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ELECTRICAL WIRING DEVICE HAVING IMPROVED CAPTURED SCREW TERMINALS

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Fig. 1.

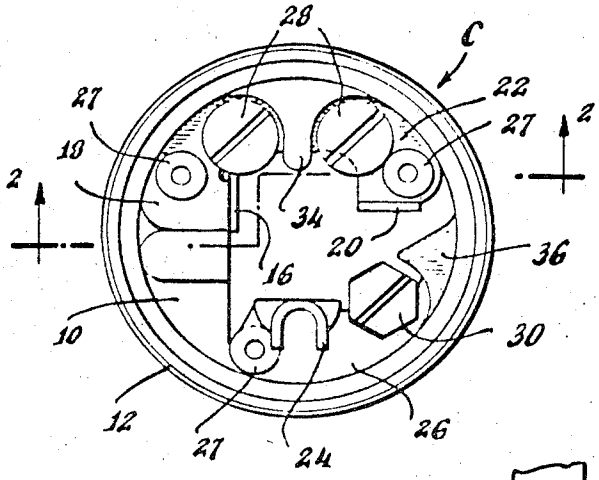


Fig. 3.

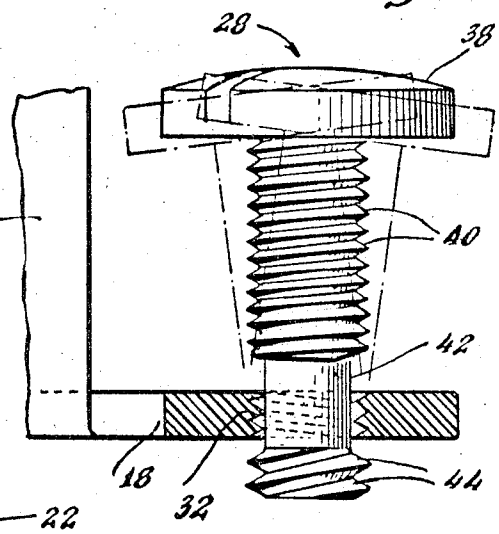
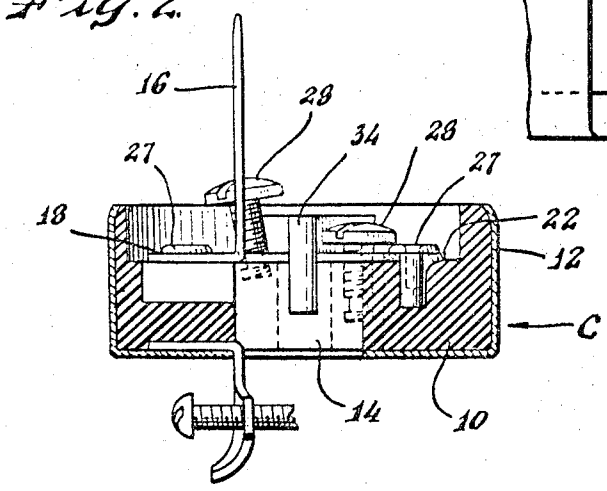


Fig. 2.



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ELECTRICAL WIRING DEVICE HAVING IMPROVED CAPTURED SCREW TERMINALS

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ABSTRACT OF THE DISCLOSURE

A captured binding screw terminal having a terminal plate with a threaded opening and a binding screw having a head on one side of the plate, the screw including a first threaded shank portion located adjacent the head having threads of the same pitch as the threaded opening, an intermediate nonthreaded shank portion of reduced diameter, and a second threaded shank portion located at the end of the screw having a coarser pitch than the first portion.

This invention relates to electrical wiring devices, and more particularly, to improved screw terminals for such devices, and more particularly to an improved screw.

In many electrical wiring devices, it is desirable to mount terminal binding screws in their terminal plates to be captured; that is, irremovable on normal backing of the screws out of the plates. Structurally, this is accomplished frequently by deforming the end thread at the free end of the screw shank after the screw has been mounted in the terminal plate, as by upsetting it by a stacking operation. It would be desirable to provide a screw of the non-back-out, captive type which would be originally assembled during production simply by screwing it into a threaded opening in the terminal plate, and which thereafter would be captively mounted without requiring additional manufacturnig steps, such as deforming the end screw thread required heretofore. It will be readily appreciated by those skilled in the art that to captivate a terminal binding screw in a terminal plate by staking its outer thread is a time-consuming and costly operation, the elimination of which would be highly desirable. Further still, in applications of captured screws in electrical terminals in electrical wiring devices, they are frequently employed in restrictive areas of wiring devices which create difficulties in wiring the usual conductor wires to them, because of the lack of adequate clearance between the screw and the other portions of the wiring device.

It is a principal object of this invention to provide an improved electrical wiring device having an improved captured terminal binding screw and mounting therefor.

It is another object of this invention to provide an improved non-back-out screw.

It is still another object of the invention to provide an improved electrical wiring device having a captured terminal binding screw of improved construction which additionally affords a sufficient amount of lateral movement of the screw relative to the wiring device after it is mounted therein to provide sufficient clearance to facilitate attachment of a conductor wire thereto.

The objects of this invention are achieved in one form by means of a terminal binding screw having a shank comprising three portions: a first threaded portion adjacent the screw head of substantial axial length; an intermediate unthreaded shank portion of reduced diameter, and an outer threaded shank portion of a coarser thread than the first threaded portion and of a significantly less axial length than said first threaded portion, and mounting the terminal binding screw in a threaded opening in a terminal plate formed by threads of the same pitch as that of the thread of said first portion.

The manner in which the foregoing objects are achieved will be more apparent from the following description, the appended claims and the figures of the attached drawing, wherein:

FIG. 1 is an end elevational view of an electrical connector cap having terminal binding screws constructed and mounted in accordance with the invention;

FIG. 2 is a cross sectional view taken substantially along the line 2—2 of FIG. 1, and

FIG. 3 is an enlarged elevational view of a terminal binding screw constructed and mounted in a terminal plate in accordance with the invention.

In the drawings, the invention is illustrated as embodied in an electrical connector cap, however, it may be incorporated in other types of wiring devices, as well as other devices wherein it is desired to have a captured screw.

With reference to FIGS. 1 and 2, there is illustrated a connector cap C comprising a body **10** of insulating material and enclosed within a metal shell **12**. The body and shell define a central opening **14** for receiving the end of an electrical cable to be wired to the cap. Mounted in suitable recesses in the forward end of the body **10** is a contact blade **16** which extends outwardly at a 90° angle from its unitary terminal and mounting plate **18**. Another contact blade **20** extends outwardly from its terminal and mounting plate **22**. A U-shaped grounding pin **24** also projects from the body **10** from a grounding and mounting plate **26**. The plates are secured to the body **10** by means of rivets **27**. Line contact terminal binding screws **28** and grounding terminal binding screw **30** are mounted in tapped holes **32** formed in the mounting plates.

The body **10** includes an annular peripheral rim and internally extending ribs **34**, **36** closely adjacent the binding screws which form the recesses. As will be readily apparent from FIG. 1, the clearances between each of the binding screws, the ribs, the rim and the contact blades or grounding pin is very minimal. This arrangement provides for restrictive clearance between the binding screws and the associated portions of the connector cap and, in practice, makes it difficult to attach conductor wires to binding screws.

It is extremely desirable to mount the line terminal binding screws **28** and grounding terminal binding screw **30** so as to be captured. It is the practice in the electrical wiring device industry to captivate terminal binding screws by deforming the outer thread of the screw shank after the binding screw is threadedly secured in a threaded opening in a terminal plate. This creates manufacturing problems and adds to the cost of production. For example, it requires that the terminal binding screws be attached to their terminal plates, which often form a part of contact-terminal subassemblies, before the terminal plates are mounted in the wiring device body, in order that the thread deforming step may be effected. It will be quickly apparent that it would be desirable to be able to mount captured terminal binding screws without requiring the thread deforming step. In addition to eliminating the time and cost of the deforming step, it would permit terminal binding screws to be mounted to terminal plates after the latter were secured in place in the wiring device and thereby further facilitate manufacture.

The instant invention provides for the individual and cumulative advantages of a non-back-out terminal binding screw which does not require a thread deforming step in assembling it to a wiring device, and which further provides for additional wiring clearance. The instant invention comprises essentially a unique terminal binding screw in association with a plate having a threaded open-

ing, all the threads and threaded portions having predetermined relationships.

In the drawings, with particular reference to FIG. 3, an improved terminal binding screw **28** is illustrated as mounted in the pretapped threaded opening **32** in the terminal plate **18**. A description of this terminal binding screw will serve to be exemplary of improved terminal binding screws contemplated by the invention. The screw **28** includes a head **38** having a slot for insertion of a screw driver, and a uniquely formed shank comprising a first threaded portion **40** extending axially from the screw head a substantial distance along the shank, the pitch of the threads thereon being substantially equal to the pitch of the threads of the threaded opening **32**; an intermediate shank portion **42** that is plain, cylindrical and of reduced diameter that is equal to or less than the minor diameter of the threads on the first portion, the axial length of the intermediate portion being in excess of the thickness of the plate **18**, and a second threaded portion **44** comprising a plurality of threads of the same root diameter as those of portion **40** having a coarser pitch than that of the threads of the first portion **40** and the threaded opening **32**, the axial length of the portion **44** being significantly shorter than that of the portion **40**.

In practice it has been found that terminal binding screws constructed in accordance with the foregoing description have proved eminently successful, for example, when the threads of portion **40** of the screw shank and the threads of the pretapped threaded opening **32** in the terminal plate comprised standard 8–32 threads; the screw shank portion **44** comprised standard 8–24 threads, and the axial length of the portion **44** was slightly less than the axial length of the pretapped threaded opening **32**, the former comprising about two threads and the latter comprising about three threads. The arrangement is such that on assembly of the improved binding screw to a pretapped threaded opening in a terminal plate, the latter being already assembled in a wiring device if desired, the portion **44** is threadedly inserted into the opening **32** and the interengaging threads will mismatch; however, it is possible to threadedly insert the binding screw into the threaded opening by manipulating a screw driver and holding portion **44** in place relative to the threaded opening **32**. A certain amount of binding will result from the mismatch; however, in view of the relatively short axial length of the portion **44** having coarser threads, it can be relatively easily forcibly screw-threaded into the opening without complete binding. Continued turning of the screw will result first in full insertion of the portion **44** through opening **32** until portion **42** is disposed in the opening **32** (as shown in FIG. 3) and, ultimately the screw threads on the portion **40** will neatly match the screw threads of the opening **32** and the screw will be mounted in the plate by first portion **40** engaging the threads of opening **32**.

In normal operation, the screw may be axially adjusted with the threads on the portion **40** in engagement with the threads in the opening **32** over the full axial length of portion **40**. For this reason, the axial length of portion **40** is made as large as possible, significantly larger than that of portion **44**. On initial wiring—that is, wrapping a bared conductor wire around the portion **40** under the head **38**, it will be observed in FIG. 3, that the screw may be adjusted to bring the plain cylindrical portion **42** radially within the opening **32**, at which time the entire screw may wobble in a pivotal manner in the opening, as represented by the phantom lines in FIG. 3. This wobbling of the improved screws will result in providing a greater amount of clearance between the screw head and adjacent portions of the wiring device—for example, the contact blades themselves or body rib or rim portions, such as the ribs **34** and **36**. After wrapping the conductor wire around the screw shank, it may be turned to cause the threads on the portion **40** to interengage the threads

of the opening **32** and be tightened until it firmly clamps the conductor wire between the screw head and the plate **18**. Thereafter, if an attempt is made to withdraw the terminal screw from the terminal plate, the screw may be turned, as by use of a screw driver, until the portion **40** is completely withdrawn out of the opening **32**. When the threaded portion **40** disengages the threads of the opening **32**, the plain cylindrical portion **42** will loosely wobble in the opening **32** and it will be difficult to continue to retract the screw out of the opening by turning the screw driver. It is necessary that the end of the screw be grasped by the fingers, a pair of pliers or the like, and manipulated until the mismatched threads of the section **44** engage the mismatched threads forming the opening **32**. Then the screw driver can be used to turn the screw to back it out further. However, the force required creates a certain amount of binding between the threads of the portion **44** and the opening **32**. In view of the nature of the action of the screw driver in unthreading the screw out of the opening to move away from the terminal plate, it is considerably more difficult to unthread the portion **44** out of the opening **32** than it is to initially thread it into the opening on insertion, because in the latter instance the screw driver can be used both to turn the screw to cause the threads to engage, as well as apply a closing force to overcome any binding resulting from the mismatched threads of the portion **44** and the opening **32**.

In view of the foregoing, it will be apparent that my improved binding screws may be manufactured in large quantities so as to provide the three shank portions **40**, **42** and **44** described. In usage, particularly when incorporated into electrical wiring devices, it is a simple matter for the assembler to insert the screws into pretapped threaded openings in terminal plates and, therefore, special thread deforming steps are eliminated in manufacture and assembly. Further, after assembly, it is a simple matter to effect attachment of a conductor wire to a binding screw because of the wobbling action produced by the plain cylindrical portion of the screw shank, yet it is difficult to retract the screw entirely out of the terminal plate and it is effectively irremovable in normal operation. Therefore, my improved terminal binding screws satisfy all the objects of this invention by providing a non-back-out screw which can be captively mounted in a plate without requiring staking or other deforming procedures on the screw shank after it is mounted, and further, wherein additional clearance for wiring is provided in wiring devices.

As will be evident from the foregoing description, certain aspects of my invention are not limited to the particular details of construction of the examples illustrated, and I contemplate that various and other modifications and applications will occur to those skilled in the art. It is therefore my intention that the appended claims shall cover such modifications and applications as do not depart from the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A screw comprising: an enlarged head; and a substantially cylindrical shank extending from said head, said shank including a first threaded portion adjacent said head, an intermediate plain cylindrical portion adjacent said first threaded portion and having a diameter equal to or less than the minor diameter of the threads of said first threaded portion, and a second threaded portion adjacent said intermediate portion and at the end of said shank removed from said head, said second threaded portion having threads of the same root diameter as but of coarser pitch than the threads of said first threaded portion and wherein said first threaded portion extends axially of said shank a substantially greater distance than said second threaded portion.

2. A binding screw terminal for an electrical wiring device comprising: a terminal plate defining an internally

threaded opening therethrough; and a binding screw; said screw including a head on a first side of said plate, a substantially cylindrical shank extending from said head and through said opening, said shank including a first threaded portion adjacent said head that is threadable into said opening and has threads of a pitch substantially the same as the pitch of the threads of said opening, an intermediate plain cylindrical portion adjacent said first threaded portion and having a diameter equal to or less than the minor diameter of the threads of said first threaded portion and the smallest diameter of said opening, and a second threaded portion adjacent said intermediate portion and at the end of said shank removed from said head, said second threaded portion having threads of the same root diameter as but coarser pitch than the threads of said first threaded portion.

3. The terminal of claim 2 wherein said intermediate portion is axially longer than the thickness of said plate.

4. The terminal of claim 2 wherein said first threaded portion extends axially of said shank a substantially greater distance than said second threaded portion.

5. The terminal of claim 2 wherein the interrelationship of said second threaded portion and said opening is such as to provide for some binding on interengaging but not complete binding.

6. The terminal of claim 2 wherein said first threaded portion and said threaded opening have standard 8–32 threads; said second threaded portion has standard 8–24 threads; said threaded opening has approximately three threads; and said second threaded portion has approximately two threads.

7. An electrical wiring device which comprises: an insulation body having a recess accessible from the exterior of said body at one end thereof; electrical contact-terminal means mounted on said body including a terminal plate disposed in said recess rigidly secured to said body and defining an internally threaded opening therethrough; a portion of said body open adjacent and

inwardly of said opening; and a binding screw including a head on a first side of said plate accessible from the exterior of said body, a substantially cylindrical shank extending from the head and through said opening into said open body portion, said shank including a first threaded portion adjacent said head that is threadable into said opening and has threads of a pitch substantially the same as the pitch of the threads of said opening, an intermediate plain cylindrical portion adjacent said first threaded portion of an axial length in excess of the thickness of said plate and of a diameter equal to or less than the minor diameter of the threads of said first threaded portion and less than the smallest diameter of said opening, and a second threaded portion adjacent said intermediate portion and at the end of said shank removed from said head, said second threaded portion being of an axial length not in excess of the thickness of said plate and having threads of the same root diameter as but coarser pitch than the threads of said first threaded portion.

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