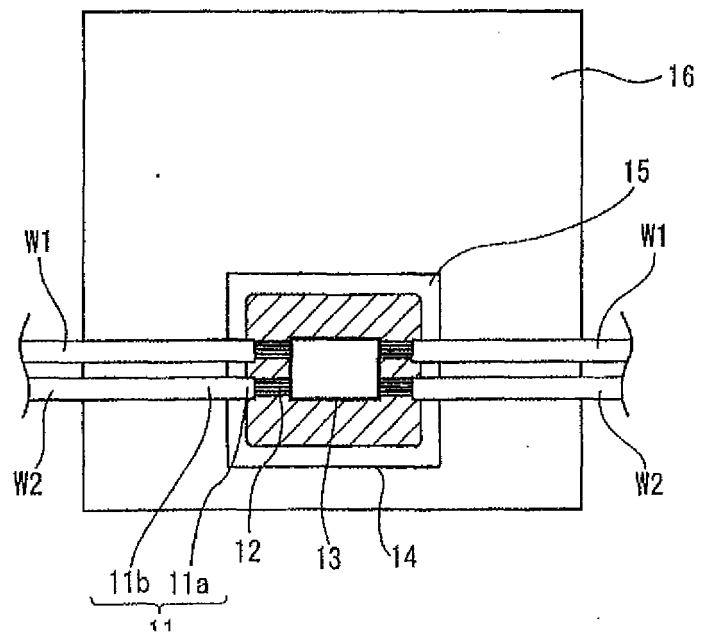


FIG. 5A

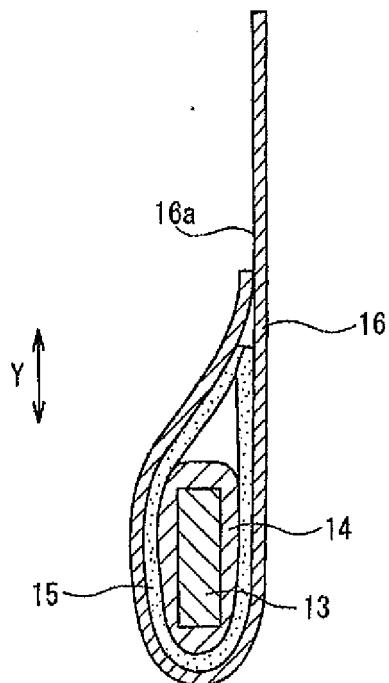


FIG. 5B

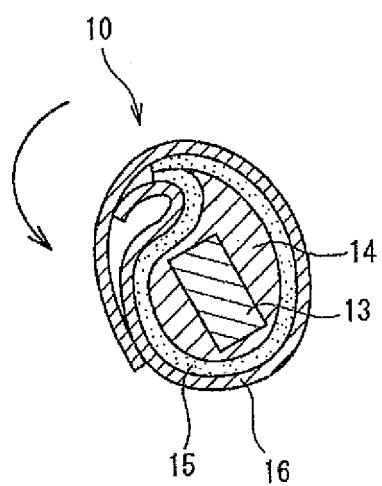
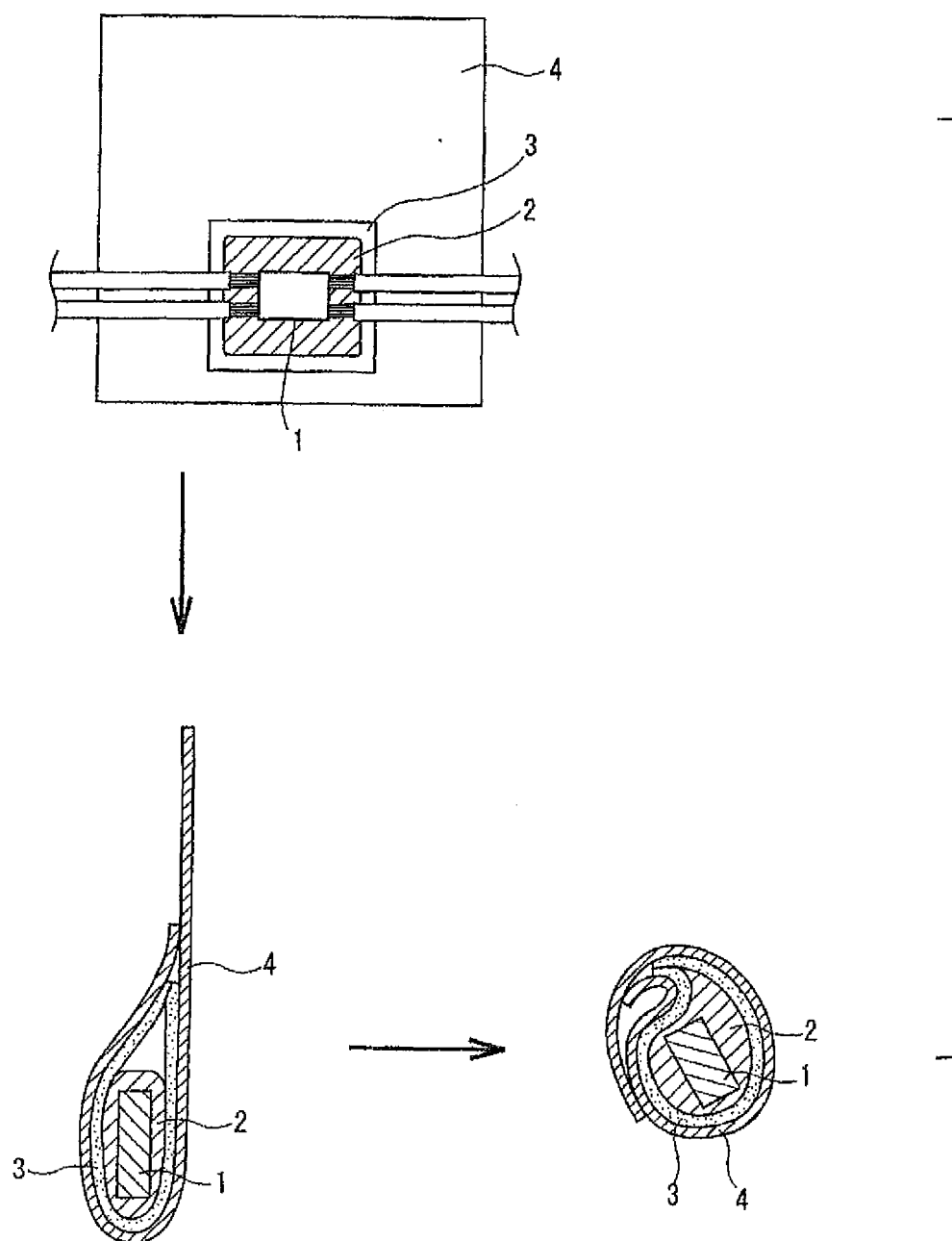


FIG. 6 (PRIOR ART)



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/070993

A. CLASSIFICATION OF SUBJECT MATTER

H01R4/70 (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)

H01R4/70

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2007
Kokai Jitsuyo Shinan Koho	1971-2007	Toroku Jitsuyo Shinan Koho	1994-2007

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2005/104302 A1 (Sumitomo Wiring Systems, Ltd.), 03 November, 2005 (03.11.05), Par. Nos. [0020] to [0027]; Figs. 1 to 5 & EP 001744403 A Par. Nos. [0020] to [0027]; Figs. 1 to 5	1-2
Y	JP 7-255115 A (Sumitomo Wiring Systems, Ltd.), 03 October, 1995 (03.10.95), Par. Nos. [0017] to [0029]; Figs. 1 to 4 (Family: none)	1-2
Y	JP 8-148200 A (Sumitomo Wiring Systems, Ltd.), 07 June, 1996 (07.06.96), Par. Nos. [0017] to [0024]; Figs. 1 to 4 (Family: none)	2

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search
12 November, 2007 (12.11.07)Date of mailing of the international search report
20 November, 2007 (20.11.07)Name and mailing address of the ISA/
Japanese Patent Office

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2005104302 A [0003] [0005]