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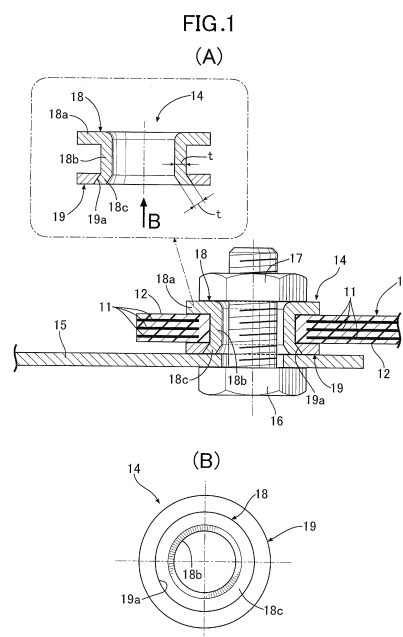
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(54) **FRP PLATE FASTENING STRUCTURE**

(57) Since a metal grommet (14) includes a grommet main body (18) and a washer (19), the grommet main body (18) includes a washer portion (18a) abutting against one surface of a FRP plate (13) and a collar portion (18b) formed integrally with the washer portion (18a) and fitted into a through hole (13a) of the FRP plate (13), and the washer (19) is latched onto an extremity of the collar portion (18b) and abuts against the other surface of the FRP plate (13), it is unnecessary to integrally mold the washer (19) by stretching the collar portion (18b) of the grommet main body (18), the thickness of the collar portion (18b) can be maintained by an amount corresponding thereto, thus enhancing the strength, and while preventing the thickness of the portion corresponding to the washer (19) from decreasing, a crack from occurring, and the strength from deteriorating, the area around the through hole (13a) of the FRP plate is sandwiched between the washer portion (18a) of the grommet main body (18) and the washer (19), which is a separate member, and it is thus possible to suppress the progress of detachment of fibers of the FRP plate (13) and enhance the durability.



Description

TECHNICAL FIELD

[0001] The present invention relates to a securing structure for an FRP plate in which a metal grommet is fixed to an FRP plate and the FRP plate is secured to a secured member by screwing a nut onto a bolt extending through the metal grommet and the secured member.

BACKGROUND ART

[0002] An arrangement in which, at the same time as producing a metal grommet having a pair of washer portions connected to opposite ends of a collar portion, in order to mount the metal grommet on an FRP plate, a metal plate and the FRP plate are bored using a rotating tool having a sharp extremity in a state in which the metal plate is superimposed on one surface of the FRP plate, part of the metal plate is thereby deformed into a collar shape and made to project from the other surface of the FRP plate, and subsequently the projecting portion is press formed into a flat washer shape is known from Patent Document 1 below.

RELATED ART DOCUMENTS

PATENT DOCUMENTS

[0003] Patent Document 1: German Patent No. 10 2009 013 265 B4

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] However, in the above arrangement, part of the metal plate that has been deformed into a collar shape with the rotating tool becomes thin, and when the projecting portion at the extremity of the thin portion is press formed into a washer shape, the thickness further decreases, a crack occurs, the tightening force of a bolt extending through the metal grommet cannot be supported by the collar portion and the washer portion, which are thin, deformation occurs, and there is a possibility that this will cause damage to the FRP plate.

[0005] The present invention has been accomplished in light of the above circumstances, and it is an object thereof to provide a metal grommet that can easily be produced and can strongly fix an FRP plate.

MEANS FOR SOLVING THE PROBLEMS

[0006] In order to attain the above object, according to a first aspect of the present invention, there is provided a securing structure for an FRP plate in which a metal grommet is fixed to an FRP plate, and the FRP plate is secured to a secured member by screwing a nut onto a

bolt extending through the metal grommet and the secured member, wherein the metal grommet comprises a grommet main body and a washer, the grommet main body comprises a washer portion that abuts against one surface of the FRP plate and a collar portion that is formed integrally with the washer portion and is fitted into a through hole of the FRP plate, and the washer is latched onto an extremity of the collar portion and abuts against the other surface of the FRP plate.

[0007] Further, according to a second aspect of the present invention, in addition to the first aspect, the washer is latched by means of a swaged portion formed by swaging the extremity of the collar portion.

[0008] Furthermore, according to a third aspect of the present invention, in addition to the second aspect, a thickness of the swaged portion is substantially the same as a thickness of the collar portion.

[0009] Moreover, according to a fourth aspect of the present invention, in addition to the second or third aspect, a taper portion is formed in advance on an inner periphery of the washer, the taper portion increasing in diameter in a direction going away from the grommet main body.

[0010] Further, according to a fifth aspect of the present invention, in addition to any one of the second to fourth aspects, a swaging tool for swaging the collar portion comprises a flat portion that abuts against the washer and a taper portion that protrudes from the flat portion so as to be tapered and fits within the collar portion.

[0011] Furthermore, according to a sixth aspect of the present invention, in addition to any one of the first to fifth aspects, the grommet main body is formed by extending a rotating tool having a sharp extremity through a metal plate and the FRP plate in a state in which the metal plate is superimposed on one surface of the FRP plate.

[0012] Moreover, according to a seventh aspect of the present invention, in addition to the sixth aspect, a pilot hole is formed in advance in the metal plate, and the extremity of the rotating tool is pressed against the center of the pilot hole and extended therethrough.

[0013] Further, according to an eighth aspect of the present invention, in addition to the sixth or seventh aspect, an excess portion that protrudes from the extremity of the collar portion due to the rotating tool being extended therethrough is cut off prior to a swaging step.

[0014] Furthermore, according to a ninth aspect of the present invention, in addition to any one of the first to eighth aspects, the washer portion and the washer have an annular form.

[0015] Moreover, according to a tenth aspect of the present invention, in addition to any one of the first to ninth aspects, the FRP plate is an automobile part made of FRP, and the secured member is an automobile frame made of metal.

EFFECTS OF THE INVENTION

[0016] In accordance with the first aspect of the present invention, the metal grommet is fixed to the FRP plate, and the FRP plate is secured to the secured member by screwing the nut onto the bolt extending through the metal grommet and the secured member. Since the metal grommet includes the grommet main body and the washer, the grommet main body includes the washer portion abutting against one surface of the FRP plate and the collar portion formed integrally with the washer portion and fitted into the through hole of the FRP plate, and the washer is latched onto the extremity of the collar portion and abuts against the other surface of the FRP plate, it is unnecessary to integrally mold the washer by stretching the collar portion of the grommet main body, the thickness of the collar portion can be maintained by an amount corresponding thereto, thus enhancing the strength, and it is possible to prevent the thickness of the portion corresponding to the washer from decreasing, a crack from occurring, and the strength from deteriorating. Moreover, the area around the through hole of the FRP plate is sandwiched between the washer portion of the grommet main body and the washer, which is a separate member, and it is thus possible to suppress the progress of detachment of fibers of the FRP plate and enhance the durability.

[0017] Furthermore, in accordance with the second aspect of the present invention, since the washer is latched by means of the swaged portion formed by swaging the extremity of the collar portion, it is possible to strongly integrate, by means of a simple structure, the grommet main body and the washer, which are formed from separate members.

[0018] Moreover, in accordance with the third aspect of the present invention, since the thickness of the swaged portion is substantially the same as the thickness of the collar portion, it is possible to ensure the strength of the swaged portion and support the tightening force of the bolt.

[0019] Furthermore, in accordance with the fourth aspect of the present invention, since the taper portion, which increases in diameter in a direction going away from the grommet main body, is formed in advance on the inner periphery of the washer, it is possible to enhance the strength of the swaged portion joining the extremity of the collar portion of the grommet main body and the washer.

[0020] Moreover, in accordance with the fifth aspect of the present invention, since the swaging tool for swaging the collar portion includes the flat portion abutting against the washer and the taper portion protruding from the flat portion so as to be tapered and fitting within the collar portion, not only is it possible to swage effectively the extremity of the collar portion by means of the taper portion, but it is also possible to finish the latching part between the washer and the collar portion so that it is flat by means of the flat portion, thus enhancing the precision

of machining.

[0021] Furthermore, in accordance with the sixth aspect of the present invention, since the grommet main body is formed by extending the rotating tool having a sharp extremity through the metal plate and the FRP plate in a state in which the metal plate is superimposed on one surface of the FRP plate, not only is it possible to simply produce the grommet main body integrally including the washer portion and the collar portion from the metal plate, but it is also possible to machine the through hole of the FRP plate at the same time, and moreover it is not necessary to employ a step of assembling the grommet main body to the FRP plate.

[0022] Moreover, in accordance with the seventh aspect of the present invention, since the pilot hole is formed in advance in the metal plate, and the tip of the rotating tool is pressed against the center of the pilot hole and extended therethrough, it is possible to prevent excessive stress from acting on the metal plate, which causes cracks, thereby enabling the grommet main body to be machined with good precision.

[0023] Furthermore, in accordance with the eighth aspect of the present invention, since the excess portion protruding from the extremity of the collar portion due to the rotating tool being extended therethrough is cut off prior to the swaging step, it is possible to finish the swaged portion, via which the washer and the collar portion latch, with good precision.

[0024] Moreover, in accordance with the ninth aspect of the present invention, since the washer portion and the washer have an annular form, it is possible to evenly disperse the tightening force of the bolt throughout the FRP plate.

[0025] Furthermore, in accordance with the tenth aspect of the present invention, since the FRP plate is an automobile part made of an FRP, and the secured member is an automobile frame made of metal, it is possible to strongly secure the part made of an FRP to the frame made of metal while lightening the weight by replacing a conventional metal part with an FRP part.

BRIEF DESCRIPTION OF DRAWINGS

[0026]

[FIG. 1] FIG. 1 is a diagram showing a state in which an FRP plate having a metal grommet fitted therein is secured to a secured member. (first embodiment)

[FIG. 2] FIG. 2 is a diagram for explaining a step of boring a metal plate and an FRP plate. (first embodiment)

[FIG. 3] FIG. 3 is a diagram for explaining a step of cutting off the metal grommet. (first embodiment)

[FIG. 4] FIG. 4 is a diagram for explaining a step of swaging the metal grommet. (first embodiment)

[FIG. 5] FIG. 5 is a diagram showing an example in which the present invention is applied to an automobile vehicle body. (first embodiment)

[FIG. 6] FIG. 6 is a sectional view along line 6-6 in FIG. 5. (first embodiment)

EXPLANATION OF REFERENCE NUMERALS AND SYMBOLS

[0027]

13	FRP plate
13a	Through hole
14	Metal grommet
15	Secured member
16	Bolt
17	Nut
18	Grommet main body
18a	Washer portion
18b	Collar portion
18c	Swaged portion
18e	Excess portion
19	Washer
19a	Taper portion
20	Metal plate
20a	Pilot hole
21	Rotating tool
23	Swaging tool
23a	Flat portion
23b	Taper portion

BEST MODE FOR CARRYING OUT THE INVENTION

[0028] An embodiment of the present invention is explained below by reference to FIG. 1 to FIG. 6.

FIRST EMBODIMENT

[0029] As shown in FIG. 1, a metal grommet 14 made of iron or an aluminum alloy is fitted into an FRP (fiber-reinforced plastic) plate 13 formed by solidifying continuous fibers 11 formed from carbon fibers or glass fibers aligned in one direction using a matrix resin 12, and by screwing a nut 17 onto a bolt 16 extending through a secured member 15 such as a steel plate, for example, and the metal grommet 14, the FRP plate 13 is secured to the metal plate 15.

[0030] The metal grommet 14 is formed by joining two members, that is, a grommet main body 18 and a washer 19; the grommet main body 18 includes a collar portion 18b extending cylindrically from the center of an annular washer portion 18a, and in a state in which the washer portion 18a abuts against one surface of the FRP plate 13 the collar portion 18b extends through a circular through hole 13a of the FRP plate 13 and the extremity thereof projects from the other surface of the FRP plate 13. The washer 19 is an annular member having substantially the same shape as that of the washer portion 18a of the grommet main body 18, and a taper portion 19a that increases in diameter in a direction going away from the grommet main body 18 is formed on the inner

periphery of the washer 19. The washer 19 is fitted onto the extremity of the collar portion 18b of the grommet main body 18 in a state in which it abuts against the other surface of the FRP plate 13, and is integrally joined by means of a swaged portion 18c.

[0031] A method for producing the metal grommet 14 is now explained by reference to FIG. 2 to FIG. 4.

[0032] As shown in FIG. 2 (A), a disk-shaped metal plate 20, which is a material for the grommet main body 18, is superimposed on one surface of the FRP plate 13. In this process, a circular pilot hole 20a is concentrically formed in advance in the metal plate 20. Subsequently, when a rotating tool 21 having a conical sharp extremity is inserted into the center of the pilot hole 20a while rotating, as shown in FIG. 2 (B) the metal plate 20 around the pilot hole 20a is bored and pushed and widened in a cylindrical shape to thus form the collar portion 18b, and the washer portion 18a is formed in the remaining portion of the metal plate 20. At the same time as this, the FRP plate 13 that has been bored by means of the rotating tool 21 is pushed and widened by means of the collar portion 18b, and the through hole 13a into which the collar portion 18b is fitted is thus formed. A thin excess portion 18e projects from the extremity of the collar portion 18b extending through the FRP plate 13.

[0033] When the metal plate 20 and the FRP plate 13 are subjected to boring with the rotating tool 21, the matrix resin of the FRP plate 13 is softened by the frictional heat generated, and the continuous fibers 11 aligned in one direction move so as to bypass the outer periphery of the grommet main body 18, thus enabling the through hole 13a to be formed in the FRP plate 13 without degrading the strength by breaking the continuous fibers 11 (see FIG. 2 (B)).

[0034] Subsequently, as shown in FIG. 3 (A), after the thin excess portion 18e projecting from the extremity of the collar portion 18b extending through the FRP plate 13 is cut off, as shown in FIG. 3 (B), the washer 19, which is a separate member, is fitted onto the extremity of the collar portion 18b of the grommet main body 18.

[0035] Subsequently, as shown in FIG. 4 (A), in a state in which the washer portion 18a of the grommet main body 18 is supported on a receiving member 22, the extremity of the collar portion 18b is swaged by means of a swaging tool 23. Formed on the extremity of the swaging tool 23 are a flat portion 23a and a frustoconical taper portion 23b projecting from the flat portion 23a; the flat portion 23a abuts against the washer 19, and the taper portion 23b abuts against and swages the extremity of the collar portion 18b of the grommet main body 18, thus forming the swaged portion 18c, which is plastically deformed, on the radially outer side of the extremity of the collar portion 18b, and thereby integrally joining the washer 19 to the grommet main body 18. In a state in which swaging is completed, a thickness t of the collar portion 18b of the grommet main body 18 coincides substantially with a thickness t of the swaged portion 18c (see FIG. 1).

[0036] The operation of the embodiment of the present invention having the above arrangement is now explained.

[0037] When the FRP plate 13 is secured to the secured member 15 by means of the bolt 16 and the nut 17, since the metal grommet 14 mounted on the FRP plate 13 and having the bolt 16 extending therethrough is formed from the grommet main body 18 and the washer 19, the grommet main body 18 is formed from the washer portion 18a abutting against one surface of the FRP plate 13 and the collar portion 18b formed integrally with the washer portion 18a and fitted into the through hole 13b of the FRP plate 13, and the washer 19 is latched onto the extremity of the collar portion 18b and abuts against the other surface of the FRP plate 13, the area around the through hole 13a of the FRP plate 13 is sandwiched between the washer portion 18a of the grommet main body 18 and the washer 19, which is a separate member, thereby suppressing the progress of detachment of the continuous fibers 11 of the FRP plate 13 and enhancing the durability. In this process, since the washer portion 18a of the grommet main body 18 and the washer 19 have an annular shape, it is possible to disperse the tightening force of the bolt 16 evenly throughout the FRP plate 13.

[0038] Moreover, since the grommet main body 18 and the washer 19 are formed from separate members, when the grommet main body 18 is shaped by means of the rotating tool 21, it is not necessary to stretch the collar portion 18b and mold the washer 19 as a unit, and not only is it possible to enhance the strength by ensuring the thickness of the collar portion 18b by an amount corresponding thereto, but it is also possible to prevent cracks from occurring and the strength from deteriorating due to the thickness of the portion corresponding to the washer 19 becoming small.

[0039] Furthermore, since the washer 19 is latched onto the extremity of the collar portion 18b by swaging, it is possible to strongly integrate the grommet main body 18 and the washer 19, which are formed from separate members, with a simple structure. Moreover, since the thickness t of the swaged extremity of the collar portion 18b is substantially equal to the thickness t of the washer 19 (see FIG. 1), the strength of the swaged portion 18c is ensured, and the tightening force of the bolt 16 can be supported. In this process, since the taper portion 19a, which increases in diameter in a direction going away from the grommet main body 18, is formed in advance on the inner periphery of the washer 19, it is possible to enhance the strength of the swaged portion 18c joining the extremity of the collar portion 18b and the washer 19.

[0040] Moreover, since the swaging tool 23 for swaging the extremity of the collar portion 18b includes the flat portion 23a abutting against the washer 19 and the taper portion 23b protruding from the flat portion 23a so as to be tapered and fitting within the collar portion 18b, not only is it possible to swage effectively the extremity of the collar portion 18b by means of the taper portion 23b,

but it is also possible to finish the swaged portion 18c between the washer 19 and the collar portion 18b so that it is flat by means of the flat portion 23a, thus enhancing the precision of machining.

[0041] Furthermore, since in the step of producing the metal grommet 14, the grommet main body 18 is formed by extending the rotating tool 21 having a sharp extremity through the metal plate 20 and the FRP plate 13 in a state in which the metal plate 20 is superimposed on one surface of the FRP plate 13, not only is it possible to simply produce from the metal plate 20 the grommet main body 18 integrally having the washer portion 18a and the collar portion 18b, but it is also possible to machine the through hole 13a of the FRP plate 13 at the same time and, moreover, it is unnecessary to employ a step of assembling the grommet main body 18 to the FRP plate 13.

[0042] In this process, since the pilot hole 20a is formed in advance in the metal plate 20, and the extremity of the rotating tool 21 is pressed against and extended through the center of the pilot hole 20a, it is possible to prevent excessive stress from acting on the metal plate 20 to thus cause cracks, and the grommet main body 18 can be machined with good precision. Furthermore, since the excess portion 18e (see FIG. 3 (A)), which is made to protrude from the extremity of the collar portion 18b by extending the rotating tool 21 therethrough, is cut off before the swaging step, it is possible to finish the latching portion 18c by swaging the washer 19 and the collar portion 18b with good precision.

[0043] FIG. 5 and FIG. 6 show an example in which the present invention is applied to an automobile vehicle body.

[0044] The secured member 15 formed from a flat metal plate is welded to front ends of a pair of left and right front side frames 24 disposed in the fore-and-aft direction in a front part of the vehicle body in order to support an engine or a transmission, and the front end of a lower member 25 extending downward to the front from a front pillar upper, which is not illustrated, is welded on the outside in the vehicle width direction of the secured member 15. An FRP bumper beam extension 26 connecting an end part in the vehicle width direction of a bumper beam, which is not illustrated, and the secured member 15 includes front side flanges 26a and 26a connected to the bumper beam and rear side flanges 26b and 26b connected to the secured member 15. The rear side flanges 26b and 26b correspond to the FRP plate 13 of the present invention, and six metal grommets 14 fitted thereinto are secured to the secured member 15 by means of the bolts 16 and the nuts 17.

[0045] As described above, since the FRP plate 13 forming part of the FRP automobile bumper beam extension 26 is secured to the secured member 15 forming part of the automobile metal frame via the metal grommets 14, it is possible to strongly secure the FRP part to the metal frame while achieving a light weight by replacing a conventional metal part with an FRP part.

[0046] An embodiment of the present invention is ex-

plained above, but the present invention may be modified in a variety of ways as long as the modifications do not depart from the spirit and scope thereof.

[0047] For example, it is not always necessary to employ the pilot hole 20a of the metal plate 20, and a metal plate 20 having no pilot hole 20a may be bored directly.

[0048] Furthermore, if the excess portion 18e formed when molding the grommet main body 18 by means of the rotating tool 21 is small, it is not always necessary to cut off the excess portion 18e.

Claims

1. A securing structure for an FRP plate in which a metal grommet (14) is fixed to an FRP plate (13), and the FRP plate (13) is secured to a secured member (15) by screwing a nut (17) onto a bolt (16) extending through the metal grommet (14) and the secured member (15), wherein the metal grommet (14) comprises a grommet main body (18) and a washer (19), the grommet main body (18) comprises a washer portion (18a) that abuts against one surface of the FRP plate (13) and a collar portion (18b) that is formed integrally with the washer portion (18a) and is fitted into a through hole (13a) of the FRP plate (13), and the washer (19) is latched onto an extremity of the collar portion (18b) and abuts against the other surface of the FRP plate (13).
2. The securing structure for an FRP plate according to Claim 1, wherein the washer (19) is latched by means of a swaged portion (18c) formed by swaging the extremity of the collar portion (18b).
3. The securing structure for an FRP plate according to Claim 2, wherein a thickness of the swaged portion (18c) is substantially the same as a thickness of the collar portion (18b).
4. The securing structure for an FRP plate according to Claim 2 or Claim 3, wherein a taper portion (19a) is formed in advance on an inner periphery of the washer (19), the taper portion (19a) increasing in diameter in a direction going away from the grommet main body (18).
5. The securing structure for an FRP plate according to any one of Claim 2 to Claim 4, wherein a swaging tool (23) for swaging the collar portion (18b) comprises a flat portion (23 a) that abuts against the washer (19) and a taper portion (23b) that protrudes from the flat portion (23 a) so as to be tapered and fits within the collar portion (18b).
6. The securing structure for an FRP plate according to any one of Claim 1 to Claim 5, wherein the grommet main body (18) is formed by extending a rotating

tool (21) having a sharp extremity through a metal plate (20) and the FRP plate (13) in a state in which the metal plate (20) is superimposed on one surface of the FRP plate (13).

7. The securing structure for an FRP plate according to Claim 6, wherein a pilot hole (20a) is formed in advance in the metal plate (20), and the extremity of the rotating tool (21) is pressed against the center of the pilot hole (20a) and extended therethrough.
8. The securing structure for an FRP plate according to Claim 6 or Claim 7, wherein an excess portion (18e) that protrudes from the extremity of the collar portion (18b) due to the rotating tool (21) being extended therethrough is cut off prior to a swaging step.
9. The securing structure for an FRP plate according to any one of Claim 1 to Claim 8, wherein the washer portion (18a) and the washer (19) have an annular form.
10. The securing structure for an FRP plate according to any one of Claim 1 to Claim 9, wherein the FRP plate (13) is an automobile part made of FRP, and the secured member (15) is an automobile frame made of metal.

Amended claims under Art. 19.1 PCT

Dear Sirs,

The applicant, who received the International Search Report and Opinion relating to the above identified International Application, transmitted on 01.07.2014, hereby files Amendment under Article 19(1) as in the attached sheets.

the applicant hereby cancels sheets Nos. 11-12, and submits new sheets Nos. 11-12 & 12/1 for replacement, because the following amendments are made to claims on file:

Claims 1-10: these claims remain unchanged; and Claim 11: this claim is added in an independent form.

In view of the invention claimed in Claims 1-10 being indicated as lacking inventive steps in the International Search Report and Opinion, based on the features of Claims 1 and 6, Claim 11 directed to a process is added which is believed to more clearly define the technical features of this invention.

The preamble portion of Claim 11 is substantially identical with the feature defined in Claim 1, and its characterizing portion is based on the feature defined in Claim 5, and the descriptions of paragraphs [0032] & [0034] in the originally filed specification

and Figs. 2 & 3

The invention claimed in Claim 11 can provide the effects of Claims 1 & 6, that is, the effects described in paragraphs [0016] & [0021] in the originally filed specification and the effect indicated in the description of the mode for carrying out this invention, that is, the effect described in paragraph [0033].

It is believed that Claim 11 should be patentable over the prior art cited in the International Search Report and Opinion.

Statement under Art. 19.1 PCT

1. A securing structure for an FRP plate in which a metal grommet (14) is fixed to an FRP plate (13), and the FRP plate (13) is secured to a secured member (15) by screwing a nut (17) onto a bolt (16) extending through the metal grommet (14) and the secured member (15), wherein the metal grommet (14) comprises a grommet main body (18) and a washer (19), the grommet main body (18) comprises a washer portion (18a) that abuts against one surface of the FRP plate (13) and a collar portion (18b) that is formed integrally with the washer portion (18a) and is fitted into a through hole (13a) of the FRP plate (13), and the washer (19) is latched onto an extremity of the collar portion (18b) and abuts against the other surface of the FRP plate (13).

2. The securing structure for an FRP plate according to Claim 1, wherein the washer (19) is latched by means of a swaged portion (18c) formed by swaging the extremity of the collar portion (18b).

3. The securing structure for an FRP plate according to Claim 2, wherein a thickness of the swaged portion (18c) is substantially the same as a thickness of the collar portion (18b).

4. The securing structure for an FRP plate according to Claim 2 or Claim 3, wherein a taper portion (19a) is formed in advance on an inner periphery of the washer (19), the taper portion (19a) increasing in diameter in a direction going away from the grommet main body (18).

5. The securing structure for an FRP plate according to any one of Claim 2 to Claim 4, wherein a swaging tool (23) for swaging the collar portion (18b) comprises a flat portion (23a) that abuts against the washer (19) and a taper portion (23b) that protrudes from the flat portion (23a) so as to be tapered and fits within the collar portion (18b).

6. The securing structure for an FRP plate according to any one of Claim 1 to Claim 5, wherein the grommet main body (18) is formed by extending a rotating tool (21) having a sharp extremity through a metal plate (20) and the FRP plate (13) in a state in which the metal plate (20) is superimposed on one surface of the FRP plate (13).

7. The securing structure for an FRP plate according

to Claim 6, wherein a pilot hole (20a) is formed in advance in the metal plate (20), and the extremity of the rotating tool (21) is pressed against the center of the pilot hole (20a) and extended therethrough.

8. The securing structure for an FRP plate according to Claim 6 or Claim 7, wherein an excess portion (18e) that protrudes from the extremity of the collar portion (18b) due to the rotating tool (21) being extended therethrough is cut off prior to a swaging step.

9. The securing structure for an FRP plate according to any one of Claim 1 to Claim 8, wherein the washer portion (18a) and the washer (19) have an annular form.

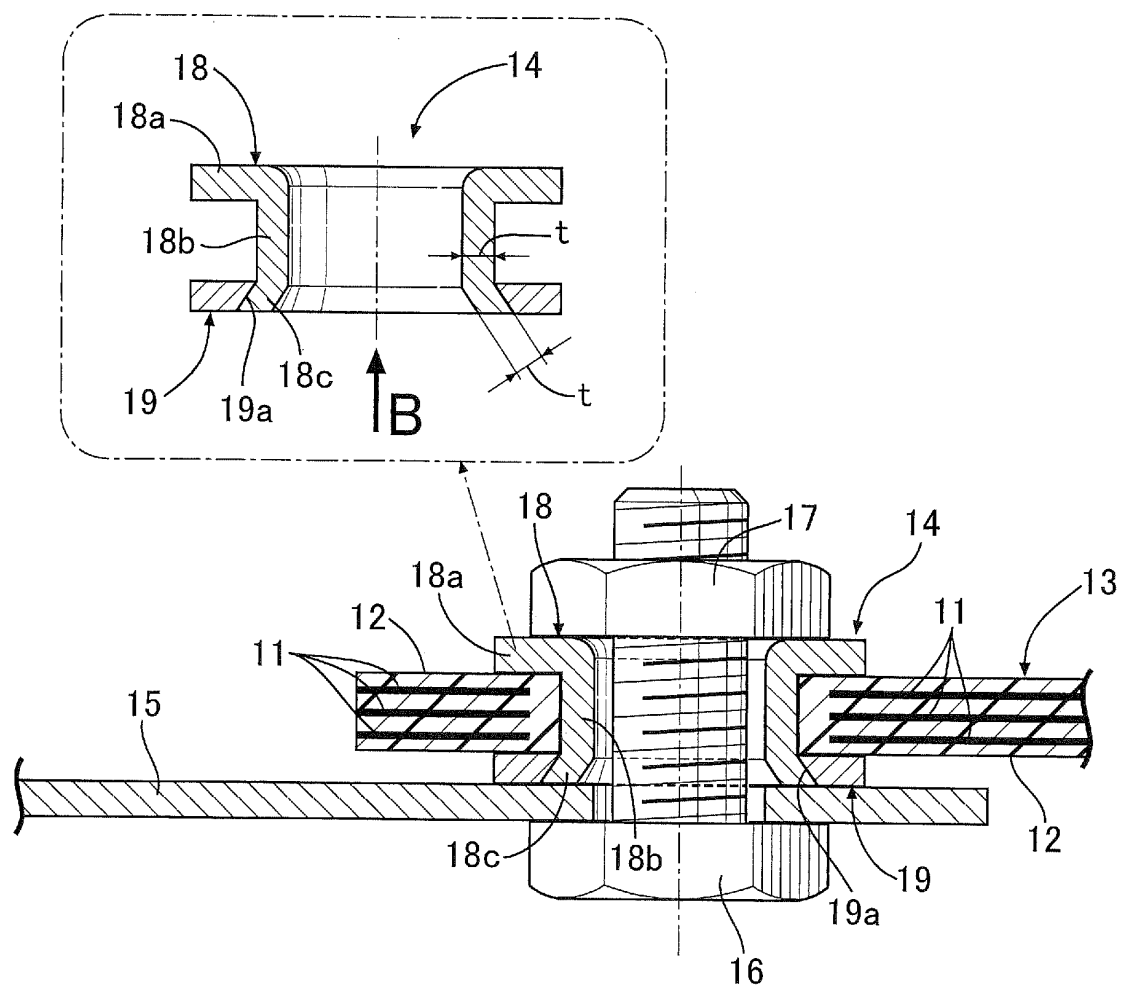
10. The securing structure for an FRP plate according to any one of Claim 1 to Claim 9, wherein the FRP plate (13) is an automobile part made of FRP, and the secured member (15) is an automobile frame made of metal.

11. added) A method for producing a securing structure for an FRP plate in which a metal grommet (14) is fixed to an FRP plate (13), the FRP plate (13) is secured to a securing member (15) by screwing a nut (17) onto a bolt (16) extending through the metal grommet (14) and the securing member (15), the metal grommet (14) comprises a grommet main body (18) and a washer (19), the grommet main body (18) comprises a washer portion (18a) that abuts against one surface of the FRP plate (13) and a collar portion (18b) that is formed integrally with the washer portion (18a) and is fitted into a through hole (13a) of the FRP plate (13), and the washer (19) is latched onto an extremity of the collar portion (18b) and abuts against the other surface of the FRP plate (13), wherein

the method comprises steps of superimposing a disk-shaped metal plate (20) as a material for the grommet main body (18) on one surface of the FRP plate (13) formed by solidifying a continuous fiber (11) aligned in one direction with a matrix resin (12), subsequently rotating a rotating tool (21) having a conical sharp tip part, making the rotating tool (21) extend through the metal plate (20) and the FRP plate (13), forming the collar portion (18b) by boring, pushing, and cylindrically widening the metal plate (20), forming the washer portion (18a) with the remaining portion of the metal plate (20), at the same time as this, forming the through hole (13a), into which the collar portion (18b) is fitted, by pushing and widening the FRP plate (13), which has been bored by the rotating tool (21), with the collar portion (18b), and subsequently fitting the washer (19), which is a separate member from the grommet main body (18), onto the extremity of the collar portion (18b) projecting outside the through hole (13a).

FIG.1

(A)



(B)

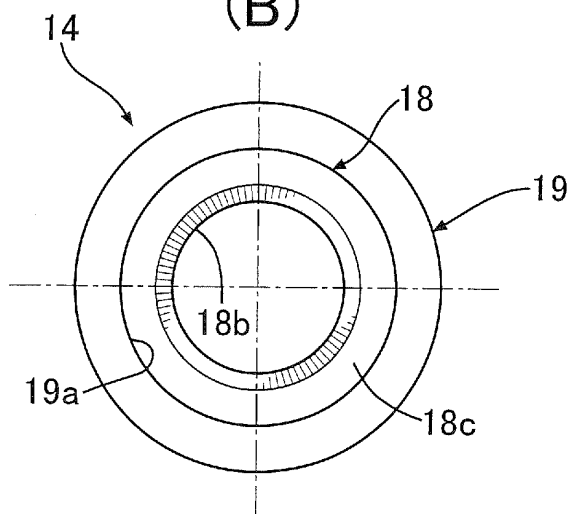


FIG.2

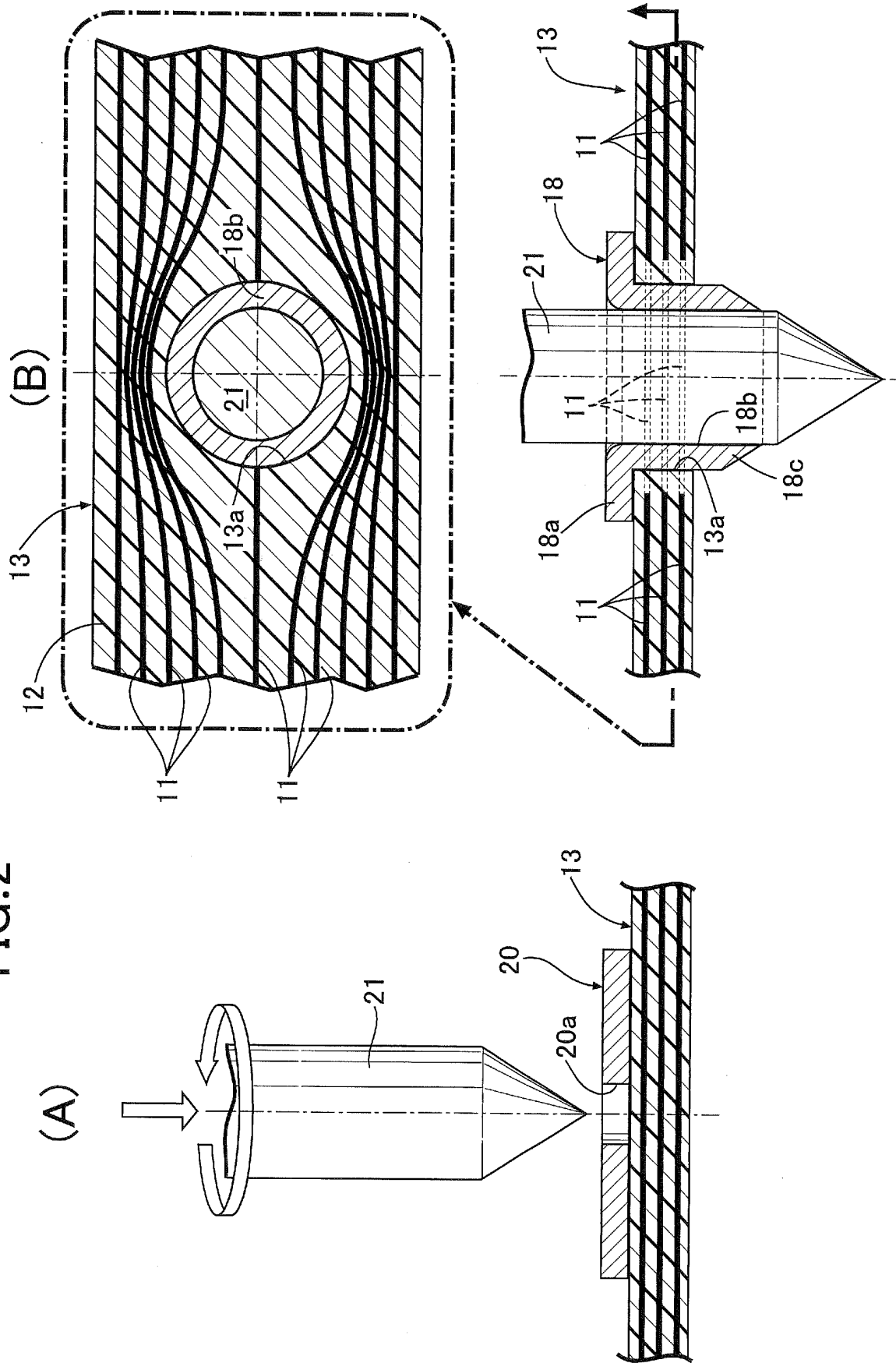


FIG. 3

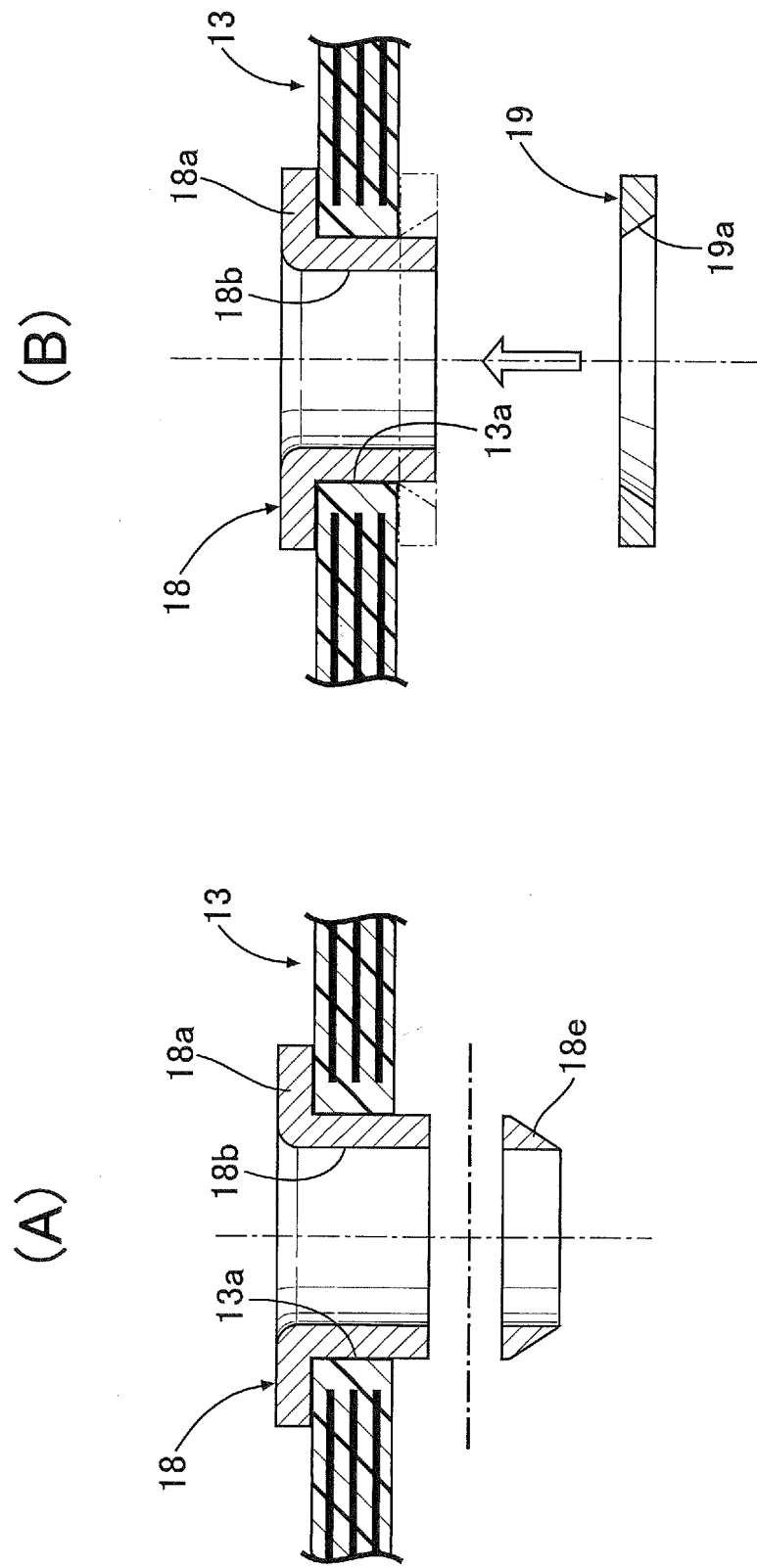


FIG. 4

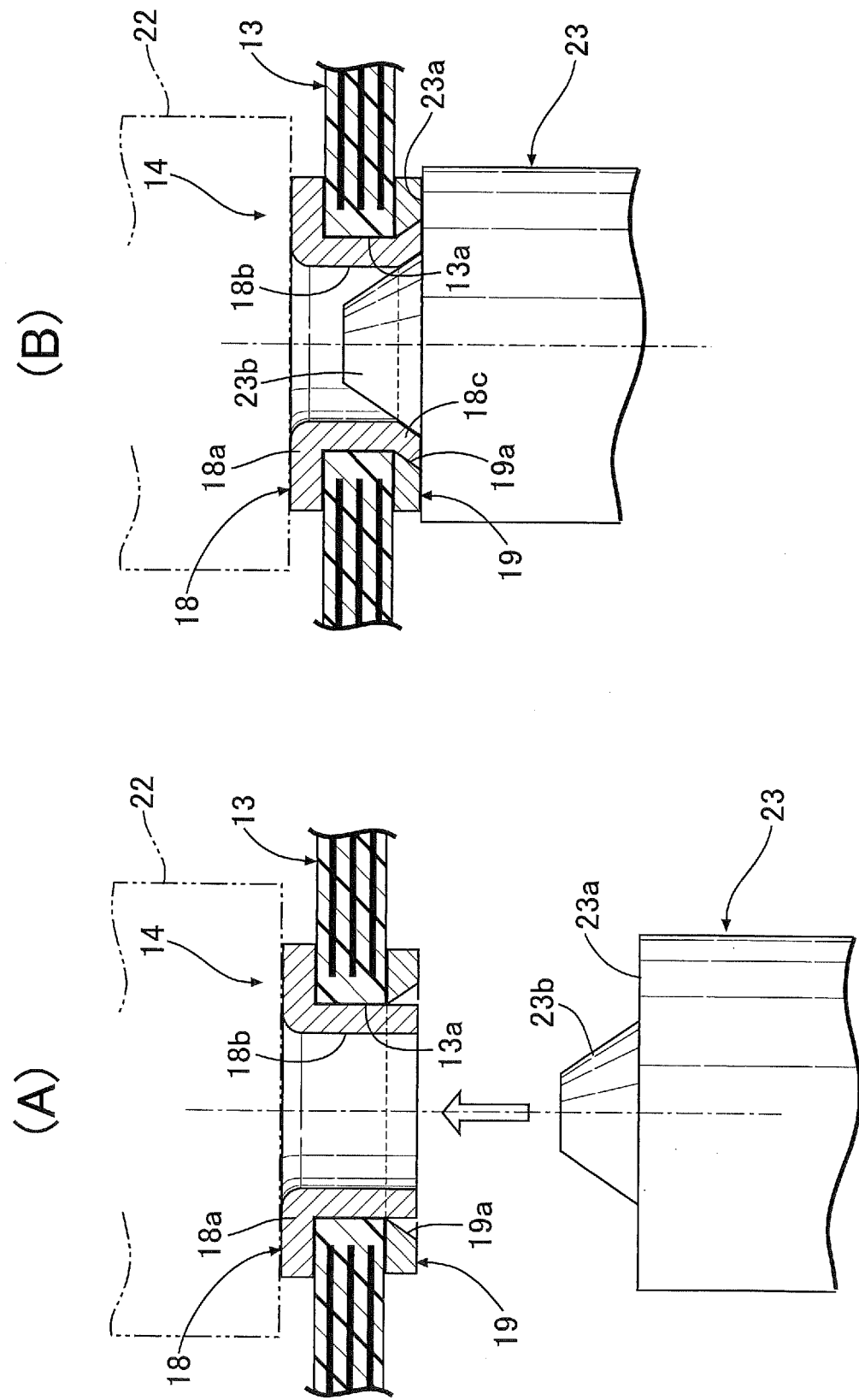


FIG.5

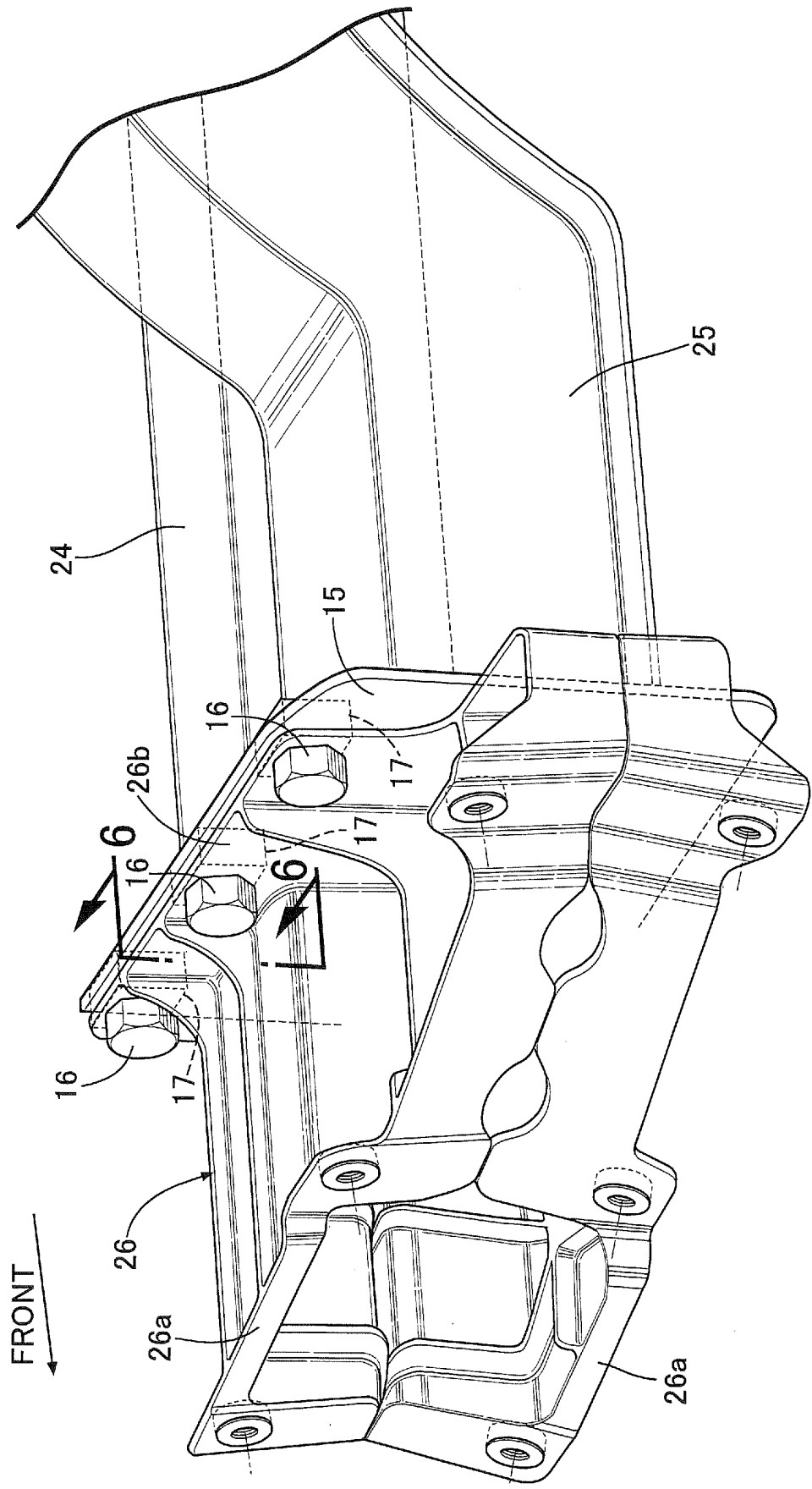
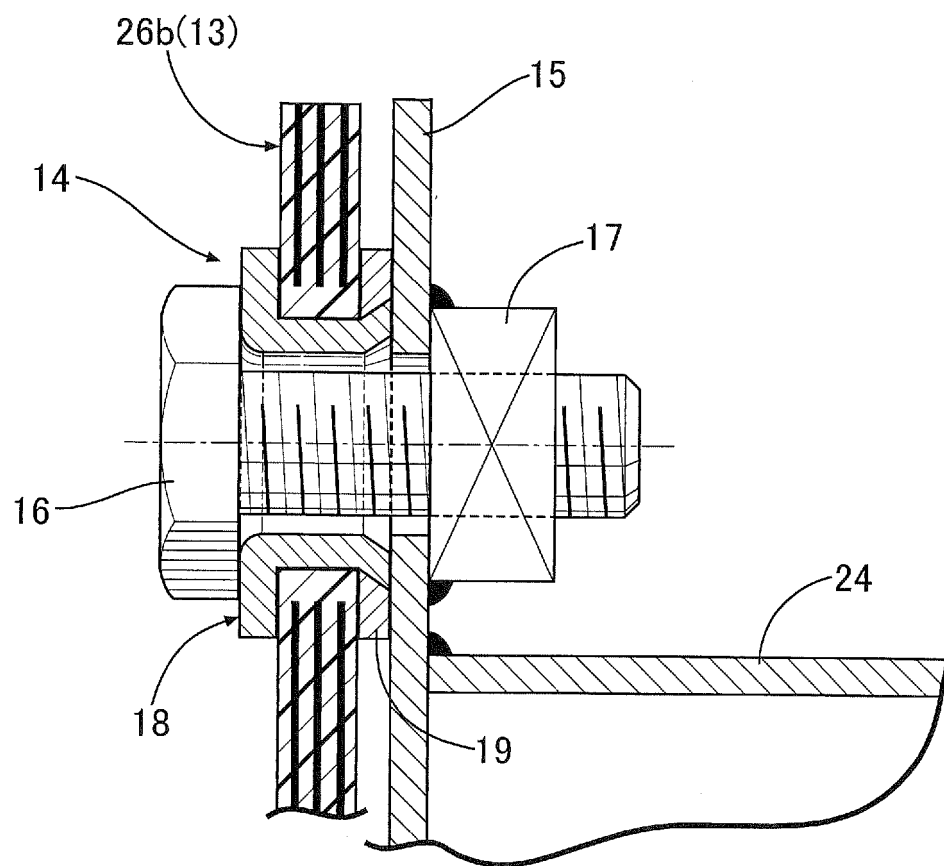


FIG.6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/061070

A. CLASSIFICATION OF SUBJECT MATTER

B21D39/00(2006.01)i, B21J5/06(2006.01)i, B29C65/60(2006.01)i, F16B5/02(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B21D39/00, B21J5/06, B29C65/60, F16B5/02

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014
Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 56-18112 A (Tridair Industries), 20 February 1981 (20.02.1981), column 2, line 12 to column 7, line 18; fig. 1 to 4 & US 4232496 A & GB 2048417 A & DE 3016499 A & FR 2455689 A	1-2, 9 3-8, 10
Y	US 3771480 A (JOHNSON DIE & ENGINEERING CO.), 13 November 1973 (13.11.1973), column 5, lines 22 to 47; fig. 6 & CA 980547 A	3-8, 10
Y	DE 102009013265 A1 (TECHNISCHE UNIVERSITAET CHEMNITZ), 16 September 2010 (16.09.2010), paragraphs [0037] to [0055]; fig. 1 to 6 (Family: none)	6-8, 10

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

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Date of the actual completion of the international search
20 June, 2014 (20.06.14)

Date of mailing of the international search report
01 July, 2014 (01.07.14)

Name and mailing address of the ISA/
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/061070

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 58-145324 A (Deere & Co.), 30 August 1983 (30.08.1983), page 5, upper right column, line 20 to page 6, upper left column, line 20 & US 4428214 A & EP 85888 A2 & DE 3364569 D & AU 1038383 A & ES 519583 A & ES 522152 A & FI 830395 A & BR 8300550 A & CA 1196217 A & DK 52183 A & ZA 8300792 A & AU 548871 B & FI 830395 A0	7-8, 10
Y	JP 2014-24392 A (Honda Motor Co., Ltd.), 06 February 2014 (06.02.2014), claims; fig. 7 (Family: none)	10

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- GB 102009013265 B4 [0003]