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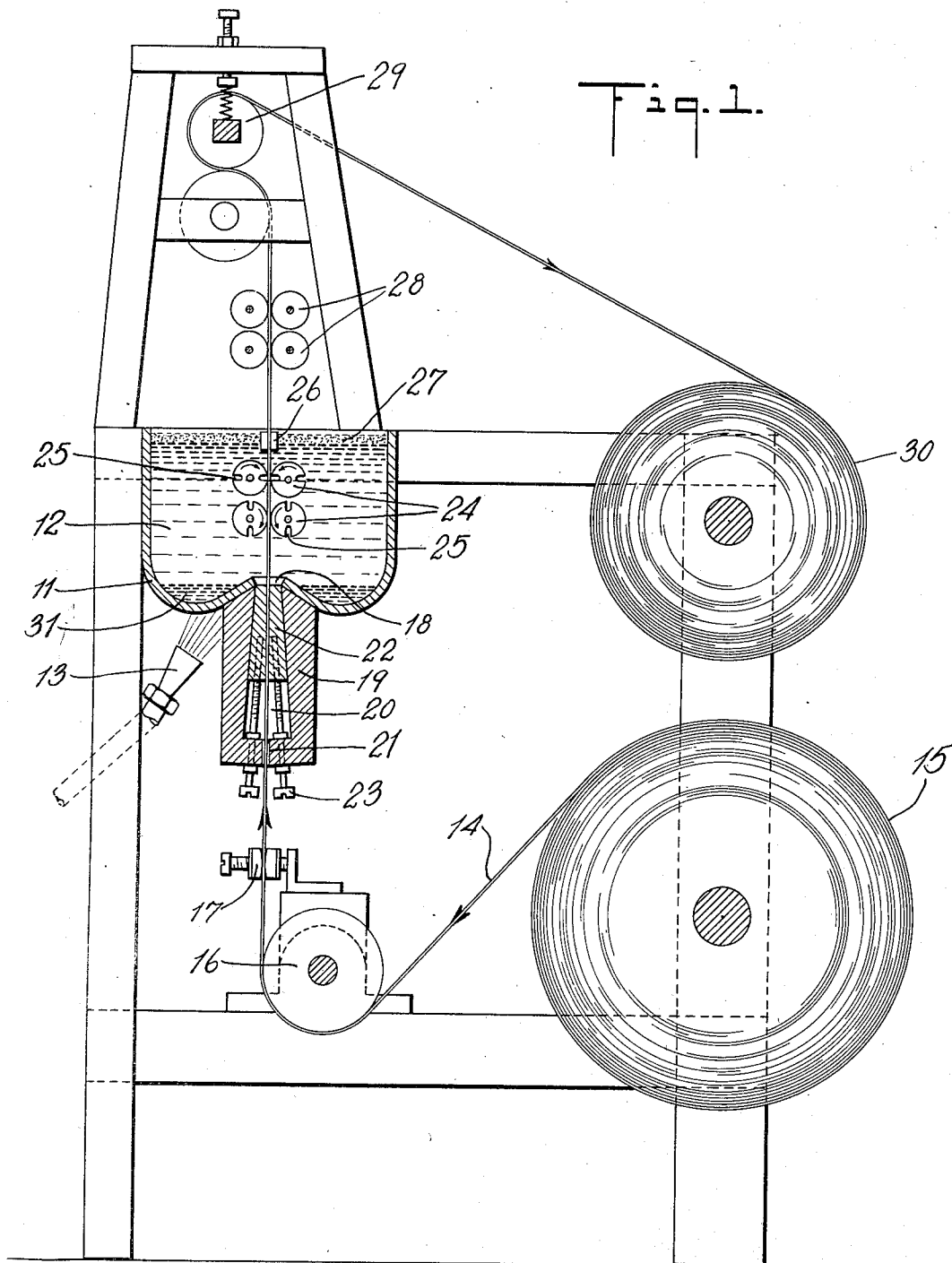
W. F. GRUPE

2,394,545

TIN PLATE MANUFACTURE

Filed Aug. 28, 1942

2 Sheets-Sheet 1



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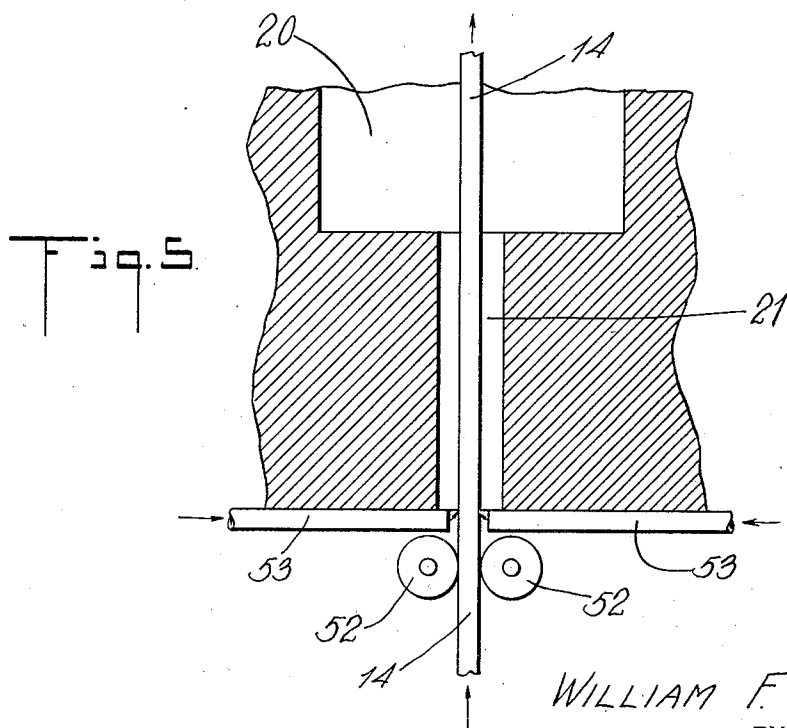
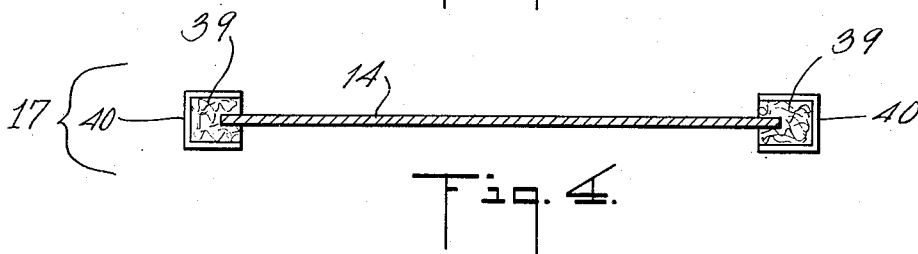
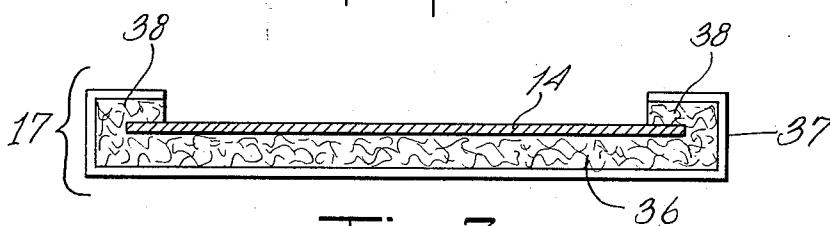
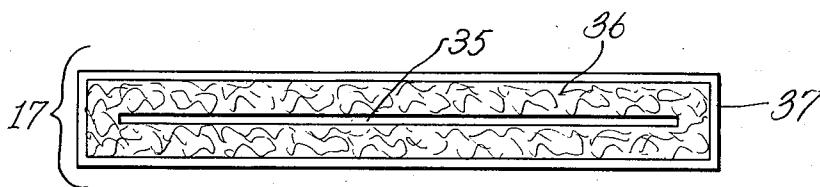
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UNITED STATES PATENT OFFICE

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TIN PLATE MANUFACTURE

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Application August 28, 1942, Serial No. 456,569

7 Claims. (Cl. 117—37)

This invention is concerned with the production of tin plate for use in the packaging of food-stuffs and the like, and it aims to provide a simple, economical method of producing tin plate, in sheets or continuous strips, with the tin applied only to predetermined areas. One phase of my invention involves a new method of feeding steel to be tinned into a tin bath; another phase of my invention involves the application of a flux, whose characteristics are determined by the bath temperature and speed of operation, to portions of a moving strip of steel, and wiping of the strip as it leaves the bath to get a strip tinned in predetermined areas.

In conventional tinning of steel by the hot dip method, a bath of molten tin maintained at 500 to 600° F. is provided in a pot having a central divider in the middle of the bath extending partially into the tin. Covering the molten tin in one-half of the bath is flux (such as zinc chloride); in the other half is palm-oil. Sheets are fed through the flux, into the tin, and out through the palm-oil, by appropriate rollers. The palm-oil is used to prevent excessive spotting of the plate by the accumulation of oxide dross at the top of the bath, while the sheets are kept at all times above the level of the tin-iron alloy dross at the bottom of the bath; in spite of all precautions, however, dross rejects are commonly obtained in considerable quantity.

Electrolytic tinning of plate has also been introduced. While the method conserves tin as compared with hot dipping (except where a definite tin thickness is required, as with some food packages) it is more expensive, and seconds are produced in considerable quantity. Furthermore, due to the light weight of tin deposited (usually ½ pound to a base box) the protection obtained is not sufficient to permit the use of such plate on wet packs.

Progress has also been made, in an attempt to conserve tin, in partial tinning of the steel plate. This method proposes to tin only at the portions of the plate which form the edges of cans which must be soldered, where tin is essential; a portion of the tinned strip and the rest of the iron, is preferably coated with varnish, etc., to protect it from corrosion, as disclosed in my Patent No. 2,174,071, issued September 26, 1939. The principal difficulty with all hitherto known methods for strip tinning is that complicated special machinery is required to protect the portions of the sheet which are not to be tinned.

I have invented a method of producing tin plate, tinned as desired, which is simple and eco-

nomical, and produces plate with a minimum of rejects. My invention, in one phase, involves a new method of feeding plate to be tinned into a bath of molten tin at a point below the oxide dross level, and above the iron-tin alloy dross level. In another phase of my invention, selective tinning is obtained by the cleaning of the object to be tinned, in selected areas, preferably by coating with a flux which remains on the plate at temperatures below those which it reaches in going through the bath, but which either evaporates or decomposes at the temperatures reached in the bath.

The invention can be best understood by referring to the accompanying drawings, which disclose various modifications of the invention as applied to webs of steel, and in which:

Fig. 1 is a diagrammatic representation of the apparatus used in the practice of my invention;

Figs. 2, 3 and 4 are cross-sections through various forms of the flux-applying mechanism used in my invention;

Fig. 5 is a detail of an alternate cleaning device.

Referring to Fig. 1, I provide a pot 11 which holds a body of molten tin or other metal or alloy 12, maintained at conventional temperatures (e. g. 550–600° F. for ordinary tin) as by a gas burner 13. The pot 11 has an opening 18 in the bottom, through which the web of steel 14 is drawn from the storage reel 15. The opening 18 is filled by a composite plug 19, having a central hollow opening 20 coinciding with the opening 18 at the top, and connecting with the outside by a slot 21 in the bottom of the plug 19. A pair of adjustable plugs 22, preferably made of mica or graphite, or, in the alternative, of metal faced with oxide or other material not wet by tin, are mounted on screws 23, so that they can completely fill the opening 18. When a run is made, they are opened just sufficiently to permit the web 14 to pass through; since the sides are not wet by the tin, no flow occurs. As speed is picked up, they may be further opened, since the cold steel chills the tin near the opening, and thus reduces the tendency to flow; at operating speeds the opening is large enough to permit the passage of lap joints of the metal.

In the tinning operation, the web 14 is fed over a driving roll 16 through a flux coater 17 which applies the flux as desired, through the slot 21 into the tin pot. One or more pairs of rolls 24 forces the tin into intimate contact with the web. These rolls are preferably driven in a direction opposite the web travel, to insure optimum cleaning action. I provide them with cut-

out slots 25, which carry the dirt off into the bath, and render the rolls self-cleaning. The web emerges from the bath through a wiper 26, which protects the web from the bulk of the oxide dross in the layer 27. This wiper may, if desired, be positioned above the bath; in this case, the dross collecting on the plate must be removed with the tin. Two pairs of rolls 28 serve to remove what dross is accumulated; the web then passes through further drive rolls 29 to a rewind reel 30.

It will be observed that the pot 11 is shaped, in cross-section, somewhat like a W, with the opening 18 well above the top of the level at which the heavy dross of tin-iron alloy 31 accumulates. Thus, the web enters into clean tin, and leaves from clean tin.

If it is desired to do merely conventional over-all tinning, the flux coater 17 may be of the form shown in Fig. 2, comprising merely a slot 35, surrounded by felt 36 impregnated with the flux, backed by a reinforcing holder 37. Ordinary zinc chloride flux may be used in such event; the excess flux will float to the top and collect with the dross in the dross layer 27.

This method, as applied to conventional over-all tinning, has very definite advantages over ordinary methods. In the first place, the positive application of the flux by means of the felt coater permits the use of oily steel, since the pressure applied, and the squeegee action, insures complete wetting of even dirty plate. Another advantage arises through the feed—a clean tin surface is hit, since the dross collects below and above the level of feed. The union of tin and steel through flux, which is prevented by dross, is complete; and the improvement is indicated by the sharp reduction obtained in dross rejects as compared to conventional processes.

Where partial tinning only is desired, it is necessary to use flux coaters of special design, and to use special fluxes. Typical applicators are shown in Figs. 3 and 4. In Fig. 3, the applicator comprises a felt 36 and holder 37, designed with overhangs 38; the strip 14 passes through the coater and contacts with the felt on one complete side, and at two edges. The resultant strip becomes tin-coated completely on one side, and at the two edges of the other side. It may be used with the completely tinned side inward, as a substitute for fully tinned cans.

Similarly, for edge coating only, two U-shaped felts 39 and holders 40 are provided. This type of blank is ordinarily varnish-coated, at least on one side.

When the strip from the coater of Figs. 3 and 4 passes through the tin bath, the tin adheres to the strip firmly only over the flux; the remainder of the strip is kept clean by the wiper 26, which removes the excess tin.

The tin may be stripped transversely to the direction of travel by printing flux onto the web, instead of by using a flux wiper.

If a horizontal feed is desired instead of a vertical feed for reasons of economy of space, the opening in the pot can obviously be made in the side thereof, instead of at the center of the bottom of the W. In such event, the pot can be of conventional cross-section.

The flux used in partial tinning must be carefully chosen if tin specks are to be avoided on the untinned surfaces. If conventional fluxes are used, the spattering of the tin throws both flux and tin at the web as it emerges, and spots occur. I have found that clean tinning can be obtained by using a flux which is volatilized or

decomposed rapidly at the temperatures attained in the bath, so that no flux floats on the surface. The flux must not be so volatile, however, that it is removed by the heat of the bath before it enters it. This lower limit obviously depends on the speed of the web, the insulation applied to the pot, etc. With an ordinary metal pot, heated to 550° F. and uninsulated, and a speed of 120 feet per minute, I find that suitable fluxes include succinic acid, ammonium succinate and ammonium lactate, or mixtures thereof; with higher speeds, more volatile fluxes, such as ammonium chloride (which decomposes before it reaches the bath at speeds of 120 feet per minute) may be used.

While fluxing is the preferred method of producing a clean surface for use in my process, the cleaning may be done by abrasive action, provided the cleaned plate is kept away from oxygen. This method of cleaning is shown in Fig. 5. There, the web 14, free of flux, is being fed through the slot 21 into the opening 20. A set of abrasive wheels 52 cleans the steel as desired—tubes 53 carrying carbon dioxide, nitrogen, or other inert gas, blow the debris away from the steel, and maintain an inert atmosphere both in the slot 21 and the opening 20, so that the steel carries a clean, unoxidized strip as desired for tinning.

While the drawings disclose the application of my invention to web steel, it can obviously be applied to sheet steel by changing the feeding devices shown so that they can handle sheets.

The application of my invention to partial tinning, by the use of volatile or decomposable fluxes, is not limited to bottom feeding, although that is the preferred method of feeding. Thus, a sheet or web coated as in Figs. 3 and 4, can be fed vertically downward into a bath of molten tin, and removed upwardly by redirecting, or downwardly through a wiper. In order to reduce dross specking with such a feed, a wiper 26, such as is shown in Fig. 1, can be used; the steel enters the bath below the surface, at a point where no oxide dross is collected. The principal difficulty with this method, as compared with the bottom feed, is that excessive drossing occurs due to oxidation of the tin.

I claim:

1. The method of making tin plate which comprises treating steel to make it receptive to tin, feeding the steel into a bath of molten tin at a point between the oxide dross level and the tin-iron alloy dross level, passing the steel through the bath, and wiping the steel to remove excess tin and dross before emergence from the bath.

2. The method of making tin plate which comprises treating steel to make it receptive to tin by applying flux to the steel, feeding the steel into a bath of molten tin at a point between the oxide dross level and the tin-iron alloy dross level, passing the steel through the bath, and wiping the steel to remove excess tin and dross before emergence from the bath.

3. The method of continuously producing tin plate from a web of steel, which comprises continuously passing the web through a flux-applying means and upwardly into a bath of molten tin above the tin-iron alloy level, and wiping the web to remove excess tin and dross as it emerges from the bath.

4. The method of making tin plate which comprises applying flux to steel, feeding and passing the steel upwardly through a bath of molten tin from a point above the tin-iron alloy level, wiping

ing the excess tin from the steel below the surface of the bath, and maintaining the tinned steel out of contact with both the main body of tin in the bath and dross thereafter.

5. The method of producing tin plate tinned in predetermined areas only, which comprises applying to a base plate in predetermined areas a flux which loses its fluxing properties on heating at the temperature of the tinning bath in which the base plate is to be tinned, passing the fluxed base plate into a bath of molten tin, wiping excess tin and dross from the plate and withdrawing the plate from the bath to produce a plate tinned only in the areas to which the flux is applied.

6. The method of producing tin plate tinned in predetermined areas only, which comprises applying to a base plate in predetermined areas a flux which loses its fluxing properties on heating at the temperature of the tinning bath in

which the base plate is to be tinned, passing the fluxed base plate into a bath of molten tin at a point between the oxide dross level and the tin-iron alloy dross level, passing the plate upwardly through the bath and wiping excess tin and dross from the plate as it emerges from the bath to produce a plate tinned only in the areas to which the flux is applied.

7. The method of producing tin plate tinned in predetermined areas only, which comprises cleaning a base plate in predetermined areas only to make the plate receptive to tin in the predetermined areas, passing the plate upwardly through a bath of molten tin from a point above the tin-iron alloy level, wiping excess tin and dross from the plate to produce a plate tinned only in the cleaned areas and immediately withdrawing the plate from the bath.

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