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Boke

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[54] **LOCK NUT COOPERABLE WITH ELECTRICAL TERMINAL BLOCK**

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[52] **U.S. Cl.** ..... **339/198 R**, 339/263 R, 339/272 R, 151/7

[51] **Int. Cl.** **H01r 9/00**

[58] **Field of Search** 339/198, 263, 268, 269, 339/270, 272; 151/7

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[57] **ABSTRACT**

A lock nut for a screw seated in a deep, narrow recess has an axially elongated plastic body formed at one end for torque applying engagement by a noncircular driving tool. Opening to its other end is a coaxial hole that is deep enough to receive the entire screw shank. A tapped metal insert is secured in the hole at its outer end. Inwardly of the insert the hole has a portion of smaller transverse dimension than the screw diameter to provide internal surface portions that snugly engage the crests of the screw threads.

4 Claims, 4 Drawing Figures

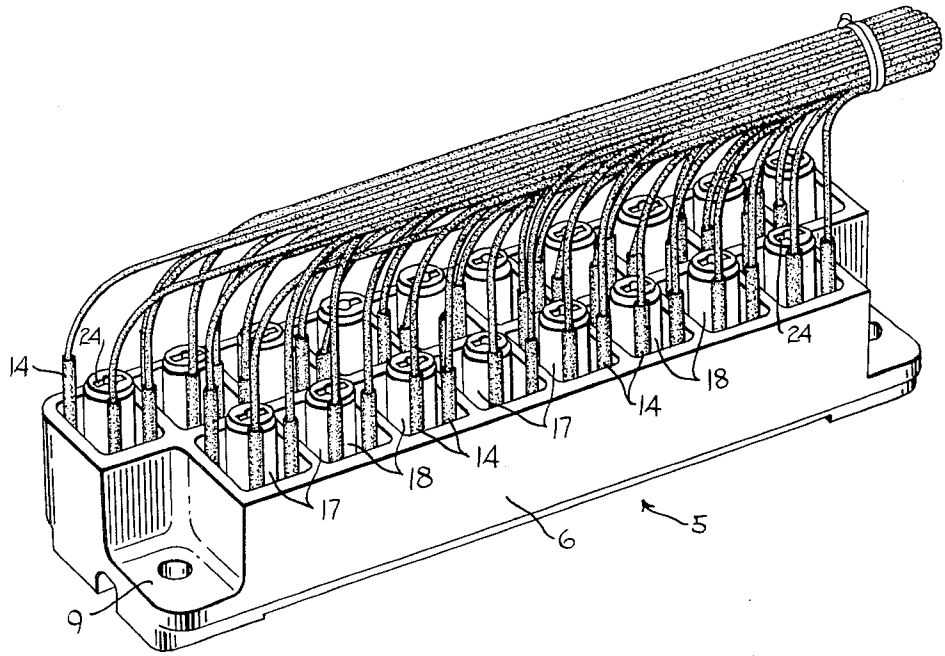


FIG. 1.

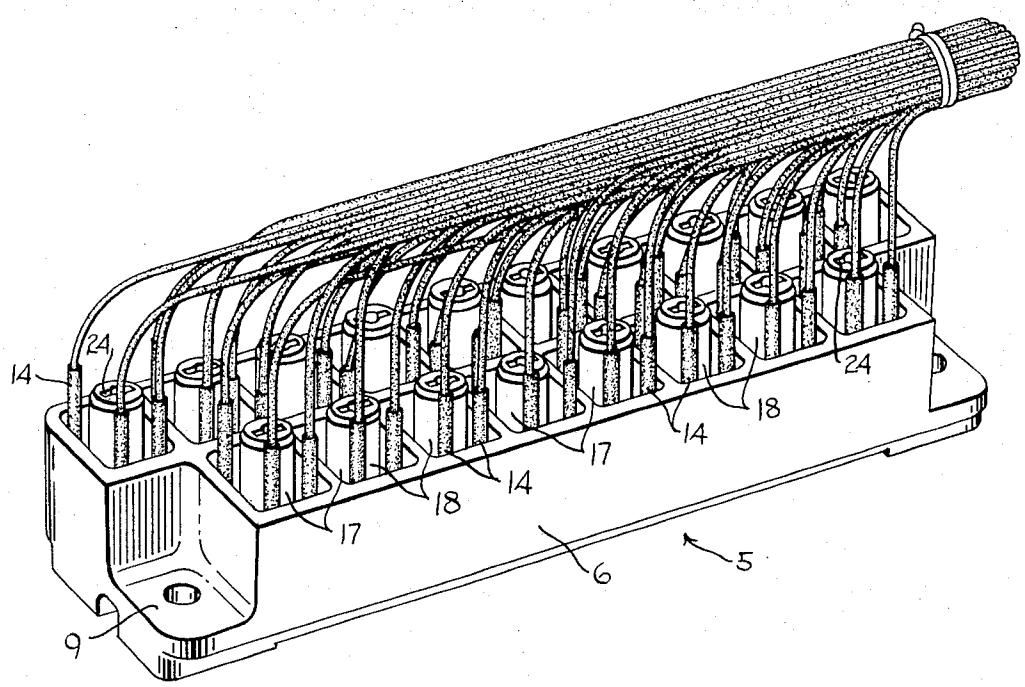


FIG. 4.

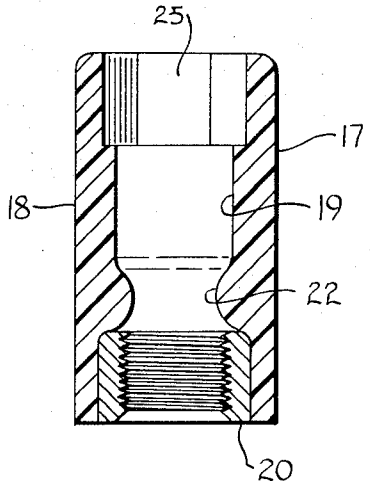


FIG. 2

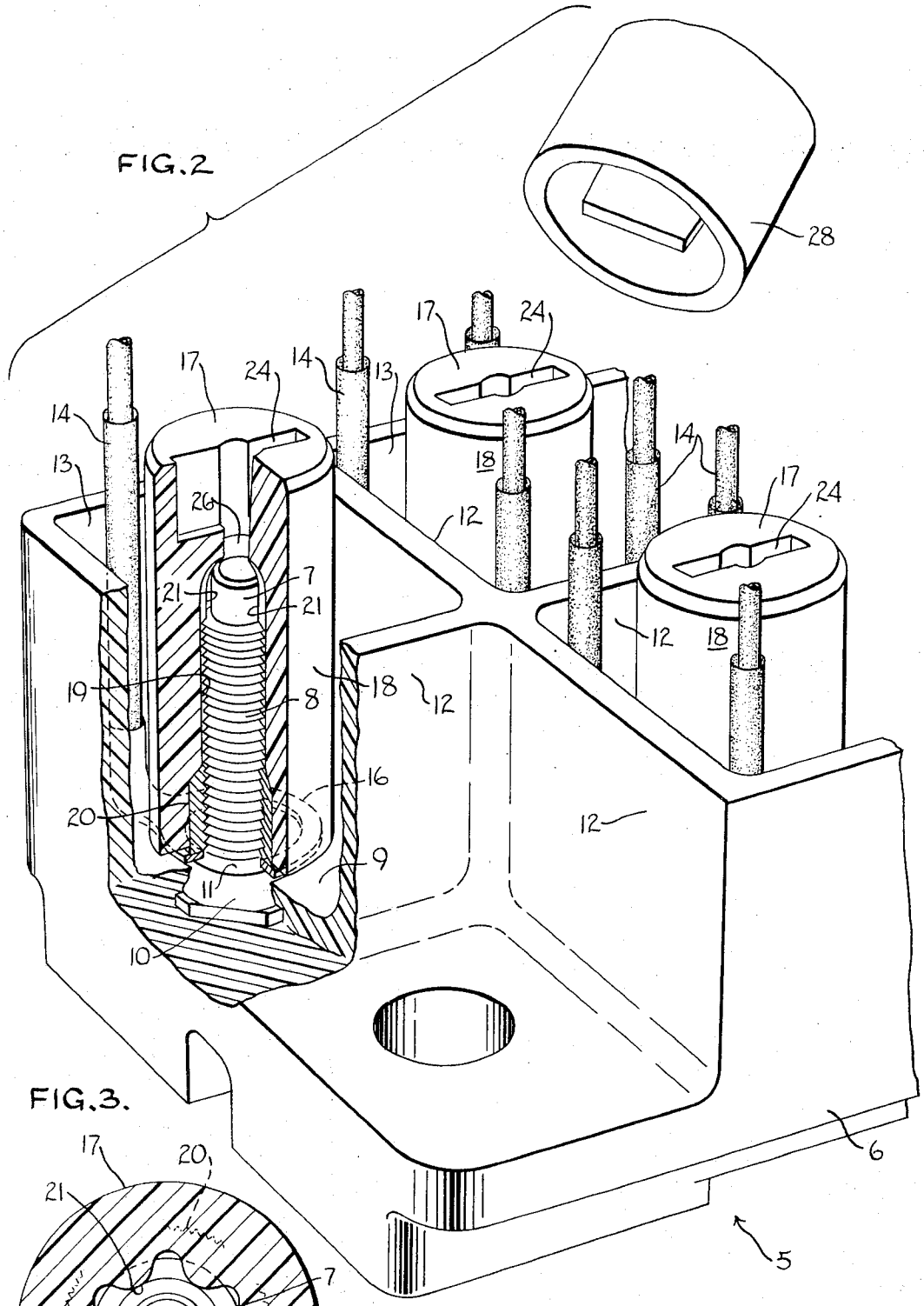
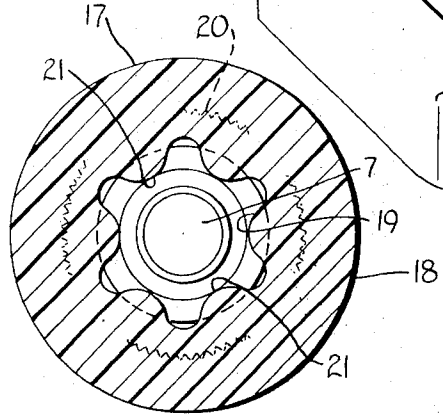


FIG. 3.



LOCK NUT COOPERABLE WITH ELECTRICAL TERMINAL BLOCK

This invention relates generally to lock nuts and has more particular reference to lock nuts that can be applied to screws which are so situated that conventional wrenches and similar nut torquing tools cannot be conveniently used. The invention also relates to an electrical terminal block having terminal screws seated in relatively deep recesses and to which such lock nuts are applied.

In certain installations a screw to which a lock nut must be fastened is so situated that there is not sufficient lateral space around the screw to permit a wrench to be conveniently used for applying to the lock nut the comparatively high torque force required to run it onto the screw.

The problem frequently presents itself with respect to electrical terminal blocks to which a substantially large number of conductors are brought. Such blocks usually comprise a base of insulating material from which screws or threaded studs project in one direction. The conductors with which the terminal block cooperates have eyelet connectors on their ends that are placed around the screws and secured by nuts. Where the installation is subject to vibration, as in aircraft applications, lock nuts must be used to hold the eyelet connectors in place. However, for compactness, the screws or studs are spaced apart by only small distances, and to prevent arcing and short-circuiting between adjacent screw terminals each screw is received in a recess or is isolated from adjacent screws by partitions. In such an environment it is very difficult to secure conventional lock nuts to the terminal screws even in the absence of the wires, but the presence of numerous conductors connected with the screw terminals further complicates such securement.

With these considerations in mind it is a general object of the present invention to provide a lock nut that can be readily threaded onto a screw that is situated in a relatively deep, narrow recess, and which lock nut can be turned onto and off the screw by means of a substantially conventional torque applying tool.

Another and more specific object of this invention is to provide a lock nut for an electrical terminal screw which provides an insulating cover and enclosure for substantially the whole of the screw but which nevertheless enables a test prod to be engaged with the screw for purposes of circuit checking.

It is also an object of this invention to provide an electrical terminal block assembly which comprises the lock nuts of this invention and which is unusually compact but is nevertheless capable of providing mechanically and electrically sound connections with a large number of conductors.

In general the objects of the invention are achieved with an axially elongated nut body of plastic or other insulating material that has one of its ends formed to be drivingly engaged by a noncircular torque applying tool and has a tapped well or hole opening to its other end, said well or hole being deep enough to receive substantially the whole shaft of a screw upon which the nut is to be received and having an axially inner portion formed to have frictional rotation retarding engagement with the crests of the screw threads, the internal threads in said hole being preferably provided in a tubular metal insert in said hole near the axially outer end thereof.

With these observations and objectives in mind, the manner in which the invention achieves its purpose will be appreciated from the following description and the accompanying drawings, which exemplify the invention, it being understood that changes may be made in the specific apparatus disclosed herein without departing from the essentials of the invention set forth in the appended claims.

The accompanying drawings illustrate two complete examples of embodiments of the invention constructed according to the best modes so far devised for the practical application of the principles thereof, and in which:

FIG. 1 is a front perspective view of a terminal block having a large number of terminal screws, each seated in a recessed compartment and each having one or more conductors secured to it by means of a lock nut of this invention;

FIG. 2 is a fragmentary perspective view on a larger scale of one of the compartments of the terminal block shown in FIG. 1, with portions shown broken away to illustrate details of construction;

FIG. 3 is a view in cross section taken on the plane of the line 3—3 in FIG. 2; and

FIG. 4 is a view in longitudinal section of a modified embodiment of the lock nut of this invention.

Referring now to the accompanying drawings, the numeral 5 designates generally a terminal block of a type which is especially suitable for aircraft and other installations where extreme compactness and substantial immunity to vibration are important requirements. The terminal block 5 comprises a body member 6 that can be readily molded of plastic insulating material and a plurality of terminal screws 7 that have their threaded shaft portions 8 projecting upwardly from a bottom wall 9 of the body member. The head 10 of each screw is preferably noncircular at least in part and has its noncircular portion embedded in the bottom wall 9 to thus anchor the screw against all movement relative to the body member 6. A circumferential shoulder 11 on the head of the screw can be exposed flush with the top surface of the bottom wall, or at a level slightly above it, to provide a contact surface around the shaft of the screw.

The body member has integral partition walls 12 projecting upwardly from its bottom wall 9 to a level near the tops of the terminal screws. The screws are preferably located at uniform distance intervals and arranged in ranks and files, and there is a partition wall 12 between each pair of adjacent screws, equidistant from them. The partition walls 12 thus define substantially deep rectangular cells or recesses 13 in which the screws are seated.

Each conductor 14 that is to have a connection to the terminal block 5 has a conventional eyelet connector 16 on its end, receivable around the shaft 8 of the terminal screw to which it is to be connected and adapted to flatwise overlie the shoulder 11 on the screw to have electrical connection therewith. The eyelet terminals on each screw are clampingly secured in firm flatwise engagement with one another and with the shoulder 11 on the screw by means of a lock nut 17 of this invention that is threaded onto the screw shaft.

In general, the lock nut 17 comprises an elongated body 18 of plastic or other insulating material. Macrolon, nylon, polysulfon and the like are suitable materi-

als for the nut body, which must be generally rigid but capable of some deformation under force. In external configuration the nut body can be generally cylindrical, or it can taper somewhat towards its upper end, but in any case it has a length substantially greater than that of the screw shaft. A coaxial hole or well **19** that opens to one end of the nut body (its lower end, as shown) is deep enough to receive substantially the entire shaft portion **8** of the terminal screw; hence the nut body provides an insulating cover and enclosure for the terminal screw.

The axially outermost portion of the hole or well **19** has a diameter substantially larger than that of the screw shaft and has snugly received therein a tapped tubular metal insert **20.** To constrain the insert to rotate with the nut body, the insert can have an external surface that is hexagonal in end view, or it can be knurled or otherwise made noncircular; and the axially outer end portion of the well in which the insert is received can be given a corresponding noncircular shape. To insure that the insert will be securely retained in the body it can be cemented into the well **19.** The axially outer end of the insert can be flush with the adjacent end of the nut body, or can project very slightly beyond it. to make good contact with an eyelet connector that it overlies.

Axially inwardly of the metal insert the well or hole **19** has a reduced diameter such that portions of its inner surface can firmly engage the crests of the threads of the screw on which the nut is received, to frictionally impede rotation of the nut. As best seen in FIG. **3,** this axially inner portion of the well can be formed with axially extending radially inwardly projecting lands or ridges **21** that engage the crests of the screw threads at circumferentially spaced intervals. Alternatively, as illustrated in FIG. **4,** the screw receiving well **19** can be formed with a circumferential land or bead **22** that has an inside diameter slightly smaller than the overall diameter of the screw shaft, said bead being axially inwardly adjacent to the metal insert **20.**

At its end opposite the one to which the hole or well **19** opens the nut body is formed to receive a noncircular driving tool by which torque can be applied to it. Since the nut body is longer than the screw shank so that its upper end projects above the partition walls **11,** it could have its projecting end portion externally formed to a hexagonal shape, to receive a conventional wrench. Preferably, however, the body is formed with a tool receiving socket in its upper end. Thus, as illustrated in FIGS. **1, 2** and **3,** the upper end of the nut body can be formed with a screwdriver cross-slot **24;** or, as illustrated in FIG. **4,** it can have a hexagonal socket **25** for receiving an Allen wrench. In view of the presence of the bead **22** in the FIG. **4** embodiment, the Allen wrench socket must have a minimum transverse dimension no smaller than the inside diameter of the portion of the well **19** that is axially inwardly adjacent to it, to enable the nut body to be formed with the use of conventional molding equipment.

The tool receiving socket is communicated the hole or well **19,** as at **26** in FIG. **2,** to enable a test prod to be inserted through the tool receiving socket and engaged against the terminal screw. In this manner circuit continuity and the like can be checked without the need for removing lock nuts.

While the nut body has an outside diameter only slightly less than the length and width of the rectangular cell or recess in which it is received, the rectangular configuration of the recess provides corner zones in which the conductors **14** can be accommodated. Thus as many as four conductors can be connected with each terminal screw, and by disposing the conductors in the four inner corners defined by the partition walls **11** around the screw, the conductors will be held in place by those partition walls in cooperation with the lock nut on the screw and will be nicely isolated from one another and maintained in an orderly arrangement that leaves the tool receiving socket in the lock nut readily accessible.

Since the plastic body of the lock nut must be somewhat soft, to allow the thread engaging land **22** or lands **21** to be yieldingly deformed by engagement with the crests of the screw threads, it is preferable that the tool used for driving the lock nut of this invention have means thereon for supporting the wall of the tool receiving socket. Thus a screwdriver **27** to be used with the lock nuts illustrated in FIGS. **1–3** can have a cup-shaped coaxial sleeve **28** around the tip portion of its blade to fit closely around the upper end of the plastic nut body. With such a screwdriver the crossslot in the nut body can be made relatively large, to facilitate screwdriver insertion. A similar sleeve can of course be provided on an Allen wrench used with the FIG. **4** embodiment so that the wall around its tool receiving socket can be made relatively thin without danger of breaking.

From the foregoing description taken with the accompanying drawings it will be readily apparent that this invention provides a lock nut that can be readily installed on and removed from a screw or threaded stud that is situated in a relatively deep recess, and that the lock nut of this invention is especially suitable for electrical terminal blocks because it provides an insulating enclosure for substantially the whole shaft of the screw on which it is installed.

Those skilled in the art will appreciate that the invention can be embodied in forms other than as herein disclosed for purposes of illustration.

The invention is defined by the following claims:

1. Terminal means for electrical conductors having eyelet connectors on their end portions and by which the eyelet connectors can be fixed in good electrical and mechanical connection with one another, said terminal means comprising:

A. a terminal body member of insulating material having a base wall;

B. a screw member fixed to said base wall and having a threaded shaft projecting upwardly therefrom;

C. said terminal body member having other wall portions projecting upwardly from said base wall to near the top of said shaft, said other wall portions surrounding the shaft all around the same and in close proximity thereto and joining one another at corners in which can be received portions of conductor wires that have their eyelet connectors around the shaft and adjacent to the base wall; and

D. means for maintaining good electrical connection between the screw shaft and eyelet connectors around it while securely but removably holding the eyelet connectors in place adjacent to the base wall, for confining in said corners the conductor wires that are connected to said eyelet connectors, and for electrically insulating the screw shaft and

the eyelet connectors while leaving said shaft accessible to a test prod, said means comprising

1. a substantially tubular member of rigid but deformable insulating material, substantially longer than the screw shaft, said tubular member having a substantially cylindrical external surface of a diameter to be closely receivable between said other wall portions and having a bore extending through the entire length thereof, said bore
   1. being of noncircular cross section in an upper end portion thereof to receive a correspondingly noncircular driving tool by which the tubular member can be rotated, and
   2. having, intermediate its ends, a transverse dimension somewhat smaller than that of the screw shaft to provide inner surface portions on the tubular member that are deformably engageable with the crests of the threads on the screw shaft to inhibit rotation of the tubular member relative thereto; and
2. a coaxial substantially tubular metal insert anchored in the lower end portion of said bore and having an internal thread cooperable with the thread on the screw shaft.

2. The terminal means of claim **1** wherein said tubular member is further characterized by:

the inner surface of the tubular member, intermediate its ends, being formed with axially extending, radially inwardly projecting, circumferentially spaced ridges, the radially inner portions of which define said transverse dimension and are engageable with the crests of the screw threads at circumferentially spaced zones therearound.

3. Terminal means for electrical conductors having eyelet connectors on their end portions, said terminal means being of the type comprising a terminal body member of insulating material having a base wall and a threaded metal screw shaft which is fixed in said base wall and projects upwardly therefrom and around which the eyelet connectors can be engaged, said terminal means being arranged to releasably hold the eyelet connectors in good electrical and mechanical connection with one another and to hold their adjacent end portions of their conductors substantially parallel to the screw shaft, said terminal means comprising:

A. other wall portions on said body member, projecting upwardly from the base wall to near the top of the screw shaft, said other wall portions surrounding the screw shaft and being close to the same except at corners at which said other wall portions meet and in which said end portions of conductors are receivable;

B. a substantially rigid tubular retaining member of rigid but deformable insulating material, substantially longer than the screw shaft, said retaining member
   1. having a substantially cylindrical external surface of a diameter to be closely receivable between said other wall portions so that when received on the screw shaft the retaining member confines said end portions of conductors in said corners, and
   2. having a bore extending through the entire length thereof, said bore
      a. having an upper end portion which is of noncircular cross section to receive a correspondingly noncircular torque applying tool and which is of a size to receive a test prod to be engaged with the screw shaft, and
      b. said bore having, intermediate its ends, a transverse dimension somewhat smaller than that of the screw shaft to provide inner surface portions on the retaining member that are deformably engageable with the crests of the threads on the screw shaft to inhibit rotation of the retaining member relative thereto; and

C. a coaxial substantially tubular metal insert anchored in the lower end portion of the bore in the retaining member and having an internal thread cooperable with the thread on the screw shaft.

4. The terminal means of claim **3** wherein said transverse dimension of the bore, intermediate its ends, is defined by inner surface portions of the retaining member at diametrically opposite sides thereof which are equidistant from the axis of the metal insert.

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