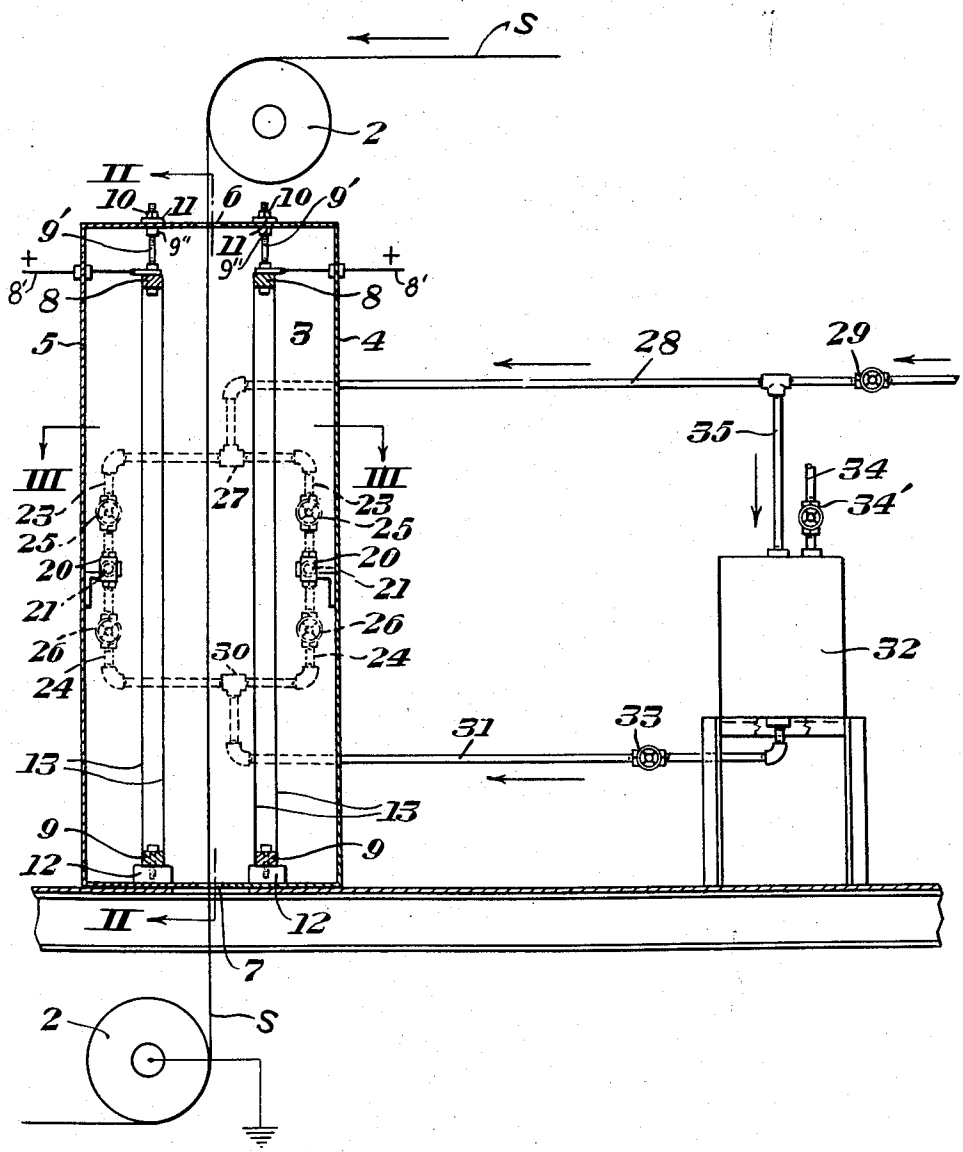
Jan. 19, 1954 A. E. KADELL 2,666,716

METHOD FOR APPLYING A LIQUID FILM TO STRIP-LIKE MATERIAL

Original Filed Nov. 15, 1944 2 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

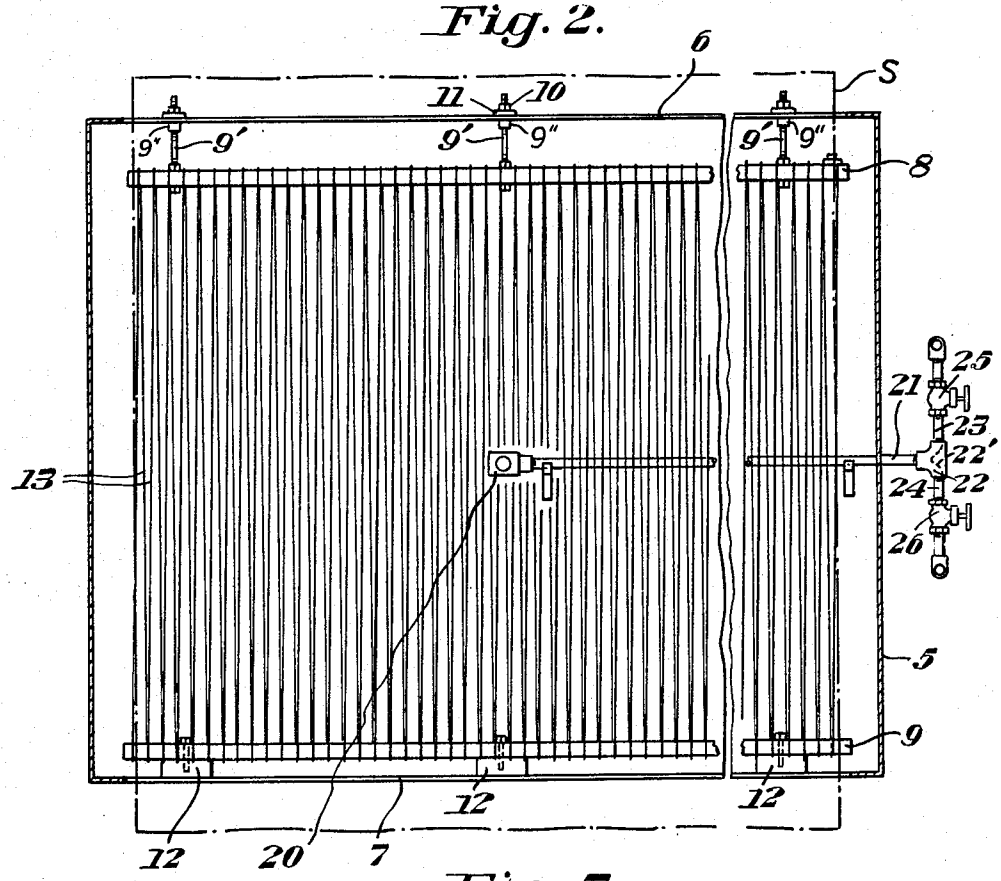
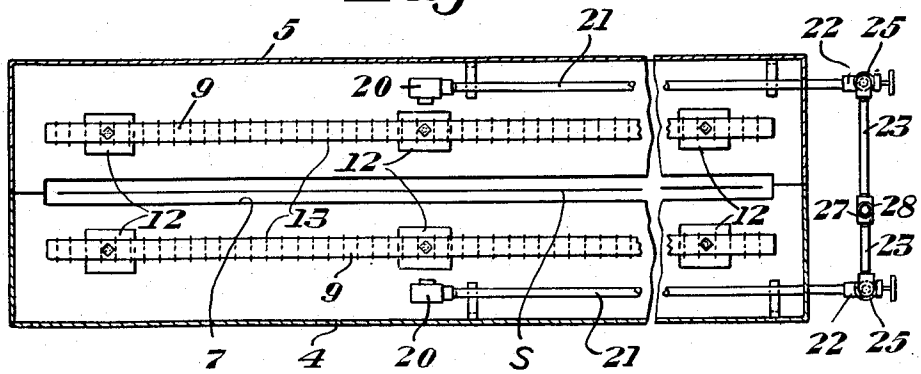


Fig. 3.



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METHOD FOR APPLYING A LIQUID FILM TO STRIP-LIKE MATERIAL

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1 Claim. (Cl. 117—68)

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The present invention relates to a method of applying a thin film of a liquid to strip-like material. More particularly, it relates to the application of an oily liquid to metal in strip-like form and is especially useful in the application of an oily liquid to electro-coated tin plate at the conclusion of the coating, washing, and reflowing operations. However, it will be obvious from what is stated hereinafter that my invention is not limited to the application of an oily liquid to tin plate but may be employed wherever it is desirable to apply a liquid in finely divided form to strip-like material regardless of whether it has been coated previously.

In the manufacture of electro-coated tin plate, it has been found desirable to provide a thin coating or layer of oil, or some oily liquid such as dibutyl sebacate, on the coated strip after the coating operation has been completed. The oil is desired in order to facilitate mechanical handling of the product. Without the oil, the sheets stick together and, in general, do not work well in automatic machines. The amount of oily liquid necessary to eliminate these difficulties is quite small. Approximately, one-tenth gram to one-half gram per base box has been found preferable. If too much oil is applied other objectionable factors are introduced in lacquering, soldering, labeling, etc.

Heretofore, oil has been placed upon the strip by a Branner machine, but this machine, due to inherent limitation, cannot be utilized satisfactorily to put oil on the strip at the speeds required in the high speed electro-coating lines now employed in this art. While the Branner machine will supply some oil to electro-coated tin plate at the speeds which are normally employed, the oil is not applied with any degree of uniformity.

I have found that suitable oily liquids, such as dibutyl sebacate, palm oil or the like may be applied to the strip in the desired amount and at the high speeds employed in electro-coating lines by atomizing the oily liquid and passing it into an electrostatic field which charges the particles and causes them to be attracted to and deposited on the strip as it is passed through the field.

In accordance with my invention, the strip, which is suitably grounded, is continuously

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moved past an electrode which is connected to a suitable power source. The electrode may be of any suitable form, although I have found that desirable results can be achieved by using a plurality of wires of the character described hereinafter. The oily liquid to be applied to the strip is passed into the space between the strip and the electrode in a finely divided condition. The electrode with a desired voltage impressed on it charges the droplets of oil which come into its proximity. Since the strip is charged with a potential of opposite polarity, the oil droplets are attracted to and deposited on the strip. Where electro-coated tin plate is being coated with a thin film of oily liquid, both sides must be coated and, consequently, an electrode connected to a suitable power source is provided on each side of the strip. Likewise, carburetting, atomizing or vaporizing means are provided on both sides of the strip to pass the oily liquid in finely divided condition to both electrostatic fields. The amount of oil deposited on the strip can be controlled or regulated by increasing or diminishing the voltage impressed upon the electrodes or it may be controlled or regulated by increasing or diminishing the amount of oily liquid passed to the electrostatic field. Of course, in all cases sufficient oil must be provided in the field or no amount of voltage will produce the desired coating. These factors must be correlated properly in order to give the desired results.

This application is a division of my application Serial No. 563,564, filed November 15, 1944, for "Apparatus for Applying a Liquid Film to Strip-Like Material," and now abandoned.

In the accompanying drawings, I have shown, for purpose of illustration only, one embodiment of my invention as applied to the oiling of electro-coated tin plate. In the drawings,

Figure 1 is an elevational view, partly in section, showing one form of apparatus which may be used in carrying out my invention;

Figure 2 is a vertical section taken along the line II—II of Figure 1; and

Figure 3 is a horizontal section taken along the line III—III of Figure 1.

After the strip S has been coated and just before it passes to the coiling apparatus, it is passed through the apparatus for electrostatical-

ly applying the film of oily liquid. In order to properly guide the strip through the oil applying apparatus the strip passes around suitable guide rollers 2. Between the rolls the strip passes through a chamber 3 which is formed of open-faced boxes 4 and 5. The juxtaposed edges of the top and bottom walls of the boxes 4 and 5 are cut away so as to provide slots 6 and 7 through which the strip may pass. Each of the boxes 4 and 5 is provided with an upper bus bar 8 and a lower bus bar 9. Each of these bars extends transversely throughout substantially the entire width thereof, and each upper bus bar 8 is connected to the positive side of a source of electric current by a lead wire 8'. Each bus bar 8 is supported from the top wall of the box in which it is mounted by means of bolts 9' which extend through the upper wall. Nuts 10 and washers 11 are provided for holding the bolts, and hence the bar mounted thereon, in any desired position. The bolts 9' should be insulated from the top wall of the box in any suitable manner. For example, bushings of dielectric material 9'' can be placed between the bolts 9' and the top of the box. Likewise, the washers 11 should be made of dielectric material. Each lower bus bar 9 is mounted on insulating blocks 12 for electrically insulating it from the box.

A wire, or a plurality of wires, extend between each upper bus bar 8 and each bus bar 9. In the apparatus shown in the drawings, a single continuous wire 13 is wound around the top and bottom bus bars, the turns being spaced apart approximately one inch. Tungsten wire having a diameter of approximately .075 inch may be used.

The guide rolls 2 are grounded electrically. An electrostatic field is set up between the wires and the strip on each side of the strip, and particles of liquid which are projected into that field are forcibly projected against the surfaces of the strip.

Various ways of supplying oil or some other suitable oily liquid to the chamber 3 can be employed. In the apparatus shown in the drawings, an atomizer or carburetting device 20 is provided between the vertically extending wires and the back of each shell, and these carburetting devices are preferably positioned approximately centrally of each shell. Oil and air under pressure and supplied to each carburetor or atomizer 20 through the horizontally extending pipe 21. Each pipe 21 is connected to a fitting 22 which is connected to a compressed air line 23 and an oil line 24. Each fitting 22 is provided with a baffle 22' for directing both the oil and air into the pipe 21. A valve 25 is positioned in each air line for regulating the amount of air under pressure which is supplied to the carburetting device and a valve 26 is positioned in each oil line 24 for regulating the quantity of oil supplied to the fitting 22 and the carburetting device 20. The air lines 23 from the carburetting devices are joined to a fitting 27 which is connected to a line 28 which is in turn connected to a suitable source of compressed air. A regulating valve 29 is provided in the line 28. Each oil line 24 is connected to a fitting 30 which is also connected to a line 31 through which oil is fed from a tank 32 to the carburetting devices. A valve 33 is mounted in the line 31 to regulate the supply of oil to the carburetting device. Oil is fed to the tank 32 through a supply line 34 having a valve 34' therein. Compressed air from the line 28 is fed to the upper end of oil tank 32 by a line 35 for maintaining the oil under pressure.

In the apparatus just described, oil under pressure is fed from the tank 32 to the fittings 22 and to the carburetting devices 20. Air under pressure of approximately 100 pounds per square inch is likewise fed to the fittings 22 and the carburetting devices 20 which are connected thereto. The air and oil are mixed at the fitting and, since the oil is under a substantial pressure, when it is discharged from the carburetting device 20 it is broken up into small particles dispersed in a gaseous medium, air, which are discharged into the areas between the electrodes and the strip. Due to the fact that the electrodes are each connected to the positive side of an electric circuit and due to the fact that the strip is grounded, an electrostatic field is created between each electrode and the strip and the small atomized particles of oil are propelled against the strip.

The amount of oil deposited on the strip as it is continuously carried past the electrodes is determined, in large measures, by the voltage applied to the electrodes. I have found that even though the voltage impressed on the electrodes is relatively small some oil will be deposited on the strip. For example, it is possible to provide a substantial amount of oil on the strip by utilizing an E. M. F. in the neighborhood of 500 or 1000 volts. However, the higher voltages are preferable. I found that where direct current is employed, the voltages may be varied over a relatively wide range. For example, voltages as low as 100 and as high as 17,000 may be employed.

While direct current is preferable, it is not essential to the success of my invention. An intermittent, unidirectional current may be employed and suitable results obtained. Likewise alternating current may be employed.

The oily liquid which I preferably use is dibutyl sebacate. However, palm oil and other oils may be employed. It is only necessary that the liquid have the properties desired and be capable of being propelled electrostatically in finely divided state, against the strip. Dibutyl sebacate is preferred as it is liquid at the ambient temperatures prevailing in the apparatus. Where palm oil and other similar oils are used it is necessary to heat them in order to adequately vaporize or atomize them.

In the apparatus shown in the drawings, the oil is vaporized by a mechanical carburetting device. In carrying out my invention, it is not necessary to mechanically atomize the oil as it may be vaporized by heating. It is merely necessary to atomize or vaporize the liquid to such an extent that the electrostatic field created between the electrodes and the strip will charge the particles to a sufficient extent to drive them against the rapidly moving strip.

I claim:

The method of continuously applying a minute but controlled amount of oily liquid in a thin uniform layer to each surface of electro-coated tinplated strip delivered from an electrolytic high speed tinplating line, which method comprises continuously passing the tinplated strip from the line through a zone at a high speed corresponding to the speed of the strip in the line, forming an electrostatic field in the zone on both sides of the strip including the step of applying a potential of one polarity to the strip, atomizing a stream of oily liquid to form finely divided particles of oily liquid dispersed in a gaseous medium, passing the atomized oily liquid into the electrostatic field

on both sides of the strip so that particles of oily liquid charged to a polarity opposite the polarity of the strip are propelled to each surface of the strip, and controlling the amount of oily liquid passed into the field and the intensity of the electrostatic field in accordance with the speed of the strip moving through the zone to deposit on both surfaces of the strip a uniform film of oily liquid in a quantity at least equal to 0.1 gram and no greater than 0.5 gram of oily liquid per base box.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,855,869	Pugh	Apr. 26, 1932
2,191,827	Benner	Feb. 27, 1940
2,221,338	Wintermute	Nov. 12, 1940
2,334,648	Ransburg	Nov. 16, 1943

FOREIGN PATENTS

Number	Country	Date
591,474	Great Britain	Aug. 19, 1947