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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
26 April 2007 (26.04.2007)

PCT

(10) International Publication Number
WO 2007/047304 A1

(51) International Patent Classification:
G02B 6/00 (2006.01) *F21S 8/12* (2006.01)
B60Q 3/04 (2006.01)

(21) International Application Number:
PCT/US2006/039716

(22) International Filing Date: 10 October 2006 (10.10.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2005-304330 19 October 2005 (19.10.2005) JP

(71) Applicant *(for all designated States except US)*: **3M INNOVATIVE PROPERTIES COMPANY** [US/US]; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **TOKUNAGA, Taishi,** [JP/JP]; Sumitomo 3M Limited 33, 1 Tamagawadai, Setagaya, Tokyo 158-8583 (JP). **TAKAGI, Akimitsu** [JP/JP]; Sumitomo 3M Limited 33, 1 Tamagawadai, Setagaya, Tokyo 158-8583 (JP). **IRIE, Shinichi** [JP/JP]; Sumitomo 3M Limited 33, 1 Tamagawadai, Saint Paul, Tokyo 158-8583 (JP).

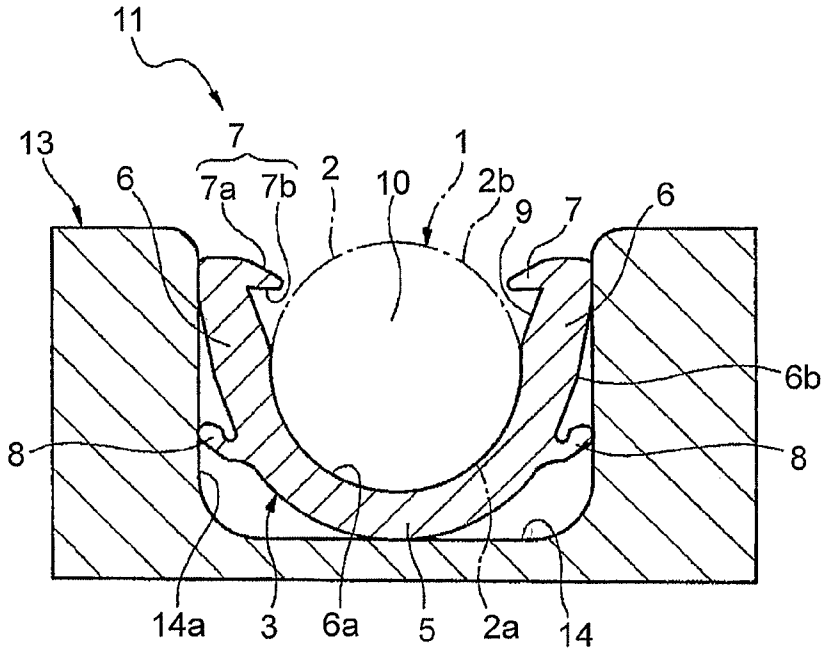
(74) Agents: **KNECHT, Harold, C., III** et al.; 3M Center, Office of Intellectual Property Counsel, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, 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, 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, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: METHOD FOR FIXING ELONGATE BODY, STRUCTURE FOR FIXING ELONGATE BODY, AND ELONGATE BODY HOLDER



(57) Abstract: The present invention provides a method and a device for fixing a linear member, without deteriorating the its appearance or cousing damage or breakage thereof . A panel (13) shaped in correspondence to a fiber holder (3) and having an engaging groove (14) defining a predetermined arrangement passage. A light fiber (1) is fixed to the engaging groove via the fiber holder while exposing the outer surface of the non-exposed portion of the light fiber outside. The light fiber is a linear member for uniformly- reflecting a light beam fed from one end into the interior thereof .

WO 2007/047304 A1

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

METHOD FOR FIXING ELONGATE BODY, STRUCTURE FOR FIXING ELONGATE BODY, AND ELONGATE BODY HOLDER

Field of the Invention

The present invention relates to a method for fixing a linear member arranged along a predetermined passage to an engaging groove defined on an object as the arrangement passage, a linear member fixing structure and a linear member holder.

Background

Generally, methods for fixing a linear member arranged along a predetermined passage to an object are described in Japanese Unexamined Utility Model Publication No. 7-30533 and Japanese Unexamined Patent Publication Nos. 2004-229485 and 2001-314028. In Japanese Unexamined Utility Model Publication No. 7-30533, a method is disclosed for attaching electric wires to a pillar or a wall of a residence or others by using an electric wire attachment appliance having a bottom wall and a pair of legs extending upward from the bottom wall. Japanese Unexamined Patent Publication Nos. 2004-229485 discloses a method for fixing a flat wire harness onto a plate of a body panel of an automobile, while pressing opposite widthwise regions of the flat wire harness by using a plurality of attachment ribs having an L-shaped cross-section projected from the plate. Japanese Unexamined Patent Publication Nos. 2001-314028 discloses a method for fixedly supporting an electric wire by fastening bolts while clamping the electric wire between a pair of clamping members.

Summary

It has been found that a light fiber such as, for example, an illuminant used as an additional light for an instrumental panel or a compartment lamp of an automobile, or as an illumination for a building, has to be fixed by a method different from the conventional wire attachment method. That is, if the conventional wire fixing method is applied to the light fiber, there is a possibility of causing a problem in that the light fiber is partially fixed to an object to be attached, in the fixed portion, the light fiber is concealed to generate the lighting irregularity, resulting in a poor looking, and, on the other hand, in the unfixed portion, the light fiber moves by the vehicle vibration to damage a hard outer

surface thereof or break itself.

The present invention provides a method for fixing a linear member, a structure for fixing the linear member and a linear member holder, capable of maintaining a favorable appearance of the linear member as well as preventing the linear member from being damaged or broken.

In one aspect of the present invention, a method is provided for fixing a linear member arranged on a predetermined passage to an engaging groove defining the passage on an object. The method comprises holding a fixed portion of the linear member to be held in the engaging groove by a long linear member holder, pushing the linear member holder in which the linear member is held into the engaging groove so that an outer surface of a non-fixed portion of the linear member is exposed outside, and fixing the linear member to the engaging groove via the linear member holder by a surface pressure applied to a contact surface of an inner surface of the engaging groove with an outer surface of the linear member holder. The linear member holder can be elastic.

In another aspect of the present invention, a structure is provided for fixing a linear member that comprises a linear member arranged on a predetermined passage, a long-sized linear member holder for holding the linear member while exposing one part of an outer surface of the linear member and covering the other part thereof, and an object having an engaging groove of a cross-sectional shape corresponding to that of the linear member holder, defining the predetermined passage for arranging the linear member. The linear member is fixed to the engaging groove via the linear member holder while exposing an outer surface of a non-fixed portion of the linear member outside. The linear member holder can be elastic. The linear member can be a light fiber for uniformly reflecting a light beam fed from one end to the interior thereof. The linear member holder can have a bottom wall extending in the axial direction of the linear member and a pair of opposed walls extending upward from opposite sides of the bottom wall in the same direction to define a retaining space encircled thereby and the bottom wall.

In an additional aspect of the present invention, a linear member holder is provided that is used for holding a linear member arranged on a predetermined passage in an engaging groove forming the passage on an object. The linear member comprises a bottom wall extending in the axial direction of the linear member and a pair of opposed walls extending upward from opposite sides of the bottom wall in the same direction to define a

retaining space encircled thereby and the bottom wall. The linear member is held while exposing one part of an outer surface of the linear member and covering the other part thereof, by the elastic recovery force operated about the roots of the pair of opposed walls. The linear member holder can have elasticity.

The linear member holder can include a flexible inner engaging element that projects from at least one of inner surfaces in the opposed walls for preventing the linear member from coming off from the retaining space. The linear member holder can also include a flexible outer engaging element that projects outward from at least one of outer surfaces in the opposite walls for preventing the holder from coming off from the engaging groove. At least one of the flexible inner engaging element and the flexible outer engaging element can be provided parallel to the central axis of the linear member to be held.

In accordance with the present invention, it is possible to uniformly expose the outer surface of the non-fixed portion of the linear member from the opening end of the engaging groove by fixing the linear member in the engaging groove in the object, and to assuredly fix the linear member to the object without deteriorating the fine appearance of the linear member. The fixed portion of the linear member can operate to fix the linear member not to come off from the engaging groove by using the linear member holder having a size in correspondence to a gap between the linear member and the engaging groove so that a surface pressure is applied to the contact surface of the linear member/linear member holder and the contact surface of the linear member holder/engaging groove. The linear member is protected by the linear member holder and prevented from being damaged or broken due to the looseness of the linear member or others.

Also in accordance with the present invention, the absorption of vibration of the structure can be enhanced, and the linear member/linear member holder and the linear member holder/engaging groove brought into tight contact with each other in a wide area. Thus, the linear member can be well protected and prevented from being damaged or broken due to the looseness of the linear member.

Further in accordance with the present invention, with the linear member being an illuminant light fiber, the light beam of the light fiber is not disturbed and it is possible to avoid the irregularity of light as well as prevent the fine appearance of the light fiber from

damaging. With the outer surface of the light fiber, which is pure quartz or plastics, being held by the elastic linear member holder, the outer surface of the light fiber is not brought into direct contact with the inner surface of the engaging groove, whereby the damage or breakage of the light fiber can be effectively avoidable.

In accordance with the present invention, with the linear member holder having, as a one-piece member, the bottom wall extending in the axial direction of the linear member and the pair of opposed walls extending upward in the same direction from the opposite sides of the bottom wall, it is possible to continuously restrict the outer surface of the fixed portion of the linear member as a whole both in the axial and circumferential directions, whereby the light irregularity of the linear member used as an illuminant can be reduced, and also the linear member can be held in a stable manner in comparison with a case wherein the linear member is partially held and fixed.

Also in accordance with the present invention, with the linear member holder having, as a one-piece member, the bottom wall extending in the axial direction of the linear member and the pair of opposed walls extending upward from the opposite sides of the bottom wall in the same direction, it is possible to continuously restrict the outer surface of the fixed portion of the linear member as a whole both in the axial and circumferential directions, whereby the circumference of the fixed portion of the linear member can be held in a stable manner. Also, it is possible to uniformly expose the outer surface of the non-fixed portion of the linear member from the linear member holder, whereby the decorativeness of the linear member can be enhanced. If the light fiber is used as a linear member, the light irregularity can be eliminated and the light fiber can be uniformly luminous.

Further in accordance with the present invention, the vibration absorption of the linear member holder can be facilitated, and the linear member/linear member holder and the linear member holder/engaging groove respectively brought into tight contact with each other with no gap in a wide area. Thus, the protection of the linear member can be enhanced, whereby the linear member can be prevented from being damaged or broken due to the looseness thereof.

In accordance with the present invention, with the flexible inner engaging element being provided on the inner surface of one of the opposed walls while extending toward the other opposed wall, the linear member can be inserted from the open end into the

retaining space while flexing the flexible inner engaging element, after which the open end can be closed by the elastic restoration of the flexible inner engaging element to the original position thereof to prevent the linear member from unintentionally coming off from the retaining space.

Also in accordance with the present invention, with the flexible outer engaging element being provided outward on the outer surface of the opposed wall in an area to be in contact with the inner surface of the engaging groove, the linear member holder can be pushed into the engaging groove while flexing the flexible outer engaging element. Thus, the elastic recovery force of the pair of opposed walls directing in the opening direction and the elastic recovery force of the flexible outer engaging element can be simultaneously applied to the inner surface of the engaging groove, whereby the linear member holder can be prevented from coming off from the engaging groove due to the synergistic effect of both the elastic recovery forces.

Further in accordance with the present invention, if the flexible inner engaging element is disposed parallel to the central axis of the linear member to be held, it is possible to uniformly illuminate the linear member in comparison with a case wherein a plurality of engaging elements are partially arranged at a certain interval, whereby the decorativeness is further enhanced. If the flexible outer engaging element is disposed parallel to the central axis of the linear member to be held, the linear member or the linear member holder is continuously fastened by the flexible engaging elements in the axial direction, whereby it is possible to prevent the linear member or the linear member holder from coming off.

Brief Description of the Drawings

Fig. 1 is a perspective view illustrating one embodiment of a structure for fixing a linear member according to the present invention.

Fig. 2 is a sectional view of the structure for fixing a linear member shown in Fig. 1.

Fig. 3 is a perspective view illustrating a first embodiment of a linear member holder according to the present invention.

Fig. 4 is a sectional view of the linear member holder shown in Fig. 3.

Fig. 5 is a conceptual illustration of the application of a light fiber (linear member) to an automobile.

Fig. 6 is an illustration of a first modification of the light fiber; (a) is a sectional view thereof prior to being fixed, and (b) is after being fixed.

Fig. 7 is an illustration of a second modification of the light fiber; (a) is a sectional view thereof prior to being fixed, and (b) is after being fixed.

Fig. 8 is an illustration of a third modification of the light fiber; (a) is a sectional view thereof prior to being fixed, and (b) is after being fixed.

Fig. 9 is an illustration of a fourth modification of the light fiber; (a) is a sectional view thereof prior to being fixed, and (b) is after being fixed.

Detailed Description

Concrete embodiments of the present invention will be described in more detail below with reference the attached drawings. Fig. 1 illustrates one embodiment of the inventive structure for fixing a linear member. The structure for fixing the linear member of this embodiment includes a light fiber (linear member) 1, a light source (not shown) for supplying light to the light fiber 1, a fiber holder (linear member holder) 3 and a panel (object) 13 to which is fixed the light fiber 1 via the fiber holder 3. A fiber assembly 11 is constituted by the light fiber 1 and the fiber holder 3.

The light fiber 1 is an illuminant having a function for repeatedly and uniformly reflecting a light beam supplied from one end to the interior thereof and illuminating itself at a brightness controlled by the light source, and is molded with plastics to have a long size and a large diameter. Since the plastic light fiber 1 is excellent in flexibility, it has a high degree of handling freedom and is capable of bending in an optional direction. Such a light fiber 1 may be constituted, for example, by a core member of acrylic resin and a

clad member of fluorine resin. A length of the light fiber 1 is optional; i.e., a long one may be molded as a one-piece or a plurality of short fibers may be connected together while using optical connectors.

The light fiber 1 having a diameter as large as approximately 10 mm has been manufactured. At present, a thicker one can be produced. The light fiber having a large diameter is capable of absorbing the axial deviation when being connected to the other. Also, it is less in light loss at the mutual connection and an end thereof can be easily polished. Also, the handling is better than a thinner one.

In this regard, while quartz may be used as material for the light fiber 1, it is low in flexibility in comparison with plastics and difficult to have a large diameter light fiber, whereby there is a limitation in the vehicle use.

The light source not shown is means for supplying light beams from one end of the light fiber into the interior thereof to illuminate the light fiber 1 at optional brightness and color. For example, as the light source, a halogen lamp having an output of 100 W may be used.

The fiber holder 1 is molded with elastic resinous material such as polyvinyl chloride as a one-piece member. The resinous material is not limited to soft one having the elasticity but may include hard material having no elasticity such as polypropylene or polyethylene.

As shown in Fig. 2 or 4, the fiber holder includes a bottom wall 5 extending in the axial direction of the light fiber 1 and a pair of opposed walls 6, 6 extending in the same direction from both sides of the bottom wall 5 to form a continuous trough having a U-shaped cross-section and extending in the longitudinal direction thereof (see Fig. 3). The bottom wall 5 and the pair of opposed walls 6, 6 are smoothly coupled to each other so that the outer surface 2 of the light fiber 1 is brought into tight contact with the inner surface of the fiber holder 3 with no gap. An interior space encircled with the bottom wall 5 and the pair of opposed walls 6, 6 defines a holding space 10. The outer surface 2 of a non-fixed portion 2b of the light fiber 1 is exposed from an open end 9 of the fiber holder 3.

A height of the respective opposed wall 6 is defined to be equal to or lower than a diameter of the light fiber 1 so that the end of the opposed wall 6 is not higher than the light fiber 1. A wall thickness of the bottom wall 5 and the pair of opposed walls 6 is

selected while taking the elasticity and the absorption of vibration of the fiber holder 3 as well as a gap between the light fiber 1 and the engaging grove 14 of the panel 13 into account.

Inner hooks (flexible inner stoppers) 7 extending parallel to a central axis of the light fiber 1 are provided at positions opposed to each other, for preventing the light fiber 1 from unintentionally removing from the fiber holding space 10. The inner hook 7 is formed to have a thicker root and a thinner tip end so that it is flexible about the root thereof. A projected length of the inner hook 7 is optional provided the fine appearance of the light fiber 1 is not deteriorated and the fixation of the light fiber 1 is ensured. A rear surface of the inner hook 7 operates as a stopper surface 7a for the light fiber 1 and a front surface thereof operates as a slanted guide surface 7b.

When a fixed portion 2a of the light fiber 1 is attached to the fiber holder 3, the light fiber 1 is inserted from the open end 9 of the fiber holder 3 into the holding space 19 while sliding along width direction of the guide surface 7b and flexes the inner hook 7 outward about the root thereof, whereby the pair of opposed walls 6, 6 are pushed away from each other until the light fiber 1 is brought into contact with the bottom wall 5. In Fig. 2, a fixed stated of the light fiber 1 is illustrated.

After the light fiber 1 has been attached, the inner hooks 7 restore the original positions thereof and the stopper surfaces 7a become generally horizontal. The light fiber 1 is clamped by the pair of opposed walls 6, 6 due to the elasticity thereof, and is left there by the stopper surfaces 7a, not to come off from the fiber holder 3. Also, since the light fiber 1 and the inner hooks 7 are brought into linear contact with each other over a whole length in the longitudinal direction, and the light fiber 1 is brought into area contact with the pair of opposed walls 6, 6 and the bottom wall 5 over a whole length in the longitudinal direction, the light fiber 1 is improved in absorption of vibration, whereby the jolt is avoidable. In such a manner, a fiber assembly 11 in which part of the outer surface 2 of the light fiber 1 is exposed is formed as an intermediate product prior to being fixed in the engaging groove 14 of the panel 13.

An outer hook (flexible outer stopper) 8 is provided parallel to the central axis of the light fiber 1 on the outer surface 6b on a root side of the respective opposed wall 6 for preventing the fiber holder 3 from coming off from the engaging groove 14 of the panel 13. Since the outer hook 8 is continuously formed in the longitudinal direction of the fiber

holder 3 over a whole length thereof, the outer hook 8 is brought into linear contact with an inner surface 14a of the engaging groove 14 in the panel 13 to enhance the fixing force.

The outer hook 8 is formed to incline slightly upward (reverse to the inserting direction) from the root to the tip end thereof. Also, a partially thin portion is provided on the root side of the outer hook 8 to facilitate the outward bending (in the opening direction). The tip end of the outer hook 8 is rounded to increase a contact area thereof with the inner surface 14a of the engaging groove 14. Thereby, when a force is applied to the fiber holder 3 in the direction for causing the fiber holder to come off from engaging groove of the panel 13, the outer hook 8 deforms in the direction for increasing a frictional force between the tip end of the outer hook 8 and the inner surface 14a of the engaging groove 14. Accordingly, it is possible to assuredly prevent the fiber holder 3 from unintentionally coming off from the engaging groove 14.

The panel 13 to which is fixed the light fiber 1 is mainly an instrument panel 15 or a door panel 16 as shown in Fig. 5 if it is applied to an automobile, or a panel board attached to an inner wall or an outer wall if it is applied to a building. As described above, since the light fiber 1 is flexible to be usable while bending in an optional direction, the panel 13 on which the light fiber 1 is fixed is not limited to a flat one but may include a three-dimensionally curved one.

The panel 13 may be molded with resinous material such as polypropylene (PP) or polyethylene (PE). On a surface of the panel 13, the engaging groove 14 is recessed to form a predetermined arrangement passage for the light fiber 1. The cross-sectional shape of the engaging groove 14 is determined in accordance with the relationship thereof with the fiber holder 3, and in this embodiment, a U-shape is selected (see Fig. 2). While the light fiber 1 may be slightly exposed from the engaging groove 14, a depth of the groove in this embodiment is determined so that the light fiber 1 is never exposed therefrom. A width of the groove is determined in accordance with the relationship of a diameter of the light fiber 1 and a thickness of the fiber holder. That is, the dimension is determined so that when the fiber assembly 11 is fixed to the engaging groove 14, the fiber assembly 11 is brought into contact with the engaging groove 14 and the light fiber 1 is clamped by the fiber holder 3.

When the light fiber 1 is attached to the panel 13 via the fiber holder 13 while exposing the outer surface 2 of the non-fixed portion 2b outside, the elastic force caused

by the elastic restoration of the pair of opposed walls 6, 6 flexed inward upon the attachment operates on the contact surface between the inner surface 14a of the engaging groove 14 and the outer surface 6b of the fiber holder 3, whereby the fiber holder 3 or the fiber assembly 11 is fixed to the engaging groove 14.

An example wherein the light fiber 1 is applied to an automobile is illustrated in Fig. 5. The light fiber 1 is attached to the instrument panel 15, a door panel 15 and a console box 17 in a car compartment. Although not shown, the light fiber 1 may be used as a courtesy lamp, a map lamp, room lamp or an exterior part.

As described above, according to the linear member fixing structure in this embodiment, since the light fiber 1 is fixed to the panel 13 via the fiber holder 3, the outer surface 2 which is the non-fixed portion of the light fiber 1 is uniformly exposed from an open end of the engaging groove 14, it is possible to prevent the illumination light from being irregular and the fine appearance of the light fiber 1 from being disturbed. Since the light fiber 1 is not bulged out from the panel 13, it is possible to avoid the interference of the light fiber 1 and other parts. By using the elastic fiber holder 3, the fiber 1 can be fixed without looseness, whereby the damage or breakage of the light fiber 1 is avoidable.

Since the fiber holder 3 in this embodiment has a trough-like cross-section and extends in the longitudinal direction, the outer surface 2 of the fixed portion 2a in the light fiber 1 is continuously bound as a whole both in the axial and circumferential directions, and the outer surface 1 of the non-fixed portion 2b in the light fiber 1 is uniformly exposed from the fiber holder 3. Since the inner hooks 7 and the outer hooks 8 are provided, respectively, on the inner surface 6a and the outer surface 6b of the pair of opposed walls 6, 6, it is possible to assuredly avoid the coming-off of the light fiber from the fiber holder 3, and to avoid the coming-off of the fiber holder 3 from the engaging groove 14 of the panel 13.

Also, according to the method for fixing the light fiber 1 by using the fiber holder 3, since the light fiber 1 can be fixed to the panel 13 while protecting a pure hard surface of the light fiber by the fiber holder 3, the damage or breakage of the light fiber 1 during the attachment is avoidable to facilitate the attachment or the maintenance.

Next, Figs. 6 to 9 illustrate various modifications, respectively, of this embodiment included in the concept of the present invention. In Fig. 6, a modification wherein the light fiber 1 is held by using a fiber holder 3A having no inner hooks 7. Each of the pair

of opposed walls 6, 6 is formed so that a tip end thereof is thicker than a root thereof, and a distance between both the opposed walls is narrower in the tip end area than in the root area. When the light fiber 1 is fixed to the panel 13, the light panel 1 is applied with the elastic force from the pair of opposed walls 6, 6, not to come-off from the panel. Other structures are the same as in the embodiment shown in Figs. 1 to 4.

In Fig. 7, another modification is illustrated, wherein the light fiber 1 is held by using a fiber holder 3B having no outer hooks 8. Each of the pair of opposed walls 6, 6 is formed so that the root thereof is thicker than the tip end thereof to form a bulge 18. There is a corner groove 19 to be engaged with the bulge 18 at the respective corner of the engaging groove 14 in the panel 13. When the light fiber 1 is fixed to the panel 13, the bulge 18 of the fiber holder 1 is tightly engaged with the corner groove 19 to prevent the fiber holder 3B from coming off from the engaging groove 14. Other structures are the same as in the embodiment shown in Figs. 1 to 4.

In Fig. 8, a further modification is illustrated, wherein the light fiber 1 is held by using a fiber holder 3C having none of inner hooks 7 and outer hooks 8. This modification is a combination of the modifications shown in Figs. 6 and 7. Other structures are the same as in the embodiment shown in Figs. 1 to 4.

In Fig. 9, a furthermore modification is illustrated, wherein the light fiber 1 is held by using a fiber holder 3D having, instead of the outer hooks 8, a male type engaging rib 20 extending on the bottom surface 5 in the axial direction. A tip end of the engaging rib 20 is partially thicker than the root thereof. A female groove 21 engageable with the engaging rib 20 is provided in the engaging groove 14 of the panel 13. When the light fiber 1 is fixed to the panel 13, the engaging rib 20 is engaged with the groove 21 to prevent the fiber holder 3D from coming off from the engaging groove 14. Other structures are the same as in the embodiment shown in Figs. 1 to 4.

The present invention is not limited to the above-mentioned embodiment and modifications, but can be executed in other forms. For example, while the light fiber 1 is used as a linear member in this embodiment, the present invention is applicable to a colored electric wire (an optical communications cable, a coaxial cable, a power cable) covered with an insulation coating around a core. Also, the light fiber 1 fixed to the panel 13 is not limited to one but a plurality of light fibers may be used.

Also, while the inner hook 7 for preventing the light fiber 1 from coming off from

the fiber holder 3 and the outer hook 8 for preventing the fiber holder 3 from coming off from the engaging groove 14 of the panel 13 are provided in the pair of opposed walls 6, 6, they may be selectively provided in either of the pair of opposed walls 6.

What is claimed is:

1. A method for fixing a linear member arranged on a predetermined passage to an engaging groove defining the passage on an object, said method comprising

holding a fixed portion of the linear member to be held in the engaging groove by a long linear member holder,

pushing the linear member holder in which the linear member is held into the engaging groove so that an outer surface of a non-fixed portion of the linear member is exposed outside, and

fixing the linear member to the engaging groove via the linear member holder by a surface pressure applied to a contact surface of an inner surface of the engaging groove with an outer surface of the linear member holder.

2. A method for fixing a linear member as defined by claim 1, wherein the linear member holder is elastic.

3. A structure for fixing a linear member, comprising

a linear member arranged on a predetermined passage,

a long-sized linear member holder for holding said linear member while exposing one part of an outer surface of said linear member and covering the other part thereof, and

an object having an engaging groove of a cross-sectional shape corresponding to that of said linear member holder, defining said predetermined passage for arranging said linear member,

wherein said linear member is fixed to said engaging groove via said linear member holder while exposing an outer surface of a non-fixed portion of said linear member outside.

4. A structure for fixing a linear member as defined by claim 3, wherein said linear member holder is elastic.

5. A structure for fixing a linear member as defined by claim 3 or 4, wherein said linear member is a light fiber for uniformly reflecting a light beam fed from one end to the interior thereof.

6. A structure for fixing a linear member as defined by any one of claims 3 to 5, wherein said linear member holder has a bottom wall extending in the axial direction of said linear member and a pair of opposed walls extending upward from opposite sides of said bottom wall in the same direction to define a retaining space encircled thereby and said bottom wall.

7. A linear member holder used for holding a linear member arranged on a predetermined passage in an engaging groove forming said passage on an object, comprising a bottom wall extending in the axial direction of said linear member and a pair of opposed walls extending upward from opposite sides of said bottom wall in the same direction to define a retaining space encircled thereby and said bottom wall, wherein said linear member is held while exposing one part of an outer surface of said linear member and covering the other part thereof, by the elastic recovery force operated about the roots of said pair of opposed walls.

8. A linear member holder as defined by claim 7, having the elasticity.

9. A linear member holder as defined by claim 7 or 8, wherein a flexible inner engaging element is projected from at least one of inner surfaces in said opposed walls for preventing said linear member from coming off from said retaining space.

10. A linear member holder as defined by any one of claims 7 to 9, wherein a flexible outer engaging element is projected outward from at least one of outer surfaces in said opposite walls for preventing said holder from coming off from said engaging groove.

11. A linear member holder as defined by any one of claims 7 to 10, wherein at least one of said flexible inner engaging element and said flexible outer engaging element is provided parallel to the central axis of said linear member to be held.

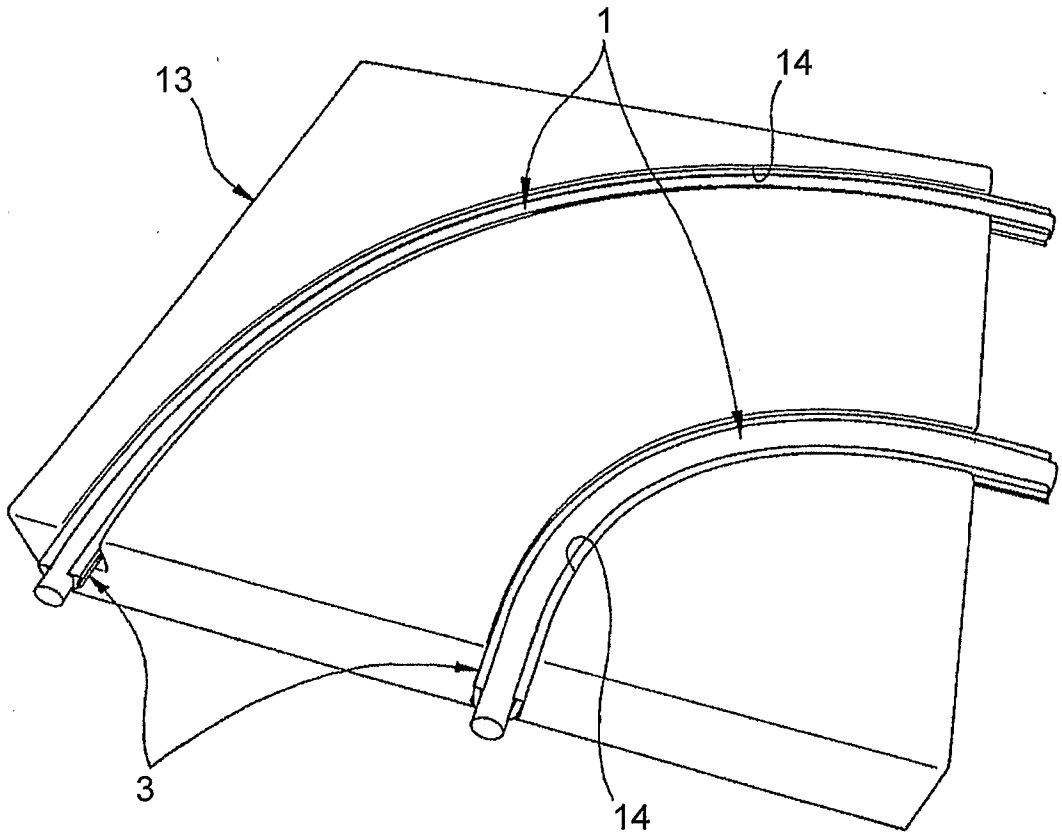


FIG. 1

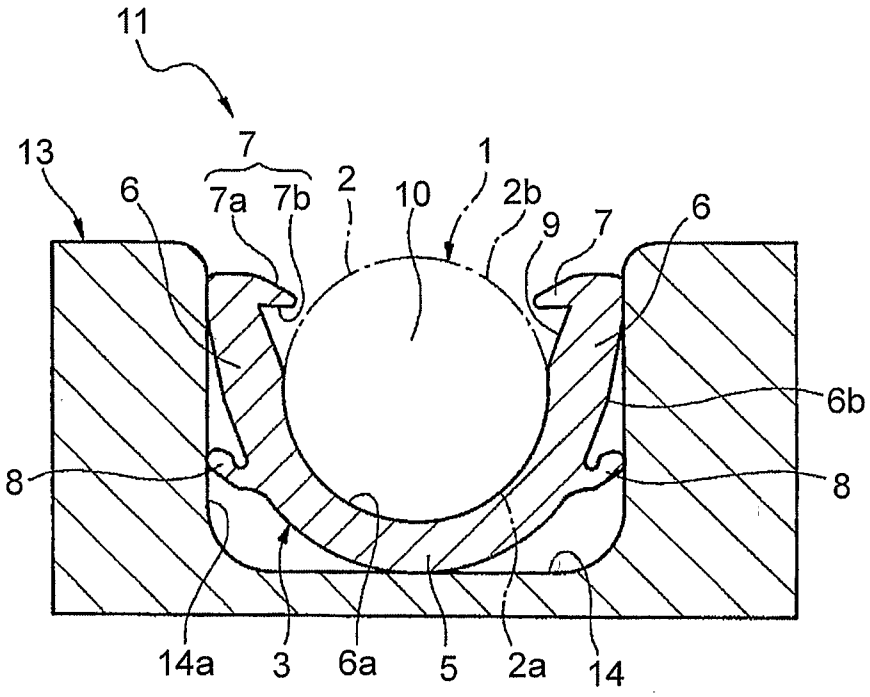

11
7
13
6
7a
7b
2
10
1
2b
9
7
6
6b
8
8
14a
3
6a
5
2a
14

FIG. 2

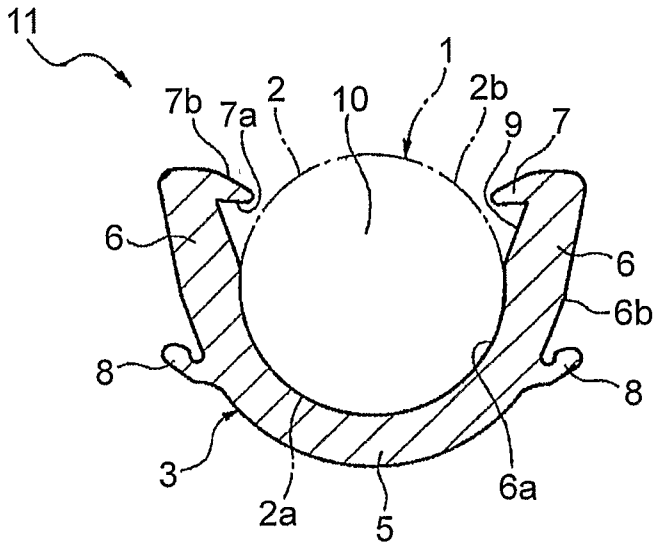

11
7b
7a
2
10
1
2b
9
7
6
6
6b
8
8
3
2a
5
6a

FIG. 3

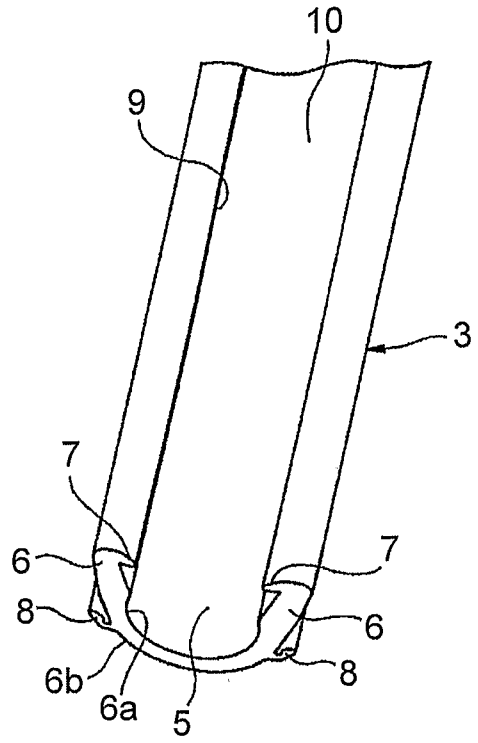


FIG. 4

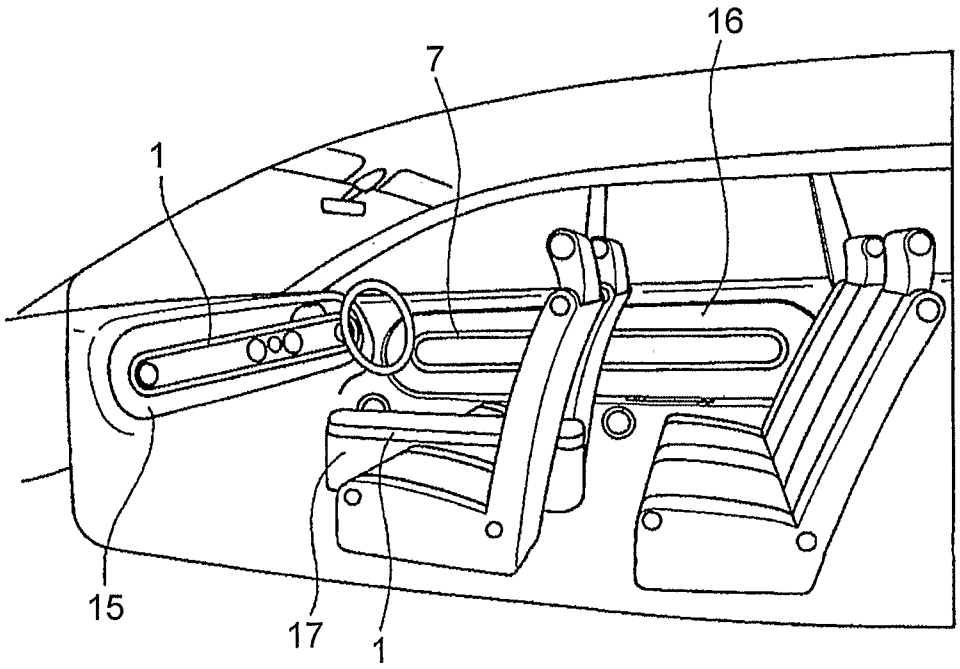


FIG. 5

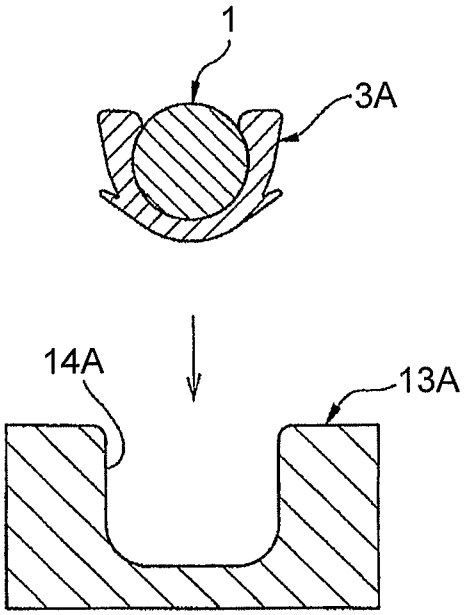


FIG. 6a

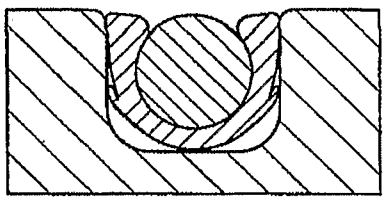


FIG. 6b

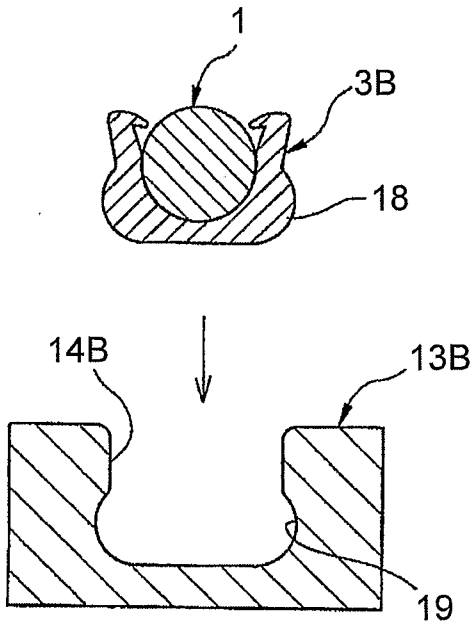


FIG. 7a

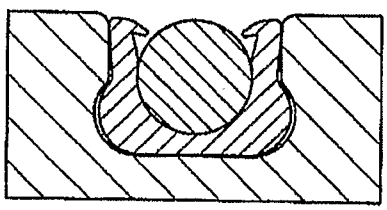


FIG. 7b

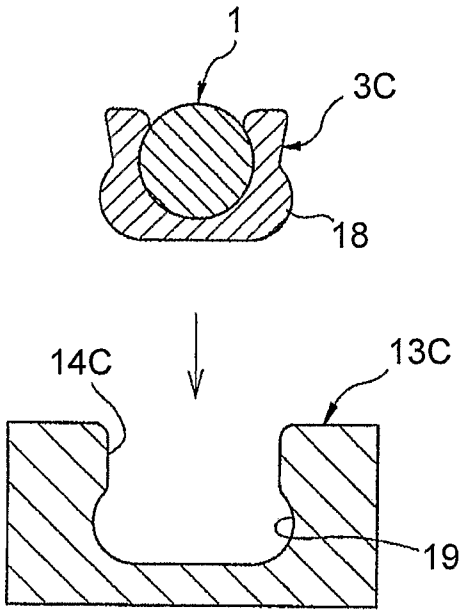


FIG. 8a

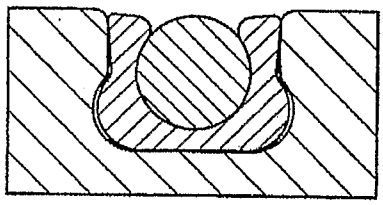


FIG. 8b

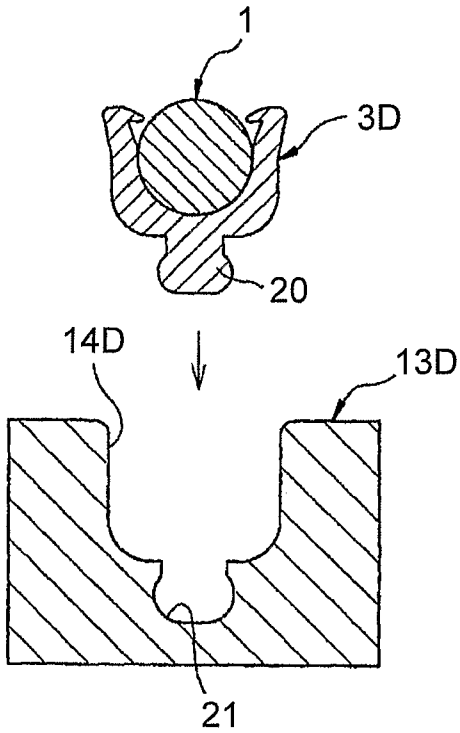


FIG. 9a

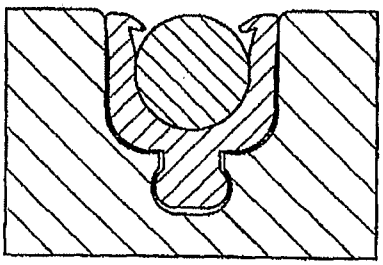


FIG. 9b

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/039716

A. CLASSIFICATION OF SUBJECT MATTER
INV. G02B6/00 B60Q3/04 F21S8/12

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)
G02B B60Q F21S

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 742 916 B1 (DUNN CHARLES B [US]) 1 June 2004 (2004-06-01) column 6, line 8 - line 61; figures 1-3 claims 1,15 column 8, line 66 - column 9, line 10	1-11
P,X	FR 2 876 174 A (GRANGER LIONEL [FR]) 7 April 2006 (2006-04-07)	1,3,5,6
P,A	page 4, line 1 - line 27; figures 6,7	7,11
A	WO 2004/078518 A (INTIER AUTOMOTIVE INC [US]; BECKLEY DANIEL VERN [US]) 16 September 2004 (2004-09-16) abstract; figures 2,3	1,3,5,7
A	US 6 523 986 B1 (HOFFMANN FRIEDEMAN [ES]) 25 February 2003 (2003-02-25) claim 1; figures 1,2	1,3,5,7

☐ Further documents are listed in the continuation of Box C.

☒ 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
5 February 2007	01/03/2007

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, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Bousquet, Karl

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2006/039716

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6742916 B1	01-06-2004	NONE	
FR 2876174 A	07-04-2006	NONE	
WO 2004078518 A	16-09-2004	NONE	
US 6523986 B1	25-02-2003	WO 0055541 A1 ES 1042498 U1	21-09-2000 01-09-1999