Nov. 14, 1961 C. J OWEN 3,008,892

APPARATUS FOR COATING SELECTED PORTIONS OF THE SURFACE OF A BASE MATERIAL

Filed Sept. 10, 1957

FIG. 1.

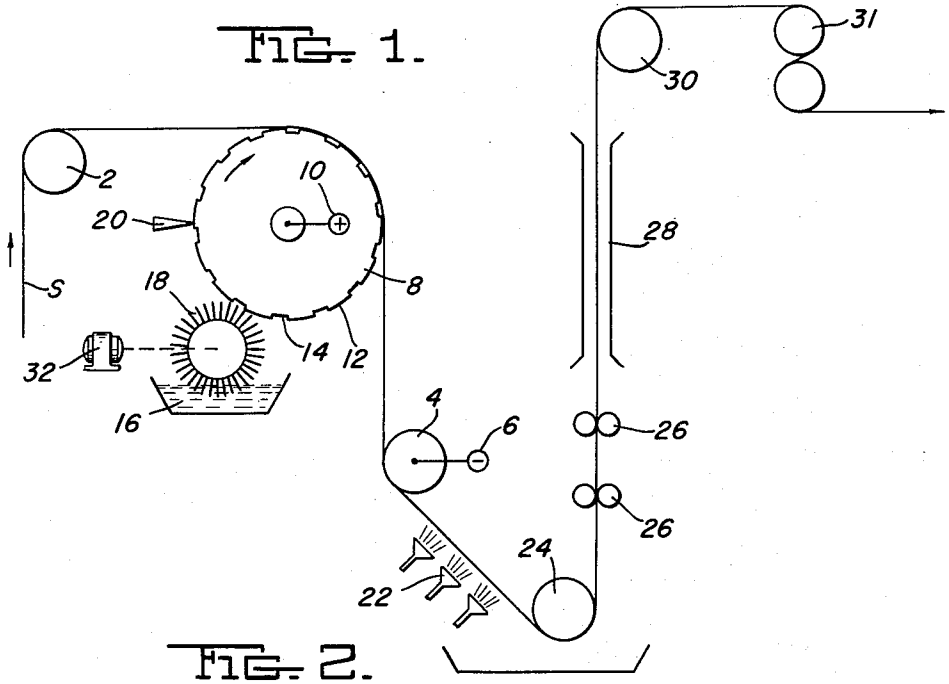


FIG. 2.

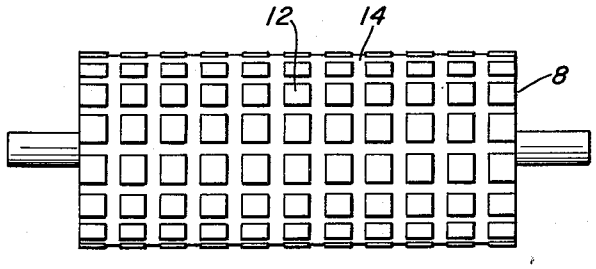
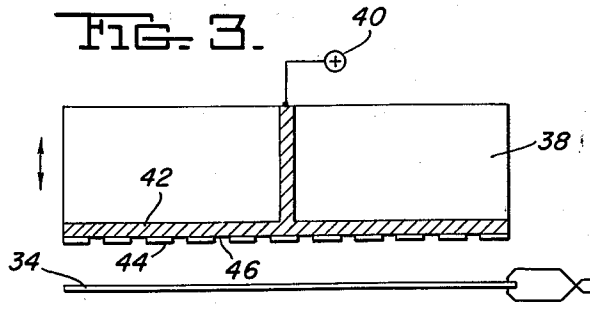


FIG. 3.



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APPARATUS FOR COATING SELECTED PORTIONS OF THE SURFACE OF A BASE MATERIAL

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This invention relates to apparatus for coating selected portions of the surface of a base material. In the coating of selected portions of the surface of a base material such as the coating of steel strip with another metal an aqueous solution of the salt of the coating metal is generally used as the electrolyte. In addition to the salt and water the electrolyte may include addition agents. The electrolytes of which I have knowledge are such that they will flow readily and hence cannot be applied on an inclined surface or in a specific pattern.

It is therefore an object of my invention to provide apparatus for continuously coating selected portions of a moving strip.

These and other objects will be more apparent after referring to the following specification and attached drawings, in which:

FIGURE 1 is a schematic view of the apparatus of my invention;

FIGURE 2 is a view of a roll used in the apparatus of FIGURE 1; and

FIGURE 3 is a schematic view showing another form of apparatus which may be used in the practice of my invention.

Referring more particularly to FIGURES 1 and 2 of the drawings, the reference numerals **2** and **4** indicate conductor rolls over which a strip S to be coated passes. The roll **4** is connected to a source of negative current **6**. An engraved roll **8** is located between the rolls **2** and **4** and is connected to a source of positive current **10**. The rolls **2** and **4** also serve to hold the strip S in close contact with the roll **8**. The roll **8** is preferably made of stainless steel with a thin hard non-conducting material **12** over its outer surface with depressions **14** therein extending down to the stainless steel. The depressions **14** form the design which is to be applied to the strip S. A container **16** is located beneath the roll **8** and contains the electrolytic mixture of my invention. A feeder roll **18** is in contact with the electrolytic mixture and with the roll **8**. The feeder roll **18** may be provided with brushes or other means for taking the electrolytic mixture from the container **16** and delivering it to the roll **8**. A doctor blade **20** bears against the roll **8** so as to remove any excess of the electrolytic mixture therefrom. From the roll **4** the strip passes through a water spray **22** downwardly to a roll **24**, then upwardly through pinch rolls **26** to a drying tower **28** and over roll **30**. Suitable conventional means such as bridle rolls **31** may be provided for moving the strip S through the processing equipment. The roll **18** is also rotated in any suitable manner, such as by means of a motor **32**.

The operation of this apparatus is as follows: As the strip S moves through the processing equipment all of the rolls will rotate and the electrolytic mixture will be applied to the roll **8** to fill the depressions **14** therein. The doctor blade **20** scrapes away the excess viscous electrolytic mixture on the surface of the roll **8** leaving the depressions **14** filled to the outer surface of the roll. Plating current passes from roll **8** through the electrolytic mixture in the depressions **14** to the strip S depositing the metal ion contained in the electrolyte on the strip S. Current is carried away from the strip by the roll **4**. As the coated strip passes the water spray **22** excess electrolytic mixture is washed from the strip. The surface of the strip S is dried as it passes through the drying tower **28**.

The apparatus as shown in FIGURE 1 may be used for several different purposes. If the strip S is tin plate the roll **8** may be engraved with a trademark, mill identifying marks or any other desired design. Radio and electronic-instrument circuit patterns may be applied on surface-activated non-conductors in strip form. Tin may be applied to the edges of strip to be used in the manufacture of tin cans so as to facilitate soldering.

The apparatus shown in FIGURE 3 is particularly adapted for depositing heavy coating and/or applying intricate patterns to a base material. The reference numeral **34** indicates a sheet to be plated and it is connected to a source of negative current **36**. A base block **38** is connected to a source of positive current **40**. Base block **38** has a detachable sheet **42** of the plating metal on the lower surface thereof which is covered with a thin hard non-conducting material **44** similar to the coating material **12** on the roll **8**. Depressions **46** extend through the material **44** to the sheet **42**.

In the operation of this device the electrolytic mixture of my invention is rolled into the depressions **46** and the excess scraped from the non-conducting surface **44**. Block **38** is then placed on the surface of sheet **34** with the coating **44** in contact therewith. Current is applied to the system and the coating material is deposited on the sheet **34** with the design being formed by the depressions **46**. The electrolytic mixture may also be used to patch a damaged plated surface.

The electrolytic mixture of my invention comprises from 1 to 76% by weight of the usual electrolyte, from 22 to 80% by weight of a miscible gum with the remainder being substantially all water and the usual addition agents. The gum used may be any one of the class consisting of water soluble algin colloid, purified Indian gum, starch-base paste, and gum-arabic. All of the above gums except the algin colloid are available commercially in ready mixed gum form. The algin colloid is usually sold as a powder and is prepared as a gum by mixing 4 to 10% by weight of the powder (preferably 6%) with water and allowing the mixture to gel overnight. All of these gums are not miscible with all of the common electrolytes, but no difficulty is encountered in selecting one of the group which will be miscible with the electrolyte being used. Examples of common electrolytes used in the coating process include Watts type nickel, which is a mixture containing from 240 to 450 g./l. of nickel sulfate, 37.5 to 60 g./l. of nickel chloride and 30 to 50 g./l. of boric acid; organic bright nickel, which is a mixture containing from 240 to 350 g./l. nickel sulfate, 37.5 to 60 g./l. nickel chloride, 30 to 50 g./l. boric acid, 5 to 10 g./l. nickel benzene disulfonate and 0.1 to 0.2 ml./l. triaminotolyldiphenylmethane; acid tin which is a mixture containing from 36 to 72 g./l. tin sulfate, 8 to 25 g./l. phenolsulfonic acid and 4 to 8 g./l. dihydroxydiphenylsulfone; acid copper which is a mixture containing from 180 to 260 g./l. copper sulfate, 45 to 85 g./l. sulfuric acid; acid zinc which is a mixture containing from 180 to 360 g./l. zinc sulfate, 2 to 30 g./l. aluminum sulfate, 0 to 30 g./l. ammonium chloride, 0 to 15 g./l. sodium acetate and 0.5 to 1.5 g./l. licorice; and alkaline tin, which is a mixture containing from 75 to 250 g./l. potassium stannate, 30 to 90 g./l. tin metal and 7.5 to 25 g./l. free potassium hydroxide. A specific electrolytic mixture of my invention includes from 6 to 76% by weight of Watts type nickel electrolyte and from 22 to 80% by weight of miscible gum which may be purified Indian gum with the remainder being substantially all water. Other mixtures may include from 7 to 76% by weight of organic bright nickel electrolyte and from 22 to 80% by weight of miscible gum which may be starch base paste with the remainder being substantially all water; 1 to 76% by weight of acid tin electrolyte and from 22 to 80% by

weight of miscible gum which may be gum-arabic with the remainder being substantially all water; 4.5 to 76% by weight of acid copper electrolyte and from 22 to 80% by weight of miscible gum which may be purified Indian gum with the remainder being substantially all water; 4 to 76% by weight of acid zinc electrolyte and from 22 to 80% by weight of miscible gum which may be starch base paste with the remainder being substantially all water; and 2.5 to 76% by weight of alkaline tin electrolyte and from 22 to 80% by weight of miscible gum which may be water soluble algin colloid with the remainder being substantially all water.

While several embodiments of my invention have been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. Apparatus for continuously coating selected portions of an electrically conducting strip which comprises two spaced apart rolls arranged in tandem, a source of negative current connected to one of said rolls, a source of positive current connected to the other of said rolls, said last named roll being made of conducting material with a non-conducting surface thereon and having depressions therein extending through said non-conducting surface, means for directing the strip around a substantial arc of each of said rolls, and means for filling said depressions with an electrolytic mixture including from 1 to 76% by weight of an electrolyte, from 22 to 80% by weight of a miscible gum and the remainder substantially all water and usual addition agents.

2. Apparatus for continuously coating selected portions of an electrically conducting strip which comprises two spaced apart rolls arranged in tandem, a source of negative current connected to one of said rolls, a source of positive current connected to the other of said rolls, said last named roll being made of conducting material with a non-conducting surface thereon and having depressions therein extending through said non-conducting surface, means for directing the strip around a substantial arc of each of said rolls, a container adjacent said last named roll containing an electrolytic mixture including from 1 to 76% by weight of an electrolyte, from 22 to 80% by weight of a miscible gum and the remainder substantially all water and usual addition agents, a feeder roll in contact with said electrolytic mixture and said last named roll, a wiper for removing excess electrolyte from said second named roll, means for spraying water on the strip after it has been coated to remove excess electrolyte, and means for drying said coated strip.

3. Apparatus for continuously coating selected portions of an electrically conducting strip which comprises two spaced apart rolls arranged in tandem, a source of negative current connected to one of said rolls, a source of positive current connected to the other of said rolls, said last named roll being made of conducting material with a non-conducting surface thereon and having depressions therein extending through said non-conducting surface, means for directing the strip around a substantial arc of each of said rolls, and means for filling said depressions with an electrolytic mixture.

4. Apparatus for continuously coating selected portions of an electrically conducting strip which comprises two spaced apart rolls arranged in tandem, a source of negative current connected to one of said rolls, a source of positive current connected to the other of said rolls, said last named roll having depressions therein, means for directing the strip around a substantial arc of each of said rolls, a container adjacent said last named roll containing an electrolytic mixture, a feeder roll extending from said container to said last named roll to feed the electrolytic mixture, a wiper for removing excess electrolyte from said second named roll, means for spraying water on the strip after it has been coated to remove excess electrolyte, and means for drying said coated strip.

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