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(54) **WIRE HARNESS ASSEMBLING DEVICE AND WIRE HARNESS ASSEMBLING METHOD**

(57) There is provided an apparatus (1) for assembling a wire harness and a method of the same for allowing a sub-harness to be easily wired.

The wire harness includes a plurality of sub-harnesses. Each sub-harness includes sub-harness identifying data for identifying the sub-harnesses each other. The apparatus 1 includes a wiring board (10), LEDs (11), a bar code scanner (12), and a controller (13). The sub-harnesses, namely, the wire harness is wired on a surface (14a) of a main board (14) of the wiring board (10). The LEDs (11) are disposed corresponding to turning points and terminals of wires as the sub-harnesses. The bar code scanner (12) reads the sub-harness identifying data. The controller (13) identifies the turning points, through which the sub-harness identified by the sub-harness identifying data is to be wired, and the terminals to be disposed on the wiring board (10). The controller (13) switches on the LEDs 11 corresponding to the turning points and the terminals, and off the other LEDs.

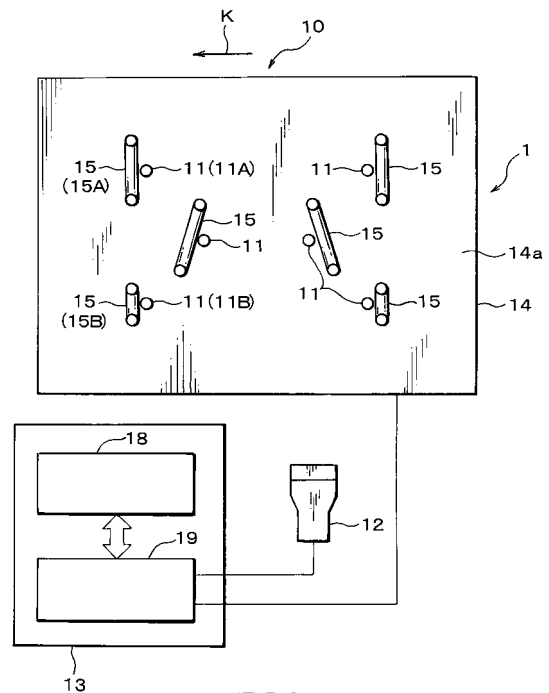


FIG. 1

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**Description****[TECHNICAL FIELD]**

**[0001]** This invention relates to an apparatus for assembling a wire harness wired in such as a vehicle and a method of the same.

**[BACKGROUND ART]**

**[0002]** Various electronic devices are mounted on a motor vehicle as a mobile unit. Therefore, the motor vehicle includes a wire harness for transmitting power from a power source and control signals from a computer to the electronic devices. The wire harness includes a plurality of sub-harnesses. Sub-harnesses are respectively mounted on systems installed on the vehicle. The sub-harness includes a plurality of electric wires and connectors attached to ends of the wires.

**[0003]** The wire includes an electrically conductive core wire and a coating made of insulating synthetic resin, which coats the core wire. The wire is a so-called coated wire. A connector includes a terminal fitting and a connector housing that receives the terminal fitting therein. The terminal fitting, consisting of electrically conductive sheet metal or the like, is attached to an end of the wire and electrically connected to the core wire of the wire. The connector housing made of electrically insulating synthetic resin is formed in a box-shape. When the connector housing is connected to the electronic devices, each wire is connected to the corresponding electronic device through the terminal fitting, thereby the wire harness transmits the desired electric power and signals to the electronic devices.

**[0004]** When the wire harness is assembled, firstly, the sub-harnesses are assembled. Then, the sub-harnesses are sequentially wired on a wiring board for producing a wire harness. Then, exterior parts such as a harness protector or grommets are attached to the wiring board at predetermined positions thereof, and a tape is wrapped around the sub-harnesses. Thereby, the wire harness is assembled.

**[0005]** The wiring board includes a flat main board and hooks mounted on the wiring board. The namely the sub-harnesses and the wires of the wire harness are wired according to a predetermined pattern on the main body. A pattern (hereunder referred to as "wiring pattern") is previously made on a surface of the main body for guiding the sub-harnesses and the wires to be wired.

**[0006]** The hook is allowed to hook the wire and the sub-harnesses. A plurality of the hooks is arranged according to the wiring pattern on the main board. Specifically, the hooks are mounted corresponding to turning points where the wires or the like turn in various directions, and terminals of the wires.

**[0007]** The wires and the sub-harnesses are wired sequentially on the predetermined hooks according to the wiring pattern formed on the wiring board.

**[DISCLOSURE OF THE PRESENT INVENTION]****[PROBLEM TO BE SOLVED BY THE INVENTION]**

**[0008]** However, the number of electric components mounted on a vehicle tends to increase due to user requests. Accordingly, the number of the sub-harnesses composing the wire harness and the number of wires received in one sub-harness also tends to increase.

**[0009]** Therefore, the wiring pattern for wiring the sub-harnesses tends to be complex, and it becomes hard to identify the hooks corresponding to the sub-harnesses. Namely, it becomes hard to wire the sub-harnesses on the wiring board according to the wiring pattern, and the time required to assemble the wire harness tends to be long.

**[0010]** Further, a worker for wiring each sub-harness on the wiring board must memory routes of the wiring pattern linked to lengths of connectors and wires. Therefore, required time for wiring the sub-harness according to the wiring pattern becomes varied depending on proficiency of the workers. Further, the increase of the numbers of the wires and the sub-harnesses extends the time for such wiring, and the time for a worker to acquire proficiency in assembling the wire harness becomes longer.

**[0011]** Accordingly, an object of the present invention is to provide an apparatus for assembling a wire harness and a method of the same for allowing the sub-harnesses to be wired easily.

**[MEANS FOR SOLVING THE PROBLEM]**

**[0012]** For attaining the object, according to the present invention as claimed in claim 1, there is provided an apparatus for assembling a wire harness from a plurality of sub-harnesses including:

a wiring board on which the wire harness being wired; lighting members mounted on the wiring board corresponding to terminals of wires of the wire harness and turning points where the wires turning in various directions;

a data storage wherein data stored in the data storage indicates the turning points and the terminals on a wiring route of each sub-harness;

a data reader for reading sub-harness identifying data for identifying each sub-harness;

a controller for identifying the turning points and the terminals on the wiring route of the sub-harness from the data stored in the data storage according to the data read by the data reader, and lighting the lighting member corresponding to the turning points and the terminals.

**[0013]** According to the present invention as claimed in claim 2, there is provided the apparatus for assembling a wire harness as claimed in claim 1, wherein each of said sub-harnesses includes a plurality

of connectors attached to the terminals of the wires, wherein one of the connectors is selected as a reference connector, and the controller blinks the lighting member corresponding to the terminal to which the reference connector is attached when the lighting member is lighted.

**[0014]** According to the present invention as claimed in claim 3, there is provided the apparatus for assembling a wire harness as claimed in claim 1, wherein said sub-harnesses are wired while the wiring board is moving, wherein each of said sub-harnesses includes a plurality of connectors attached to the terminals of the wires, wherein one of the connectors is selected as a reference connector, and the lighting member corresponding to the terminal to which the reference connector is attached is disposed at a predetermined position corresponding to a direction of moving the wiring board.

**[0015]** According to the present invention as claimed in claim 4, there is provided a method of assembling a wire harness including the steps of:

wiring a plurality of sub-harnesses on a wiring board;  
and  
assembling the sub-harnesses each other,  
wherein said method further including the steps of:

mounting lighting members on the wiring board corresponding to terminals of wires of the wire harness and turning points where the wires turning in various directions;  
reading sub-harness identifying data identifying the sub-harness to be wired on the wiring board;  
lighting the lighting members corresponding to the turning points and terminals on a wiring route of the sub-harness identified by the identifying data; and  
wiring the sub-harness to the lighted lighting members corresponding to the turning points and terminals.

**[0016]** According to the present invention as claimed in claim 5, there is provided the method of assembling a wire harness as claimed in claim 4, wherein each of said sub-harnesses includes a plurality of connectors attached to the terminals of the wires, wherein one of the connectors is selected as a reference connector, and the lighting member corresponding to the terminal to which the reference connector is attached is blinked when the lighting members are lighted.

**[0017]** According to the present invention as claimed in claim 6, there is provided the method of assembling a wire harness as claimed in claim 4, wherein said sub-harnesses are wired while the wiring board is moving, wherein each of said sub-harnesses includes a plurality of connectors attached to the terminals of the wires, wherein one of the connectors is selected as a reference connector, and the lighting member corresponding to the

terminal to which the reference connector is attached is disposed at a predetermined position corresponding to a direction of moving the wiring board, wherein when the sub-harnesses are wired to the wiring board, the terminal to which the reference connector is attached is firstly wired to the wiring board.

#### [EFFECT OF INVENTION]

**[0018]** According to the present invention as claimed in claim 1, the lighting means corresponding to the turning points and the terminals on the wiring route of the sub-harness to be wired are lighted. Thus, wiring the turning points and the terminals corresponding to the lighted lighting members makes it easy to wire the sub-harness on the wiring board.

**[0019]** According to the present invention as claimed in claim 2, mounting the terminal having the reference connector on the blinked lighting member makes it secure to mount the reference connector of each sub-harness on the predetermined position of the wiring board.

**[0020]** According to the present invention as claimed in claim 3, mounting the terminal having the reference connector on the predetermined position of the lighting member corresponding to the direction of moving the wiring board makes it secure to mount the reference connector of each sub-harness on the predetermined position of the wiring board.

**[0021]** According to the present invention as claimed in claim 4, firstly, the lighting members corresponding to the turning points and terminals on the wiring route of the sub-harness to be wired are lighted. Then, the wires are wired to the lighted lighting members corresponding to the turning points and terminals. Thereby, the sub-harness is easily wired on the wiring board.

**[0022]** According to the present invention as claimed in claim 5, mounting the terminal having the reference connector on the blinked lighting member makes it secure to mount the reference connector of each sub-harness on the predetermined position of the wiring board. Thus, blinking the lighting member corresponding to the terminal having the reference connector makes it easy to wire the sub-harness to the predetermined position on the wiring board.

**[0023]** According to the present invention as claimed in claim 6, mounting the terminal having the reference connector on the predetermined position of the lighting member corresponding to the direction of moving the wiring board makes it secure to mount the reference connector of each sub-harness on the predetermined position of the wiring board. Thus, arranging the lighting member corresponding to the terminal, to which the reference connector is attached, at the predetermined position makes it easy to wire the sub-harness at the predetermined position on the wiring board.

## [BRIEF DESCRIPTION OF THE DRAWINGS]

## [0024]

[Fig. 1] An explanatory view showing a structure of an apparatus for assembling a wire harness according to an embodiment of the present invention.

[Fig. 2] A perspective view showing a main part of a wiring board of the apparatus for assembling a wire harness shown in Fig. 1.

[Fig. 3] A sectional view taken on line III - III in Fig. 2.

[Fig. 4] An explanatory view showing an example of a wire harness assembled by the apparatus shown in Fig. 1.

[Fig. 5] An explanatory view showing a structure of a first sub-harness as one component of the wire harness in Fig. 4.

[Fig. 6] An explanatory view showing a structure of a second sub-harness as another component of the wire harness in Fig. 4.

[Fig. 7] An explanatory view showing a state of reading sub-harness identifying data of the first sub-harness shown in Fig. 5.

[Fig. 8] An explanatory view showing lighted LEDs corresponding to hooks to hook the first sub-harness, said hooks being identified by reading the sub-harness identifying data of the first sub-harness.

[Fig. 9] An explanatory view showing a state of reading sub-harness identifying data of the second sub-harness shown in Fig. 6.

[Fig. 10] An explanatory view showing lighted LEDs corresponding to hooks to hook the second sub-harness, said hooks being identified by reading the sub-harness identifying data of the second sub-harness.

[Fig. 11] An explanatory view showing the sub-harnesses respectively wired on the wiring board of the apparatus shown in Fig. 1.

[Fig. 12] A perspective view showing the wiring board of the apparatus for assembling a wire harness shown in Fig. 1.

[Fig. 13] An explanatory view showing a plurality of the wire harnesses showing in Fig. 12 being installed on a floor of a factory or the like.

## [EXPLANATIONS OF LETTERS OR NUMERALS]

## [0025]

|           |                                         |
|-----------|-----------------------------------------|
| 1         | apparatus for assembling a wire harness |
| 2         | wire harness                            |
| 3, 3a, 3b | sub-harnesses                           |
| 4         | electric wire                           |
| 4a        | terminal                                |
| 5         | connector                               |
| 5A, 5B    | reference connectors                    |
| 6a, 6b    | sub-harness identifying data            |
| 7         | turning point                           |

|          |                                         |
|----------|-----------------------------------------|
| 10       | wiring board                            |
| 11       | LED (lighting member)                   |
| 11A, 11B | LEDs (lighting members)                 |
| 12       | bar code scanner (data reader)          |
| 18       | data storage (memory)                   |
| 19       | control unit (controlling member)       |
| K        | direction of moving the wiring board 10 |

## [BEST MODE FOR CARRYING OUT THE INVENTION]

[0026] Hereunder, an apparatus for assembling a wire harness 1 according to an embodiment of the present invention will be explained with reference to Figs. 1 to 11. The apparatus as shown in Fig. 1 assembles a wire harness shown in Fig. 4. As shown in Fig. 4, a plurality of sub-harnesses 3 is assembled into the wire harness 2.

[0027] According to this embodiment, the wire harness 2 includes a first sub-harness 3a as shown in Fig. 5, a second sub-harness 3b shown in Fig. 6, not-shown exterior parts such as harness protector, harness grommets, a tape, and the like. As shown in Figs. 5 and 6, the first and the second sub-harnesses 3a, 3b respectively include a plurality of electric wires 4 and connectors 5 attached to ends 4a of the wires 4.

[0028] The wire 4 is so-called a coated wire having a conductive core wire and an insulating covering of the core wire. The connector 5 includes conductive terminal fittings and a connector housing for receiving the terminal fittings. The terminal fitting is attached to such as the terminal 4a of the wire 4 to electrically connect with the core of the wire 4. The connector housing is made of insulating synthetic resin, and has a box shape.

[0029] Identification data 6a, 6b are formed on outer walls of the connector housings of the first and the second connectors 3a, 3b (hereunder referred to as "reference connectors 5A, 5B"), each reference connector 5A, 5B being disposed at one of both sides of each connector 3a, 3b. When the sub-harnesses 3a, 3b are wired on a later-described wiring board 10, the reference connectors 5A, 5B are disposed at forefronts of the connectors 5 in a direction "K" of moving the wiring board 10. Thus, the reference connectors 5A, 5B are disposed on predetermined locations on the wiring board 10 according to the direction "K" of moving the wiring board 10. The sub-harness identifying data 6a, 6b differ according to the sub-harnesses 3a, 3b. Therefore, the sub-harnesses 3a, 3b can be identified according to the sub-harness identifying data 6a, 6b.

[0030] Well-known bar cords can be used as the sub-harness identifying data 6a, 6b. Preferably, the sub-harness identifying data 6a, 6b are formed on the outer walls of the reference connectors 5A, 5B in a manner that liquid coloring agent with a specific amount thereof is spouted and coated on the outer walls of the reference connectors 5A, 5B. Other methods for forming the sub-harness identifying data 6a, 6b are also acceptable.

[0031] Incidentally, in this specification, the coloring material means a liquid substance, in which a coloring

material (organic substance for use in industry) is dissolved and dispersed in water or other solvent. The organic substance described above is a dye or a pigment (most of them being organic substances and synthetic substances). Sometimes, a dye is used as a pigment and a pigment is used as a dye. As a concrete example, the coloring material may be a coloring liquid or coating material.

**[0032]** The coloring liquid is a liquid, in which a dye, as the coloring material, is dissolved or dispersed in a solvent. The coating material is a material in which a pigment as the coloring material is dispersed in a liquid dispersion as the solvent. When the outer surface of the wire is colored with a coloring liquid, the dye permeates into the coating of the wire. When the outer surface of the wire is colored with a coating material, the pigment adheres to the outer surface without permeating into the coating of the wire. In the specification, "to color the outer surface of the wire" means to dye a part of the outer surface of the coating of the wire with a dye or to coat a part of the outer surface of the coating of the wire with a pigment.

**[0033]** Preferably, the solvent and liquid dispersion have an affinity to the synthetic resin that constitutes the coating in order to securely permeate the dye into the coating or to allow the pigment to securely adhere to the outer surface of the coating.

**[0034]** In this specification, "spouting" means that the liquid coloring material in a state of the liquid drop is ejected vigorously from the coloring nozzle onto the outer surface of the wire.

**[0035]** Further, the wire harness 2 having the sub-harnesses 3a, 3b includes a plurality of turning points 7 (shown with an alternative long and short dashed line in Figs. 4 to 6). The wires 4 are turned in various directions at the turning points 7.

**[0036]** As shown in Fig. 1, the apparatus for assembling a wire harness 1 includes a wiring board 10, a plurality of LEDs 11 as lighting members, a bar code scanner 12 as a data reader, and a controller 13 as a controlling member.

**[0037]** As shown in Fig. 13, a plurality of the wiring boards 10 is installed on such as a floor of a factory. While the wiring board 10 is moved along a circular moving path 100 on the floor, the sub-harnesses 3a, 3b are wired by such as workers. In this case, the wiring board 10 is, for example, moved along an arrow "K" in Fig. 13. The arrow "K" indicates the direction of moving the wiring board 10.

**[0038]** As shown in Figs. 1 to 3 and Fig. 12, the wiring board 10 includes a main board 14 and a plurality of hooks 15. The main board 14 is formed in a plate shape. Not shown wiring patterns for the sub-harnesses 3a, 3b of the wire harness 2 are formed on a surface 14a of the main board 14. The wiring patterns are equivalent to those for wiring the sub-harnesses 3a, 3b in a vehicle.

**[0039]** The hooks 15 are mounted on the surface 14a of the main board 14 of the wiring board 10. As shown

in Figs. 2 and 3, the hook 15 integrally includes a pillar 16 and a wire holder 17. The pillar 16 stands up from the main board 14 of the wiring board 10. As shown in Fig. 3, the wire holder 17 is formed in a U-shape from a side view. The wire holder 17 continues to a top end of the pillar 16.

**[0040]** The hooks 15 are arranged according to the wiring pattern formed on the surface 14a. The hooks 15 are mounted respectively corresponding to the turning points 7 and the terminals 4a of the wires 4 of the wire harness 2 to be wired on the wiring board 10. The hooks 15 are arranged in the vicinity of the turning points 7 and the terminals 4a.

**[0041]** The wires 4 of the sub-harnesses 3a, 3b of the wire harness 2 are wired through the wire holders 17 of the hooks 15. The sub-harnesses 3a, 3b of the wire harness 2 are wired according to the wiring pattern by the hooks 15 hooking and turning the wires 4 at the turning points 7 on the wiring board 10.

**[0042]** The LEDs 11 are mounted on the surface 14a of the main board 14 of the wiring board 10. The LEDs 11 are respectively arranged just under (in the vicinity of) the turning points 7 and the terminals 4a of the sub-harnesses 3a, 3b of the wire harness 2 wired on the wiring board 10. Thus, the LEDs 11 are disposed on the wiring board 10 respectively corresponding to the turning points 7 and the terminals 4a. The LEDs 11 are switched on, off, or blinked according to control signals of the controller 13.

**[0043]** The hooks 15 for hooking the terminals 4a to which the reference connectors 5A, 5B are attached (hereunder referred to as "hooks 15A, 15B") and the LEDs 11 corresponding to the terminals 4a to which the reference connectors 5A, 5B are attached (hereunder referred to as "LEDs 11A, 11B") are disposed at the fore-fronts among a plurality of the hooks 15 and the LEDs 11 in the direction of the arrow "K". Thus, the LEDs 11A, 11B corresponding to the terminals 4a to which the reference connectors 5A, 5B are attached are arranged in the predetermined positions.

**[0044]** The bar code scanner 12 reads the sub-harness identifying data 6a, 6b provided on the connectors 5 of the sub-harnesses 3a, 3b and outputs to the controller 13.

**[0045]** The controller 13 is a well-known computer having RAM, ROM, and a CPU. The controller 13 is connected to the wiring board 10 and the bar code scanner 12, and controls a whole apparatus 1 for assembling a wire harness.

**[0046]** As shown in Fig. 1, the controller 13 includes a data storage 18 as a memory member and a control unit 19 as a controlling member. The data storage 18 is mainly composed of the ROM and the like. The data storage 18 stores locations of the hooks for hooking the wires 4 of the sub-harnesses 3a, 3b to be wired on the wiring board 10. Namely, the data stored in the data storage 18 indicates the turning points 7 through which the sub-harnesses 3a, 3b are to be wired and the terminals 4a to be disposed on the wiring board 10.

**[0047]** The control unit 19 is mainly composed of the RAM and the CPU. The bar code scanner 12 inputs the sub-harness identifying data 6a, 6b of the sub-harnesses 3a, 3b into the control unit 19. The control unit 19 identifies the hooks 15 for hooking the sub-harnesses 3a, 3b from the data stored in the data storage 18 according to the sub-harness identifying data 6a, 6b.

**[0048]** In other words, the control unit 19 identifies the turning points 7 through which the sub-harnesses 3a, 3b are to be wired and the terminals 4a to be disposed on the wiring board 10 from the data stored in the data storage 18 according to the sub-harness identifying data 6a, 6b. The control unit 19 switches on the LEDs 11 corresponding to the identified hooks 15, and switches off the other LEDs 11. Further, the control unit 19 blinks the LEDs 11A, 11B corresponding to the hooks 15A, 15B for hooking the terminals 4a to which the reference connectors 5A, 5B are attached. Namely, the control unit 19 blinks the LEDs 11A, 11B corresponding to the terminals 4a to which the reference connectors 5A, 5B are attached.

**[0049]** When the wire harness 2 is assembled with the apparatus 1, firstly, the bar code scanner 12 reads the sub-harness identifying data 6a formed on the reference connector 5A of the first sub-harness 3a as shown in Fig. 7. Then, the bar code scanner 12 inputs the sub-harness identifying data 6a into the control unit 19.

**[0050]** Then, the control unit 19 identifies the turning points 7 through which the first sub-harness 3a is to be wired and the terminals 4a to be disposed on the wiring board 10 from the data stored in the data storage 18 according to the sub-harness identifying data. Then, as shown in Fig. 8, the control unit 19 switches on the LEDs 11 corresponding to the turning points 7 through which the wires 4 of the first sub-harness 3a are to be wired and the terminals 4a, and switches off the other LEDs. In Fig. 8, each lighted LED has a reference numeral "11a". Further, when lighting the LEDs 11a, the control unit 19 blinks the LED 11A corresponding to the terminal 4a to which the reference connector 5A is attached.

**[0051]** Then, a worker hooks the terminal 4a having the reference connector 5A on the hook 15A corresponding to the blinking LED 11A. Then, a worker hooks the wire 4 on the hook 15a corresponding to the blinking LED 11a to wire the first sub-harness 3a on the wiring board 10. Incidentally, in Fig. 8, a reference numeral "15a" indicates the hook 15 corresponding to the lighted LED 11a. Thus, the first sub-harness 3a is wired through the turning points 7 and the terminals 4a are disposed corresponding to the lighted LEDs 11a. Thus, when the first sub-harness 3a is wired, the terminal 4a having the reference connector 5A is firstly wired on the wiring board 10.

**[0052]** Then, as shown in Fig. 9, the bar code scanner 12 reads the sub-harness identifying data 6b formed on the reference connector 5B of the second sub-harness 3b and inputs the sub-harness identifying data 6b into the control unit 19. The control unit 19 identifies the turn-

ing points 7 through which the second sub-harness 3b is wired and the terminals 4a from the data stored in the data storage 18 according to the inputted sub-harness identifying data 6b. Then, as shown in Fig. 10, the control unit 19 switches on the LED 11b corresponding to the identified turning points 7 and the terminals 4a and switches off the other LEDs. Incidentally, in Fig. 10, a reference numeral "11b" indicates the lighted LED 11. Further, when lighting the LED 11b, the control unit 19 blinks the LED 11B corresponding to the terminal 4a having the reference connector 5B.

**[0053]** Then, a worker hooks the terminal 4a having the reference connector 15B on the hook 15B corresponding to the blinking LED 11B. Then, a worker hooks the wire 4 on the hook 15b corresponding to the blinking LED 11b to wire the second sub-harness 3b on the wiring board 10. Incidentally, in Fig. 10, a reference numeral "15b" indicates the hook 15 corresponding to the lighted LED 11b. Thus, the second sub-harness 3b is wired through the turning points 7 and the terminals 4a corresponding to the lighted LED 11b. Thus, when the second sub-harness 3b is wired, the terminal 4a having the reference connector 5B is firstly wired on the wiring board 10.

**[0054]** Thus, the sub-harness identifying data 6a, 6b formed on the connectors 5 of the sub-harnesses 3a, 3b are read, and the LEDs corresponding to the turning points 7 through which the sub-harnesses 3a, 3b are to be wired and the terminals 4a to be disposed are lighted according to the sub-harness identifying data 6a, 6b. Then, as shown in Fig. 11, the sub-harnesses 3a, 3b are wired on the wiring board 10. Then, exterior parts such as a harness protector or grommets are attached to predetermined positions of the wiring board 10, and a tape is wrapped around the sub-harnesses 3a, 3b. Then, the sub-harnesses 3a, 3b are visually examined and continuity of the sub-harnesses 3a, 3b is tested. Finally, the wire harness 2 is assembled.

**[0055]** According to this embodiment, the LEDs 11 corresponding to the turning points 7 through which the sub-harnesses 3a, 3b are to be wired and the terminals 4a to be disposed on the wiring board 10 are lighted. The wires 4, namely, the sub-harnesses 3a, 3b are wired by hooking the wires 4 on the hooks 15 corresponding to the lighted LED 11. Namely, the wires 4 as the sub-harnesses 3a, 3b are wired through the turning points 7 and the terminals 4a corresponding to the lighted LEDs 11. Therefore, the sub-harnesses 3a, 3b can be easily wired on the wiring board 10.

**[0056]** Since the terminals 4a having the reference connectors 5A, 5B are attached to the blinking LEDs 11A, 11B, the reference connectors 5A, 5B of the sub-harnesses 3a, 3b are reliably attached at predetermined positions on the wiring board 10. Thus, the LEDs 11A, 11B corresponding to the terminals 4a to which the reference connectors 5A, 5B are attached are blinked, the sub-harnesses 3a, 3b can be easily wired at predetermined positions on the wiring board 10.

**[0057]** Since the terminals 4a to which the reference connectors 5A, 5B are attached are hooked on the hooks 15A, 15B corresponding to the LEDs 11A, 11B disposed on the predetermined positions corresponding to the direction "K" of moving the wiring board 10, the reference connectors 5A, 5B of the sub-harnesses 3a, 3b are reliably attached at the predetermined positions on the wiring board 10. Thus, Arranging the LEDs 11A, 11B corresponding to the terminals 4a to which the reference connectors 5A, 5B are attached at the predetermined positions makes it easy to wire the sub-harnesses 3a, 3b at the predetermined positions on the wiring board 10.

**[0058]** Incidentally, in this embodiment, the sub-harness identifying data 6a, 6b are formed on the reference connectors 5A, 5B. However, according to the present invention, the sub-harness identifying data 6a, 6b may not be formed on the reference connectors 5A, 5B. According to the present invention, the reference connectors 5A, 5B can be selected optionally from a plurality of the connectors 5 of the sub-harnesses 3a, 3b.

**[0059]** Further, in this embodiment, the LEDs 11A, 11B are disposed at the forefront among the LEDs in the direction "K" of moving the wiring board 10. However, according to the present invention, the LEDs 11A, 11B are disposed at optional positions on the wiring board 10 as long as the optional positions are predetermined corresponding to the direction "K".

**[0060]** The LEDs 11A, 11B corresponding to the terminals 4a to which the reference connectors 5A, 5B are attached are blinked. However, according to the present invention, the LEDs 11A, 11B may not be blinked as long as the LEDs 11A, 11B are disposed at the predetermined positions corresponding to the direction "K".

**[0061]** Further, in this embodiment, assembling the sub-harnesses 3a, 3b each other makes the wire harness 2. However, according to the present invention, the wire harness 2 may be assembled by a larger sub-harness including the assembled sub-harnesses 3a, 3b and another sub-harness.

**[0062]** Further, according to the present invention, various materials may be used as the coloring liquid or coating material, for example, acrylic-coating material, ink (dye or pigment) or UV-ink.

**[0063]** This embodiment is described to aid in understanding the present invention and variations may be made by one skilled in the art without departing from the spirit and scope of the present invention.

## Claims

1. An apparatus for assembling a wire harness from a plurality of sub-harnesses comprising:

a wiring board on which the wire harness being wired;  
lighting members mounted on the wiring board corresponding to terminals of wires of the wire

harness and turning points where the wires turning in various directions;

a data storage wherein data stored in the data storage indicates the turning points and the terminals on a wiring route of each sub-harness;  
a data reader for reading sub-harness identifying data for identifying each sub-harness;  
a controller for identifying the turning points and the terminals on the wiring route of the sub-harness from the data stored in the data storage according to the sub-harness identifying data read by the data reader, and lighting the lighting member corresponding to the turning points and the terminals.

2. The apparatus for assembling a wire harness as claimed in claim 1,  
wherein each of said sub-harnesses includes a plurality of connectors attached to the terminals of the wires,  
wherein one of the connectors is selected as a reference connector, and the controller blinks the lighting member corresponding to the terminal to which the reference connector is attached when the lighting member is lighted.

3. The apparatus for assembling a wire harness as claimed in claim 1,  
wherein said sub-harnesses are wired while the wiring board is moving,  
wherein each of said sub-harnesses includes a plurality of connectors attached to the terminals of the wires,  
wherein one of the connectors is selected as a reference connector, and the lighting member corresponding to the terminal to which the reference connector is attached is disposed at a predetermined position corresponding to a direction of moving the wiring board.

4. A method of assembling a wire harness including the steps of:

wiring a plurality of sub-harnesses on a wiring board; and  
assembling the sub-harnesses,  
wherein said method further comprising the steps of:

mounting lighting members on the wiring board corresponding to terminals of wires of the wire harness and turning points where the wires turning in various directions;  
reading sub-harness identifying data identifying the sub-harness to be wired on the wiring board;  
lighting the lighting members corresponding to the turning points and terminals on a

wiring route of the sub-harness identified by the identifying data; and  
wiring the sub-harness to the lighted lighting members corresponding to the turning points and terminals.

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5. The method of assembling a wire harness as claimed in claim 4,  
wherein each of said sub-harnesses includes a plurality of connectors attached to the terminals of the wires,  
wherein one of the connectors is selected as a reference connector, and the lighting member corresponding to the terminal to which the reference connector is attached is blinked when the lighting members are lighted.
6. The method of assembling a wire harness as claimed in claim 4,  
wherein said sub-harnesses are wired while the wiring board is moving,  
wherein each of said sub-harnesses includes a plurality of connectors attached to the terminals of the wires,  
wherein one of the connectors is selected as a reference connector, and the lighting member corresponding to the terminal to which the reference connector is attached is disposed at a predetermined position corresponding to a direction of moving the wiring board,  
wherein when the sub-harnesses are wired to the wiring board, the terminal to which the reference connector is attached is firstly wired to the wiring board.

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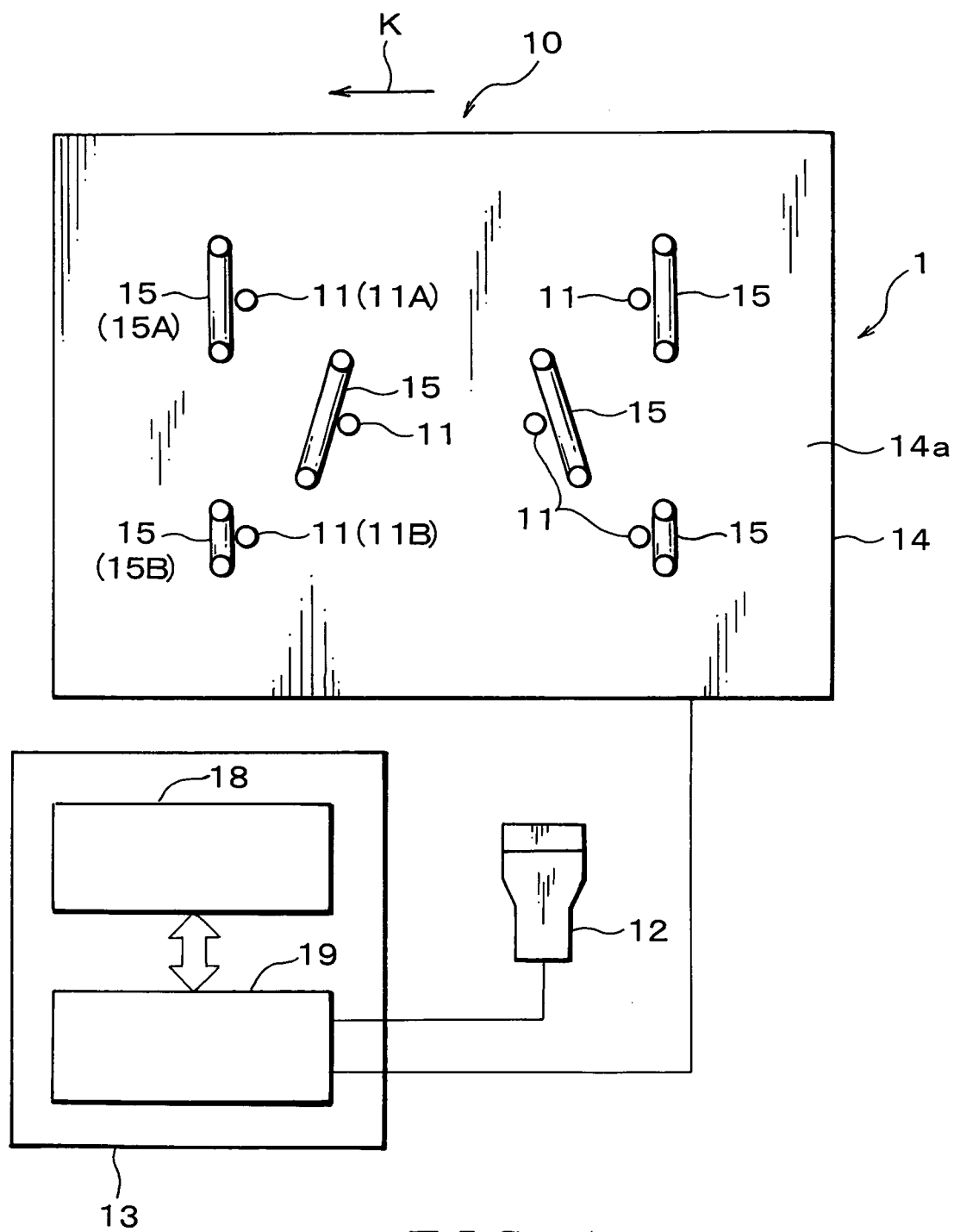


FIG. 1

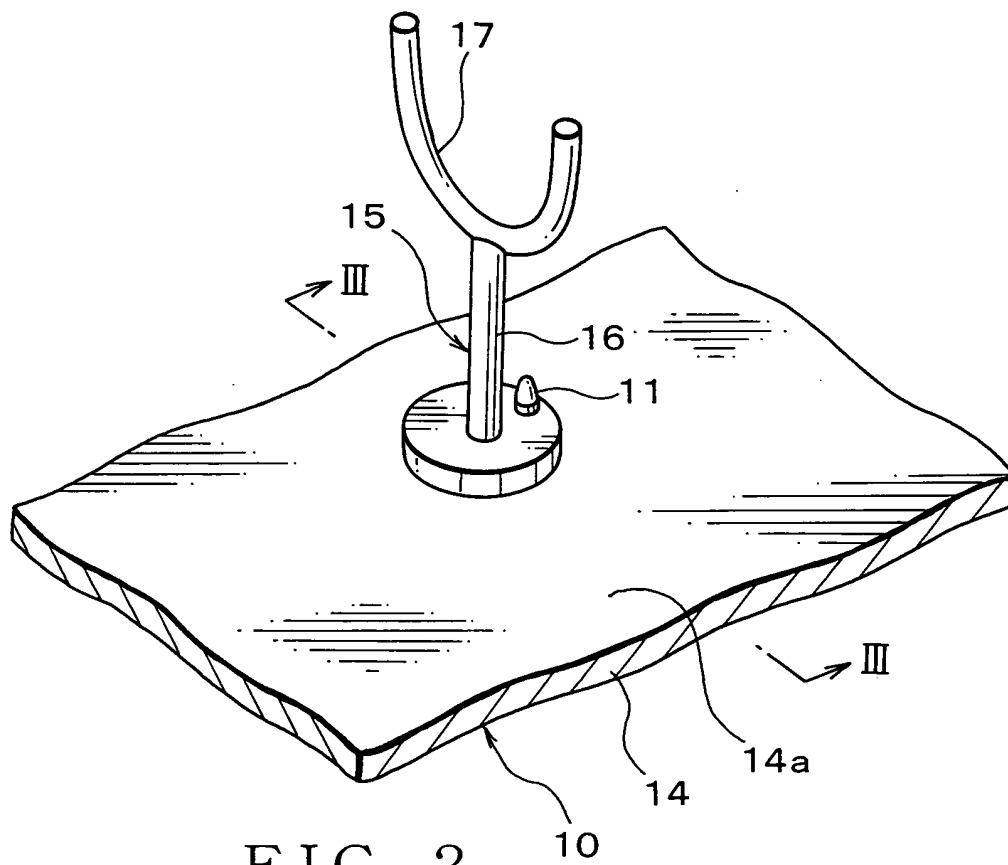


FIG. 2

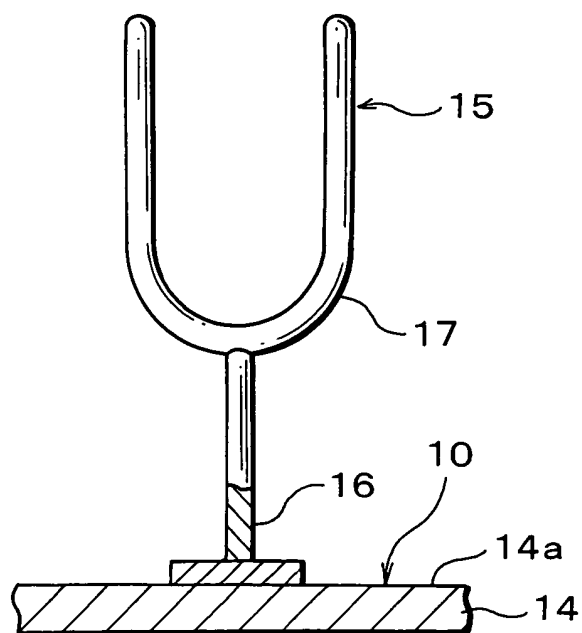


FIG. 3

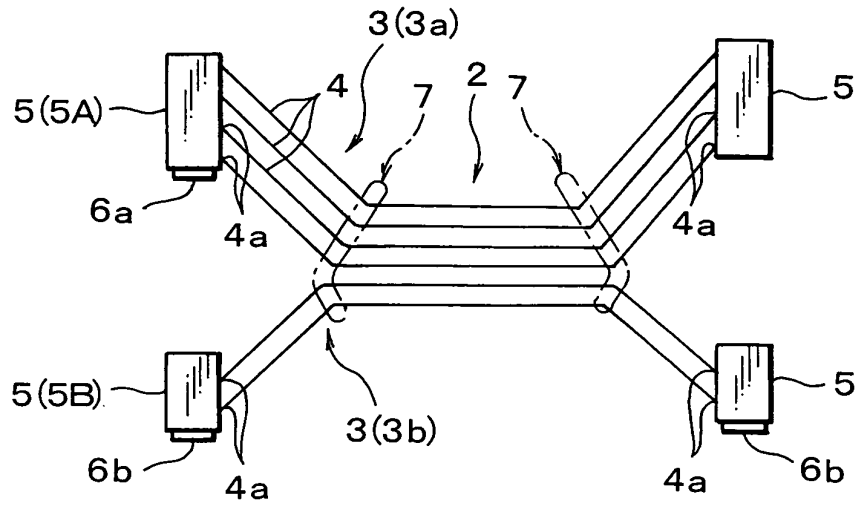


FIG. 4

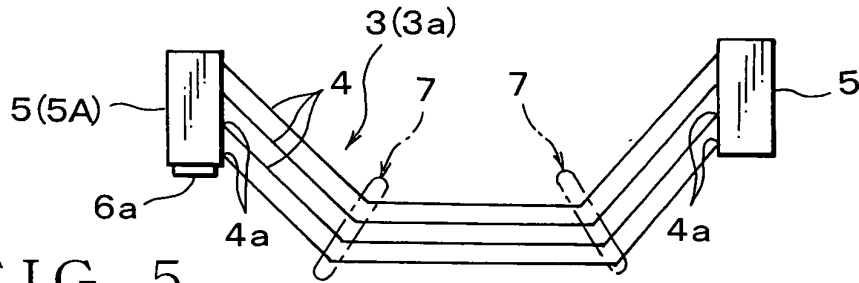


FIG. 5

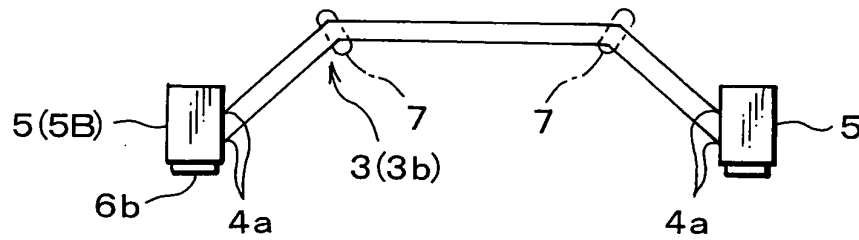


FIG. 6

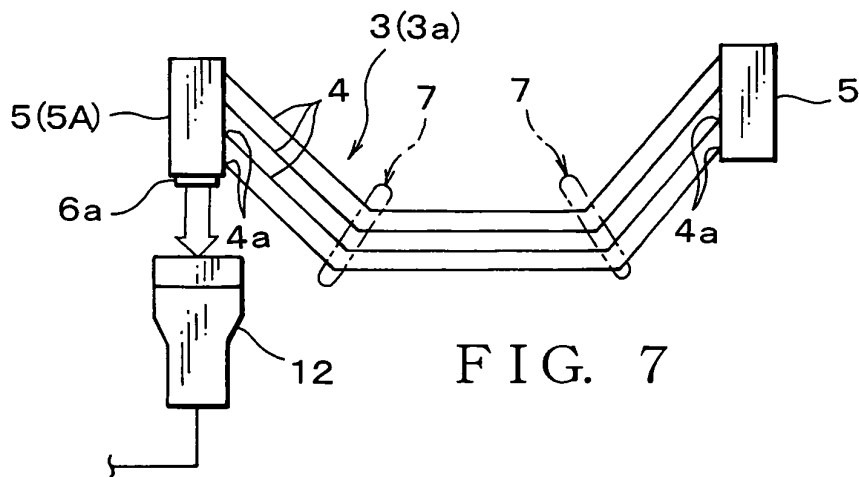


FIG. 7

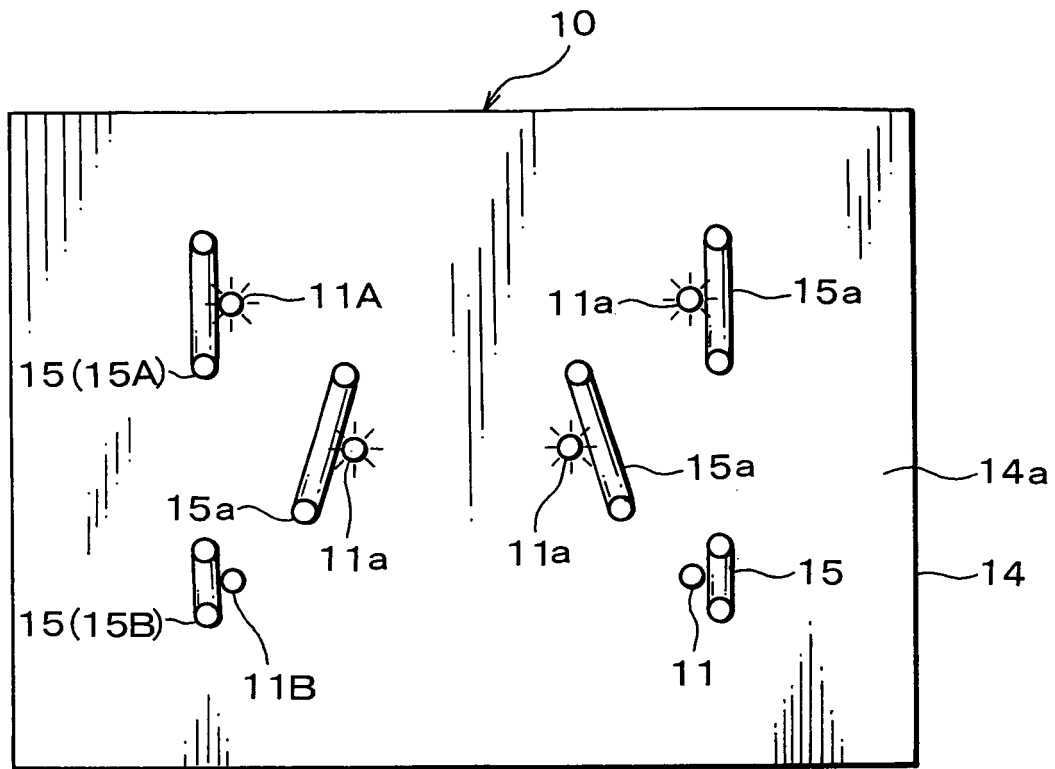


FIG. 8

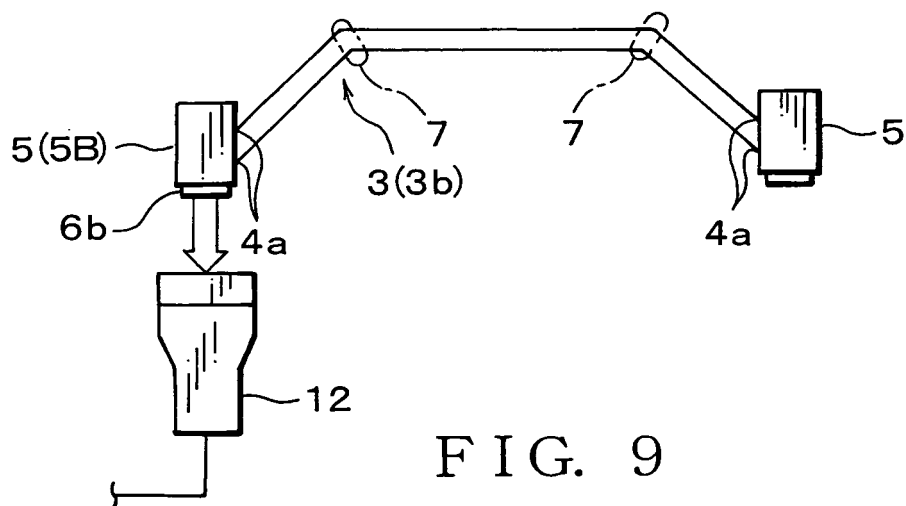


FIG. 9

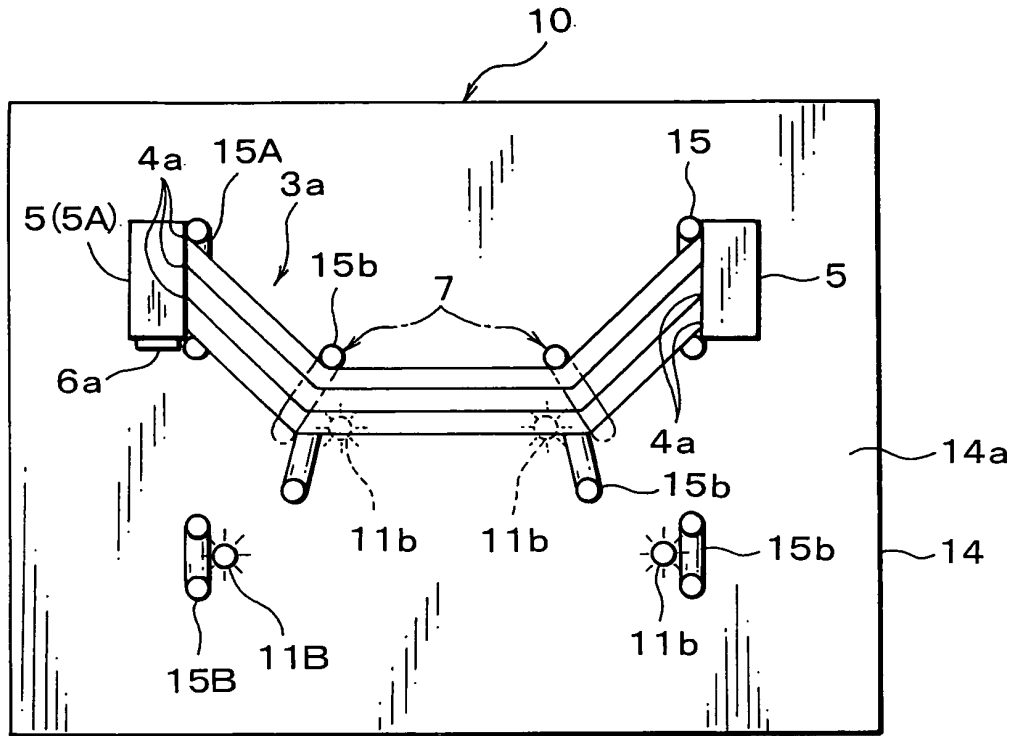


FIG. 10

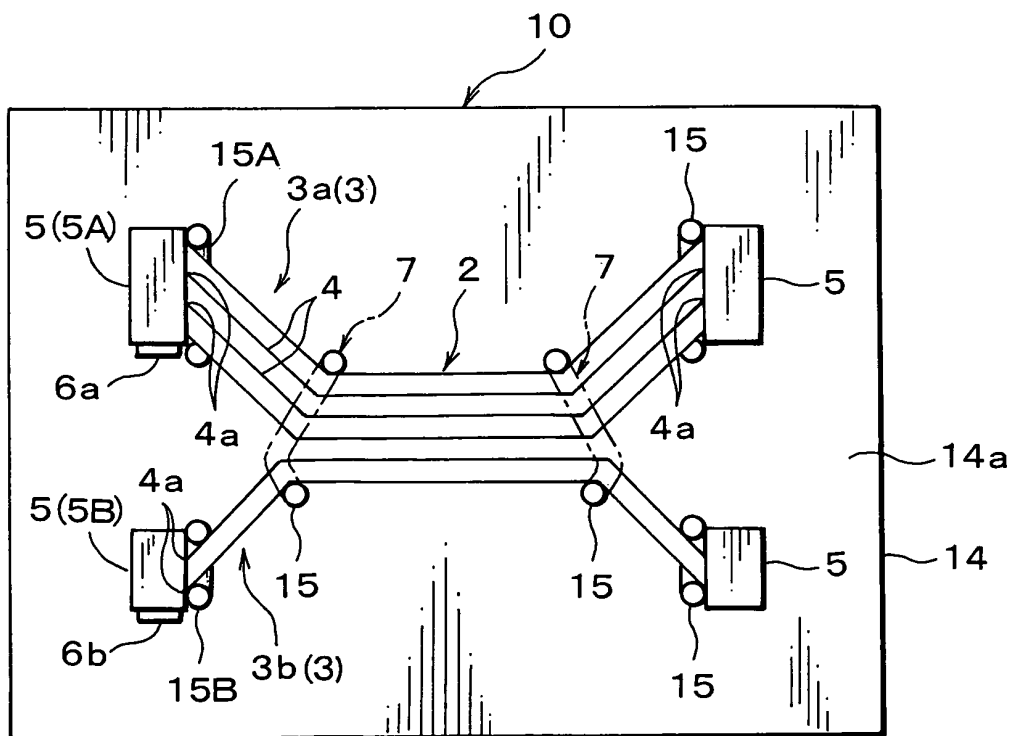


FIG. 11

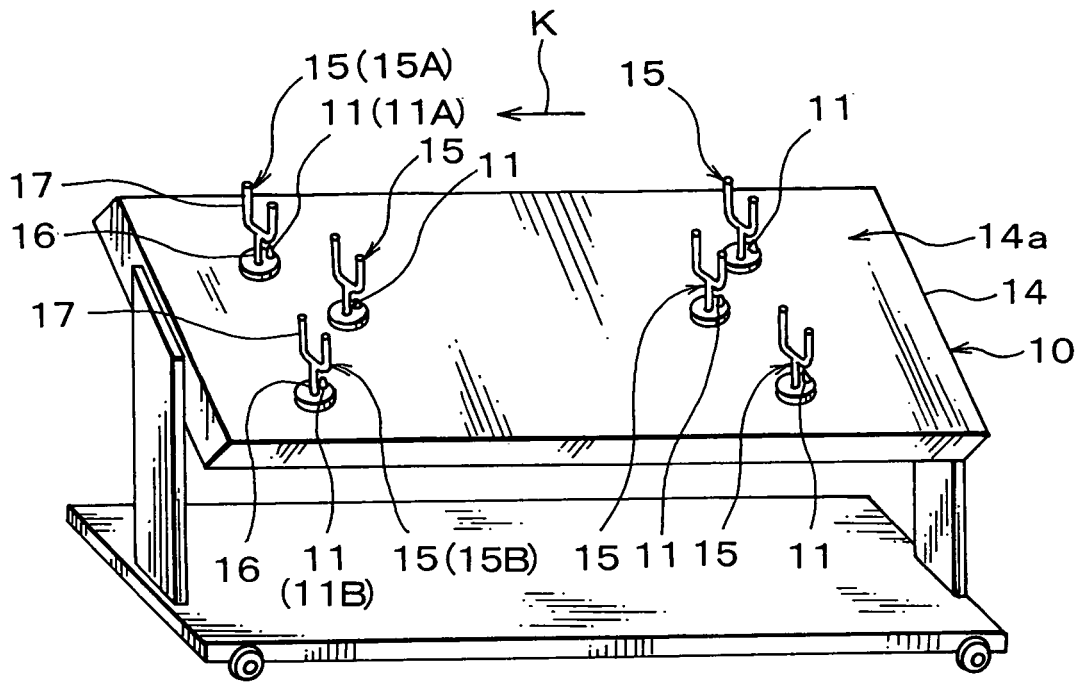


FIG. 12

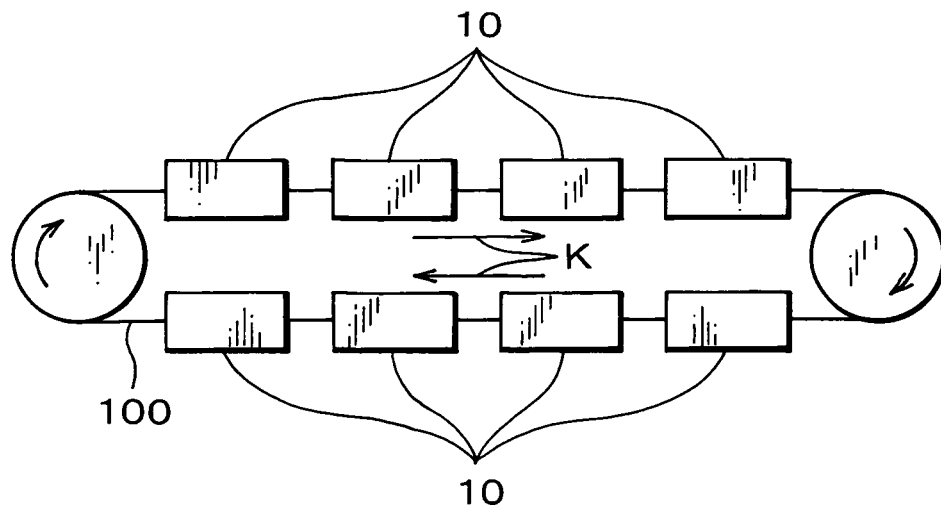


FIG. 13

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/007268

| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br>Int.Cl. <sup>7</sup> H01B13/012                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                           |                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| According to International Patent Classification (IPC) or to both national classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                           |                                                                                  |
| <b>B. FIELDS SEARCHED</b><br>Minimum documentation searched (classification system followed by classification symbols)<br>Int.Cl. <sup>7</sup> H01B13/00, 13/012                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                           |                                                                                  |
| Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched<br>Jitsuyo Shinan Koho 1926-1996 Jitsuyo Shinan Toroku Koho 1996-2004<br>Kokai Jitsuyo Shinan Koho 1971-2004 Toroku Jitsuyo Shinan Koho 1994-2004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                           |                                                                                  |
| Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                           |                                                                                  |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                           |                                                                                  |
| Category*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                        | Relevant to claim No.                                                            |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | JP 2002-75086 A (Sumitomo Wiring Systems, Ltd.),<br>15 March, 2002 (15.03.02),<br>(Family: none)                                                                                                                                                          | 1-6                                                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | JP 2002-109977 A (Sumitomo Wiring Systems, Ltd.),<br>12 April, 2002 (12.04.02),<br>(Family: none)                                                                                                                                                         | 1-6                                                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Microfilm of the specification and drawings<br>annexed to the request of Japanese Utility<br>Model Application No. 114067/1987 (Laid-open<br>No. 19222/1989)<br>(Ryosei Electro-Circuit Systems, Ltd.),<br>31 January, 1989 (31.01.89),<br>(Family: none) | 1-6                                                                              |
| <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                           |                                                                                  |
| * Special categories of cited documents:<br>"A" document defining the general state of the art which is not considered to be of particular relevance<br>"E" earlier application or patent but published on or after the international filing date<br>"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)<br>"O" document referring to an oral disclosure, use, exhibition or other means<br>"P" document published prior to the international filing date but later than the priority date claimed<br>"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<br>"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<br>"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<br>"&" document member of the same patent family |                                                                                                                                                                                                                                                           |                                                                                  |
| Date of the actual completion of the international search<br>11 August, 2004 (11.08.04)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                           | Date of mailing of the international search report<br>31 August, 2004 (31.08.04) |
| Name and mailing address of the ISA/<br>Japanese Patent Office                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                           | Authorized officer                                                               |
| Facsimile No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                           | Telephone No.                                                                    |

Form PCT/ISA/210 (second sheet) (January 2004)

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/007268

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                           | Relevant to claim No. |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 109308/1987 (Laid-open No. 13628/1989) (NEC Corp.), 24 January, 1989 (24.01.89), (Family: none) | 1-6                   |

Form PCT/ISA/210 (continuation of second sheet) (January 2004)