Jan. 11, 1938. L. H. CHURCH 2,105,182

WIRE CONNECTER

Filed Oct. 26, 1934 3 Sheets-Sheet 1

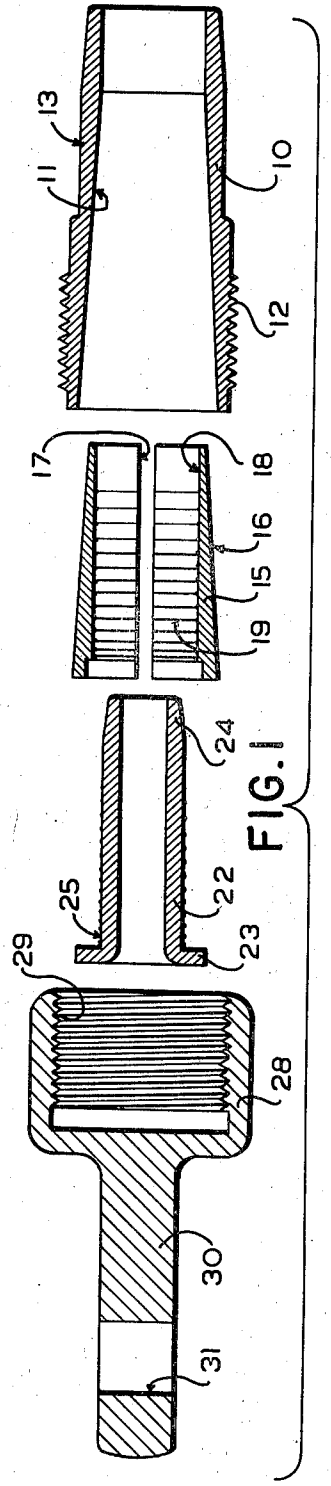


FIG. 1

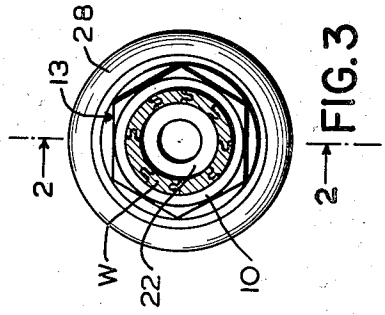


FIG. 3

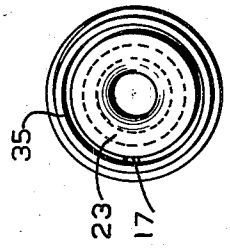


FIG. 5

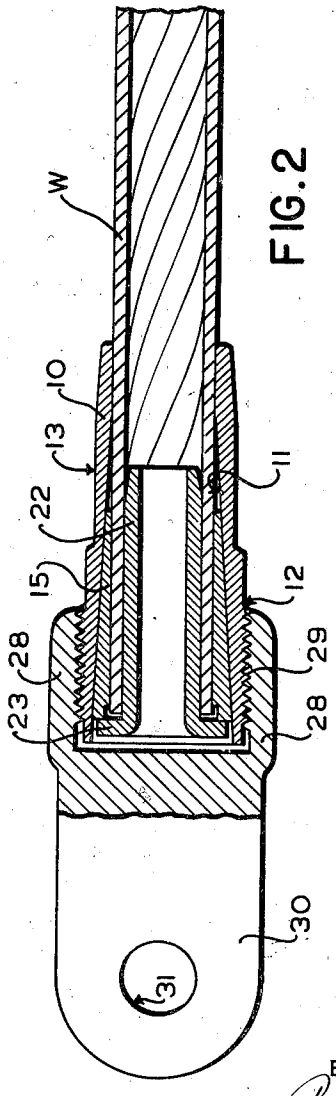


FIG. 2

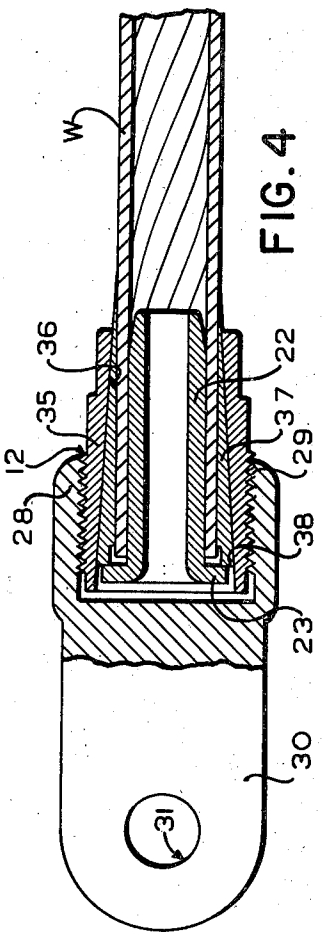


FIG. 4

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Jan. 11, 1938. L. H. CHURCH 2,105,182

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Filed Oct. 26, 1934 3 Sheets-Sheet 2

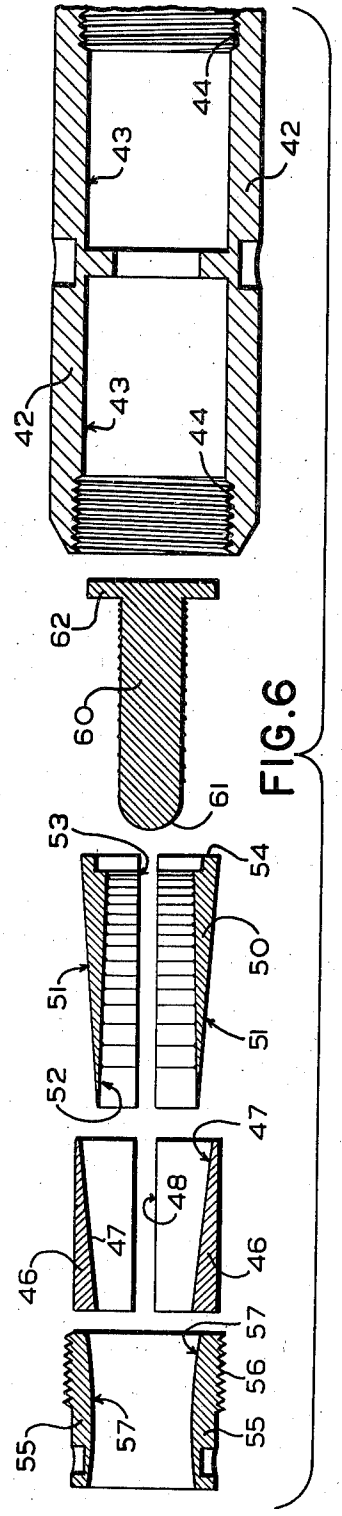


FIG.6

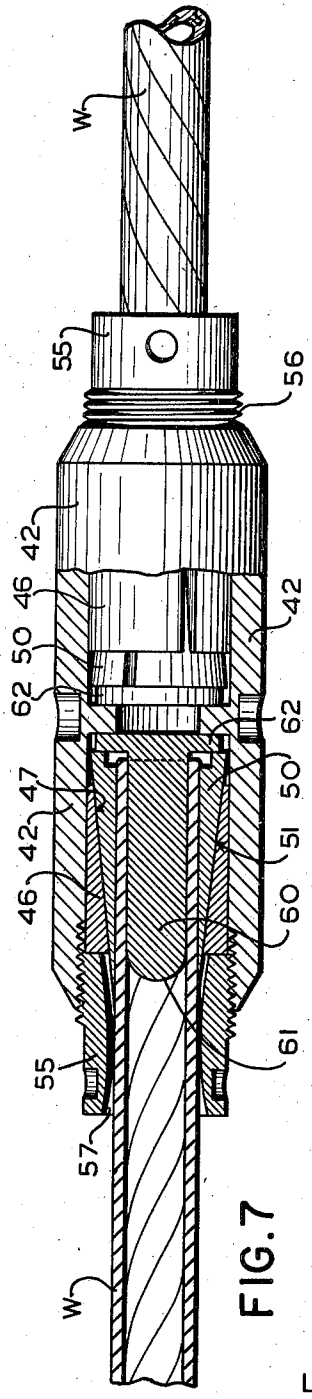


FIG.7

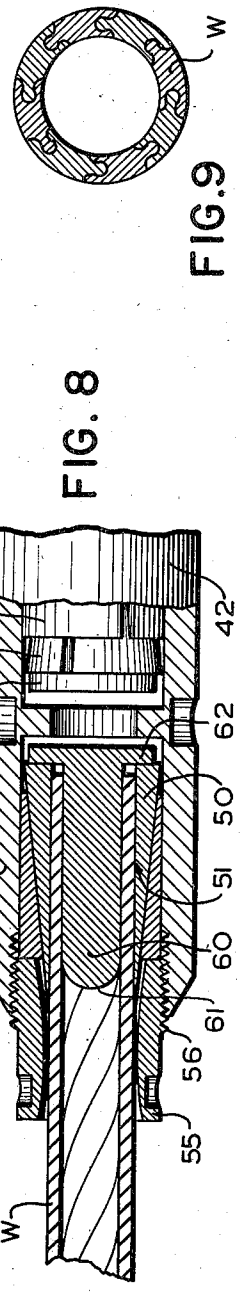


FIG. 8

FIG.9

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Jan. 11, 1938. L. H. CHURCH 2,105,182

WIRE CONNECTER

Filed Oct. 26, 1934 3 Sheets-Sheet 3

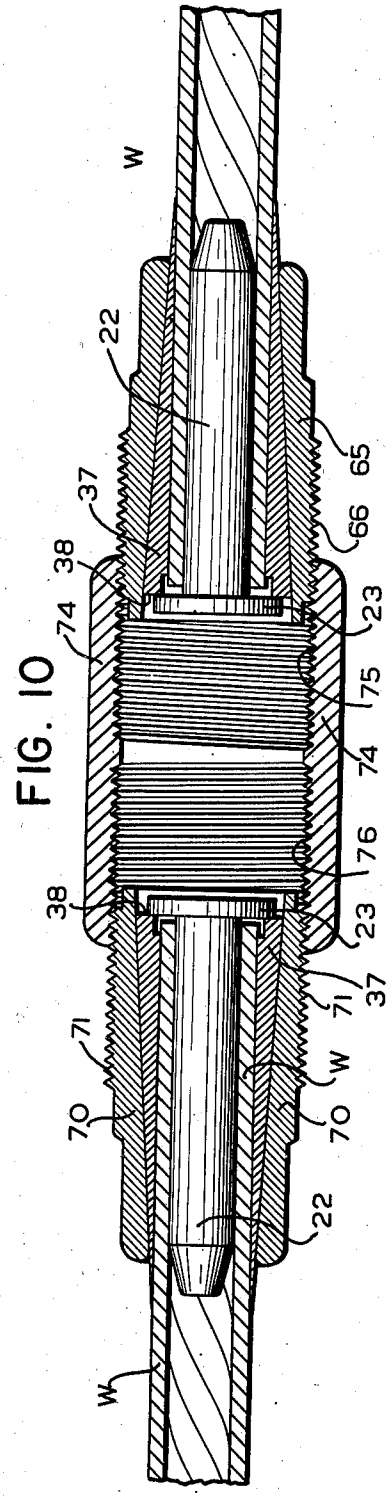


FIG. 10

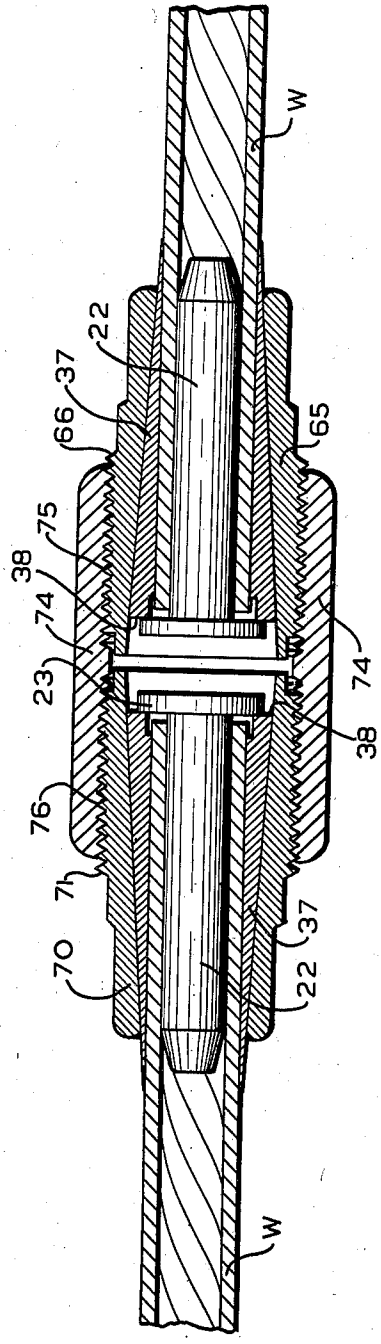


FIG. 11

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WIRE CONNECTER

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Application October 26, 1934, Serial No. 750,087

4 Claims. (Cl. 173—303)

The invention relates to a wire connecter which is adapted to be secured to a wire and particularly to secure the end of a wire to some other structure, or to secure the ends of two wires in order to couple them together. The invention has particular applicability to hollow high tension wire built up of segmental interlocking strips. Such high tension wires may have a diameter between one and two inches and be stretched between towers quite widely spaced so that the connecter is subjected to a heavy strain in supporting a considerable weight of cable or wire.

Sometimes the weight of the cable or wire is increased by the formation of ice thereupon in the winter, and a connecter must be able to withstand this added strain caused by the increased weight supported thereby. Such connecters, in addition to withstanding the heavy strains to which they are subjected, must also be capable of withstanding this strain irrespective of the effect of varying temperature changes which may expand the parts of the connecter unevenly and may tend to unloosen them. In other words, the connecter must not become unloosened, which might occur due to different coefficients of expansion and contraction of the parts thereof under the changing temperatures to which connecters are exposed.

It is one of the principal objects of the invention to devise a wire connecter which will be retightened, in case it should become unloosened for any reason, by the tension or pull exerted thereupon by the weight of the wire supported by the connecter, and which result is accomplished with a minimum number of parts for the connecter.

Another main object is to devise a wire connecter which will aid in keeping the connecter tightly gripping the wire and also retighten the same by the pull on the wire in case it should become unloosened, and which wire connecter does not carry any operating means for initially tightening the connecter. In this construction a hammer or separate means may be used to produce initial tightening of the connecter, or it may be produced by the pull exerted by the wire when two connecters are fastened or coupled together.

Another fundamental object is to devise a wire connecter in which one of the parts thereof extends beyond the end of the internal conical surface provided upon one of the parts of the wire clamping means and engages or contacts the wire in order to reduce or dampen vibration of the wire and to prevent scoring of the wire by the end of the contractile sleeve.

Another object is to extend particularly the contractile sleeve so that it projects beyond the end of the internal conical surface of the clamping means and also projects beyond the end of a plug, if one is provided, in order to dampen vibration of the wire and particularly to prevent scoring of the wire by the end of the contractile sleeve.

Another broad object of the invention is to construct a wire connecter having a retightening characteristic and in which the initial tightening of the connecter is augmented by the pull of the wires as two connecters are drawn towards each other in coupling the ends of two wires together.

The broad objects of the invention have been outlined above and other objects can be stated which comprise various combinations of the principal objects set forth. Such other objects of the invention will be more apparent from the following description and claims taken in connection with the accompanying drawings illustrating some preferred embodiments of the invention, in which:

Figure 1 is an exploded view of one form of wire connecter in which no initial operating means is provided on the connecter in order to initially grip the wire, and the parts of the connecter are shown in section.

Figure 2 is a longitudinal section of the assembled wire connecter of Figure 1 with the end of a hollow high tension wire secured therein.

Figure 3 is an end view of the assembled connecter shown in Figure 2.

Figure 4 is a longitudinal section of a wire connecter similar to that shown in Figure 2, but which differs therefrom in having the contractile clamping sleeve projecting beyond the end of the supporting part.

Figure 5 is an end view of the connecter of Figure 4.

Figure 6 is an exploded view of a wire connecter adapted to couple the ends of two wires together, and having the contractile sleeve extending beyond the internal conical surface and the end of the plug.

Figure 7 is an assembled longitudinal section of the wire connecter of Figure 6 after the connecter has been initially contracted on the wire.

Figure 8 is a longitudinal section showing the wire connecter of Figure 7 after it has been retightened by a pull on the wire.

Figure 9 shows an enlarged end view of the

wire and the interlocking connection between the segments forming the hollow wire.

Figure 10 is a longitudinal section through a wire connecter which is initially tightened by an external means or by the pull of the wire when two connecters are drawn together, in order to provide a coupling for the ends of two wires. The two wire connecters are shown preparatory to drawing them together by a coupling member or means.

Figure 11 is a longitudinal section through the wire connecter of Figure 10 with the two connecters drawn completely into the coupler member during which process the connecters have become initially contracted.

The wire connecter to be described herein is devised to provide as simple a structure as possible for securing the ends of high tension wire to some other structure or to the end of another wire. The connecter, even though of simple construction, will support the heavy strain to which it will be subjected in service and has the characteristic of retightening itself in case it should become unloosened for any reason, such as uneven expansion or contraction of different parts thereof brought about by varying temperatures to which the connecter is subjected.

The connecter shown in exploded view in Figure 1 consists of a means **10** having an internal taper or conical surface **11**. The means **10** carries screw threads **12**, shown particularly on the exterior thereof, the purpose of which will be disclosed hereinafter. The means **10** may also carry flat portions or a hexagonal portion **13** to enable the means to be held with a wrench. A contractile sleeve or means **15** has an external taper or conical surface **16** corresponding with the internal conical surface **11** of the means **10**. The sleeve **15** is rendered contractile by a longitudinal slot **17** extending through the length of the contractile sleeve. Other means of rendering the sleeve contractile may be used. The bore **18** of the contractile sleeve **15** is preferably provided with biting ridges or teeth **19** which are heaviest and deepest at the thick end of the sleeve and gradually taper off to a smooth surface at the smaller end of the sleeve. Preferably too the bore **18** is slightly smaller in diameter at the thicker end so that the inner end of the connecter carries a greater part of the clamping action on the wire than the thinner end of the sleeve.

A plug **22** which is shown as being hollow, although a solid plug may be utilized, has a diameter approximately that of the hole through the hollow wire W so that it is insertable therein. The plug carries an outwardly extending flange **23** preferably at the end thereof. The purpose of the flange will be described hereinafter. The other end of the plug carries a taper **24** which aids in inserting this plug within the hollow high tension wire. The plug **22** may also be provided with biting ridges or teeth **25** which are both more numerous and greater adjacent the flange **23** and taper off gradually towards the tapered end **24** of the plug.

A securing lug **28** is provided with internal threads **29** for engagement with the threads **12** on the connecter means **10**. Any other means may be used to secure the lug **28** to the internal conical surface means **10**. The securing lug carries a flat extension **30** having an opening **31** therein for receiving a bolt or other anchorage means by which the connecter is secured to some supporting structure.

In assembling the connecter described, the means **10** with the contractile sleeve **15** inserted therein is slipped over the end of the wire W until the end of the wire is adjacent to or at the inner end of the contractile sleeve **15**. The plug **22** is then inserted within the end of the wire until the flange **22** engages the end of the contractile sleeve **15**. The end of the plug may then be struck with a hammer in order to drive the plug and contractile sleeve into the means **10** so that the cooperating conical surfaces **11** and **16** on the means **10** and the contractile sleeve **15** forcibly contract the sleeve to grip the wire between the sleeve and the plug. Any other means separate from and independent of the connecter may be utilized to enforce this axial movement between the contractile sleeve **15** and the means **10**, whereby the tapers or conical surfaces cooperate to contract the contractile sleeve **15** and initially grip the wire. The lug **28** is then threaded upon the threads **12** of the means **10** to provide means for securing the connecter and the wire to some other structure.

The contractile sleeve **15** is positioned upon the wire so that the small end thereof is spaced from the end of the wire and the large end thereof is adjacent to the end of the wire. The contractile sleeve therefore is in a retightening position as will appear more fully hereinafter. When the contractile sleeve **15** is contracted, the wire W, which has a certain degree of flexibility, is contracted slightly therewith so that the wire W, the contractile sleeve, and the plug **22** are clamped together as a unit through this clamping action. The biting ridges or teeth **19** in the bore **18** of the contractile sleeve **15** and the biting teeth **25** on the external surface of the plug **22** dig into the wire and firmly fix or anchor the contractile sleeve and the plug **15** to the wire so that these three parts move together by the pull on the wire in case the connecter should become unloosened due to changing temperatures, whereupon the contractile sleeve **15** is pulled axially with respect to the internal conical surface **11** to retighten the connecter.

The retightening characteristic or feature of the connecter is principally obtained by the flange **23** carried by the plug or plug means **22**. The flange abuts the end of the contractile sleeve **15**. The plug **22** is freely movable with the wire W in order to retighten the connecter if it should become unloosened. If unloosening should occur and the wire tends to pull out of the connecter, the plug **22** moves with the wire W and the flange **23** engaging the end of the contractile sleeve **15** forces the contractile sleeve axially with respect to the means **10** and the internal conical surface **11** thereon to assure positive retightening of the connecter. The flange **23** therefore is one of the means cooperating between the plug **22** and the contractile sleeve **15** for retightening the connecter.

The flange **23**, particularly shown as being carried by the plug **22**, provides means carried by the plug which engages a shoulder **38** formed by the end of the contractile sleeve **15** which is spaced from the small end of the contractile sleeve. The means carried by the plug **22** for engaging the shoulder **38** on the contractile sleeve **15** need not be a flange **23** nor does the shoulder carried by the contractile sleeve **15** need be the shoulder formed by the end of the contractile sleeve. The flange **23** and shoulder **38** together form means cooperating between the plug **22** and the contractile sleeve **15** to retighten the connecter by the pull on the cable in case it should become

unloosened. In the construction shown in Figures 1 to 5 inclusive, a hammer or other external and separate initial tightening means is utilized in order to initially secure the end of the wire W within the connecter, and the connecter is provided with a second operating means for retightening the connecter by the pull on the wire in case it should become unloosened when in use. The second operating means cooperates with the contractile sleeve to force the latter axially within the means **10**. In other words, the connecter described is capable of being retightened by the pull on the wire in case it becomes unloosened and consists of only three essential parts, namely a means having an internal conical surface which means is adapted to be secured to some other structure, a contractile sleeve positioned upon the wire, as shown and described, and a plug insertable within the wire and having means cooperating with the contractile sleeve to retighten the connecter by the pull on the wire. The means **10** is shown as extending substantially beyond the end of the contractile sleeve **15** and the end of the plug **22**, which extension engages the wire W. This extension of the connecter means **10** tends to prevent vertical oscillation of the wire and also resists abrasion at the end of the contractile sleeve which may cause subsequent fracture of the wire. Such an extension provides means engaging the wire beyond the end of the internal conical surface.

Figure 4 shows another form of construction quite similar to that shown in Figures 1 and 2. In this construction the anchorage means or securing lug **28** is threadedly secured to the means **35** which carries an internal taper **36**. A contractile sleeve **37** is adapted to fit over the wire W with its smaller end spaced from the end of the wire and its larger end adjacent to the end of the wire, so that it is in a position to be retightened by the pull on the wire in case it should become unloosened. The construction of Figure 4 differs from that of Figures 1 and 2 in the contractile sleeve **37** projecting beyond the end of the means **35** and engaging the wire W at a point beyond the end of the internal conical surface **36**, instead of having the means **35** perform this function. The means **35** in Figure 4 is consequently shorter than the corresponding means **10** of Figure 2.

The projecting end of the contractile sleeve **37** provides a flexible end therefor which is unsupported by any exterior part. The swaying of the wire W is tended to be dampened by the projecting end of the contractile sleeve, and also the contractile sleeve provides no rigid or rigidly supported corner to score the wire when it vibrates or sways and thereby eventually produce a weakened wire. The end of the projecting contractile sleeve extends to a substantially sharp edge so that this end is not rigid, but has a certain degree of flexibility. The connecters of Figures 1 through 4 show therefore that one of the parts of the connecter extends beyond the end of the internal conical surface and engages the wire to prevent scoring of the wire by the contractile sleeve and to tend to prevent vibrations or the undesirable effects of vibrations of the wire W.

The plug **22** of Figures 1 and 2 may be inserted into the wire W, which plug may be provided with the flange **23**. The flange **23** provides means carried by the plug which engages an axial shoulder **38** formed by the end of the contractile sleeve for retightening the contractile sleeve in case it should become unloosened. It will be noted too, that the contractile sleeve **37** projects beyond the end of the plug **22** and projects well beyond the point where the tapered end of the plug begins, which is the innermost point of the wire which contacts with the plug, so that the flexibility of the end of the contractile sleeve is not affected either by the plug **22** or the means **35**.

Although the construction shown in Figure 4 shows the use of a plug **22** inserted within the end of the wire, which plug carries a flange, it will be understood that the combination disclosed in this view may be utilized on solid wires and may be utilized on hollow wires without the use of a plug. The improvement fundamentally lies in one of the parts, and particularly the contractile sleeve **37**, projecting beyond the internal conical surface to prevent scoring of the wire W.

Figures 6 through 8 show a wire connecter constructed much like the connecter shown in the Buchanan application 688,560. This connecter has a body member **42** having an internal bore **43** and internal screw threads **44** at the end of the body member. An outer expansible sleeve **46** having an internal conical surface **47** is inserted within the bore **43** of the body member **42**. The expansible sleeve **46** has a slot **48** to render this sleeve expansible. An inner contractile sleeve **50** has an outer conical surface **51** which engages the internal conical surface **47** on the outer expansible sleeve **46**. The contractile sleeve **50** has a bore **52** within which a hollow wire W is received so that the contractile sleeve fits over the end of the wire W. The contractile sleeve **50** has a longitudinal slot **53** which renders the sleeve contractile.

An operating means or nut **55** has external screw threads **56** which cooperate with the internal threads **44** on the body member **42**. The operating nut engages the large end of the outer expansible sleeve **46** and forces it into the body member so that the conical surfaces on the sleeves **46** and **50** forcibly engage to contract the contractile sleeve **50** and expand the expansible sleeve **46**.

It will be observed that the operating nut **55**, the expansible sleeve **46** and the body member **42** are combined into an integral or one piece element in the construction shown in Figures 1 through 4 and in Figures 10 and 11. These three parts in the form of construction shown in Figures 6 through 8, therefore, together form means having an internal conical surface. Because this means in Figures 6 through 8 also includes the operating nut **55**, as well as the expansible sleeve **46**, this construction provides means carried by the connecter which is capable of another function, namely the function of initially contracting the contractile sleeve **50** by causing relative movement to occur between the internal conical surface **47** and the contractile sleeve **50**. Any initial operating means whatever is contemplated by the invention which has the function of producing relative movement between an internal conical surface, such as the surface **47**, and the contractile sleeve **50**. Such operating means may or may not be carried by the connecter.

The operating nut **55** is preferably provided with a bore **57** so that the wire has ample room to vibrate therein and so that the flexible end of the contractile sleeve **50** is unsupported beyond the end of the internal conical surface **47**. The operating nut **55** may engage the wire W, as described in the Buchanan Patent 2,056,248, so long

as it does not support the free end of the contractile sleeve 50.

The expansible sleeve 46 upon being forced into the body member 42 expands as the contractile sleeve 50 contracts, so that the expansible sleeve expands into firm engagement with the bore 43 of the body member 42. This firm engagement between these two parts assures better electrical contact through the connecter and also assists in resisting the pull of the wire so that the weight of the wire is not carried entirely by the screw threads of the operating nut 55. The expansible sleeve need not be expansible, if it is not desired to take advantage of the additional function provided by it being expansible.

A plug or plug means 60 has a tapered end 61 to facilitate the insertion of the plug within the hollow wire. The plug 60 also has a flange 62 which engages an axial shoulder 54 spaced from the smaller end of the contractile sleeve and formed by the larger end thereof. The flange provides means carried by the plug 60 for retightening the connecter in case it should become unloosened by the pull of the wire. This retightening characteristic is obtained in that the plug 60 is freely movable with the wire so that when the wire tends to pull out of the connecter, the plug moves therewith and the flange 62 forces the contractile sleeve 50 to also move with the wire, whereupon the contractile sleeve is further contracted to more firmly grip the wire.

In the construction shown in Figures 10 and 11, a wire connecter, much like that shown in Figure 4, is illustrated. In this construction, however, the means 65 has right-hand screw threads 66, whereas the other means 70 has left-hand screw threads 71. The coupler means 74 has internal right-hand threads 75 and internal left-hand threads 76 to receive, respectively, the right-hand threads 66 on the means 65 and the left-hand threads 71 on the means 70. Upon rotating the coupler means 74, the means 65 and 70 and hence the wire connectors of which they are a part, are drawn towards each other and in so being drawn towards each other, the pull on the wire will initially tighten the contractile means 37 so that no other initial operating means may be necessary. In order to assure, however, that the wire is initially secured therein with a sufficient degree of security, each contractile sleeve 37 may be initially contracted by hitting the head or flange 23 of each plug 22 with a hammer.

It is understandable, of course, that the construction shown in Figures 10 and 11 may be used for solid wire, in which case of course a plug cannot be used, and may also be used with hollow wire without the use of a plug, if so desired. It should also be noted that in the double ended connecters for securing the ends of two wires together, such as in the constructions shown in Figures 6 through 11, one of these wire connecters is broadly a means for securing the other connecter to some other structure, which is also the purpose of the lug 30, shown in the construction in Figures 1 through 4. The biting ridges or teeth 19 and 25 shown on plug 22 and contractile sleeve 15 may be likewise provided on the same parts in the other forms illustrated.

It has been found also that by making the bore 52 of the contractile sleeve 50 slightly tapered, so that the bore is slightly less in diameter at the large end of the contractile sleeve, that upon contraction of the sleeve, a larger proportion of the clamping stress is carried near the end of the wire. This result is understandable since with uniform contraction throughout the length of the sleeve, the smaller bore at the inner end of the contractile sleeve 50 would provide greater gripping power at this end, since the bore 52 will at all times have a diameter less than the diameter at the other end of the bore. The purpose for tapering the bore 52 of the contractile sleeve is to so construct the sleeve that a smaller proportion of the total clamping strain on the wire is carried at the small end of the contractile sleeve where excessive strains are more likely to fracture the wire.

Various modifications will occur to those skilled in the art in the configuration, composition and disposition of the component elements going to make up the invention as a whole, as well as in the selective combination or application of the respective elements, and no limitation is intended by the phraseology of the foregoing description or illustrations in the accompanying drawings.

What is claimed is:

1. A wire connecter comprising means having an internal conical surface, a contractile sleeve adapted to fit over the wire and having an exterior conical surface engaging the internal conical surface, the contractile sleeve having its smaller end spaced from the end of the wire and its larger end adjacent to the end of the wire, the contractile sleeve having a flexible end extending substantially outwardly and engaging the wire beyond the end of the internal conical surface to provide a yieldable support for the wire where it enters the connecter, an operating nut carried by the aforesaid means for initially contracting said contractile sleeve to grip the wire by enforcing relative movement between the contractile sleeve and the internal conical surface, and the operating nut extending outwardly beyond the contractile sleeve and adapted to engage the wire.

2. A wire connecter for hollow wire comprising means having an internal conical surface, a contractile sleeve adapted to fit over the wire and having an exterior conical surface engaging the internal conical surface, the contractile sleeve having its smaller end spaced from the end of the wire and its larger end adjacent to the end of the wire, plug means insertable within the wire, means carried by the plug means and cooperating with the contractile sleeve to retighten the connecter in case it should become unloosened, the contractile sleeve having a flexible end extending outwardly and engaging the wire beyond the end of the internal conical surface and the end of the plug means where it engages the inner surface of the wire to provide a yieldable support for the wire where it enters the connecter, an operating nut to initially contract said contractile sleeve to grip the wire by enforcing relative movement between the contractile sleeve and the internal conical surface, and the operating nut extending outwardly beyond the contractile sleeve and plug means and adapted to engage the wire to further protect the wire against scoring.

3. A self-tightening wire connecter for connecting the end of a hollow wire comprising a connecter sleeve having an internal conical surface the smaller diameter of which is spaced from and the larger diameter of which is located adjacent to the end of the wire, the connecter sleeve having an open front end through which the wire is adapted to be projected and an open

rear end, a contractile sleeve adapted to fit over the wire and having an external conical surface engaging the inner conical surface of the connecter sleeve with its smaller end spaced from and its larger end located adjacent to the end of the wire, a plug insertable within the end of the wire, means carried by the plug and the contractile sleeve cooperating together to move the latter axially relatively to the connecter sleeve when an external force is applied at the large diameter end of the contractile sleeve through the open rear end of the connecter sleeve for initially tightening the said contractile sleeve against the wire and plug and also for retightening the contractile sleeve by the pull on the wire, and means on said connecter sleeve for securing the latter to some other structure.

4. A self-tightening wire connecter for connecting the end of a hollow wire comprising a connecter sleeve having an internal conical surface the smaller diameter of which is spaced from and the larger diameter of which is located adjacent to the end of the wire, the connecter sleeve having an open front end through which the wire is adapted to be projected and an open rear end, a contractile sleeve adapted to fit over the wire and having an external conical surface engaging the inner conical surface of the connecter sleeve with its smaller end spaced from and its larger end located adjacent to the end of the wire, a plug insertable within the end of the wire, means carried by the plug and the contractile sleeve cooperating together to move the latter axially relatively to the connecter sleeve when an external force is applied at the large diameter end of the contractile sleeve through the open rear end of the connecter sleeve for initially tightening the said contractile sleeve against the wire and plug and also for retightening the contractile sleeve by the pull on the wire, means on said connecter sleeve for securing the latter to some other structure, and means operating through the open rear end of the connecter sleeve to initially force the contractile sleeve relatively to the connecter sleeve to initially tighten the wire connecter.

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