

TITLE OF THE INVENTION

Tee Nut

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a tee nut, and more particularly, it relates to a tee nut comprising a hollow shaft portion which is provided with a female screw on its inner peripheral surface, and a flange portion, outwardly extending from an end of the shaft portion, provided with a plurality of pawls.

Description of the Background Art

Fig. 9 is a perspective view showing a conventional tee nut 1, which is of interest to the present invention.

The tee nut 1 comprises a shaft portion 2 and a flange portion 3 outwardly extending from a first end of the shaft portion 2, which are integrally made of a metal material. The shaft portion 2 is in the form of a hollow cylinder, which is provided with a female screw 4 on its inner peripheral surface. The female screw 4 is formed along the overall inner peripheral surface of the shaft portion 2.

On the other hand, the flange portion 3 is provided with two pairs of pawls 5, 6, 7 and 8, which are opposite to each other along a radial direction of the flange portion 3, extending from the first end toward a second

end of the shaft portion 2. These pawls 5 to 8 are formed by upwardly bending parts of the outer peripheral edge of the flange portion 3.

Such a tee nut 1 is fixed to an object such as a timber, for example, by inserting the shaft portion 2 in a hole which is previously provided in the object and driving the pawls 5 to 8 into the object. Upon such fixing to the object, the tee nut 1 is inhibited from rotation so that a screw member such as a bolt can be fitted with the female screw 4 which is formed on the inner peripheral surface of the shaft portion 2.

Such a tee nut 1 is generally called a "hopper feed tee nut", since the tee nut 1 can be smoothly moved along a feed track which is provided on a nut fixer for fixing the same to the object, for enabling automatic feeding. For example, British Patent No. 1,157,734 describes a type of such a hopper feed tee nut in detail.

Fig. 9 shows the aforementioned feed track 9 in phantom lines. This feed track 9 comprises a pair of guide rails 10 and 11 having C-shaped sections, which are symmetrically arranged to be opposite to each other. The flange portion 3 is received in these guide rails 10 and 11, so that the tee nut 1 is moved along the feed track 9 in a prescribed condition while locating the pawls 5 to 8 between the guide rails 10 and 11. The feed track 9 is

frequently bent to bring the tee nut 1 into a desired condition although such a bent state is not shown in Fig. 9, so that the shaft portion 2 is aligned with a hole which is provided in an object (not shown).

However, the aforementioned state of the tee nut 1 which is fixed to the object is maintained substantially only by the pawls 5 to 8 biting into the object. The pawls 5 to 8 thus biting into the object may be so loosened with time that the tee nut 1 is unfixed from the object at the worst. Figs. 10 and 11 show another conventional tee nut 12, which has been proposed in order to solve such a problem. Figs. 10 and 11 are a front elevational view and a bottom plan view showing the tee nut 12 respectively.

This tee nut 12 comprises a shaft portion 13 and a flange portion 14 outwardly extending from a first end of the shaft portion 13, which are integrally made of a metal material, similarly to the aforementioned tee nut 1. The shaft portion 13 is in the form of a hollow cylinder and has a prospective caulked portion 15 in a second end which is opposite to the aforementioned first end, while a female screw 16 is formed on an inner peripheral surface portion excluding the prospective caulked portion 15. The prospective caulked portion 15 has a relatively small thickness.

On the other hand, the flange portion 14 is provided with two pairs of pawls 17, 18, 19 and 20, which are opposite to each other along a radial direction of the flange portion 14, extending from the first end toward the second end of the shaft portion 13. These pawls 17 to 20 are formed by upwardly bending parts of the outer peripheral edge of the flange portion 14.

Such a tee nut 12 is used in the manner shown in Fig. 12, for example. Referring to Fig. 12, an object 21 such as a timber, for example, is previously provided with a through hole 22. The shaft portion 13 of the tee nut 12 is inserted in this through hole 22. In this state, the prospective caulked portion 15 shown in Fig. 10 is caulked by a caulker, so that a caulked portion 15a is formed on one surface of the object 21. At the same time, the pawls 17 to 20 are driven into the other surface of the object 21. Thus, the tee nut 12 is completely fixed to the object 21.

In such a mounting state of the tee nut 12, the pawls 17 to 20 inhibit the tee nut 12 from rotation with respect to the object 21, while the flange portion 14 and the caulked portion 15a hold the object 21 to inhibit disengagement of the tee nut 12 from the through hole 22. Thus, the tee nut 12 is strongly fixed to the object 21, and such a fixed state is semipermanently maintained.

This tee nut 12 is also applied as a "hopper feed tee nut", similarly to the aforementioned tee nut 1.

Therefore, the tee nut 12 is also moved along the feed track 9 shown in Fig. 9. When a plurality of such tee nuts 12 are moved along the feed track 9, however, the movement is frequently hindered as follows:

The flange portion 14 of the tee nut 12 is substantially in the form of a circle before formation of the pawls 17 to 20. Therefore, the pair of pawls 17 and 18 and the other pair of pawls 19 and 20 are coupled with each other by arcuate sides 23 and 24 respectively. When a plurality of tee nuts 12 are serially moved along the feed track 9 (see Fig. 9), therefore, the flange portions 14 tend to overlap with those of adjacent tee nuts 12. Consequently, the tee nuts 12 are frequently erroneously fed along the feed track 9 or clogged.

On the other hand, the flange portion 3 of the tee nut 1 shown in Fig. 9 is in the form of an octagon as a whole, and the paired ones of the two pairs of pawls 5, 6, 7 and 8 are coupled with each other by linear sides 25 and 26 respectively. When a plurality of such tee nuts 1 are fed along the feed track 9, therefore, the flange portions 3 relatively hardly cause the aforementioned overlapping phenomenon.

Thus, it is understood possible to reduce the

aforementioned overlapping phenomenon in the tee nut 12 shown in Figs. 10 and 11 by linearly changing the shapes of the arcuate sides 23 and 24 of the flange portion 14. However, the arcuate shapes cannot be so easily changed as hereinafter described, and in practice, it is impossible to find such a modified tee nut in the market:

In general, the tee nut 12 is obtained by drawing a strip-shaped metal plate. Such a strip-shaped metal plate is fed along a progressive die to be worked along prescribed order, so that an intermediate product is separated from the strip-shaped metal plate in a stage subjected to working for obtaining the tee nut 12 to some extent. This intermediate product has portions corresponding to the shaft portion 13 and the flange portion 14, with slits for forming the pawls 17 to 20. The intermediate product is then grasped by a chuck in the portion corresponding to the flange portion 14, so that the prospective caulked portion 15 and the female screw 16 are formed in the portion corresponding to the shaft portion 13 in this state. The prospective caulked portion 15 is formed by cutting the inner peripheral surface of the shaft portion 13 with a cutting tool for reducing the thickness. Thereafter the pawls 17 to 20 are raised up from the flange portion 14, to obtain the desired tee nut 12.

The flange portion 14 is substantially in the form of a circle in a stage before formation of the pawls 17 to 20 as hereinabove described, in relation to the grasping of the intermediate portion by a chuck in working for obtaining the prospective caulked portion 15. If the flange portion 14 to be grasped by the chuck has a substantially circular shape, it is possible to grasp the flange portion 14 by the chuck while properly centering the shaft portion 13 since the flange portion 14 has no directivity with respect to such chucking. In this case, further, the flange portion 14 has no corner in its outer peripheral portion, whereby no flash is caused by the chuck grasping the flange portion 14 since no outer peripheral part of the flange portion 14 is crushed by the chuck.

On the other hand, it is difficult to grasp the flange portion 3 having a substantially octagonal shape as shown in Fig. 9 by a chuck due to its directivity, while it is also difficult to center the shaft portion 2. When the flange portion 3 is grasped by a chuck, further, corners of the flange portion 3 may be compressively deformed to result in flashes. Such flashes inhibit the tee nut 1 from smooth movement along the feed track 9. While a chuck having a specific structure may be employed in order to solve the aforementioned problem, it is

necessary to regularly set the flange portion 3 along a constant direction with a complicated operation in this case.

In the tee nut 12 having the prospective caulked portion 15 as shown in Figs. 10 and 11, therefore, the flange portion 14 must be substantially in the form of a circle in a stage before formation of the pawls 17 to 20.

SUMMARY OF THE INVENTION

Accordingly, an object of the present invention is to provide, in relation to a tee nut comprising a prospective caulked portion, a structure which can prevent a flange portion from overlapping with that of another tee nut during movement along a feed track.

The present invention is directed to a tee nut which comprises a shaft portion and a flange portion outwardly extending from a first end of the shaft portion, which are integrally made of a metal material. The shaft portion is in the form of a hollow cylinder and has a relatively thin prospective caulked portion on a second end which is opposite to the first end, while a female screw is formed on an inner peripheral surface portion excluding the prospective caulked portion. Two pairs of pawls are arranged on an outer peripheral portion of the flange portion in opposite positions along a radial direction of the flange portion, to extend from the first end toward

the second end. A peripheral edge of the flange portion has such a shape that paired ones of the two pairs of pawls are coupled with each other by substantially linear sides respectively.

As hereinabove described, the tee nut according to the present invention is provided with a relatively thin prospective caulked portion in its shaft portion, while the flange portion comprises substantially linear sides. In order to obtain such a structure, it is necessary to solve the aforementioned problem resulting from a chuck grasping the flange portion, while this problem can be solved in the following manner, for example: When the tee nut according to the present invention is manufactured, the relatively thin prospective caulked portion is formed by forging, for example, in a stage of an intermediate product for the tee nut which is not yet separated from a strip-shaped metal plate. Thus, it is not necessary to grasp each intermediate product by a chuck and cut the same with a cutting tool in this state for forming the prospective caulked portion. The present invention is not directed to a method of manufacturing a tee nut. Therefore, the method of manufacturing the tee nut is not restricted to the above.

When a plurality of tee nuts according to the present invention are serially moved along a feed track,

respective flange portions of adjacent tee nuts are in contact with each other in portions of substantially linear sides coupling paired ones of pawls. Therefore, the flange portions hardly overlap with those adjacent thereto.

When the tee nut according to the present invention is fixed to an object, on the other hand, the pawls bite into the object to inhibit the tee nut from rotation with respect to the object, while the prospective caulked portion is so caulked that the as-caulked portion and the flange portion hold the object to inhibit the tee nut from falling or coming off from the object.

According to the present invention, therefore, it is possible to prevent the flange portions from overlapping with those adjacent thereto when a plurality of tee nuts are moved along a feed track, thereby smoothly moving the plurality of tee nuts along the feed track.

On the other hand, the tee nut according to the present invention comprises a prospective caulked portion although the same has a flange portion which is provided with substantially linear sides, whereby the tee nut can be strongly mounted on an object, while it is possible to maintain the tee nut in an excellently fixed state even if the object causes a dimensional change with time such as contraction caused in a timber due to drying, for example.

When the pawls of the tee nut according to the present invention are indented or in the form of hooks, it is possible to further strongly fix the tee nut to the object.

The tee nut according to the present invention may be further provided with protrusions, projecting in the same direction as the pawls, in opposite directions along a radial direction which is perpendicular to that opposing the two pairs of pawls. When the tee nut is moved along a feed track, these protrusions are located in a pair of guide rails which are provided in the feed track. Thus, clearances of the guide rails are substantially blocked with such protrusions, whereby the flange portion is prevented from upward movement in the guide rails. This also prevents the flange portion from overlapping with that adjacent thereto. The protrusions contribute to smooth movement of the tee nut along the feed track also in the following mode: Formation of the pawls in the flange portion often results in flashes which project in the same direction as the pawls. Such flashes inhibit the tee nut from smooth movement along the feed track. Therefore, the flashes are generally removed by barrel polishing. However, it is relatively difficult to completely remove the flashes. Even if the flashes are incompletely or not in the least removed, it is possible

to allow the aforementioned protrusions outwardly project beyond the flashes, thereby preventing the flashes from inhibiting the movement of the tee nut along the feed track.

According to the present invention, the thread of the female screw may be partially irregularized. In this case, a male screw of a bolt fitted with the female screw requires relatively large force to pass through the irregularized part of the female screw, while this means that large force is also required when the male screw of the bolt is unfixed from the female screw. Once the bolt is fitted with the female screw of the tee nut, therefore, the irregularized part of the female screw is adapted to lock such a fitted state.

The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing a tee nut 31 according to a first embodiment of the present invention;

Fig. 2 is a front elevational view of the tee nut 31 shown in Fig. 1;

Fig. 3 is a bottom plan view of the tee nut 31 shown

in Fig. 1;

Fig. 4 is a sectional view taken along the line IV - IV in Fig. 3;

Fig. 5 is a perspective view showing a tee nut 46 according to a second embodiment of the present invention;

Fig. 6 is a front elevational view showing a pawl 49 of a tee nut according to a third embodiment of the present invention;

Fig. 7 is a front elevational view showing a pawl 50 of a tee nut according to a fourth embodiment of the present invention;

Fig. 8 is a sectional view showing a female screw forming portion 35 of a shaft portion 32 of a tee nut according to a fifth embodiment of the present invention;

Fig. 9 is a perspective view showing a conventional tee nut 1, which is of interest to the present invention;

Fig. 10 is a front elevational view showing another conventional tee nut 12, which is of interest to the present invention;

Fig. 11 is a bottom plan view of the tee nut 12 shown in Fig. 10;

Fig. 12 is a sectional view showing a used state of the tee nut 12 shown in Fig. 10;

Fig. 13 is a perspective view showing a tee nut 85 according to a sixth embodiment of the present invention;

Fig. 14 is a plan view of the tee nut 85 shown in Fig. 13; and

Fig. 15 is a side elevational view of the tee nut 85 shown in Fig. 13.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figs. 1 to 4 show a tee nut 31 according to a first embodiment of the present invention. Fig. 1 is a perspective view of the tee nut 31 and Fig. 2 is a front elevational view of the tee nut 31, while Fig. 3 is a bottom plan view of the tee nut 31 and Fig. 4 is a sectional view taken along the line IV - IV in Fig. 3.

The tee nut 31, which is integrally obtained by drawing a ferrous metal plate, for example, comprises a shaft portion 32 and a flange portion 32 outwardly extending from a first end of the shaft portion 32.

The shaft portion 32 is in the form of a hollow cylinder similarly to the conventional tee nut 12 shown in Figs. 10 and 11, and provided with a prospective caulked portion 34 in a second end which is opposite to the first end. A portion of the shaft portion 32 excluding the prospective caulked portion 34 defines a female screw forming portion 35, so that a female screw 36 is formed on an inner peripheral surface of the female screw forming portion 35. The prospective caulked portion 34 is smaller in thickness than the female screw forming portion 35.

Thus, thread cutting for forming the female screw 36 can be started from either the first or second end of the shaft portion 32.

Similarly to the conventional tee nut 1 shown in Fig. 9, two pairs of pawls 37, 38, 39 and 40, extending from the first end toward the second end of the shaft portion 32, are arranged on an outer periphery of the flange portion 33 to be opposite to each other along a radial direction of the flange portion 33. These pawls 37 to 40 are formed by upwardly bending parts of the outer peripheral edge of the flange portion 33. The pawls 37 to 40 are indented respectively.

The flange portion 33 is substantially in the form of an octagon as a whole, similarly to the flange portion 3 shown in Fig. 9. In particular, the pair of pawls 37 and 38 and the other pair of pawls 39 and 40 are coupled with each other through linear sides 41 and 42 respectively.

Fig. 1 shows a feed track 43 for serially feeding a plurality of tee nuts 31 in phantom lines. This feed track 43 comprises a pair of symmetrically arranged guide rails 44 and 45 having C-shaped sections, similarly to the feed track 9 shown in Fig. 9. The flange portions 33 are received in the respective ones of the guide rails 44 and 45, between which the pawls 37 to 40 are located, so that the tee nuts 31 are moved along the feed track 43. At

this time, the linear side 41 or 42 of the flange portion 33 of each tee nut 31 faces the linear side 41 or 42 of the flange portion 33 of the tee nut 31 which is adjacent thereto. Thus, the flange portions 33 are prevented from overlapping with the adjacent flange portions 33.

Each tee nut 31 is fixed to an object in the aforementioned mode shown in Fig. 12. Namely, the shaft portion 32 is inserted in a through hole which is previously formed in the object, so that the prospective caulked portion 34 is subjected to caulking and the pawls 37 to 40 bite into the object in this state. Thus, the tee nut 31 is strongly and semipermanently fixed to the object.

Fig. 5 is a perspective view corresponding to Fig. 1, showing a tee nut 46 according to a second embodiment of the present invention. This tee nut 46 includes a number of elements which are common to those of the aforementioned tee nut 31, and hence the elements of the former corresponding to those of the latter are denoted by similar reference numerals, to omit redundant description.

Protrusions 47 and 48 are provided on a peripheral edge portion of the tee nut 46 in opposite positions along a radial direction which is perpendicular to that opposing two pairs of pawls 37, 38, 39 and 40 respectively. These protrusions 47 and 48 project toward a second end of a

shaft portion 32, similarly to the pawls 37 to 40. Such protrusions 47 and 48 are formed by inwardly crushing parts of the outer peripheral edge of a flange portion 33 from the exterior. Consequently, notches having substantially semicircular sections are left in the outer peripheral edge of the flange portion 33.

Fig. 5 shows a feed track 43 in phantom lines. When the flange portion 33 is received in respective ones of guide rails 44 and 45 which are provided in the feed track 43, the protrusions 47 and 48 are located in the guide rails 44 and 45 respectively. In this state, it is possible to substantially block clearances in the guide rails 44 and 45 with the protrusions 47 and 48.

Therefore, the flange portion 33 of the tee nut 46 is prevented from upward movement in the guide rails 44 and 45, and this also prevents the flange portion 33 from overlapping with a flange portion 33 of an adjacent tee nut 46. Even if the protrusions 47 and 48 are in contact with the guide rails 44 and 45, it is possible to extremely reduce frictional resistance therebetween when the protrusions 47 and 48 have pointed forward ends. This also contributes to smooth movement of the tee nut 46 along the feed track 43.

Formation of the protrusions 47 and 48 is not restricted to the aforementioned method, but the

protrusions 47 and 48 may alternatively be formed by bending parts of the peripheral edge of the flange portion 33 or pressing parts of the flange portion 33 in a direction perpendicular to its surface direction.

The tee nut 46 shown in Fig. 5 is different in inessential points from the tee nut 31 shown in Fig. 1, in addition to the provision of the protrusions 47 and 48. First, the shaft portion 32 of the tee nut 46 is longer than that of the tee nut 31. This means that the length of the shaft portion 32 can be changed in various ways at desire. Second, indented shapes of the pawls 37 to 40 of the tee nut 46 are slightly different from those of the tee nut 31. This means that the indented shapes of the pawls 37 to 40 can be also changed in various ways.

Figs. 6 and 7, each corresponding to a part of Fig. 2, show third and fourth embodiments of the present invention. These figures show modifications of pawls respectively.

A pawl 49 shown in Fig. 6 is in the form of a hook. On the other hand, a pawl 50 shown in Fig. 7 is neither indented nor hook-shaped, but has a straight shape. Thus, the shapes of the pawls are not particularly restricted in the tee nut according to the present invention.

Fig. 8 shows a fifth embodiment of the present invention, in correspondence to a part of Fig. 4.

Referring to Fig. 8, elements corresponding to those shown in Fig. 4 are denoted by similar reference numerals, to omit redundant description.

Parts of an outer peripheral surface of a female screw forming portion 35, which is provided on a shaft portion 32, are so inwardly crushed as to form two concave portions 51 and 52 with an angular space of 180° , for example. Such concave portions 51 and 52 are formed by holding prescribed parts of the female screw forming portion 35 with a pair of proper tools and strongly pressing these tools against the female screw forming portion 35. The concave portions 51 and 52 are preferably formed in positions which are close to a flange portion 33. If the pair of tools are driven in positions far from the flange portion 33, the concave portions 51 and 52 are hardly formed and the section of the shaft portion 32 is easily flatly deformed. Further, the concave portions 51 and 52 are preferably formed in a stage before formation of pawls 37 to 40 (Fig. 1) in the flange portion 33, so that such pawls 37 to 40 will not hinder formation of the concave portions 51 and 52 in the vicinity of the flange portion 33.

Although the tee nut according to this embodiment is provided with two concave portions 51 and 52, the number of such concave portions is not restricted to two but the

inventive tee nut may alternatively be provided with only one, or three or more concave portions, for example.

Upon formation of the concave portions 51 and 52, the thread of a female screw 36 is partially irregularized. Thus, a bolt (not shown) which is fitted with the female screw 36 cannot pass through such irregularized portions 53 and 54 unless the same is relatively strongly rotated. At this time, the thread may be partially crushed in the irregularized portions. Consequently, the bolt is locked in the state fitted with the female screw 36, and prevented from disengagement from the tee nut.

While the present invention has been described with reference to the embodiments shown in the drawings, the flange portion is not restricted to an octagonal shape but may have another shape so far as the pairs of pawls are coupled with each other by substantially linear sides.

Figs. 13 to 15 show a tee nut 85 of a "hopper feed tee nut" type, which is characterized in shapes of outer peripheral edges of a flange portion 86 as compared with the tee nut 31 shown in Figs. 1 to 4. Between pairs of pawls 87 which are close to each other, the outer peripheral edges of the flange portion 86 define slightly arcuate edges 88 for providing shallow cavities. As clearly understood from Fig. 15, both ends of each arcuate edge 88 forming base portions of the pawls 87 are provided

with rounded shapes 89. Further, each arcuate edge 88 is formed with a burr 90 which protrudes in the same direction as the pawls 87. This tee nut 85 comprises a shaft portion 94 having a portion 91 to be caulked and a female screw forming portion 93 with a female screw 92 formed thereon, similarly to the aforementioned tee nut 31.



WHAT IS CLAIMS IS:

1. A tee nut being made of an integral metal material and comprising a shaft portion (94) and a flange portion (86) outwardly extending from a first end of said shaft portion (94),

said shaft portion (94) being in the form of a hollow cylinder and having a female screw (92) formed on its inner peripheral surface,

two pairs of pawls (87) being arranged on an outer periphery of said flange portion in opposite positions along a radial direction of said flange portion (86) to extend from said first end toward said second end, wherein

an outer peripheral edge of said flange portion (86) has a continuous arcuate inward concave entirely over its length between paired ones of said two pairs of pawls (87) as viewed from said second end toward said first end.

2. The tee nut according to claim A, wherein the outer peripheral edge of said flange portion (86) positioned between said paired ones of said two pairs of pawls (87) has such a rounded shape (89) that positions base portions of each said pawl (86) closer to said second end.



3. The tee nut according to claim A or A1, wherein the outer peripheral edge of said flange portion (86) positioned between said paired ones of said two pairs of pawls (87) has a burr (90) generated during cutting, protruding toward said second end left unremoved.