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OR 2,386,197
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Oct. 9, 1945. H. G. DAWSON 2,386,197

NUT

Filed July 8, 1944

Fig. 1.

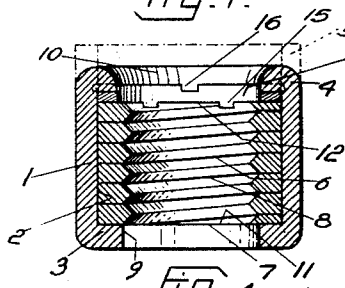


Fig. 3.

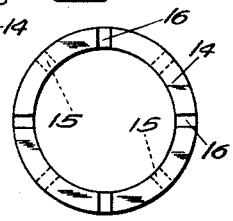


Fig. 2.

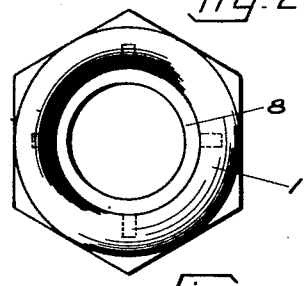


Fig. 4.

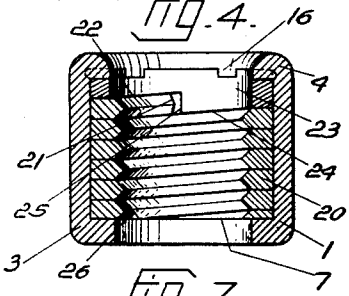


Fig. 5.

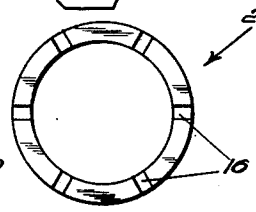


Fig. 6.

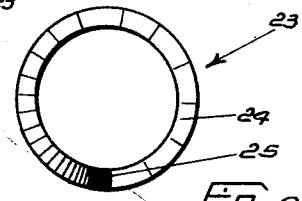


Fig. 7.

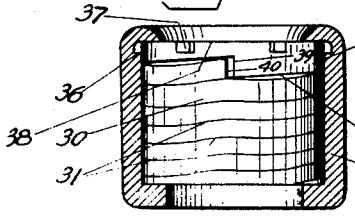


Fig. 8.

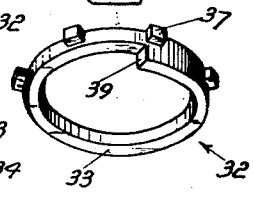


Fig. 9

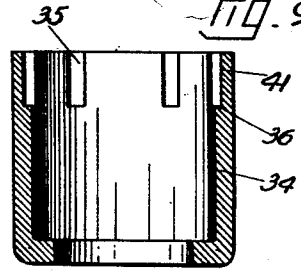


Fig. 11.

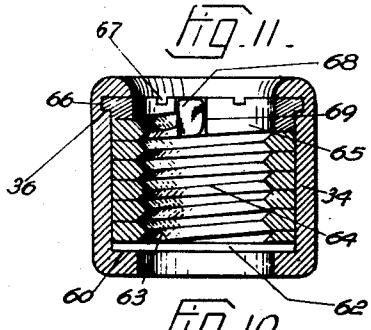


Fig. 12.

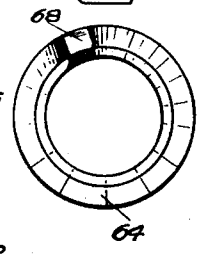


Fig. 13.

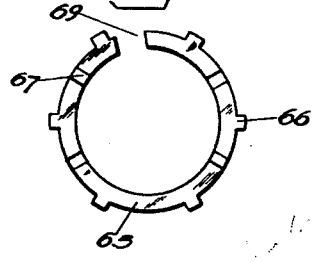
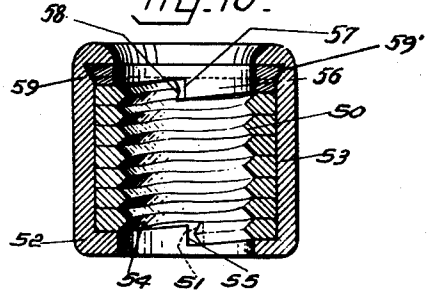


Fig. 10.



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85 DRIVEN, HEADED, & SCREW
THREADED FASTENINGS
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UNITED STATES PATENT OFFICE

2,386,197

NUT

Hector G. Dawson, Glendale, Long Island, N. Y., assignor to Aircraft Screw Products Company, Inc., Long Island City, N. Y., a corporation of New York

Application July 8, 1944, Serial No. 544,042

10 Claims. (Cl. 85—32)

The invention relates to a composite nut comprising a barrel with an inner cylindrical surface and a coil therein between a bottom flange and a top rim of the barrel, both inwardly projecting, and screw-thread-forming portions of the coil convolutions projecting inwardly of the flange and rim. In general, the barrel of a nut of the mentioned type has to withstand relatively high stresses, particularly in the bottom flange and top rim, as it is desired to reduce the dimensions of such composite nut as much as admissible so that it does not materially, or only as little as possible, exceed the conventional one-piece nut in size as to both its height and its diameter or circumference. It is also desired that the external shape of the nut does not materially differ from the usual form. Furthermore, a torque applied to the barrel must be transmitted to the coil so that the nut can be screwed on and off a correspondingly threaded screw bolt, and for many uses it is even required that a certain limited movement of the coil relatively to the barrel is possible, notwithstanding the mentioned transmission of the torque from the one to the other. This latter requirement must be taken into consideration especially when the resilient quality of the coil is utilized as in various types of stop or lock nuts.

The present invention aims to provide a composite nut which is better suited to fulfill the mentioned requirements than the composite nuts of conventional structure. It consists essentially in that the nut comprises, in addition to the barrel and coil, an anchoring member secured interiorly of the barrel near its top end and embodying a face or faces for engagement by the coil so as to limit or to prevent movement of the latter, be it in axial or peripheral direction in relation to the barrel.

Further objects and details of the invention will be apparent from the description given hereinafter and the accompanying drawing illustrating several embodiments thereof by v ay of example. In the drawing,

Fig. 1 is a longitudinal cross-section of a nut according to the invention;

Fig. 2 is a top plan view thereof;

Fig. 3 is a top plan view of the anchoring member thereof;

Fig. 4 is a cross-section of another embodiment;

Figs. 5 and 6 are top and bottom plan views respectively of the anchoring member thereof;

Fig. 7 is a side elevation of the coil and anchoring member in the barrel of a third embodiment, the barrel being in section;

Fig. 8 is a perspective view of the anchoring member thereof;

Fig. 9 is a cross-section of the barrel prior to the insertion of the coil and the anchoring member;

Fig. 10 is a cross-section of a modification of Fig. 7;

Fig. 11 is another modification thereof; and

Figs. 12 and 13 are top plan views of the coil and anchor ring of Fig. 11.

With reference to the drawing, Figs. 1 to 3, the nut according to the invention comprises a barrel 1 with cylindrical inner surface 2, a bottom flange 3 and an inwardly turned top rim 4 which in its original position has the form 5 indicated in dotted lines. A cylindrical coil 6, preferably of resilient material, fits into the barrel and bears on the top surface 7 of the flange 3. The cross-section of the coil convolutions may be of any suitable configuration with screw-thread-forming portions 8 inwardly projecting with respect to the openings 9 and 10 of the bottom flange and the top rim respectively. It is necessary to secure the coil to the barrel so that a torque can be transmitted from the one to the other. However, it is desirable to allow for a slight relative movement of the two parts in either an axial or a peripheral direction or both. This is particularly true if the resiliency of the coil is used in order to obtain a locking action of the nut. It will be clear that the resiliency of the total length of the coil cannot be put to play if points of the coil intermediate its ends are fixed to the barrel. Even a rigid fixation of both coil ends will permit only certain deformations so that, e. g. if one convolution is slightly expanded, one or several others must be contracted, or if the spacing of two adjacent convolutions is increased the spacing of others must be accordingly decreased. In consequence, if a rigid connection is applied such connection should be provided on one end only. However, in that event it is not immaterial which end is to be selected for this purpose. If a coil of the kind here under consideration is screwed on a threaded bolt, there is the tendency of the convolutions to expand. Such expansion is desirable, particularly in that convolution which is leading i. e. the bottom convolution, when the composite nut is applied to such bolt in order to facilitate the inter-engagement of the two members. Obviously, the deformation of the leading convolution is least restricted if the anchoring point is far remote therefrom. For this reason, it is the trailing or

top end of the coil which according to the invention is anchored to the nut barrel, whereas the leading or bottom end should be free to move or deform within limits. It will be understood that such limits will be extremely narrow. A hundredth or even a thousandth of an inch of freedom to move or to deform may be all that is required according to the tolerances used in making the nut and the bolt for which the nut is destined. However, in other cases, it may be preferable to provide for a larger freedom to an extent say of one- or two-tenths of an inch. Although it is possible to secure the top convolution of the coil directly to the barrel, I prefer to provide an anchoring member for the connection of coil and barrel for reasons to be explained hereinafter.

In the illustrated embodiment, the bottom and top surfaces 11 and 12 respectively of the coil are plane at right angles to the nut axis, and the bottom surface 11 bears on the flange 3. In the top surface 12 one or a plurality of radial grooves 13 are provided for the purpose of anchoring the coil. The anchoring member consists of a ring 14 with projections 15 on its lower face and a plurality of grooves or notches 16 in its top face. The ring fits into the barrel and its inner diameter substantially corresponds to that of the opening 10 of the top rim 4. When the ring 14 is placed on top of the coil the projections 15 fit into the grooves 13 while material of the top rim 4 engages the grooves or notches 16 of the ring when the rim of the barrel is tilted over by swaging or any other suitable operation from its original position 5 into the final position and shape 4. Thus it will be clear that the anchor ring is held against movement relatively to the barrel rim and the upper coil end is prevented from turning relatively to the barrel by its engagement with the anchor ring. Still, beginning from its lower end, the coil may expand as much or as little as e. g. a sliding fit of the coil in the barrel permits is a screw bolt exerts radial pressure on the convolutions. It has been stated hereinbefore that it may become necessary to transmit considerable forces between the members of the composite nut. There will be among other stresses e. g. an appreciable pressure per unit area on the top face 7 of the flange 3, and the top rim 4 with its material engaging the grooves 16 of the anchor ring will have to resist a torque or at least a major portion of a torque set up between coil and barrel. This calls for a high grade or hard material of the barrel. On the other hand, the barrel material should be sufficiently ductile to permit the tilting over of the top rim 4 from its original position 5. The expedient of hardening the nut barrel in general after the nut is otherwise finished is not applicable because the material of the coil may be harmfully affected. The following method, however, which is also part of the invention, gives satisfactory results. The barrel is made of a ductile material which can be hardened, in the shape shown in Fig. 1 and with its top rim erected in the form indicated at 5. Then, the lower portion of the barrel with its flange 3 and up to e. g. one-third of its height is subjected to a hardening treatment so that the hardness gradually decreases upwardly from the level of the flange top surface 7. This leaves the top portion of the barrel soft. Thereupon, the coil 6 and the anchor ring 14 are inserted and the top rim swaged or otherwise turned inwardly down upon the anchor ring so that material of the rim enters the grooves or notches 16 of the ring. When the nut is in its finished shape the top rim is subjected to a hardening treatment wherein care is taken that the effect of such treatment does not extend downward beyond the lower level of the ring. In this manner, hardening of the barrel in its portions where required can be accomplished without interfering with the structure of the coil material, because the thickness of the ring 14 can be used as a safety zone in which the effects of the treatment can decrease to a minimum. Although other methods of hardening may be useful in connection with the mentioned treatment, the so-called and well-known induction hardening method appears to be particularly well suited for the purpose here under consideration with respect to both the lower portion of the barrel and its top rim.

In the modification illustrated in Figs. 4 to 6, the barrel 1 is of the same kind and shape as that of Fig. 1. The coil 20, however, has a cross-section suitable for a round thread rather than for a V-thread as in the case of the coil 6. This difference is not material from the viewpoint of the present invention as stated hereinbefore. However, the top end of the coil ends in a face 21 which is substantially parallel to the coil axis. In other words, the top face 22 of the coil is helically curved according to the pitch of the coil. This top face bears against an anchor ring 23 the bottom face 24 of which is correspondingly curved so as to furnish a bearing surface for at least the major portion of the top coil convolution. Between the highest and lowest portion of this surface there is a substantially radial face 25 adapted as an abutment for the coil end face 21. The ring is secured to the barrel by suitable means which are shown as being of the same kind as in Fig. 1, that means the top face 26 of the ring is provided with grooves 16 into which material of the barrel rim engages after the latter has been turned down upon the assembled coil and ring. It will be noticed that a small clearance is shown between the end face 21 of the coil and the abutment face 25 of the anchor ring. Such clearance allows for a greater deformation and movement of the coil in the barrel than otherwise possible, and its actual size may be selected according to the particular condition for which the nut is destined. If this nut is screwed on a bolt the torque applied to the barrel will cause a slight shift until the face 25 of the ring bears against the end face 21 so as to transmit the torque to the coil. Thereby a very small gap may occur between the lower plane face 26 and the top face 7 of the barrel flange so that the coil is free to stretch a little and to fit as closely as possible the bolt threading when progressively more convolutions come into engagement. When finally the nut bears upon a supporting face, further tightening of the nut will cause a tension whereby the coil is pressed against the top surface 7 of the flange 3 so that the total load of the nut is transmitted through the bottom flange 3. If the nut is to be screwed off the bolt, a relative shift of coil and barrel may occur in the opposite direction. In that event the top face of the coil will slide along the helical face 24 of the ring. Thereby, the pressure between th bottom flange of the barrel and the coil will be increased until the friction between the two overcomes the friction in the threading whereupon the entire nut will follow the torque applied to the barrel.

In certain instances it may be a disturbing factor that the swaging of the barrel rim 4 tends to compress the coil and anchor ring with the result that resilient deformations of the coil are

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rendered impossible, unless great care is taken in the production to avoid such happening. This would be particularly harmful where the nut is to be used as a lock nut and where for that purpose the coil is formed for instance with waves, in either axial or radial direction. The modification shown in Figs. 7 to 9 illustrates a structure whereby such undesirable compressions of the coil can be avoided.

The arrangement in Fig. 7 is very similar to that of Fig. 4, the coil **30** differing from the coil **20** merely by the waving indicated at **31**. The anchor ring **32** has a helical lower face **33** of the same pitch as the coil **30**, but is not waved in the manner of the coil convolutions. In order to secure the ring to the barrel **34** against turning, the top portion **41** of the barrel is provided while still in its erected position as shown in Fig. 9, with axial grooves **35** forming shoulders **36** at a predetermined level. Into the grooves **35** engage radially extending projections **37** of the anchor ring **32**. The projections **37** engaging the shoulders **36** cannot be pressed downward when the top rim of the barrel is turned over to bear upon the top face **38** of the anchor ring as shown in Fig. 7. It will be clear that in this manner it is possible to provide for any desired freedom of coil deformations, notwithstanding pressure exerted on the ring **32** in an axial direction. It is, of course, also possible to provide, in addition to the projections **37**, grooves in the top face of the anchor ring such as the grooves **16** in Figs. 1 and 2, to be engaged by the material of the top rim of the barrel. In other respects, the nut of Fig. 7 is similar to the structure shown in Fig. 4 so that the transmission of a torque applied to the barrel will be accomplished by the ring face **39** abutting against an end face **40** of the top coil convolution.

Fig. 10 illustrates a modification of the embodiment shown in Fig. 7. It differs from the latter essentially in that the coil **50** has not only a helical top surface, but also a helical lower end with a face **51** in a substantially radial plane parallel to the nut axis. Correspondingly, the bottom flange **52** of the barrel **53** has a helical top surface **54** to support the coil, and a surface **55** to serve as an abutment for the coil surface **51**. Similarly, the anchor ring **56** has a lower helical surface of the type shown in the embodiments of Figs. 4 and 7 with an abutment face **57** for engagement with the upper end face **58** of the coil. The upper portion of the ring **56** differs from ring **32** in that it is provided with a serrated conical periphery **59** so as to engage a conical shoulder **59'** of the barrel, the serrations cutting into the barrel material when the ring is pressed down into position. It will be clear that such structure serves the same purpose as the projections **37** of the ring **32**, in securing the ring to the barrel against axial as well as peripheral relative movement. In other respects, the nut of Fig. 10 is similar to the nut of Fig. 7. Hence, when the nut is applied to a bolt, coil **50** will bear with its face **58** against the face **57** of the ring **56** in the same manner as the face **40** will abut against face **39** in Fig. 7. When, however, the nut of Fig. 10 is screwed off the bolt, the coil will tend to turn in the barrel so that the face **58** moves away from face **57** and the lower coil end face **51** will abut against face **53** to prevent further turning of the coil **50** relatively to the barrel **53**, whereas in the case of Fig. 7 such further relative movement is prevented when the coil has initially turned sufficiently to clamp the coil firmly between the plane top surface of the bottom flange and the anchor ring owing to the helical shape of the bottom surface of the latter. It will be understood that the initial relative movement will be caused in both instances by the friction between the coil convolutions and the bolt threading. Furthermore, in both instances contraction of the coil owing to such friction will be prevented on account of the fact that the force resisting relative movement of the coil acts against the lower coil end. Any locking action of such nut will, therefore, relay more or less exclusively on such locking features as e. g. the waving **31** of the coil convolutions.

However, it is possible also to provide the nut with self-locking qualities without such additional measures like the mentioned waving. This is shown in Fig. 11. The barrel in this case may be provided with either a flat top surface **60** of the bottom flange as illustrated or with a helical flange surface of the type of Fig. 10. The lower portion of the coil may be shaped accordingly but it is necessary that there is originally sufficient clearance between the lower end face of the coil and the top face of the flange to allow for a limited axial expansion of the coil. Such clearance is indicated at **62** between the face **63** of the coil **64** and the face **60** of the barrel flange. Contrary thereto, the top end of the coil must be so anchored as to prevent it from any turning movement relatively to the barrel, and owing to the requirement of a certain axial deformation or even movement of the coil, it is to be preferred that no axial force is exerted on the coil when the barrel rim is swaged as hereinbefore described. In other words, the anchor ring **65** should be held in a suitable manner as e. g. according to Fig. 7 or 10. Thus, ring **65** is provided with radial projections **66** which bear on shoulders **36** of the barrel **34**. Rotation of the ring in the barrel may be prevented by such means as hereinbefore described, or by indentations **67** of the top face to be engaged by the material of the barrel rim, or by other suitable means. The top end of the coil **64** may be secured to the anchor ring in the manner shown in Fig. 1. However, in view of the possibility of an axial movement a greater axial length of the engaging faces is to be preferred. For this reason the end **68** of the coil is so shaped as to project upwards. The thread forming portion **69** of the top convolution does not extend into the upturned end **68** so that a bolt is free to be screwed through the whole length of the nut. The anchor ring **65** is substantially shaped like ring **32** of Fig. 8, except for a recess **69** to receive therein the coil end **68**. It will be noticed that the recess is provided between the widest and the narrowest portion of the ring **65**.

Now it will be clear that if the nut of Fig. 11 is screwed on a bolt, the convolutions of the coil will tend to expand until the nut comes into contact with a supporting surface whereupon the coil will be firmly pressed on the top surface **60** of the barrel flange. If, however, a torque is applied to the nut in a direction to screw it off a bolt, the friction between bolt threading and the coil will tend to contract the convolutions which to a certain degree can follow such tendency owing to the freedom of the lower coil end. In consequence, the coil may increase its grip on the bolt with a desired locking action.

It will be understood that the abovementioned hardening process may be advantageously used in the production of the last described nut as well as of any one of the preceding nuts.

Having now described several embodiments of my invention, it will be apparent to those skilled in the art that many alterations and modifications thereof may be made without departing from the spirit and essence of my invention, which shall be limited only by the scope of the appended claims.

I claim:

1. A composite nut comprising a barrel with cylindrical inner surface and an interiorly projecting bottom flange, a wire coil fitting into said barrel and having a bottom face substantially corresponding to the shape of the top face of said flange, the convolutions of said coil including screw-thread-forming portions, and an anchoring member secured to said barrel on top of said coil and including faces for engagement with the top portion of said coil to transmit torques in both directions of turning from the barrel to the coil with freedom of the lower coil end to deform slightly and accordingly to shift relatively to the barrel flange.

2. A composite nut comprising a barrel with cylindrical inner surface, a bottom flange and a top rim both interiorly projecting, a wire coil fitting into said barrel and having a bottom face substantially corresponding to the shape of the top face of said flange, the convolutions of said coil including screw-thread-forming portions, and an anchor ring between said coil and said rim and secured to said barrel against relative movement, said ring including faces for engagement with the top portion of said coil to transmit torques in both directions of turning from the barrel to the coil with freedom of the lower coil end to deform slightly and accordingly to shift relatively to the barrel flange.

3. A composite nut comprising a barrel with cylindrical inner surface, a bottom flange and a top rim both interiorly projecting, a wire coil fitting into said barrel and having a bottom face substantially corresponding to the shape of the top face of said flange, the convolutions of said coil including screw-thread-forming portions, an anchor ring between said coil and said rim and secured to said barrel against relative rotation, means in connection with said ring and said barrel to prevent said ring from shifting in an axial direction, said ring including faces for engagement with the top portion of said coil to transmit torques in both directions of turning from said barrel to said coil.

4. A nut as claimed in claim 3, the top face of said coil and the bottom face of said ring being substantially plane and including interengaging indentations and projections.

5. A nut as claimed in claim 3, said coil and said ring having helically curved top and bottom faces respectively and including abutment faces in planes substantially parallel to the nut axis.

6. A nut as claimed in claim 3, said coil and said ring having helically curved top and bottom faces respectively, said ring being provided with a recess, and the upper coil end including an upwardly extending projection in engagement with said recess.

7. A composite nut comprising a barrel with cylindrical inner surface, a bottom flange and a top rim both interiorly projecting, a wire coil fitting into said barrel and having a bottom face substantially corresponding to the shape of the top face of said flange, the convolutions of said coil including screw-thread-forming portions, an anchor ring between said coil and said rim and secured to said barrel against relative rotation, means in connection with said ring and said barrel to prevent said ring from shifting in an axial direction, said ring including faces for engagement with the top portion of said coil to transmit torques in both directions of turning from said barrel to said coil, and the length of the coil, when the nut is not in use, being slightly smaller than the space available for the coil between said ring and said flange.

8. A composite nut comprising a barrel with a cylindrical inner surface, a bottom flange and a top rim, both inwardly projecting, a wire coil fitting into said barrel and an anchor ring between said coil and said rim and secured to said barrel, the bottom face of said rim, the top face of said flange and the top and bottom faces of said coil being helically curved with the same pitch, said ring and said flange including abutment faces for the coil ends in planes substantially parallel to the nut axis, and said coil being slightly shorter than the distance between said abutment faces.

9. A composite nut comprising a barrel with a cylindrical inner surface, a bottom flange and a top rim, both interiorly projecting, a wire coil fitting into said barrel on top of said flange, the convolutions of said coil including screw-thread-forming portions, and an anchor ring between said coil and said rim and secured to said barrel against relative movement, said ring and the top portion of said coil including means to transmit torques from the one to the other, said barrel including a lower portion hardened prior to the insertion of said coil and said ring, and including an upper portion hardened after the forming of the inwardly projecting rim.

10. A composite nut as claimed in claim 9 wherein said hardened lower barrel portion extends from the bottom face of the barrel upwards beyond the level of said flange, and said upper hardened portion extends from the top surface of the barrel slightly below the lower level of said rim.

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