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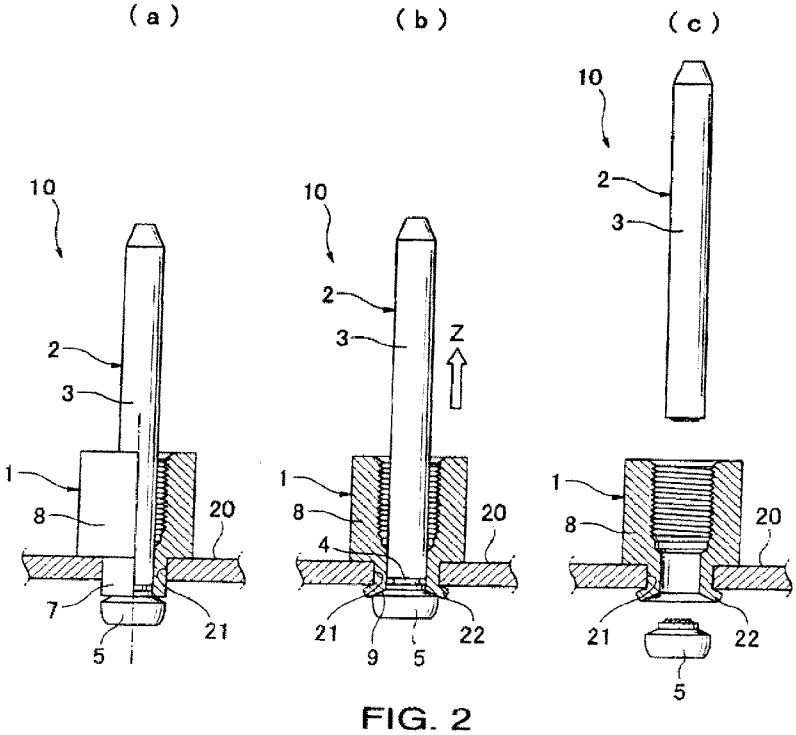

FIG. 2

(57) Abstract: A fastener (10) including a spanner nut (1) and a mandrel (2). The spanner nut (1) has a hollow main body (8) with female threads on an inner surface. Tip region (7) extends from the nut body (8) with a diameter smaller than the diameter thereof. The spanner nut (1) has a setting part at the tip region (7), and the mandrel body has a breaking portion (4) of a diameter smaller than the diameter thereof. The spanner nut (1) is made so that when only the tip region (7) is completely inserted into a hole in a workpiece and the mandrel (2) is passed through the hollow interior of the spanner nut (1) and pulled up, the setting portion is deformed as its diameter expands, and the main body and the head (5) are broken apart at the breaking portion (4).

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FASTENER AND ATTACHMENT METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit to Japanese Application No. 2008-321452, filed December 17, 2008. The disclosure of the above application is incorporated herein by reference.

BACKGROUND OF THE INVENTION

Technical Field

The present invention relates to a fastener. More specifically, the present invention relates to a fastener that comprises a one-side fastening spanner nut that does not require a press or the like for attachment, and a mandrel.

Background Art

In general, a pressure-insertion type spanner nut is used by pressing one end of it against a workpiece that is a mother material such as a metal plate and securing another member at a position separated from that mother material so as to maintain a certain interval between the two materials. For attaching such a spanner nut or other pressure-insertion type spanner nut to a workpiece, a press is generally used.

However, in order to attach a spanner nut to a workpiece, depending on the size, the material, and the shape and the like of the workpiece, the use of a large press or

special jig or the like is sometimes necessary. In such cases, the necessity arises to newly provide a large press or special jig, and the overall operation becomes costly, so this is not economical. At the time of fastening, moreover, operational problems sometimes occur.

In Patent Literature 1, a stud that comprises a stud body, a flange integrally joined to the stud body, a setting body formed integrally therewith and a mandrel with a mandrel head and a mandrel shank, accommodated inside the stud body and setting body, is disclosed. In said Literature 1, the configuration of the stud is such that when the mandrel shank is drawn out from the end of the stud body on the opposite end from the setting body, the setting body is plastically deformed and secured inside a setting hole. When the mandrel is pulled out further, the mandrel shank breaks off at a slit or slits formed in the shank, and the mandrel head is left in the interior of the setting body. With such a stud as this, however, the mandrel head remains in the mother material to which the stud is attached, and this portion sometimes becomes displaced during use after fastening.

Patent Literature 1: Patent Application KOKAI Number TOKKAI No. 2008-14356 (Gazette)

Disclosure of the Invention

Problems the Invention Would Solve

The present invention was devised for the purpose of solving such problems and provides a fastener comprising a one-side fastening spacer nut and a mandrel that can be attached to a workpiece easily, in a short time and economically, without requiring a press or special dedicated jig.

Means for Solving the Problems

In order to solve the problems noted above, the fastener of the present invention comprises a spanner nut and a mandrel. The spanner nut comprises a spanner nut body and a cylindrical tip region that extends concentrically with the center axis of the spanner nut body from the spanner nut body, having a diameter smaller than the diameter of the spanner nut body. In the spanner nut body and tip region, a through hole is formed concentrically with the center axis of the spanner nut body. In the inner wall of the spanner nut body, female threads are formed.

The mandrel comprises a cylindrical mandrel body longer than the combined length of the spanner nut body and tip region and a mandrel head formed concentrically with the mandrel body at one end of the mandrel body, with a diameter larger than the diameter of the mandrel body. The diameter of the mandrel body is such that it can be inserted into the through hole, and between the mandrel head and the mandrel body, a sloping part is formed the diameter of which decreases linearly from the diameter of the mandrel head to the diameter of the mandrel body. In the mandrel body, furthermore, a breaking portion is formed with a diameter smaller than the diameter of the mandrel body. The diameter of the breaking portion is determined so that when the mandrel

body is pulled in a direction such that the tip region is crushed, after the tip region expands to the outside along the sloping part, the mandrel body will break off.

It is preferable that after fastening is finished, the mandrel head be completely cut away from the mandrel body and thrown aside so it does not remain.

When using the fastener of the present invention, a tool generally used for rivet fastening can be employed for pulling the mandrel upward.

The present invention also discloses a method of attaching a fastener comprising a spanner nut and a mandrel to a workpiece. This method has a step for preparing the fastener on a workpiece that is to be attached to. The spanner nut has a spanner nut body in the inner wall of which are formed female threads and a cylindrical tip region that extends from the spanner nut body concentrically with the spanner nut body, having a diameter smaller than the diameter of the spanner nut body. In the spanner nut body and tip region, a through hole is formed concentrically with the center axis of the spanner nut body. The mandrel, which has a diameter such that it can be inserted into that through hole, also has a cylindrical mandrel body longer than the combined length of the spanner nut body and the tip region and a mandrel head, formed concentrically with the mandrel body at one end of the mandrel body, having a diameter larger than the diameter of the mandrel body. Between the mandrel head and the mandrel body, a sloping part is formed the diameter of which decreases linearly from the diameter of the mandrel head to the diameter of the mandrel body, and a breaking portion is formed in the mandrel body with a diameter smaller than the diameter of the mandrel body.

Furthermore, this method has a step for installing the fastener so that its tip region is fitted into a lower hole in the workpiece. The mandrel body is formed so as to pass through the through hole in the spanner nut body and protrude out from the spanner nut body, and the mandrel head is therefore positioned below the tip region. Next, when the mandrel is pulled upward perpendicularly to the surface of the workpiece using a fastening tool, as the mandrel is being pulled up, the tip of the tip region expands to the outside along the sloping part of the mandrel, and the spanner nut is set by expanding to the workpiece. Then, when the breaking portion of the mandrel breaks off due to the pulling force, the mandrel body and the head are broken apart and separated, the spanner nut is completely secured to the workpiece, and the fastening of the spanner nut to the workpiece is thereby finished. The fastening tool may be a tool used for fastening ordinary rivets or the like.

Effectiveness of the Invention

In the spanner nut fastener of the present invention, a mandrel is used in attaching the spanner nut to a workpiece. The portion of the mandrel near its mandrel head end is given a reduced diameter smaller than the diameter of the mandrel body so that it will readily break. During fastening, when the mandrel is pulled up, the mandrel will be broken at that portion, the mandrel body and mandrel head will separate and when fastening is finished, that head will no longer be on the setting portion of the spanner nut. Because the mandrel head does not remain on the spanner nut, the mandrel head will not come loose in the interior of a machine in which this spanner nut

is used, nor will noise be caused by a loose mandrel head. There is also no danger of an electrical component being shorted out due to a loose mandrel head.

With an ordinary pressure-insertion type spanner nut, a flat flange is provided in the end surface of the nut, which flange portion is secured to the workpiece. In contrast, the fastener of the present invention requires no provision of a flange, and the end surface of the spanner nut body is secured to the workpiece so the configuration of the spanner nut is made simpler.

With the spanner nut fastener of the present invention, when attaching the spanner nut, a mandrel is used in the same manner as when attaching a rivet or the like. Consequently, whereas a special press or tool is usually necessary when attaching a spanner nut that is a pressure-insertion type fastener, a tool like that used for rivets can be used for attaching the spanner nut of the present invention, so fastening is easy. Unlike when fastening with a press, moreover, the shape or size of the member being fastened will not pose any problem. Nor is it necessary to provide a press or the like, and the work can be performed easily, so fastening times can be greatly shortened. Also, because there is no necessity of newly providing a press or the like, investment in fastening equipment can be greatly lessened. Such is the outstanding effectiveness shown by the present invention.

Description of Drawings

Fig. 1 is a partially sectional view of a spanner nut fastener relating to the present invention.

Fig. 2 is a diagram showing the process of attaching the spanner nut fastener relating to the present invention; Fig. 2a illustrates the manner in which the fastener is established on a workpiece, Fig. 2b illustrates the process of a mandrel being pulled out, and Fig. 2c illustrates the condition after the fastening of the fastener is finished.

Preferred Embodiments of the Invention

Embodiments of the present invention shall now be described with reference to the attached drawings. In this specification, identical elements are identified by the same references.

Fig. 1 is a partially sectional view of a first embodiment of a fastener 10 of the present invention made by combining a one-side fastening spanner nut 1 and a mandrel 2. In Fig. 1, the part above the axis line Y in the lateral direction of the fastener 10 is an external view of the fastener 10, while the part below the axis line Y is a section of the fastener 10. The fastener 10, comprising the spanner nut 1 and the mandrel 2, is made so that the mandrel 2 is inserted into the hollow interior of the spanner nut 1 in order to pass through and protrude out from the spanner nut 1.

The spanner nut 1 is configured by a nut body 8 and a nut tip region 7 extending from and formed integrally with it. Overall, the spanner nut 1, comprising the nut body 8

and the nut tip region 7, is shaped as a hollow cylinder. In this embodiment, the outer shape of the nut body is substantially cylindrical, but this poses no limitation, and nut bodies of various shapes can be adopted. Concentrically with the center axis of the spanner nut body 8, the tip region 7 extends from that spanner nut body and has a diameter that than the diameter of the spanner nut body. In the nut body 8 and nut tip region 7, a through hole is formed, concentrically with the center axis of the nut body 8, so that the mandrel described below can pass through it. Female threads 6 are formed in the inner wall of the nut body 8, but female threads are not formed in the inner wall of the nut tip region 7. As described below, the end region 22 on the mandrel head end of the nut tip region 7 is formed as a setting part by which the spanner nut 1 of the fastener 10 is attached to a workpiece. The end region 22 which functions as this setting part may be of a comparatively short length. The tip region 7 overall is made so as to fit into and pass through a hole in the workpiece to be attached to, as described below. Accordingly, the size of the diameter of the tip region 7 is such that it can fit into the hole in the workpiece to which the fastener 10 is to be attached.

The mandrel 2 is configured by a mandrel body 3 and a mandrel head 5. The mandrel body 3 is cylindrical, of a length longer than the combined lengths of the spanner nut body 8 and nut tip region 7. The size of the mandrel body's diameter is such that it can be inserted into the through hole in the nut body 8 and tip region 7. The mandrel head 5 is formed concentrically with the mandrel body 3 at one end of the mandrel body 3, having a diameter larger than the diameter of the mandrel body 3. Between the mandrel head 5 and the mandrel body 3, a sloping part 9 is formed the

diameter of which decreases linearly from the diameter of the mandrel head 5 to the diameter of the mandrel body 3. Also, a breaking portion 4 with a diameter smaller than the diameter of the mandrel body 3 is formed at a slight distance from the mandrel head 5 end of the mandrel 2. As described below, at this breaking portion 4, the mandrel head 5 and the mandrel body 3 will be cut apart after spanner nut fastening. It is necessary that the breaking portion 4 be given a diameter that is reduced to such a degree that when the mandrel 2 is pulled upward on the end opposite the mandrel head 5, it can easily be broken by that pulling force. As a result of such a configuration, as described below, by pulling the mandrel 2 out, the spanner nut 1 will be fastened to a workpiece 20.

As will be seen by referring to Fig. 1, when the mandrel 2 is inserted into the hollow interior of the spanner nut 1 and combined therewith, the mandrel head 5 will protrude out to the exterior of the spanner nut 1, and part of the mandrel body 3 will then be contained inside the spanner nut 1, with the portion from there toward its tip protruding out from the spanner nut 1.

Fig. 2 shows the process of attaching the spanner nut fastener 10, divided into three steps. Fig. 2a illustrates the manner in which the spanner nut fastener 10 of the present invention shown in Fig. 1 is established on a workpiece 20. In Fig. 2a, at a position where the spanner nut fastener 10 is to be attached on the workpiece 20, a lower hole 21 is formed in the workpiece 20. In this lower hole 21, the fastener 10, in which the spanner nut 1 and the mandrel body 3 are combined, is inserted. The

diameter of the lower hole 21 is slightly larger than the diameter of the tip region 7 of the fastener 10, and is of a size so that the tip region 7, when inserted inside the lower hole 21, will fit nicely. The length of the tip region 7, moreover, must be greater than the thickness of the workpiece as is necessary in order for the tip portion 22 of the tip region 7 that exceeds the width of the workpiece to function as a setting part and in order to secure the nut body 8 and the tip region 7 to the workpiece 20. For that reason, the tip region 7 of the spanner nut 10 is established so as to be deployed in order to exceed the thickness of the lower hole 21 of the workpiece 20; the outer surface of the tip region 7 and the lower hole 21 of the workpiece 20 are then joined together so that they mesh. The end surface of the nut body 8 is made so as to be secured on the surface of the workpiece 20. The mandrel 2, moreover, is disposed inside the nut body 1 so that the mandrel head 5 protruding from the tip region 7 will protrude out and downward from the lower hole 21.

Fig. 2b illustrates the manner in which the mandrel 2 is pulled upward in the direction opposite the mandrel head 5, using a special tool. In the present invention, the special tool may be the same kind of tool as is used for common one-side fastening rivets. As will be seen by referring to Fig. 2b, as the mandrel body 3 of the mandrel 2 is pulled upward in the direction of the arrow symbol Z, due to the existence of the sloping part 9 and mandrel head 5 of the mandrel 2, the tip portion 22 of the nut tip region 7 that extends so as to protrude from the workpiece 20 will be deformed and thus gradually expand along the sloping part 9. That is, the mandrel body 3 will be pulled in a direction

that crushes the tip region 7. Meanwhile, the position of the mandrel breaking portion 4 of the mandrel 2 also gradually rises until it reaches the lower hole 21 of the workpiece 20.

Fig. 2c illustrates the manner in which the spanner nut 1 is attached to the workpiece 20. In Fig. 2c, the mandrel 2 of the fastener 10 is pulled upward further from the condition illustrated in Fig. 2b. Due to the force of this pulling, the mandrel 2 will break at the mandrel breaking portion 4 of reduced diameter, and the mandrel 2 will be separated into the mandrel body 3 end and the mandrel head 5 end. Meanwhile, the tip region 7 of the spanner nut 1 will continue to be plastically deformed outwardly, along the sloping part 9 of the mandrel 2, as described above and thus will be expanded; the spanner nut 1 will then be secured to the workpiece 20. In this manner, the fastening of the spanner nut fastener 10 to the workpiece 20 is finished.

In this embodiment, after the fastening of the spanner nut 1 to the workpiece 20 is finished, the mandrel 2 will be completely broken and separated at the breaking portion 4, and the mandrel head 5 will not remain on the spanner nut 1. For that reason, in the interior of a machine in which a spanner nut configured as per this embodiment is used, there will no longer be any danger of the mandrel head coming loose or of noise being produced, or of an electrical component being shorted out, or the like.

In the embodiments of the present invention, a pressure-insertion type spanner nut 1 which conventionally required a press or the like can be fastened by using a mandrel 2 as with a one-side fastening rivet. For that reason, the spanner nut can be fastened to a

workpiece using a tool like that used for one-side fastening rivets. Because the fastening is done with the same tool as used for a one-side fastening rivet, fastening can be accomplished easily, irrespective of the shape or size of the workpiece, as compared to conventional fastening using a press. Furthermore, because work is finished with simple fastening, work time can be greatly shortened. Also, because no new equipment is necessary for fastening, less investment in fastening equipment is sufficient, rendering the present invention economical.

In embodiments of the present invention, when the spanner nut 1 of the spanner nut fastener 10 of the present invention is used, tightening is done by a bolt. In this case, however, the spanner nut body 1 itself sometimes turns. In order to avoid anything like that from happening, it is possible to implement projections or knurling by machining on the back side 31 of the spanner nut body 1, or about the entire outer circumference of the tip region 7 or on both. Then, the knurling or projections machined on portions of the spanner nut 1 that are inserted into or connect to the workpiece 20 will function to stop pull-out and stop turning by raising the coefficient of friction or by causing serrations to be engaged.

In the fastener of the present invention, any shape or dimensions whatsoever can be adopted without being limited to or by the embodiments of the invention described above, as long as the scope of the claims is not exceeded.

Claims

1.

A fastener comprising a spacer nut and a mandrel; wherein:

said spanner nut comprises a spanner nut body and a cylindrical tip region extending from said spanner nut body coaxially with the center axis of said spanner nut body, with a diameter smaller than the diameter of said spanner nut body;

a through hole is formed concentrically with the center axis of said spanner nut body in said spanner nut body and said tip region;

female threads are formed in the inner wall of said spanner nut body;

said mandrel comprises a cylindrical mandrel body longer than the combined length of said spanner nut body and said tip region, and a mandrel head with a diameter larger than the diameter of said mandrel body;

said mandrel body has a diameter such that it can be inserted into said through hole;

between said mandrel head and said mandrel body, a sloping part is formed the diameter of which decreases linearly from the diameter of said mandrel head to the diameter of said mandrel body;

in said mandrel body, a breaking portion is formed which has a diameter smaller than the diameter of said mandrel body; and

the diameter of said breaking portion is determined so that, when said mandrel body is pulled in a direction such that said tip region is crushed, after said tip region has expanded to the outside along said sloping part, said mandrel body breaks off.

2.

The fastener according to claim 1, wherein after fastening is finished, said mandrel head is completely cut away from said mandrel body and thrown aside so it does not remain.

3.

The fastener according to claim 1, wherein a tool generally used for rivets is employed for pulling said mandrel body.

4.

A fastening method for a fastener comprising a spacer nut and a mandrel, comprising the following steps:

preparing a fastener comprising a spanner nut and a mandrel on a workpiece to which said fastener is to be attached; said spanner nut has female threads formed on its inner wall, a spanner nut body and a cylindrical tip region with a diameter smaller than the diameter of said spanner nut body; said mandrel has a diameter such that it can be inserted into a through hole formed in said spanner nut body and said tip region, concentrically with the center axis of said spanner nut body; said mandrel also has a cylindrical mandrel body longer than the combined length of said spanner nut body and said tip region and a mandrel head of a diameter larger than the diameter of said mandrel body; between said mandrel head and said mandrel body, a sloping part is formed the diameter of which decreases linearly from the diameter of said mandrel head to the diameter of said mandrel body; and in said mandrel body, a breaking portion with a diameter smaller than the diameter of said mandrel body is formed;

installing said fastener in said workpiece so that said tip region is fitted into a lower hole in said workpiece, said mandrel body being formed so as to pass through said through hole in said spanner nut body and protrude out from said spanner nut body; said mandrel head is thus positioned below said tip region; and

pulling up said mandrel in a direction perpendicular to the surface of said workpiece;

as said mandrel is pulled up, the tip of said tip region then expands to the outside along said sloping part, and said spanner nut is set in said workpiece;

the breaking portion of said mandrel is broken by the force of pulling, and said mandrel body and head are then broken apart and separated; and

the fastening of said spanner nut to said workpiece is completed when said spanner nut is completely secured to said workpiece.

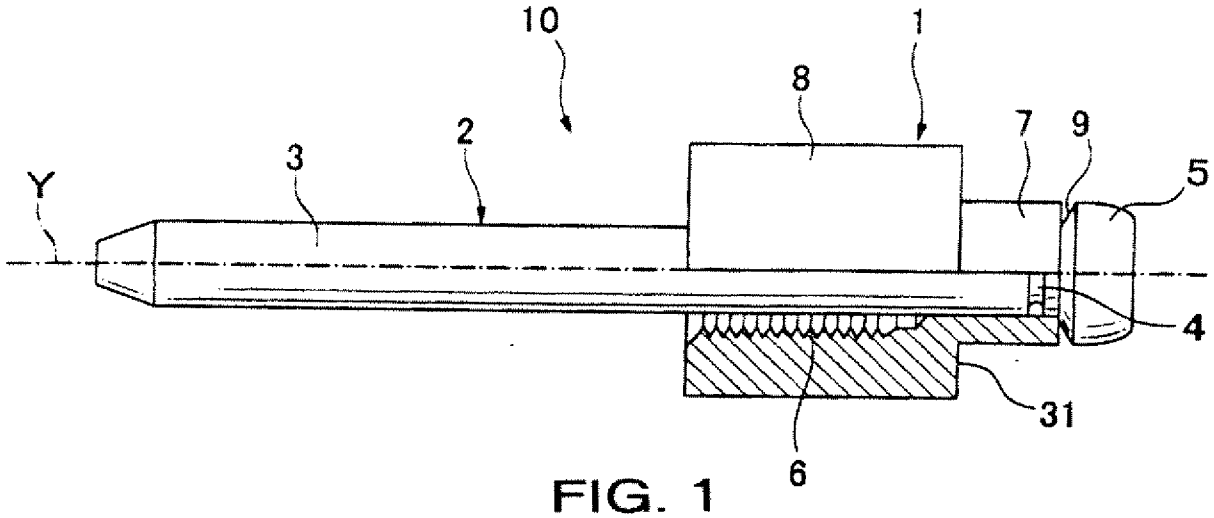

FIG. 1

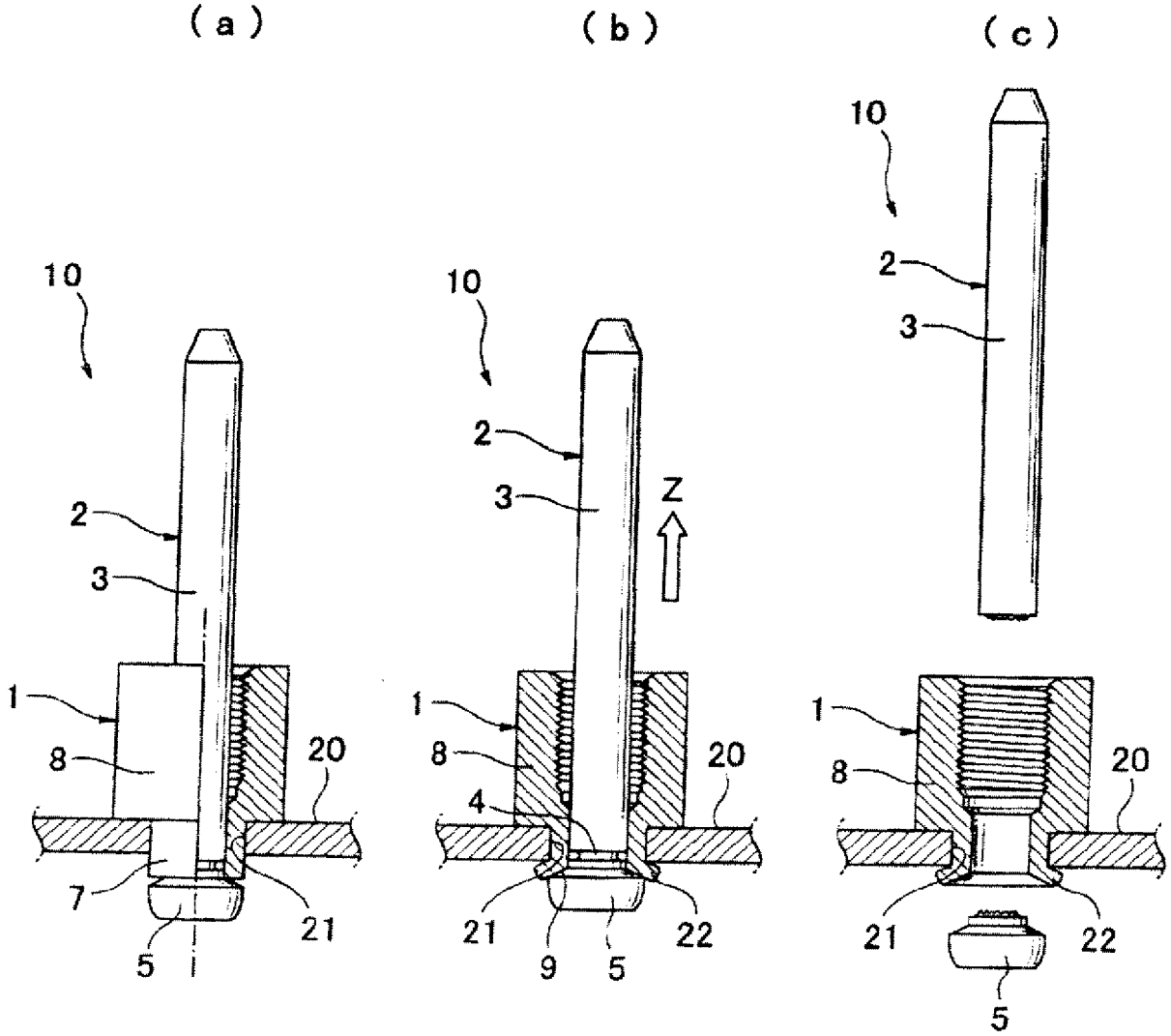

FIG. 2