

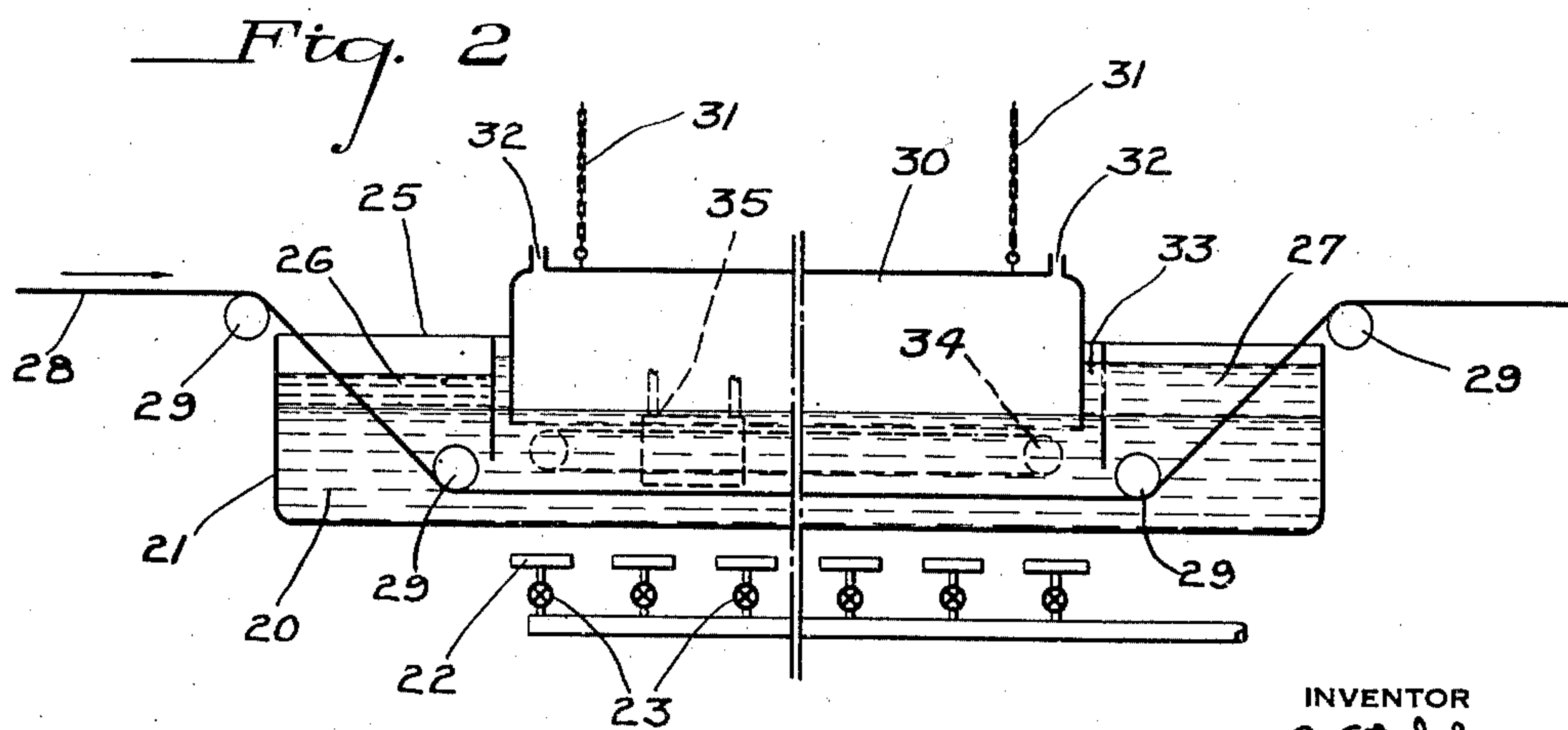
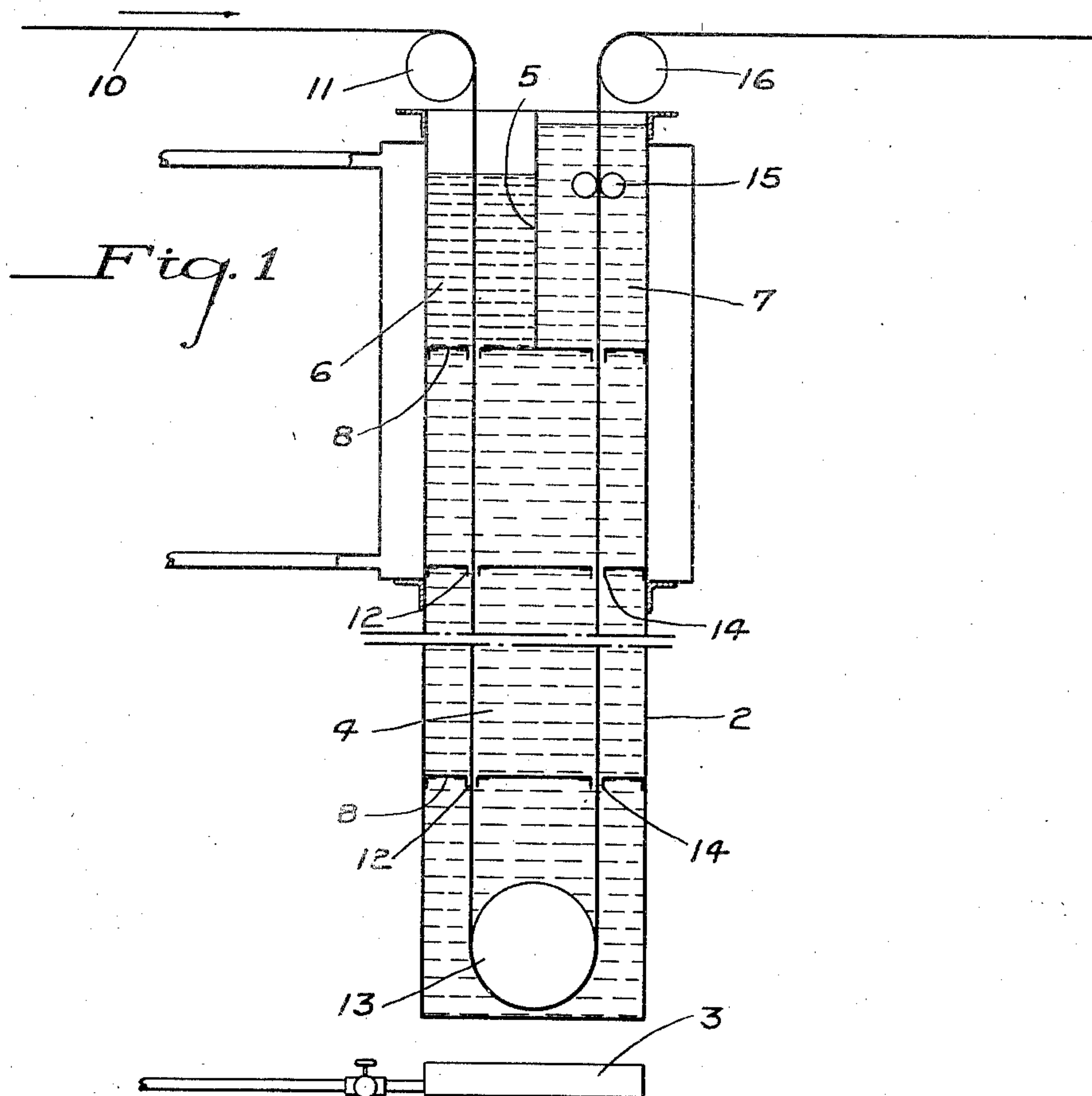
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ANNEALING AND COATING A BASE WITH A METAL

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ANNEALING AND COATING A BASE WITH A METAL

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This invention relates to annealing and coating a base with a metal, and is particularly useful for continuously annealing and coating a rolled strip with a metal, such as tin, in the continuous manufacture of tin plate, although the invention has many other applications.

I provide for annealing a base and coating it with a metal by subjecting the base to coating metal which is at a temperature at least as high as the annealing temperature of the base and cooling the same to a lower temperature in the absence of oxygen. The process is preferably carried out by immersing the base in a bath of coating metal, a portion of which is maintained at a temperature above the annealing temperature of the base, and while the base is still immersed in the bath, moving it to a portion of the bath which is at a temperature lower than the annealing point. The strip enters the cooler portion of the bath and passes to the hotter zone, where it is annealed. The strip then passes to a cooler portion of the bath, giving up the heat it has absorbed, and then passes out of the bath.

In the accompanying drawing illustrating two embodiments of the invention,

Figure 1 is a vertical section through an apparatus employing a relatively deep and narrow bath, and

Figure 2 is a similar view through an apparatus employing a relatively long and shallow bath.

Referring first to Figure 1, there is shown a relatively deep and narrow bath 2 provided with heating means 3 at the bottom portion and almost filled with a molten coating metal 4, such as tin. The top of the bath is divided into two parts by a division wall 5. A suitable flux 6 is placed on one side of the division wall and palm oil 7 is provided on the other side.

The temperature of the bath at the top portion is preferably maintained at about 450° F., while the bottom of the bath adjacent the heater is maintained at a temperature which is approximately the annealing temperature of the base, which in this case is rolled steel. The boiling point of tin is

well above this temperature, so that it is entirely feasible to maintain the lower portion of the bath at above the annealing temperature. Baffles 8 are provided for impeding circulation in the bath, thus permitting maintenance of a desired temperature gradient through the bath without undue loss of heat. A cooler 9 is used at the top of the bath to maintain the desired temperature at that point.

Strip material 10 is carried to the coating bath and passes over a guide 11, then downwardly through the flux 6 and into the molten tin. Openings 12 are provided in the baffles 8 to permit the strip to pass downwardly to the bottom of the bath. At the bottom of the bath there is provided a pulley 13 around which the strip turns and passes upwardly through openings 14 in the baffles. At the top of the bath the material passes through the palm oil 7 and between exit rolls 15 therein. It then passes over a guide 16 above the top of the bath.

In operation the unannealed base metal 10 passes through the flux and travels downwardly to the bottom of the bath. During such travel it absorbs heat from the molten metal and finally reaches a temperature at the bottom of the bath which is above the annealing point of the base. In passing upwardly the metal is cooled in the absence of oxygen. It is perfectly annealed and no opportunity is given for a coating of scale to form. On the contrary, the conditions are ideal for coating of the metal and, in fact, a much better adherence of the coating metal to the base may be expected than would be found in the ordinary tinning bath because of the fact that at the high temperature obtaining near the bottom of the bath an alloying, rather than a mere plating or coating action, is obtained.

A desirable feature of the apparatus shown in Figure 1 is that the downwardly and upwardly moving portions of the base strip are adjacent each other, so that a heat transfer is set up which saves heat otherwise lost, and the desired gradient through the bath is more easily attained.

Figure 2 illustrates an embodiment of the

invention wherein a relatively long and shallow bath is employed. The coating metal 20 is contained in a tank 21 having a row of burners 22 therebeneath. Each burner is provided with a regulating valve 23 so that the desired heat condition along the bath may be maintained. Cross walls 24 are provided adjacent each end of the bath so as to leave bath portions 25 for the reception of flux 26 and palm oil 27 at the entering and leaving ends respectively of the apparatus. A metal base 28 passes over guides 29 which guide it downwardly through the flux into the bath of molten tin and then upwardly through the palm oil.

In order to prevent oxidation of the tin, it is covered by a hood 30 suspended from chains 31. Conduits 32 are provided at either end of the hood 30. These conduits permit of supplying an inert gas, such as nitrogen, above the bath so as to prevent oxidation. The ends of the hood 30 terminate adjacent the cross walls 24, and the small space in between the hood and the cross walls and between the side walls of the hood and the tank is filled with palm oil, as indicated at 33 so as to eliminate any possibility of oxidation there.

In operation only a relatively small number of the burners 22 will be employed after the apparatus has once been brought up to the desired temperature. The burners will be so adjusted that the central portion of the bath is kept hottest.

The passage of the base through the bath will induce a flow of tin from left to right in the bath as viewed in the drawing. A bypass 34 making connection with the bath adjacent the ends of the hood 30 is provided so that the hot tin may flow from the bath at the right hand end back through the conduit to the left hand end of the bath. A cooler 35 is provided for maintaining the tin at the proper temperature.

While I have illustrated preferred embodiments of the invention, it will be understood that the invention is not thus limited, since it may be otherwise practiced or embodied within the scope of the following claims.

I claim:

1. The method of annealing a base and coating it with a metal, which includes immersing the base in a bath of coating metal at an initial temperature below the annealing temperature of the base, subjecting the base while it is still immersed in the bath to a temperature at least as high as the annealing temperature of the base, and while the base is still immersed in the bath, cooling it below the annealing temperature.

2. The method of annealing a base and coating it with a metal, which includes immersing the base in a bath of coating metal at an initial temperature below the annealing temperature of the base, subjecting the

base while it is still immersed in the bath to a temperature at least as high as the annealing temperature of the base, cooling it below the annealing temperature while the base is still immersed in the bath, and utilizing the heat given up during the cooling step to assist in heating other base material.

3. The method of annealing a base and coating it with a metal, which includes immersing the base in a bath of coating metal, maintaining one portion of the bath at a temperature at least as high as the annealing temperature of the base, and cooling the entrance and exit of the bath to a lower temperature.

4. The method of annealing a base and coating it with a metal, which includes immersing the base in a coating metal bath, maintaining a portion of the bath at a temperature at least as high as the annealing temperature of the base, cooling the entrance and exit portions of the bath below the annealing temperature to cool the base while it is still immersed in the coating bath, and withdrawing it while thus cooled.

In testimony whereof I have hereunto set my hand

ABRAM P. STECKEL.