M. JACOBS.

SELF LOCKING NUT.

APPLICATION FILED JUNE 8, 1908.

959,222.

Patented May 24, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

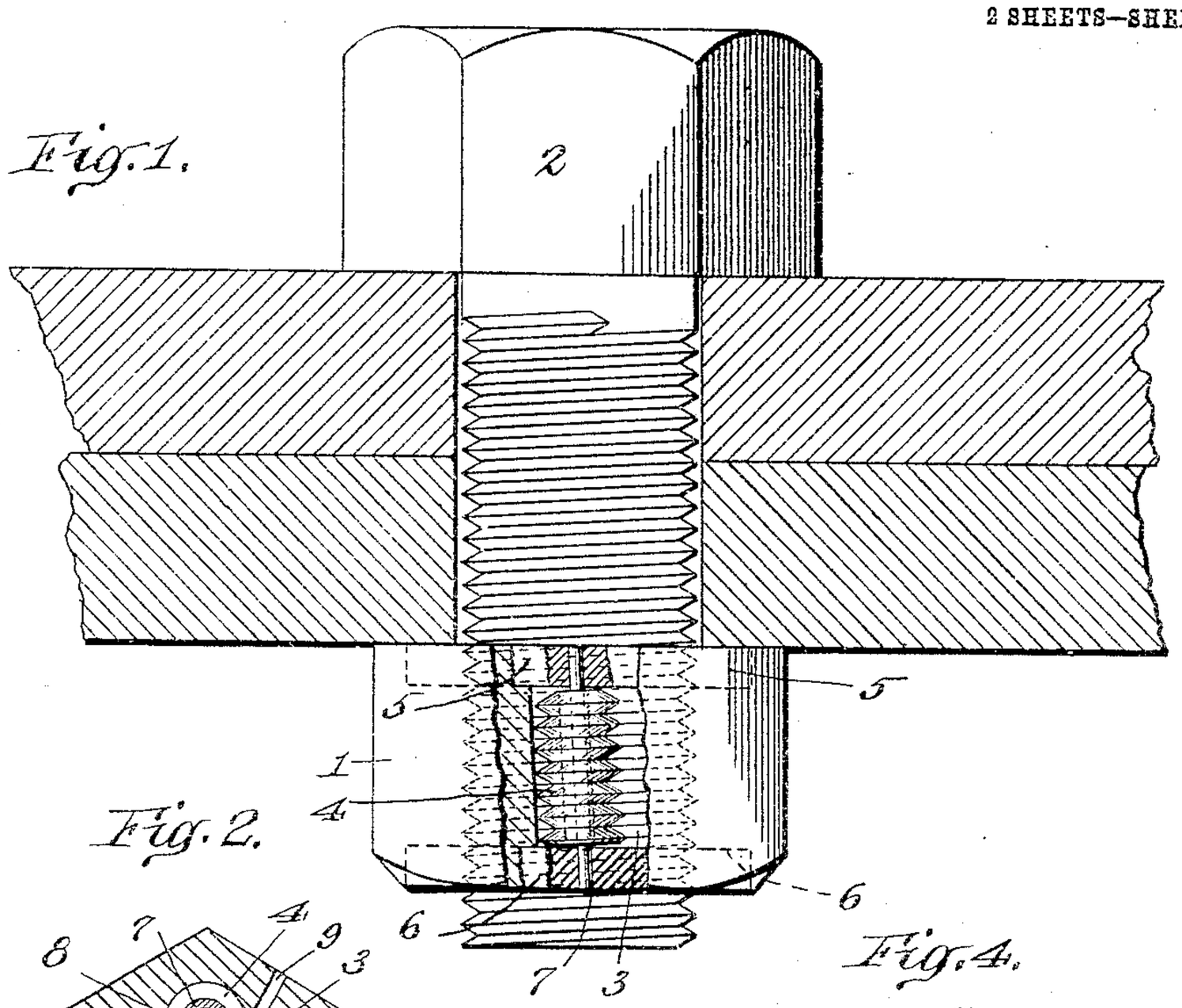


Fig. 2.

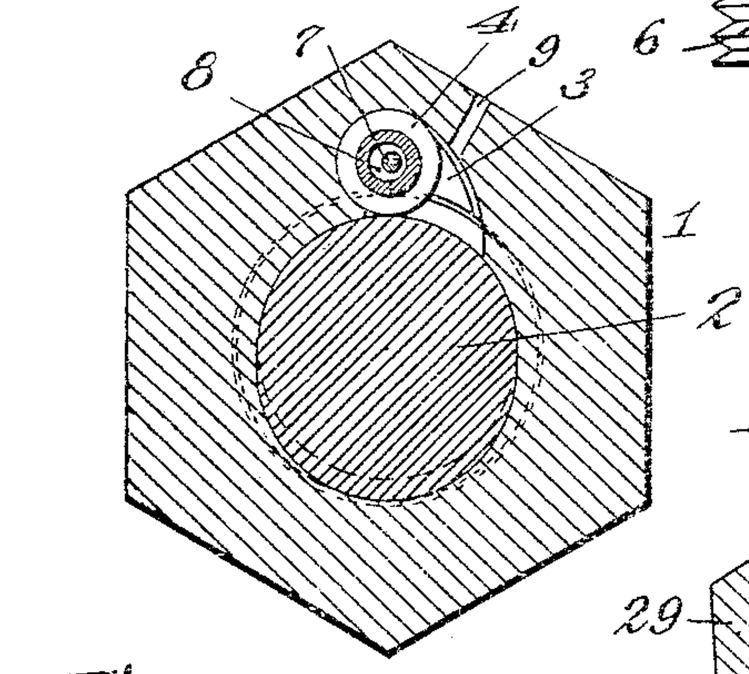


Fig. 3.

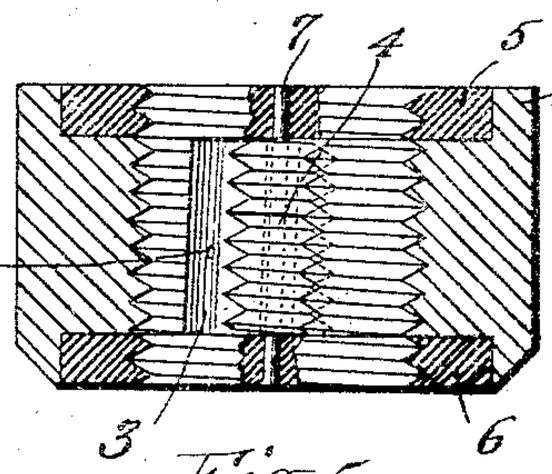


Fig. 3a.

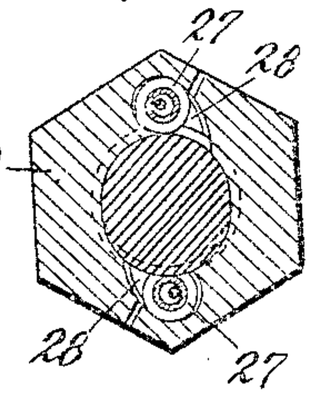
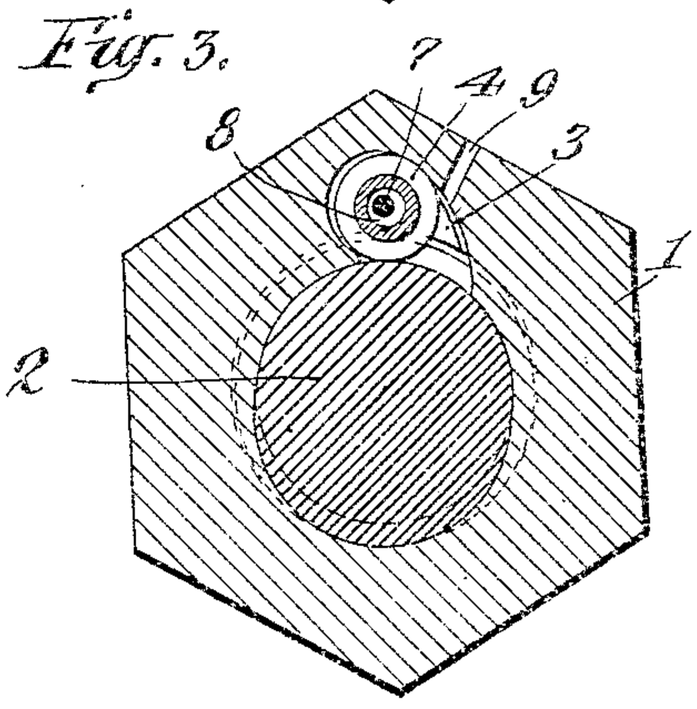


Fig. 5.



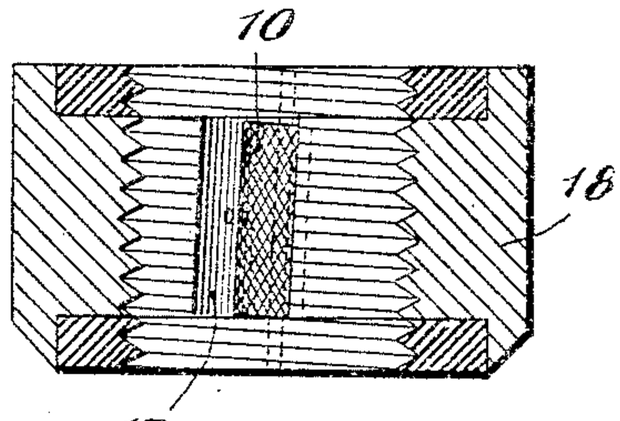
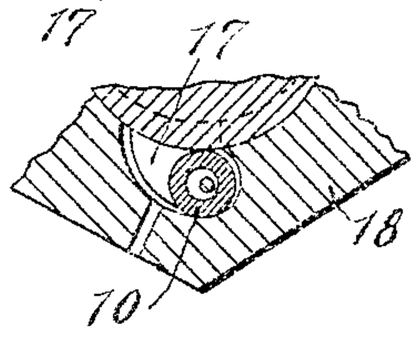


Fig. 6.



Witnesses:

Wm. Ashley Kelly

Victor D. Bones

Inventor

Morris Jacobs

By his Attorney

Henry D. Williams

M. JACOBS.

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2 SHEETS—SHEET 2.

Fig. 7.

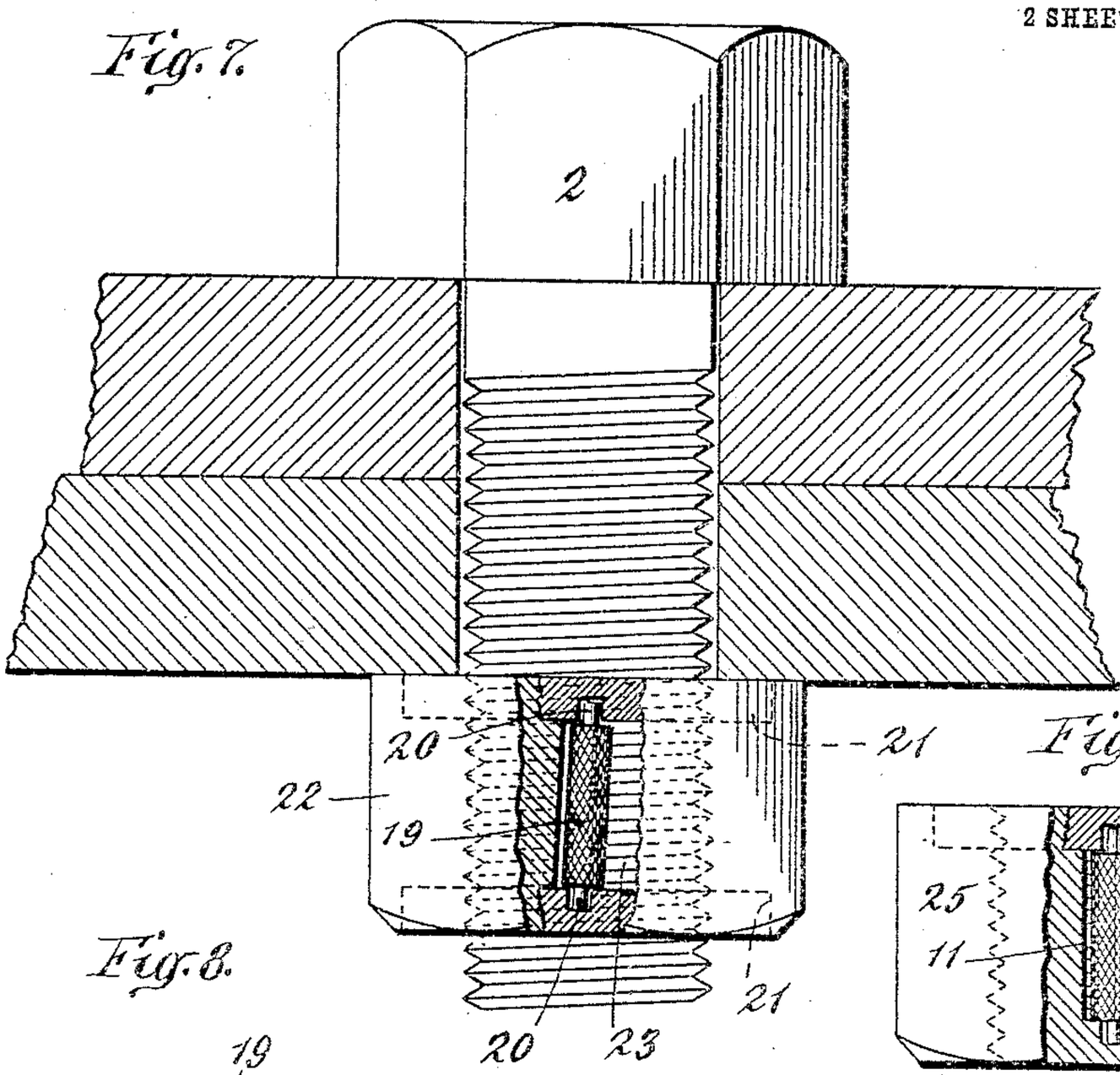


Fig. 8.

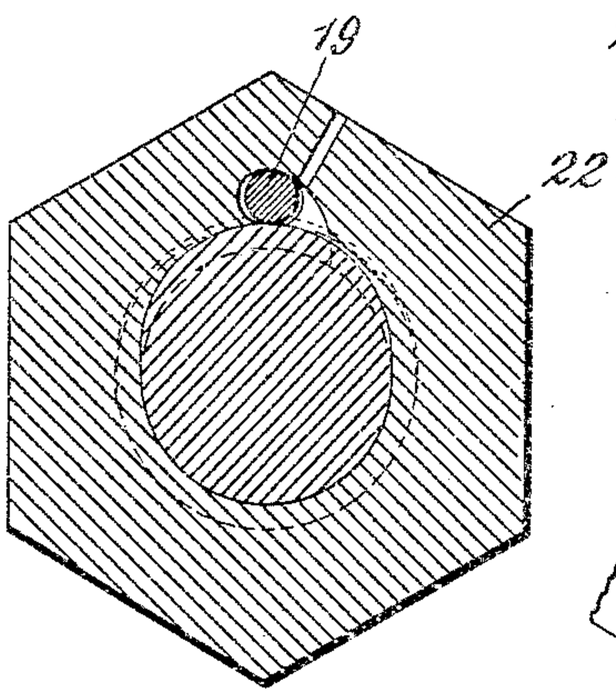


Fig. 9.

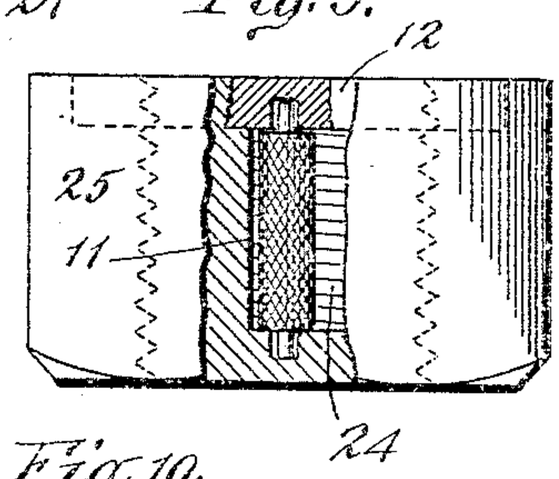


Fig. 10.

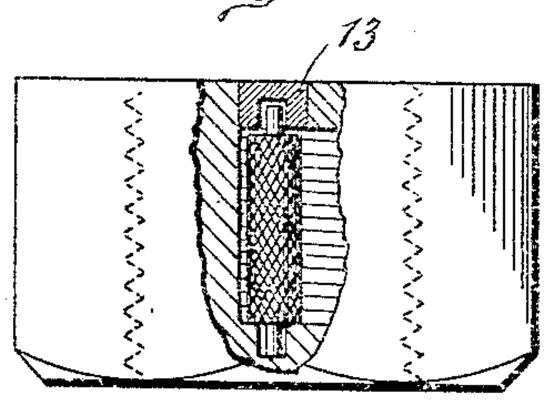


Fig. 11.

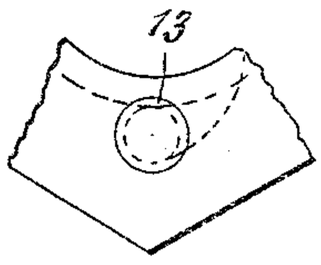


Fig. 12.

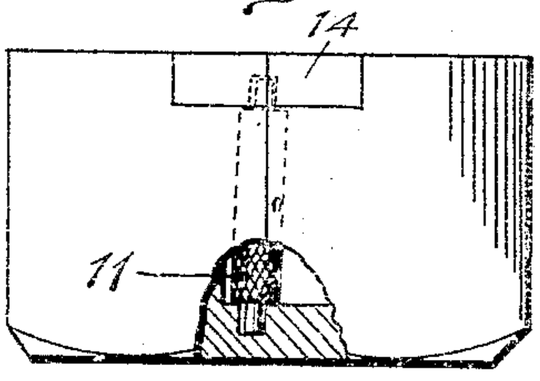


Fig. 13.

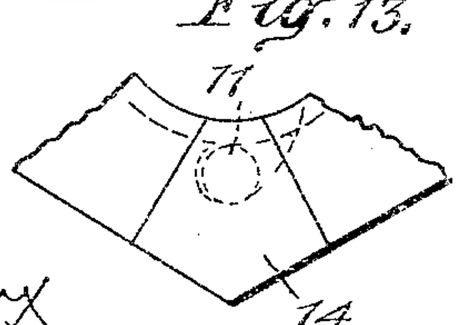
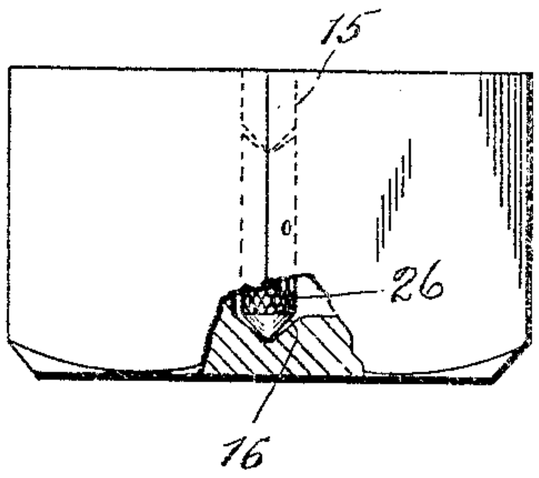


Fig. 14.



Witnesses:
Wm. Ashley Kelly
Victor D. Bonsall

Inventor
Morris Jacobs
By his Attorney
Henry D. Williams

UNITED STATES PATENT OFFICE.

MORRIS JACOBS, OF NEW YORK, N. Y.

SELF-LOCKING NUT.

959,222. Specification of Letters Patent. Patented May 24, 1910.

Application filed June 8, 1908. Serial No. 437,309.

To all whom it may concern:

Be it known that I, MORRIS JACOBS, a citizen of the United States, residing at the borough of Brooklyn, city of New York, in the county of Kings and State of New York, have invented a certain new and useful Improvement in Self-Locking Nuts, of which the following is a specification, reference being had therein to the accompanying drawings, forming part thereof.

My invention relates to means for locking coöperative screw-threaded parts, such as bolts and nuts, against unintentional or accidental unscrewing, as often disastrously occurs by reason of vibrations and jars attendant with use, particularly on vehicles of all kinds, railroad fish-plates, agricultural machinery, engines and the like.

My invention has for its objects the employment of bolts or the like of ordinary construction, the secure locking of the parts without mutilation or injury in locking the parts or by reason of such locking, and the self-tightening of the parts, whereby vibrations act to keep the parts in a tightened position and also to tighten them up if they are inadvertently left loose.

Another object of my invention is the ready intentional unscrewing of the parts when desired without mutilation or injury.

Another object of my invention is to prevent separation and loss of any of the parts of the locking device.

Other objects of my invention are to protect the locking device from the elements and to obtain a construction which, when assembled with the parts in coöperative relation, presents the appearance of an ordinary nut and bolt, the locking device being then hidden from view.

Other objects and advantages of my invention will appear from the following description.

My invention includes an elongated locking member mounted on a pivot which is loosely journaled or has lost motion so as to permit free movement or play of the locking member in a direction transverse to the length of the bolt, while at the same time the pivot retains the locking member in the nut.

In one of its forms my invention includes a locking roller of tubular form or having a longitudinal bore through which passes a retaining pin of substantially smaller diameter than the bore. My invention also includes a closure for closing the ends of a recess which contains the locking member.

My invention also includes other advantageous features and several details of construction hereinafter described.

I shall now describe my invention with reference to the accompanying drawings and shall thereafter point out my invention in claims.

Figure 1 is an elevation, partly in section, showing my self-locking nut locked on a bolt and coacting with the bolt in clamping two objects together. Fig. 2 is a cross-section through the bolt, nut and locking roller as viewed from the outer or screw end of the bolt, and shows the locking roller in non-locking position. Fig. 3 is a similar view, but with the locking roller rolled to locking position. Fig. 3ª is a view similar to Fig. 3 of a modified construction wherein the locking member is duplicated in a diametrically opposite position. Fig. 4 is a longitudinal central section of the nut shown in Figs. 1, 2 and 3, and in rotatively reversed position or turned one-half around relatively to Fig. 1. Fig. 5 is a similar view of another modified construction. Fig. 6 shows the nut of Fig. 5 in position on a bolt, portions being broken away, and is a cross-section of the bolt and of the nut as viewed in an upward direction in Fig. 5, the locking roller being in locking position. Fig. 7 is a view similar to Fig. 1, showing another modification. Fig. 8 is a cross-section similar to Fig. 3, showing the modified form of Fig. 7 in locking position. Fig. 9 is an elevation partly in section and shows a slight modification of the nut shown in Fig. 7. Fig. 10 is a similar view and shows a slight modification of the construction shown in Fig. 9. Fig. 11 is a plan view of Fig. 10 looking downward with portions broken away. Fig. 12 is an elevation, partly in section, of another modification. Fig. 13 is a plan view of Fig. 12 looking downward, with portions broken away. Fig. 14 is an elevation, partly in section, showing a further modified form of nut.

In the embodiment of my invention illustrated in Figs. 1 to 4, inclusive, of the accompanying drawings, a nut 1, which is provided with locking means, is screwed on an ordinary bolt 2. The nut 1 is provided on its inner or threaded surface with a longitudinally straight and transversely curved

groove or recess 3, which becomes gradually of less depth or shallower toward one edge and forms thereby a curved cam face or cam surface as clearly shown in Figs. 2 and 3. The groove or recess 3 does not extend longitudinally entirely through the nut from one end thereof to the other, but stops short of such nut ends, as shown in the drawings. In this embodiment of my invention (Figs. 1 to 4, inclusive) the groove or recess 3 extends longitudinally at an angle to an intersecting diametral plane of the nut 1 and of the coöperative bolt 2, as most clearly shown in Figs. 1 and 4, the groove or recess 3 extending substantially at right angles to the threads of the nut 1 and to the adjacent threads on the bolt 2. Internally threaded annular plugs 5 and 6 form the end portions of the nut 1 and form closures for the ends of the groove 3. The plugs 5 and 6 are concentric with the nut 1 and are driven into or otherwise firmly secured in sockets formed to receive them in the ends of the nut 1, the outer surfaces of the plugs being substantially flush with the ends of the nut. The plugs 5 and 6 are employed chiefly for convenience in manufacture, as the groove 3 may be conveniently cut entirely through the nut from end to end and then the ends of the groove may be closed by these plugs. However, the plugs 5 and 6 may be formed integral with the nut 1, if desired.

For "right-hand" threads, as shown in the drawings, the deeper side of the recess or groove, when viewed from the screw end of the bolt, will be at the left and the curved cam surface will extend toward the right. For "left-hand" threads the deeper side of the groove will be at the right and the cam surface extending toward the left when similarly viewed.

Within the groove 3, and extending substantially the whole length thereof, is an elongated locking member shown as a locking roller 4, mounted upon a journal pin or retaining pin 7. The roller 4 is provided with a central bore 8 considerably larger than the pin 7, thus allowing the journal pin 7 to fit very loosely in the bore 8. The pin 7 has its ends fixed in the plugs 5 and 6 and is shown as passing through the plug 5 and also through the plug 6 and extends substantially centrally through the deeper portion of the groove 3. The sole function of the pin 7 is to retain the locking roller 4 in place in the recess 3 when the nut is off the bolt, thereby making the locking roller virtually a part of the nut. Without some retaining means for the locking roller it would become separated from the nut, with attendant great inconvenience and probable loss of the rocking roller. The pin 7 and the locking roller 4 extend substantially parallel with the sides of the groove 3 and therefore lie at an angle to a diametral plane of the nut 1 and also of the coöperative bolt 2, such plane intersecting the locking roller, this angle being shown as such that the locking roller extends substantially at right angles to the adjacent threads of the bolt. In the surface of the roller 4 there is provided a succession of V-shaped grooves forming a series of sharp annular or circumferential teeth, as shown, which are in alinement with the threads of the nut and fit into the threads of the bolt in parallel relation thereto.

The groove 3 is of sufficient depth at its deepest portion that the roller 4 is in only slight contact with the threads of the bolt and permits the nut to be freely screwed on, as shown in Fig. 2; but this contact is sufficient to cause the roller to be carried against the cam surface or cam face of the recess or groove 3 when the nut is turned in the opposite direction, and to bind between the nut and bolt and form an effective lock, as shown in Fig. 3. This arrangement for retaining the locking roller in the nut is extremely simple of manufacture. A hole may be drilled straight down through the plug 5 and the plug 6 (or through corresponding integral portions of the nut) and the retaining pin 7 driven in. The retaining pin 7 in no way impedes the working of the locking roller, but, because of the looseness or lost motion between the roller 4 and the pin 7, allows all the play to the roller necessary for locking and has the great advantage above noted of keeping the roller in place in the nut when the nut is removed, thus rendering it always ready for immediate use.

When the roller is in the locking position, the clearance between the nut and the bolt is taken up thereby and the nut and bolt are forced to a slightly eccentric relation, the extent of which depends upon the amount of clearance. It is evident that this fact increases the friction between the threads of the nut and bolt on the side opposite to the roller, which increased friction assists in the locking of the nut.

When it is desired to unscrew the nut, it is necessary to push the roller from its locking position to the deepest portion of the groove and hold it there while unscrewing the nut; and for this purpose a small bore or hole 9 is provided, extending from the side of the nut adjacent to the cam surface of the groove 3 into the groove, and entering the groove at a point in the path of the locking roller as it moves from its non-locking to its locking position. It is merely necessary to insert some sufficiently small implement in the hole 9 and the same will push or press against the locking roller, and this pressure will force the roller back to its unlocking position, and the implement, being left in the hole, will retain the roller in this position. The bore 9 also serves the function of an

oiling duct for the groove 3, locking roller 4, and for the threads of the bolt and nut.

In the modification illustrated in Figs. 5 and 6, a locking roller 10 is provided in which the annular circumferential teeth are omitted and in lieu thereof a roughened or knurled cylindrical surface is provided which will engage the threads of the bolt in frictional contact and serve the purpose of the larger engaging surface afforded by the teeth. Because of the omission of the teeth the locking roller 10 may be, as is shown in the drawings, of smaller diameter than the above described toothed roller 4, and accordingly a cam groove or cam-faced recess 17 of less size than the groove 3 and corresponding in size to the locking roller 10 is provided in a nut 18. The construction and operation in all other respects are substantially the same as in the first described construction.

In the modification illustrated in Figs. 7 and 8, a locking roller 19 is provided which differs from the locking roller 10, last described, in that it has no axial bore for a retaining pin but instead thereof is provided at its ends with projecting retaining pins 20, which may be integral and which are loosely received in holes or sockets in end plugs 21 in a nut 22 and forming closures for the ends of a cam-faced groove 23, along the cam surface of which the locking roller 19 is adapted to roll to and from its locking position in relation to the threads of the bolt 2. In this construction the locking-roller 19 is placed in position in the recess 23 before one of the plugs 21 is inserted, the plugs 21 coacting with the pins 20 to retain the locking-roller 19 in the nut. The construction illustrated in Figs. 7 and 8 is further modified from both of those above described in that the locking roller 19 and also the recess or groove 23 therefor are inclined in an opposite direction to an intersecting diametral plane of the nut and bolt from the inclination in the two first described constructions.

It has been found that the inclination of the locking roller as described substantially aids in the locking and self-tightening operations, and that it makes no substantial difference as to the direction of the inclination, excepting that in the toothed roller of Figs. 1 to 4, inclusive, the teeth fit better into the threads of the bolt when the inclination of the locking roller is as described in reference to those figures.

The modification illustrated in Fig. 9 differs from that last described in the two particulars that only a single end plug 12 is provided, the closure for the other end of a roller-receiving groove 24 being formed integral with a nut 25, and also in that a locking-roller 11 is provided, similar to the locking-roller 19, but which, together with the recess 24, extends parallel with a diametral plane of the nut intersecting the locking roller.

The modification illustrated in Figs. 10 and 11 differs from that last described in the single particular that, instead of the annular plug 12 concentric with the nut 25, a small cylindrical plug 13 is provided, the bore or socket for the plug 13 being slightly larger than the locking-roller so that the locking-roller may be inserted into place through such opening.

In the modification shown in Figs. 12 and 13, I cut out a portion of the face of the nut over the groove and fill the cut out portion with a plate 14, which serves as a bearing for the locking roller. The locking roller is shown as inclined the same as in Figs. 7 and 8.

In Fig. 14, I have shown a modification of the method of retaining the locking roller in the groove. A plug 15 is provided with a cone-shaped point which fits loosely into a corresponding depression in the end of a locking roller 26; and the other end of the roller is provided with a similar point which fits loosely in a corresponding pocket 16 in the bottom of the groove or recess. The locking roller 26 should have sufficient looseness or play to permit it to roll to and from locking position. In manufacture the locking roller 26 is first placed in position and then the retaining plug 15 is driven in. The roller 26 is shown as uninclined, similar to Figs. 9 and 10.

Any jar or vibration to which this self-locking nut may be subjected incident to its use will have the effect to tighten or maintain tight the nut on the bolt. In fact, it has been found that if the nut be left partly unscrewed, it will tighten up of its own accord when subjected to vibration. Vibration can move it only in the direction of tightening and will move it in that direction only, and the parts will roll together and repeated vibrations will tighten the nut and will thus correct the error of a careless workman who neglected to tighten it. The nut is therefore not only self-locking, but also self-tightening.

Because of the fact that the roller-receiving recess in the nut is closed at its ends, the locking roller is hidden from view and the appearance presented, when my self-locking nut is on a bolt, is substantially the same as that of an ordinary nut and bolt. Also the threaded closures for the ends of the recess protect the locking device from the elements, preventing the entrance of dust and the like and protecting the locking device from moisture and liability to rust. The recess in the nut forms an oil cup, into which, when desired, oil may be injected through the unlocking aperture in the side of the nut. The locking device remains at all times a permanent part of the nut, and

because of the fact that the locking device is substantially inclosed and protected by the nut it is at all times secure from injury. These self-locking nuts are inexpensive of manufacture and may form a distinct article of manufacture and commerce for use upon ordinary bolts.

In the modification illustrated in Fig. 3ª, a plurality of locking members is provided shown as two locking rollers 27 located in diametrically opposite recesses 28 in a nut 29. The recesses 28 are duplicates as are also the contained locking rollers 27. With the exception of the duplication of locking devices or locking members, the construction of Fig. 3ª is identical with that of Figs. 1, 2, 3 and 4. A duplication or plurality of locking members or locking devices in a single nut may in some situations be desirable for the purpose of securing increased locking strength.

The terms "nut" and "bolt" have been used for convenience in the above description and in the following claims to designate two coöperative threaded parts.

It is obvious that various modifications may be made in the constructions shown and above particularly described within the principle and scope of my invention.

I claim:

1. The combination with a screw-threaded bolt, of a screw-threaded nut having a recess in its threaded portion forming a cam surface, a locking roller in the recess and adapted to roll along the cam surface thereof, the locking roller being adapted to be frictionally engaged by the screw threads of the bolt to roll the locking roller along the cam surface of the recess, and a pivotal lost motion connection at both ends of the locking roller between the locking roller and the nut to retain the locking roller in the recess, the lost motion being in a direction transverse to the longitudinal axis of the bolt, this lost motion permitting the locking roller to roll transversely to the length of the bolt along the cam surface of the recess and being sufficient to permit the locking roller to roll to and from its locking position.

2. The combination, with a screw-threaded bolt, of a screw-threaded nut having a roller-receiving recess in its threaded portion forming a cam surface, such recess having closed ends forming fixed portions of the ends of the nut, a substantially cylindrical locking roller in the recess adapted to roll along the cam surface thereof and have locking engagement with the bolt, the closures of the ends of the recess retaining the locking roller in the recess longitudinally, and means at the ends of the locking roller for preventing the locking roller from dropping out through the bolt-receiving hole in the nut when the nut is not on the bolt.

3. The combination, with a screw-threaded bolt, of a screw-threaded nut having a roller-receiving recess in its threaded portion forming a cam surface, plugs closing the ends of the recess and forming fixed portions of the ends of the nut, a substantially cylindrical locking roller in the recess adapted to roll along the cam surface thereof and have locking engagement with the bolt, and means at the ends of the locking roller and engaging the plugs for preventing the locking roller from dropping out through the bolt-receiving hole in the nut when the nut is not on the bolt.

4. The combination with a screw-threaded bolt, of a screw-threaded nut having a recess in its threaded portion forming a cam surface, such recess having closed ends, a locking roller in the recess and adapted to roll along the cam surface thereof, the locking roller being provided with an axial bore extending therethrough and a retaining pin fixed at its ends in the end closures of the recess and passing loosely through the axial bore of the locking roller so as not to impede the rolling movement of the locking roller along the cam surface of the recess, the locking roller being adapted to be frictionally engaged by the screw threads of the bolt to roll the locking roller along the cam surface of the recess.

5. The combination with a screw-threaded bolt, of a screw-threaded nut having a recess in its threaded portion forming a cam surface, such recess having closed ends, an annular threaded plug concentric with the nut and countersunk flush with the end thereof and forming a closure for the end of the recess, a locking roller in the recess and adapted to roll along the cam surface thereof, the locking roller being adapted to be frictionally engaged by the screw threads of the bolt to roll the locking roller along the cam surface of the recess, and means for continuously retaining the locking roller in the nut at all times including when the nut is off the bolt.

6. The combination, with a screw-threaded bolt, of a screw-threaded nut having a roller-receiving recess in its threaded portion forming a cam surface, such recess having closed ends forming fixed portions of the ends of the nut, a locking roller in the recess adapted to roll along the cam surface thereof and have locking engagement with the bolt, the closures of the ends of the recess retaining the locking roller in the recess longitudinally, and fixed means for preventing the locking roller from dropping out through the bolt-receiving hole in the nut when the nut is not on the bolt.

7. The combination with a screw-threaded bolt, of a screw-threaded nut having a recess in its threaded portion, a locking member located in the recess and adapted to be shifted therein to and from locking position

relatively to the bolt, and a retaining pin relatively to which the locking member has lost motion in a direction transverse to the length of the bolt sufficient to permit the locking member to shift to and from the locking position, such retaining pin being adapted to retain the locking member in the nut at all times, including when the nut is off the bolt, without interfering with its locking function.

8. The combination with a screw-threaded bolt, of a screw-threaded nut having a recess in its threaded portion, such recess having closed ends, a locking member located in the recess and adapted to be shifted therein to and from locking position relatively to the bolt, the locking member being provided with a longitudinal bore, and a retaining pin fixed at its ends in the closures for the ends of the recess and passing loosely through the bore of the locking member, such bore being substantially larger in diameter than the pin for permitting shifting movement of the locking member in the recess.

9. The combination of a screw-threaded nut having in its screw-threaded portion a roller-receiving recess provided with a cam surface, annular internally screw-threaded end plugs concentric with the nut and countersunk substantially flush with the ends thereof and closing the ends of the recess, a circumferentially toothed locking roller in the recess and adapted to roll along the cam surface thereof, the locking roller extending substantially at right angles to the adjacent threads of the nut and the recess being similarly inclined, the locking roller being provided with an axial bore therethrough, a retaining pin of substantially smaller diameter than the bore of the locking roller and passing through such bore and having its ends fixed in the end plugs, and a screw-threaded bolt coöperative with the nut and its locking roller, the locking roller being adapted to have its circumferential teeth frictionally engaged by the screw threads of the bolt to roll the locking roller along the cam surface of the recess.

10. The combination, with a screw-threaded bolt, of a screw-threaded nut provided with a recess communicating with the bolt-receiving aperture, a locking roller in the recess adapted to have locking engagement with the bolt, the locking roller being provided with an axial bore, and a locking roller retaining pin carried by the nut and entering the axial bore of the locking roller, such bore being of sufficiently larger diameter than the pin to permit the locking roller to roll transversely to the retaining pin to and from its locking position without transverse movement of the retaining pin relatively to the nut.

In testimony whereof I have affixed my signature in presence of two witnesses.

MORRIS JACOBS.

Witnesses:
WM. ASHLEY KELLY,
VICTOR D. BORST.