

[54] **DANGLER ASSEMBLY FOR  
ELECTRO-CHEMICAL INSTALLATIONS**

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[51] Int. Cl. .... **C23b 5/78, B01k 3/00**

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204/279-280, 286, 297 R**

[56] **References Cited**

**UNITED STATES PATENTS**

3,366,566 1/1968 Sandrock ..... 204/280

*Primary Examiner*—John H. Mack

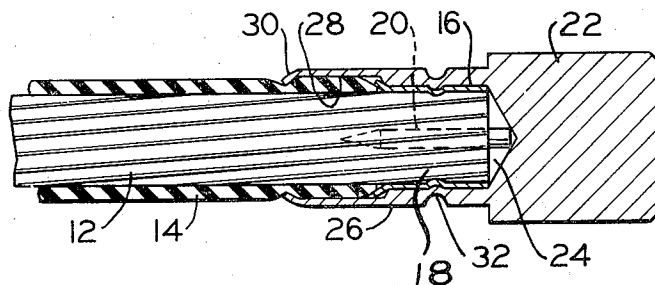
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[57] **ABSTRACT**

A cathode for an electrochemical apparatus, such as an electroplating barrel, is provided which is more securely attached to the end of the electrical conductor cable in order to better resist detachment caused by chemical erosion and/or impact with work products being agitated or tumbled in the barrel. The combination of a cathode and a length of insulated electrical conductor cable extending into the electroplating barrel is referred to in the art as a dangler. The subject dangler assembly comprises an insulated conductor cable having one end stripped of insulation and inserted into a compressible sleeve. A pin is driven into the sleeve encased end of the conductor concentric therewith. A metal cylinder, referred to in the art as a contactor, is then concentrically fitted over the sleeve encased conductor end and compressed, usually by rolling, to place the sleeve and conductor end in compression about the pin. This assembly has been found to have longer life and greater current carrying capacity than prior art danglers.

**3 Claims, 5 Drawing Figures**



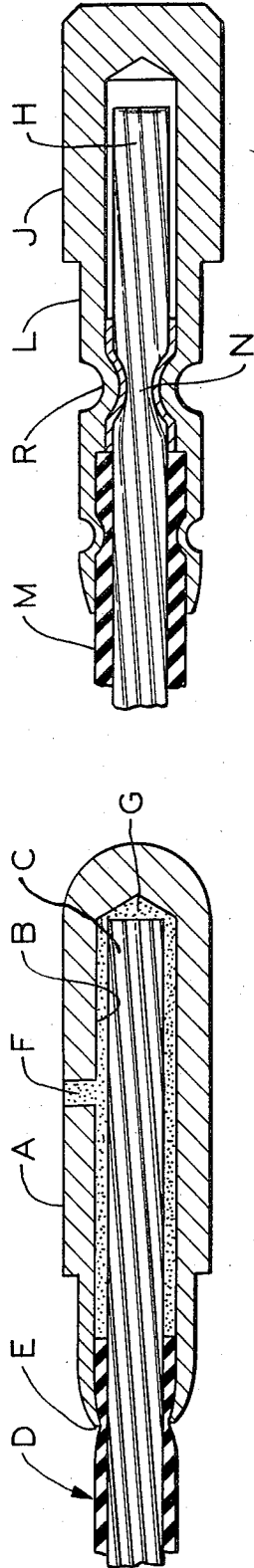


FIG. 1. (PRIOR ART)

FIG. 2. (PRIOR ART)

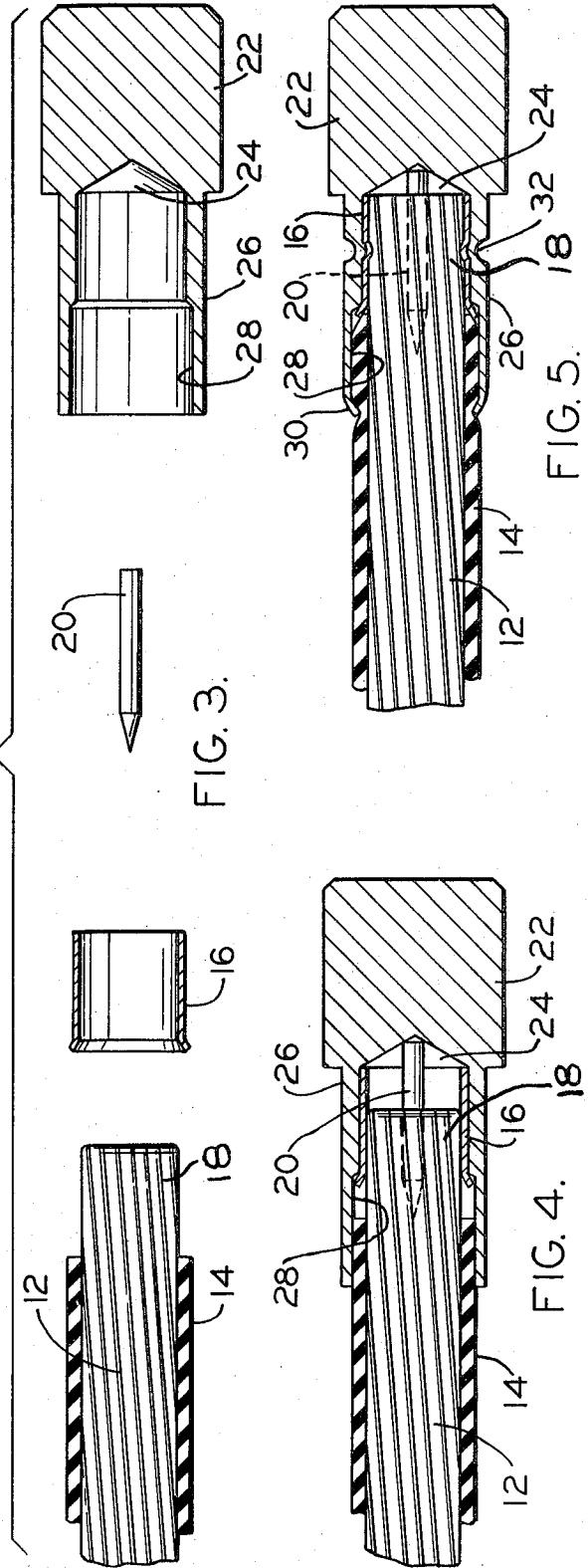


FIG. 3.

FIG. 4.

FIG. 5.

## DANGLER ASSEMBLY FOR ELECTRO-CHEMICAL INSTALLATIONS

This invention relates to a dangler assembly for an electrochemical installation, and represents an improvement upon dangler assemblies such as shown in U.S. Pat. No. 2,562,084 to Collick, and in particular the present invention is an improvement over U.S. Pat. No. 3,366,566 to Sandrock. Presently known dangler assemblies experience short life due to the hostile environment in which they are required to function, wherein corrosive chemicals used in plating operations permeate the connections between the conductor and the cathode, weakening the connection therebetween. Additionally, the impingement of work products against the cathode tends, in time, to strip the cathode from the end of the conductor, even in the absence of corrosive influences.

It is a general object of the present invention to provide an improved dangler assembly that will not only withstand weakening by a corrosive environment, but will also withstand for a much longer period of time than presently known dangles the tendency of work products to strip the cathode from the conductor.

Another important object of the invention is to provide a dangler assembly in which the current carrying capacity of the dangler is not reduced by the means employed in securing the cathode to the conductor.

Another object of the invention is to provide a dangler assembly in which the current carrying capacity of the dangler is greatly improved over the current carrying capacity of prior art dangles.

Other objects, advantages and features of the invention will be apparent from the description which follows and from the accompanying drawings in which:

FIG. 1 is a dangler assembly in section presently used in the electrochemical plating industry;

FIG. 2 is a section of a dangler assembly in section also presently available for use in the electrochemical plating industry;

FIG. 3 is an exploded view in section of the component parts of the present invention;

FIG. 4 is a sectional view of the component parts of the present invention showing these parts in partially assembled relationship; and,

FIG. 5 is a sectional view of the dangler assembly the subject of this invention showing the parts fully assembled.

The prior art dangler assembly shown in FIG. 1 comprises a cylindrical contactor A having a blind hole B formed concentrically therein to receive the uninsulated conductor end C of an insulated cable D. The open end of the contactor A is crimped at E about the insulated surface of the conductor D. A hole F is provided for flooding a molten solder like material G about the end C of the insulated cable D to secure the end of the contactor A. Corrosive chemicals attack the solder G exposed in the hole F, and in time destroy the bond between the conductor end C and the contactor A wherein the contactor is thereafter easily separated from the conductor end C.

Referring now to prior art FIG. 2, herein is disclosed a means for securing the conductor end H of a conductor cable M to a contactor J in an effort to overcome the deficiencies of the dangler shown in FIG. 1. Herein a contactor J is compressed at R to crimp a cylindrical sleeve L about the uninsulated end H of the conductor cable M. It is a well known phenomenon that current

is transmitted by a conductor primarily on the surface of the conductor. This phenomenon is commonly referred to as the skin effect. Thus when there is a constriction in a conductor such as at N in FIG. 2, this increases the resistance to the passage of current on the surface of the conductor, resulting in heating and associated electrical inefficiencies. Experience has shown that a cable rated to carry 750 to 1,000 amperes, due to heating caused by the constriction at N can only effectively carry approximately 400 amperes.

Referring now to FIG. 3, which shows the component parts of the subject invention, the dangler 10 comprises an electrical conductor 12 encased in an insulation 14. A metal, or metallic sleeve 16, preferably copper, is gauged to fit snugly over the uninsulated end 18 of conductor 12 to prevent any expansion thereof. A metal or metallic pin 20, preferably copper, is then driven into the center of the conductor 12 to further expand the conductor outwardly against the retaining sleeve 16. Preferably, the pin 20 is sufficiently long that a portion will extend outwardly beyond the end of the conductor. Contactor 22 which is preferably of durable material, such as stainless steel, is generally cylindrical in configuration and is provided with a blind hole 24 in sleeve portion 26, the outer end being of increased internal diameter 28 to receive sleeve 16 therein. Contactor sleeve portion 26 is then forced onto cable 14 so as to engage not only the uninsulated conductor end 18 but also a portion of the insulation 14, while at the same time driving pin 20 further into the cable to expand the electrical conductor outwardly against the insulation 14.

As finally assembled, the cross-section of the dangler is shown in FIG. 5 wherein the sleeve portion 26 of the dangler encasing the end of the cable is lightly rolled at 32 to compress the sleeve 16 against the electrical conductor 18 whereby the electrical conductor 18 is in turn compressed between the sleeve 16 and the pin 20. The pin 20 prevents the electrical conductor 18 from constricting or deforming due to the pressure of the sleeve 16 and, accordingly, the carrying capacity of the surface of the electrical conductor 18 is not appreciably diminished by virtue of the pressure connections between the contactor 22, sleeve 16, conductor 18, and pin 20. Although not comprising a part of this invention, the preferred embodiment of this dangler assembly is crimped at the open end of the contactor 22 at 30 to create a seal between the contactor and the insulation 14 of the cable to prevent corrosive chemicals from penetrating between the insulating surface of the cable and the interior surfaces 24 and 28 of the contactor 22.

With the above described dangler assembly, it has been found that this dangler can be operated in excess of the rated capacity of the cable. By way of example, with a 750 to 1,000 ampere rated cable the described dangler assembly has been destructively tested as high as 1,200 amperes, at which time the rubber insulation of the cable would burn off, but with no observed harm having been experienced by the dangler assembly. Additionally, it has also been observed that during normal operation the present dangler assembly has enjoyed approximately 30 percent more useful life than prior art dangler assemblies tested under similar conditions. With respect to the ability of this present dangler assembly to resist stripping from the electrical conductor end, laboratory tests have shown that this dangler can

resist as much as a 4,000 pound load in tension. Prior art dangler assemblies known to the inventor have not been able to withstand a destructive test of this magnitude.

The present invention has been described in conjunction with certain preferred embodiments; however, various changes in these embodiments, and other embodiments of the present invention, will be obvious to those skilled in the art upon reading and understanding of the foregoing description. It is intended to include all such embodiments and modifications of the present embodiments within the present invention insofar as they are within the scope of the appended claims.

What is claimed is:

1. A dangler assembly for an electrochemical installation comprising:

- a. an electrical conductor,
- b. a metallic sleeve encasing one end of said conductor,
- c. a metallic pin embedded in said end concentric therewith, and,
- d. a contactor encasing said metallic sleeve in compression, whereby said conductor is compressed between said metallic sleeve and said concentric pin.

2. A dangler assembly for an electrochemical installation comprising:

- a. an insulated electrical conductor having at least one end stripped of insulation,
- b. a metallic sleeve adapted to fit snugly over and encase the uninsulated end of said conductor,

- c. a metallic pin embedded in the center of said uninsulated end and extending coaxially therewith,
- d. a metal contactor having a blind coaxial hole in one end to form a second sleeve telescoped over said uninsulated end and a portion of the insulated conductor in pressure gripping contact therewith, whereby said uninsulated conductor is gripped between said metallic sleeve and said pin.

3. The dangler assembly for an electrochemical installation comprising:

- a. an elongated electrical conductor,
- b. an insulating sheath of electrically non-conductive material enclosing the intermediate portion of said electrical conductor and terminating short of at least one end of said conductor,
- c. a metallic conductor sleeve adapted to fit snugly over said one end of said conductor and to extend coterminously with said end from said sheath to the outer axial extremity of said end,
- d. a metallic pin embedded in the center of said conductor and extending axially from said sheath to beyond the said outer axial extremity of said end, and
- e. a contactor having a blind end sleeve snugly telescoped over said sleeve encased conductor end and an adjacent portion of said insulating sheath in pressure gripping contact therewith, whereby said blind end sleeve compresses said conductor sleeve causing said conductor to be gripped between said conductor sleeve and said pin.

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