United States Patent

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[72] Inventor **John D. Milne**
c/o MM Plastics (Mfg) Company, 62 Shaft Road, Rexdale, Ontario, Canada

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[54] **BUSHING FOR INCORPORATION IN ELECTRICAL CONNECTOR ASSEMBLY**
7 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** ..... **174/83,** 174/65 R
[51] **Int. Cl.** **H02g 15/00**
[50] **Field of Search** ..... 174/64, 65 R, 65 SS, 65 G, 74 A, 82, 83, 135, 151, 152 G, 167; 16/2, 108

[56] **References Cited**

UNITED STATES PATENTS

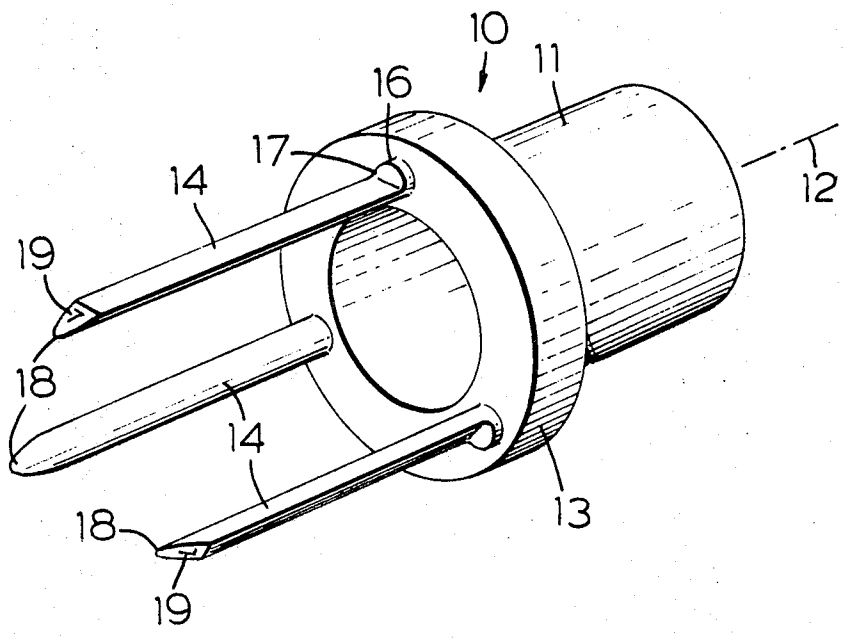
1,799,765	4/1931	Schneider et al.	174/83
1,842,216	1/1932	Thomas, Jr.	174/83 X
1,857,197	5/1932	Knoderer	174/83 X
1,912,115	5/1933	Allen	174/74 A X
1,966,451	7/1934	Le Manquais	174/65 R X
2,082,279	6/1937	Fore	174/74 A
2,603,682	7/1952	Uline et al.	174/83 X
3,219,367	11/1965	Franck	174/83 UX

FOREIGN PATENTS

116,745	2/1970	Denmark	174/83
1,494,898	8/1967	France	174/151

Primary Examiner—Laramie E. Askin
Attorney—Maybee & Legris

ABSTRACT: An electrically insulating bushing presenting one or more prongs which so project that, with the bushing incorporated in an electrical connector assembly in which an end portion of an electric cable is connected to, for example, a junction box, the bushing being disposed within the connector with a cylindrical portion of the bushing disposed between the electrical conductors and the outer casing of the electric cable, the ends of the prongs project from the connector to be visible externally of the connector assembly, either with or without the removal of an element of the connector. Thus, although removal of an element of the connector may be required in order to permit inspection of the connector assembly to ensure that a bushing has been installed therein, such inspection can be performed without requiring dismantling of the connector assembly. The projecting ends of the prongs present informational indicia concerning, for example, the size of the bushing, each prong being of segmental form in cross section with the arcuate face thereof facing towards, and the flat face thereof facing away from, the longitudinal axis of the bushing.



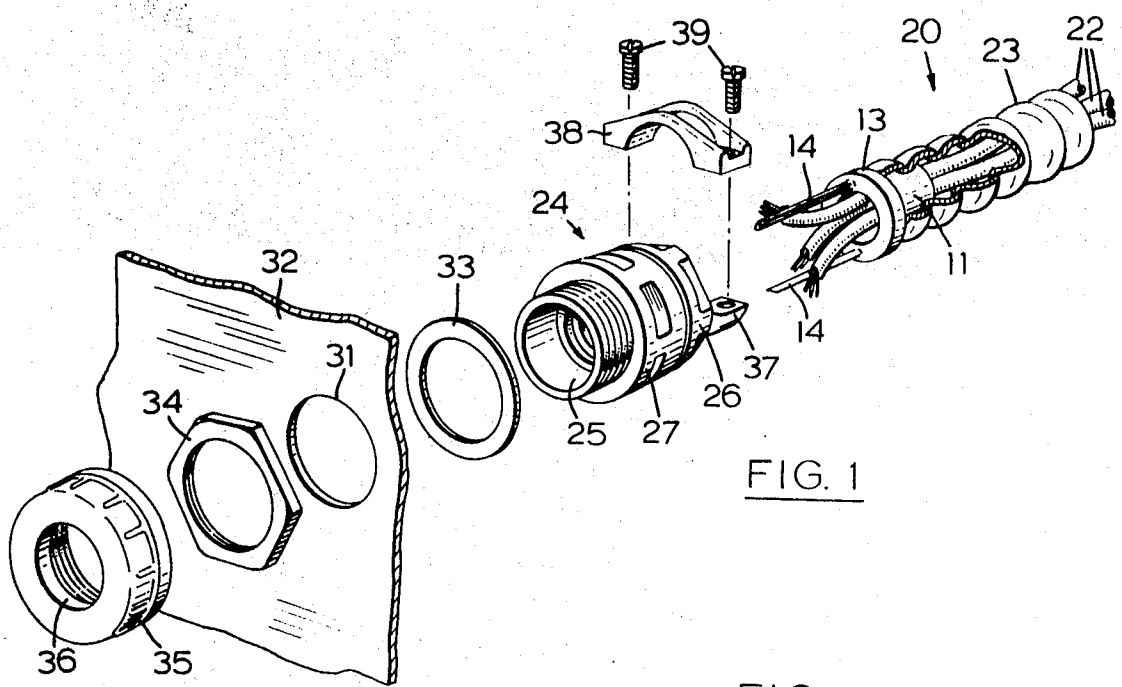


FIG. 1

FIG. 2

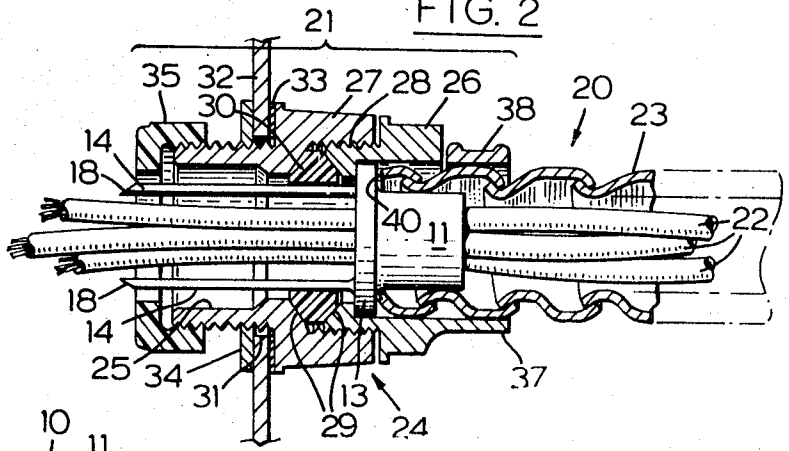
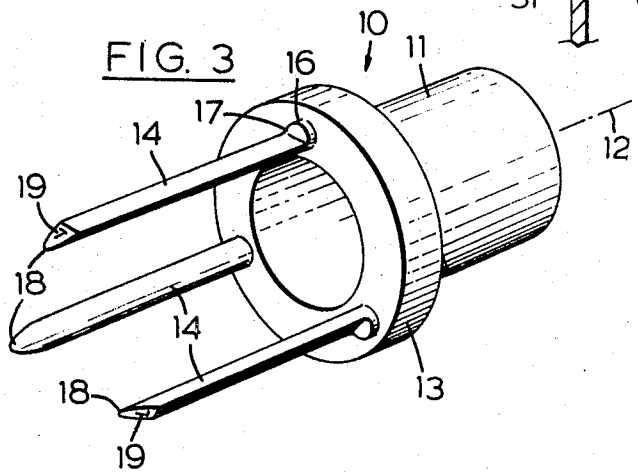


FIG. 3



INVENTOR.
JOHN D. MILNE
BY Maybee & Legris
ATTORNEYS

BUSHING FOR INCORPORATION IN ELECTRICAL CONNECTOR ASSEMBLY

This invention is concerned with improved bushings which are adapted operatively to be incorporated in electrical connector assemblies of the type comprising a connector having a through passage within which an end portion of an electrical cable is disposed, the connector being secured to the tubular outer casing of the electric cable and being mounted on a support structure such as a wall of a junction box or electric switch within which are disposed electrical terminals to which it is desired to connect the electrical conductors of the electric cable. It is conventional practice in such an assembly to incorporate an electrically insulating bushing having a tubular portion which is disposed between the insulated electrical conductors and the outer casing of the electric cable, a flange portion of the bushing which is presented at one end of the tubular portion being positioned in abutting contact with the end face of the outer casing of the cable. As will be appreciated, this end face of the outer casing is disposed at a spaced distance from the associated ends of the electrical conductors which pass, within the through passage in the connector, through an opening or hole formed in a wall of the junction box or switch for connection to the terminals disposed therein, the bushing serving the purpose of substantially preventing chafing on the insulated electrical conductors of the end of the outer casing of the cable, particularly where this outer casing is of metallic form such as of a type comprising interlocking spiral metal tape of hard drawn aluminum or galvanized steel. Electric cable the outer casing of which is of this type is known as AC cable. The presence of the bushing thus prevents or minimizes the risk of the electrical conductors being short-circuited.

Such an electrical connector assembly is usually installed and assembled by an electrical contractor but requires to be inspected, prior to use, by independent inspection personnel, the inspector's function being to ensure that the assembly has been properly installed and assembled according to the applicable regulations and other requirements. It has hitherto been a disadvantage of such an assembly that, in many cases, it has not been possible once the assembly has been completed to determine by inspection whether an electrically insulating bushing has been incorporated in the hereinbefore described manner without dismantling the assembly, and it is accordingly a primary object of the present invention to provide an improved bushing which, when incorporated in an electrical connector assembly, substantially overcomes the above disadvantage of the hitherto known forms of bushing by enabling an inspector to determine with certainty whether a bushing has, in fact, been incorporated in the assembly without dismantling of the connector assembly being required, although it may be necessary for the inspector temporarily to disconnect an element of the connector.

A bushing according to the present invention comprises a tubular portion having a longitudinal axis, and a flange portion which is presented at one end of the tubular portion and which projects outwardly from and around the tubular portion. The flange portion presents at least one prong which projects from the flange portion in a direction opposite from the direction in which the tubular portion projects from the flange portion said at least one prong being of approximately segmental form in cross section with the arcuate face of the prong directed substantially towards the longitudinal axis of the tubular portion.

In order that the invention may be more clearly understood and more readily carried into effect the same will now be more fully described, by way of example, with reference to the accompanying drawing in which:

FIG. 1 is an exploded and partially broken away isometric view of an electrical connector assembly incorporating a bushing according to a preferred embodiment of the invention;

FIG. 2 is a generally axially sectioned view of the assembly shown in FIG. 1 when in the fully assembled condition; and

FIG. 3 is an isometric view of a bushing according to an alternative embodiment of the invention.

With reference to the drawing, in the different views of which like reference numerals are used to denote like parts, **10** denotes generally a bushing which is preferably integrally formed of an electrically insulating plastics material, such as linear polyethylene or nylon. The bushing **10** comprises a tubular portion **11** which is of cylindrical form and which has a longitudinal axis **12** (shown, for clarity, only in FIG. **3**). At one end of the cylindrical portion **11** there is presented a flange portion **13** which projects outwardly from and around the cylindrical portion **11**. The flange portion **13** presents at least one prong **14** which projects from the flange portion **13** in a direction opposite from the direction in which the cylindrical portion **11** projects from the flange portion **13**, and preferably in a direction substantially parallel to the longitudinal axis **12** of the cylindrical portion **11**, the bushing **10** illustrated in FIGS. **1** and **2** incorporating two such prongs **14** which are diametrically opposed to one another relative to the axis **12**, and the bushing **10** illustrated in FIG. **3** incorporating three such prongs **14** which are equi-angularly spaced about the axis **12**. Although not specifically illustrated in the accompanying drawing, it is clearly to be understood that, in bushings **10** according to alternative embodiments of the invention, there may be more than three prongs **14** or only a single prong **14**, as is indicated above.

Each of the prongs **14** is of approximately segmental forming cross section with arcuate face of the prong **14** facing substantially towards the longitudinal axis **12**, and with the flat face of each prong **14** facing substantially directly away from the axis **12**. In the preferred embodiments of the invention illustrated in FIGS. **1** to **3** the portion **16** of each prong **14** immediately adjacent to the associated flange portion **13** is of substantially circular form in cross section, with this portion **16** merging with the remaining portion of approximately segmental cross section of the prong **14** through a concave fillet **17**, the provision of the portion **16** and the fillet **17** in each prong **14** substantially reducing the risk of the prong **14** being inadvertently broken off from the flange portion **13** where the bushing **10** is integrally formed of linear polyethylene or nylon.

Remote from the flange portion **13** the end portion of each prong **14** is preferably of tapered form as indicated by the reference numeral **18**, with the end of each prong **14** remote from the flange portion **13** disposed on the side of the prong **14** which is directed substantially towards the longitudinal axis **12** of the tubular portion **11**. The inclined face constituting the tapering **18** presents informational indicia **19** relating to the bushing **10**. This indicia **19** may constitute, for example, a size marking identifying say, the diameter of the bushing **10**. It is to be characteristic however, that the indicator **19** may relate to any characteristics or characteristics of the bushing **10**. Furthermore, although in the bushing **10** according to the preferred embodiments of, the invention illustrated in the accompanying drawing, the end of each prong **14** remote from the flange portion **13** is of sharp configuration because of the presence of the tapering **18**, it is clearly to be understood that this is not an essential feature of the invention and that the term "prong" as herein used is not to be construed as necessarily referring to an elongated projection the end of which is pointed.

With particular reference to FIGS. **1** and **2**, there is therein illustrated an electrical connector assembly which incorporates a bushing **10** as hereinbefore described. The connector assembly comprises an electric cable which is denoted generally by the reference numeral **20**, and a connector which is denoted generally by the reference numeral **21**.

The electric cable **20** comprises insulated electrical conductor means constituted by the insulated conductors **22**, together with an outer substantially tubular casing **23** constituted by an interlocking spiral metal tape of hard drawn aluminum or galvanized steel, the cable **20** thus being of the type known as AC cable.

The connector **21** comprises a body portion **24** which is formed with a through passage **25** and which is constituted by

a first part 26 and a second part 27, an end portion of the first part 26 being externally screw threaded and an end portion of the second part 27 being internally screw threaded whereby these parts 26, 27 may be detachably interconnected by engagement between said screw threaded end portions thereof, as shown at 28 FIG. 2. The adjacent end faces 29 of the first and second parts 26 and 27, respectively, are of frustoconical form, a resiliently deformable sealing ring 30 of substantially triangular form in cross section being disposed between these end faces 29.

The end portion of the second part 27 of the connector 21 remote from the first part 26 thereof is externally screw threaded and is disposed through an opening or hole 31 formed in a wall 32 which is only partially shown in FIGS. 1 and 2 and which may, for example, constitute a wall of a junction box or electric switch. Disposed between the wall 32 and the adjacent face of the second part 27 is a washer 33, a lock nut 34 being screw-threadedly engaged with said screw-threaded portion of the second part 27 on the opposite side of the wall 32 thereby securely to mount the connector 21 on the wall 32 which thus constitutes a support structure for the connector 21. A cap 35, having a central opening 36 which constitutes a continuation of the through passage 25 and through which the insulated conductors 22 are disposed in the manner shown in FIG. 2 for connection of the conductors 22 to electrical conducting means such as terminals (not shown) disposed within the junction box or electric switch, in screw-threadedly mounted on the end portion of the second part 27 remote from the first part 26.

The end portion of the first part 26 of the connector 21 remote from the second part 27 thereof is in the form of a support cradle 37 on which a complementary bridge portion 38 is adapted to be securely mounted by means of screws 39 with the cable 20 disposed between the cradle 37 and the bridge portion 38 thereby securely to connect the connector 21 to the outer casing 23 of the cable 20.

The bushing 10 is disposed within the through passage 25 with the cylindrical portion 11 of the bushing 10 between the insulated conductors 22 and the outer casing 23 of the cable 20, the flange portion 13 of the bushing 10 being in abutting contact with the end face 40 of the outer casing 23 of the cable 20, and the prongs 14 projecting through the through passage 25 with the end portions thereof remote from the flange portion 13 disposed beyond the connector 31 whereby these end portions are visible externally of the connector 21 by, for example, an inspector who requires merely to remove a cover plate or the like (not shown) associated with the junction box or electric switch and does not require to dismantle the connector assembly in order to confirm that a bushing 10 has been installed in the assembly. As will be appreciated, during this inspection the inspector can, furthermore, also confirm by checking the indicia 19 that it is the correct bushing 10, having regard to the particular characteristic or characteristics of the bushing 10 which are denoted by the indicia 19 which has been so installed.

While, as described above with reference to FIGS. 1 and 2, the end portion of each prong 14 remote from the flange portion 13 thereof projects beyond the cap 35, it is to be understood that said end portion of each prong 14 may alternatively project beyond the second part 27 of the connector 21 but not beyond the cap 35, in which case this end portion of each prong 14 is visible externally of the connector 21, by for example, an inspector, after the cap 35 has been temporarily disconnected from the remainder of the connector 21 by being unscrewed from the second part 27 of the connector 201 and slidably moved a short distance along the conductors 22. In such alternative embodiments there is still, however, no requirement for the connector assembly to be dismantled in order for the inspector to confirm that a bushing 10 has been installed in the assembly, since the connector 21 remains secured to the outer casing 23 of the cable 20, the connector 21 remains mounted on the wall 32 of the junction box or electric switch, and the conductors 22 remain connected to, for example, the terminals disposed within the junction box or electric switch.

What I claim as my invention is:

1. A bushing comprising a tubular portion having a longitudinal axis, and a flange portion which is presented at one end of the tubular portion and which projects outwardly from and around the tubular portion, wherein the flange portion presents at least one prong which projects from the flange portion in a direction opposite from the direction in which the tubular portion projects from the flange portion, said at least one prong being of approximately segmental form in cross section with the arcuate face of the prong directed substantially towards the longitudinal axis of the tubular portion.

2. A bushing according to claim 1, wherein the tubular portion is of substantially cylindrical form.

3. A bushing according to claim 1, wherein said at least one prong comprises a plurality of prongs which are substantially equi-angularly spaced about the longitudinal axis of the tubular portion.

4. A bushing according to claim 1, wherein the end portion of said at least one prong remote from the flange portion presents informational indicia relating to the bushing.

5. A bushing according to claim 1, wherein the end portion of said at least one prong remote from the flange portion is of tapered form, with the end of said at least one prong remote from the flange portion disposed on the side of the prong which is directed substantially towards the longitudinal axis of the tubular portion.

6. A bushing according to claim 1, wherein the bushing is integrally formed of linear polyethylene or nylon.

7. A bushing comprising a tubular portion having a longitudinal axis, and a flange portion which is presented at one end of the tubular portion and which projects outwardly from and around the tubular portion, wherein the flange portion presents at least one prong which projects from the flange portion in a direction opposite from the direction in which the tubular portion projects from the flange portion, said at least one prong being of approximately segmental form in cross section with the arcuate face of the prong directed substantially towards the longitudinal axis of the tubular portion, and the end portion of said at least one prong adjacent to the flange portion being of circular form in cross section and merging with the remaining portion of the prong of approximately segmental form in cross section through a concave fillet.

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