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[54] HOLLOW CONDUCTOR ROLL

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[51] **Int. Cl.**.....**B01k 3/00**

[58] **Field of Search** .....191/1 A; 204/279, 25

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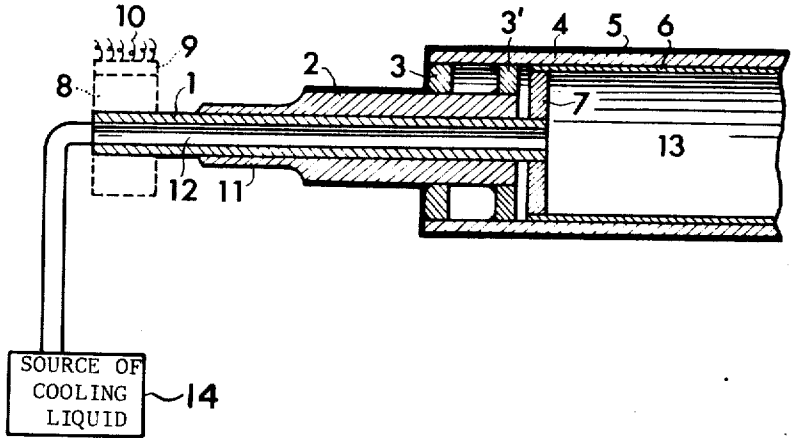
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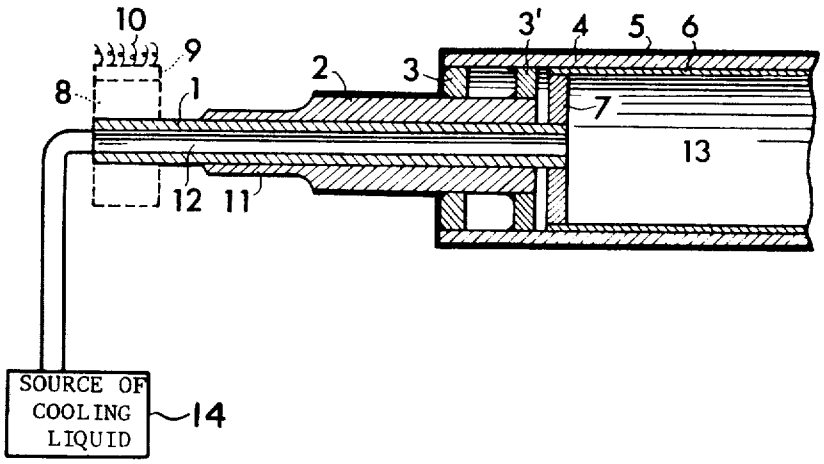
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[57] **ABSTRACT**

A hollow conductor roll is used in electrical zinc plating, the outer surface of which is made of middle carbon steel and hard metal plating, and the inner surface of which is made of pure metal with low hardness and good electric conductivity. The hard outer metal plating renders the roll less susceptible to damage thereby reducing production cost and the hollow roll is relatively easy to cool by passing cooling liquid therethrough.

10 Claims, 1 Drawing Figure




10
9
8
1
2
3
3'
4
5
6
7
13
12
11
SOURCE OF COOLING LIQUID
14

HOLLOW CONDUCTOR ROLL

This invention relates to a conductor roll to be employed, for example, in electrical zinc plating, and more particularly to a conductor roll for conducting an extremely high current at a comparatively low voltage.

When a metal strip is continuously zinc plated electrically, a conductor roll is brought into contact with the metal strip. The roll is driven by a suitable driving device to be rotated at an equivalent peripheral speed as the speed of the metal strip moving through the system, and conducts the plating current through the metal strip to an outside circuit. A plating current of about 16,000 amperes, at about 18 volts is passed through this conductor roll.

Heretofore, such conductor rolls have been solid structures made of pure nickel or copper. However, such a solid roll made of pure metals such as nickel or copper for obtaining high electrical conductivity, has a comparatively low hardness, which renders the roll highly susceptible to mechanical damage. Due to the high cost of materials and labor, these prior art conductor rolls are uneconomical.

Furthermore, it is difficult to cool these solid conductor rolls when a large quantity of heat is created therein. These and other disadvantages have constituted almost unavoidable drawbacks of the conventional conductor rolls.

Therefore, the main object of the present invention is to provide a conductor roll which is mechanically strong, has a good electrical conductivity, and is economical to manufacture.

It is a further object of this invention to provide a conductor roll which is relatively easy to cool.

According to this invention, a hollow roll shaft member is provided on each side of the conductor roll and is made of a metal having a high electrical conductivity. A roll sleeve member is provided on each side of the conductor roll and is tightly fit on the outside surface of at least a portion of the roll shaft. A hollow roll body is connected to the roll sleeve at each end thereof by means of coupling members which connect the inner surface of the roll body to the roll sleeves. The hollow roll body has a hard metal layer on the outside surface thereof and a lining made from a metal having a high electrical conductivity on at least a portion of the inside surface thereof. Further provided is a connecting member interconnecting the high conductivity metal lining to the roll shafts.

The invention will be better understood from the following detailed description taken in conjunction with the accompanying drawing which illustrates a sectional view of a preferred embodiment thereof.

In the drawing, a roll shaft 1 of hollow construction is made of 99.9 percent pure copper and a roll sleeve 2 made of general structural steel is tightly fit on the outer surface of the roll shaft 1. Coupling members 3, 3' connect the roll sleeve 2 to a roll body 4 of hollow construction to join together all of the members 1 through 4 to form an integrated conductor roll. The roll body 4 is made of a medium carbon steel for machine structure, and the coupling members 3, 3' are made of an ordinary structural rolled steel. All of the junctions between the coupling members 3, 3' and the roll body 4 and between the coupling members 3, 3' and the roll sleeve 2 are welded together. The peripheral surface of the roll body 4 is electrically plated with a hard chromium layer 5, and the inside surface of the roll body 4 is provided with a lining 6 consisting of about 5 mm thickness of 99.9 percent pure copper. This copper lining 6 is brazed to the inner end of the copper roll shaft 1 by means of an intermediate connecting number 7.

A source of cooling liquid 14 is connected to hollow roll shaft 1 for passing a cooling liquid therethrough. Complementary apparatus (not shown) is provided at the other end (not shown) of the conductor roll assembly. This cooling apparatus is of a well known type and is not described herein in more detail. Its operation should be apparent to those ordinarily skilled in the art.

Although the drawing illustrates merely the left side half of the conductor roll, the right side half of the conductor roll

(not shown) has a similar construction as the left side half. Further provided is a conductor ring 8 and brushes 9 contacting the conductor roll on the outer end of the copper roll shaft for conducting the current passing through the strip being plated to leads 10. A portion 11 of sleeve 2 is journalled on a bearing (not shown) in a manner well known in the art and 12 and 13 designate hollow spaces inside the roll shaft 1 and the roll body 4, respectively.

When the conductor roll according to the present invention is used in an electrical plating system, the electric current flowing through the metal strip (not show) to be plated is at first passed through the hard chromium plated layer 5 on the hollow roll main body 4, then through the roll main body 4, and thereafter through the inner conductive lining layer 6. The current then passes through connecting member 7, roll shaft 1, conductor ring 8, brushes 9, and a group of conductor leads 10, to a bus-bar (not shown).

As described above, the conductor roll according to the present invention is so constructed that the outside peripheral portions which contact the strip to be plated and which are subject to mechanical damage, are made of medium class carbon steel having a hard outer chromium plated layer 5 thereon. The inside portion of the roll is provided with a lining 6 of a lower hardness pure metal having a good electrical conductivity. Thus, a conductor roll of superior quality results which has a higher resistance to outside physical damage than the conventional solid conductor rolls made of pure metal, and an equivalent electrical conductivity to the conventional rolls. The rolls according to this invention are economical to manufacture, requiring only about one-fourth of the cost of the conventional rolls because of the hollow roll shaft 1 and the roll body 4 which is made of relatively inexpensive steel.

Further, since it is easy to flow a cooling liquid such as water through the hollow spaces 12, 13 within the roll shaft and the roll body, respectively, heat created in the conductive roll may be removed in a simple and inexpensive manner.

What is claimed is:

1. A fluid cooled conductor roll comprising:
   - a hollow roll body (4) having a hard metal layer (5) on the outside surface thereof and a lining (6) made from a metal having a high electrical conductivity bonded on at least a portion of the inner surface thereof;
   - a hollow roll shaft member (1) made of a metal having a high electrical conductivity, at least a portion of said roll shaft member (1) extending into the hollow portion of said hollow roll body (4);
   - a roll sleeve member (2) tightly fit on the outside surface of at least a portion of said roll shaft (1);
   - coupling members (3, 3') connecting an end of the inner surface of said roll body (4) to said roll sleeve member (2), said coupling members (3, 3') being spaced from each other and being welded to said roll body (4) and to said roll sleeve member (2); and
   - a connecting member (7) interconnecting said high conductivity metal lining (6) to said roll shaft member (1) only adjacent an end of said hollow roll body (4) so that said hollow roll body (4) has no radial obstructions in the central portions thereof, thereby providing an improved coolant flow path therethrough.

2. A conductor roll according to claim 1 wherein said hollow roll shaft member (1) extends only partially into the hollow portion of said hollow roll body (4) so that said hollow roll body (4) has no obstructions in the central portions thereof.

3. A conductor roll according to claim 2 wherein said hollow roll shaft member (1) extends into the hollow portion of said hollow roll body (4) only to said connecting member (7).

4. A conductor roll according to claim 1 wherein said hard metal layer (5) is an electrically plated hard metal layer.

5. A conductor roll according to claim 1 wherein said hard metal layer (5) is a chromium layer.

6. A conductor roll according to claim 1 wherein said lining (6) is a layer of substantially pure copper.

7. A conductor roll according to claim 1 wherein said lining (6) is brazed to the inner surface of said hollow roll body (4).

8. A conductor roll according to claim 1 further comprising a ring and brush assembly (8,9) mounted on an end of said roll shaft member (1) to conduct electric current from said conductor roll.

9. A conductor roll according to claim 1 wherein said hollow portions of said roll shaft member (1) and of said roll body (4) are in communication.

10. A conductor roll according to claim 9 further comprising cooling means (14) coupled to said hollow roll shaft member (1) for passing a cooling liquid through said shaft member (1) and through said hollow roll body (4).

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