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2,513,365

SOLDERED ALUMINUM-TO-COPPER CONNECTION

Filed May 18, 1945

FIG. 1.

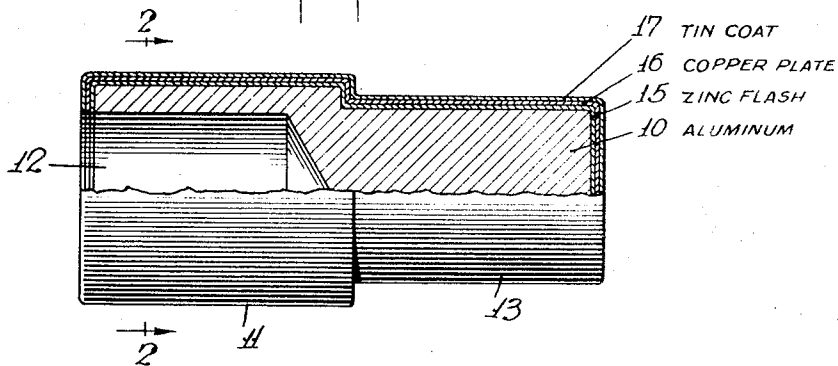


FIG. 2.

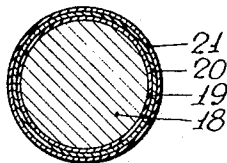
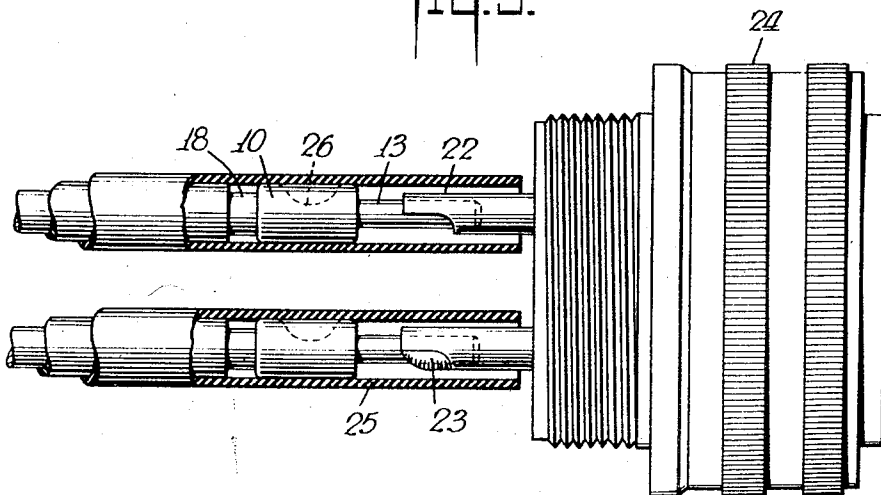


FIG. 3.



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SOLDERED ALUMINUM-TO-COPPER
CONNECTIONJulian Rogoff, New Rochelle, N. Y., assignor to
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Application May 18, 1945, Serial No. 594,406

2 Claims. (Cl. 173—324)

1 My invention relates to electrical connections between aluminum and copper or copper alloy parts.

One object of my invention is to provide an aluminum connector or conductor which can be soldered to a connecting device.

Another object of my invention is to eliminate the electrochemical corrosion which occurs when aluminum and copper are in contact in presence of an electrolyte such as moisture, etc.

Still another object of my invention is to provide an aluminum conductor which can be joined or connected by conventional soldering, clamping or indenting means without the usual special precautions to remove or break down the oxide film on the surface of the aluminum.

I accomplish these and other objects and obtain my new results as will be apparent from the device described in the following specification, particularly pointed out in the claims, and illustrated in the accompanying drawing in which:

Fig. 1 is a side view of an aluminum connector partially in section, and coated to enable it to be soldered.

Fig. 2 is a cross-section of a piece of aluminum conductor.

Fig. 3 is a side view, partially in section, showing my aluminum connectors soldered to the pins or sockets of a plug and receptacle connector.

In Fig. 1 of the drawing I have illustrated in section an aluminum connector 10. In Fig. 2, I have shown in section an aluminum cable 18.

In order to solder the aluminum, I have provided essentially three coatings therefor, which will be described more in detail hereafter.

The aluminum connector 10, comprises a tubular body section 11, having a bore 12, and an extending pin member 13.

A typical use for such an aluminum connector is illustrated in Fig. 3, wherein the connector 10 is shown inserted into a tubular sleeve 22 which may have a semi-cylindrical portion of it removed at its tip to facilitate soldering the pin 13, as at 23. The sleeves 22, two of which are shown, are secured to the plug and receptacle body 24, illustrated as of the "AN" type, and the pin to sleeve connector may be encased in an insulating sleeve 25.

If the aluminum cable 18 is coated as indicated in Fig. 2, the cable may be directly inserted into the sleeve 22, and soldered thereto. If the aluminum cable is not so coated, the connection to the connector 10 may be made by indenting, as at 26, wherein the treatment described in copending application No. 591,813, filed May 3, 1945,

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which has issued into Patent No. 2,423,290 on July 1, 1947, may be employed.

The coatings for the aluminum connector 10 are identified as the zinc flashing 15, the copper plating 16, and the final coating of tin 17. These, in the case of the aluminum cable 18, are referred to as 19, 20, and 21 respectively.

Specifically I have provided the coatings by employing the following procedure and materials:

- (1) Degrease the aluminum in a vapor or emulsion cleaner, carbon tetrachloride being an example. Avoid alkalis.
- (2) Rinse in hot water.
- (3) Etch for 3 minutes at 185° to 200° F. in tri-sodium phosphate.
- (4) Rinse in cold water.
- (5) Dip in nitric acid for 15 seconds at room temperature.
- (6) Rinse in cold water.
- (7) Zinc flash. Immersion dip in a solution of zinc salts for 1 minute at room temperature.
- (8) Rinse in cold water.
- (9) Electro-copper plate.
- (10) Rinse in hot water.
- (11) Electro tin plate.
- (12) Rinse in hot water and dry thoroughly.
- (13) Flow tin plate.
- (14) Degrease as above.
- (15) Rinse in hot water and dry.

The tin employed should be approximately 65% tin and 35% lead. The above fundamentally employs the three basic steps, namely zinc-flashing which simultaneously removes the aluminum oxide from the aluminum and replaces it with a coating of zinc; copper plating; and finally placing the tin or final coat which permits soldering the coated aluminum to a copper or copper alloy part.

By the foregoing type of coating I have eliminated any possibility of electrochemical corrosion, and I can join an aluminum part to a copper part by conventional soldering, clamping or indenting means, which objective I have sought to attain.

In place of zinc flashing I may use other metals such as cadmium which will replace the aluminum oxide by a more permanent coating. Additional other metals may be used in place of copper plating; i. e. silver plating may be employed. The final solder coating too may be of any soldering material which will readily adhere to the electroplated coating and permit soldering thereto.

I have thus described my invention, but I de-

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sire it understood that it is not confined to the particular forms or uses shown and described, the same being merely illustrative, and that the invention may be carried out in other ways without departing from the spirit of my invention, and, therefore, I claim broadly the right to employ all equivalent instrumentalities coming within the scope of the appended claims, and by means of which, objects of my invention are attained and new results accomplished, as it is obvious that the particular embodiments herein shown and described are only some of the many that can be employed to attain these objects and accomplish these results.

I claim:

1. A soldered electrical connection for aluminum-to-copper conductors comprising an aluminum conductor, an aluminum connector having a body portion provided with a socket containing the conductor end, said body portion being indented into the aluminum conductor, said connector terminating in an extending portion soldered to a copper conductor, said extending portion having an aluminum-oxide free surface zinc-flashed, copper plated, and tin coated, which tin coating is soldered to the copper conductor to form a soldered aluminum-to-copper connection of high electrical joint efficiency.

2. A solderable aluminum connector for transmitting current from an aluminum conductor to a copper surface, comprising a connector body having a socket for receiving the conductor, said connector body having a wall thickness capable of being indented to the conductor, said conductor terminating in an extending portion having a

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substantially aluminum oxide-free surface formed integrally with the connector body, said aluminum oxide-free surface of the extending portion covered with a zinc flash, an outer solderable coating of tin and an intermediate copper plate coating to obtain maximum electrical current carrying efficiency between the aluminum conductor and the copper surface.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
536,152	Legate	Mar. 19, 1895
1,147,718	Hall	July 27, 1915
1,875,241	Idank	Aug. 30, 1932
2,068,639	Alsaker	Jan. 26, 1937
2,309,563	Abeel	Jan. 26, 1943
2,405,111	Carlson	Aug. 6, 1946

FOREIGN PATENTS

Number	Country	Date
3,668	Great Britain	Feb. 14, 1898
5,055	Great Britain	Oct. 15, 1908
15,105	Great Britain	Oct. 7, 1909
130,586	Great Britain	June 19, 1919

OTHER REFERENCES

"Electroplating Aluminum," published by Aluminum Co. of America, copyright 1930, page 32.
 "The Metal Industry," May 29, 1931, page 556.