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(54) Threaded Locking Fastening Device

(57) In a threaded fastening device such as a nut or a bolt having a workpiece-engaging surface on which is formed a plurality of ratchet-like projections (15) of sawtooth cross-section, each projection has a first side edge (17) and a second side edge (18) with a leading point (19) which forms a high end of the projection, the point (19) facing in the opposite direction to the direction of tightening of the fastening device, and each of edges (17) is on a respective first line (22) and each of the edges (18) is on a respective second line (23) which crosses the first line, the lines (22,23) being formed at regular intervals such that a plurality of intersecting points of the first and second lines are formed between an outer edge and an inner edge of the engaging end surface thereby forming a plurality of circular rows of the above mentioned leading points (19) between the outer and inner edge of the engaging surface.

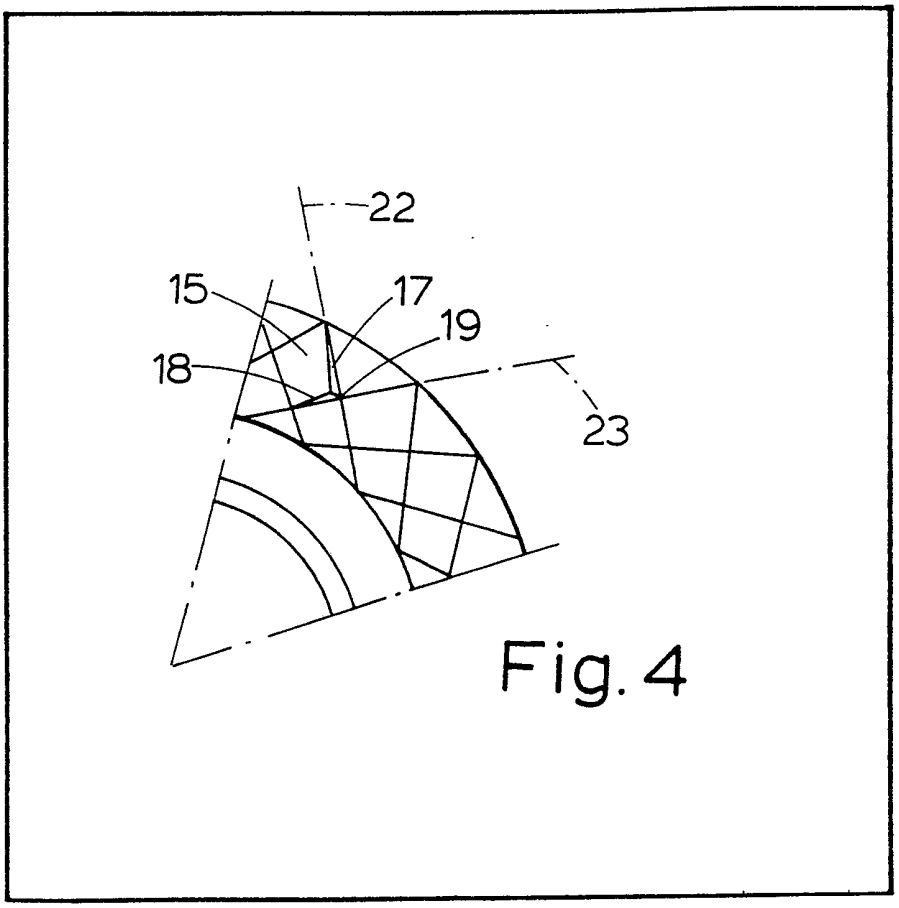

Fig. 4

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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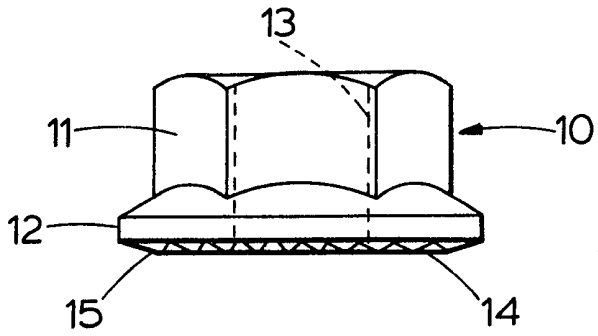

Fig.1

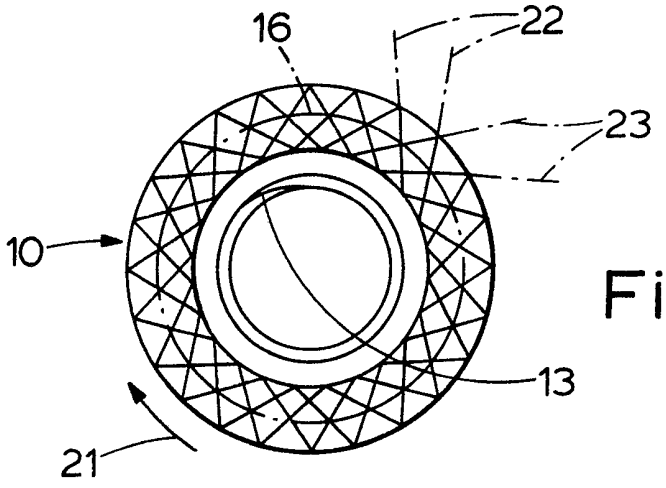

Fig.2

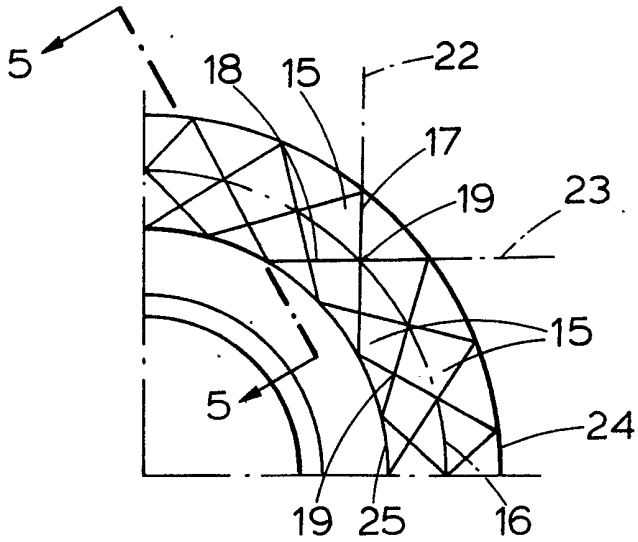

Fig.3

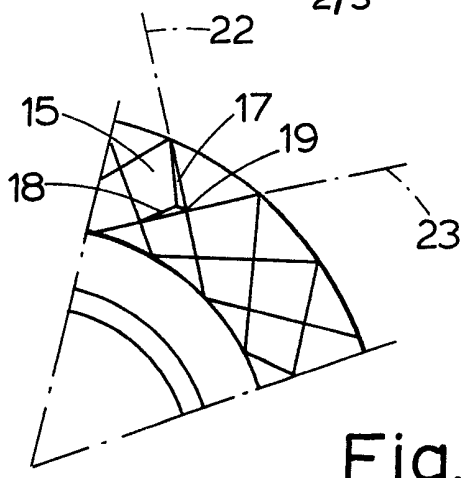

Fig. 4

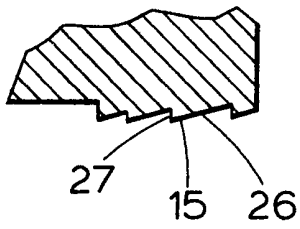

Fig. 5

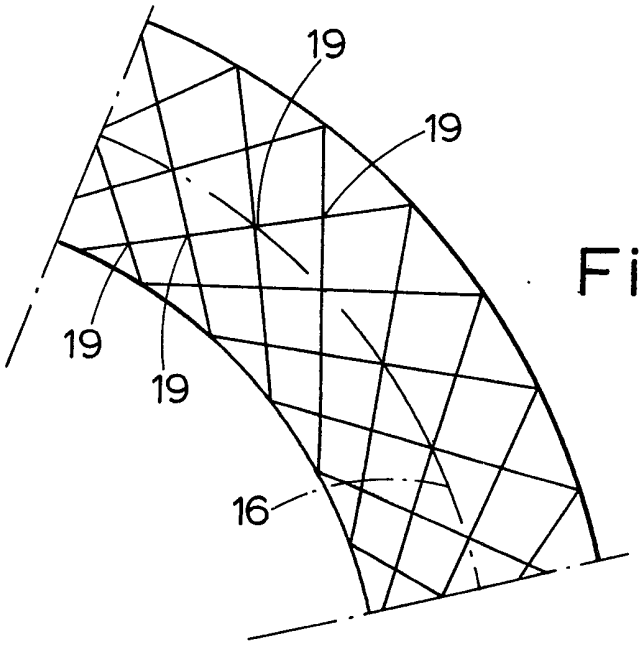

Fig. 6

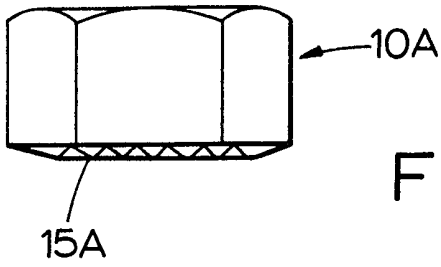

Fig. 7

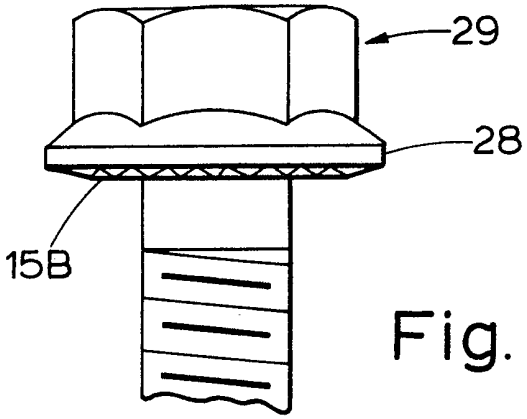

Fig. 8

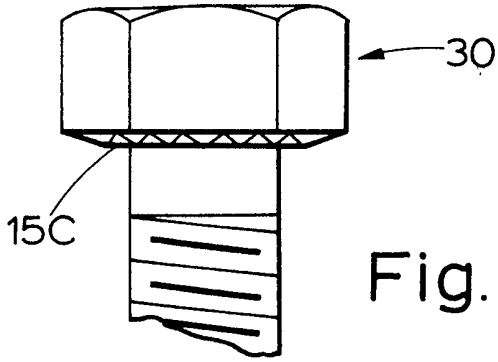

Fig. 9

SPECIFICATION

A Fastening Device

The present invention relates to a fastening device having a toothed engaging surface, and more particularly to a fastening device such as a bolt, a nut, or the like, having a lower engaging surface providing with teeth constructed and arranged to afford substantial resistance to loosening of the fastening device after it is brought into pressure engagement with an adjacent surface of a work piece by the tightening of the fastening device.

An object of the present invention is to provide an improved fastening device such as a nut or bolt having a toothed engaging surface such that the torque required to loosen the fastening device substantially exceeds the torque required to tighten it.

According to the invention there is provided a fastening device comprising a body having an engaging surface and threads concentric with the axis thereof; and a plurality of ratchet-like projections formed on the engaging surface, and projection being in the form of a sawtooth in cross section, each projection having a first side edge and a second side edge with a leading point which forms a high end of the projection, said points facing in the opposite direction to the direction of tightening of the fastening device, each of said first edges lying on a first tangent extending tangentially with respect the axis of the device and each of the said second edges lying on a second tangent which crosses the first tangent, the said first and second tangents being formed at regular intervals such that a plurality of intersecting points of the first and second lines are formed between an outer edge and an inner edge of the engaging end surface thereby forming a plurality of the said leading points between the outer and inner edge of the engaging surface.

The engaging surface of the threaded fastening device of the invention thus has ratchet-like projections each in the form of a "double-edge sword", whereby when the fastening device is turned in a loosening direction an adjacent work piece surface is cut by the projections and engaged with the latter without abrasion of or damage to the points of the projections, thereby obtaining locking action of the fastening device. All the projections on the engaging surface are capable of engaging on average with an adjacent workpiece when the fastening device is rotated in a loosening direction. The fastening device has a higher release torque to application torque ratio than generally known lock nuts or bolts having engaging projections.

In the accompanying drawings:

Figure 1 is a side view of an embodiment of the invention is the form of a flanged nut;

Figure 2 is an end view of the nut illustrated in Figure 1;

Figure 3 is a fragmentary enlarged end view of the nut of Figure 1;

Figure 4 is a fragmentary end view showing one projection of the nut of Figure 1;

Figure 5 is a fragmentary sectional view taken along the line 5—5 in Figure 3;

Figure 6 is a fragmentary enlarged end view of an another embodiment; and

Figure 7, 8 and 9 are respectively side views of other embodiments of the present invention, Figure 7 showing a nut, Figure 8 showing a bolt with a flanged head and Figure 9 showing a bolt with a non-flanged head.

Figures 1 to 5 show a threaded, flanged nut 10 provided with a body 11 having an annular flange 12 formed at a lower portion of the body, a threaded bore 13 extending axially through the body and an engaging end surface 14 having a number of ratchet-like projections 15. Each projection 15 has a first side edge 17 and a second side edge 18 terminating in a leading point 19 which is formed at a high end of the projection.

Each of the first edges 17 lies on an appropriate first tangent 22 extending tangentially with respect the axis of the nut, and each of the second edges 18 lies on an appropriate second tangent 23 which crosses the first tangent 22.

The first and second tangents 23 are formed on the engaging surface 14 at regular intervals and cross at approximately a right angle at points lying on an imaginary circle 16 which is located midway between an outer edge 24 and an inner edge 25 of the engaging surface 14. The interval between the tangent is such that a plurality of, and preferably two to five points 19 are formed between the outer and the inner edges 24, 25 of the engaging surface. In Figures 2 and 3, the number of the said points between the outer edge and the inner edge is two, and in the embodiment of Figure 6, the number is four.

Preferably, gently inclined surfaces 26 and sharply inclined surfaces 23 of the projections intersect substantially at right angles as shown in Figure 5.

In operation, it will be understood that the sharp angle points 19 of the projections on the engaging surface 14 serve as a spearheads when the nut is turned in a clockwise direction, that is, the loosening direction as shown by arrow 21 in Figure 2, thereby cutting into the surface on an adjacent work piece. The points 19 and edges 17 and 18 easily bite into the adjacent work piece and the projections are not abraded or damaged thereby.

In addition, each of the projections is compressed from the opposite sides by outer cut material and inner cut material of the work piece so as to cause a wedge effect on the projections, thereby increasing the locking action of the nut.

Furthermore, it will be understood that the projections in the radially outer portion of the engaging surface 14 have longer side edges 17 and 18 and points with larger angle as compared to the radially inner projections because the first and second tangents extend tangentially with respect the axis of the nut and cross each other. In

general, the coefficient of friction of the outer portion on the engaging end surface 14 is larger than that of the inner portion on the engaging surface, so that a larger torque load may be applied to the outer portion than the inner portion of the engaging surface. If all projections were to be uniform, the radially outer projections would be worn away earlier than the radially inner projections. In the present invention, the radially outer projections are larger than the radially inner projections, whereby all projections on the engaging end surface 14 may be engaged on average with the adjacent work piece when the fastening device is rotated in a loosening direction, thus obtaining an effective locking action of the fastening device.

Figure 7 shows an embodiment of the present invention in the form of a standard nut 10A in which projections 15A having the same form as the projections 15 in the first embodiment are provided to give the same locking action as in the case of the first embodiment.

Figure 8 and 9 illustrate other embodiments of the present invention in which projections 15B similar to the projections 15 are formed on the lower surface of a flange head 28 of a bolt 29 in Figure 8, and projections 15C similar to the projections 15 are formed on a standard headed bolt 30 in Figure 9. It will be understood that the bolts illustrated in Figures 8 and 9 achieve the same locking action as in the case of the embodiments of Figures 1 to 6.

Claims

1. A fastening device comprising a body having an engaging surface and threads concentric with the axis thereof; and a plurality of ratchet-like projections formed on the engaging surface, and projection being in the form of a sawtooth in cross section, each projection having a first side edge and a second side edge with a leading point which forms a high end of the projection, said points facing in the opposite direction to the direction of tightening of the fastening device, each of the said first edges lying on a first tangent extending tangentially with respect the axis of the device and each of the said second edges lying on a second tangent which crosses the first tangent, the said first and second tangents being formed at regular intervals such that a plurality of intersecting points of the first and second lines are formed between an outer edge and an inner edge of the engaging end surface thereby forming a plurality of the said leading points between the outer and inner edge of the engaging surface.

2. A fastening device as claimed in claim 1 wherein the first and second tangents cross at approximately right angles to one another midway between an outer edge and an inner edge of the engaging end surface.

3. A fastening device as claimed in claim 1 or 2 wherein the number of points formed between the outer edge and the inner edge of the engaging end surface is from two to five.

4. A fastening device as claimed in any one of claims 1 to 3 wherein the engaging surface is formed on the bottom surface of a flanged nut.

5. A fastening device as claimed in any one of claims 1 to 3 wherein the engaging surface is found on the bottom surface of a nut having a non-flanged head.

6. A fastening device as claimed in any one of claims 1 to 3 wherein the engaging surface is formed on the bottom surface of a flanged head of a bolt.

7. A fastening device as claimed in any one of claims 1 to 3 wherein the engaging surface is formed on the bottom surface of a bolt having a non-flanged head.

8. A fastening device substantially as herein described with reference to Figures 1 to 5, or Figure 6, or Figure 7, or Figure 8, or Figure 9, of the accompanying drawings.

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