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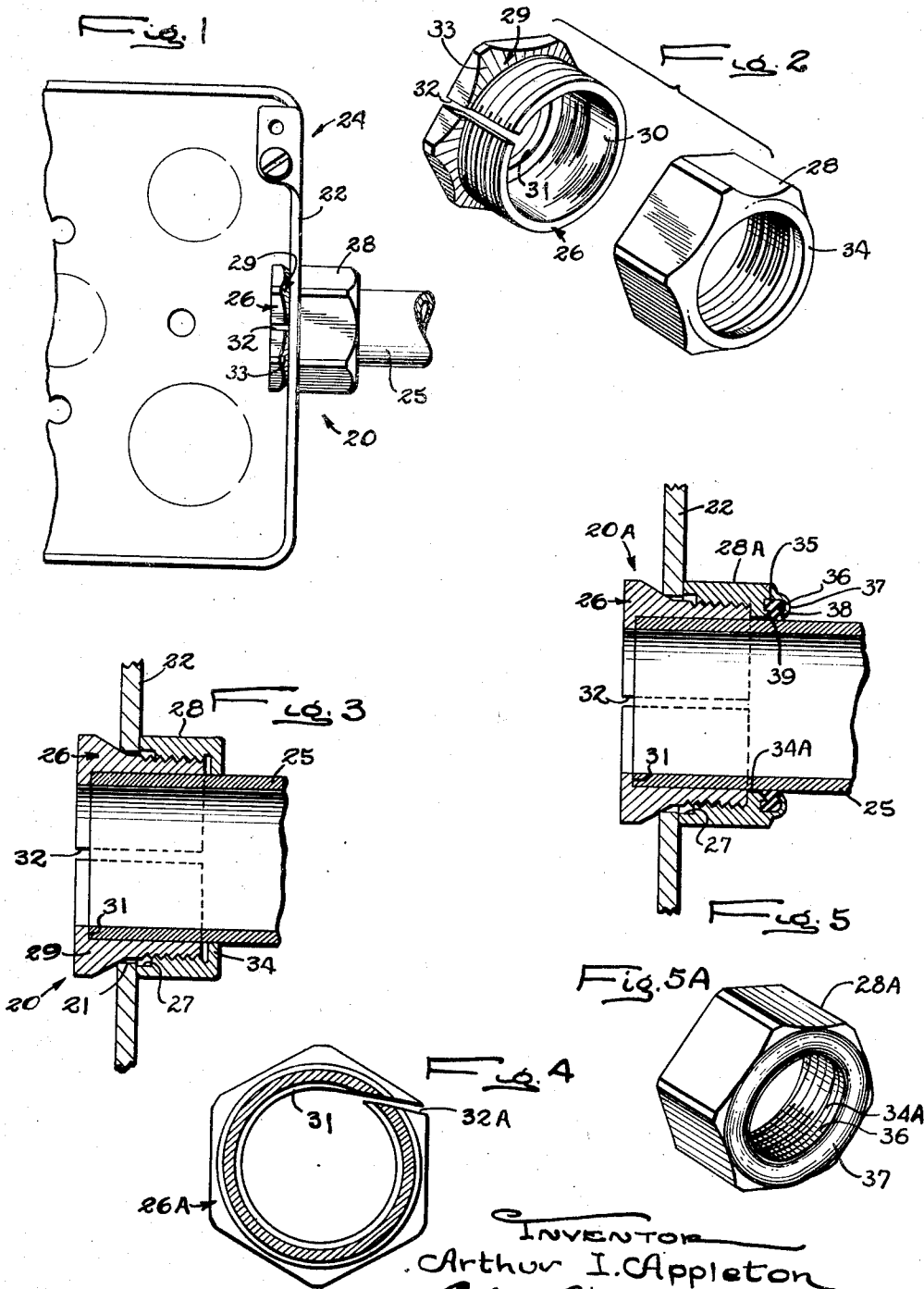
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ELECTRICAL CONNECTOR AND METHOD OF MAKING SAME

Filed Sept. 29, 1950

2 Sheets-Sheet 1



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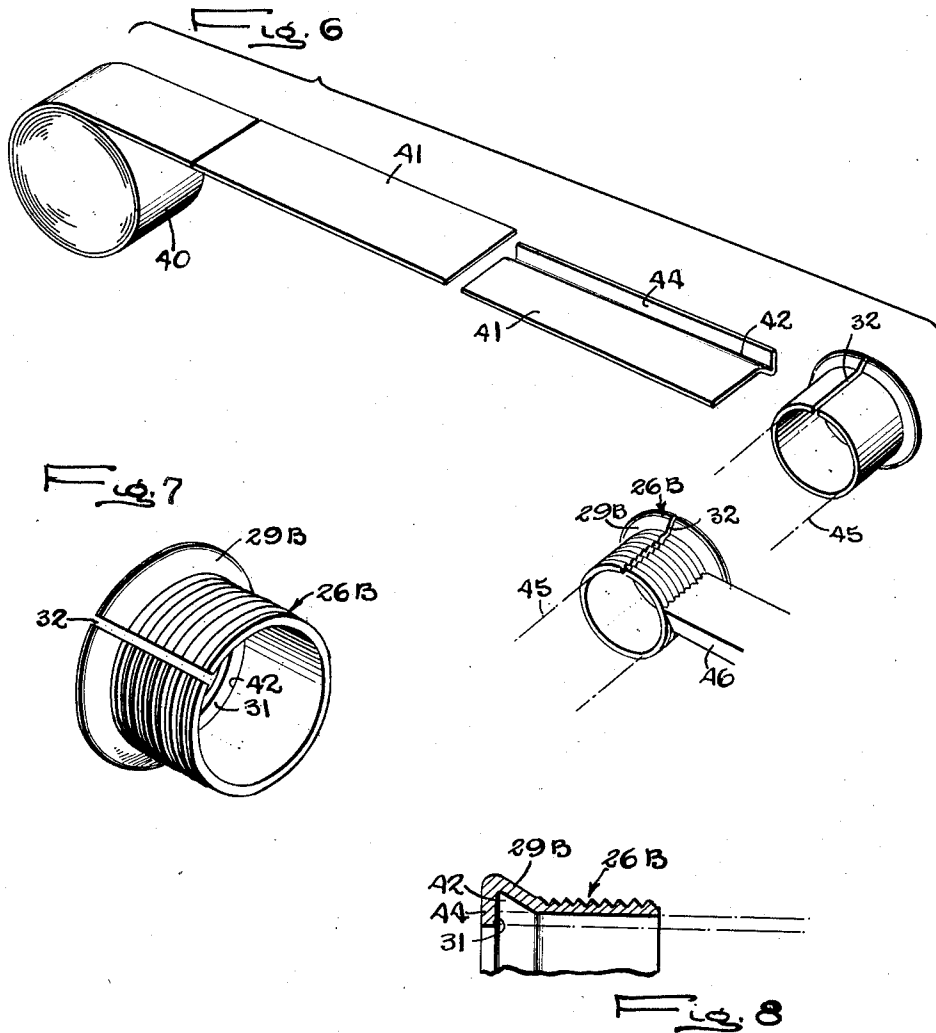
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ELECTRICAL CONNECTOR AND METHOD OF
MAKING SAME

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3 Claims. (Cl. 285—6.5)

1

The present invention relates to fittings or connectors for use in securing electrical conduit to junction boxes, outlet boxes and the like, finding particular but by no means exclusive utility in the fastening of conduit known in the trade as "thin-wall." More specifically, the invention is concerned with an improvement over the split bushing connectors of the general type disclosed in United States Patent No. 1,669,190, issued May 8, 1928 to Dunmire and United States Patent No. 1,879,920, issued September 27, 1932 to Church.

In another one of its aspects, the invention relates to a novel method of making connectors of the type disclosed herein.

One object of the invention is to provide an electrical connector of the character set forth and which will be susceptible of quick, easy, yet secure installation in the knockout opening of a box wall. A related object is to provide a connector which can readily be clamped in place by the use of a simple hand tool such as a pliers or wrench applied to that portion of the fitting located outside the box.

Another object is to provide an electrical connector of the above type and which can be sealed, as an incident to its installation, against the entry of water or freshly poured concrete which might otherwise enter between the outer peripheral surface of the conduit and the connector body.

A further object is to provide an electrical connector which will be capable of making intimate electrical contact with the box wall so as to permit the maintenance of a well-grounded conduit system.

Still another object is to provide a novel method of manufacturing connectors of the foregoing type on an economical, mass productive basis.

Further objects and advantages will become apparent as the following description proceeds, taken in connection with the accompanying drawings, wherein:

Figure 1 is a fragmentary plan view of an outlet box equipped with an illustrative electrical connector embodying the present invention.

Fig. 2 is an enlarged exploded perspective view of the illustrative connector shown in Fig. 1.

Fig. 3 is an enlarged fragmentary horizontal sectional view through the box and connector of Fig. 1 and looking toward the open end or top of the box.

Fig. 4 is an enlarged transverse sectional view through the body of a slightly modified connector also embodying the present invention.

Fig. 5 is a view similar to Fig. 3 but showing still another modification of the connector.

2

Fig. 5A is a perspective view detailing the nut of the modified connector of Fig. 5.

Fig. 6 is a stop motion perspective view illustrating sequentially the steps in the practice of the method of the present invention.

Fig. 7 is an enlarged perspective view of a connector body manufactured in accordance with the method of the present invention.

Fig. 8 is a longitudinal sectional view through the connector body shown in Fig. 7.

While the invention is susceptible of various modifications and alternative constructions, certain preferred embodiments have been shown in the drawings and will be described below in considerable detail. It should be understood, however, that there is no intention to limit the invention to the specific forms disclosed, but on the contrary, the intention is to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring more specifically to the drawings, there is shown in Figs. 1 to 3 an illustrative connector 20 embodying the present invention and in this instance installed in knockout aperture 21 located in side wall 22 of outlet box 24. The connector 20 telescopically receives and secures to the box 24 the end portion of a thin-walled electrical conduit 25, permitting unrestricted communication between the bore of the conduit 25 and the interior of the box 24 for the passage of electrical wiring. A simple bushing or body 26, threaded along a portion of its external peripheral surface and which projects through the knockout opening 21, together with a clamping nut 28 located outside the box 24, comprise the connector 20.

In order to effect secure engagement between the conduit 25 and the box wall 22, the body 26 is fashioned with a lateral enlargement in the form of a generally frusto-conical head 29 presenting a tapered surface which gradually decreases in diameter toward the threaded end of the body. Thus when mounted in the knockout aperture 21 with its threaded portion projecting outwardly therethrough, the body can easily be clamped in place by threading the nut 28 thereon until the inner end face of the nut abuts against the marginal edge portion of the box wall surrounding the aperture 21. Continued tightening of the nut tends to draw the head 29 into the aperture 21 with the result that the surrounding portion of the box wall 22 exerts a powerful squeezing action which effectively clamps the body 26 in place. Advantage is taken of this squeezing action to clamp the end por-

3

tion of the conduit 25 rigidly within the bore 30 of the body and with the end face of the conduit in abutting relation with a conduit stop in the form of an annular shoulder 31 at the inside end of the bore 30. This is accomplished by forming the body 26 with a generally longitudinal slot 32 therein. Consequently, as the nut 28 draws the frusto-conical head 29 into the aperture 21, the squeezing action effected by the surrounding box wall causes a generally radial deflection of the body 26 which wraps the same tightly around the end of the conduit 25. To further enhance this gripping action, the bore 30 of the body is preferably formed with a series of convolutions or ridges as by means of a rough tool cut.

In instances where the connector body is plated with certain soft metals such as zinc, the plating tends to act as a lubricant. To obtain sufficient friction between the head 29 and the contiguous edges of the box wall opening, the head may be slightly knurled as at 33.

Provision is made for utilizing the connector clamping nut 28 to define an outboard lateral support for the conduit and thus minimize any tendency of the connector to swivel in the knockout aperture 21 and loosen up. In furtherance of such objective, the nut 28 is provided with an annular shoulder 34 which receives the conduit 25 with a comfortable sliding fit. When in the tightened position illustrated in Figs. 1 and 3, the annular end face of the nut snugly abuts against the box wall and the annular shoulder 34 snugly surrounds the conduit. Thus the nut 28 serves as a rigid buttress between the conduit 25 and the box wall 22, effectively resisting lateral deflection of the conduit which might otherwise result in swiveling of the connector.

When the cylindrical portion of the body 26 is threaded as by means of a screw machine, care must be taken to avoid running the threading tool into the tapered head 29. One convenient way to accomplish this is to initiate radial retraction of the cutting tool shortly before the same completes its axial travel from the smaller end of the body toward the head 29. As a consequence of such action, however, that portion of the thread adjacent the head 29 becomes progressively shallower than the other portion of the thread cut before retraction of the tool was initiated. In order to avoid binding of the nut 28 on the shallow portion of the body thread, a condition which might prevent full tightening of the connector in the knockout aperture, the bore of the nut is relieved adjacent its end face by means of an annular groove 27. The latter is preferably of sufficient depth, measured axially of the nut, to clear the shallow portion of the body thread regardless of how thin the box wall may be.

In constructions where it is desirable to hold the slot width to a minimum, the connector might include a modified body 26A, shown in Fig. 4, in place of the body 26. The two bodies or bushings are substantially identical except for the fact that modified body 26A is provided with a slot 32A which is generally tangential to its bore 30. Due to its tangential orientation, the slot 32A can be made much narrower than a radial slot 32 while permitting the same degree of maximum radial deflection of the body under the clamping action of the nut and box wall. The modified body construction is advantageous in the event that the connector is to be sealed against the entry of water between the conduit and the body.

4

Turning now to Figs. 5 and 5A, there is shown a modified connector 20A generally similar to the connector 20 but provided with an appropriate seal to preclude the entry of water, or fluid from newly poured concrete, into the connector along the outer peripheral surface of the conduit 25. Such sealing action is often required temporarily in locations where semi-fluent material such as fresh concrete is being poured around installed electrical conduit. The modified connector 20A may include either the body 26 or the body 26A, the body 26 being shown in the present instance. Outboard of the annular shoulder 34A the nut 28A is formed with an undercut annular recess 35 which houses a sealing element in the form of a resilient collar 36. A curved annular skirt 37 is rolled or spun into overlying relation with the edge 38 of the skirt squeezing the collar 36 tightly against annular ridge 39 on the other side of the slot. With the collar 36 so held, it tends to stretch radially when the nut 28A is slid over the conduit 25, thereby making snug sealing contact with the peripheral surface of the conduit. By reason of the foregoing arrangement, any water or other fluid in contact with the outer peripheral surface of the conduit 25 is effectively prevented from entering the connector 20A and the box 24. Moreover, the sealing action is accomplished in a remarkably simple manner and as an incident to tightening the connector in place.

While it is of course possible to form connector bodies of the type disclosed earlier herein by introducing solid or tubular stock into an automatic screw machine, other modes of fabrication may be profitably employed. Referring to Figs. 7 and 8 there is shown a slightly modified connector body 26B which lends itself particularly well to fabrication by means of sheet metal stamping and forming operations. In this instance, the body 26B is formed without tool flats or knurling on its head 29B although these could be included if necessary. The method of making connector bodies such as the body 26B by stamping and forming operations is an important aspect of the present invention.

Turning now to Fig. 6, the steps in the method of the present invention are illustrated sequentially. Accordingly, sheet metal stock of appropriate width is unwound from a coil 40 from which a procession of blanks 41 are severed. The severing may be either complete or partial, depending upon the particular transfer and feed mechanism utilized to advance the blanks. The next step involves making a groove 42 in the blank 41 laterally along the top (as viewed in Fig. 6) to initiate formation of the head 29B, the groove 42 being preferably of V-shaped cross section. At the same time, or shortly after this is done, the top edge portion 44 of the blank is folded up into a plane perpendicular to the general plane of the blank, thereby initiating formation of stop shoulder 31. The grooved blank is then wrapped around a mandrel 45 with the groove 42 facing against the surface of the mandrel. The latter is of a diameter corresponding to the diameter of the bore to be defined within the body 26B. In addition, the circumferential dimension of the blank 41 is such that when wrapped around the mandrel 45, the ends of the blank will fail to meet by an amount which is just equal to the width of the longitudinal slot to be defined in the body 26B. After the wrapping operation has been completed, and preferably while the unfinished body 26B is still upon

5

the mandrel, the body may then be threaded as by means of one or more threading tools 46. The latter are preferably of the type which cut threads into the body 26B although it would also be permissible to roll the threads into the metal of the body. At the conclusion of the threading operation, the finished body 26B may readily be ejected from the mandrel 45 in any suitable manner. In the event that it should be desired to apply flats and knurling to the head 29B of the body, it would be preferable to do so while the latter is still upon the mandrel 45. The finished body 26B is, of course, susceptible of use with either the unsealed nut 28 or the sealing type nut 28A described earlier herein.

I claim as my invention:

1. A connector for securing one end of an unthreaded electrical conduit to the sidewall of an outlet box or the like with the conduit end extending through a knockout opening in the box, said connector comprising, in combination, a hollow longitudinally split bushing adapted to fit into the knockout opening and sidably receive the conduit therein, a radially inwardly projecting conduit stop abutment on the inner end of said bushing, external threads adjacent the outer end of said bushing, a radially enlarged annular head adjacent the inner end of said bushing presenting a frusto-conical surface tapering toward the outer end of said bushing, a clamping nut internally threaded to fit on the outer end of said bushing, the inner end of said nut defining an annular surface adapted to abut solidly against the sidewall of the box for forcing said head into engagement with the sidewall edges defining said opening to constrict said bushing for clamping the conduit, and the outer end of said nut having an annular shoulder thereon projecting radially inward to define an annular abutment surface adapted to have snug engagement with the conduit for buttressing the conduit against lateral rocking forces by using the exterior of the box wall as a footing.

2. A connector for securing one end of an unthreaded electrical conduit to the sidewall of an outlet box or the like with the conduit end extending through a knockout opening in the box, said connector comprising, in combination, a hollow longitudinally split bushing adapted to fit into the knockout opening and sidably receive the conduit therein, a radially inwardly projecting conduit stop abutment on the inner end of said bushing, external threads adjacent the outer

6

end of said bushing, a radially enlarged annular head adjacent the inner end of said bushing presenting a frusto-conical surface tapering toward the outer end of said bushing, a clamping nut internally threaded to fit on the outer end of said bushing, the inner end of said nut defining an annular surface adapted to abut solidly against the sidewall of the outlet box for forcing the frusto-conical surface of said head into engagement with the sidewall edges defining said opening to constrict said bushing for clamping the conduit, the bore of said nut at the inner end thereof being radially relieved to receive the small end of said conical head, the outer end of said nut having an annular shoulder thereon projecting radially inward to define an annular abutment surface adapted to have snug engagement with the conduit for buttressing the conduit against lateral rocking forces; said shoulder having a portion thereof disposed longitudinally from said surface and defining an annular, radially inwardly facing recess; and a resilient washer fixed in said recess and adapted to effect a watertight seal between the washer and the conduit.

3. The method of making a split bushing for an electrical connector which comprises the steps of stamping a generally rectangular blank from a sheet of metal stock, reversely bending one longitudinal marginal edge of the blank to form an elongated head inclined to one side of the blank and an elongated shoulder on the outside edge of said head disposed substantially perpendicularly to the body of said blank and extending beyond the opposite side thereof, bending said blank longitudinally into an annulus, and threading the cylindrical outer peripheral surface of the annulus.

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