

Jan. 4, 1944.

J. D. KELLER

2,338,438

APPARATUS FOR COATING SHEET METAL

Filed Oct. 31, 1940

2 Sheets-Sheet 1

Fig. 1.

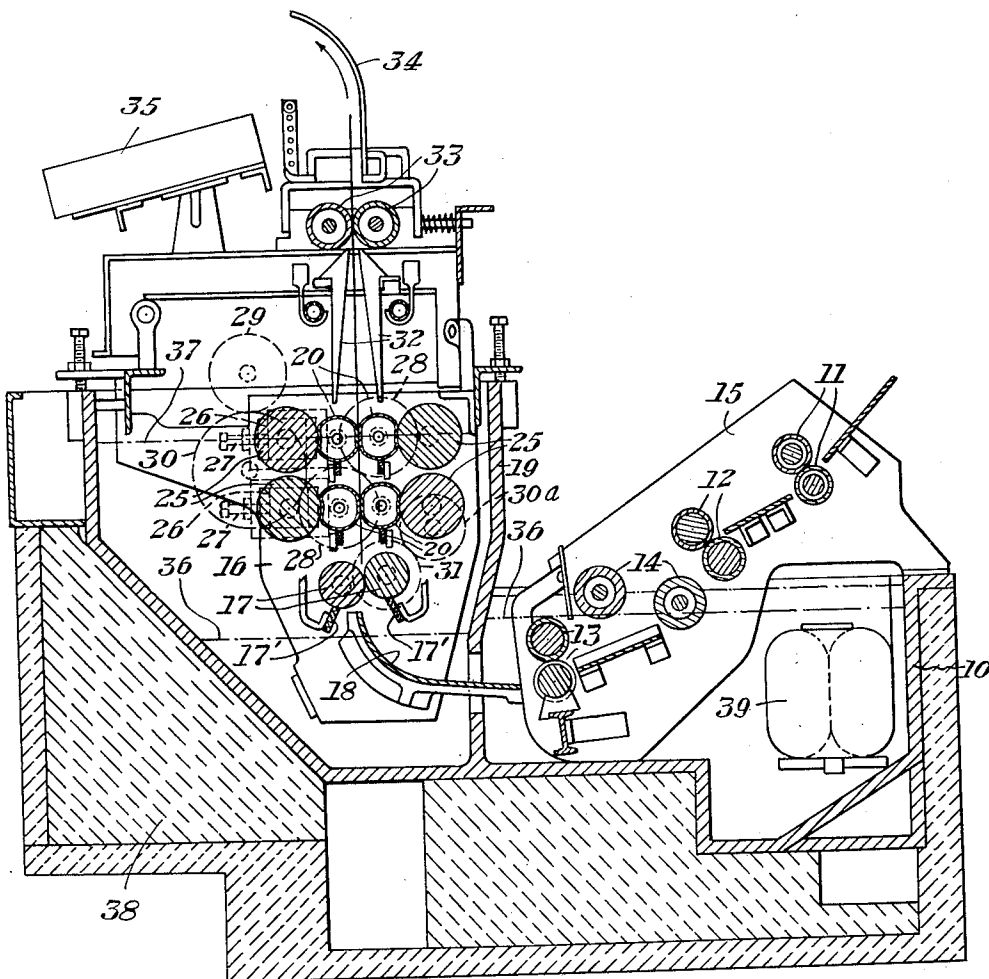
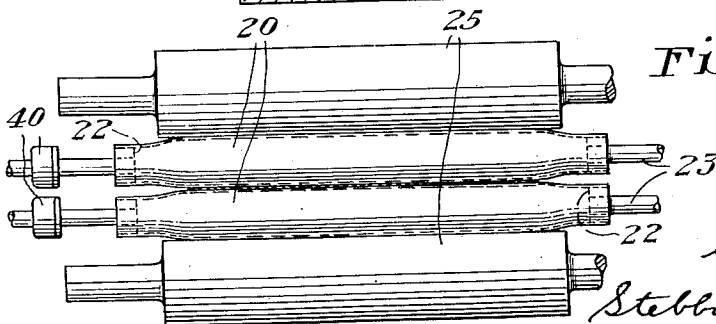


Fig. 2A.



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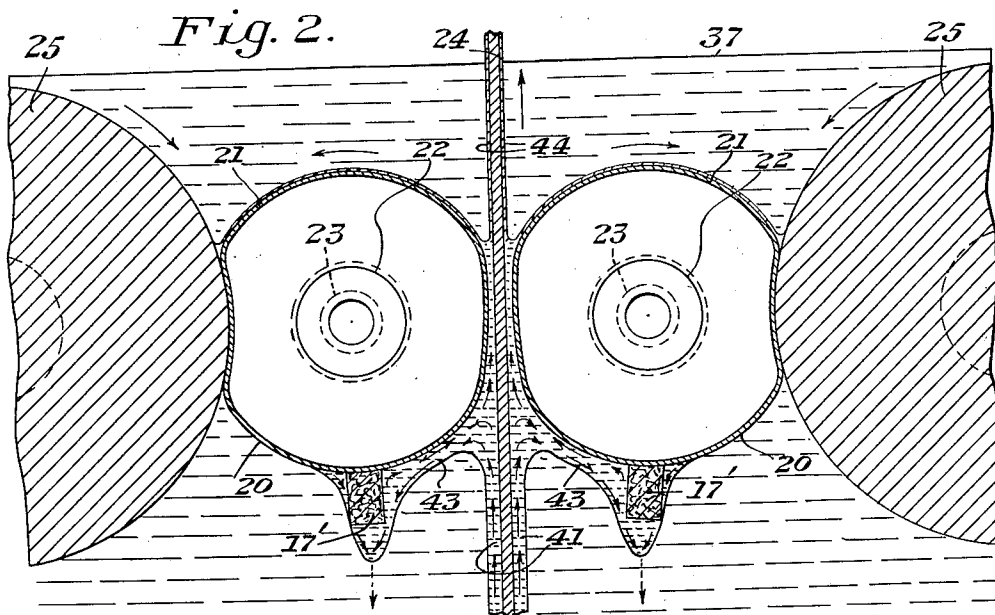
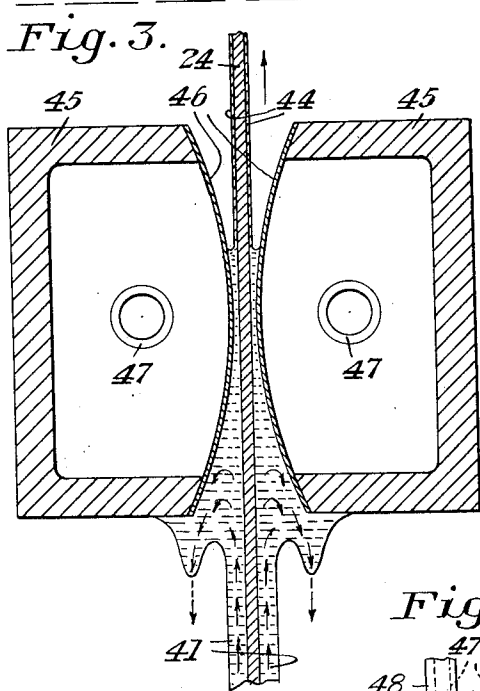
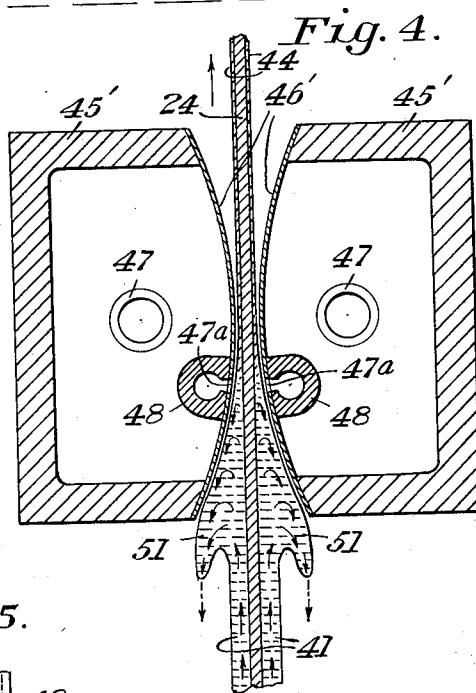
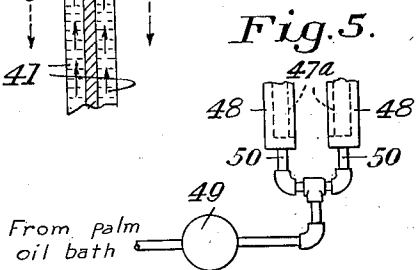
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APPARATUS FOR COATING SHEET METAL

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2 Sheets-Sheet 2



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APPARATUS FOR COATING SHEET METAL

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Application October 31, 1940, Serial No. 363,652

4 Claims. (Cl. 91—12.5)

This invention relates to the coating of sheet or strip metal and, particularly, to the tinning of steel sheets.

It is desirable for various reasons that the protective coating of tin applied to steel sheets or strip be as thin as possible. One of these reasons, of course, is the cost of the tin itself. Another reason is that a thin coating exhibits better adherence than a thick coating under deformation of the coated material.

It is the general belief that the tin coat on a steel sheet includes a bottom alloy layer and an outer layer of tin several times thicker than the alloy layer. Attempts have been made heretofore to reduce the thickness of the tin layer by increasing the pressure exerted on the coated strip by the exit rolls of the conventional tinning apparatus. It has been found, however, that when the adjustment of the exit rolls is such as to reduce the amount of tin applied to the sheets below about 1.35 pounds per base box, the surfaces of the tin sheets are not uniformly bright in appearance, but, instead, are dull and streaky. This condition, known as scruff streaks or bands, appears to be the result of wiping off the tin layer clear down to the alloy layer. Regardless of its cause, it precludes the sale of the coated sheets as prime material. For this reason, it has been generally believed that the thickness of the tin layer cannot be reduced much below that corresponding to a total weight of tin per base box of about 1.35 pounds.

I have invented a novel apparatus whereby the thickness of the layer of pure tin formed on steel sheets or strip by passage through a bath of molten tin or by some other method of applying molten tin may be reduced considerably below that usually obtained heretofore, without producing scruff streaks. In a preferred embodiment and practice of the invention, I subject the material emerging from the bath of molten tin to the action of a pair of wiping members each including a flexible wall. I am thus able to exert enough pressure on the emerging sheet to wipe off more of the excess tin than it has been possible to remove heretofore but at the same time, I avoid solid contact between the wiping members and the material and thereby prevent removal of the tin clear down to the alloy layer which would produce scruff streaks as explained above. The wiping surfaces are preferably urged against the coated sheet passing therebetween under fluid pressure which can be accurately controlled and is uniform at all points.

The wiping members are immersed in a palm oil bath floating on the tin bath, as in the conventional tin pot. The palm oil being at substantially the same temperature as the molten tin, keeps the tin coating on the sheets or strip fluid while it is subjected to the action of the wiping members. The latter may take the form of hollow rolls having their bodies formed of thin, flexible material or may be constituted by elongated box-like members having one wall composed of such material. Further details of the apparatus of my invention will become apparent during the following complete description and explanation which refers to the accompanying drawings illustrating a typical form and practice. In the drawings:

Fig. 1 is a longitudinal central, vertical section through a tin pot which is largely of conventional design but is modified to embody my invention;

Fig. 2 is a portion of Fig. 1 enlarged considerably to illustrate diagrammatically the manner in which the apparatus functions to remove excess tin;

Fig. 2a is a plan view of the wiping rolls and backing rolls therefor;

Fig. 3 is a view similar to Fig. 2 showing a modified construction;

Fig. 4 is a similar view showing a still further modification; and

Fig. 5 is a diagram of the piping employed in connection with the modification of Fig. 4.

Referring now in detail to the drawings, a tin pot 10 is largely of conventional construction, including feed-in rolls 11, 12 and 13 and guide rolls 14 journaled in spaced side frames 15, the side frames 15 being removably disposed in the entering end of the pot 10.

In the exit end of the pot 10, side frames 16 are disposed having feed rolls 17 journaled therein. Wipers 17' engage the rolls 17 to remove any solidified particles or tin-iron crystals which may adhere thereto. A curved guide plate 18 extends through an opening in the center wall 19 of the pot to direct a sheet from the rolls 13 to the rolls 17. Above the roll 17, wiping rolls 20 are disposed in pairs, being journaled in the side frame 16. The rolls 20, as more clearly shown in Fig. 2, comprise body portions 21 having end closures 22 secured thereto. The end closures have bearing trunnions 23 projecting therefrom.

The body portions 21 of the rolls 20 are composed of thin-walled tubes sufficiently flexible to be deformed, as shown, under the wiping pres-

ures exerted on the sheet metal emerging from the coating bath, as indicated at 24. To permit this deformation, the rolls are preferably constructed as shown in Fig. 2a, the end closures 23 being smaller than the roll bodies and the latter being contracted adjacent their ends.

Backing rolls 25 are journaled in the side frame 16 and engage the body portions of the rolls 20. The backing rolls on one side of the wiping rolls are journaled in bearing blocks 26 adjustable relative to the side frames 16 by screws 27.

One of the rolls 20 of each pair has a gear 28 thereon and is driven by a motor (not shown) through gears 29 and 30, the latter meshing with one of the gears 28. The backing rolls may also be driven if desired. The rolls 17 preferably have a separate drive including a gear 31 mounted on one of the rolls and a gear 30a meshing therewith driven by a suitable motor. This permits the rolls 20 to be driven at a peripheral speed different from that of rolls 17 if desired.

Above the wiping rolls, the apparatus is largely of conventional construction including converging guides 32, traction rolls 33 and a deflector 34. The emerging sheets are finally delivered down a chute 35 to suitable apparatus for further processing. Rolls 33 may be driven at a surface speed differing from that of the rolls 20, if desired.

The level of molten tin is maintained in the two sides of the pot 10 at about the elevations indicated by chain lines 36. The level of the palm oil in the exit end of the pot is similarly indicated at 37. The entire pot is disposed in a suitable setting 38 which may be of conventional construction. An immersion heater 39 is disposed in the entry end of the pot.

In order to cause the rolls 20 to exert sufficient pressure on the emerging sheet or strip 24, to remove the desired amount of surplus tin therefrom, I provide connections 40 cooperating with the bearing trunnions 23 to supply fluid under pressure to the interior of the wiping rolls. The bodies of the rolls 20 are, of course, fluid-tight whereby the pressure exerted on the sheet may be controlled by varying the pressure of the fluid on the interior of the roll bodies. This pressure, furthermore, is uniform throughout the length of the rolls.

Referring now particularly to Fig. 2, the sheet 24 as it leaves the tin bath carries an excessively thick adherent layer of molten tin 41. The flexible-walled tubes may be made of very thin metal such as stainless steel or of a rubber composition suitable for withstanding the action of the temperature and the oil. The rolls 25 are preferably, but not necessarily, composed of non-tinning metal.

As the sheet or strip 24 ascends between the rolls 20, the excess tin is wiped off as indicated at 43 and the strip emerges from the nip of the rolls with a very thin coating of tin indicated at 44. As clearly shown in Fig. 2, the rolls 20 do not make mechanical contact with the sheet or strip. At the same time, the pressure of the fluid such as air or oil on the interior of the rolls 20, may be regulated to equalize the fluid pressure exerted by the molten tin adhering to the sheet, for any desired thickness of tin coating on the finished sheet. The molten tin acts like a lubricant to maintain separation between the sheet and the rolls, the actual separation and hence the final thickness of the tin layer depending on the pressure maintained within the

rolls 20 and the adjustment of the backing rolls 25.

Fig. 3 illustrates a modification wherein the rolls 20 are replaced by elongated box-like enclosures 45 having a thin, flexible wall 46 on one side thereof and a connection 47 for the supply of fluid under pressure. The members 45 function in the same manner as the rolls 20 to remove excess tin. One of the members is preferably adjustable relative to the other as by screws such as those shown at 27. The thickness of the tin coating on the finished product, however, is preferably controlled by varying the pressure within the members 45.

It will be apparent that the rolls 20 and the box-like members 45 serve to wipe off excess tin without mechanical contact between the wiping surface and the steel sheet or the alloy layer which forms next to it. The production of a uniformly bright coating on the surface of the sheets is thus assured and scruff marks are eliminated.

Fig. 4 illustrates a further modification generally similar to that of Fig. 3, except that the flexible walls 46' of the box-like members 45' have slots 47a therein and conduits 48 extending therealong through which hot palm oil may be discharged onto the sheet ascending therebetween. Fig. 5 illustrates a pump 49 having its inlet connected to the palm oil bath and its outlet to flexible piping connections 50 communicating with the conduits 48. As illustrated in Fig. 4, the conduits 48 discharge elongated streams of hot palm oil downwardly along the surfaces of the ascending sheet and thereby effectively wipe off excess tin as indicated at 51. With this arrangement, an oil film is maintained between the tin layer on the finished product and the flexible walls 46' which prevents contact therebetween. To aid in maintaining this condition, the walls 46' may be composed of a material such as a rubber composition or of a metal which does not tin.

It will be apparent from the foregoing description and explanation that the invention is characterized by important advantages. In the first place, it makes possible the production of tinned steel sheets unmarked by scruff streaks or bands, with a bright tin coating thinner than that provided by using about 1.35 pounds of tin per base box, which is about the limit for satisfactory tin plate produced by methods and apparatus used previously. Further advantages reside in the simplicity of the apparatus and the fact that it can be practiced by a slight modification of the conventional tin pot.

Although I have illustrated and described but a preferred embodiment and practice of the invention with certain modifications, it will be understood that changes in the structure and procedure disclosed may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. In an apparatus for tinning sheet steel including a tin pot, means for removing excess tin from the sheet metal comprising a pair of wiping rolls having bodies composed of a tube of flexible material deformable under the pressure of the liquid tin adhering to the sheet metal after its emergence from the pot, and means mounting said rolls for rotation.

2. A device for removing excess coating material, for use in an apparatus for coating sheet metal including a tank for holding a bath of molten coating metal, and feed rollers for passing

the sheet metal through the bath, said device comprising a pair of wiping members above the bath between which the sheet metal passes after emerging from the bath, at least one of said wiping members being a roll having a body presented to the emerging sheet metal and composed of a tube of flexible metal deformable under the pressure of the molten coating metal adhering to the emerging sheet metal, and means mounting said roll for rotation at a peripheral speed different from that of the feed rollers.

3. A device for removing excess coating material, for use in an apparatus for coating sheet metal including a tank for holding a bath of liquid coating material, and feed rollers for passing the sheet metal through the bath, said device comprising a pair of wiping members above the bath between which the sheet metal passes after emerging from the bath, at least one of said wiping members being a roll having a body presented to the emerging sheet metal and composed of a

5 tube of flexible material deformable under the pressure of the coating material adhering to the emerging sheet metal, and means mounting said roll for rotation at a peripheral speed different from that of the feed rollers.

10 4. A device for removing excess coating material, for use in apparatus for coating sheet metal including means for conveying the sheet metal and means for forming a coating of liquid material thereon, said device comprising a pair of wiping members between which the strip passes after traversing the coating apparatus, at least one of said wiping members being a roll having a body presented to the ongoing sheet metal and composed of a tube of flexible material deformable under the pressure of the liquid coating material adhering to the sheet metal, and means mounting said roll for rotation at a peripheral speed different from that of said conveying

20 means.

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