

July 17, 1956

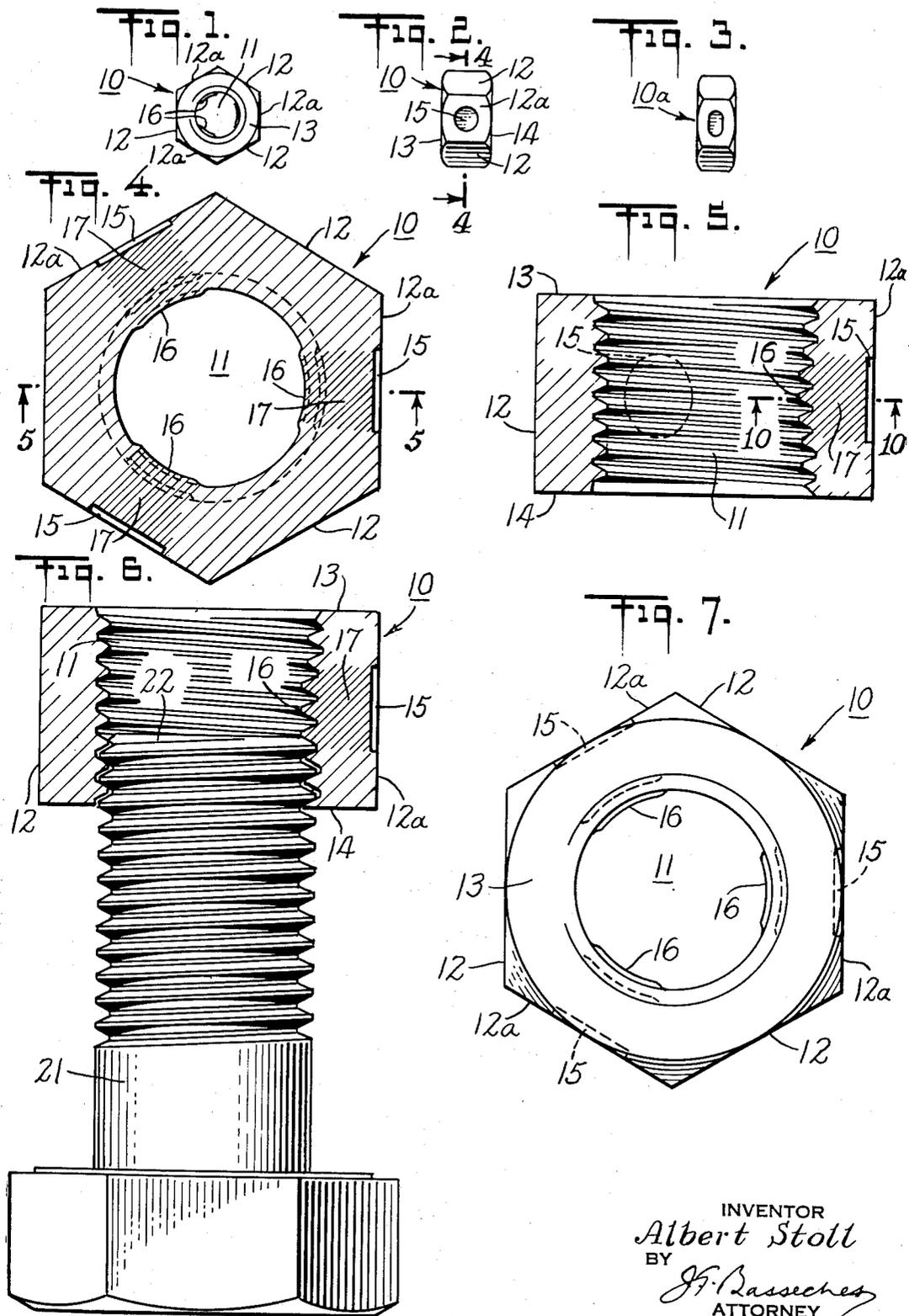
A. STOLL

2,754,871

SELF-LOCKING NUT HAVING A RADIALLY DEFORMED THREAD  
PORTION AND METHOD FOR THE PRODUCTION OF THE SAME

Filed Sept. 4, 1952

3 Sheets-Sheet 1



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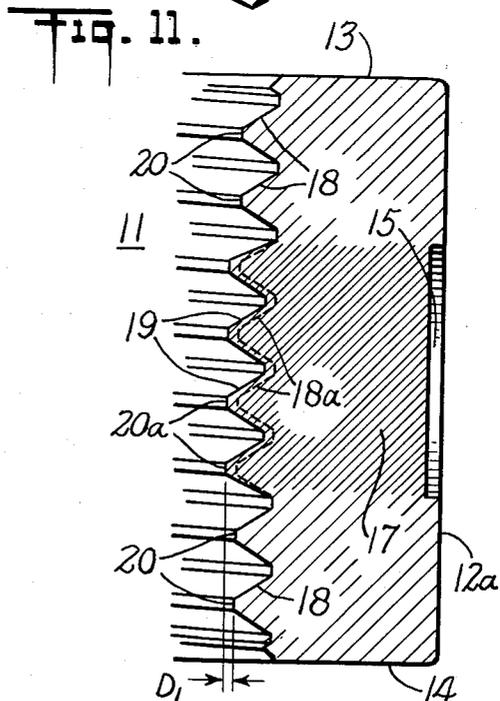
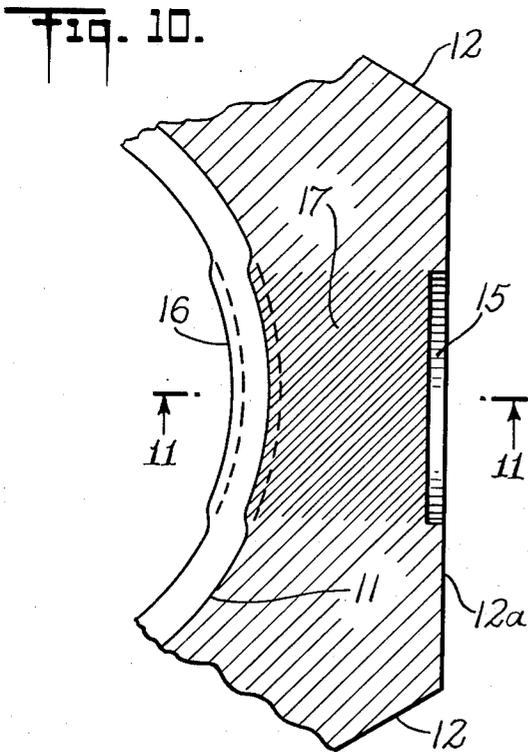
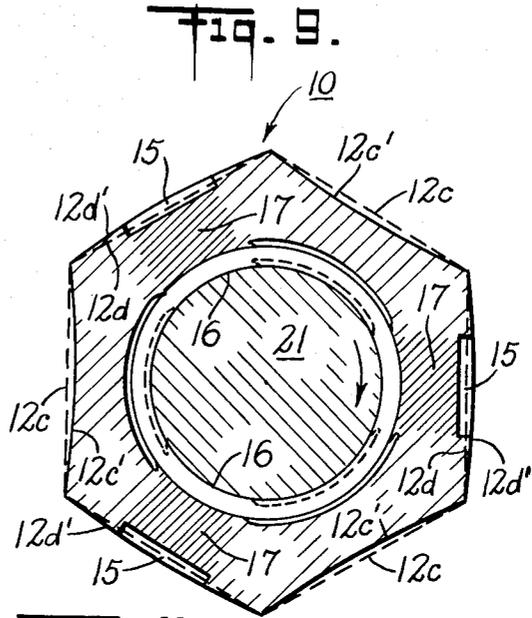
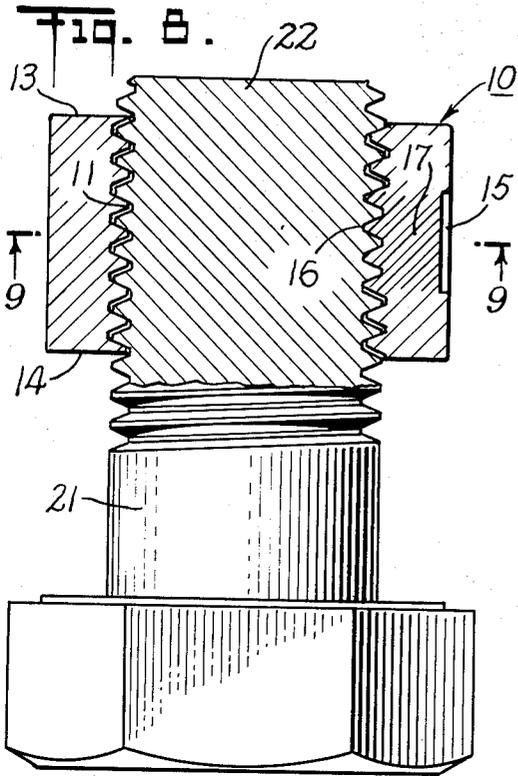
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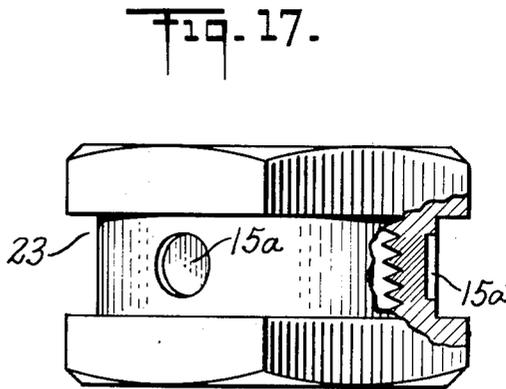
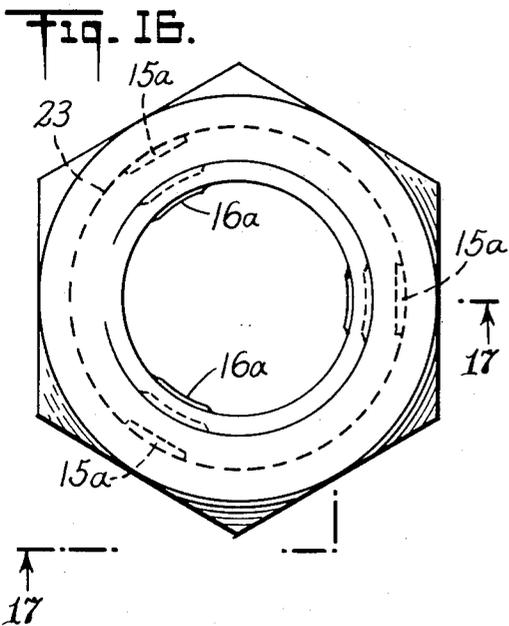
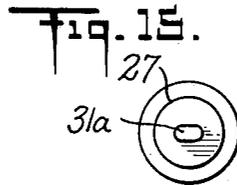
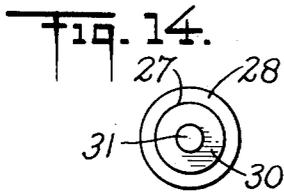
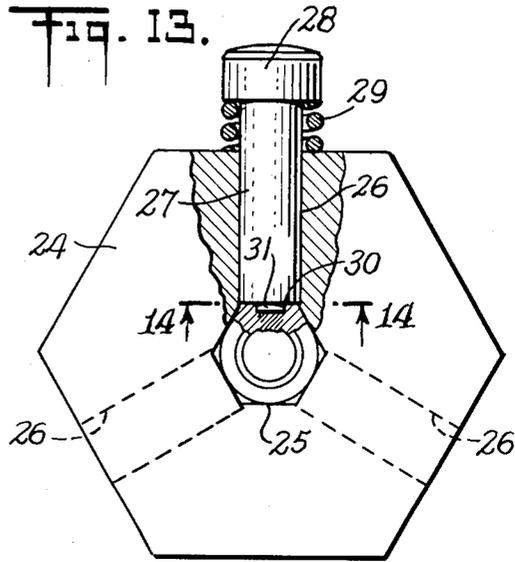
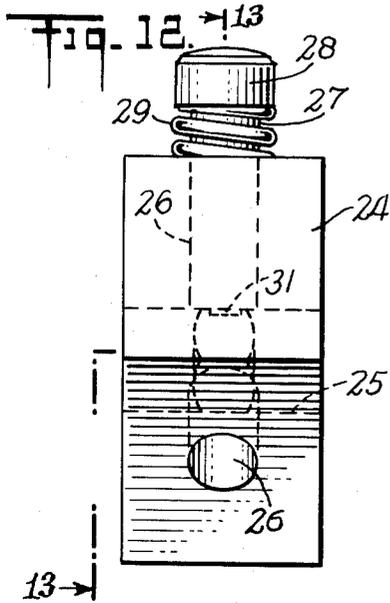
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PORTION AND METHOD FOR THE PRODUCTION OF THE SAME

Filed Sept. 4, 1952

3 Sheets-Sheet 3



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2,754,871

**SELF-LOCKING NUT HAVING A RADIALLY DEFORMED THREAD PORTION AND METHOD FOR THE PRODUCTION OF THE SAME**

Albert Stoll, Detroit, Mich.

Application September 4, 1952, Serial No. 307,775

3 Claims. (Cl. 151—21)

This invention relates to the production of nuts and more particularly stop nuts, and still more particularly to a method for the production of self-locking nuts.

It is an object of my invention to provide in a nut of the standard variety, whether of the regular, square, hexagonal or other outer form, features which make these nuts self-locking employing the initial simple and low-cost nut manufacturing procedure and tolerances to effect substantial economies.

In its more specific phases, my invention is concerned with an alteration of standard nuts or the class of standards, insofar as internal thread tolerances are concerned, known as Cl. 2-B and Cl.3-B under the New Unified (1950) and American Standards, and constitutes all-metal, one-piece construction with self-locking features which will not damage its mating screws; which may be produced at a low cost; which may be used to effect the bolted position with high speed power wrenches; which is symmetrical and may be started from either end of the nut onto the male screw-threaded fastener; which provides a seal against oil or gas leakage along the helical path of thread clearance, both at the minor and major diameters as well as along the non-loaded thread flanks between assembled bolt and nut screw threads of conventional design; which may be employed without danger of bolt thread galling and seizure and which will retain its self-locking qualities when subjected to a large variety of vibration stresses in use.

Still more particularly, by my invention I provide a one-piece, simple, low-cost, self-locking nut characterized by its symmetrical construction to permit free fit threading upon a bolt from either end and providing symmetrically arranged indentations or sealing islands characterized by a kind of threaded flank interference between the internal and external mating threaded members at the island areas, to provide between the nut and the bolt a circumferential oil and gas seal along the helix of the threads and self-locking frictional fit of the magnitude resulting from indentations of a depth greater than the maximum thread flank clearance provided by the respective thread fit tolerance between the nut and the bolt areas, while at the same time providing no interference between the nut thread minor diameter and the bolt thread root diameter.

To attain these objects and such further objects as may appear herein or be hereinafter pointed out, I make reference to the accompanying drawings, forming a part hereof, in which

Figure 1 is a plan view showing a nut in accordance with my invention;

Figure 2 is a side elevation thereof;

Figure 3 is a view similar to Figure 2, showing another embodiment of my invention;

Figure 4 is a magnified section taken on the line 4—4 of Figure 2;

Figure 5 is a section taken on the line 5—5 of Figure 4;

Figure 6 is a side elevation, partly in section, of a nut, partly threaded upon a bolt;

Figure 7 is an end elevation thereof;

Figure 8 is a bolt with a nut threaded in position;

Figure 9 is a section taken on the line 9—9 of Figure 8;

Figure 10 is a still further magnified fragmentary section taken on the line 10—10 of Figure 5;

Figure 11 is a fragmentary section taken on the line 11—11 of Figure 10;

Figure 12 is a side elevation of a jig for making a nut in accordance with my invention;

Figure 13 is a staggered section taken on the line 13—13 of Figure 12;

Figure 14 is a face view of the tool taken looking in the direction of the arrows 14—14 of Figure 13;

Figure 15 is a face view of the punch for making a nut, in accordance with the embodiment illustrated in Figure 3;

Figure 16 is a plan view of a nut in accordance with another embodiment of my invention;

Figure 17 is a staggered sectional view taken on the line 17—17 of Figure 16.

Making reference to the drawing I illustrate in Figures 1 and 2 a hexagonal nut 10 which, for present purposes, corresponds to the New Unified (1950) and American Standards as regards internal thread tolerances at its thread aperture 11, so that as an initial stock material the nut 10 of standard design is provided with a cylindrical standard nut thread. The walls 12 initially are finished flat as in the standard nut and formed with uniform and symmetrical ends 13, 14, by the usual arching chamfer.

With this type of nut thus provided, each alternate wall 12a is indented at 15 in a medial and symmetrical position between the edges 13 and 14, to provide by extrusion internal thread lock islands 16 which are formed by partially shearing the metal 17. The extensiveness of the indentation and the resultant island areas and the magnitude of these areas will be amplified as this description proceeds.

Reference is now made to Figure 11, showing in detail the effect of the indentation by impact means hereafter described in which 18 indicates the load carrying nut thread flanks of the threads; 18a, shown in dotted lines, is the position of the threads before distortion by the indenting procedure, the shaded area 17 along the edge 18b representing the partially sheared metal of the nut wall and the flanks of the threads after indentation are shown at 19; the comparative displacement from the minor diameter of the main body of the threads which is effected as shown at 20; as compared with the extended minor diameter at the islands, which is indicated by 20a; the displacement or extrusion is shown by the extended dot and dash lines to be the distance D<sub>1</sub>.

The extent of the extrusion to form the island or islands 16 is calculated, in the preferred form, so that the spacing of unaltered threads between the island area or areas of the internal screw threads is equal to or greater than the islands themselves.

With a nut as thus provided, it will be clear that it may be freely threaded upon the bolt 21 over the end 22 for the distance inwardly from the edges 13 or 14 as more clearly shown in Figure 6, without encountering any abnormal frictional resistance or interference. As the end 22 encounters the areas defined by an island 16, the frictional resistance may be overcome by hand wrenches as well as by the employment of high speed power wrenches currently employed in assembly line production methods in the automotive field.

I have found that a helix seal may be obtained by the magnitude of the indentation which will avoid metal seizure and permit threading with high speed wrenches by employing what is hereafter defined as a "thread sealing" protrusion, which is intended in the claims to cover

the depth or amount of the thread flank interference between the internal and external mating thread members at the island areas which is to be no greater than the maximum thread flank clearance provided by the respective thread fit tolerances between the nut and bolt threads, while at the same time there shall be no interference between the nut thread minor diameter and the bolt thread root diameter, or more particularly, the pitch diameter of the nut threads measured at the protrusion shall be smaller than the minimum pitch diameter of the screw thread of the engaging bolt, but the resulting interference between the threads of the protrusion and the minimum diameter of the bolt threads shall not exceed 20% of the sum of the tolerances of the nut and bolt threads.

Observing the preferred limitations as to the extensiveness of the islands and the depth of the indentations as defined, it will appear that I have provided a lock nut in which a thread seal against leakage of gas and oil is combined with the requisite self-locking action while retaining durability of these qualities in a manner heretofore not experienced, and which permits repeated use of the nut without destroying the elastic enveloping qualities of the end borders of the nut which are free fitting in respect of the mating bolt. This property is particularly retained without causing seizure of the contacting faces of the internal threads of the nut and the mating threads of the bolt, and may be explained by referring to Figure 9 wherein there is illustrated the elastically sprung nut walls caused by the pressure engagement of the nut lock islands with the bolt screw threads, the dotted lines 12c and 12d representing the unsprung nut walls whereas the solid lines 12c' and 12d' represent the elastically sprung nut walls in ironing out the nut thread lock islands, due to their pressure engagement with the bolt threads.

By way of explanation of the incidence of threading the nut upon a mating bolt, it may be said that a species of outwardly directing bulging of the nut wall faces may be involved on the walls 12a and an inwardly sprung position at the alternate thicker portions of the walls 12 by reason of the pressure in ironing out the nut thread lock islands. This arrangement provides a thread seal along the helix of the thread without thread galling or seizure and by interposing the islands between continuous, free fitting thread bands to each side thereof, elastic envelopment of the seal is obtained, which I believe may be explained by the fact that the elastic limit of the band carrying the protrusions has not been reached in the bands to each side of the medial area of the nut formed with the thread lock islands.

Thus by providing the nut with free fitting nut threads to each side of the interfering fit, the desired combination of thread seal and self-locking feature may be achieved, assuring operativeness within the limits of the prevailing torque of high speed nut wrenches, without the danger of bolt thread galling and seizure.

While I have shown and described an hexagonal nut provided with an extrusion in every alternate nut wall of the hexagonal faces, it will be understood that I may similarly modify the alternate walls of a square nut. Likewise, while I have shown a plurality of such extrusions lying medially between the ends of the nut to provide elastically enveloping bands to each side of the belt in which the thread lock islands are formed, it will be understood that I may, in a measure, secure some of the benefits of the combination thread seal and self-locking features by the use of a single protrusion spaced between the spaced ends of the nut, to leave an elastic enveloping band to each side thereof and that also the single or the plurality of such protrusions may be spaced inwardly from the ends, although not necessarily medially between the nut ends.

Likewise, while I have shown and described a protrusion formed through the thickness of the nut wall in a direction normal to the faces of the end wall, I may, as

shown in Figures 16 and 17, secure a predetermined torque requirement by a reduction of the thickness of the nut wall before extruding, indenting or punching the islands therefrom. For this purpose, as shown in Figures 16 and 17, the nut may be formed substantially medially with an annular groove 23 to reduce the wall thickness before indenting the outer nut wall surface to form the thread locking islands.

Likewise, wall thickness reduction may be secured by drilling the spot for the indentation to leave a wall thickness which, upon indentation and extrusion, will result in securing a predetermined torque requirement without sacrificing the elastic envelopment properties of the bands to each side of such areas. This sealing and desired frictional engagement may be achieved without over-stressing, to the point of fatigue of the wall of the nut itself.

In providing the indentations I make reference to the jig or tool illustrated in Figures 12 and 13. In these figures, the jig comprises a massive frame 24 having a central seat 25, within which the nut to be treated is guided or fed from one end to the other. Radially and normal to the seat 25 there are provided one or more guides or passages 26 into which the punch 27 is slidably fitted. The punch has an enlarged head 28 extending over the expansion spring 29 normally to space the punch from the axial position. The punch face 30 has an extension 31 of a length determined by the extensiveness of the protrusion desired in forming the thread lock islands previously described, the balance of the punch face thereby acting as a stop, as will be readily understood.

I have shown and described in Figure 2 a circular extrusion and for this purpose the extension 31 from the punch is illustrated in Figure 14 of circular outline. It will be understood, as shown in Figure 3, that the protrusion may be ovoid or otherwise contoured than circular, and for this purpose I illustrate in Figure 15 an extension 31a to conform to the contour of the extrusion desired in the embodiment shown in Figure 3.

Accordingly, various changes may be made in the contour of the punch with due regard to the desired self-locking features, the nature of the metal, the character of hardening or tempering of the metal of the nut, the degree of stressing with regard to the wrenching device which is employed in affixing the nut upon the mating bolt.

While I have described and illustrated my invention in connection with a standard nut and bolt known as Cl. 2-B Standard, to be engaged with a Cl. 2-A Standard bolt, it will be understood that my invention has applicability to provide dry seal pipe threads for various pipe couplings whereby the aforescribed thread sealing protrusion benefits are secured. These features, when embodied in pipe couplings, are non-thread galling as compared with standard dry seal pipe threads in that, in the latter case, exceeding the preferred relationship of the protrusion to the minimum pitch diameter of the screw threads of the engaging bolt, as aforesaid, will result in thread seizing and galling in failing to provide clearance of the magnitude into which the excess metal may escape. Accordingly, also, the term "lock nut" as used in the claims is intended to cover as well, pipe couplings having two series of circumferential thread lock islands, as described, whether the coupling is to be used for joining the same sized pipes or stepped sizes, to thereby secure therein the novel thread sealing protrusion features.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is:

1. A lock nut comprising a polygonal body defining an internally threaded bore and having a plurality of substantially flat side walls, alternate side walls of said body each having an integral portion thereof extruded abruptly into said bore to form a thread lock island spaced from the ends of the bore, said thread lock islands extending in a direction substantially perpendicular to the associated side walls and the areas of said islands ranging between being equal to and less than the unaltered remaining space be-

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tween the islands, the remaining portion of said body including the portions of said body intermediate the islands being substantially undistorted, the magnitude of the protrusions being such that said islands cause said nut body to be elastically stressed within its elastic limits only when said nut threadably engages a mating threaded member whereby a predetermined torque resistance is obtained.

2. A lock nut comprising a polygonal body defining an internally threaded bore and having a plurality of substantially flat side walls, alternate side walls of said body each having an integral portion thereof extruded abruptly into said bore to form a thread lock island substantially midway between the ends of the bore, said thread lock islands each extending in a direction substantially perpendicular to the associated side wall and the areas of said islands ranging between being equal to and less than the unaltered remaining space between the islands, the remaining portions of said body including the portions of said body intermediate the islands being substantially undistorted, the magnitude of the protrusions being such that said islands cause said nut body to be elastically stressed within its elastic limits only when said nut threadably engages a mating threaded member whereby a predetermined prevailing torque resistance is obtained.

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3. The method of making a self-locking nut from a nut body having an internally threaded bore and a plurality of substantially flat side walls which includes the steps of extruding thread lock islands in the nut threads through alternate said walls of the nut normal to the same and spaced from the ends of the nut while confining and maintaining the remaining portions of said nut body in a substantially undistorted condition, the protrusions being limited to areas ranging between being equal to and less than the unaltered remaining space between the extruded islands, the screw threaded portions adjacent the ends of the bore and the screw threaded portions intermediate the islands being undistorted for free fitting upon the mating bolt threads.

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