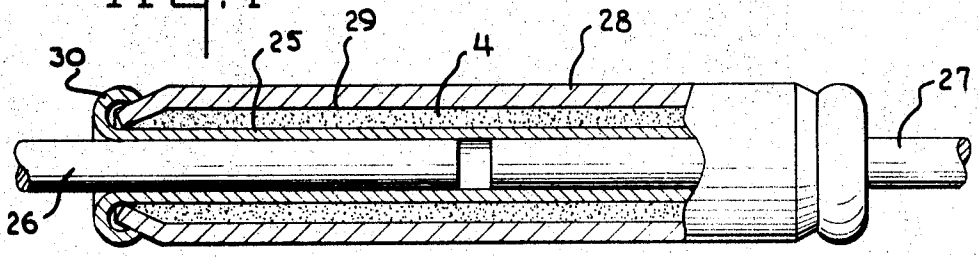
Jan. 16, 1968 H. J. MODREY 3,364,304

ELECTRICAL CABLE SPLICE WITH EXPLOSIVE CHARGE

Original Filed May 3, 1954

Fig. 1



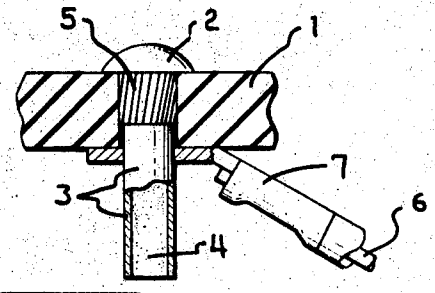


Fig. 2

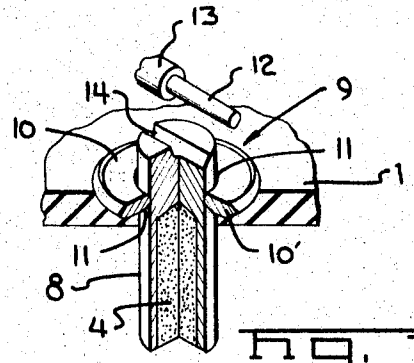


Fig. 3

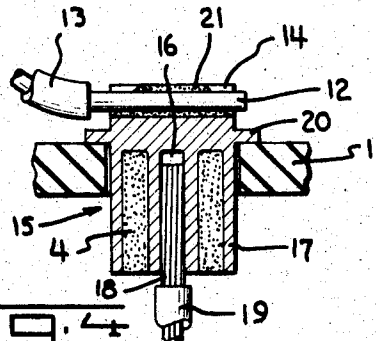


Fig. 4

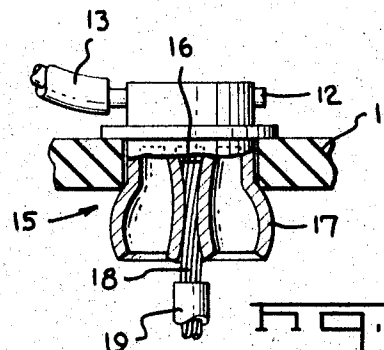


Fig. 5

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3,364,304

ELECTRICAL CABLE SPLICE WITH EXPLOSIVE CHARGE

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Continuation of application Ser. No. 427,256, May 3, 1954. This application Nov. 27, 1963, Ser. No. 329,620
2 Claims. (Cl. 174—94)

The present invention relates to electric wiring terminals fastened to or in a support base such as a panel and also to terminals of the kind known as splice links or service taps for overhead wiring; being a continuation of my earlier filed and now abandoned parent application, Ser. No. 427,256 filed on May 3, 1954, for Electric Wiring Terminal.

More particularly, the invention relates to hollow terminals containing a suitable explosive charge. This charge when detonated, causes a deformation of the terminal walls which is used to secure the terminal to its support and the wires to be connected to the terminal.

Explosive terminals of the general kind above referred to are fully disclosed in my U.S. Patent No. 2,909,758 for Explosive Terminal and Method of Firing, filed Sept. 24, 1953, and granted Oct. 20, 1959.

The principal purpose of the present invention is to provide improvements on explosive terminals broadening the basic concept as disclosed in the aforesaid prior application and generally enlarging the usefulness and versatility of explosive terminals.

An object of the invention is to provide a novel and improved terminal of the splice link kind which permits connection of two wires without the use of special tools by simply applying heat to the splice link, for instance, by a blow torch. Overhead lines and other outdoor wires must often be connected under adverse weather conditions such as rain, snow or extreme cold. Under such conditions, soldering operations heretofore often used for joining wires, insertion and tightening of clamping screws, etc. are difficult to carry out. In contrast thereto, the simple heating or cartridge-like splice link presents no difficulties, even under the most unfavorable weather conditions.

Still another object of the invention is to provide a novel and improved terminal, the design of which permits connection of a wire symmetrically to the body of the terminal, affords an extensive contact surface between the terminal and the wire thereby assuring high quality contact characteristics and avoiding a strongly localized pressure on the wire so that there is no danger of cutting of the wire. This affords the advantage that thin or standard wires may be used.

Other and further objects, features and advantages of the invention will be pointed out hereinafter and set forth in the appended claims forming part of the application.

In the accompanying drawing several preferred embodiments of the invention are shown by way of illustration and not by way of limitation.

In the drawings:

FIGURE 1 is a view, partly in section, of a terminal in the form of a splice link;

FIGURE 2 is a sectional view of a wiring terminal provided with an outer gripping surface;

FIGURE 3 is an isometric, sectional view of a wiring terminal having a removable head;

FIGURE 4 is a sectional view of a wiring terminal for connecting a wire thereto, symmetric with the axis of the terminal;

FIGURE 5 is a sectional view of the terminal of FIGURE 3 secured to its support.

Referring first to FIGURE 2, this figure shows a wiring terminal inserted in an opening of a support base 1 which

may be visualized as a panel or frame made of insulation material.

The terminal comprises a head 2 and a shank 3 partly seated within base 1 and partly protruding therefrom. The protruding part of the shank is hollow and filled with an explosive charge 4 of suitable composition. The shank portion seated within base 1 or at least part of this shank portion is formed with an outer gripping surface 5. This gripping surface may be obtained by any suitable means; for instance it may be a file-like surface produced by knurling or milling shank portion 5. For the purpose of the invention, it is merely essential that the grip of the surface with the wall of the base opening is such that the terminal is provisionally retained within the base. A spiral knurl as shown, has the specific advantage that the edges of the knurl will bite into the base material when the terminal is forced into the opening by a slight pressure thereby assuring a secure retention of the terminal within the base.

While the terminal is shown in FIGURE 2 in a position in which it will remain in the base by its own weight, it is apparent that in actual practice, the position of the terminal in the base may often be such that the terminal will tend to fall out of the base unless retained therein. The provision of the gripping surface 5 permits a convenient mounting of the terminal in any position of slant, including an upside down position.

FIGURE 2 further shows the connection of a wire 6 to the terminal by slipping the eyelet 7 thereof upon the protruding shank part.

A detonation of the charge by applying heat to the terminal will cause a strong lateral expansion of the protruding shank part of the terminal. Such expansion forms in effect, a second head on the terminal which safely anchors the terminal within the base and the wire to the terminal by holding eyelet 7 between the expanded shank part and the lower side of base 1.

Additional wires may be connected to the terminal by slipping the eyelets thereof over the protruding shank part or fitting the eyelets between head 2 and base 1.

The cumulative effect of the heat applied to the terminal for detonating the charge and of the heat generated by the detonation can also be used to attach a further wire to the terminal by a soldering operation as will be more fully explained hereinafter.

The wiring terminal according to FIGURE 3 comprises a shank 8 and a head generally designated by 9. The protruding part of the shank is again hollow and filled with a suitable explosive charge 4, detonation of which results in the aforedescribed lateral expansion of the protruding shank part anchoring the terminal to the support base 1.

While head 2 in FIGURE 2 is integral with shank 3 so that it is difficult to separate the head from the shank, head 9 of FIGURE 3 is so joined to its shank that it can be easily and conveniently separated therefrom. To this end, the material joining the head to the shank is weakened. The head as shown is in form of a collar 10 which is peripherally grooved at 11 directly adjacent to the shank. As may be noted, a peripheral groove 11 is provided on each side of the collar so that the same is joined to the shank by a comparatively weak bridge of material.

A similar effect can be obtained by other suitable means such as providing a perforation encircling of the shank.

As is apparent, the break line formed by grooves 11 permits a separation of the head from the shank without operations, such as drilling or chiselling that would be necessary to remove a head as shown in FIGURE 2.

If the terminal is fitted in a blind or inaccessible hole, a hammer blow on the top of the shank will generally be sufficient to separate the collar from the shank. When this is not feasible, the collar may be pried off by inserting a suitable tool for instance, a screw driver between the col-

lar and base 1 and levering the collar upwards until it breaks away from the shank. After removal of the collar, the shank can be pushed through its hole.

To facilitate the insertion of a screw driver or other tool between the base and the collar, the peripheral rim thereof is preferably slightly turned up as is shown at 10'.

One or several wires may be secured to the terminal in the same manner as has been described for wire 6 and its eyelet 7.

An additional wire may be connected to the terminal by a soldering operation. For this purpose, the stripped end 12 of a wire 13 is placed in contact with the upper face end of shank 8 and soldering material is applied to the wire end 12 and the shank.

When the explosive charge of the terminal is detonated by applying heat to the shank, the cumulative effect of this heat and of the heat generated by the detonation will melt the soldering material. As a result, the single step of applying heat to the terminal sets the terminal in the base by expansion of the hollow shank part, connects wires fitted upon the said shank part to the terminal and solders wire end 12 to the terminal.

To facilitate the soldering operation, shank 8 is preferably extended beyond collar 10 and its face is formed with a transverse groove 14 which may be lined with soldering material and in which wire end 12 is placed.

While the terminals according to FIGURES 2 and 3 provide for connection of a wire to the outside of the terminal, FIGURES 4 and 5 show an exemplification of the invention providing for the insertion of a wire into the terminal. For this purpose, shank 15 is formed with an inner axial bore or chamber 16 and an outer axial bore or chamber 17. The inner bore serves to receive the stripped end 18 of a wire 19 and the outer bore is filled with the explosive charge 4. As will be noted, the outer bore forms an annular chamber encompassing the inner bore. This inner bore is preferably disposed coaxially with the axis of the shank.

FIGURE 4 shows the terminal in its non-detonated condition in which it is retained in the base opening by a shoulder 20. The upper end of the shank is again formed with a groove 14 to connect wire end 12 to the terminal as has been explained in connection with FIGURE 3. Soldering material is indicated at 21.

FIGURE 5 shows the detonated terminal. As appears from this figure, the wall portions of the shank defining the annular chamber 17 are outwardly and inwardly expanded by the pressure of the explosion. The outward expansion of the shank wall overhangs the perimeter of the base opening thereby anchoring the terminal within the base. The inward expansion effects a tight grip of the respective shank wall portion with wire end 18. This wire end is retained within the terminal prior to the explosion by any suitable means such as a slight friction fit.

By the disposition of bore 16 coaxially with the axis of the terminal, wire 19 is held symmetrically to the body of the terminal which is useful in many applications. The tight grip between the inner shank wall and wire end 18 assures contact at an extensive area and hence high quality contact characteristics. The elongated contact surface with which the shank and the wire are in engagement prevents a strongly localized pressure upon the wire thereby eliminating any danger of the wire being cut by the pressure. As a result, thin or stranded wire may be used.

As has been described in connection with FIGURE 3, the cumulative effect of the heat applied to the terminal for detonating the explosive charge and of the heat generated by the explosion is sufficient to melt soldering material 21. In other words, the single step of applying heat to the terminal again effects three operations; namely, setting the terminal within the base, securing a wire within the terminal and soldering a wire to the outside of the terminal. It will be apparent that the terminal may be provided with a gripping surface 5 for preventing a falling out of the terminal before it is set in the base by the explosion. Similarly, the terminal of FIGURE 3 may be provided with a gripping surface.

Furthermore, shoulder 20 may be replaced by a removable collar 10 as described in connection with FIGURE 3.

The wire splice of FIGURE 1 comprises an inner sleeve 25 or a similarly shaped member for inserting therein two wires 26 and 27 to be electrically and mechanically joined. Inner sleeve 25 is surrounded by an outer sleeve 28 or a similarly shaped member. The two sleeves are spaced apart to form therebetween a cylindrical space 29 which is filled with the explosive charge 4. To direct the pressure developed by a detonation of the charge into the useful direction, chamber 29 is preferably substantially or completely closed at both ends, for instance by crimping the inner sleeve over the outer sleeve as is shown at 30.

When the cartridge-like splice thus formed is exploded by applying heat to sleeve 28, the resulting pressure would tend to compress the inner sleeve inwardly and expand the outer sleeve outwardly. In other words, the deformation of the sleeves would be similar to the deformation of the shank walls as shown in FIGURE 5. Compression of the inner sleeve presses against wires 26 and 27 thereby mechanically securing these wires within the splice and electrically connecting the same along a long contact surface. However, the outward bulging of the outer wall of the terminal—which is used in FIGURE 5 to anchor the terminal to the base—is not useful with the splice type terminal of FIGURE 1. To prevent outward bulging of sleeve 28 as much as possible and to produce a strong pressure of sleeve 25 against wires 26 and 27, sleeve 25 is preferably made considerably weaker than sleeve 28. This can be accomplished by selecting suitable materials for sleeves 25 and 28 or as shown, by using a thinner gauge for sleeve 25 than for sleeve 28.

While the invention has been described in detail with respect to certain now preferred examples and embodiments of the invention it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

What is claimed as new and desired to be secured by Letters Patent is:

I claim:

1. An electrical connection forming assembly comprising a first sleeve of conductive ductile material, an explosive charge in a continuous layer extending axially along the entire length of the first sleeve and substantially enveloping the outside surface of said sleeve, a second sleeve coaxially disposed over said first sleeve and extending over said explosive charge along its length, the said second sleeve having each end formed inwardly against the outer surface of an end of said first sleeve with said charge being thereby substantially sealed between said sleeves to direct the pressure developed by detonation of said charge inwardly against said first sleeve, the said first sleeve further including at each end thereof an annular flange member formed radially outward and then radially inward against the outer annular surface of each end of said second sleeve to position and secure said second sleeve and perfect the seal of said charge, two elongated members of conductive material inserted in said first sleeve extending axially therein in aligned end-to-end relationship and approximate abutment, the detonation of said charge effecting a radial constriction of said first sleeve inwardly along the entire enveloped periphery thereof to seize the two members and provide an electrical connection therebetween through said first sleeve.

2. An electrical connection forming assembly comprising a first sleeve of conductive ductile material, an explosive charge in a continuous layer extending axially along the entire length of the first sleeve and substantially enveloping the outside surface of said sleeve, a second sleeve coaxially disposed over said first sleeve and ex-

tending over said explosive charge along its length, the said second sleeve having each end formed inwardly against the outer surface of an end of said first sleeve with said charge being thereby substantially sealed between said sleeves to direct the pressure developed by detonation of said charge inwardly against said first sleeve, the said first sleeve further including at each end thereof an annular flange member formed radially outward and then radially inward against the outer annular surface of each end of said second sleeve to position and secure the said second sleeve and perfect the seal of said charge and the said first sleeve being relatively weaker with respect to deformation than the second sleeve, two elongated members of conductive material inserted in said first sleeve extending axially therein in aligned end-to-end relationship and approximate abutment, the detonation of said charge effecting a radial constriction of said first sleeve inwardly along the entire enveloped periphery thereof to

seize the two members and provide an electrical connection therebetween through said first sleeve.

References Cited

UNITED STATES PATENTS

2,037,906	4/1936	Holran et al.	339—276
2,083,842	6/1937	Henning	339—276
2,367,206	1/1945	Davis	339—276
2,745,345	5/1956	Sweetman	339—276
650,860	6/1900	McTighe	339—276
650,862	6/1900	McTighe	339—276

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