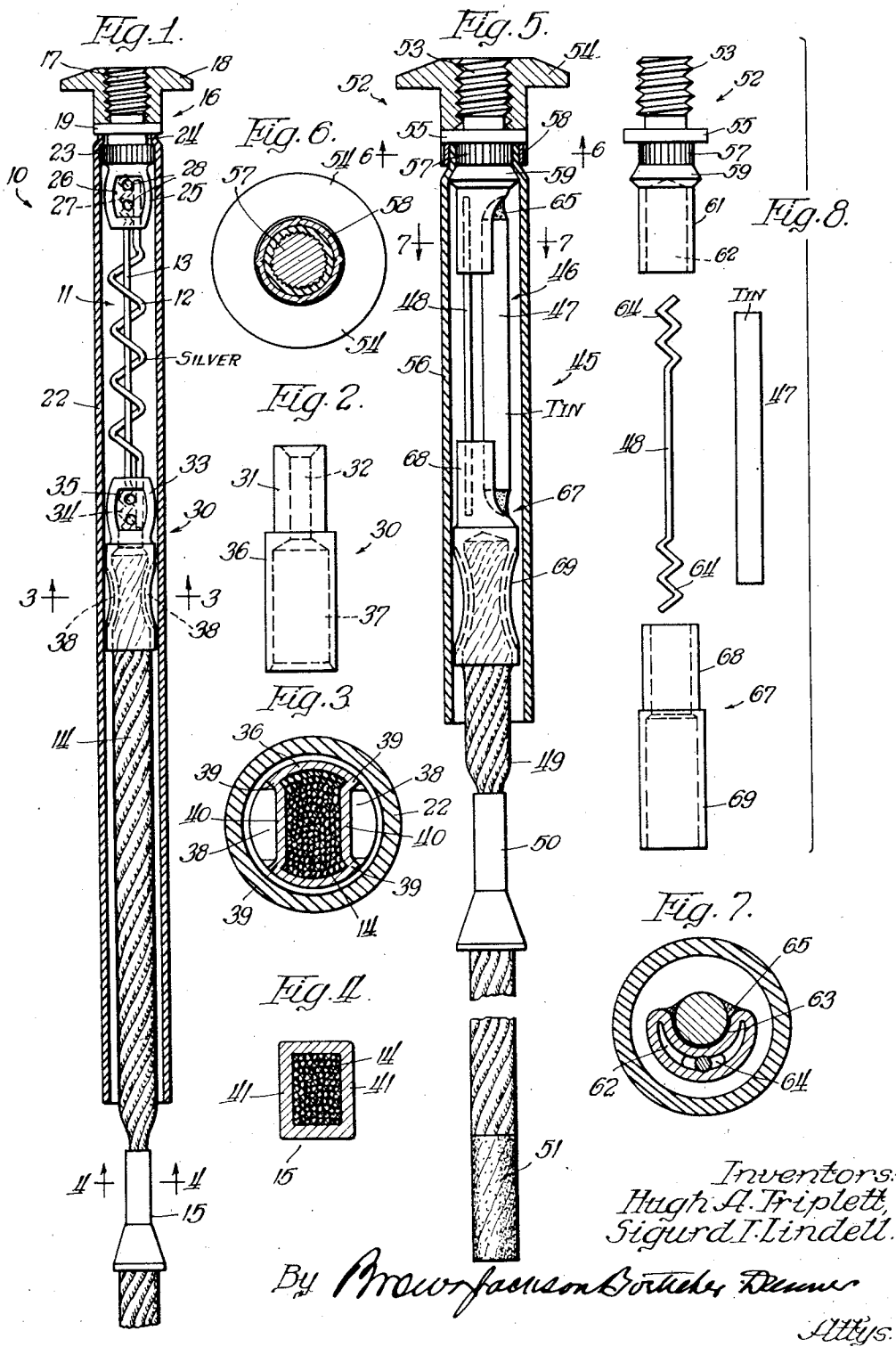
Oct. 3, 1939. H. A. TRIPLETT ET AL 2,174,767

FUSE

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FUSE

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38 Claims. (Cl. 200—135)

This invention relates, generally, to fuse devices and it has particular relation to the construction and assembly of renewable fuse links for universal use which may be inserted in practically any of the fuse housings of the expulsion type that are now being sold.

The object of this invention, generally stated, is to provide a universal fuse link construction that shall be simple and efficient in operation and which may be readily and economically manufactured and installed.

An important object of this invention is to secure electrical and mechanical contact engagement between the terminals of a fuse link and the strain and fusible elements and the flexible conductor forming parts of the same.

Another important object of this invention is to provide for securing a terminal, of a fusible element of a fuse link for example, to a stranded conductor or flexible lead in such manner as to provide a high degree of permanent electrical contact engagement therebetween.

Another object of this invention is to interconnect a tubular terminal and a flexible conductor formed of a plurality of strands of wire in such manner that the maximum outside dimension of the assembly will be substantially the same as the initial outside diameter of the terminal and not substantially greater than the diameter of an unclamped portion of the flexible conductor.

A specific object of this invention is to provide high contact pressure between a tubular metal sleeve or socket and a flexible conductor comprising a plurality of strands of wire by deforming a substantial portion of the sleeve or socket onto the strands of the conductor in such manner that the high contact pressure remains after the means employed to produce the same is removed.

Another object of this invention is to secure a fusible element and a strain element in a terminal in a new and improved manner.

Another important object of this invention is to provide for securing a strain element and a fusible element to the inside and outside, respectively, of the tubular end portions of a pair of fuse link terminals which face each other.

A further object of this invention is to provide for holding the ends of a strain wire in the opposing ends of a pair of fuse link terminals by deformation and for securing the ends of a fusible wire composed principally of tin thereto by heat and fusion.

Still another important object of this invention is to positively hold one end of a sleeve of insulating material onto one terminal of a fuse link.

A still further object of this invention is to clamp one end of a sleeve of insulation to the knurled intermediate portion of a fuse link terminal by crimping a retaining ring around the end of the sleeve.

Other objects of this invention will, in part, be obvious and in part appear hereinafter.

Accordingly, this invention is disclosed in the embodiments hereof shown in the accompanying drawing and it comprises features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

For a more complete understanding of the nature and scope of this invention reference may be had to the following detailed description taken in connection with the accompanying drawing in which:

Figure 1 is a view, in side elevation, of one embodiment of this invention, the tubular insulating sleeve and the terminal cap being shown in section in order to more clearly disclose the details of construction;

Figure 2 is a view, in side elevation, of the tubular connector that is employed in the construction shown in Figure 1 after the machining operations have been completed and before its ends have been deformed in the manner to be described hereinafter;

Figure 3 is a sectional view taken along the line 3—3 of Figure 1;

Figure 4 is a sectional view taken along the line 4—4 of Figure 1;

Figure 5 is a view, similar to that shown in Figure 1, showing another embodiment of this invention;

Figure 6 is a sectional view taken along the line 6—6 of Figure 5;

Figure 7 is a sectional view taken along the line 7—7 of Figure 5; and

Figure 8 is a view showing certain parts of the fuse link illustrated in Figure 5 in disassembled relation.

Referring now particularly to Figure 1 of the drawing, it will be observed that the reference character 10 designates, generally, a fuse link that is intended for universal use in many of the expulsion type cutouts that are being sold on the market today. The fuse link 10 comprises fusible means 11 which includes a fusible element 12, preferably formed of silver, and a strain element

13, preferably formed of a nickel-chromium alloy for relieving the fusible element 12 of any tension stress that might otherwise be imposed thereon. The fusible and strain elements 12 and 13 are preferably in the form of wires with the former being formed in an open spiral around the latter. A flexible conductor 14, formed of a plurality of strands of fine wire is arranged to be connected to the fusible means 11 in a manner to be hereinafter described. A cone terminal 15 is pressed onto the flexible conductor 14, as illustrated, to permit attachment to a suitable terminal of the cutout in which the fuse link 10 is to be positioned.

At the upper end of the fuse link 10 a terminal, shown generally at 16, is provided having its upper end threaded as indicated at 17 for receiving a terminal cap 18. The fuse link 10 may be positioned in the bore of the fuse housing with the cap 18 in engagement with the upper terminal thereof. For certain other types of fuse housing construction the terminal cap 18 may be removed and the terminal 16 may be threaded into a suitable connector. A flange 19 is provided intermediate the ends of the terminal 16 by leaving this portion of the original stock from which the terminal is machined.

With a view to enclosing the fusible means 11 and to provide an inherent expulsion action in the fuse link 10 itself, a tubular sleeve 22 of insulation is provided. The tubular sleeve 22 may be formed of fiber. The length of the sleeve 22 is generally determined by the voltage of the circuit to which the fuse link 10 is intended to be connected. In the drawing the sleeve 22 is shown relatively long for application to a high voltage circuit but it will be understood that a shorter length of sleeve may be employed without departing from the scope of this invention. The upper end of the sleeve 22 is crimped onto a knurled portion 23 of the terminal 16. The extreme upper end is further crimped into a circumferential groove 24 that is formed by a suitable machining operation between the flange 19 and the knurled portion 23.

For the purpose of providing for electrically connecting the fusible and strain elements 12 and 13 to the terminal 16, its lower end 25 is drilled axially at a diameter that depends upon the size of these elements. The fusible and strain elements 12 and 13 are then inserted into the drilled hole and the opposite walls of it are deformed by flattening them as indicated at 26 on either side to cause the metal of the terminal 16 to come into intimate contact engagement with the ends of the fusible and strain elements 12 and 13. The upper end 27 of the strain element 13 is corrugated so that it is positively secured in the portion 25 of the terminal 16 when it is deformed thereon. In order to further insure that the metal of the terminal 16 is deformed into intimate contact engagement with the upper ends of the fusible and strain elements 12 and 13, a suitable tool, such as a punch, is employed to further depress the metal on one of the flattened portions 26 by forming the punch marks 28. The corrugated end 27 of the strain element 13 is embedded in the lower end 25 of the terminal 16 since the latter is usually formed of brass or copper while the former, as indicated, is formed of a much harder material. The end of the fusible element 12, being relatively soft, is flattened to conform to the adjacent inner surfaces.

Considerable difficulty has been encountered in the past in interconnecting the fusible means 11 and the flexible conductor 14, particularly in certain current ratings and for certain types of housing in which the available space is limited. It is desirable that this connection be formed in such manner that the internal diameter of the sleeve 22 may be as small as possible so that full advantage of the expulsion action may be taken on blowing of the fusible means 11 to extinguish the arc either in connection with the sleeve 22 itself or the housing in which it may be installed. It is also desirable to provide such a connection that the bore of the sleeve 22 will be substantially filled to obtain the maximum expulsion action. Since the fuse link 10 is ordinarily subjected to considerable tension stress in order to obtain rapid separation of the terminals between which the arc is drawn, this connection must be so formed as to resist this tension stress. From the standpoint of heating under load conditions, the fuse link of the highest ampere rating designed for use in a particular cutout housing requires the use of the largest flexible conductor 14 that can be inserted in the sleeve 22. A relatively massive terminal should be provided for the flexible conductor 14 to serve as an arcing terminal during short circuit interruption. The requirements then include the provision of a relatively massive terminal, high contact pressure engagement with the strands of the conductor 14, and, at the same time, a minimum of wall thickness to reduce the diameter of the sleeve to a minimum. It is undesirable to use soldered connections for the reason that the solder may be softened because of heat generated from normal current flowing through the fuse link 10 to such an extent that the tension applied may be sufficient to pull the flexible conductor 14 away from the fusible means 11.

According to the present invention this problem has been solved by the provision of the tubular connector, shown generally at 30. The maximum outside diameter of the tubular connector 30 is so chosen that it is slightly less than the internal diameter of the sleeve 22. It is thereafter deformed, as will be presently described, in such manner that no change results in this maximum outside diameter. At the same time the bore of the sleeve 22 is substantially closed to obtain the desired expulsive effect.

The form and shape of the tubular connector 30 before it is deformed are illustrated in Figure 2. As there shown, the upper end portion 31 is somewhat reduced in section as compared to the balance of the connector and it has an axially drilled hole 32 therein. The upper end 31 is beveled and the diameter of the drilled hole 32 depends upon the size of the fusible and strain elements 12 and 13. It will be understood that larger diameters of fusible and strain elements are employed for larger current ratings. After the lower ends of the fusible and strain elements 12 and 13 have been inserted in the hole 32 the opposite sides of the upper portion 31 of the connector 30 are deformed to cause the metal to come into intimate contact engagement with these lower ends. It will be observed that this construction and method of assembly are identical with the construction and method of assembly of the upper ends of the fusible and strain elements 12 and 13 into the lower portion 25 of the terminal 16. The lower end 34 of the strain element 13 is corrugated and the metal of the connector 30 is further forced into contact engagement with the lower ends of the fusible and strain elements 12 and 13 by means of a tool such

as a punch which leaves indentations as indicated at 35 as previously described.

As illustrated, the lower end 36 of the tubular connector 30 is of sufficient diameter to substantially fill the bore of the sleeve 22. This end is drilled out to provide the longitudinal aperture 37 therein. The diameter of the aperture 37 is such as to readily permit the insertion therein of the upper end of the flexible conductor 14.

In order to securely hold the tubular connector 30 to the upper end of the flexible conductor 14 and to provide high contact pressure therebetween, the opposite sides of the lower end 36 or a substantial portion of its walls are longitudinally and transversely deformed and sprung to form longitudinal and transverse arched portions that extend inwardly as indicated at 38 in Figures 1 and 3 of the drawing. This deforming and springing operation is performed by placing the end 36 of the tubular connector 30 in a suitably shaped forming die and moving or springing the opposite walls inwardly by suitably shaped tools, the transverse dimensions of which in engagement with these walls is somewhat less than the diameter of the aperture 37, to such an extent that they assume the positions shown in Figure 3 where the transverse arched construction is clearly illustrated. The longitudinal edges 39 of the deformation 38 extend inwardly so that the portions 40 therebetween are braced radially to a substantial extent. The length and width of the deforming tools are so chosen that the resulting deformations 38 of the portion 36 are entirely within its confines with the upper and lower ends being substantially unaffected, with the cross-sectional area midway between them being substantially reduced, and with no increase in maximum outside dimension. These end portions retain their original shape and spacing and thus provide for substantially filling the sleeve 22 and yet leaving uniform clearance between the largest diameter of terminal 30 and the bore of the sleeve 22 to prevent sticking due to swelling of the latter with change in weather conditions.

While the transverse arched construction has been illustrated in Figure 3 of the drawing, it will be understood that a similar longitudinal arched construction is also present because of the shape of the ends of the deformations 38. In this manner the upper end of the flexible conductor 14 is secured within the end 37 of the tubular connector 30 and contact engagement therebetween is provided under high pressure. The portions of the terminal stock along the edges 39 are permanently deformed and take a permanent set. In the final shape the outwardly acting resilient forces of the deformed strands of the conductor 14 are balanced by the inwardly acting resilient forces of the walls of the end 37. Since these walls are so curved that they are particularly adapted to resist these outwardly acting forces, a high contact pressure engagement remains therebetween after the deforming tools are removed. For purposes of illustration in the enlarged cross-sectional view in Figure 3, the various strands of the flexible conductor 14 have been shown. As a matter of fact these several strands are compressed into a substantially solid section so that a saw cut or the like along the section line 3—3 would reveal substantially a plane surface.

The transverse and longitudinal inwardly arched construction may be more readily understood by comparing the sectional view as shown in Figure 3 with that shown in Figure 4 of the drawing. As shown in Figure 4 the upper portion of the cone terminal 15 has been pressed into a rectangular shape onto the flexible conductor 14. Since the cone terminal is outside of the sleeve 22, its cross-sectional dimensions are not limited to the extent that those dimensions of the terminal 30 inside the sleeve 22 are limited. As shown, a greater wall thickness may be employed and it is deformed onto the conductor 14 in the simplest possible manner, as by compressing it in a tool having a rectangular groove and a cooperating flat punch. The greater wall thickness obviates the need of the inwardly arched construction used in the terminal 30 since the cone terminal 15 is deformed beyond its elastic limit to form a permanent set and thereby a rigid enclosure.

While the preferred method of assembling the tubular connector onto the upper end of the flexible conductor 14 is to employ the transverse and longitudinal arched construction, it will be understood that either of these constructions may be employed without the other by the use of suitably shaped forming tools. However, in order to develop the full strength of the joint, it is preferable to use the combination of these two constructions.

From the foregoing it will be apparent that a fuse link construction has been provided in which the fusible means 11 is securely held in the terminal 16 without the use of solder or other material that might soften and loosen its hold because of heat developed while the fuse link 10 is conducting normal current. Likewise it will be observed that the fusible means 11 and the flexible conductor 14 are positively interconnected without the use of solder or like material and at the same time high contact pressure is retained and the connection is inherently well adapted to withstand any tension stress that may ordinarily be applied thereto. Furthermore, the tension stress transmitting ability of the joint will not be changed despite the fact that it may be heated to an elevated temperature under normal operating conditions at which a material, such as solder, might be melted.

Another embodiment of the invention is illustrated in Figure 5 of the drawing. As there shown the reference character 45 designates, generally, a fuse link that is also adapted for use as a universal fuse link in connection with various types of expulsion fuse housings. In this embodiment of the invention the fusible means, shown generally at 46, comprises a fusible element 47 that is formed preferably of tin and a strain element 48 that may be formed of a nickel-chromium alloy, similar to the strain element 13 described hereinbefore.

The fuse link 45 may be connected into the circuit by a flexible conductor 49 that is similar to the conductor 14 and which is provided with a cone terminal 50 that is similar to the cone terminal 15. The lower end 51 of the flexible conductor 49 may be dipped into solder in order to prevent the strands fraying.

At its upper end a terminal, shown generally at 52, is provided that is similar to the terminal 16. It is provided with a threaded portion 53 for receiving a threaded terminal cap 54. The flange 55 is provided intermediate the ends of the terminal 52 and it may be the diameter of the stock from which it is machined.

In this embodiment of the invention a sleeve 56 of insulation is provided and it may be composed of rolled paper. The upper end of the

sleeve 56 is crimped onto a knurled portion 57 of the terminal 52. Since the sleeve 56 is composed of paper, it is desirable that some additional means be provided for securing it to the terminal 52 and for this purpose a retaining ring 58 is provided. Initially the ring 58 is of such diameter that it will readily fit over the outside of the sleeve 56. It may be crimped into position for holding the sleeve 56 in place as shown in Figure 6 of the drawing. A flange 59, beveled as shown, is provided below the knurled portion 57 to prevent the paper sleeve 56 from being pulled off of the terminal 52.

The lower portion 61 of the terminal 52 is formed differently than the lower portion 25 of the terminal 16. As shown in Figure 8 of the drawing, the lower portion 61 is drilled out as indicated at 62 and then it is deformed, as shown in Figure 7, to form a fusible element receiving portion 63. This deforming operation serves two purposes. First, the upper corrugated end 64 of the strain element 46 is embedded therein, as shown in Figure 7, so that it is securely held in position. Second, the fusible element receiving portion 63 is formed for readily receiving the upper end of the fusible element 47. This may be secured therein as by solder which is indicated at 65.

It will be understood that the deformation of the lower portion 61 of the terminal 52 is sufficient to cause the metal to come into intimate contact with the corrugated end 64 of the strain element 46. It is thus positively secured in position and held in place against any ordinary tension stresses that may be applied thereto. By providing the fusible element receiving portion 63 in the lower portion 61 of the terminal 52 the assembly of the fusible element 47 with it is facilitated. A minimum of solder is required and at the same time a maximum of the surface, as shown in Figure 7, is exposed thereto.

The fusible means 46 is secured to the flexible conductor 49 by a tubular connector that is shown generally at 67. The upper end 68 of this connector is similar to the lower end portion 61 of the terminal 52. The lower corrugated end 64 of the strain element 49 is secured therein in a similar manner as is also the lower end of the fusible element 47.

It will be observed that a cradle for receiving the fusible element 47 is provided by deforming the end portions 61 and 68 of the terminals 52 and 67, respectively, onto the corrugated ends 64 of the strain element 46. By this means it is possible to accurately space these portions apart and to maintain this spacing while sufficient heat is applied to solder the ends of the fusible element 47 in the semi-cylindrical sockets adapted to receive them. Therefore, the heat employed to perform the soldering operation does not loosen the joints between the strain element and the terminals. Moreover, varying tensions that will ordinarily be applied during assembly or in the field tending to separate the terminals 52 and 67 do not, with this construction, cause a change in the spacing therebetween. Because of the accurate spacing thus provided the free length of the fusible element, and hence its time-current characteristics, will always be the same for a given ampere rating.

In order to secure the tubular connector 67 to the upper end of the flexible conductor 49 its lower end portion 69 is deformed longitudinally and transversely, as described hereinbefore with reference to the manner in which the lower end 30 of the tubular connector 30 is secured to the upper end of the flexible conductor 14.

Since certain further changes may be made in the foregoing constructions and different embodiments of the invention may be made without departing from the scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

We claim as our invention:

1. In a fuse, in combination, fusible means, a flexible conductor, and a connector interconnecting said fusible means and said flexible conductor and secured to the latter by having a substantial portion of the wall of the connector longitudinally coextensive with the conductor arched inwardly onto the conductor.

2. In a fuse, in combination, fusible means including strain and fusible elements, a flexible conductor, and a connector interconnecting said fusible means and said flexible conductor, said connector being secured to said strain element by deformation thereon and to said flexible conductor by having a substantial portion of its wall coextensive therewith arched inwardly onto the same.

3. In a fuse, in combination, fusible means, a flexible conductor, and a tubular connector interconnecting said fusible means and said flexible conductor, said tubular connector having a substantial portion of its periphery enclosing said flexible conductor arched inwardly.

4. In a fuse, in combination, fusible means including strain and fusible elements, a flexible conductor, and a tubular connector interconnecting said fusible means and said flexible conductor, said tubular connector being deformed at one end in such manner as to hold said strain element in engagement therewith and at the other end in such manner as to hold said flexible conductor therein by having a substantial portion of its periphery enclosing the same arched inwardly.

5. In a fuse, in combination, fusible means including strain and fusible elements, a flexible conductor, and a tubular connector interconnecting said fusible means and said flexible conductor, said tubular connector being deformed at one end onto said strain and fusible elements and at the other end onto said flexible conductor by an inwardly arched deformation.

6. In a fuse, a relatively infusible terminal, a fuse wire and a strain wire each having one end extending into one end of said terminal, and a flexible conductor having one end extending into the other end of said terminal, the metal of the terminal around the ends of the fuse and strain wires being permanently deformed thereon and around the end of the flexible conductor being permanently inwardly arched both to insure electrical contact engagement.

7. In a fuse link, in combination, a conductor, and a terminal having a tubular end portion for receiving said conductor, a substantial portion of the surface of said tubular end portion being arched inwardly onto the end of said conductor therein for fixedly holding the same in position.

8. In a fuse, a tubular connector for connection at one end to fusible means and arranged and adapted to receive a flexible conductor comprising a plurality of strands of wire at the other end, said other end of said tubular connector being deformed in such manner as to secure said flexible conductor therein by having a substan-

tial portion of its periphery enclosing the same arched inwardly.

9. In a fuse, a tubular connector for connection at one end to fusible means and arranged and adapted to receive a flexible conductor comprising a plurality of strands of wire at the other end, said other end of said tubular connector being longitudinally arched inwardly to secure said flexible conductor therein.

10. In a fuse, a tubular connector for connection at one end to fusible means and arranged and adapted to receive a flexible conductor comprising a plurality of strands of wire at the other end, said other end of said tubular connector being transversely arched inwardly to secure said flexible conductor therein.

11. In a fuse, a tubular connector for connection at one end to fusible means and arranged and adapted to receive a flexible conductor comprising a plurality of strands of wire at the other end, said flexible conductor substantially filling said other end of said tubular connector, said other end of said tubular connector being longitudinally and transversely arched inwardly in such manner that said flexible conductor is secured therein.

12. The method of securing a terminal having a tubular end portion to a flexible conductor comprising a plurality of strands of wire which comprises inserting one end of the flexible conductor into the tubular end portion, and deforming the tubular end portion inwardly onto the flexible conductor in such manner as to provide longitudinally and transversely arched configurations therein.

13. The method of securing a terminal having a tubular end portion to a flexible conductor comprising a plurality of strands of wire which comprises inserting one end of the flexible conductor into the tubular end portion, and exerting sufficient force on opposite sides of the tubular end portion to deform it inwardly onto the flexible conductor in such manner as to provide longitudinally and transversely arched configurations therein and to reduce the stranded conductor within the deformed portion to a substantially solid section.

14. In a fuse, in combination, a pair of terminals, a fusible element composed principally of tin interconnecting said terminals, and a strain element for relieving said fusible element of tension stress applied to said terminals, the ends of said strain element being corrugated and said terminals being deformed thereon and secured thereto solely by such deformation.

15. A cradle for receiving a fusible element comprising, in combination, a pair of terminals disposed in predetermined spaced relation and having tubular end portions extending toward each other, and a strain element interconnecting said terminals with its ends disposed in said tubular end portions, said tubular end portions being deformed in such manner onto said ends of said strain element as to form substantially U-shaped fusible element receiving portions.

16. In a fuse, in combination, a pair of terminals having tubular end portions extending toward each other, a strain element interconnecting said terminals with its ends disposed in said tubular end portions, said tubular end portions being deformed in such manner as to form substantially U-shaped fusible element receiving portions, and a fusible element also interconnecting said terminals with its ends disposed in said U-shaped fusible element receiving portions.

17. In a fuse, in combination, a pair of terminals having tubular end portions extending toward each other, a strain element for interconnecting said terminals with its ends disposed in said tubular end portions, said tubular end portions being deformed about said strain element in such manner as to embed the same therein and to form substantially U-shaped fusible element receiving portions, and a fusible element also interconnecting said terminals with its ends disposed in said U-shaped fusible element receiving portions.

18. In a fuse, in combination, a pair of terminals having tubular end portions extending toward each other, a strain wire for interconnecting said terminals with its ends disposed in said tubular end portions, said ends of said strain wire being corrugated and said tubular end portions being deformed thereon in such manner as to embed them therein and to form substantially U-shaped fusible element receiving portions, and a fuse wire also interconnecting said terminals with its ends disposed in and soldered to said U-shaped fusible element receiving portions.

19. In a fuse, in combination, a tubular connector having one end longitudinally deformed to provide a substantially U-shaped fusible element receiving portion, a fusible element secured in said receiving portion, and a flexible conductor comprising a plurality of strands of wire having one end disposed in the other end of said connector, said other end of said connector being arched inwardly to secure said conductor therein.

20. In a fuse, in combination, a strain element, a tubular connector having one end longitudinally deformed onto one end of said strain element for securing it therein and to provide a substantially U-shaped fusible element receiving portion, a fusible element secured in said receiving portion, and a flexible conductor comprising a plurality of strands of wire having one end disposed in the other end of said connector, said other end of said connector being arched inwardly to secure said conductor therein.

21. In a fuse, in combination, a strain element, a flexible conducting element, and a terminal having oppositely extending tubular end portions for receiving the ends of said elements, a substantial portion of each of said tubular end portions being arched inwardly onto the element therein for fixedly holding the same in position.

22. The method of securing a train element having at least one corrugated end portion and a fusible element to a terminal having a tubular end portion which comprises deforming the tubular end portion onto the corrugated end portion of the strain element and at the same time forming a U-shaped fusible element receiving portion therein, and securing one end of the fusible element in the U-shaped fusible element receiving portion.

23. The method of securing a strain wire having a corrugated end portion to a terminal having a tubular end portion which comprises inserting the corrugated end of the strain wire into the tubular end portion, and deforming the tubular end portion onto the corrugated end portion to embed the same therein and at the same time form a U-shaped fusible wire receiving socket.

24. The method of securing a strain wire having a corrugated end portion and a fusible wire to a terminal having a tubular end portion which comprises inserting the corrugated end of the strain wire into the tubular end portion, deforming the tubular end portion onto the corrugated

end portion to form a U-shaped fusible wire receiving portion and to clamp the end of the strain wire therein, placing one end of the fusible wire in the U-shaped fusible wire receiving portion, and securing the end of the fusible wire in position by heat and fusion.

25. In a fuse link, in combination; a terminal fitting having a terminal attaching portion at one end, a fusible element receiving portion at the other end, a knurled portion intermediate said ends, and a flanged portion intermediate said knurled portion and said fusible element receiving portion; a fusible element secured to said fusible element receiving portion, a sleeve of insulation surrounding said fusible element in spaced relation and at one end extending over said flanged and knurled portions, and a retaining ring crimped around said one end of said sleeve and holding it in position on said knurled portion.

26. In combination, a flexible stranded conductor, and a connector including a tubular section having relatively thin walls surrounding said conductor, the end portions of said tubular section being of substantially the initial form thereof and portions of said walls intermediate said end portions being arched inwardly in at least one direction with no part extending radially beyond the confines of said end portions.

27. In combination, a flexible stranded conductor, and a connector including a relatively thin walled tubular conductor receiving section having end portions and an intermediate portion, said end portions remaining substantially unchanged and said intermediate portion being reduced in cross-section by deformation of a substantial part of its wall onto said conductor in such manner that the strands thereof are retained in compression by a portion of said wall being concave and circular and another portion being convex and arched in at least one direction.

28. The method of securing a terminal having a tubular end portion to a stranded conductor which comprises inserting one end of the conductor into the tubular end portion, deforming the tubular end portion inwardly intermediate its ends onto the stranded conductor in such manner as to provide inwardly arched configurations without increasing the radial dimension of any part of the tubular end portion.

29. In a fuse, in combination, a pair of terminals, a fusible element interconnecting said terminals and secured thereto by fusion, and a strain element also interconnecting said terminals and secured thereto solely by deformation of said terminals for relieving said fusible element of tension stress between said terminals.

30. The method of securing a pair of terminals having tubular end portions to the ends of strain and fusible elements which comprises deforming the tubular end portions onto the ends of the strain element, and securing the ends of the fusible element to the terminals by fusion.

31. The method of securing a pair of terminals having tubular end portions to the ends of strain and fusible element which comprises deforming the tubular end portions onto the ends of the strain element and at the same time forming aligned U-shaped fusible element receiving portions therein, placing the ends of said fusible element in said aligned U-shaped portions, and securing the ends of said fusible element in position in said U-shaped portions by heat and fusion.

32. The method of securing the tubular end portion of a metallic connector to a conductor comprising a plurality of strands of wire which comprises: inserting one end of the stranded conductor into the tubular end portion, and deforming the tubular end portion inwardly onto the stranded conductor in such manner as to provide at least one longitudinally and transversely arched configuration therein.

33. The method of securing the tubular end portion of a metallic connector to a conductor comprising a plurality of strands of wire which comprises: inserting one end of the stranded conductor into the tubular end portion, and exerting sufficient force on opposite sides of the tubular end portion to deform it inwardly onto the stranded conductor in such manner as to provide at least one longitudinally and transversely arched configuration therein and to reduce the stranded conductor within the deformed portion to a substantially solid section.

34. The method of joining a pair of conductors in end-to-end relation at least one of which is made up of a plurality of strands of wire which comprises inserting the ends of the conductor into the tubular end portions of a deformable metallic connector, and exerting sufficient force on opposite sides of the tubular end portions to deform them inwardly onto the conductors therein by providing at least one longitudinally and transversely arched configuration in each end portion and to reduce the stranded conductor within its tubular end portion to a substantially solid section.

35. In combination, a pair of conductors in end-to-end relation at least one of which comprises a plurality of strands of wire, and a connector having tubular end portions for receiving the ends of said conductors, a substantial portion of each of said tubular end portions being arched inwardly onto the conductor therein for fixedly holding the same in position.

36. In a fuse, in combination, a pair of terminals, a fusible element composed principally of tin interconnecting said terminals and secured thereto by fusion and a strain element also interconnecting said terminals for relieving said tin fusible element of tension stress between said terminals by withstanding a substantial portion of the same, said strain element being secured to at least one of said terminals by deformation of the same thereonto.

37. The method of securing a terminal having a tubular end portion to one of the ends of strain and fusible elements which comprises deforming the tubular end portion onto one end of the strain element, and securing one end of the fusible element to the terminal by fusion.

38. The method of securing a terminal having a tubular end portion to one of the ends of strain and fusible elements which comprises deforming the tubular end portion onto one end of the strain element and at the same time forming a U-shaped fusible element receiving portion therein, placing one end of the fusible element in said U-shaped portion, and securing the end of said fusible element in position in said U-shaped portion by heat and fusion.

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CERTIFICATE OF CORRECTION.

Patent No. 2,174,767. October 3, 1939.

HUGH A. TRIPLETT, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, second column, line 52, claim 22, for "train" read strain; page 6, first column, line 65, claim 31, for the word "element" read elements; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 31st day of October, A. D. 1939.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)

CERTIFICATE OF CORRECTION.

Patent No. 2,174,767. October 3, 1939.

HUGH A. TRIPLETT, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, second column, line 52, claim 22, for "train" read strain; page 6, first column, line 65, claim 31, for the word "element" read elements; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 31st day of October, A. D. 1939.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.