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SYSTEM FOR CLEANING CONTACT ROLLS IN A PLATING TANK

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FIG. 1.

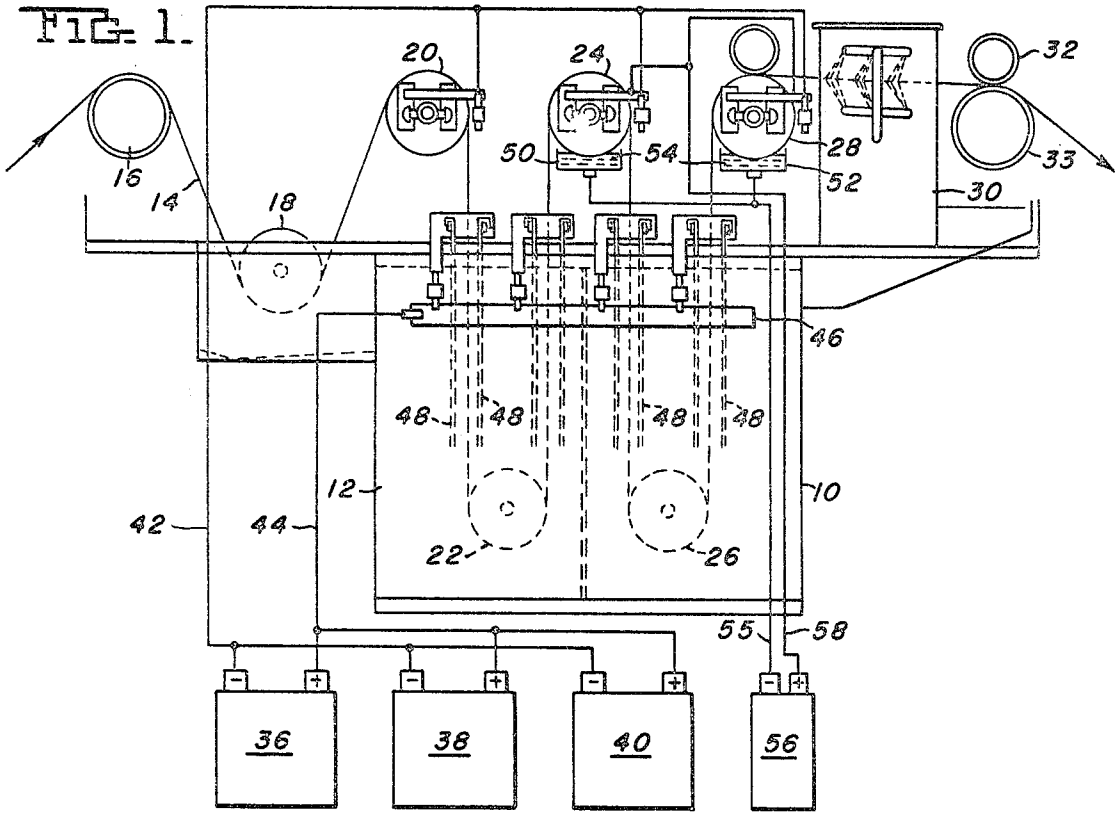
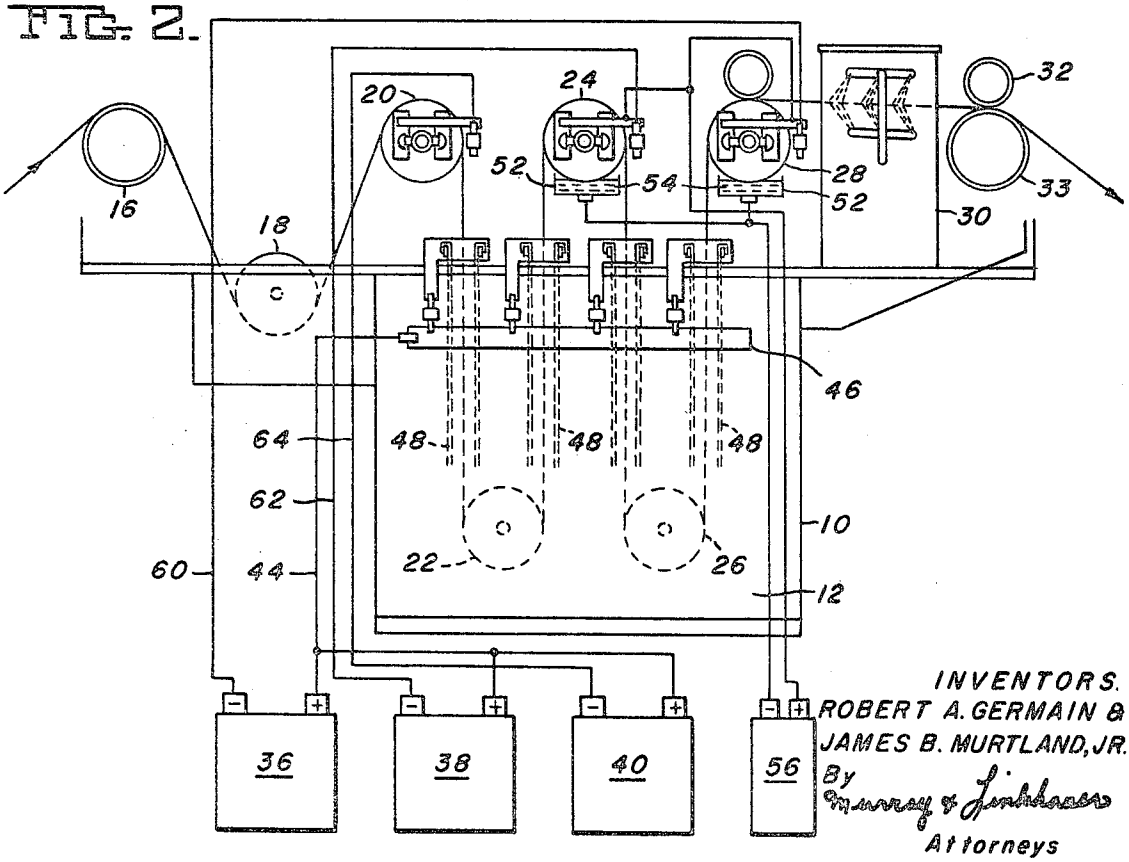


FIG. 2.



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SYSTEM FOR CLEANING CONTACT ROLLS IN A PLATING TANK

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ABSTRACT OF THE DISCLOSURE

Described is a system for preventing the build-up of a coating on contact rolls over which strip material passes in an electrolytic coating process. This is accomplished by a process of de-plating wherein the coating is removed electrolytically from the contact rolls by a reverse current and deposited in an easily cleaned pan.

BACKGROUND OF THE INVENTION

In the commercial production of silicon steel strip material, it is usually necessary to apply a coating to the strip material which acts as an insulating medium between laminations in the transformer or other device in which the sheets are used. Such coatings are usually inorganic oxides, such as magnesium oxide. Recently, a method has been developed whereby oxide coatings can be applied electrolytically by passing the strip over contact rolls and into an electrolytic bath. In this process, current passes through the contact rolls, which act as electrodes, thereafter through the strip and thence to electrodes immersed in the bath, typical currents passing through each contact roll being on the order of 3000 to 5000 amperes, depending upon strip width, line speed and coating thickness.

In a plating process of this type, the electrolyte clinging to the strip as it emerges from the bath will cause an electrolytic oxide to form on the contact rolls as well as the strip material passing through the electrolytic bath. It is necessary to prevent excessive build-up of this oxide on the surface of the contact rolls in order to avoid excessive arcing or burning of the strip. That is, the oxide on the contact rolls acts as an insulation and inhibits good electrical contact between the rolls and the strip. Mechanical scrapers have been used in the past in order to remove the oxide coating from the contact rolls and, when operating properly, are at least partially effective in keeping the rolls clean. However, care must be taken to prevent the scrapers, which are necessarily in contact with the rolls, from damaging the surfaces of the rolls. Furthermore, such mechanical devices are difficult to maintain and present a serious production problem. When failure of one or more of the scrapers occurs, burning of the strip occurs rapidly, resulting in a less desirable product and also a reduction in current available which results in a lower line speed.

SUMMARY OF THE INVENTION

As an overall object, the present invention seeks to provide a system for minimizing build-up of a coating on contact rolls over which strip material passes in an electrolytic coating process.

More specifically, an object of the invention is to provide a system for preventing build-up of a coating on such contact rolls by establishing a current of proper polarity between the contact rolls and an electrolyte in a pan or pans beneath the contact rolls and into which the rolls are at least partially immersed.

Still another object of the invention is to provide a new and improved method for preventing build-up of a coating on contact rolls in an electrolytic plating process.

In accordance with the invention, means are provided for preventing an electrolytically deposited coating from building up on contact rolls in an electrolytic coating line of the type in which metallic strip material emerging from an electrolytic bath passes over at least one metal contact roll, and wherein one terminal of a source of electrical potential is electrically connected to the contact roll and another terminal is electrically connected to an electrode immersed in the electrolytic bath. Build-up of an electrolytically deposited coating on the contact rolls is minimized by means including a pan beneath the roll, an electrolyte in the pan maintained at a level to immerse at least a portion of the roll, and a source of potential having its opposite terminals electrically connected to the roll and the electrolyte in the pan, with the aforesaid source of potential acting to polarize the contact roll oppositely to the polarization effected by the main source of electrolyzing potential.

There is a lower level of reverse current density through the contact roll at which effective de-plating will occur; and this can best be determined empirically for a given installation. Higher reverse currents tend to produce what appears to be a brown oxide on the contact roll; however this deposit does not affect the electrolytic de-plating process nor does it act as an insulating medium on the contact roll.

The above and other objects and features of the invention will become apparent from the following and detailed description taken in connection with the accompanying drawings which form a part of this specification, and in which:

FIG. 1 is an illustraiton of a preferred embodiment of the invention; and

FIG. 2 is an illustration of an alternative embodiment of the invention.

With refrence now to the drawings, and particularly to FIG. 1, an electrolytic plating line is shown comprising a tank **10** containing an electrolytic bath **12** which may, for example, comprise a solution of magnesium acetate (i.e., 1.19% MgO, 2.85% acetic acid in water). Such an electrolyte is used to apply a coating of magnesium oxide on silicon steel strip material. As was explained above, this oxide is applied to the strip material to act as an insulating coating between laminations of the silicon steel sheets in transformers, motors and the like.

The silicon steel strip, identified by the reference numeral **14** passes over roll **16**, then under roll **18** and over a first electrical contact roll **20**. After passing over roll **20**, the strip passes down into the electrolytic bath **12**, thence around a roll **22** immersed in the bath **12**, thence around a second contact roll **24** and back into the bath **12** where it passes around a second submerged roll **26**. Finally, the strip **14** passes over a third contact roll **28** and through an air blast chamber **30** to exit pinch rolls **32** and **33**.

In the embodiment of the invention shown in FIG. 1, three main power rectifiers **36**, **38** and **40** have negative terminals connected to a common power bus **42** which is, in turn, connected to each of the contact rolls **20**, **24** and **28**. The positive terminals of the rectifiers **36–40** are, in turn, connected through a common lead **44** to a bus bar **46**. The bus bar **46** is connected to a plurality of stainless steel electrodes **48** depending downwardly into the electrolytic bath **12** on either side of the strip material **14** as it passes around rolls **22** and **26**. While the bus **42** is shown as being connected to each of the rolls **20**, **24** and **28** in the embodiment of FIG. 1, it should be understood that under certain circumstances it may be con-

nected to only one or two of the rolls, depending upon the requirements of a specific installation.

As was explained above, the strip **14** as it emerges from the electrolytic bath **12**, will be wet and will contain a layer of the electrolyte; and this tends to become deposited upon the contact rolls **24** as an insulating layer. Continued build-up of the insulating layer causes arcing and damage to the emerging strip material. In accordance with the present invention, therefore, pans **50** and **52** are disposed beneath the rolls **24** and **28** and contain an electrolyte, preferably the same as the electrolyte in tank **10**. The electrolytic baths in the pans **50** and **52**, generally indicated by the reference numeral **54**, rise to a level where they contact the lower peripheral edges of the rolls **24** and **28** as they rotate.

The pans **50** and **52** and, hence, the electrolytic baths within them are connected through lead **55** to the negative terminal of a separate rectifier **56**; while the rolls **24** and **28** are connected through lead **58** to the positive terminal of the rectifier **56**. In this manner, the rolls **24** and **28** are polarized with respect to the electrolytic baths **54** in a sense opposite to the polarization with respect to the electrolytic bath **12** effected by rectifiers **36–40**. Consequently, a de-plating effect will occur as the rolls **24** and **28** rotate, the de-plated material falling into the pans **50** and **52**.

An alternative embodiment of the invention is shown in FIG. 2 wherein elements corresponding to those shown in FIG. 1 are identified by like reference numerals. In this case, the positive terminals of the rectifiers **36**, **38** and **40** are again connected to a common lead **44** which, in turn, is connected to the bus bar **46** and electrodes **48**. However, the negative terminals of the rectifiers **36**, **38** and **40** are individually connected to the respective contact rolls **20**, **24** and **28**. Thus, the negative terminal of rectifiers **36** is connected through lead **60** to contact roll **28**; the negative terminal of rectifier **38** is connected through lead **62** to contact roll **24**; and the negative terminal of rectifier **40** is connected through lead **64** to contact roll **20**. Connecting all of the contact rolls to a common negative bus as in FIG. 1 appears to offer some advantages in that the voltage rise normally associated with the "reverse-plating" phenomenon is inhibited. In the common voltage configuration of FIG. 1, the voltage across each rectifier remains the same, forcing current to take the path of least resistance. This interconnection has one major drawback, however, which must be taken into consideration. With all rolls connected, a single roll causing difficulty cannot be removed from service without the installation of expensive switching equipment. With the arrangement of FIG. 2, removal of one roll can be accomplished much more simply; however the advantages of the common bus arrangement must be sacrificed.

In actual tests, it has been found that the current required through the contact rolls and pan **50** or **52** to effect a cleaning of the contact roll is less than one ampere per square inch of immersed roll surface, a typical value being about **0.2** to **0.4** ampere per square inch. When the current density falls too low, effective oxide removal does not occur; and arcing between the rolls and the strip material **14** will result. As the current is increased above a certain value, de-plating still occurs, but a brown oxide deposit is produced on the rolls. This brown oxide deposit has no visible effect upon the coating process and does not inhibit good electrical contact between the rolls and the strip material **14**. Nevertheless, it is preferable to avoid as much of the deposit as possible.

Periodically, the pans **50** and **52** should be flushed with water to remove deposits, and a new electrolytic solution added. If one of the rolls **24** or **28** should become coated with oxide to the point where arcing and possible damage to the strip might result, the main power from sources **36–40** to that roll may be shut off while leaving the reverse current from source **56** flow between that roll and its electrolytic bath **54** until the roll is cleaned. At the same time, the main plating current is applied to the other rolls so that the line need not be shut down, although a lower line speed may have to be used.

Although the invention has been shown in connection with a certain specific embodiment, it will be readily apparent to those skilled in the art that various changes in form and arrangement of parts may be made to suit requirements without departing from the spirit and scope of the invention.

We claim as our invention:

1. In the method for preventing build-up of an oxide coating on a contact roll in an electrolytic plating process wherein strip material emerging from a main electrolytic bath passes around the contact roll and a main source of electrical potential has its opposite terminals connected to the roll and electrodes in the bath; the steps of immersing at least a portion of said contact roll in an auxiliary electrolytic bath separate and apart from the foresaid main electrolytic bath through which the strip material passes, and establishing an electrical potential between the roll and said auxiliary electrolytic bath whereby current will flow between the roll and auxiliary bath in a sense opposite to the flow of current through the roll from said main source of potential.

2. The method of claim **1** wherein there are a plurality of contact rolls each adapted to be connected to said main source of potential and each provided with a separate auxiliary electrolytic bath, and including the step of disconnecting one of said rolls from said main source of potential while at least another of said rolls remains connected to said main source of potential, while maintaining said electrical potential between said one roll and its auxiliary electrolytic bath to cause cleaning of said one roll.

3. The method of claim **2** including the step of periodically flushing and replenishing said auxiliary electrolytic baths.

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