

March 27, 1951

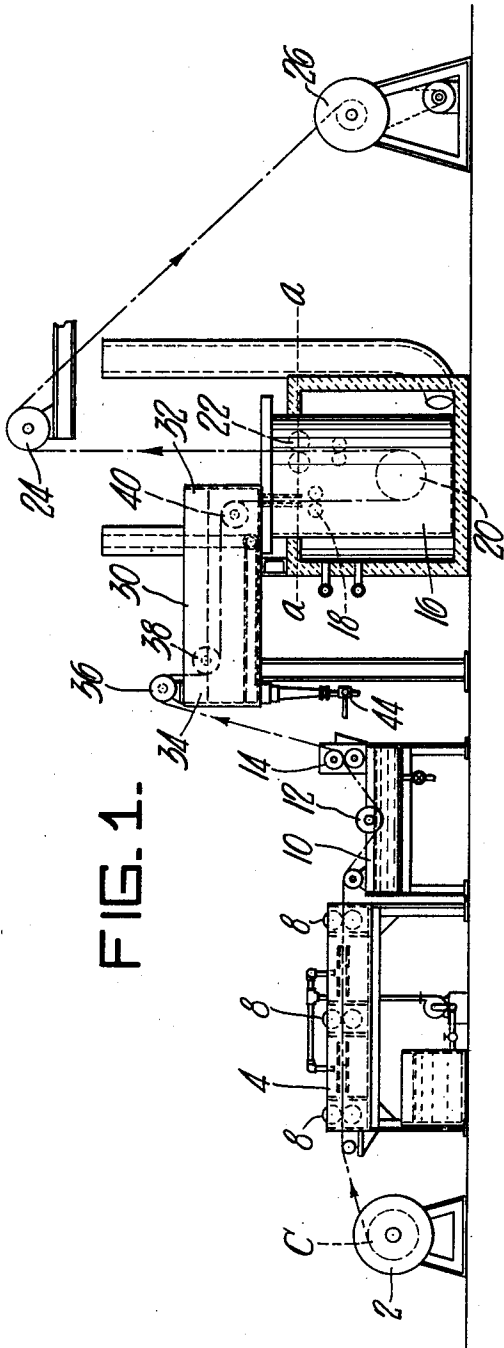
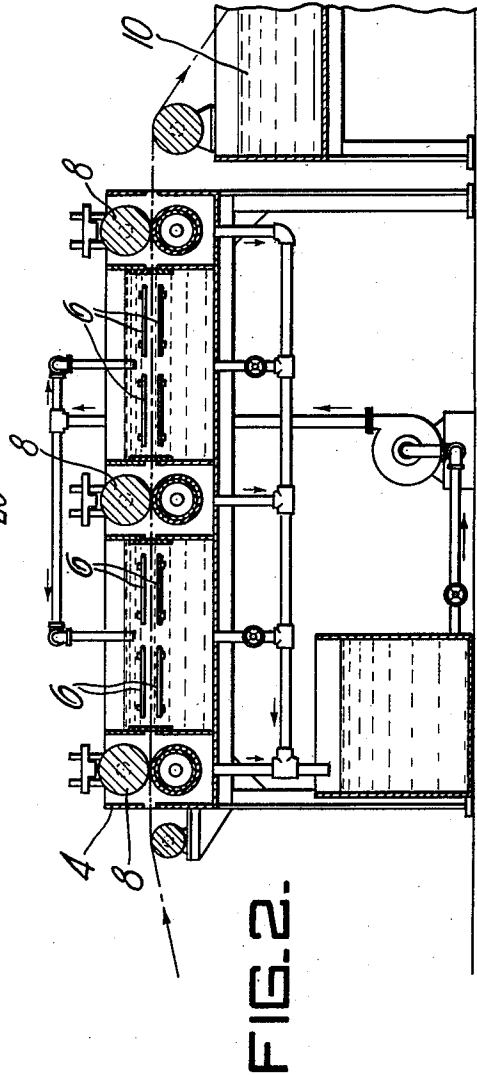
M. C. KING

2,546,451

METHOD OF GALVANIZING

Filed Aug. 28, 1947

2 Sheets-Sheet 1



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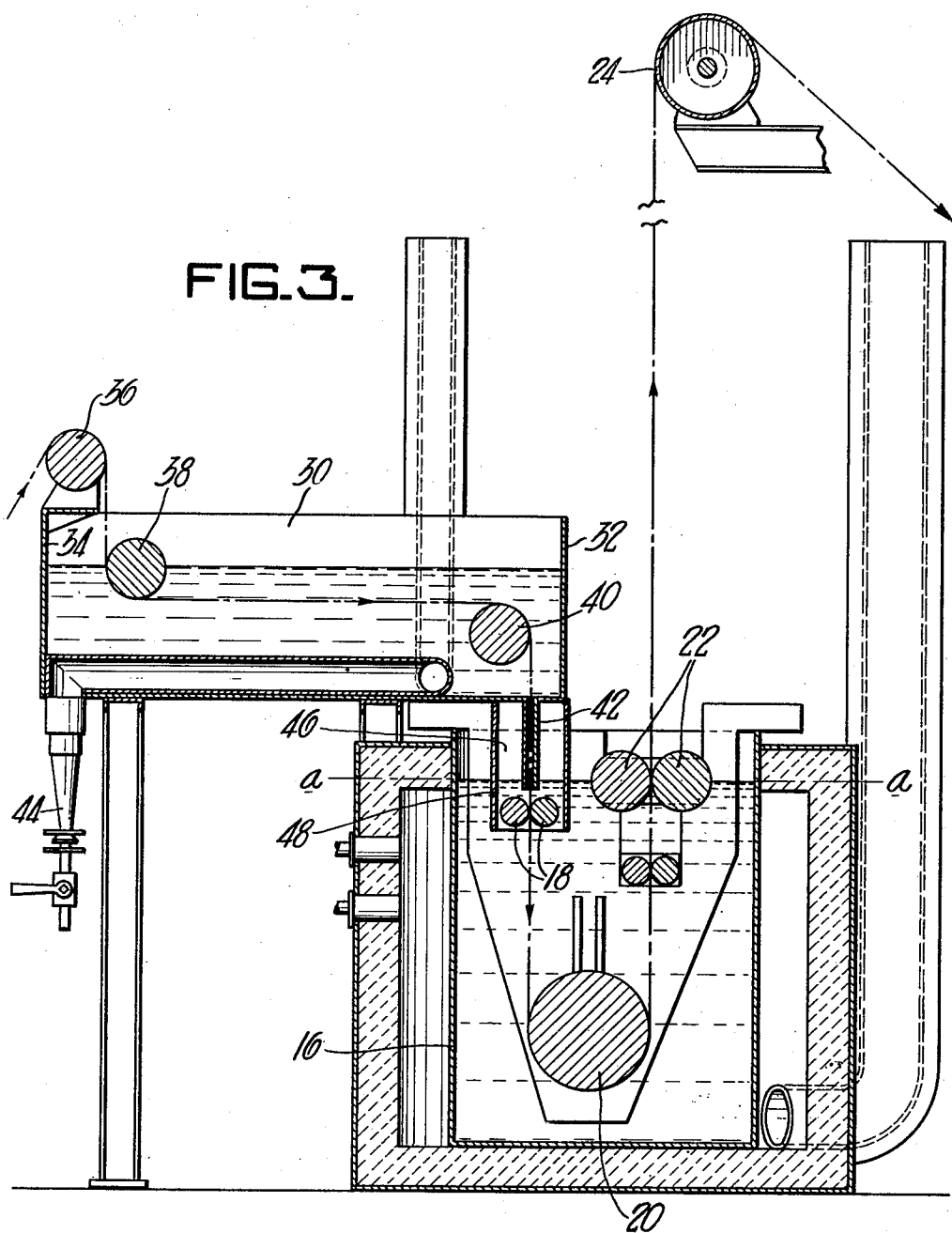
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METHOD OF GALVANIZING

2 Sheets-Sheet 2

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UNITED STATES PATENT OFFICE

2,546,451

METHOD OF GALVANIZING

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Application August 28, 1947, Serial No. 771,066

2 Claims. (Cl. 117—52)

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This invention relates to an improved method and apparatus for hot-dip galvanizing steel strip and the like.

Present day methods of applying molten zinc to ferrous metal sheets to obtain good bonds therebetween involve, as a rule, treatments of the sheet or strip surface to obtain thereon a layer of substantially pure iron. I have determined, however, that the obtaining of such a layer is unnecessary if certain steps hereinafter disclosed for preparing the metal surface are followed. By so doing, the expensive and intricate practices of the prior art are avoided and, at the same time, better bonded coatings are obtained.

I have discovered that superior coating adherence, as well as improved performance of the hot-dip galvanizing pots, is obtained by passing the strip or sheets through a bath of palm oil, Hydrofol, a hydrogenated fish oil or oleic acid, which is in contact with the molten spelter. It has heretofore been impossible to have palm oil and the like in direct contact with the molten zinc spelter, since the conventional 790 to 850° F. temperature of the spelter exceeds the flash point of such material.

It is accordingly an object of the present invention to provide an improved method and apparatus for galvanizing ferrous metal sheets and strip.

It is a further object to provide a method and apparatus for maintaining an entry bath of palm oil and the like in contact with the molten zinc spelter bath for hot-dip galvanizing ferrous metal sheets and strip.

The foregoing and further objects will become apparent from the following specification when read in conjunction with the attached drawings, wherein:

Figure 1 is a side elevation partly in section;

Figure 2 is an enlarged detail of the cleaning tank; and

Figure 3 is an enlarged detail of the galvanizing pot.

Referring more particularly to the drawings, the letter C designates a coil of ferrous strip material which has preferably been box annealed in a reducing atmosphere at a temperature between 1200° F. and 1300° F. The annealed coil C is mounted on an uncoiler 2 which feeds the strip into an electrolytic pickling tank 4 provided with electrodes 6 and guide rolls 8. The electrolyte used in the tank is preferably a 15% aqueous solution of hydrochloric acid held at a temperature between 90 and 120° F.

Disposed adjacent to and in longitudinal align-

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ment with the pickling tank 4 is a water rinse tank 10 having a partially submerged roller 12 at its mid-portion for maintaining the strip below the surface of the water in the tank. At the outlet end of the water tank are squeegee rolls 14 adjusted to remove most of the rinse water from the advancing strip.

In longitudinal alignment but somewhat spaced from the rinse tank 10 is a hot-dip galvanizing pot 16 containing a bath of molten zinc spelter having conventional commercial purity or alloyed with effective small percentages of tin, antimony or aluminum and maintained at substantially a level indicated by the dotted line a-a. The pot is provided with submerged inlet guide rolls 18, a lower submerged guide roll 20 and partially submerged outlet squeegee rolls 22. As the strip leaves the pot, it travels upwardly over a guide roll 24 and downwardly to a coiler 26.

In accordance with the teachings of my invention, there is provided above the pot 16 a box-like container 30 for palm oil and the like. The forward end 32 of the container extends to approximately the mid-portion of the pot whereas the rearward end 34 extends outwardly from the pot towards the rinse tank 10. A guide roll 36 is provided above the rearward end 34 and submerged guide rollers 38 and 40 are provided in the container adjacent the rearward and forward ends respectively. The strip is adapted to travel over rolls 36 and 40 and under roll 38.

On the bottom of the forward end of the container 30, there is provided a downwardly depending elongated narrow spout member 42 which extends to a point adjacent the guide rolls 18 and below the level of the molten spelter. This slot-like guide member 42 extends across substantially the width of the container 30 so as to receive the widest strip passed therethrough. From this, it is seen that the palm oil or other material in the container is maintained in contact with the molten spelter so that the strip is encased in the palm oil bath until it enters the zinc plating bath.

The palm oil bath has a double function of driving off from the stock passing through it the remains of pickling acid and rinse water left on it by squeegee rolls 8 and then preparing the surface of the stock for the reception of zinc coating. The container 30 is designed to provide an adequate cooling of the palm oil or an equivalent substance therein. In many cases, it is possible to achieve the desired lowering of the temperature by natural heat radiation in atmosphere by reason of tank 30 having sufficiently

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large dimensions in proportion to the surface area of spout 42. Since heat is supplied to the tank 30 principally by radiation and convection from galvanizing pot 16, a proper adjustment of supply of heat to the oil may be achieved, when so desired, by partial heat insulation of tank 30 on the sides receiving heat from galvanizing pot 16, or by complete heat insulation of them using only moderately efficient insulating material. In some cases, a burner 44 may be provided for heating tank 30 independently of galvanizing pot 16.

A total prevention of heat access to tank 30 is neither intended nor desired, since proper functioning of palm oil and of equivalent substances, is predicated on maintaining it at an elevated temperature in the range of 300° to 350° F. and preferably at 325° F. Heat radiated from galvanizing pot 16 provides this heating effect in a convenient manner.

Maximum heating of the oil occurs near the bottom slot of spout 42. Cooler oil is carried down by the strip and, being prevented from further downward motion by the hydrostatic effect of molten zinc, accumulates in spout 42 where it comes in contact with the heated walls thereof. Heated oil then rises into tank 30 thus assisting circulation necessary for keeping oil temperature at a predetermined level. Most average operating conditions do not require forced circulation, but, when required, this forced circulation can be provided by many methods familiar to those skilled in the art.

If desired, the conventional flux box 48 can be retained on the pot to form a hermetic chamber 46 and thereby reduce oxidation of the surface of the molten zinc adjacent the strip inlet.

It has been discovered that, once properly cleaned strip is treated by the application of hot palm oil and the like, further galvanizing operations can be conducted in a conventional manner, provided the original immersion of steel base into molten spelter is effected through an oil seal as described above.

In the preferred manner of producing the present invention for making tight-coated galvanized steel, low-carbon common steel ingots are reduced to strip of the desired gage in conventional manner, coiled, and the coils are annealed under cover at substantially 1200° to 1300° F. in a reducing atmosphere, exemplified by gas containing 4 to 6% CO₂, 9% CO, 10% H₂, the rest being nitrogen. After cooling to substantially room temperature, the annealed strip is pickled in a 15% aqueous solution of hydrochloric acid held at 90° to 120° F., rinsed in water, substantially freed from adhering liquid by passing through squeegee rolls, immersed into the palm oil bath contained in the feeding device and having an average temperature of substantially 300° to 350° F., 325° F. being preferable. The strip is then passed into the galvanizing pot containing spelter alloyed with 0.12 to 0.25% aluminum and maintained at a tempera-

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ture of 820° to 830° F. On leaving the pot, the coated strip is allowed to cool in still or agitated air, depending on the character of spangle desired, while passing to roll 24 and then to coiler 26.

Galvanized strip made according to the method of the present invention has coating adherence characteristics superior to those encountered in commercial hot-dipped product having so-called tight-coat characteristics. The method further provides an efficient and economical means for converting conventional galvanizing lines into equipment suitable for manufacturing high-grade galvanized steel.

While I have shown and described one specific embodiment of my invention, it will be understood that this embodiment is merely for the purpose of illustration and description and that various other forms may be devised within the scope of my invention, as defined in the appended claims.

I claim:

1. A method of producing a galvanized ferrous metal body by immersing said body in a bath of molten zinc comprising passing said body through a bath of palm oil and then into and through a molten zinc bath, said palm oil bath being disposed a substantial distance above the molten zinc bath, said palm oil bath being connected to the zinc bath by a narrow spout-like column of palm oil extending downwardly from said palm oil bath onto said molten zinc bath, the thickness of said column being very little in excess of the thickness of the article passed therethrough.

2. A method of producing a galvanized ferrous metal body by immersing said body in a bath of molten zinc comprising passing said body through a bath of palm oil and then into and through a molten zinc bath, said palm oil bath being maintained at a temperature between 300° and 350° F. and being disposed a substantial distance above the molten zinc bath, said palm oil bath being connected to the zinc bath by a narrow spout-like column of palm oil extending downwardly from said palm oil bath onto said molten zinc bath, the thickness of said column being very little in excess of the thickness of the article passed therethrough.

MICHAEL C. KING.

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