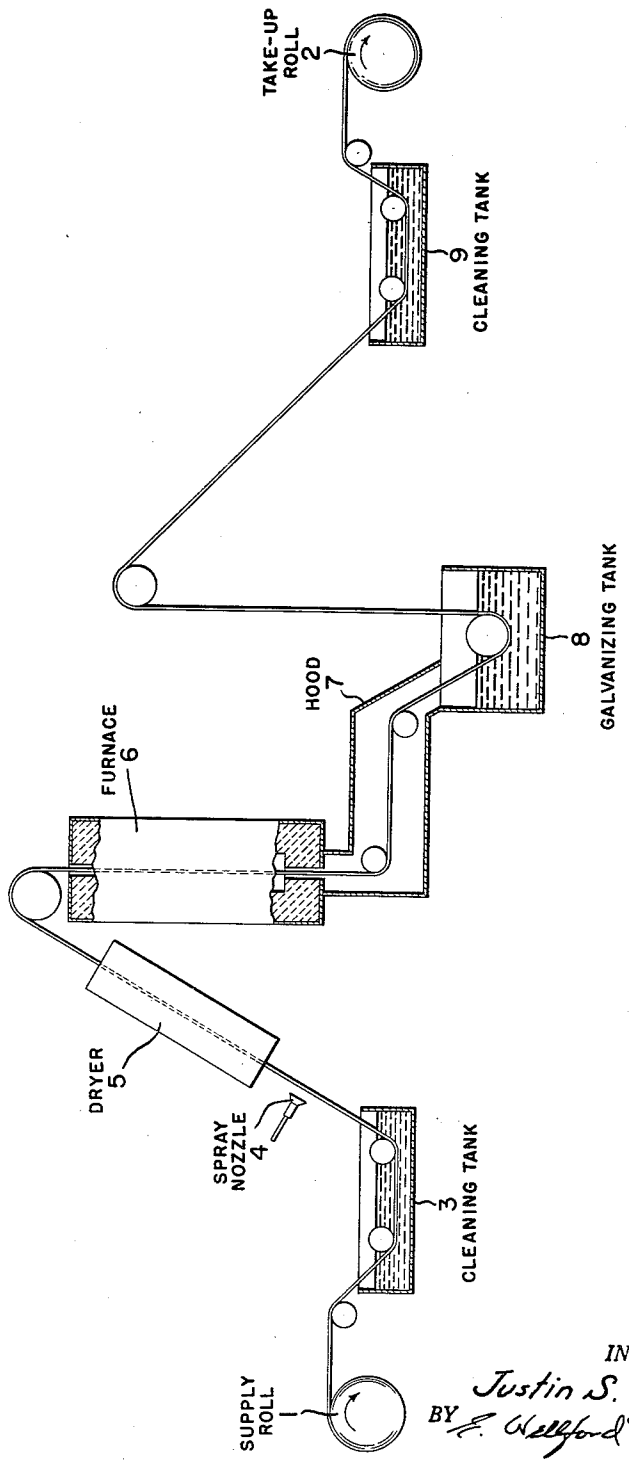
Feb. 11, 1964 J. S. BLAY 3,121,019

GALVANIZING ONE SIDE OF A STRIP OF METAL

Filed Feb. 20, 1961



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United States Patent Office 3,121,019 Patented Feb. 11, 1964

3,121,019

GALVANIZING ONE SIDE OF A STRIP OF METAL

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Filed Feb. 20, 1961, Ser. No. 90,365
10 Claims. (Cl. 117—5.5)

The present invention relates to galvanizing, and more particularly to a method of galvanizing one side only of a sheet of steel.

There are many applications in which it is desirable to have corrosion resistant properties of zinc on one side of a sheet of metal, while the other side has its original, uncoated surface, to permit paint adherence, for example. In addition, when galvanized sheet is to be spot welded, the zinc adheres to the electrode tips, producing a roughened sheet surface that must be ground to smooth it before further treatment. Presently, however, most galvanizing of sheet is accomplished by conveying through a pot of molten zinc so that both sides are coated. It is then expensive and difficult, if not impossible, to remove the zinc coating from one side. Therefore, it has not been practical to use galvanized sheet in many applications where its properties would be advantageous.

It is an object of the invention to provide a method of galvanizing one side only of sheet metal. The process can be carried out either as a batch process on individual sheets, or it can be carried out as a continuous process on strip. In either case, the steps performed on the material are the same.

It is a further object of the invention to provide a process by means of which a selected portion or portions only of a metal piece can be galvanized.

In practicing the invention, the metal is first cleaned so that its surface is suitable for the reception of zinc. Those portions of the metal not to be galvanized are then coated with a solution of masking material which is dried. Thereafter the metal is heated and dipped in zinc, and when the zinc coating has solidified, the masking material is removed. The surface that was previously covered with masking material is clean and ready for whatever further treatment may be required.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages and specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

The single figure of the drawing shows diagrammatically apparatus that can be used for practicing the method.

The invention can be used with any metal capable of being galvanized, but will be described herein as being used in connection with the continuous galvanizing of low carbon steel in the form of strip. Referring to the drawing, there is shown a supply roll 1 of strip material that passes over a series of guide rolls, defining a path through which the strip travels to a take-up roll 2. Between the supply and take-up rolls that are driven at a suitable speed are located the various instrumentalities that act upon the strip to perform the method.

After leaving the supply roll, the strip passes through a cleaning tank 3 in which oil, dirt and oxides are removed from its surfaces. The side of the strip that is not to be galvanized is then coated with a solution of material which will prevent zinc from adhering to said surface. This coating can be applied in any usual manner. It is preferred, however, to spray the coating

on the strip from a series of nozzles 4 located across the strip.

The coating material is one of the alkaline earth hydroxides which include calcium, magnesium, strontium and barium. Each of the hydroxides has the same properties as far as the present invention is concerned, and reacts in the same way at substantially the same temperatures. For purposes of this description, however, the method will be described as being carried out with a solution of calcium hydroxide or slaked lime ($Ca(OH)_2$). Commercially this is the most desirable material because it is readily available, easily handled and inexpensive.

The calcium hydroxide is made in a thin solution with water so that it can be sprayed in a thin coating on the strip. The coating needs only to be thick enough to cover the strip surface. Thicker coatings are not detrimental to the process, they merely require more material than is actually necessary. The so-coated strip is then dried. This drying can take place in the air if convenient. Preferably, however, the strip is passed through an oven 5 at a temperature of about 250° F., which is above the boiling point of the water that is used as a carrier for the lime. The strip is then moved through a furnace to bring it to the desired preheat temperature, and simultaneously to react the calcium hydroxide to a dense, hard coating.

Furnace 6 is preferably of the type shown in Bloom Patent 2,869,846 in which heat in the form of radiant heat is produced by open, cup-shaped burners. Some convention heat is also provided by the hot products of combustion that are liberated in the furnace chamber. The CO_2 released in the products of combustion reacts with the calcium hydroxide on the strip to form $CaCO_3$, which makes a dense, hard coating on the strip.

In operation, the temperature of the furnace will be maintained at 2200° F. or higher, depending upon the speed of the strip and the temperature to which the strip is to be heated, and with an atmosphere having no free oxygen. The temperature to which the strip is raised will depend upon the final properties desired. If the strip is being normalized, it will be heated to about 1600° F.; if annealed, to about 1300° F. If, however, the strip is being heated only for galvanizing, it will be heated slightly above 900° F., since the strip is introduced into the zinc pot at that temperature. This temperature is sufficiently high to maintain the zinc bath at 850° F. while providing heat to melt pig additions, and to offset radiation pot losses. The amount above 900° F. the strip is heated in furnace 6 must be at least enough to allow for radiation losses between the time the strip leaves the furnace and the time it enters the zinc pot.

The reaction between $Ca(OH)_2$ and CO_2 in the products of combustion to form $CaCO_3$ will take place at about 825° F., so the strip is heated enough to produce this reaction even if it is only being heated for galvanizing. The reaction is apparently speeded in the presence of water vapor, which is also present in the products of combustion. The decomposition temperature of $CaCO_3$ appears to be in the neighborhood of 1500° F. Since, however, some time is required for the decomposition to take place, and the strip is cooled as soon as it leaves the furnace, the coating of $CaCO_3$ is not harmed by the temperature of the strip or the furnace before the cooling takes place.

When the strip leaves furnace 6, it travels through a housing or duct 7 that is filled with a non-oxidizing atmosphere to protect the strip surface. This duct extends into a zinc pot 8 through which the hot strip passes, so that the unprotected side will be galvanized. If the strip

was heated to annealing or normalizing temperature, this housing also acts as a cooling duct to bring the strip temperature down to about 900° F. before entering pot 8.

After leaving zinc pot 8, the strip is wiped, if necessary, to regulate the thickness of the zinc coating, and is permitted to cool at least sufficiently for the zinc to freeze. Thereafter the $CaCO_3$ coating may be left on the strip to protect its surface, or it may be removed from the strip to present a clean surface for further treatment.

The coaing on the strip may be removed in any suitable manner, such as by washing the strip in water and brushing the coating from the strip. Such a washing tank is shown diagrammatically at 9. It has been found that this coating of $CaCO_3$ and any oxide that may have been formed on the strip surface beneath the coating on cooling after leaving the zinc pot can readily be removed by passing it through the tank 9, having a cleaning fluid in it which is vibrated by electrical transducers to produce ultrasonic vibrations with a frequency in the neighborhood of 38,000 cycles per second. Upon discharge from the cleaning bath, the strip is wound upon roll 2 or sheared to required sheet lengths for such disposition as is desired.

It will be apparent from the above description that the method described herein is applicable to the galvanizing of other metal objects as well as strip. For example, metal sheets can be coated on one side with the $Ca(OH)_2$, or on selected areas of both sides prior to the time they are dipped in a galvanizing pot. Tubes can be coated with the solution by suitably shaped spray nozzles on either the inside or outside before being dipped in zinc. Castings of various shapes can be coated in selected areas by a spray or brush before being galvanized. Thus the selected areas can be kept zinc-free to facilitate further assembling or finishing operations.

While the present invention is described in connection with the galvanizing of strip, and is particularly applicable therewith, it will be apparent that it can be used in the coating of one metal with another when the coating metal will not adhere to the alkaline earth carbonate that is formed in furnace 6. An example of such a coating metal is aluminum.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit and scope of the invention set forth in the appended claims, and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

What is claimed is:

1. The method of galvanizing one side of a strip of metal having a melting point above that of zinc which comprises placing on one side of the strip of metal a layer of material comprising an alkaline earth hydroxide, heating said metal to a temperature above the melting point of zinc in the presence of carbon dioxide, moving said metal through a bath of molten zinc, reducing the temperature of the metal to freeze the zinc, removing the layer of material placed on said metal, and continuously performing the above mentioned steps in sequence.

2. The method of claim 1 in which the alkaline earth hydroxide is calcium hydroxide.

3. The method of claim 1 in which the alkaline earth hydroxide is magnesium hydroxide.

4. The method of galvanizing selected portions only of a ferrous metal object which comprises coating all of said object but said selected portions with a solution of a hydroxide of the group consisting of magnesium hydroxide and calcium hydroxide, heating said coated object in the presence of CO_2 and water vapor to change the hydroxide to a carbonate, immersing the object in molten zinc, the zinc adhering to all portions of the object except those coated with said solution, and removing the carbonate from said selected portions.

5. The method of preparing a carbonate of the class of magnesium carbonate and calcium carbonate which comprises coating a continuously moving strip of metal with a solution of hydroxide of the group consisting of calcium hydroxide and magnesium hydroxide, heating said coated strip in the presence of CO_2 to a temperature at which the reaction from hydroxide to carbonate takes place, and removing the carbonate from said strip as it is moving.

6. The method of coating a desired portion of a metal object with a second metal having a melting point lower than that of said object which comprises covering the portion of the object that is not to be coated with a thin solution of an alkaline earth hydroxide, drying said solution, heating the object in the presence of carbon dioxide sufficiently to cause the hydroxide to react with the carbon dioxide to form an alkaline earth carbonate on the covered portion of the object, dipping the object in a molten bath of the second metal, cooling the object to freeze the second metal, and removing the carbonate.

7. The method of continuously galvanizing one side of a strip of steel which comprises moving the strip through a path, spraying a coat of calcium hydroxide on the surface of the strip not to be galvanized, heating the strip to at least 900° F. in the presence of carbon dioxide, moving said strip through a molten zinc bath, and cooling said strip.

8. The method of continuously galvanizing one side of a strip of ferrous metal which comprises moving said strip through a path, and while it is traveling performing the following operations on it in succession, placing a solution of calcium hydroxide on the side of the strip that is not to be galvanized, drying said solution, heating the strip to at least 900° F. in the presence of carbon dioxide, moving the strip directly and without appreciable loss of heat through a non-oxidizing atmosphere into a galvanizing bath, cooling the strip to freeze the zinc and cleaning the side of the strip that was not galvanized.

9. The method of galvanizing a portion only of a ferrous metal object which comprises cleaning the object, applying a solution of alkaline earth hydroxide in a thin layer to the portion of the object which is not to be galvanized, drying said coating, heating said object in a non-oxidizing atmosphere in the presence of carbon dioxide to a temperature above 900° F. to react said hydroxide with said carbon dioxide into a hard dense coating of alkaline earth carbonate, moving the object directly from the place of heating through a non-oxidizing atmosphere into a galvanizing bath, and removing the carbonate coating from the object.

10. The process of claim 9 in which said alkaline earth hydroxide is calcium hydroxide, and in which said alkaline earth carbonate is calcium carbonate.

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