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R. M. DURIS

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TERMINAL BUSHING ASSEMBLY

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3 Sheets-Sheet 2

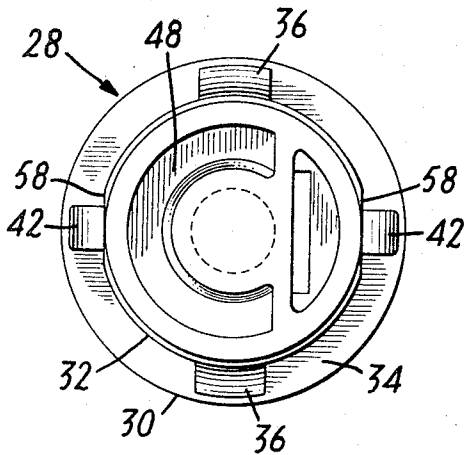


FIG. 5

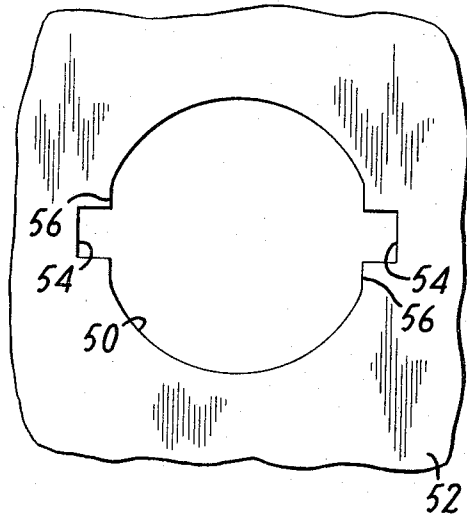


FIG. 6

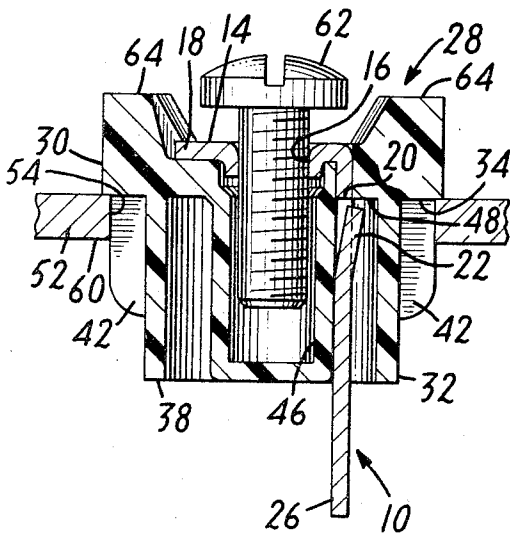


FIG. 7

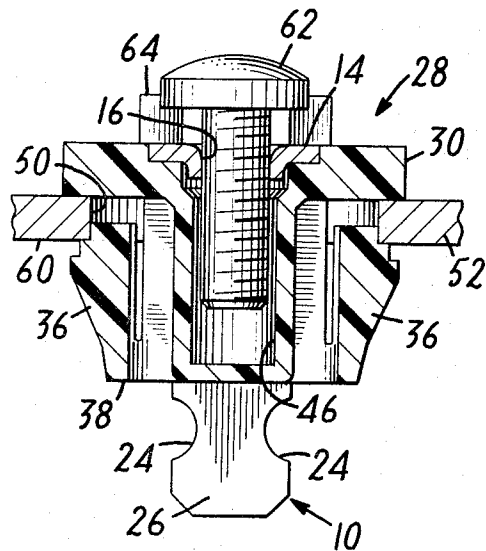


FIG. 8

INVENTOR.  
RUDOLPH M. DURIS

BY

Eyre, Mann & Lucas  
ATTORNEYS

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R. M. DURIS

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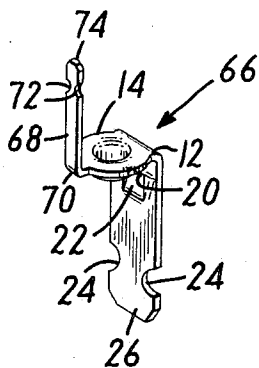


FIG. 9

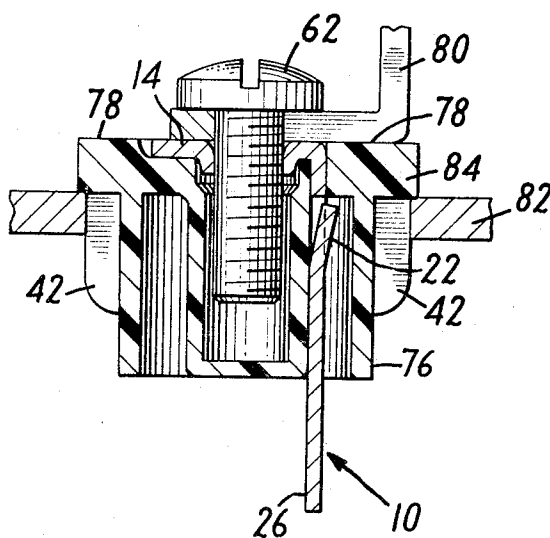


FIG. 10

INVENTOR.  
RUDOLPH M. DURIS

BY

*Eyre, Mann & Lucas*  
ATTORNEYS

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## TERMINAL BUSHING ASSEMBLY

Rudolph M. Duris, South Norwalk, Conn., assignor to  
Edwards Company Inc., a corporation of Connecticut  
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### ABSTRACT OF THE DISCLOSURE

A bushing of insulating material is constructed with a collar portion and an integral skirt portion. The wall of the skirt portion has resiliently flexible locking fingers the free ends of which are disposed adjacent and spaced from the undersurface of the collar portion. Within the skirt portion are two longitudinal spaces which communicate with corresponding openings in the collar portion to provide two channels in the bushing. An L-shaped terminal of electrically conductive material, having a screw-threaded ring as its base and an elongated strip as its leg, is mounted in the bushing so that its leg extends through and beyond one of the bushing channels and its base is seated over the other of the bushing channels, whereby an electrical conductor may be secured to the base by a screw threaded into the ring and another electrical conductor may be secured to the tip of the leg extended beyond the edge of the skirt portion. When the bushing-terminal assembly is pushed into a suitable opening in a panel, the resilient locking fingers are first cammed inwardly by the edge of the opening and then the fingers spring back outwardly, when the free ends thereof clear the panel thickness, to lock the assembly in the panel.

This invention relates to an electrical terminal-bushing assembly which can be mounted in suitable openings in panels by simply inserting the assembly therein to achieve an automatic snap-in locked mounting.

In modern electrical equipment, panels are very often provided having various points of electrical connection between conductors leading to opposite sides of the panel. These panels are in many cases prefabricated and may have literally hundreds of connection points. With such units it is extremely important that the connector at each opening in the panel be readily mounted with a minimum of time, labor and equipment.

In accordance with the invention a new form of terminal-bushing assembly has been devised for providing electrical connection through the thickness of a panel wherein conductors lead to the connection point from opposite sides of the panel. The terminal-bushing assembly of the invention may be mounted in the panel by providing a suitable opening in the panel. Upon simple insertion of the terminal-bushing assembly in the opening, a snap-in locking action is achieved whereby the assembly is securely mounted on the panel without use of any tools. This makes for quick and inexpensive assembly of prefabricated panels having many connection points as provided by the terminal-bushing assembly of the invention.

In the terminal-bushing assembly of the invention the terminal part of the structure is preferably of such type that it is mounted in the bushing of insulation material by simple insertion to achieve a locking action. Thereafter, the assembly of the terminal and the bushing is also simply inserted in an opening of the panel to achieve the same snap-in locking action. This action is provided by the bushing having a collar portion and an integral skirt portion which is provided with at least one locking finger that is movable toward the interior of the skirt by resilient

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flexure. The cross section of the skirt portion is smaller than that of the collar portion and the exterior surface of the locking finger is provided with a taper projecting outwardly in the direction from the free edge of the skirt portion toward the collar portion.

With such a taper, when the skirt portion is inserted into an opening in a panel having substantially the same cross section as that of the skirt portion, the finger is pushed towards the interior of the skirt portion by the camming action of the edge of the opening upon the tapered exterior surface. The upper free end of the finger is so constructed that upon clearing the thickness of the panel the free end springs outwardly by the restoring force of resilient flexure and abuts the surface of the panel opposite the surface engaged by the collar portion of the assembly. In this way the terminal-bushing assembly is reliably locked in place in the panel and cannot be withdrawn therefrom.

In the preferred embodiment of the invention the terminal-bushing assembly is also provided with means for locking it against rotation in the panel after it has been mounted therein. This is of particular importance where the terminal of the terminal-bushing assembly is of the screw type wherein a screw must be tightened down to provide a locking action upon the conductor that is to be secured to the terminal of the assembly.

While a single locking finger in the skirt portion of the terminal-bushing assembly will provide a snap-in locking action, it is preferred in the most beneficial embodiment of the invention, that at least two locking fingers be employed at opposite sides of the skirt portion since this will increase the locking action and in particular prevent tipping or tilting of the assembly after it has been inserted in the panel. Likewise, it is preferred that at least two locking ribs be used at opposite portions of the skirt portion to prevent rotation of the terminal-bushing assembly after it has been mounted in the panel. If desired the lock against rotation can be increased by flats or other particular shapes in opposite areas of the exterior surface of the skirt portion and by providing complementary shapes in the panel opening whereby the entire assembly is prevented from rotating by the keyed relationship between the exterior surface of the skirt portion and the opening in the panel.

For a further understanding of the details of the invention, reference will be made to the accompanying drawings which illustrate a preferred embodiment thereof and in which:

FIG. 1 is a perspective view of a preferred form of terminal for the terminal-bushing assembly of the invention.

FIG. 2 is a top plan view of a preferred form of bushing for the terminal-bushing assembly of the invention.

FIG. 3 is a sectional view taken along line 3-3 of FIG. 2.

FIG. 4 is a sectional view similar to FIG. 3 but taken along line 4-4 of FIG. 2.

FIG. 5 is a bottom plan view of the bushing shown in FIG. 2.

FIG. 6 is a top plan view of an opening in a panel adapted to receive the terminal-bushing assembly of the previous figures.

FIG. 7 is a sectional view showing the terminal-bushing assembly of the previous figures mounted in the opening of the panel shown in FIG. 6.

FIG. 8 is a view similar to FIG. 7 but rotated 90° to show the snap-in locking action of the fingers in the skirt portion of the bushing shown in the previous figures.

FIG. 9 is a perspective view of a modified form of terminal for the terminal-bushing of the invention; and

FIG. 10 is a sectional view of a modified bushing incorporated in a terminal-bushing assembly mounted in a panel opening.

Referring to FIG. 1 of the drawings a preferred form of terminal for the terminal-bushing assembly of the invention is there generally indicated by reference numeral 10. As will be seen, the terminal 10 is substantially in the form of a strip of conductive material having a right angle bend therein at 12. The horizontal portion of the bent strip is in the form of a ring 14 having a centrally located hole 16 which is provided with screw threads. Opposite the bend 12 the ring 14 is provided with a stud 18 which is used for registration and coding purposes as will be explained more fully hereinbelow.

The vertical portion of the terminal strip 10 is provided with a cut-out 20 which provides a bent locking tongue 22 projecting out from the plane of the strip 10. Near the bottom of the vertical portion of terminal strip 10, concavities 24 are provided to form a neck portion between the lower extremity of the strip 10, which serves as a soldering lug 26, and the remainder of the strip. A conductor to be soldered to lug 26 may be wrapped about the neck portion to insure a secure electrical connection.

Referring now to FIGS. 2, 3, 4 and 5 the preferred form of bushing for the terminal-bushing assembly of the invention is there generally indicated by reference numeral 28. As best illustrated in FIGS. 3 and 4, the bushing 28 has two main portions comprising a cylindrical collar portion 30 and a cylindrical skirt portion 32. The outer diameter of the skirt portion 32 is smaller than the outer diameter of collar 30 whereby the annular area of the base of the collar portion that extends beyond the skirt portion forms a shoulder 34 adapted to abut one side of a panel in which the terminal-bushing assembly is to be mounted.

The skirt portion 32, on the other hand, is adapted to extend through an opening provided in the panel and to extend beyond the opposite side of the panel. The skirt portion is provided with at least one locking finger 36 and, in the preferred embodiment illustrated in the drawings, two locking fingers 36 are employed at opposite sides of skirt portion 32.

The locking finger 36 in fact is an integral part of skirt portion 32 and is defined by an inverted U-shaped line cut-out the base of which is adjacent to the bottom surface of collar 30 and the legs of which extend to, but terminate short of the free edge 38 of skirt portion 32. By this construction the locking finger can be moved inwardly towards the interior of skirt portion 32 by resiliently flexing the finger along the imaginary line connecting the ends of the legs of the U-shaped cut-out line. This imaginary line in effect is a pivot axis about which the locking finger 36 can be moved.

As clearly shown in FIG. 4 of the drawings, the locking finger has an exterior surface which is tapered outwardly in the direction from the edge 38 of skirt portion 32 to the collar 30. This tapered exterior surface on the locking finger 36 provides for the automatic snap-in mounting in an opening in a panel as will be more fully described hereinafter.

As can be seen in FIG. 4, the upper free end of locking finger 36 has a series of shoulders 40 and 42 which are arranged in stepwise fashion descending towards the bottom surface 34 of the collar 30. By providing a plurality of stepped shoulders in the manner described, the skirt portion can be fitted into panels of different thicknesses with the same easy reliable snap-in locking action. This is because the distance between each stepped shoulder such as 42 and 40 becomes progressively greater and these spacings can therefore be varied in accordance with the thicknesses of different panels.

In addition to locking finger 36, the skirt portion 32 is also provided with a pair of locking ribs 42 which extend from the bottom surface 34 of collar 30 down along

the exterior surface of skirt portion 32. As will be noted in FIG. 5, the locking ribs 42 are spaced at opposite points along the skirt portion 32 and on a line rotated 90° from the line between the locking fingers 36.

Referring to FIGS. 1 to 3, the upper surface of the collar 30 is recessed to receive the ring portion 14 of the terminal 10. In addition, the upper surface of collar 30 is provided with a slot 44 which leads down into the interior of skirt portion 32. Centrally located below the recessed upper surface of collar 30 is a well 46 which is completely closed at the bottom and which has an open mouth at the upper surface of collar 30. The well 46 is adapted to receive a screw threaded into the threads 16 of ring 14 as will be more fully described hereinbelow.

As shown in FIG. 7 of the drawings, the assembly of terminal to bushing is made by inserting the connector 10 into slot 44 until the tongue 22 clears the interior bottom surface 48 of collar 30, at which time the tongue 22 springs back into the position shown in FIG. 7. In this manner the upper end of the tongue provides a locking snap-in action which prevents the terminal 10 from being withdrawn out of the bushing 28 through slot 44. Thus the terminal 10 is securely fastened within the bushing 28 and in particular the ring portion 14 becomes locked in the recess provided therefor in the upper surface of collar 30. The stud 18 also becomes seated in the appropriate recess provided therefor and adds to the stability of the terminal in bushing 28, particularly against rotation of the terminal in bushing 28. In addition to the rotational stability, the stud 18 provides a code which indicates the location of the soldering lug 26 on the opposite side of the panel in which terminal-bushing assembly is mounted. This indication may be useful particularly where two adjacent terminals are to be joined electrically and therefore the smallest spacing between their lugs 26 may be desired to minimize the length of wire bridge therebetween.

After the terminal 10 has been locked to the bushing 28, the resulting terminal-bushing assembly is ready for mounting in a panel. As illustrated in FIG. 6 a suitable opening 50 is punched or otherwise made in the panel 52. The opening 50 includes the two slots 54 which are suitably dimensioned so as to receive the locking ribs 42 with a snug fit. The remainder of the opening 50 defines a cross section which is substantially the same as that of skirt portion 32, including the flattened areas 56 which correspond and are designed to mate with flattened areas 58 on skirt portion 32 as is illustrated in FIG. 5 of the drawings.

The complete terminal-bushing assembly illustrated in FIG. 7 is mounted in opening 50 simply by inserting the assembly into the opening 50, the locking ribs 42 being inserted in the corresponding slots 54. As the assembly is inserted into the opening 50, the walls of the opening force the locking fingers 36 to move by resilient flexing inwardly towards the interior of skirt portion 32 due to camming action upon the tapered exterior surface of the locking fingers 36. This inward flexing movement continues until the first stepped shoulder 40 clears the bottom surface 60 of panel 52. At this point, the flexed finger springs back outwardly and the stepped vertical face adjacent shoulder 40 abuts the side of the opening 50. If as illustrated in FIG. 8 the panel 60 is thin enough, continued insertion of the terminal-bushing assembly will cause the next stepped shoulder 42 to clear the bottom surface 60 of the thin paneling 52 in which case the locking fingers 36 will again flex outwardly until the vertical face adjacent to shoulder 42 abuts against the opening 50. Thereafter, as illustrated in FIG. 8, the shoulder 42 of the locking fingers 36 will abut the lower surface 60 of panel 52 and thereby provide a secure locking action which will prevent the terminal-bushing assembly from being withdrawn out of the opening 50.

The screw 62 is then threaded into the ring 14 to complete the entire terminal-bushing assembly in its mounted

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position on the panel 52. In the preferred embodiment of the invention, the upper surface of the collar 30 is provided with upstanding shoulders 64 at opposite sides of the collar 30. These shoulders 64 provide convenient grips for the terminal-bushing assembly by which the assembly may be picked up and easily inserted into the opening 50. In addition, the shoulders 64 provide a nest or guide for a conductor which is placed in contact with the ring 14 and secured thereto by means of threading down screw 62 into firm engagement with said conductor. The opposite side of the terminal 10 is also connected via the soldering lug 26 to a conductor by soldering either in manufacture or in field.

The bushing 28 in the preferred embodiment of the invention is made of substantially rigid nylon but other plastic materials may be employed. The rigidity of the plastic materials provides for a secure terminal-bushing assembly and corresponding electrical connection through a panel and, at the same time, the resilient flexing of the locking fingers 36 provide a simple, reliable snap-in mount which locks the terminal-bushing assembly permanently in the suitable openings provided in a panel such as the one illustrated in FIG. 6. The terminal 10 on the other hand is made of brass or any other conductive metal or material as is also the screw 62.

As illustrated in the drawings, the preferred embodiment of the terminal-bushing assembly includes a well 46 which completely covers the screw 62 when it is threaded down upon a conductor placed on top of ring 14. In this way the soldering of the lugs 26 cannot result in accidental dropping of solder upon the screw or ring 14 which may cause short circuiting or other undesirable electrical phenomena.

FIG. 9 illustrates a modified form of terminal 66 which is substantially the same as the preferred form of terminal 10 illustrated in FIG. 1, with one exception. In the modified form 66, the stud 18 is eliminated and in place thereof an integral strip section 68 is substituted and joined to ring 14 through a substantially right angle bend 70 similar to but in opposite direction to the right angle bend 12. The strip section 68 is also provided with concavities 72 to form a soldering lug 74 similar to soldering lug 26. The modified form of terminal 66 in assembly with the bushing illustrated in FIGS. 2, 3, 4 and 5 provides a connection point across a panel in which both conductors leading to opposite sides of the panel may be soldered to the terminal of the assembly for a more or less permanent connection.

FIG. 10 illustrates a modified form of bushing 76 which is substantially the same as that of FIGS. 2, 3, 4 and 5 except that the sloped, upstanding shoulders 64 of the collar 30 are eliminated, whereby the upper surface of the collar at 78 is completely flat. The flat upper surface 78 can serve as a support for the terminal 80 of an electrical component such as a resistor or capacitor which, when mounted under screw 62 as illustrated in FIG. 10, will be spaced away and insulated from the panel 82 by the body of the collar 84. Thus, various forms of electrical components can be connected to the modified form of terminal-bushing assembly of FIG. 10 without any problems of short circuiting through the panel 82 which may be made of metal as is often the case in complex electrical equipment which incorporate panels of substantial size.

In the preferred embodiment illustrated in the drawings, two oppositely positioned locking fingers are used for maximum locking action and stability of the mount in panel 52. However, a single locking finger on the skirt portion 32 will also result in a snap-in locking mount although this is less desirable since the terminal-bushing assembly can still be tilted or cocked at the opposite side of skirt portion 32 which does not contain a locking finger. Similarly, a single locking rib 42 may be employed with a single slot 54 for locking a terminal-bushing assembly when mounted in the panel 52 against rotation. However,

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again the action is less than the maximum possible lock against rotation that can be achieved with two oppositely spaced locking ribs 42 as is illustrated in the drawings and this is the preferred embodiment. Furthermore, the flattened surfaces of skirt portion 32 may or may not be used in conjunction with the locking ribs 42. Also, as will be obvious to those skilled in the art, other shapes of ribs or projections upon skirt portion 32 can be used in association with mating shapes in the opening 50 to provide a key-like locking arrangement to prevent rotation of the mounted terminal-bushing assembly in the panel 52. In some cases, it is even possible to use the terminal-bushing assembly without any means for locking the assembly against rotation in the panel 52. However, these will be the less frequent cases and it is preferred that the assembly be provided with some form of locking means against rotation in the panel 52.

To summarize, the invention provides a terminal-bushing assembly which can be simply assembled by inserting the terminal part in the bushing part and thereby achieving a snap-in locking action which prevents the terminal part from being withdrawn from the bushing part. Thereafter, the terminal-bushing assembly in turn can also be simply mounted in an opening in a panel by inserting the assembly therein to again achieve a snap-in locking action which securely holds the assembly in the panel and prevents withdrawal or rotation of the assembly in the panel. Such results are achieved without the use of any tools which greatly facilitates the use and installation of the assembly. It will also be noted that a further feature of the invention is the fact that the terminal 10 is completely insulated from the panel 52 by the bushing 30. This makes the terminal-bushing assembly of the invention highly adaptable since it may be used with panels of both conductive and non-conductive materials.

It will be understood that it is intended to cover all changes and modifications of the invention herein chosen for the purpose of illustration which do not constitute departures from the spirit and scope of the invention.

What is claimed is:

1. A terminal-bushing assembly for snap-in mounting in an opening in a panel to provide electrical connection between conductors located at opposite sides of said panel which comprises

- (a) a bushing of non-conductive material having
  - (1) a collar portion one surface of which is adapted to abut one side of said panel,
  - (2) a skirt portion integral with said abutting surface of said collar portion and having a smaller cross-section than that of said collar portion, said skirt portion being adapted to extend through said panel opening and beyond the side of said panel opposite the side abutted by said collar position,
  - (3) at least one locking finger comprising an integral section of said skirt portion which is movable by resilient flexure toward the interior of said skirt portion, the movable end of said locking finger being disposed adjacent and spaced from the abutting surface of said collar portion by a distance at least equivalent to slightly greater than the thickness of the panel upon which the terminal-bushing assembly is to be mounted, and the exterior surface of said locking finger being tapered outwardly in the direction from the free edge of said skirt portion to said collar portion,

- (b) electrically conductive terminal means comprising a strip of conductive metal having a right angle bend, one side of said bend being in the form of a ring seated in said collar portion and the other side being a strip extending through said skirt portion of the bushing, said ring being disposed over an opening in said collar portion and having a screw thread for receiving and holding a screw threaded down into

the ring and the underlying opening in said collar portion, whereby insertion of said skirt portion into a panel opening having substantially the same cross section as that of the skirt portion will cause said locking finger to first resiliently flex inwardly and then spring back outwardly, when the panel thickness has been cleared by the movable end thereof, to lock the assembly securely in place upon the panel.

2. An assembly as in claim 1 which includes at least one locking rib integral with the exterior of said skirt portion and extending to the abutting surface of said collar portion, and wherein said panel opening is provided with a slot of corresponding cross section whereby upon insertion of the assembly in said opening the interfit of the locking rib and the corresponding slot will prevent said assembly from rotating in said panel opening.

3. An assembly as in claim 1 wherein the surface of said collar portion opposite the surface adapted to abut said panel is provided with two upstanding shoulders positioned at opposite sides of said collar portion.

4. An assembly as in claim 1 wherein the interior of said skirt portion includes an integral well extending through the skirt portion from the opening of said ring and which includes a screw threaded into said ring and housed within said well.

5. A terminal-bushing assembly for snap-in mounting in an opening in a panel to provide electrical connection between conductors located at opposite sides of said panel which comprises

(a) a bushing of non-conductive plastic material having

- (1) a collar portion one surface of which is adapted to abut one side of said panel,
- (2) a skirt portion integral with said abutting surface of said collar portion and having a smaller cross section than that of said collar portion, said skirt portion being adapted to extend through said panel opening and beyond the opposite side of said panel from the side abutted by said collar portion,

- (3) a pair of locking fingers at opposite sides of said skirt portion, each said locking finger comprising an integral strip-like section of said skirt portion which is movable by resilient flexure toward the interior of said skirt portion, the movable ends of said locking fingers each having a plurality of shoulders arranged stepwise adjacent and spaced from the abutting surface of said collar portion by varying distances according to the number of stepped shoulders, at least one said spacing being equivalent to a distance slightly greater than the thickness of the panel upon which the terminal-bushing assembly is to be mounted, the exterior surfaces of said locking fingers being tapered outwardly in the direction from the free edge of said skirt portion to said collar portion,

- (4) a pair of locking ribs at opposite sides of said skirt portion and on a line rotated 90° from the line between the opposite said locking fingers, each said rib being integral with said skirt portion and extending to the abutting surface of said collar portion,

(b) an electrically conductive terminal strip in said bushing, said terminal strip having a right angle bend to form a substantially L-shaped cross section there-

for, the base of said L-shaped strip being in the form of a ring having screw threads in the central opening thereof and said ring being mounted in a recess in the surface of said collar portion of said bushing opposite to said abutting surface, whereby the upper surface of said ring is flush with said opposite surface of the bushing, the leg of said L-shaped strip having a strip-like section bent out of the plane thereof, said leg being inserted into a slot adjacent to the recessed portion of said collar portion whereby said bent section clears the abutting surface of said collar portion and locks the said terminal strip in place in said bushing, the opening of said ring overlying a corresponding opening in the collar portion of said bushing,

whereby insertion of said skirt portion into a panel opening having substantially the same cross section as that of the skirt portion will cause said locking finger to first resiliently flex inwardly and then spring back outwardly, when the panel thickness has been cleared by the movable end thereof, to lock the assembly securely in place upon the panel.

6. A terminal-bushing assembly as in claim 5 wherein said bushing is made of nylon.

7. A terminal-bushing assembly as in claim 5 wherein the tip of the leg of said L-shaped terminal strip is provided with concavities at opposite edges thereof to form a lug at said tip for soldering to a conductor.

8. A terminal-bushing assembly as in claim 5 wherein said terminal strip is made of brass and a brass screw is threaded into screw threads of the ring portion of the terminal strip to provide means for securing a conductor to said ring portion.

9. A terminal-bushing assembly as in claim 5 wherein an integral lug is provided on said ring opposite the side of the right angle bend, said lug being housed in a corresponding recess in the surface of said collar portion opposite the surface abutting said panel.

10. A terminal-bushing assembly as in claim 5 wherein an integral strip-like piece is provided on said ring opposite the side of the right angle bend, said strip-like piece being joined to said ring through a second right angle bend opposite in direction to said first right angle bend and being adapted to be joined to a conductor by soldering.

11. A terminal-bushing assembly as in claim 5 wherein the unrecessed surface of said collar portion opposite the surface adapted to abut the panel is completely flat.

12. A terminal-bushing assembly as in claim 5 wherein the exterior surface of said skirt portion is flattened adjacent to said locking ribs and the opening in said panel is correspondingly flattened whereby inter-fitting of the flattened parts increases the locking action against rotation of the assembly in said panel.

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RICHARD E. MOORE, *Primary Examiner.*