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(54) FASTENER BEING PRESSABLE INTO A METAL SHEET IN A WAY SAFE AGAINST ROTATION AND PRESSING OUT

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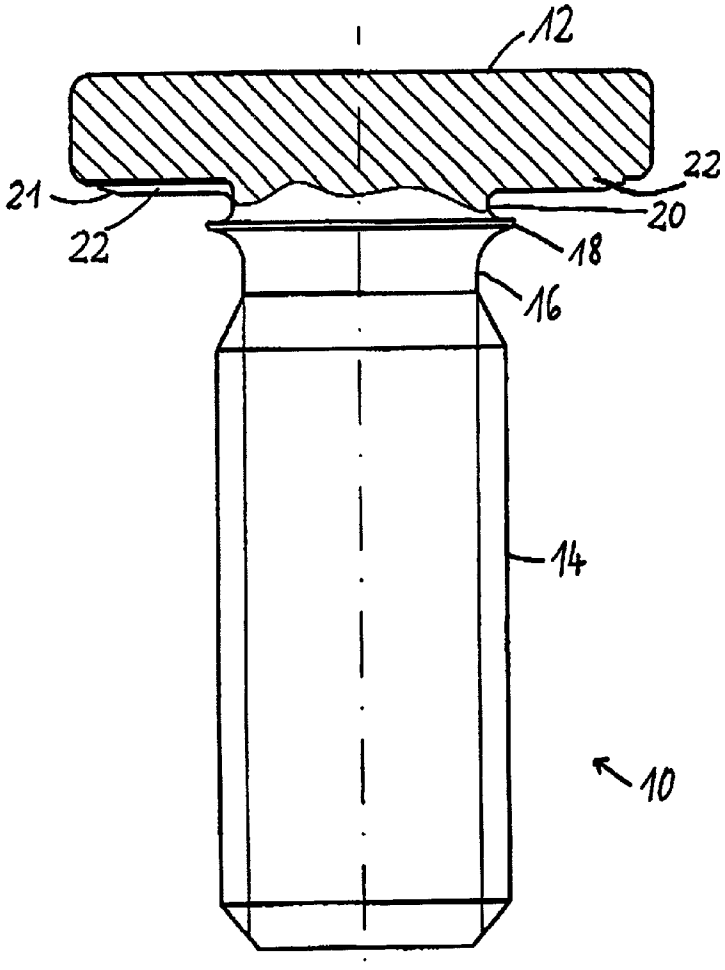
(57) **ABSTRACT**

A fastener (**10**) being pressable into a metal sheet in a way safe against rotation and pressing out having a head (**12**), the side of which after insertion facing the metal sheet is having radially positioned ridges (**22**), which, when setting the fastener (**10**), are pressed into the metal sheet, wherein a cylindrical thread-carrier (**14**) is positioned in the center of said ridges (**22**) projecting through the metal sheet beyond the other side of the metal sheet and which in the vicinity of the side of the head (**12**) facing the metal sheet in the set state is having a surrounding annular recess (**20**) into which the material of the metal sheet displaced during the setting can be pressed.



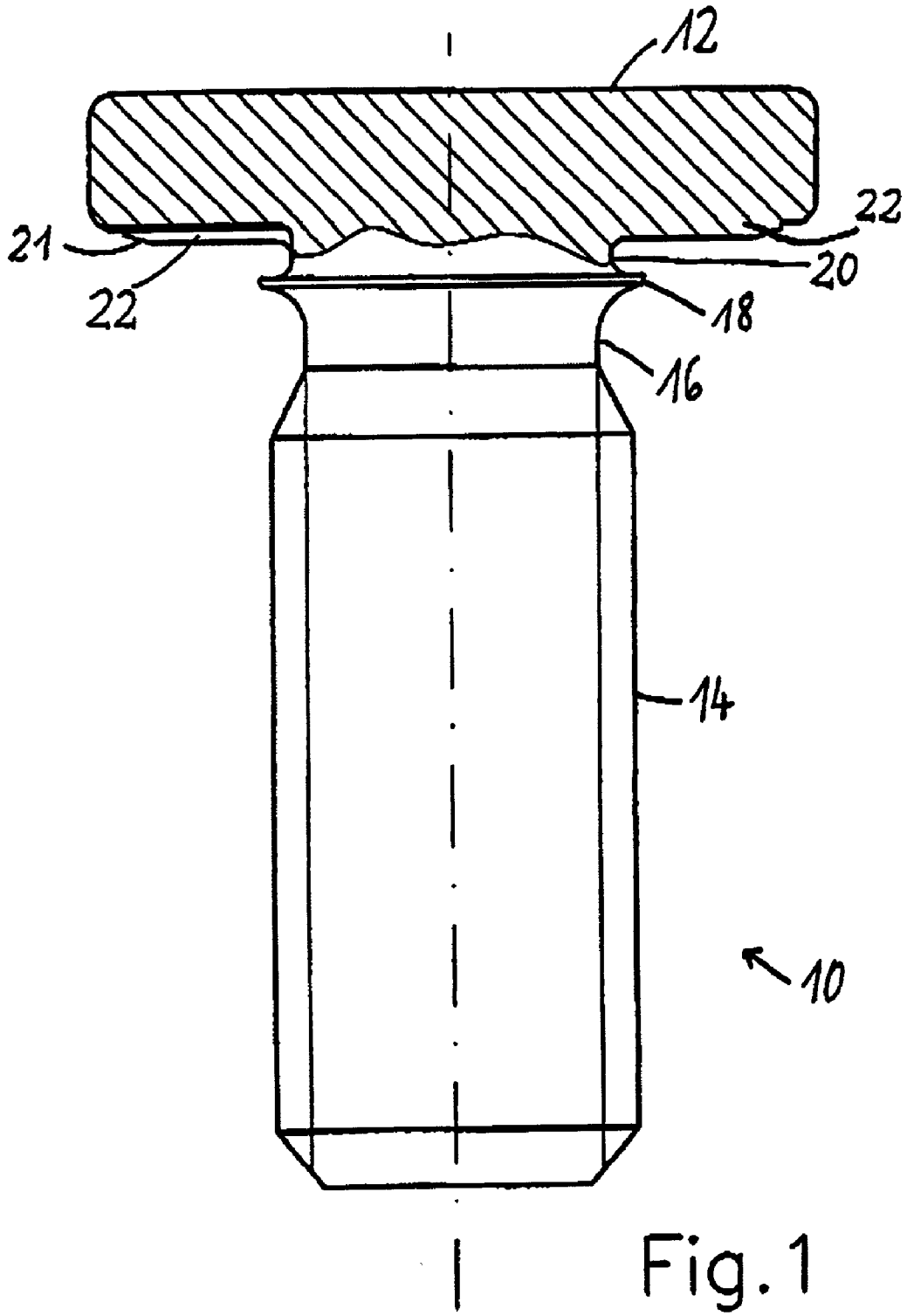


Fig. 1

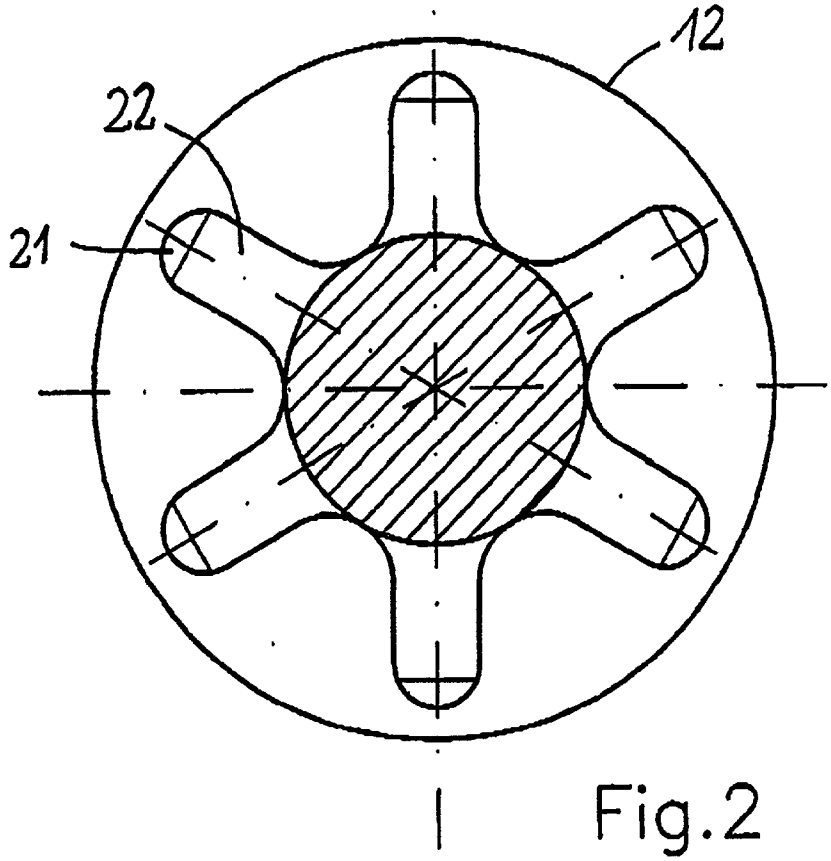


Fig.2

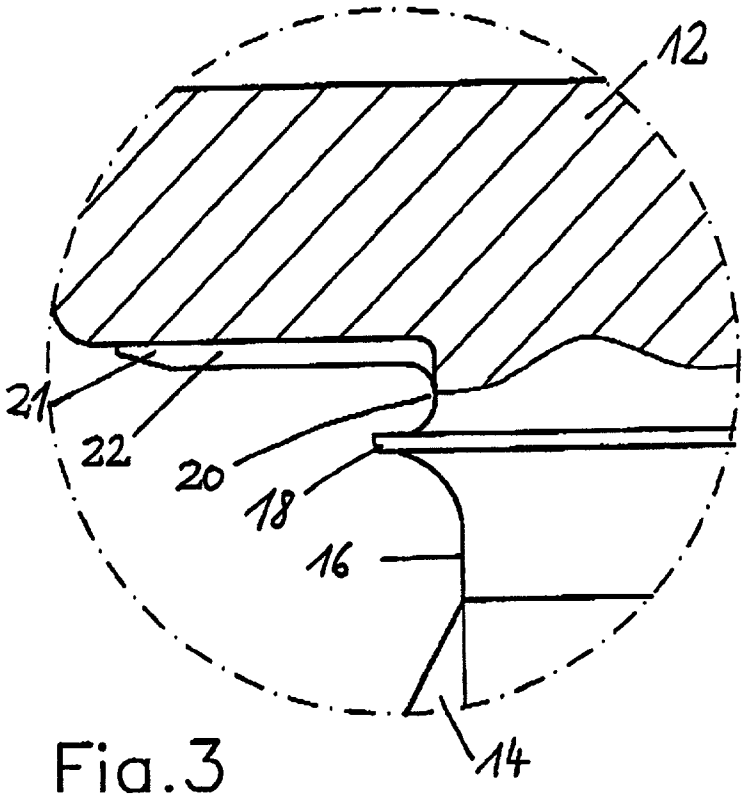


Fig.3

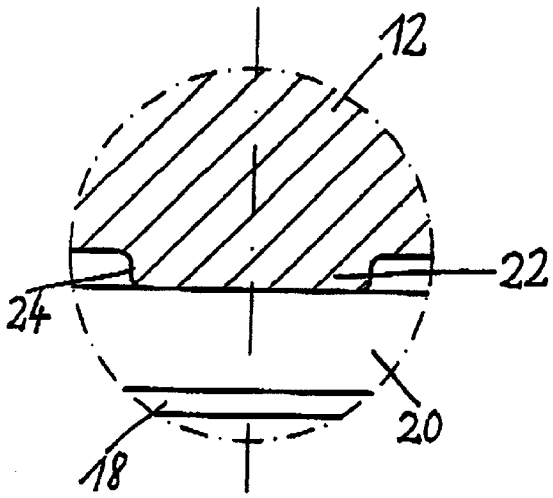


Fig.4

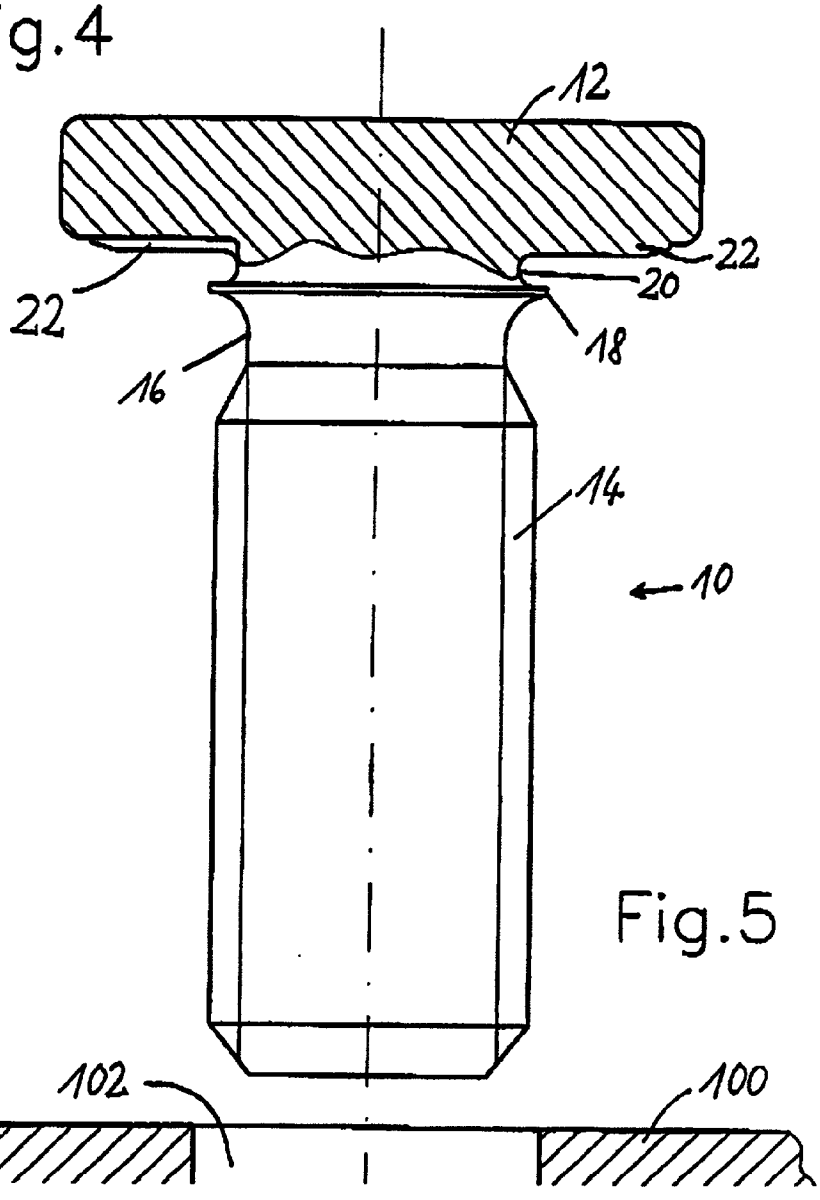


Fig.5

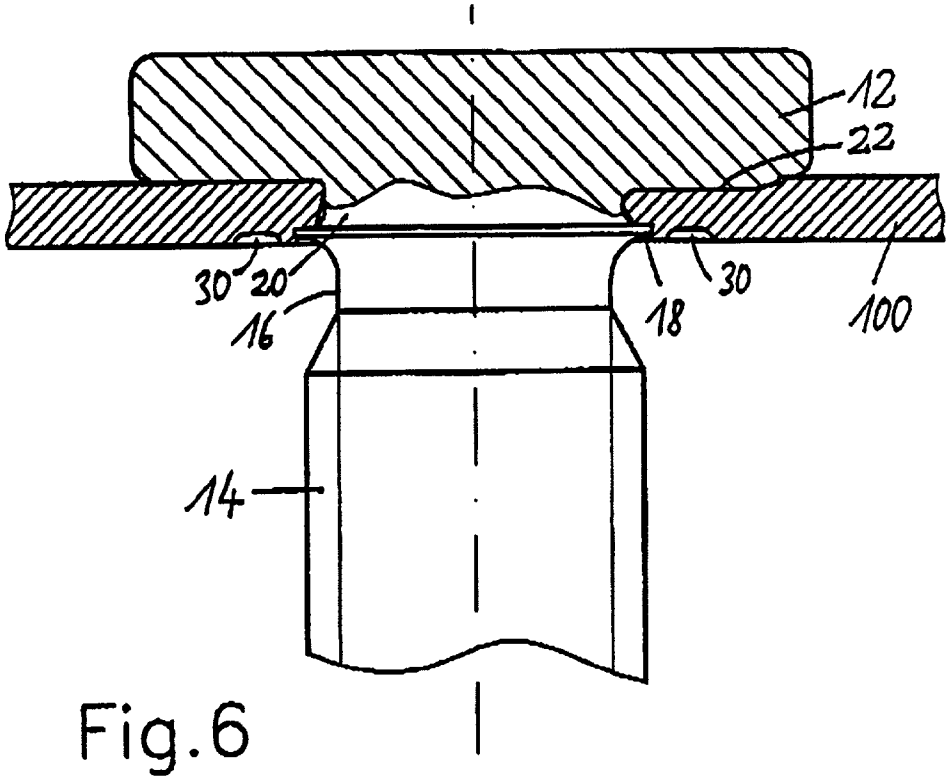


Fig.6

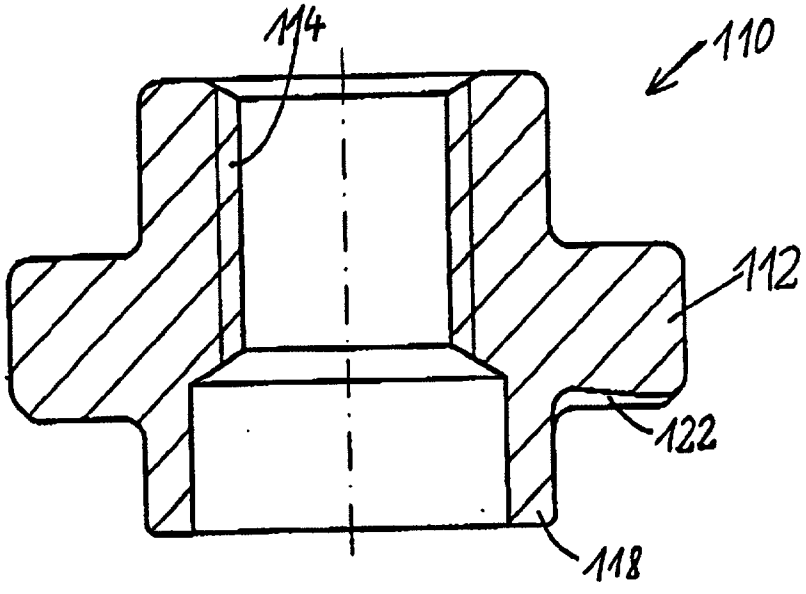


Fig.7

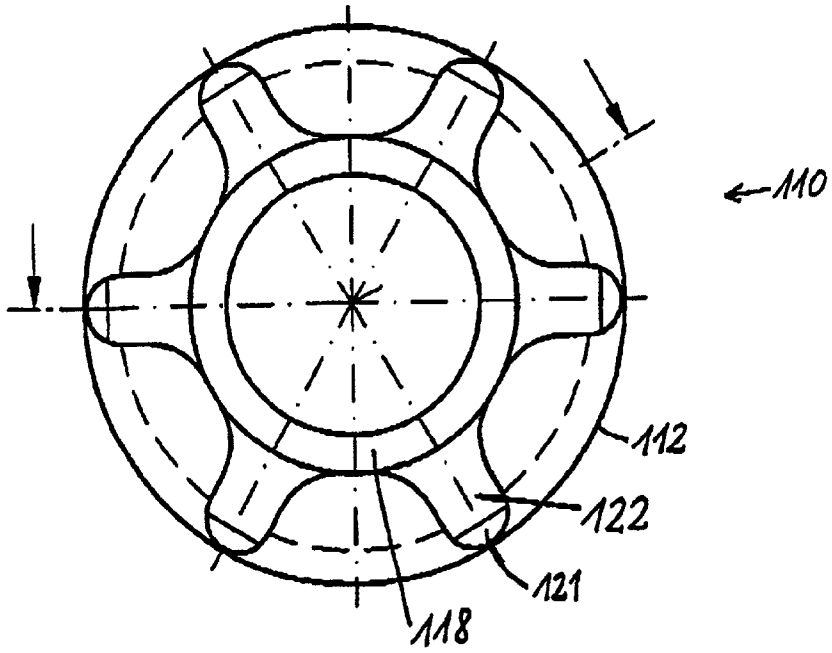


Fig.8

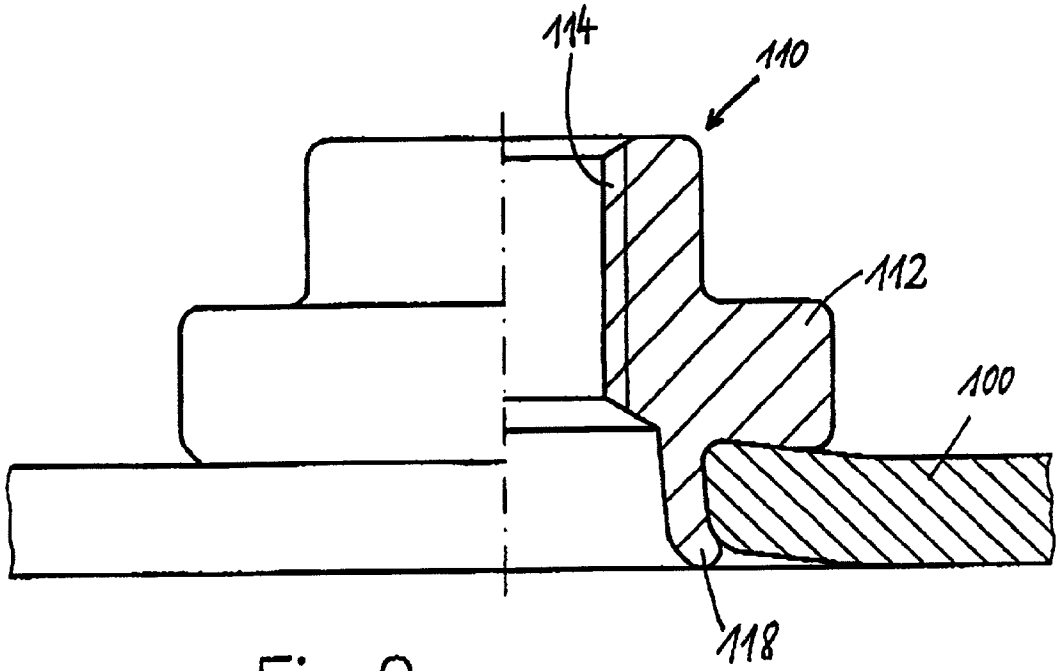


Fig.9

FASTENER BEING PRESSABLE INTO A METAL SHEET IN A WAY SAFE AGAINST ROTATION AND PRESSING OUT

[0001] The present invention relates to a fastener being pressable into a metal sheet in a way safe against rotation and pressing out, having a head or ring the side of which after insertion facing the metal sheet is having radially positioned ridges, which, when setting the fastener, are pressed into the metal sheet, wherein a cylindrical thread-carrier is positioned in the centre of said ridges projecting through the metal sheet beyond the other side of the metal sheet and which in the vicinity of the side of the head or ring facing the metal sheet in the set state is having an annular recess into which the material of the metal sheet displaced during the setting can be pressed.

[0002] Such fasteners can be performed as bolts (having a shaft with an exterior thread) as well as nuts (having a through bore with an interior thread). A corresponding fastener for example is known from WO 94/01688.

[0003] Similar constructions for example are known from the DE 44 10 475 A1, DE 195 35 537 A1 and WO 98/51934.

[0004] In all these known fasteners, the problem is existing that these cannot anymore be used with a thickness of the metal sheet about or below 1 mm or only can be used with a decreased function since the corresponding safety against rotation and pressing out is not given anymore.

[0005] Followingly, it is the task to be solved by the present invention to improve such a fastener in such a way that the fastener can be used with metal sheets having a thickness about and even below 1 mm and still achieving the sufficient safety against rotation and pressing out without a special preparation of the opening into which the fastener should be set being necessary. In solutions as e.g. according to DE 44 10 475 A1 or WO 94/01688 around the opening for setting a so-called "collar" of metal sheet has to be formed to achieve a sufficient safety against rotation and pressing out with thinner metal sheets. This necessitates in a disadvantageous way a further procedural step to form the corresponding "collar".

[0006] According to the state of art until now one has assumed that an optimal safety of the fastener against rotation and pressing out is achieved if in the vicinity of the thread-carrier as much space as possible is provided to receive the metal sheet material. With thinner metal sheets however not sufficient material of the metal sheet is present to fill such spaces. According to the prior art therefore auxiliary constructions have been used as for example the "collar" from the WO 94/01688.

[0007] Contrary to the above, the present invention starts out from the fact that for achieving an optimal safety against rotation and pressing out with thinner metal sheets not too much space for the displaced material of the metal sheet should be provided but only the volume, which by a deliberate deformation (flowing) of the metal sheet can be filled in an optimal way. This shaping into the annular recess is achieved by a flow shaping of the metal sheet material caused by the special shape of the ridges.

[0008] According to the invention, the above task is solved by the features that the ridges over a majority of their radial extension are having a constant height and width and are in the vicinity of the thread-carrier smoothly merging with the same with an increasing width.

[0009] By such a construction even with very thin metal sheets, a sufficient safety against rotation and pressing out of the fastener is achieved.

[0010] For a further improvement of the safety against rotation according to the invention it is preferred that the ridges are having a basically rectangular cross-section and their side walls are perpendicular to the side of the head facing the metal sheet. By this, the grip of the ridges in the metal sheet material is further improved.

[0011] To achieve a close contact of the head on the metal sheet and thereby to avoid the formation of gaps it is useful if the ridges in the radial exterior area are tapering off in a flat manner.

[0012] For this purpose, it is of advantage, too, if the ridges in the radial exterior area are tapering off sidewardly in a rounded manner.

[0013] In the following, the invention is more detailedly explained on the basis of two exemplary embodiments shown in the drawings. In the drawings show:

[0014] **FIG. 1 a** side view of a fastener as a bolt according to the invention;

[0015] **FIG. 2** the fastener according to **FIG. 1** in a bottom view, wherein the shaft is cut-off in the plane of the annular recess;

[0016] **FIG. 3 a** detailed view of the annular recess and the ridges of the fastener according to **FIG. 1**;

[0017] **FIG. 4 a** cross-sectional view of one ridge of the fastener according to **FIG. 1**, wherein the cross-section is across the longitudinal extension of the ridge;

[0018] **FIG. 5** the fastener according to **FIG. 1** shortly before being set in the metal sheet;

[0019] **FIG. 6** the fastener according to **FIG. 1** after setting in the metal sheet;

[0020] **FIG. 7 a** further embodiment according to the invention being performed as a nut, i.e. having an interior thread;

[0021] **FIG. 8** the fastener according to **FIG. 7** in a bottom view (i.e. seen from the side of the metal sheet), and

[0022] **FIG. 9** the fastener according to **FIG. 7** partly in section in the state set in a metal sheet.

[0023] **FIG. 1** is showing the fastener according to the invention in the form of a bolt, i.e. having a shaft with an exterior thread. The fastener **10** according to the invention is having a head **12** and a shaft **14** carrying an exterior thread. Between the thread and the head **12** in the following order there are provided a calibration collar **16**, an annular projection **18** and an annular groove **20** having a generally semi-circular cross-section. On the bottom side of the head **12**, which is facing the metal sheet during the setting of the fastener, there are provided radially extending ridges **22**, which in their radial extension generally having a constant height and which are tapering off in a flat manner merely in their radial exterior area **21**.

[0024] The head **12** is shown partly in cross-section, wherein, on the right aide, the corresponding ridge **22**, too, is shown in cross-section while the corresponding ridge **22** on the left aide is shown in front view.

[0025] **FIG. 2** is showing the head **12** of the fastener of **FIG. 1** in a bottom view, wherein the shaft is cut-off in the plane of the annular groove **20**. In **FIG. 2**, the shape of the ridges **22** is especially well shown. The ridges **22** extend in a radial direction with a generally constant width and merely in the radial exterior area **21** near the exterior edge of the screw head **12** are tapering off in their height in a flat manner and are rounded in their width. In the direction of the shaft **14**, the ridges **22** in a rounded manner are merging with the annular groove **20**.

[0026] **FIG. 3** is showing a detailed representation of the merger area between the head **12** and the thread-carrier **14**. In **FIG. 3**, the tapering off of the ridge **22** in the exterior area **21** is especially detailedly shown.

[0027] **FIG. 4** is showing a detail, namely, the cross-section of a ridge **22**, the section being across the radial direction of the head **12**. In this view, it is extremely well shown how the ridges **22** are shaped in their cross-section. The ridges **22** generally are having a flat rectangular cross-section and are limited by sidewalls **24** generally perpendicular to the level of the head **12**. Apart from that the surface of the ridges **22** facing the metal sheet during the setting generally are even and parallel to the plane of the head **12**.

[0028] **FIG. 5** is showing the fastener according to **FIG. 1** shortly before the insertion into a metal sheet **100** having a corresponding opening **102**. The diameter of the opening **102** is chosen such that the fastener can be inserted with the annular projection **18** just without contact.

[0029] In **FIG. 6** clearly the indentations **30** are shown caused by the counter tool during the setting. In the same clear way it is shown how the annular groove **20** in the area of a ridge **22** has been filled completely with the displaced material of the metal sheet (right side in **FIG. 6**) while on the left side in **FIG. 6** it is shown that in the area where there is no ridge **22** the annular recess **20** almost completely has been filled with the displaced material of the metal sheet.

[0030] The indentations **30** because of the embodiment of the ridges **22** according to the invention and because of the geometry of the annular recess can be performed in such a flat manner that no substantial decrease of the stiffness of the metal sheet even with metal sheets having a very small thickness is occurring.

[0031] **FIG. 7** is showing a further emobdiment of the invention, wherein in this case the invention has been performed with a fastener serving as a nut, i.e. a fastener having an interior thread.

[0032] This further fastener **110** according to the invention is serving as a pressable nut and basically is having a cylindrical shape. In the centre, the fastener is having a broad surrounding ring **112**. In a centre of the cylindrical fastener **110** there is a through-bore which at least over a part of the height of the fastener **110** is forming a thread-carrier **114** with an interior thread. Below the surrounding ring **112**, the central bore is increased in diameter, which means that in this area only a relatively thin annular surrounding ridge **118** is present.

[0033] The fastener **110** according to the invention is meant to be inserted with the ridge **118** first into a hole in a metal sheet **110**. On the side of the surrounding ring **112** facing the metal sheet **100** in the set state, i.e. on the underside thereof here, too, there are provided ridges **122** the shape of which being the same as the shape or the ridges **22** in the embodiment according to **FIG. 1**.

[0034] The shape and the position of the ridges **122** can be more clearly described with reference to **FIG. 8**. This is showing the fastener of **FIG. 7** from below. Here, too, the radially extending ridges **122** in their radial direction are having a basically constant width. Merely in the radially exterior area **122** they are rounded in their width and are tapering off in their height. Apart from that the same representation of the cross-section is valid for the ridges **122** as shown for the ridges **22** in **FIG. 4**. They therefore are having a basically flat surface directed downwardly and being parallel to the level of the ring **112** and sidewalls basically perpendicular thereto. Merely in the direction of the ring **118**, i.e. to the interior the ridges **122** in a rounded manner are merging with said ring, which means that they are having a rounded increase of their width in the radially interior area.

[0035] The bottom side of the ring **112** in the direction to the interior can be slightly recessed such that in this area the bottom side of the ring **112** not is horizontal but slightly concave.

[0036] **FIG. 9** is showing the fastener of **FIG. 7** in the set state. The fastener **110** is pressed into a hole in the metal sheet **100** having a corresponding diameter. In this connection, the hole in the metal sheet **100** should have a diameter, which makes it possible to insert the fastener **110** with the surrounding ridge **118** just without contact in the hole **102**. During the setting, the surrounding ridge **118** by a suitable counter tool is pressed to the exterior whereby the metal sheet is displaced into the edge between the surrounding ridge **118** and the ring **112** and between the corresponding ridges **122**. Thereby here, too, a corresponding safety against rotation and pressing out is achieved. In this case, too, the shape of the ridges **122** is of fundamental importance to achieve a complete filling of the space between the surrounding ridge **118** and the ring **112** even when setting the fastener according to the invention in a very thin metal sheet **100**.

1. Fastener being pressable into a metal sheet (**100**) in a way save against rotation and pressing out, having a head (**12**) or ring (**112**) the side of which after insertion facing the metal sheet (**100**) is having radially positioned ridges (**22**, **122**), which, when setting the fastener, are pressed into the metal sheet (**100**), wherein a cylindrical thread-carrier (**14**, **114**) is positioned in the centre of said ridges (**22**, **122**) projecting through the metal sheet (**100**) beyond the other side of the metal sheet (**100**) and which in the vicinity of the side of the head (**12**) or ring (**112**) facing the metal sheet (**100**) in the set state is having an annular recess (**20**, **120**) into which the material of the metal sheet (**100**) displaced during the setting can be pressed, characterized in that the

ridges (**20**, **122**) over a majority of their radial extension are having a constant height and width and are in the vicinity of the thread-carrier (**14**, **114**) smoothly merging with the same with an increasing width.

2. Fastener according to claim 1, characterized in that the ridges (**22**, **122**) are having a generally rectangular cross-section with their side walls (**24**) perpendicular to the side of the head (**12**) or ring (**112**) facing the metal sheet (**100**).

3. Fastener according to claim 1 or 2, characterized in that the ridges (**22**, **122**) in the radial exterior region (**21**, **121**) are tapering off in a flat manner.

4. Fastener according to any of the claims 1 to 3, characterized in that the ridges (**22**, **122**) in the radial exterior region (**21**, **121**) are tapering off in a sidewardly rounded manner.

5. Fastener according to any of the claims 1 to 4, characterized in that the fastener can be set in the metal sheet (**100**) having openings (**102**) without special additional shapes like colours or the like.

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