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ARTICLE OF MANUFACTURE

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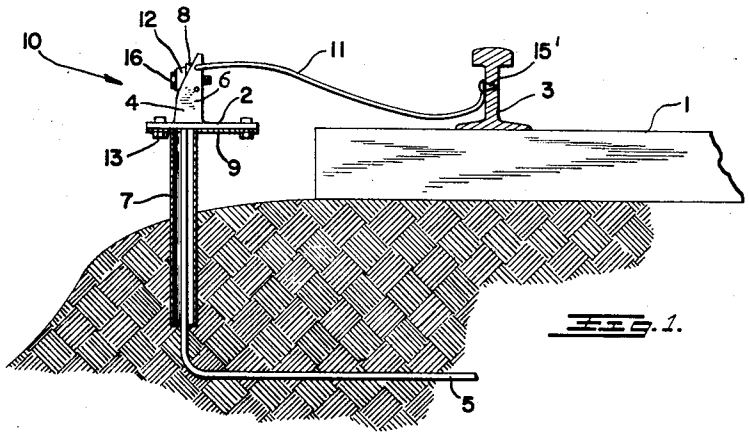


FIG. 1.

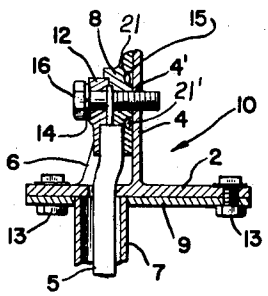


FIG. 2.

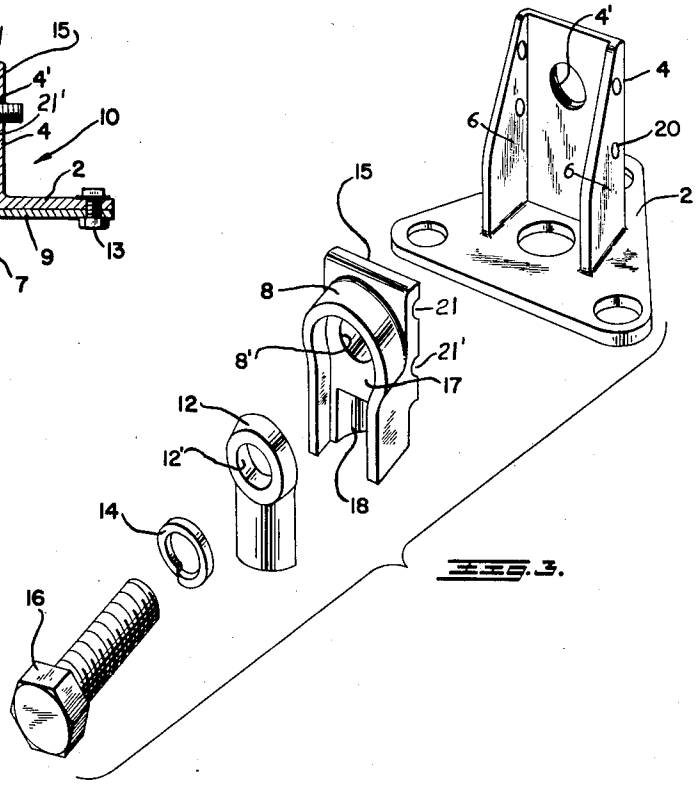


FIG. 3.

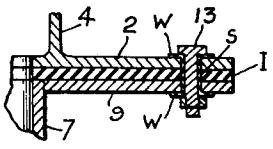


FIG. 2a.

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This invention relates to electrical connections. In particular, the invention relates to connections between conductors, where galvanic corrosion because of the proximity of dissimilar metals, is a major problem. Still more particularly, the invention relates to the connection between an electrical conductor comprised of aluminum and a connector element, portions of which may be comprise of a ferrous metal, such as galvanized steel, iron or the like.

An advantageous use of the instant invention, as shown in the attached drawings, may be for effecting an interconnection between the rails of a railway system and electrically operated signals such as block signals, grade crossing lights, etc. This connection must be highly resistant to corrosion such that electrically efficient connections between conductors and/or the track can be made with a minimum of technical or skilled labor and be subject to easy maintenance. Further, the connection must be such as to permit the advantageous use of aluminum conductors even under what has been previously considered adverse conditions, and to protect an aluminum conductor from corrosive deterioration so that it will have a satisfactory service life.

In the modern day railroad there are a great number of signals operated by electrical impulses carried by the rails. In so utilizing the rails, it is essential that some means be provided whereby the rails may be conductively connected to the various signals. Heretofore, it has not been considered practical to use aluminum as a medium for connecting the rails to the signal block, because of the exceptionally adverse conditions of installation, namely the presence of moisture which promoted galvanic action between the aluminum conductors and the connections of a dissimilar metal. Where, for example copper-aluminum or aluminum-ferrous relations exist in an atmosphere favorable to galvanic action, in most cases it will be found that the aluminum element will corrode to such an extent as to be rendered unserviceable in a relatively short period of time. Under such conditions, the corrosion of the aluminum results in a continual increase in electrical resistance at the connection point. This resistance ultimately becomes of such a high value as to render the electrical circuit, where such a connection is used, completely inoperative.

In railway track bed environment, the galvanic corrosion which occurs is aggravated by the fact that in many instances the moisture, such as drippings from refrigerated cars, petroleum cars, the discharge of human waste and the like, from passing trains usually contains ionizable salts. These salts contribute in large measure toward the establishment of conditions favorable to galvanic corrosion and, in fact, increase the rate of such corrosive action.

Thus, an object of the invention is to form an electrical connection between dissimilar metals, wherein corrosion of the less noble of the metals is reduced to a minimum.

Another object of the invention is to produce a track wire connector for an aluminum conductor, which under

adverse conditions will assure ample service life of the conductor.

A further object of the invention is to provide a track wire connection for an aluminum conductor and other elements wherein the means for effecting the connection includes parts or a part that act to protect and prevent the deterioration of the aluminum conductor ordinarily due to galvanic action.

Still a further object of the invention is to provide a track wire connector, which will be effective to form a low resistance and efficient electrical connection with an aluminum track wire and other elements.

Still another object of the invention is to enable the ready conversion of existing railroad track wire conductors to aluminum, simply, easily and with little expense while at the same time providing means for protecting the aluminum conductor against galvanic corrosion.

These and other objects of the invention not specifically referred to above will become more readily apparent when consideration is given to the following detailed description of the invention in conjunction with the attached drawings, wherein,

Figure 1 is a partial sectional view through a typical rail and road bed installation showing the manner in which the so-called "track wire connector" is used,

Figure 2 is an enlarged view of the track wire connector shown in Figure 1,

Figure 2*a* is an enlarged partial sectional view showing insulation details of the track wire connector as disclosed in Figures 1 and 2, and

Figure 3 is an exploded perspective view of the track wire connector as used in Figures 1 and 2.

Considering now Figure 1 in particular, it may be seen that the usual railroad tie **1** rests on a suitably provided roadbed, which includes the usual ballast. The conventional T-shaped rail **3** rests on the tie and is spiked or otherwise affixed thereto in a manner conventional in the art, and hence, is not specifically shown in the drawing. The rail because of its ferrous metal composition is conductive and hence may be used to transmit electrical impulses from place-to-place to a signal or the like. The signal may be placed adjacent the roadbed and serve numerous functions, such as a safety or warning guide to trains using the roadbed as to conditions existing ahead.

Such a signal is electrically connected to the rails by means of an insulated conductor **5** which is buried in the ground and passes beneath the rail **3** to a point on the other side of the usual spaced twin rails as shown or to a point outside of the lateral expanse of the rails. The conductor **5** is preferably of the aluminum core, insulated type and is passed through a vertically disposed annular pipe **7**. Pipe **7** serves both to guide the buried conductor vertically out of the ground and as a support for the track wire connector **10** in a manner to be hereinafter described. The terminal end of this insulated conductor **5** is connected to a track wire connector **10**, and connector **10** in turn is connected to the rail by means of conductors **11** as is clearly evident in Figures 1 and 2 of the drawing. The conductors **11** are generally of the uninsulated stranded type. In existing installations they are usually copper and are fixed to the rail by means of tapered pins **15'** in a manner conventional in the art.

The track wire connector **10** is engaged by bolts **13** or otherwise fixed to and insulated from the vertical terminal end of the pipe **7** by means including a flange **9** welded to the pipe **7**. Thus it may be seen that an electrical impulse directed along the rail **3** would be transmitted from the rail through the stranded conductor **11** to the connector **10** and thence to the insulated conductor **5** and from conducor **5** to the signal device which is to be actuated by the given impulse.

One manner of insulating track wire connector **10** from flange **9** and bolts **13** is clearly shown in Figure 2*a* wherein a suitable gasket I of insulating material is interposed between flange **9** and base **2** of the connector **10**. In addition each bolt **13** may be surrounded by an insulating sleeve S and insulating washers W which are interposed between the bolt head and its associated nut.

Referring now, in particular, to Figures 2 and 3, it may be seen that the track wire connector **10** comprising the present invention is formed of a flat base member or element **2** of generally triangular form having a suitable central aperture which is adapted to be aligned with the end of the vertically disposed pipe **7**. Further apertures are provided at the corners of the triangular base whereby the base may be bolted to the flange plate **9** welded or otherwise fixed to the top of the vertically disposed pipe **7**. Suitable bolts **13** are passed through the coinciding apertures to maintain the track wire connector **10** in position thereon. The connector is suitably insulated from the flange plate **9** and bolts **13** by the use of gaskets and sleeves as is usually conventional in the art and as indicated above. Attached to the base element **2** and extending vertically therefrom is a generally rectangular web **4** provided with supporting and spaced flanges **6** extending from one face thereof and connected to the opposite vertically disposed marginal edges of the web. The web **4** is provided with a threaded aperture **4'** which is adapted to receive a bolt **16** in a manner and for the purpose to be subsequently described.

As may be seen from an inspection of Figures 2 and 3, a pair of uninsulated, stranded copper conductors **11** are passed through suitable apertures **20** provided in the flanges **6** and are engaged with one face of the web **4** between the flanges **6**. The conductors are clamped against web **4** by a primary clamping member **8**. Clamping member **8** may be provided with a trough-shaped configuration on one side and a flat surfaced face **15** including recesses **21, 21'** aligning with apertures **20** across that face which in turn engages the flanged face of the vertical web **4**. Thus, when conductors **11** are properly positioned against the web **4** the face **15** including the transverse recesses **21, 21'** will compress or clamp the conductors **11** into a firmly anchored relation with respect thereto, when, as will be apparent, bolt **16** is drawn up. The trough-shaped compressive clamping member **8** is also provided with an aperture **8'** which allows the bolt **16** to pass therethrough, this aperture **8'** being surrounded by a recessed and flat face **17**. The flat face or area **17** is interrupted at the bottom thereof by a semi-circular recess **18**.

A further, or secondary compressive clamping member **12**, having an aperture **12'** is also adapted to permit passage of the bolt **16** therethrough. This secondary compressive clamping member is provided with a recess similar to the semi-circular recess **18** in member **8**. The two compressive clamping members are in opposed relation, the two recesses cooperate to form a split circular sleeve-like pocket into which is fitted the insulated end of the conductor **5**.

The insulation about the conductor core of conductor **5** is "peeled-back" or removed such that an uninsulated end of the conductor protrudes from the insulation surrounded portions thereof for a length sufficient to pass around aperture **8'** for slightly less than one turn may be clamped between flat face **17** of clamping member **8** and the adjacent flat face of clamping member **12**, when bolt **16** is drawn up.

Obviously, then as the bolt **16** is drawn up or tightened in the threaded aperture **4'** the compressive forces between web **4**, wire **11**, primary compression member **8**, track wire or conductor **5** and secondary compression member **12** increases. This in turn produces a simple but effective electrical connection between the track **3** and any electrically responsive means to which the signal

wire **5** would be connected. In a preferred embodiment of the invention a lock washer **14** is interposed between secondary compression member **12** and the head of bolt **16** to prevent accidental loosening of the bolt **16** in threaded aperture **4'** with the expected drastic results. Thus, a firmly compressive connection is effected between the respective conductors and the connector parts and a low resistance type of electrical connection is effected between the connector and the respective stranded conductor **11** and insulated conductor **5**.

It will be noted that the manner of arranging and the configuration given to both primary compression member **8** and the secondary compression member **12** results in two essential accomplishments. First, the conductive core of the aluminum conductor **5** is surrounded by the two compression members as clearly shown in Figure 2 and thus is not exposed to moisture and the like which is an essential ingredient of galvanic corrosion. Secondly, the two members **8** and **12** are of considerable mass and size when considered in terms of cross sectional area of the conductive core of insulated conductor **5** and, as will be apparent, since these members act as sacrificial anodes, the mass or size of these parts is of significant importance.

In the usual installations utilizing copper wire the signal wire **5** is generally a tin-coated copper-cored insulated conductor. This tin-coated copper conductor would ordinarily be inserted between connector parts somewhat similar to compression members **8** and **12** in the manner previously described. Web element **4**, washer **14** and bolt members **16** are generally made of galvanized iron or steel while the usual compressive elements would generally be formed of tin coated copper or copper alloy composition.

In order to facilitate an understanding of the advantages of the invention reference may be had to the ASM Metals Handbood, 1948 edition, page 897 wherein there may be found a table listing the electromotive potential of various metals with respect to hydrogen under conditions favoring galvanic action, such as in a salt solution, the value being expressed in volts.

A review of the aforesaid reference indicates that as has been the prior art practice, a tinned copper to tinned copper or copper alloy contact is effected between the signal wire **5** and compression members **8** and **12** no galvanic corrosion occurs since there is no electromotive force between these similar metals.

In addition, when the several clamping members are located adjacent to galvanized iron parts **2, 4, 6, 14** and **16** a tin to zinc (galvanized) contact is produced wherein the electromotive force is .622 volt. Thus, the zinc coating will corrode to the point where the iron or steel becomes exposed. The iron or steel parts will also be subject to corrosion but in no case does the conductor become affected for a considerable length of time. Of course, too, galvanic corrosion takes place only when moisture is present, a fact which further lengthens the life of the conductor. Thus, prior installations, where copper signal wire is used, have rendered satisfactory service.

In the past where it has been desired to substitute aluminum for the usual copper conductor **5**, by reason of cost, availability, etc. attempts to substitute the aluminum conductor have been thwarted by the galvanic corrosion problems that arise.

Referring again to the usual practice it will be seen that, when parts **4, 14**, and **16** of the usual track wire connector are galvanized iron or a similar ferrous metal, and parts **8** and **12** a tinned copper alloy, the substitution of an aluminum signal wire, i.e., insulated wire with an aluminum conductive core, such as in conductor **5**, gives rise to an electromotive potential between the conductor and the tin plated, copper alloy parts on the order of 1.16 volts and that the aluminum conductor will act as a sacrificial anode. As a result of these factors, the life of the aluminum conductor is reduced far below satis-

factory minimums and the electrical resistance at the connection rises quickly to such a value as to render the connection unserviceable in a short period of time.

The present invention contemplates the use of the aforesaid massive aluminum compression members **8** and **12** in a unique fashion whereby conductor **5** may be of an aluminum cord insulated type. Several advantageous results flow from the use of aluminum or aluminum alloy parts as the conductor clamping and connective mediums. The potential between the aluminum conductor and the aluminum connective parts is reduced to zero, thus there is no sacrificial action of the conductor. Further, the electromotive potential between the galvanized iron elements **2** and **16** and the aluminum connector elements **8** and **12** is reduced to .568 volt a considerably less value than the .622 volt potential which exists between tinned copper parts and galvanized ferrous metal parts as used in the prior installations. Thus, galvanic corrosion of the entire connection is reduced. Additionally, and what is quite significant, the large mass of the aluminum compressive elements **8** and **12** will be effective to allow considerable corrosion of these parts before any corrosion of the aluminum conductor **5** occurs. Since the aluminum components **5**, **8** and **12** are interconnected, as is clearly indicated in Figure 2, in a manner such that the aluminum conductor or track wire **5** is also advantageously shielded from exposure to corrosion producing moisture and from immediate contact with conductor **11** the areas of corrosion will be removed from the important areas of electrical contact and a completely satisfactory electrical joint is effected. Thus by the use of certain aluminum elements as a sacrificial anode in the connector the specified beneficial results are obtained and otherwise unsatisfactory results are obviated.

Thus, periodically, it is only necessary to make a visual inspection of the connector and to change only the primary and secondary compressive members **8** and **12** which are cheap and easily replaced as compared to the aluminum conductor **5**, when it is apparent that maximum allowable deterioration has occurred or is imminent. Thus, the expense of replacing the conductor **5** is completely obviated. The service life of the electrical connection is more than satisfactory and the aluminum conductors may successfully be used in an environment which heretofore has not been considered at all favorable.

Having thus described the invention, it may be realized that variations may be made all within the contemplation thereof, the invention being limited only to the extent as claimed in the following claims, wherein,

What is claimed is:

1. An electrical connector for conductively joining an aluminum conductor to another conductor of a dissimilar metal comprising a ferrous metal mounting element, separable primary and secondary compressive clamping members fixed to said element at least one of which engages both said aluminum conductor and said conductor of a dissimilar metal, said clamping members acting as sacrificial anodes and being comprised solely of aluminum and of such a configuration as to surround and shield the terminal end of said aluminum conductor at the connector such that galvanic corrosion occurring at the connector will affect said aluminum primary and secondary clamping members in preference to said aluminum conductor, the mass of said members being such that deterioration thereof due to corrosion will be prolonged for a time approximating that of the useful life of said aluminum conductor, and said clamping members when placed adjacent each other also comprising a separable sleeve adapted to surround and overlie the terminal end of said aluminum conductor to such an extent that corrosive action will occur in an area remote from the area of clamping contact between said aluminum conductor and said separable sleeve.

2. An electrical conductor as defined in claim 1, wherein said connector includes a ferrous metal base member to which said clamping elements are attached, one of said clamping members engaging said conductor of a dissimilar metal in compressively interposed relation and locking said conductor against said ferrous metal base member.

3. In a connector system for interconnecting an impulse operated signal to a railroad rail for actuation by impulses carried through said rails the combination of a base member provided with an upstanding vertical wall having a threaded aperture therein, means including primary and secondary compressive clamping members adapted to engage said wall, one of said members including a flat face adapted to bear against a conductor interposed between said vertical wall and the flat face of said member and including further a recessed area adapted to partially surround and engage an insulated portion and a terminal end of an insulated aluminum conductor, said first mentioned conductor also being of a dissimilar metal than the metal of the aluminum conductor, the other of said members including a flat face and shaped recessed area, said face being adapted to bear against said first mentioned member, said last mentioned recessed area complementing the recessed area provided in said first mentioned member and forming therewith a separable sleeve surrounding and protecting the terminal end of said insulated aluminum conductor; bolt means adapted to engage the threaded aperture in the vertical wall of said base member and to pass through said primary and secondary clamping members; said primary and secondary clamping members also being comprised of aluminum and of such mass as to act as a sacrificial anode whereby life of the aluminum conductor is prolonged, and said primary and said secondary clamping members contacting and shielding the terminal end of said aluminum conductor in such a manner that galvanic corrosion will be caused to occur in areas remote from the areas of contact between said primary and secondary clamping members and said aluminum conductor.

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