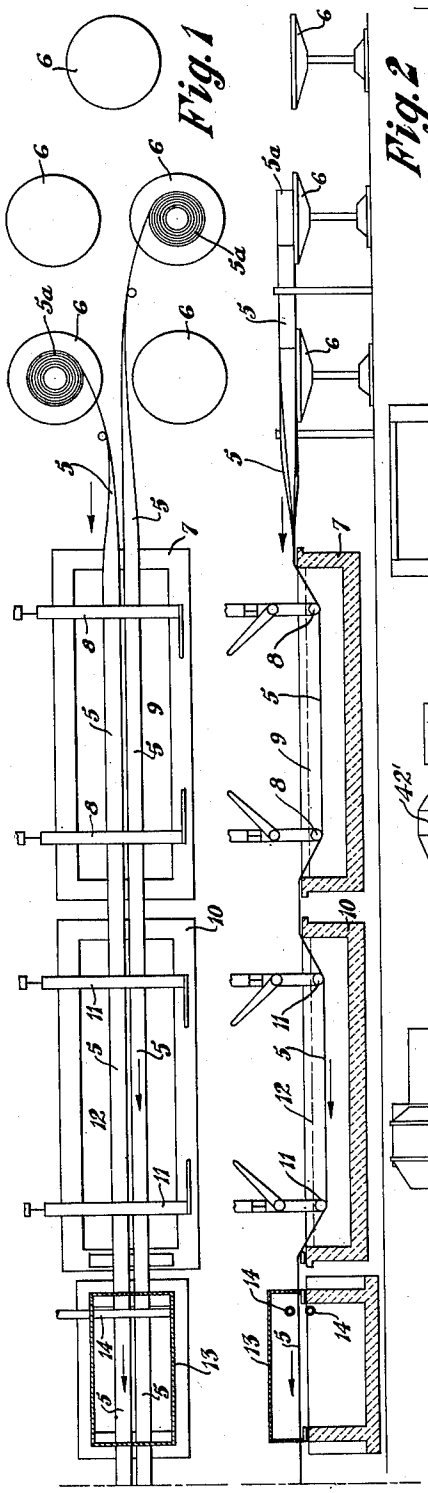
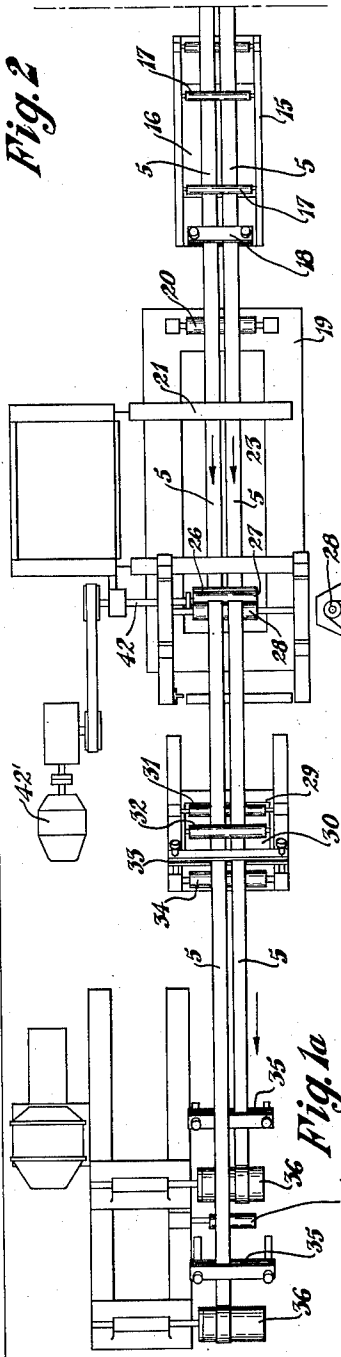
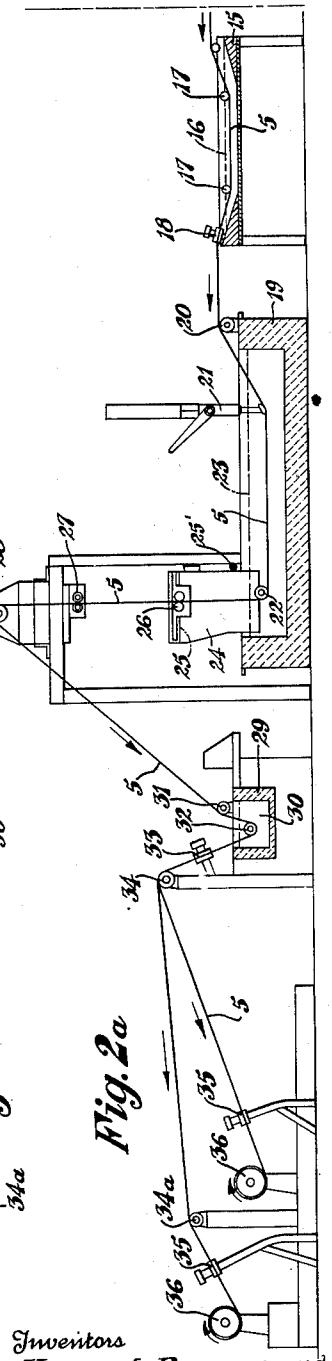
Aug. 9, 1938. H. A. ROEMER ET AL 2,126,578

METHOD OF TERNE COATING

Filed July 29, 1935 2 Sheets-Sheet 1







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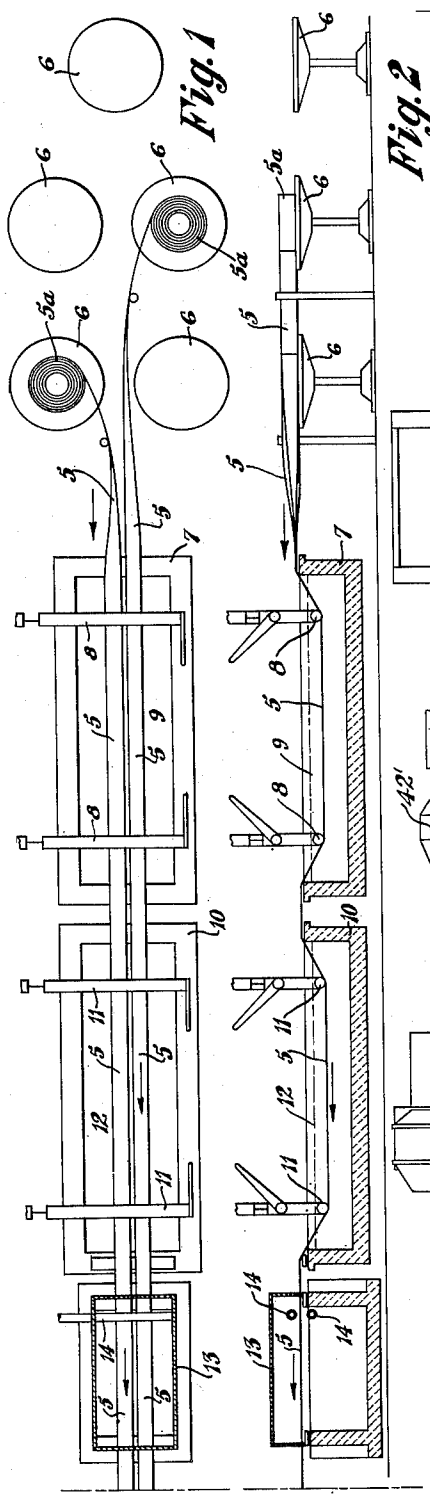

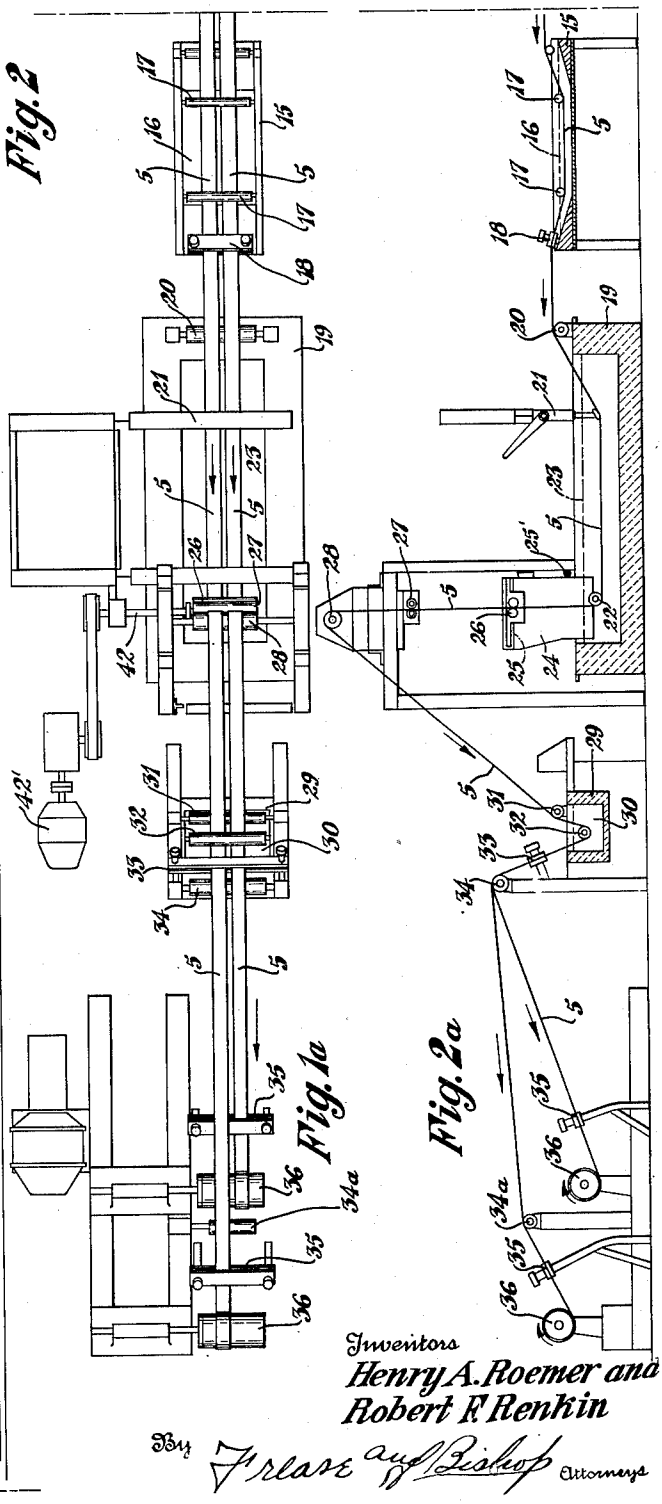

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2,126,578

METHOD OF TERNE COATING

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Application July 29, 1935, Serial No. 33,630

1 Claim. (Cl. 91—70.2)

The invention relates to the terne coating of steel sheets, strips, stripsheets, and the like, and to terne coated strip steel, and more particularly to the production of a smooth, even, uniform and lustrous terne coating.

Terne coated sheets have been made by passing sheets through a molten terne bath and wiping the same between wiper pads as they emerge from the bath; but the terne coating on such sheets is relatively thin and does not have a uniform surface because scratch-like lines appear or occur on the surface of the coating, resulting from the action of the wiper pads. For these reasons, the terne coating of sheets in this manner is more or less impractical and is seldom used.

The common practice of making terne coated sheets consists in passing sheets through a molten terne bath in an otherwise standard tinning machine in which two or more sets of exit rolls not only feed the sheets from the machine, but serve as coating and wiping rolls to control in a measure the character of the coating. However, the terne coating on sheets coated in accordance with the common practice outlined is relatively heavy and is uneven and non-uniform in thickness and appearance.

Moreover, terne coated sheets made in accordance with common practice always have a so-called "list" edge resulting because as the rear edge of each sheet emerges from the coating machine rolls, the sheet edge, by capillary attraction, picks up the molten metal and contained impurities which gather at the exit side of the nip of the coating and wiping rolls between each roll and the adjacent sheet surface.

Another difficulty which is encountered in the common practice of machine coating sheet metal is chattering; and the same occurs because it is almost impossible to run all of the feeding, coating and wiping rolls of a coating machine so that the peripheral speed of each roll is the same. Chattering should be avoided if possible, because of the deleterious effect of the same upon the coating surfaces.

Accordingly, it is a general object of the present invention to avoid the difficulties experienced in the prior common practice of terne coating.

It is also an object of the present invention to provide a method of terne coating sheets, strips, stripsheets, and the like, in which an absolutely uniform, smooth, even and lustrous terne coating is produced, substantially thicker than the thin, impractical terne coating made by using wiper pads; and substantially thinner than the heavy, uneven terne coating made in the usual tinning machine with a molten terne bath.

Moreover, it is an object of the present invention to provide a method of terne coating sheets, strips, stripsheets, and the like, by which the speed of coating may be materially increased over that utilized in common practice.

Likewise, it is an object of the present invention to provide a method of terne coating sheets, strips, stripsheets, and the like, by which the chattering occurring in common practice is eliminated, and in which the necessity of driving all rolls contacting the material during the terne coating operation at the same peripheral speed is avoided.

It is a further object of the present invention to provide a new method of terne coating sheets, strips, stripsheets, and the like, by which a buffed or polished coated surface results on the material being processed.

Heretofore, it has never been possible to make terne coated steel strips with a practical, satisfactory or acceptable terne coating thereon, because when it is attempted to make terne coated strips in accordance with prior practice, a dross-like gathering occurs periodically at irregular intervals on the coated strip, apparently due to a gathering of terne-iron alloy on the coating rolls which is transferred periodically to the strip.

It is therefore another object of the present invention to provide a terne coated strip steel product having a uniform terne coating thereon.

It is also an object of the present invention to provide a terne coated strip steel product with a coating having a smooth, even, lustrous, buffed or polished finish.

We have discovered, in carrying out the improved method of making terne coated steel strips, that by preceding the coating steps with a continuous annealing step, a terne coated steel strip with a uniform, lustrous finish may be continuously made from strip steel initially in a hard state, such as cold rolled strip steel or insufficiently annealed hot rolled strip steel.

It is therefore a further object of the present invention to provide a new method of making terne coated strip steel from strip steel in a hard state such as cold rolled or insufficiently annealed hot rolled strip steel.

And, finally, it is an object of the present invention to materially improve terne coating methods and products; to reduce the cost and increase the speed of terne coating; to avoid the prior art terne coating difficulties; and to generally advance the art of terne coating.

These and other objects may be obtained by the novel methods and products hereinafter claimed, and described with reference to the accompanying drawings in which—

Figure 1 is a diagrammatic plan view of the forward end of a line of apparatus which may be utilized for carrying out the improved method and in making the improved product;

Fig. 1*a* is a diagrammatic plan view of the remainder of apparatus which may be used following that shown in Fig. 1;

Fig. 2 is a diagrammatic side elevation view, with certain parts in section, of the apparatus shown in Fig. 1;

Fig. 2*a* is a diagrammatic side elevation, with certain parts in section, of the apparatus shown in Fig. 1*a*;

Fig. 3 is an enlarged fragmentary elevation section of some of the apparatus shown in Figs. 1*a* and 2*a*; and

Fig. 4 is a sectional view taken on the line 4—4, Fig. 3.

Similar numerals refer to similar parts throughout the various figures of the drawings.

In carrying out the improved method, a steel strip generally indicated at 5, is continuously annealed by pulling the same from a coil 5*a* on a feed reel 6 through a tank 7 having hold-down rolls 8 and containing a molten lead or salt bath 9. The strip 5 then passes through a pickling tank 10, provided with hold-down rolls 11 in which tank 10 a usual pickling solution 12 is contained.

The purpose of passing the strip 5 through the continuous annealing tank 7 is to anneal the strip from its initially hard state such as cold rolled strip steel or insufficiently annealed hot rolled strip steel. However, if the steel in the coil 5*a* is sufficiently soft, the strip 5 may be fed directly to the pickling tank 10 without passing it through the continuous annealing tank 7.

The strip 5 is then passed from the pickling tank 10 through a washer 13 located immediately after the pickling tank 10; and the washer 13 is preferably provided with spraying devices 14. Thereafter, the strip is passed through a flux tank 15 containing a usual liquid flux 16, and provided with hold-down rolls 17 and an exit wiper 18.

A terne coating pot 19 is located immediately beyond the flux box or tank 15 and the pot 19 is provided with the usual entry roll 20, hold-down device 21 and exit hold-down roll 22. The terne coating pot 19 contains a molten terning bath maintained at a temperature of from 600° to 750° F., depending upon the particular composition of the bath. The bath composition is preferably 25 per cent tin and 75 per cent lead, but the same may be varied, if desired, to contain up to 38 per cent tin and 62 per cent lead.

The strip 5 after passing through the molten terning bath 23, emerges therefrom into a compartment 24 containing palm oil 25 maintained by a gas burner 25′ or the like, at preferably 460° F., or somewhere within the range of 425° F. and 480° F., and then passes between buffing rolls, generally indicated at 26 and hereinafter described more in detail.

After being pulled between the buffing rolls 26, the strip 5 is cooled by passing it between squeeze rolls 27, over a pull-over roll 28, and into a cooling and cleaning tank 29 containing cold palm oil 30. The cooling and cleaning tank 29 is preferably provided with an entrance roll 31 and a hold-down roll 32; and the strip 5 then passes through a palm oil wipe 33, over one or more pull-over rolls 34 and 34*a*, and thence through an additional wipe 35 to a coiler reel 36 whereon the strip 5 may be again coiled.

A plurality of strips 5 are shown in the drawings as being continuously terne coated simultaneously. However, a wide strip may be individually continuously terne coated; or three or more narrow strips may be simultaneously terne coated, depending upon the width capacity of the apparatus.

Successive coils 5*a* of course are placed on the feed reels 6, in accordance with common strip handling practice, and as one coil 5*a* is used up, the end of the same is spot welded to the end of another coil 5*a* placed on the feed reel. When the welded joint reaches a coiler 36, the same may be cut out, the coil of coated strip metal removed from the coiler, and a new coil started on the coiler 36.

The coiler 36 supplies the pull to pass the strip continuously through the annealing tank 7, the pickling tank 10, the washer 13, the flux box 15, the terning pot 19, the buffing rolls 26, the cleaning tank 29, etc.; so that the strip is maintained taut between the various entry, exit, hold-down and pull-over rolls of the said devices.

Referring more particularly to Figs. 3 and 4, wherein a fragmentary portion of the terning pot 19 is shown containing the molten terning bath 23, the compartment 24 containing hot palm oil 25 is formed by box-like walls 37 open at their upper and lower ends. The lower ends 38 of the walls 37 project into the molten terning bath so that the hot palm oil 25 floats on top of that portion of the terning bath within the compartment 24, somewhat lowering the level of the molten terning bath within the compartment as shown at 39, due to the weight of the palm oil.

The buffing rolls 26 are positively rotated in directions tending to oppose forward motion of the strip 5, as shown by the arrows in Figs. 3 and 4; and the buffing rolls 26 may be driven through gearing 40 and 41 by a drive shaft 42 connected with any suitable source of power, such as the motor 42′ (Fig. 1*a*).

Each buffing roll 26 is a rigid, preferably metal roll having a polished surface maintained in that condition by the wipes 43, which are mounted at 44 in spring pressed relation to the rolls 26, on the brackets 45; and the rolls 26 are also journaled in brackets 45. The rolls 26 are maintained in opposed contacting relation with the strip 5 by the spring pressure device 46, so that as the strip 5 emerges or is withdrawn from the terning bath 23, the terning operation is completed by finally passing the strip, while maintained heated by the hot palm oil bath 25 and before the terne coating solidifies, between the rolls 26, which continuously buff or finish the terne coated surfaces of the strip while still plastic, to provide a smooth, even, uniform and lustrous terne coating on the strip 5.

The buffing or finishing rolls 26 not only provide highly polished, buffed, terne coated surfaces on the strip 5, but likewise wipe and squeeze excess coating metal from the strip surfaces.

The strip 5 is provided with a uniform and even buffed or polished terne coating thinner than has ever been to our knowledge provided in terne coating steel products. We have found that a smoother and more lustrous terne coating weighing approximately two pounds to one hundred pounds of steel results in carrying out the new

method, as compared with the common practice of making terne coated sheets wherein the coating weighs approximately four pounds per one hundred pounds of steel, for material of the same gauge.

Moreover, the improved terne coating method may be carried out much faster than is the case in the common practice of making terne coated sheets; it being possible with the improved method to increase the speed of the material being coated 50 per cent or more in excess of the usual material speeds utilized in terning operations.

For comparative experimental purposes, we have operated the equipment shown in the drawings in accordance with common sheet terning practice by driving the rolls **26** in the opposite direction to that shown by the arrows in Fig. 3.

When the rolls **26** are so driven, the coated strip is very similar, in appearance and coating weight, to sheets produced in accordance with common practice; and the apparatus must be operated at the slower speed ordinarily used in common sheet terning practice. Moreover, the coated surfaces of the strip were characterized by the spasmodic appearance thereon of dross-like gatherings, apparently due to the same causes, which result in the list edge in common sheet terning practice. Such terne coated strips were, however, so inferior in surface characteristics as to be commercially unacceptable and therefore worthless.

However, a coiled steel strip having a smooth, even and uniform terne coating thereon results when the new method is carried out; and the coated surfaces are smoothed, buffed and uniformly lustrous polished surfaces on a strip steel base.

Moreover, the improved method avoids the chattering difficulties heretofore encountered in common terne coating practice, because there are no driven rolls contacting with the coated strip surfaces after the strip leaves the molten terning bath, which have to be driven at exactly the same peripheral speed as a next succeeding or preceding stand of driven rolls.

In the new method described herein, as the strip is withdrawn from the molten terning bath, it is immediately passed or pulled between the buffing or finishing rolls **26**, which are rotating to oppose forward motion of the strip. The rolls **26** therefore hold the strip taut between the rolls **26** and the coiler **36**. Moreover, the rolls **26** control the thickness, uniformity and surface finish of the tern coating on the strip **5**.

The terms "strip steel products", "strip steel product", and "coated steel product", when used herein and in the appended claims, are intended to include coated steel sheets, coated steel strips, coated steel stripsheets, and the like.

While we have diagrammatically shown and described certain specific forms of apparatus to be used in carrying out the new methods to make the new products claimed, it is to be understood that we do not wish to be limited exactly to such particular apparatus, since various modifications may be made in the types and kinds of apparatus used, which will be apparent to those skilled in the art, without departing from the scope of the invention, as defined in the appended method and product claim.

We claim:

In a method of making terne coated strip steel products having smooth uniformly finished surfaces, the steps consisting of passing a strip through a molten terning bath, then passing the strip through a heated oil bath, and completing the terning operation by roll buffing the strip surfaces coated in the molten terning bath before the coating solidifies by subjecting both sides of the strip simultaneously to a final rigid metal roll buffing pressure rolling in a direction opposing forward motion of the strip immediately after the strip emerges from the molten terning bath and while the strip is in the heated oil bath.

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