June 16, 1936. R. ERLING 2,043,993

HOLDING MEANS FOR LOCKING ELEMENTS

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FIG. 1

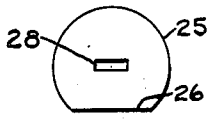


FIG. 2

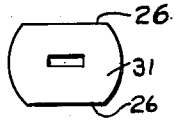
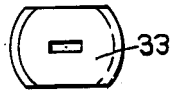


FIG. 3



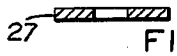


FIG. 8

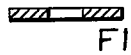


FIG. 9

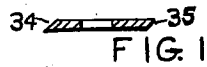


FIG. 10

FIG. 4



FIG. 5

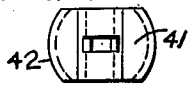


FIG. 6

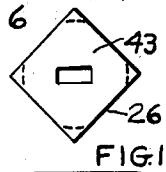




FIG. 11



FIG. 12

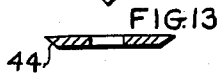
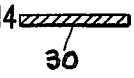


FIG. 13

FIG. 7



FIG. 14



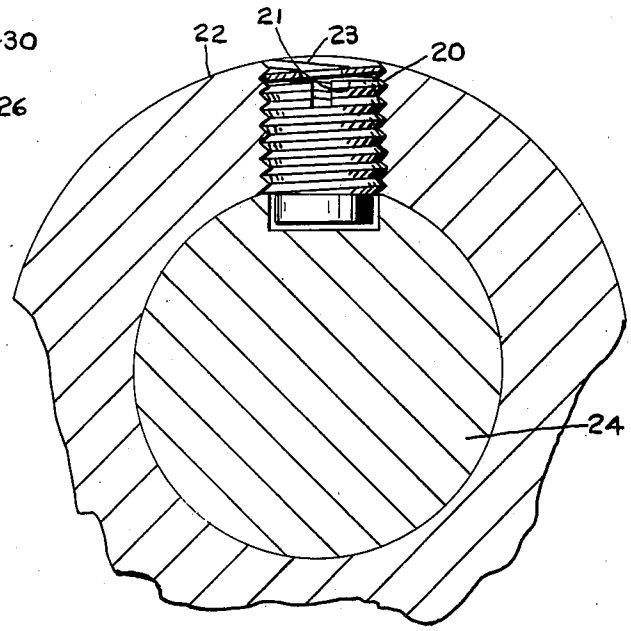
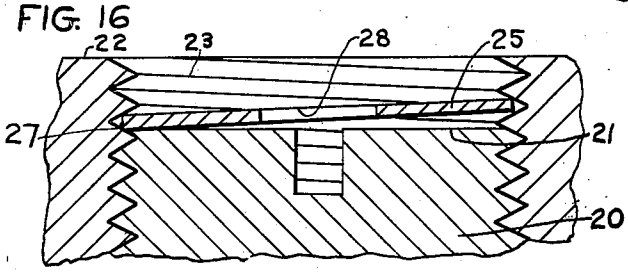


FIG. 15

FIG. 16



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FIG. 17

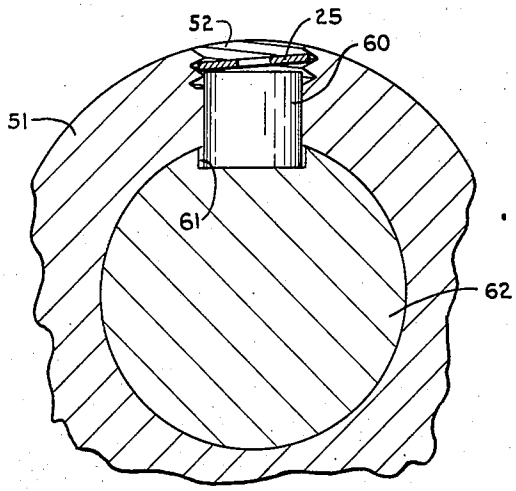


FIG. 21

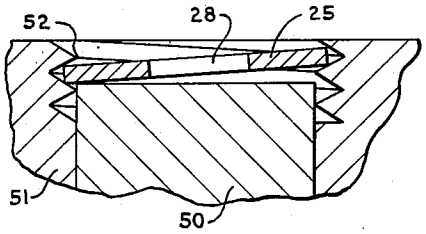


FIG. 19

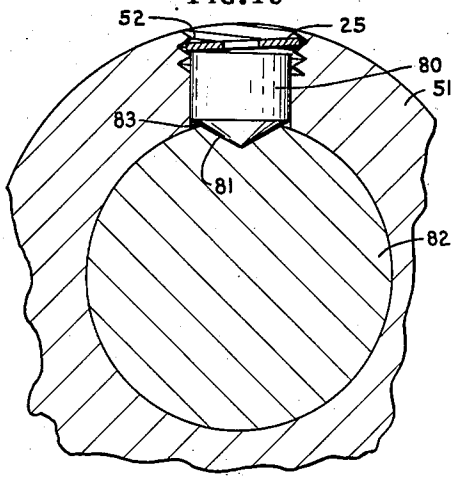


FIG. 20

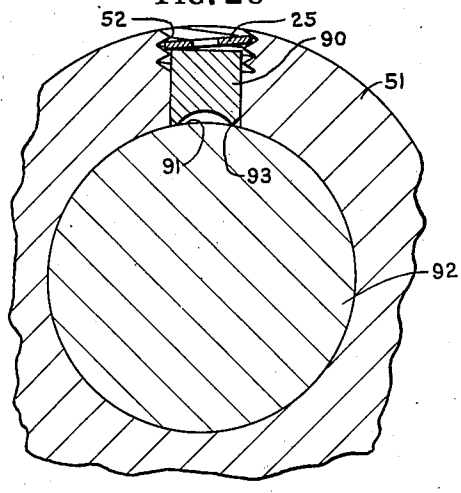
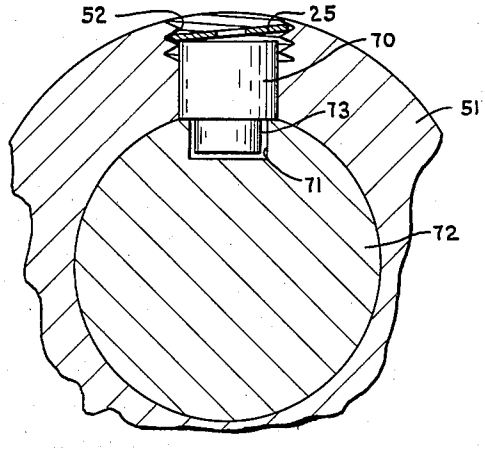


FIG. 18



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UNITED STATES PATENT OFFICE

2,043,993

HOLDING MEANS FOR LOCKING ELEMENTS

Ralph Erling, Cranford, N. J.

Application September 13, 1934, Serial No. 743,867

31 Claims. (Cl. 151—32)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This invention relates to the problem of holding a locking element, such as a set screw or similar male threaded member, a threaded or unthreaded plug or male member, so that the threaded or unthreaded element may be positively held in its operative position.

Male threaded members, such as set screws, oil plugs, and other devices, are very apt to reverse or loosen themselves from operative position, often due to chatter or vibration of the parts in which the screw or male threaded member is placed, or for many other reasons. Set screws or similar male threaded members are often placed in very inaccessible positions and are intended to remain securely in position, but prior to this invention the problem of insuring that the set screw or male threaded members would remain in the desired position in spite of any vibration or chatter to which they might normally be exposed had not been satisfactorily solved.

The set screw is often used for holding a gear, sleeve, or other element on a rotatable or reciprocal shaft and is used to prevent relative motion between the two elements. The vibration to which one of the elements may be normally exposed often sets up a corresponding vibration in the set screw, causing it to loosen or back off until eventually the set screw fails to serve its proper function and relative motion takes place between the elements otherwise secured by the set screw.

With this invention, however, the set screw is held against loosening or backing off in spite of any vibration to which it may be subjected and, as a matter of fact, such vibration may even assist in insuring the set screw against loosening from the set position.

Set screws and similar threaded male members are more expensive to manufacture than they would be if the same male member could be used without the necessity of threading it. When the threaded member is used, a further expense is involved in the time of threading a male member into operative position. While this time element is infinitesimal for an individual member, in the aggregate of thousands and millions of such members used the time feature saved by eliminating the threads becomes tremendous. With this invention it becomes possible to substitute an unthreaded male member for the threaded set screw or other threaded male element. It becomes further unnecessary to thread the cooperating female member as deeply as it was necessary when a threaded male member was used in cooperation therewith. With this invention an unthreaded male member can be substituted for the threaded male member and held in operative position even more securely than the threaded male member would hold itself in operative position without the presence of this invention. When a threaded male element is used it is necessary that the element be screwed into the cooperating female member until it has reached operative position; then when this invention is used to secure it, it is screwed into the female member a few threads until it comes into contact with the threaded male member. When used with an unthreaded male member it is only necessary to drop the male member into operative position, irrespective of whether the female member is threaded the entire length of the opening or whether it is threaded only a sufficient distance to reach just beyond the head male member when in operative position, and then the holding device of this invention is threaded into contact with the head of the male member. The present disclosure is a continuation in part of application serial No. 724,379 filed May 7, 1934, for a Set screw locking device.

Figures 1 to 7, inclusive, are elevational views of different forms of locking washers capable of carrying out the functions of this invention.

Figures 8 to 14, inclusive, are sectional views of Figures 1 to 7, inclusive.

Figure 15 is a sectional view through a sleeve held in position on a shaft by means of a set screw, the set screw being locked in position by one form of this invention.

Figure 16 is an enlarged sectional view of one form of the invention as applied in Figure 15.

Figures 17, 18 and 19 are sectional views through sleeves held in position on shafts or different types of unthreaded male members according to different forms of this invention.

Figure 20 shows yet another sectional view of yet another form of male member used for securing a sleeve on a shaft according to this invention.

Figure 21 shows an enlarged sectional view of one form of this invention as applied in Figures 17 to 20, inclusive.

There is shown at 20 a male threaded member, which, as shown in Fig. 15, may be a set screw but may equally well be an oil plug or any other similar type of male threaded member, having its head 21 of a diameter not greater than the major diameter of the threads of the set screw so that the head 21 of the set screw will be threaded below the outer surface 22 of the female threaded

member 23. The female threaded member 23 may comprise any element in which it is desired to fix the set screw 20 against reversing or backing out therefrom. As shown in Fig. 15, this female threaded member 23 may be a sleeve, gear, or other member which it is desired to secure against relative movement on a shaft 24.

The means for holding the male threaded member 20 against reversing in the female threaded member 23 consists of a disk-like member 25 which may be made in various forms, some of which are shown in Figs. 1 to 14, inclusive. This disk-like member 25 is of such a size relative to the threads of the female member 23 that it can be threaded into the female member 23 until one edge thereof abuts against the head of set screw 20, as shown in Fig. 16. This disk-like member 25 necessarily has at least one non-circular edge as at 26, permitting said disk-like member to be threaded into the threads. The diameter of this disk-like member 25 is not greater than the major diameter of the threads of the female threaded member, and the thickness of its periphery 27 is less than the pitch of the threads. The disk-like member 25 may be threaded into the member 23 by any suitable tool, such as a screw driver, wrench, magnet, vacuum cup, or other tool.

At 50 in Fig. 21 there is shown an unthreaded male member which is merely dropped into the operative position in the female member or sleeve 51. As will be observed, the opening in the female member 51 is threaded as at 52, a distance at least slightly beyond the point to which the head or end of the male member 50 comes to rest when in operative position. The same disk-like member 25 shown in various forms of Figs. 1 to 14, inclusive, likewise serves to hold the male threaded member 50 against dropping out of the opening in female member 51. After the male member 50 has been dropped into position, the omission of threads from the periphery of the male member 50 making it unnecessary to thread the member therein irrespective of how deeply the threads 52 into the female member 51 may extend, the disk-like member 25 is threaded into the threads 52 by any suitable tool cooperating therewith.

In Fig. 17 an unthreaded male member 60 is shown which is intended to drop into a previously formed well 61 formed in the shaft 62. With this form the male member 60 will hold the female member or sleeve 51 against rotation relative to the shaft 62 until the shearing strength of the metal of the male member 60 is exceeded. The plug 70 in Fig. 18 is similar to the plug 60 except that the well 71 in the shaft 72 receives a reduced neck 73 extending from the bottom of the plug 70. In this form the plug 70 will likewise hold the shaft 72 against movement relative to the sleeve 51 until the neck 73 is sheared off. Either the forms 60 or 70 will be used when it is desired to transmit great stresses between the sleeves and the shafts. If only a moderate amount of stress is to be transmitted then a plug 80, as in Fig. 19, may be used to secure the sleeve 51 to the shaft 82, the well 81 in the shaft 82 being cone-shaped to cooperate with the cone shaped end 83 formed on the lower end of the plug 80.

In some cases it is unnecessary or undesirable to form any well whatsoever such as in the shaft 92 shown in Fig. 20 wherein the sleeve 51 is held in position by means of a plug 90. This plug 90 is provided with a sharpened ridge 93 which is here shown as being circular so as to afford a slight frictional pressure against any part of the surface 91 of the shaft 92. In this form the sleeve 51 is held against rotation on the shaft 92 with only a very moderate amount of force by the disk 25 threaded into the female threads 52. As an example for which this form of invention, wherein no depression or well is to be drilled in the shaft, may be used, may be mentioned the securing of knobs on the shafts of radio dials.

If the disk-like member 25 is made of ferrous material then a magnet may be used in any of the forms.

In the forms shown in Figs. 1 to 6, the tool cooperating means on the disk-like member is in the form of a slot or kerf 28, this kerf being adapted to receive a suitable wrench or screw driver.

The form of disk-like member shown at 30 in Fig. 7 has no tool cooperating indentation therein, this form being intended to be placed into the female threaded member by a suitable vacuum cup tool.

The tool indentation need not extend entirely through the disk-like member, and when extending only partly through the member, the member to be inserted or removed by a screw driver or wrench, may equally well be operated by a vacuum cup tool.

In the form shown in Fig. 2, the disk-like member 31 is provided with two non-circular edges 26.

The form of disk-like member shown at 33 in Fig. 3 differs from the preceding forms in that the periphery 34 and 35 is beveled, it being observed that the bevels are in opposite directions.

The form shown at 36 in Fig. 4 is provided with a central hump or protuberance 37, and the kerf or tool indentation 38 is located in this protuberance 37 and thereby raised above the surface of the disk-like member 36. In addition, the periphery is serrated as shown at 39, and the serrated edges 39 of the periphery are beveled as at 40.

The form shown at 43 in Fig. 6 is provided with four non-circular edges 26, causing the shape of the disk to be substantially square or rectangular. In addition, the periphery may be beveled as shown at 44.

In practice it will be found that when the locking member, as here disclosed, is screwed into its operative position with ordinary force, it will, upon abutting the member to be locked, undergo a slight deformation, due to its thinness relative to the pitch of the threads. This deformation will be torsional as well as transverse, and will serve to hold the locking member securely against accidental rotation. Any tendency of the locked member to back out of its proper position increases the locking effect, yet, upon application of the removing tool, the locking element will be found at all times freely removable with but the use of ordinary force.

Various other forms of this invention may be devised capable of performing the functions hereof and the illustrated forms are to be considered only as representative of possible forms of invention and not as restrictive. In the same manner, the term "set screw" used herein is to be considered as equivalent of the male threaded member in its broad aspects and not to be restricted to the particular construction shown. Likewise the term "male member" is to be considered as equivalent of any threaded or unthreaded male member, pin, plug, or other suitable member which is used for preventing movement between two members relative to each other.

The invention described herein may be manu-

factured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

I claim:

1. In combination, a pair of elements intended to be held against relative movement one to the other wherein one of the elements has an aperture, at least partially threaded at its outer end, extending therethrough to the surface of the other element, an unthreaded male member, the top of the male member being below the outer end of the aperture but not below the bottom of the threaded portion, and means holding said male member against loss from said apertured member, said means comprising a disk-like member slightly less in diameter than the major diameter of the threaded portion of the aperture, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the said disk-like member being less than the pitch of the threads.

2. A locking device for an unthreaded male member which is inserted in an at least partially threaded female member comprising a disk-like member adapted to simultaneously engage the female screw threads and the outer end of the male member and to undergo slight deformation when forced into such engagement.

3. For use in securing two elements against movement relative to each other, one of said elements having an aperture extending therethrough to the surface of the other element, the aperture being at least partially threaded at its outer end; an unthreaded male member adapted to be placed through the aperture in the apertured element into contact with the other element, the top of the male member being below the surface of the apertured element but not below the threaded portion of the aperture, and a disk-like member slightly less in diameter than the major diameter of the threaded portion of the aperture, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the periphery of said disk-like member being less than the pitch of the threads.

4. In combination, a pair of elements intended to be held against relative movement one to the other wherein one of the elements has an aperture, at least partially threaded at its outer end, extending therethrough to the surface of the other element, an unthreaded male member, the top of the male member being below the outer end of the aperture but not below the bottom of the threaded portion, and a substantially single plane means holding said male member against loss from said apertured member, said single plane means cooperating with the threaded portion of the aperture.

5. For use in locking an unthreaded male member against loss from a female member at least partially threaded where the head of the male member is below the outer surface of the female member but not below the threaded portion thereof; a disk-like member slightly less in diameter than the major diameter of the threaded portion of the female member, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the periphery of said disk-like member being less than the pitch of the threads.

6. For use in locking an unthreaded male member against loss from a female member at least partially threaded where the head of the male member is below the outer surface of the female member but not below the threaded portion of the female member; a disk-like member slightly less in diameter than the major diameter of the threaded portion of the female member, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the periphery of said disk-like member being less than the pitch of the threads, and tool cooperating means on said disk-like member for inserting said disk-like member into the female threaded portion, said tool cooperating means comprising a protuberance in said disk-like member and a kerf formed in said protuberance.

7. In combination, a shaft, a sleeve mounted on said shaft, and means for securing said sleeve against movement relative to said shaft, said means including an unthreaded male member, a disk-like member, said sleeve having an at least partially threaded aperture extending therethrough to the surface of said shaft, the aperture having a diameter to allow said male member to be dropped therein into contact with the shaft, the length of said male member being such that when placed into contact with the shaft its outer end will be located below the surface of the sleeve but not below the threaded portion of the aperture, said disk-like member being slightly less in diameter than the major diameter of the threaded portion of the aperture, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the periphery of said disk-like member being less than the pitch of the threads.

8. In combination, a shaft, a sleeve mounted on said shaft, and means for securing said sleeve against movement relative to said shaft, said means including an unthreaded male member, a disk-like member, said sleeve having an at least partially threaded aperture extending therethrough to the surface of said shaft, said shaft having a well in the surface thereof adapted to be located in coincidence with the aperture in said sleeve, the aperture having a diameter to allow said male member to be dropped therein into contact within said well in the shaft, the length of said male member being such that when placed into contact with the shaft its outer end will be located below the surface of the sleeve but not below the threaded portion of the aperture, said disk-like member being slightly less in diameter than the major diameter of the threaded portion of the aperture, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the periphery of said disk-like member being less than the pitch of the threads.

9. In combination, a shaft, a sleeve mounted on said shaft, and means for securing said sleeve against movement relative to said shaft, said means including an unthreaded male member, the bottom end of said male member being sharpened, a disk-like member, said sleeve having an at least partially threaded aperture extending therethrough to the surface of said shaft, the aperture having a diameter to allow said male member to be dropped therein into contact with the shaft, the length of said male member being such that when placed into contact with the shaft its outer end will be located below the surface of the sleeve but not below the threaded portion of the aperture, said disk-like member being slightly less in diameter than the major diameter of the threaded portion of the aperture, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the periphery of said disk-like member being less

than the pitch of the threads, whereby said disk-like member may be threaded against the outer end of said male member to force and hold the sharpened bottom end thereof against the surface of said shaft.

10. For use in locking a male threaded member against reversing in a female threaded member where the head of the male member is below the outer surface of the female threaded member; a disk-like member slightly less in diameter than the major diameter of the female threaded member, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the periphery of said disk-like member being less than the pitch of the threads.

11. For use in locking a male threaded member against reversing in a female threaded member where the head of the male member is below the outer surface of the female threaded member; a disk-like member not greater in diameter than the major diameter of the male threaded member, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the periphery of said disk-like member being less than the pitch of the threads.

12. For use in locking a male threaded member against reversing in a female threaded member where the head of the male member is below the outer surface of the female threaded member; a disk-like member not greater in diameter than the major diameter of the female threaded member, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of said disk-like member being less than the pitch of the threads.

13. For use in locking a male threaded member against reversing in a female threaded member where the head of the male threaded member is below the outer surface of the female threaded member; a disk-like member slightly less in diameter than the major diameter of the female threaded member, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the periphery of said disk-like member being less than the pitch of the threads, and tool cooperating means on said disk-like member for inserting said disk-like member into female threaded portion, said tool cooperating means comprising a protuberance in said disk-like member and a kerf formed in said protuberance.

14. For use in locking a male threaded member against reversing in a female threaded member where the head of the male threaded member is below the outer surface of the female threaded member; a disk-like member slightly less in diameter than the major diameter of the female threaded member, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the periphery of said disk-like member being less than the pitch of the threads, the periphery of said disk-like member being at least partially beveled to provide a sharper edge which will more securely anchor itself in the female thread.

15. A set screw locking washer comprising a disk-like member adapted to thread into the female threaded member in which the set screw is threaded, the diameter of said disk-like member being greater than the root and less than the outside diameter of the set screw, said disk-like member having at least one or more non-circular edges in the outer periphery of the disk-like member, the periphery of said disk-like member being of a thickness less than the pitch of the threads of the set screw.

16. A set screw locking washer comprising a disk-like member adapted to thread into the female threaded portion in which the set screw is placed, said disk-like member having one or more non-circular edges in the outer periphery thereof, the thickness of said disk-like member at its outer periphery being less than the pitch of the threads.

17. A set screw locking washer comprising a disk-like member adapted to thread into the female threaded portion in which the set screw is placed, said disk-like member having one or more non-circular edges in the outer periphery thereof, the thickness of said disk-like member at its outer periphery being less than the pitch of the threads, said outer periphery being beveled to provide a sharper edge more easily anchorable in the female threaded portion.

18. A set screw locking washer comprising a disk-like member adapted to thread into the female threaded portion in which the set screw is placed, said disk-like member having one or more non-circular edges in the outer periphery thereof, the thickness of said disk-like member at its outer periphery being less than the pitch of the threads, means formed in said disk-like member facilitating cooperation of a tool therewith for threading said member into operative position, said means comprising a kerf in said disk-like member, a hump in said disk-like member in which said kerf is located, said hump raising said kerf above the surface of said disk-like member.

19. In combination, a male threaded member, the diameter of the head of said male threaded member being not greater than the major diameter of the threads of said member, a female threaded member, and single plane means for locking said male threaded member against reversing in said female threaded member when the head of said male threaded member is below the outer surface of said female threaded member.

20. A locking device for a male screw comprising a disk-like member adapted to simultaneously engage the female screw threads and the end of said male screw and to undergo slight deformation when forced into such engagement.

21. A locking device for a male screw comprising a disk-like member of thickness less than that of the screw pitch adapted to simultaneously engage the female screw threads and the end of said male screw and to undergo slight deformation when forced into such engagement.

22. For use in locking a male member against loss from a female member at least partially threaded where the head of the male member is below the outer surface of the female member but not below the threaded portion thereof; a disk-like member slightly less in diameter than the major diameter of the threaded portion of the female member, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the periphery of said disk-like member being less than the pitch of the threads.

23. For use in locking a male member against loss from a female member at least partially threaded where the head of the male member is below the outer surface of the female member but not below the threaded portion of the female member; a disk-like member slightly less in diameter than the major diameter of the threaded

portion of the female member, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the periphery of said disk-like member being less than the pitch of the threads, and tool cooperating means on said disk-like member for inserting said disk-like member into the female threaded portion, said tool cooperating means comprising a protuberance in said disk-like member and a kerf formed in said protuberance.

24. A locking means locking washer comprising a disk-like member adapted to thread into the at least partially threaded female portion in which the locking means is placed, said disk-like member having one or more non-circular edges in the outer periphery thereof, the thickness of said disk-like member at its outer periphery being less than the pitch of the threads.

25. A locking means locking washer comprising a disk-like member adapted to thread into the at least partially threaded female portion in which the locking means is placed, said disk-like member having one or more non-circular edges in the other periphery thereof, the thickness of said disk-like member at its outer periphery being less than the pitch of the threads, means formed in said disk-like member facilitating cooperation of a tool therewith for threading said member into operative position, said means comprising a kerf in said disk-like member, a hump in said disk-like member in which said kerf is located, said hump raising said kerf above the surface of said disk-like member.

26. For use in securing two elements against movement relative to each other, one of said elements having an aperture extending therethrough to the surface of the other element, the aperture being at least partially threaded at its outer end; a male member adapted to be placed through the aperture in the apertured element into contact with the other element, the head of the male member being below the surface of the apertured element but not below the threaded portion of the aperture, and a disk-like member slightly less in diameter than the major diameter of the threaded portion of the aperture, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the periphery of said disk-like member being less than the pitch of the threads.

27. In combination, a pair of elements intended to be held against relative movement one to the other wherein one of the elements has an aperture, at least partially threaded at its outer end, extending therethrough to the surface of the other element, a male member, the head of the male member being below the outer end of the aperture but not below the bottom of the threaded portion, and a single plane means holding said male member against loss from said apertured member, said single plane means cooperating with the threaded portion of the aperture.

28. In combination, a pair of elements intended to be held against relative movement one to the other wherein one of the elements has an aperture, at least partially threaded at its outer end, extending therethrough to the surface of the other element, a male member, the head of the male member being below the outer end of the aperture but not below the bottom of the threaded portion, and means holding said male member against loss from said apertured member, said means comprising a disk-like member slightly less in diameter than the major diameter of the threaded portion of the aperture, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the said disk-like member being less than the pitch of the threads.

29. A locking device for a male member which is inserted in an at least partially threaded female member comprising a disk-like member adapted to simultaneously engage the female screw threads and the end of the male member and to undergo slight deformation when forced into such engagement.

30. A locking device for a male member which is inserted in an at least partially threaded female member comprising a disk-like member of a thickness less than that of the screw pitch adapted to simultaneously engage the female screw threads and the end of the male member and to undergo slight deformation when forced into such engagement.

31. In combination, a shaft, a sleeve mounted on said shaft, and means for securing said sleeve against movement relative to said shaft, said means including a male member, a disk-like member, said sleeve having an at least partially threaded aperture extending therethrough to the surface of the shaft, the aperture having a diameter to allow said male member to be placed therein in contact with the shaft, the length of said male member being such that when placed into contact with the shaft its outer end will be located below the surface of the sleeve but not below the threaded portion of the aperture, said disk-like member being slightly less in diameter than the major diameter of the threaded portion of the aperture, at least one non-circular edge in the outer periphery of the disk-like member, the thickness of the periphery of said disk-like member being less than the pitch of the threads.

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