Dec. 5, 1950 H. C. RODGERS 2,533,048

PROCESS OF HOT DIP TINNING

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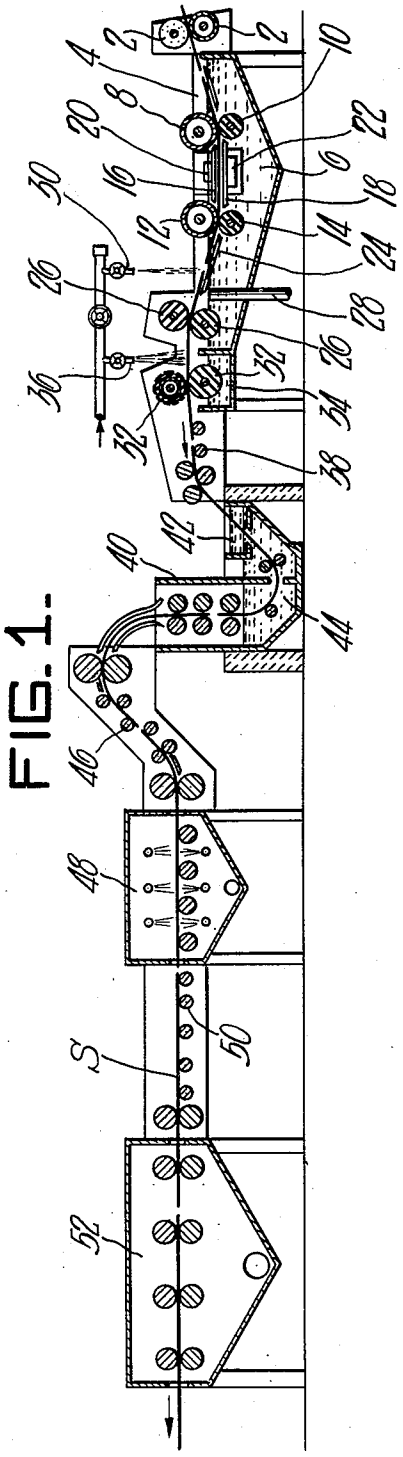


FIG. 1.

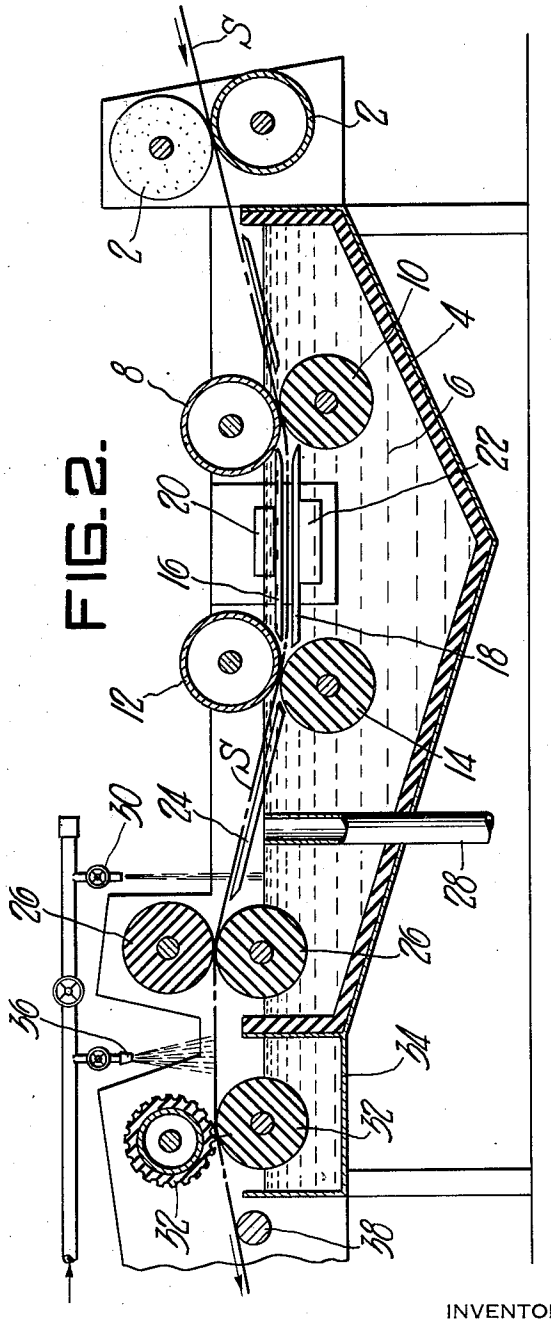


FIG. 2.

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PROCESS OF HOT DIP TINNING

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5 Claims. (Cl. 117—52)

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This invention relates to a process of hot dip tinning and more particularly to such a process for tinning steel sheets. In the ordinary method of hot dip tinning of steel sheets the sheets are loaded in batch pickler crates and sloshed up and down in sulphuric acid baths. To prevent sheets from being over-pickled, inhibitors such as flour, salt, wheat middlings and organic inhibitors are added to the bath. The pickled sheets are then transferred to a rinse tank in which circulating cold water washes off the sulphuric acid and the inhibitor. When the sheets are unloaded from the crates they are stacked on edge in a tank and covered with water having a small amount of hydrochloric acid therein. The tank is then transferred to the tin pot by a tractor and the sheets are manually transferred by hand to another water tank. The sheets are fed by a magnet out of this last tank through several sets of rolls and are guided downwardly through the zinc ammonium chloride flux which is floating on the bath of molten tin. The temperature of the flux is approximately 350° F. and that of the tin is between 600 and 650° F. The flux adheres to the sheets and is carried downwardly into the molten tin which raises its temperature. As the flux on the sheets is raised in temperature, it attacks the steel sheets which accelerates the formation of an iron tin alloy layer. The sheet then passes through various sets of rolls and guides in a tinning machine and through a bath of oil having a temperature of 465° F. The coating is solidified by low pressure compressed air and the sheet is then cleaned and polished. This process results in dull gray areas on the sheets which are known in the trade as "leopard spots." These areas are usually circular in appearance and have a diameter of between ¼" and 1". In extreme cases these spots cover large areas on the sheets and usually occur in areas where the coating is thin. The exact cause of the dull gray areas is not definitely known though countless technical articles have been written on the subject. Prior to my invention no one had discovered a way to prevent the formation of "leopard spots" without interfering with production. These spots are detrimental to the appearance of the sheets and the quality of the product. It is my belief that these spots are caused by the flux adhering to the sheets being raised to excessive temperatures in the tin pot.

It is an object of my invention to provide a process of hot dip tinning which prevents these "leopard spots" from being formed.

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

Figure 1 is a diagrammatic view of the tin line used in carrying out my invention; and

Figure 2 is an enlarged sectional elevation of the pickling tank.

Referring more particularly to the drawings, the reference numeral 2 indicates a pair of feed rolls, the top roll being made of rubber while the bottom roll is made of steel. These rolls are located in a rubber lined pickling tank 4 having a pickling solution 6 therein. This solution may be hydrochloric acid, sulphuric acid, ammonium chloride, or any other pickling solution, all of which are well known in the trade. However, it is preferred to use hydrochloric acid since it is compatible with the flux which is made from hydrochloric acid, salammoniac and zinc. The preferred solution has an acid concentration of between approximately .25 to 5.0% with excellent results being obtained with a concentration of approximately 1%. The solution also contains from .01% to .06% of an inhibitor. Any of the standard inhibitors may be used, but I prefer to use those disclosed in the patents to Cunningham Nos. 1,961,096 and 1,961,097. The pickling solution is used for approximately a week after which the tank is drained, rinsed and refilled with a new pickling solution. The pickling may be accomplished with or without the introduction of electric current, but electrolytic pickling will be described. Adjacent the inlet side of the tank 4 is a stainless steel conductor roll 8 having a rubber roll 10 bearing thereagainst. Spaced from the roll 8 is a second stainless steel conductor roll 12 also having a rubber roll 14 bearing thereagainst. Between the rolls 8 and 10 are top and bottom sheet guides 16 and 18, respectively. Mounted on the top guide 16 is a steel anode 20 and mounted on the bottom guide is a carbon anode 22. A guide 24 extends upwardly from the roll 12 toward a pair of rubber rolls 26 which feed the sheets from the tank 4. An overflow pipe 28 controls the level of the solution in the tank 4 and a petcock 30 is provided to keep the solution up to the top of the overflow pipe. Adjacent the rolls 26 is a pair of rubber rolls 32 mounted in a water tank 34, the top roll of which is preferably grooved. Between the rolls 26 and 32 is a water spray 36. From the rolls 32 the sheets S pass through a feeder 38 to the tinning machine 40 which contains a flux 42 floating on the molten tin 44. The sheets S

pass from the tinning machine over the conveyor 46 to a washer 48 from which a conveyor 50 conveys the sheets to the branner 52.

The sheets S to be tinned are dry sheets, that is, cold reduced sheets which have been electrolytically cleaned, annealed, temper rolled and sheared, but which have not been white pickled or wetted in any way after shearing. These sheets are fed to the electrolytic pickling tank by a suitable feeder such as the Dexter metal sheet feeder and through the rolls 2 into the bath 6. The sheets then pass through rolls 8 and 10, guides 16 and 18, rolls 12 and 14, guide 24 and rolls 26. As the sheets pass through the tank they receive the positive current which flows from the anodes through the pickling bath to the negative conductor rolls so that the sheets become cathodic. Pickling current having a range of from 100 to 500 amperes is supplied by a D. C. motor generator set with the current being maintained between 4 to 12 volts. The rubber rolls 26 squeeze the excess pickling solution from the sheets. Since the sheets are dry when they are fed into the pickling solution, the surface of the sheets readily absorbs the inhibitor which is carried in the minute pores in the steel through the water spray 36 directly into the flux floating in the molten tin bath. The water spray 36 merely serves to keep the surface of the sheet wet and while it may wash off of a small part of the inhibitor, sufficient inhibitor remains on the sheet to protect it. A sheet 28½ inches long will pass entirely under the water spray and through the rubber rolls in 4 seconds, thus limiting the rinsing action and allowing the major part of the inhibitor to be carried over into the tin pot. The same size sheet will be in the pickling solution approximately 9 seconds. The sheet passes from the tin pot 40 in the usual manner and is washed and passed through the branner. In the process it is very important that the pickled sheets are wet going into the flux and that the sheets leaving the pickling bath are not washed so that the inhibitor remains on the steel as it goes into the flux and protects the steel from attack thereby.

It will be apparent that other modifications and adaptations may be made without departing from the scope of the following claims.

I claim:

1. The process of hot dip tinning of ferrous metal sheets which comprises passing the sheets through a pickling solution having a pickling inhibitor therein, removing the sheets in a wetted condition from the solution with pickling solution and inhibitor thereon, passing the wetted sheets with inhibitor thereon through tinning flux floating on the tin directly into the tin, and applying tin to the sheets.

2. The process of hot dip tinning of ferrous metal sheets which comprises passing the sheets through a pickling solution having a pickling inhibitor therein, removing the sheets in a wetted condition from the solution with pickling solution and inhibitor thereon, passing the wetted sheets under a water spray, passing the wetted sheets with inhibitor thereon through tinning flux floating on the tin directly into the tin, and applying tin to the sheets.

3. The process of hot dip tinning of ferrous metal sheets which comprises passing the sheets through a pickling bath of hydrochloric acid having a pickling inhibitor therein, removing the sheets in a wetted condition from the bath with hydrochloric acid and inhibitor thereon, passing the wetted sheets with inhibitor thereon through tinning flux floating on the tin directly into the tin, and applying tin to the sheets.

4. The process of hot dip tinning of ferrous metal sheets which comprises passing the sheets through a pickling bath of hydrochloric acid having a pickling inhibitor therein, removing the sheets in a wetted condition from the bath with hydrochloric acid and inhibitor thereon, passing the wetted sheets under a water spray, passing the wetted sheets with inhibitor thereon through tinning flux floating on the tin directly into the tin, and applying tin to the sheets.

5. The process of hot dip tinning of ferous metal sheets which comprises passing the sheets through a pickling bath having hydrochloric acid of approximately 1.0% concentration and from approximately .01% to .06% pickling inhibitor, removing the sheets in a wetted condition from the bath with hydrochloric acid and inhibitor thereon, passing the wetted sheets under a water spray, passing the wetted sheets with inhibitor thereon through tinning flux floating on the tin directly into the tin, and applying tin to the sheets.

HOWARD C. RODGERS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,961,096	Cunningham	May 29, 1934
1,961,097	Cunningham	May 29, 1934
2,223,355	Gonser	Dec. 3, 1940