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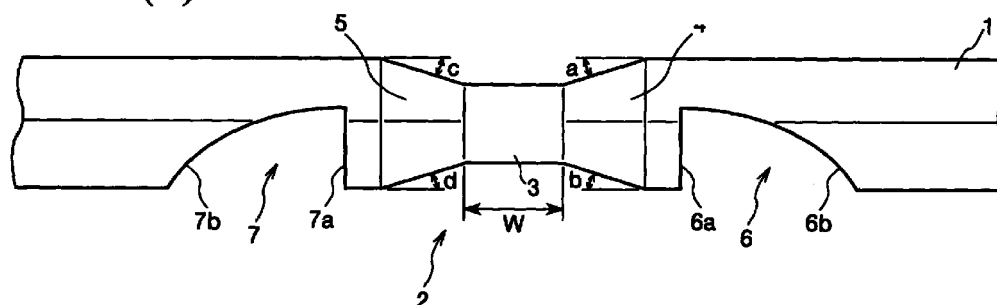
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(54) **Wire for helical coil insert**

(57) The present invention provides a wire (1) for a helical coil insert which permits, when used in the manufacture of a helical coil insert, continuous manufacture with very high efficiency, thus there is a remarkable improvement of productivity of the helical coil inserts. The wire of the invention has coil free end forming sections (2) formed at prescribed intervals of length in the

axial direction of the wire (1). The coil free end forming sections (2) have a first and a second convergent sections (4) and (5) and recesses (6) and (7) formed adjacently to the first and the second convergent sections (4) and (5).

FIG. 1(b)



Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a helical coil insert used generally by inserting the same into a tap hole of a work. More particularly, the invention relates to a wire used when manufacturing such a helical coil insert.

Description of the Related Art

[0002] When, with a directly tapped work made of a light metal such as aluminum, plastics, wood or cast iron, there is unavailable a high tightening force because of a weak female screw, it is the conventional practice to use a helical coil insert so as to ensure highly reliable screw tightening.

[0003] More specifically, a tanged helical coil insert 10T is illustrated in Fig. 4. Such a helical coil insert 10T is prepared usually by winding into a spring-shaped cylinder a high tensile special steel wire having a diamond-shaped cross-section such as a cold-rolled 18-8 stainless steel wire, and is screwed into a tap hole 101 formed in a work 100 by means of an insertion tool and secured thereto as shown in Figs. 5 and 6. Then, a bolt 20 or the like is screw-engaged with this helical coil insert 10T as a female screw. By using the helical coil insert 10T as described above, a high screw tightening force is available, and further, it is possible to repeatedly insert and disengage the bolt 20.

[0004] Because the tanged helical coil insert 10T is driven into the tap hole 101 by the insertion tool, a stopper piece 11 folded down in the radial direction of the coil, known as a tang engaged with the insertion tool is provided. This tang 11 must be removed after it is secured into the tap hole 101 of the work 100, and for this purpose, a notch 8 is formed on the outer side surface of a first coil portion in contact with the coil free end having the tang 11 formed thereon.

[0005] From the tanged helical coil insert 10T, it is necessary to collect the tang 11 removed as described above, after attachment of the insert onto the work 100. The collecting operation is however very complicated. Further, if the removed tang 11 is not collected, the tang 11 may cause an electrical or mechanical trouble. A tangless helical coil insert 10 as shown in Fig. 7 may sometimes be used for this reason.

[0006] The tangless helical coil insert 10 is as well attached to the tap hole 101 of the work as shown in Figs. 5 and 6. In the case of the tangless helical coil insert 10, unlike the tanged helical coil insert 10T, the operation of collecting the removed tang 11 after attachment is not necessary. As shown in Figs. 7 and 8, however, it is necessary to form recesses 6 and 7 for engaging with tool clicks in the proximity to heads 4 and

5 formed on the coil free ends on the both sides of the coil so as to permit the stopping of a click 31 of the insertion tool 30. In addition, the heads 4 and 5 are formed, for example, into a convergent shape in which the wire diameter is slightly reduced along the longitudinal axis of the wire toward the tip thereof so that the coil free end tip does not damage the tap hole upon attachment of the helical coil insert 10 into the tap hole.

[0007] The helical coil insert 10 having the heads 4 and 5 and the recesses 6 and 7 for the insertion tool is conventionally manufactured through many such steps as:

- (1) press-working the tip of a long wire to form, for example, a convergent head 4 having a desired shape (forming step);
- (2) forming a recess 6 for an insertion tool by press working in proximity to the head 4 of the desired shape (notching step);
- (3) preparing a helical coil having the aforementioned head as the leading end while feeding the wire, and cutting the wire upon the formation of the helical coil by a prescribed number of turns; and
- (4) forming the end of the thus cut coil into a head 5 and a recess 7 of desired shapes through the same working operation as in the above-mentioned steps (1) and (2).

[0008] It is conventional practice to manufacture one coil insert 10 by the steps described above, and therefore, this practice has a productivity problem.

[0009] It is therefore an object of the present invention to provide a wire for a helical coil insert capable of being used when manufacturing a helical coil insert, and permitting the efficient and continuous manufacture of helical coil inserts, and the remarkable improvement of productivity of helical coil inserts.

SUMMARY OF THE INVENTION

[0010] The aforementioned object of the present invention is achieved with the wire for a helical coil insert of the invention. In summary, according to an aspect of the invention, there is provided a wire for manufacturing a helical coil insert, comprising coil free end forming sections formed at prescribed intervals of length in the axial direction of a wire, the coil free end forming sections having a first and a second convergent sections extending in directions leaving each other along the axial direction of the wire to reach an outer periphery of the wire and a first and a second recesses formed respectively adjacently to the first and second convergent sections. According to an embodiment of the invention, the coil free end forming sections are formed in alignment with the axial direction of the wire. According to another embodiment of the invention, the coil free end forming sections have a coupling section, extending for a prescribed distance in the axial direction, for con-

necting the first and second convergent sections. The first and second convergent sections and the first and second recesses of the wire of the invention form a head of the coil free end tip and the recess of the helical coil insert.

[0011] According to another aspect of the invention, there is provided a wire for manufacturing a helical coil insert with a tang, comprising coil free end forming sections formed at prescribed intervals of length in the axial direction of a wire, the coil free end forming sections having a notch comprising a first and a second slants extending in a direction leaving each other along the axial direction of the wire to reach the outer periphery of the wire. According to an embodiment of the invention, the coil free end forming sections are in alignment with the axial direction of the wire. The aforesaid notch of the wire of the invention forms a notch on an inner periphery of a first coil portion adjacent to the tanged helical coil insert.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1(a) illustrates an embodiment of the wire for a helical coil insert of the present invention; and Fig. 1(b) is an enlarged view illustrating the coil free end forming section;

Fig. 2(a) is a descriptive view illustrating a method for manufacturing a helical coil insert with, the use of the wire for a helical coil insert of the invention; Fig. 2(b) illustrates a separated helical coil insert; and Fig. 2(c) illustrates a series of helical coil inserts manufactured with the use of the wire for a helical coil insert of the invention;

Fig. 3(a) illustrates another embodiment of the wire for a helical coil insert of the invention; Fig. 3(b) is a descriptive view of a method for manufacturing a tanged helical coil insert with the use of the wire for a helical coil insert of the invention; and Fig. 3(c) illustrates a separated tanged helical coil insert;

Fig. 4 is a perspective view of the tanged helical coil insert;

Fig. 5 is a descriptive view illustrating a method for using a helical coil insert;

Fig. 6 is a descriptive view illustrating a helical coil insert as attached to a work;

Fig. 7 is a perspective view illustrating a tangless helical coil insert; and

Fig. 8 is a descriptive view illustrating the relationship between the tangless helical coil insert and an attachment tool.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] The wire for a helical coil insert of the present invention will now be described further in detail

with reference to the drawings.

Embodiment 1

[0014] Fig. 1 illustrates an embodiment of the wire 1 for a helical coil insert of the present invention. According to this embodiment, a wire 1 may be, for example, a high tensile special steel wire such as a cold-worked 18-8 stainless steel wire having, for example, a diamond-shaped cross-section.

[0015] According to the invention, as shown in Fig. 1(a), coil free end forming sections 2 are formed, on the wire 1, at prescribed intervals of length (P) determined from the geometry of a helical coil insert to be manufactured, in the longitudinal axial direction of the wire 1. The coil free end forming sections 2 have a coupling section 3 having a prescribed length (W) with a cross-sectional shape smaller than the outer shape of the wire, and a first and a second convergent sections 4 and 5 which are in contact with both sides of the coupling section 3 and which extend in directions leaving each other toward the outer periphery of the wire 1 along the axial direction thereof. The length (W) of this coupling section 3 may be set at an arbitrary value as required, or may be non-existent.

[0016] The aforementioned first and second convergent sections 4 and 5 may have an identical shape or different shapes. At all events, these sections 4 and 5 have substantially the same shape as that of the convergent heads formed at the coil free end tips of the helical coil insert to be manufactured. The inclination angles α , β , γ and δ of the first and second convergent sections 4 and 5 are usually within a range of from 10° to 15° , are not limited, and may be the same or different. It is also possible to form the first and second convergent sections 4 and 5 into a rounded shape to eliminate sharp corners.

[0017] Further, the coil free end forming section 2 has recesses 6 and 7 formed adjacently respectively to the above-mentioned first and second convergent sections 4 and 5. These recesses 6 and 7 are formed perpendicularly to the axis of the wire 1, and comprise flat surfaces 6a and 7a serving as stopper surfaces engaging with clicks 31 of the insertion tool 30 (Fig. 8) after completion of the helical coil insert, and curved surfaces 6b and 7b which curvedly extend from these flat surfaces 6a and 7a in a direction counter to that of the convergent sections 4 and 5, and after completion of the helical coil insert, serve as cam surfaces acting on the click of the insertion tool. That is, the recesses 6 and 7 serve as recesses formed adjacently to the head of the manufactured helical coil insert, and take substantially the same shape as that of the recesses of the helical coil insert.

[0018] The coil free end forming section 2 having the configuration as described above can be formed by the same press working as that applied when forming the heads 4 and 5 and the recesses 6 and 7 of the con-

ventional helical coil insert 10 (forming and notching steps). Each coil free end forming section 2 is formed usually in alignment with the axial line of the wire 1.

[0019] When manufacturing a helical coil insert 10 with the use of the wire 1 of the invention, the wire 1 is continuously fed to a coil manufacturing machine so that the aforementioned coil free end forming section 2 is positioned on the inner periphery side during coiling. The coil manufacturing machine may be one commonly in use. As shown in Fig. 2(a), the wire 1 fed to the coil manufacturing machine is clamped at the tip thereof by a clamping means of the coil manufacturing machine, or as required, coiled into a coil without clamping.

[0020] Upon completion of coiling a coil with a prescribed number of turns, the wire is cut for separation from the coupling section 3, and thus, as shown in Fig. 2(b), the helical coil insert 10 already provided with the heads 4 and 5 and the recesses 6 and 7 is manufactured. After completion of the manufacture of a helical coil insert 10, the next wire 1 is fed in succession to the coil manufacturing machine to carry out the next operation of coiling for the manufacture of the next helical coil insert 10.

[0021] By using the wire 1 of the present invention, as described above, the wire 1 fed to the coil manufacturing machine already has heads and recesses formed thereon. It is therefore only required to apply coil head working to a minimum extent as required to the wire fed to the coil manufacturing machine, thus permitting remarkable improvement of productivity as compared with the conventional manufacturing method.

[0022] According to another method, a plurality of helical coil inserts 10 are continuously manufactured as shown in Fig. 2(c) by feeding the wire 1 continuously to the coil manufacturing machine. Then, the helical coil inserts 10 are individually separated, as shown in Fig. 2(b), by cutting and separating this continuous helical coil insert 10 into individual helical coil inserts at the position of the coupling section 3 of the coil free end forming sections. Subsequently, as required, finish working may be applied to make the heads 4 and 5 of each helical coil insert 10 smoother.

[0023] According to this manufacturing method, helical coil inserts are manufactured continuously, and then, it is sufficient to separate the helical coil insert into individual pieces, leading to a remarkably improved productivity. Further, since the head 4 of one helical coil insert 10 is connected to the head 5 of the next helical coil insert via the coupling section 3, it is possible to smoothly form a coil without the risk of breaking the free end forming section of the helical coil insert, and this provides the advantage of further improved productivity.

[0024] While the wire 1 has a diamond-shaped cross-section in the aforementioned embodiment, the cross-sectional shape of the wire 1 of the invention is not limited to this, but the wire of the invention may take any arbitrary shape such as a rectangle, a circle or a triangle.

Embodiment 2

[0025] Fig. 3 illustrates another embodiment of the wire rod 1 according to the present invention. In this embodiment, the coil free end forming section 2 may be a notch 8 comprising a first and a second slants 8a and 8b which extend in directions leaving each other along the longitudinal axial direction of the wire 1 to the outer periphery of the wire 1, as shown in Fig. 3(a). Similar to Embodiment 2, coil free end forming sections 2 are usually arranged in alignment with the axial line of the wire 1 at prescribed intervals in the axial direction of the wire 1.

[0026] Use of the wire 1 of the invention suitably permits manufacture of a tanged helical coil insert 10T provided with a notch 8 as shown in Fig. 3(c) on the coil innerperiphery.

[0027] More specifically, when manufacturing a tanged helical coil insert 10T, the wire 1 is continuously fed to a coil manufacturing machine so that the aforementioned coil free end forming section 2, i.e., the notch 8 is positioned on the inner periphery side during the coiling operation. The coil manufacturing machine may be one commonly in use. The wire 1 fed to the coil manufacturing machine is clamped at the tip thereof by a clamping means of the coil manufacturing machine as shown in Fig. 3(b) to form a tang, and thereafter, the wire 1 is coiled.

[0028] Upon completion of a coiling into a coil having a prescribed number of turns, the wire 1 is cut for separation at a position a prescribed distance prior to the next notch 8 position, thereby manufacturing a tanged helical coil insert 10T having a notch already formed at a first coil portion in the proximity to a tang 11, as shown in Fig. 3(c). After manufacture of one tanged helical coil insert 10T, the wire 1 is continuously fed to the coil manufacturing machine for the next operations of tang forming and coiling for the manufacture of the next tanged helical coil insert 10T.

[0029] In the tanged helical coil insert 10T manufactured by the use of the wire 1 of the invention, unlike the conventional tanged helical coil insert 10T shown in Fig. 4, the notch 8 is formed on the inner periphery of the coil. When a notch is thus formed on the coil inner periphery, there is provided the advantage of easier removal of the tang 11 after fixing the helical coil insert 10T into a tap hole 101 of the work 100. Manufacture of a tanged helical coil insert 10T of such a conventionally required shape, after manufacture of the tanged helical coil insert 10T, the manual forming of a notch 8 on the coil inner periphery can be accomplished later. This leads to very low productivity and high cost for the insert.

[0030] By the use of the wire 1 of the present invention, it is possible to manufacture a tanged helical coil insert 10T as shown in Fig. 3(c) with a high productivity, and hence at a low cost.

[0031] In this embodiment also, it is not necessary

that the wire 1 has a diamond-shaped cross-section, but the cross-section may have any arbitrary shape such as a rectangle, a circle or a triangle.

[0032] As described above, the present invention provides a wire for the manufacture of a helical coil insert having a configuration comprising coil free end forming sections formed at prescribed intervals of length in the axial direction of a wire, the coil free end forming sections having a first and a second convergent sections extending in directions leaving each other along the axial direction of the wire to reach the outer periphery of the wire rod and a first and a second recesses formed respectively adjacently to the first and second convergent sections, or coil free end forming sections having a notch comprising a first and a second slants extending in directions leaving each other along the axial direction of the wire to reach the exterior shape of the wire. It is therefore possible, by the use thereof in the manufacture of a helical coil insert, to continuously manufacture a helical coil insert at a very high efficiency, thus permitting the remarkable improvement of productivity of helical coil inserts.

Claims

1. A wire for manufacturing a helical coil insert, comprising coil free end forming sections formed at prescribed intervals of length in the axial direction of a wire, said coil free end forming sections having a first and a second convergent sections extending in directions leaving each other along the axial direction of the wire to reach the outer periphery of the wire and a first and a second recesses formed respectively adjacently to said first and second convergent sections. 30
2. A wire for a helical coil insert according to claim 1, wherein said coil free end forming sections are formed in alignment with the axial direction of the wire. 40
3. A wire for a helical coil insert according to claim 1 or 2, wherein said coil free end forming sections have a coupling section, extending for a prescribed distance in the axial direction, for connecting said first and second convergent sections. 45
4. A wire for a helical coil insert according to any one of claims 1, 2 and 3, wherein said first and second convergent sections and said first and second recesses serve to form a head and a recess of a coil free end tip of a helical coil insert. 50
5. A wire for manufacturing a helical coil insert with a tang, comprising coil free end forming sections formed at prescribed intervals of length in the axial direction of a wire, said coil free end forming sections having a notch comprising a first and a second 55

slants extending in a direction leaving each other along the axial direction of the wire to reach the outer periphery of the wire.

- 5 6. A wire for a helical insert with a tang according to claim 5, wherein said coil free end forming sections are formed in alignment with the axial direction of the wire.
- 10 7. A wire for a helical insert with a tang according to claim 5 or 6, wherein said notch forms a notch on an inner periphery of a first coil portion adjacently to said tanged helical coil insert.
- 15 8. A wire for manufacturing a helical coil insert, comprising coil free end forming sections formed at prescribed intervals of length in the axial direction of a wire.
- 20 9. A method of manufacturing a helical coil insert, comprising taking a wire as claimed in any preceding claim, forming a plurality of helical coils and separating the plurality of helical coils into individual helical coils.
- 25 10. A method of manufacturing a helical coil insert, comprising taking a wire as claimed in any preceding claim, forming a helical coil and separating the helical coil from the remainder of the wire.

FIG. 1(a)

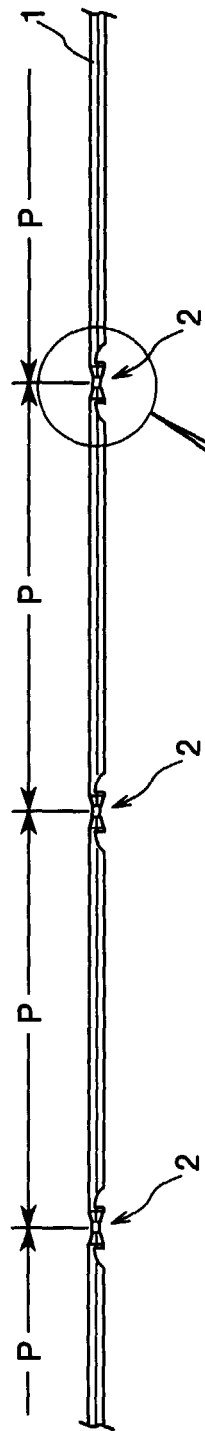


FIG. 1(b)

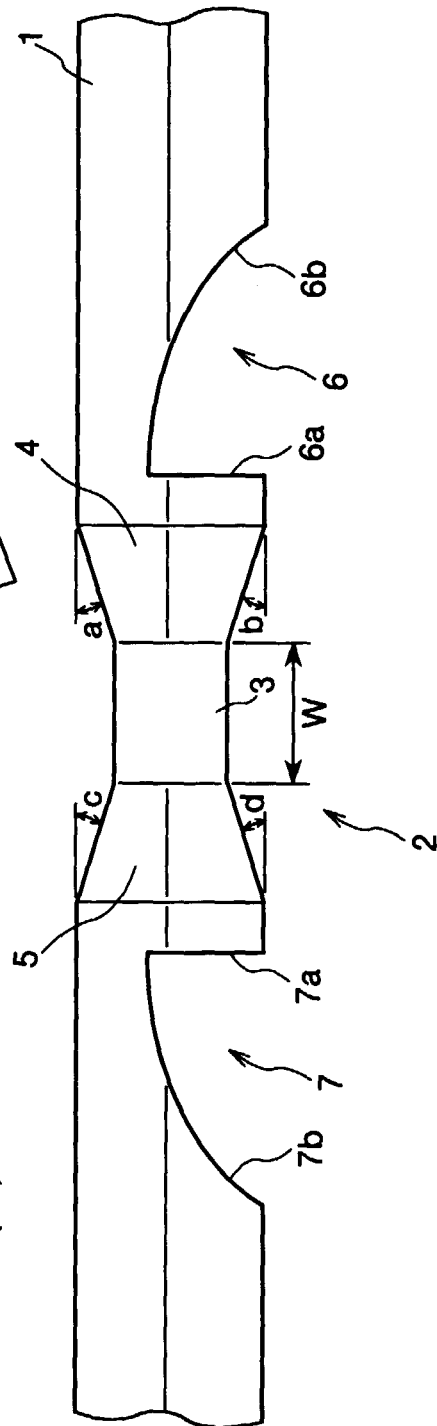


FIG. 2(a)

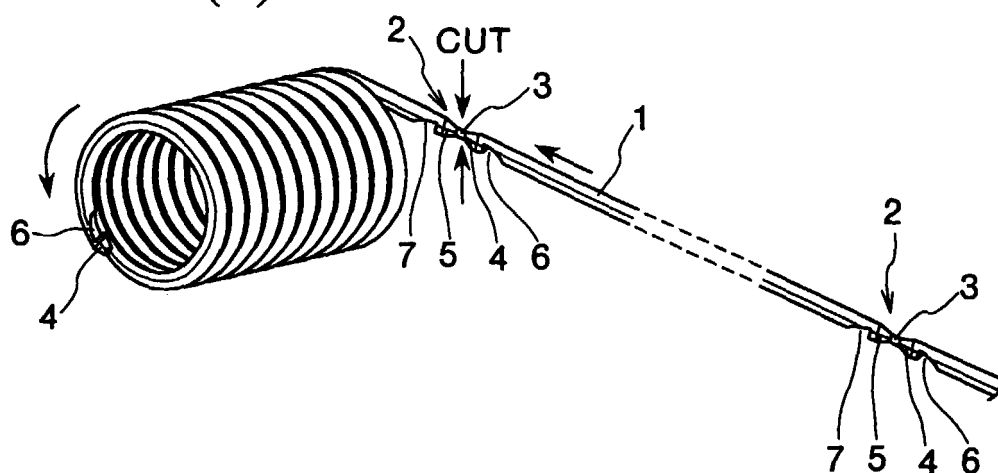


FIG. 2(b)

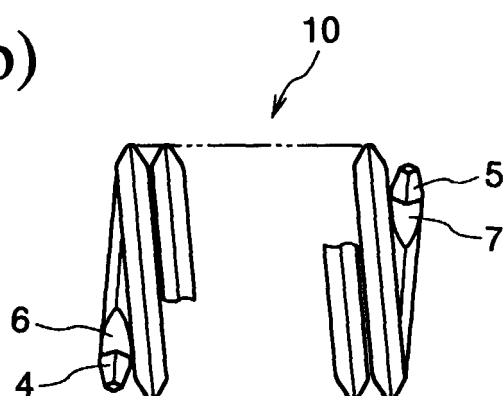


FIG. 2(c)

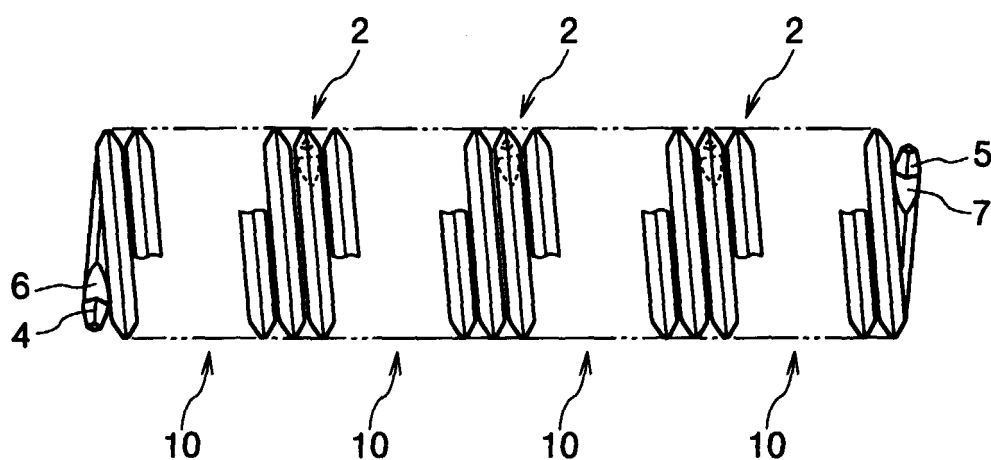


FIG. 3(a)

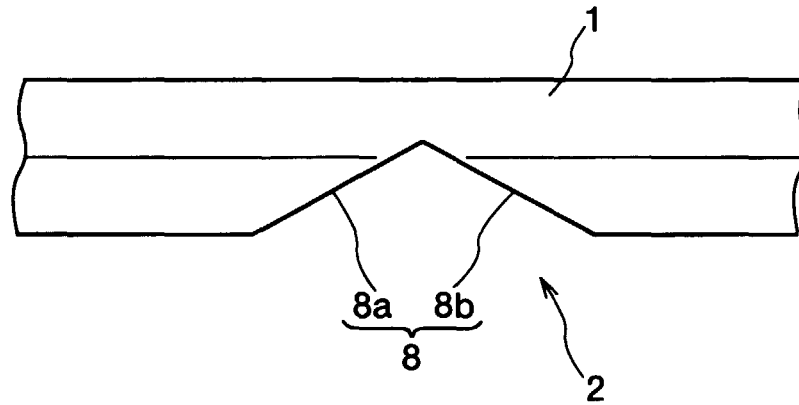


FIG. 3(b)

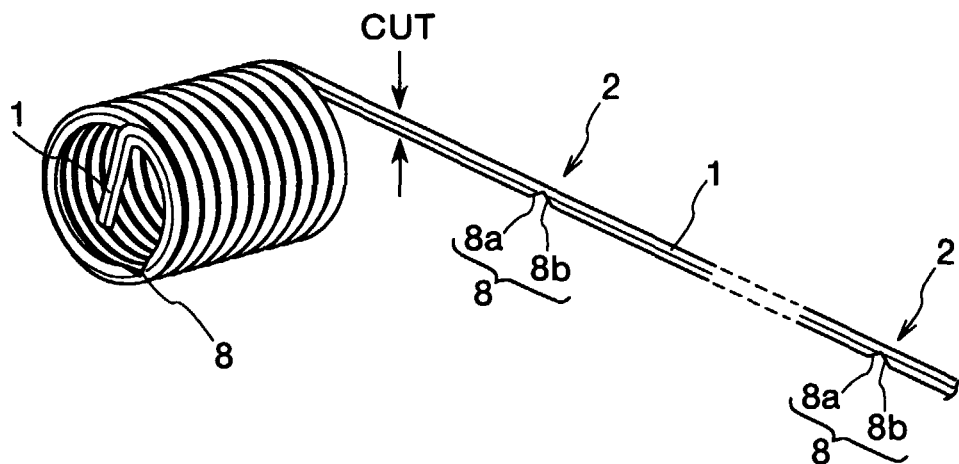


FIG. 3(c)

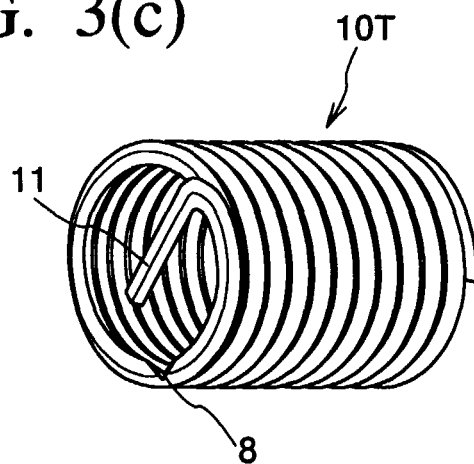


FIG. 4

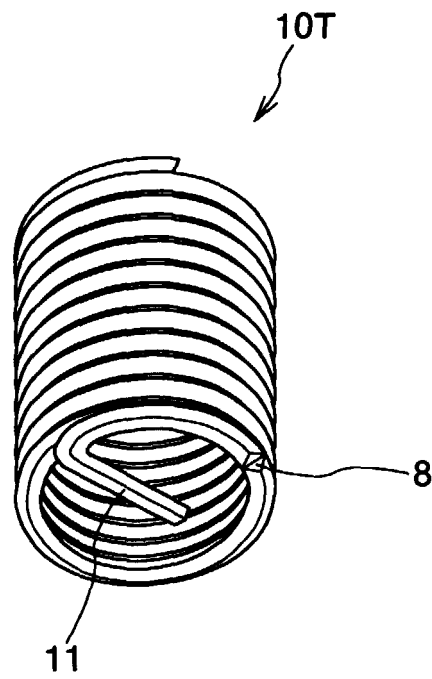


FIG. 5

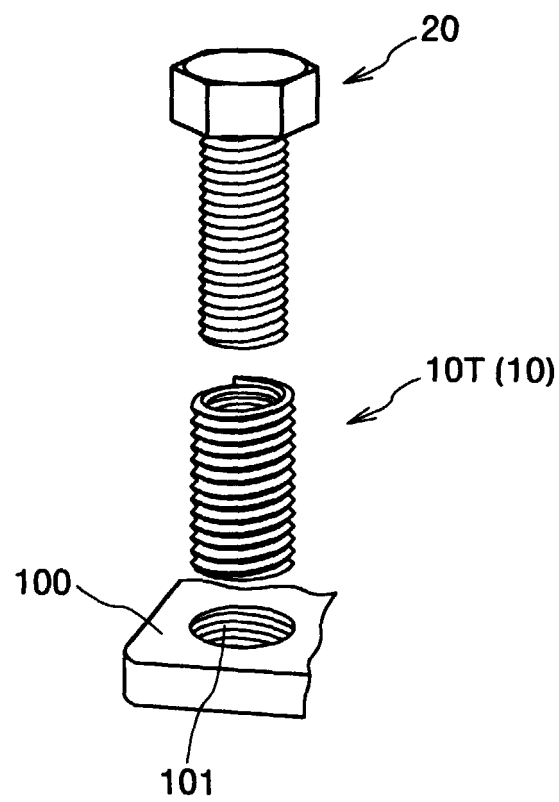


FIG. 6

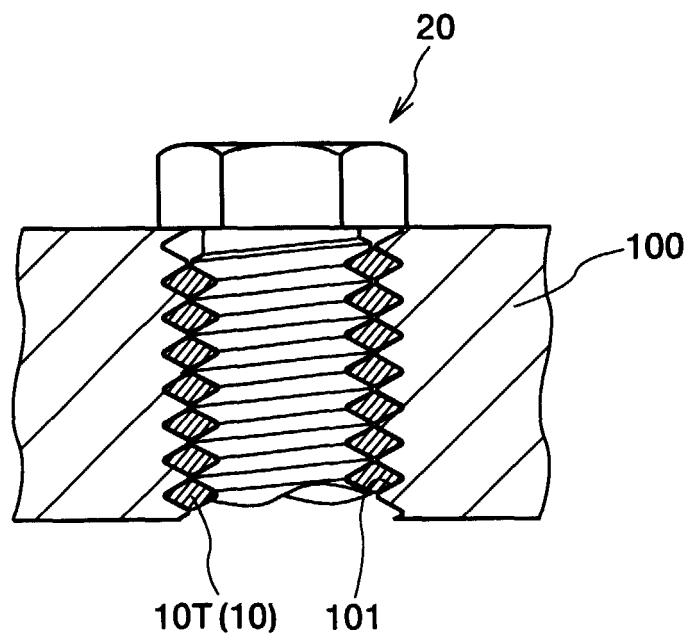


FIG. 7

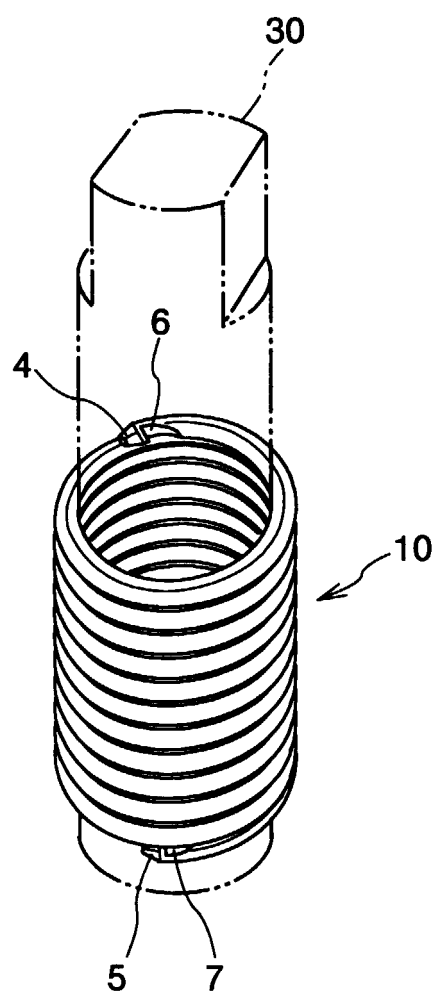


FIG. 8

