

Sept. 25, 1956

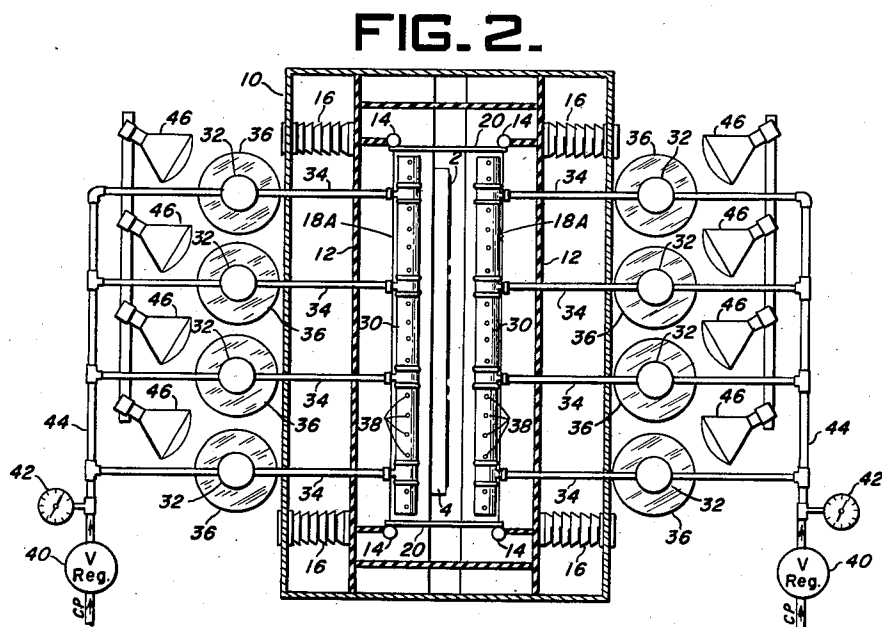
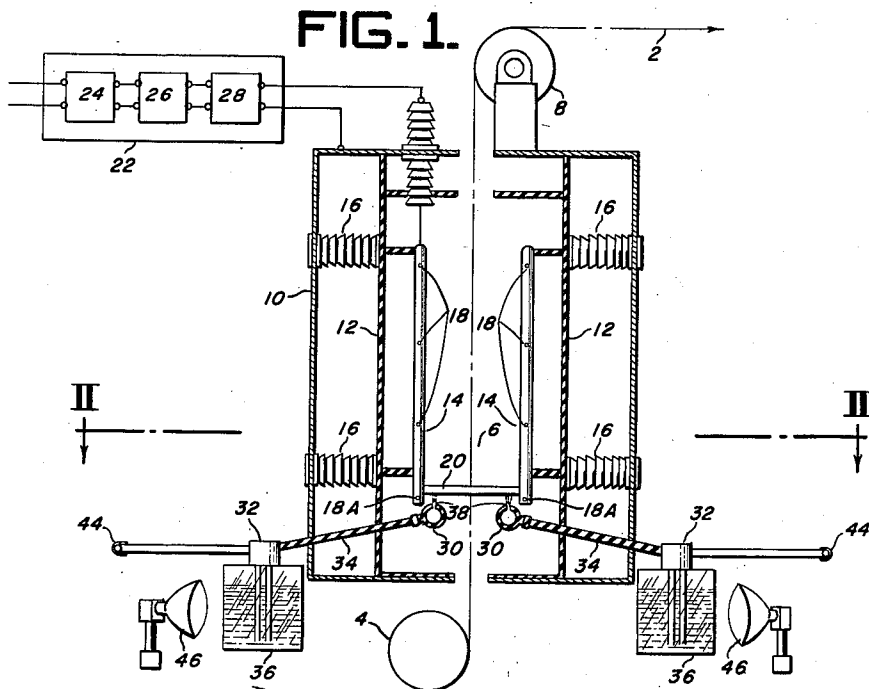
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2,764,508

ELECTROSTATIC STRIP-OILING METHOD AND APPARATUS

Filed July 29, 1953

2 Sheets-Sheet 1



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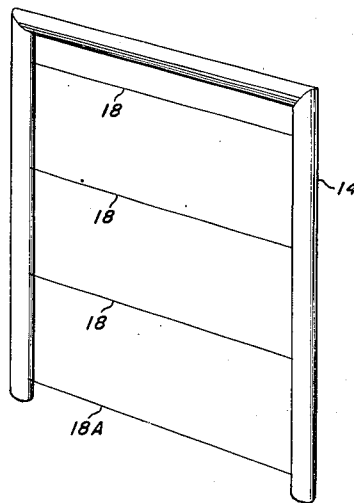
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FIG. 3.



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ELECTROSTATIC STRIP-OILING METHOD AND APPARATUS

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Application July 29, 1953, Serial No. 371,124

3 Claims. (Cl. 117-93)

This invention relates to electrostatic precipitation and in particular to apparatus for the electrostatic deposition of thin films of oil on metallic sheet, strip and the like.

In the manufacture of tin plate and the like for container stock, it is customary to oil the surface of the material to facilitate assorting and handling in subsequent fabricating operations. The amount of oil required for this purpose differs for different classes of containers and optimum amounts are known for several. Accordingly, rigid control of quantity and uniformity of oil is highly desirable. However, achieving such control has proven very difficult and expensive, primarily because of the extremely small amounts of oil involved, e. g., a heavy oil film for these purposes is about 0.4 gm. per base box (0.00093 gm. per sq. ft.), while a light film comprises as little as one tenth this amount. Electrostatic deposition has been suggested as a possible solution to this control problem, this method having proven very successful in the application of thin films of varnish and the like. While it has been found that the oil can be applied by this means, the desired degree of control has not been achieved using conventional electrostatic deposition methods and apparatus.

It is an object of the present invention to provide an electrostatic method and apparatus peculiarly adapted for applying thin films of oil in controllable amounts to sheet, strip and the like.

Another object is to provide equipment of the above character which is simple in design and operates at lower voltages.

These and other objects will be apparent from the following specification when read in conjunction with the attached drawings, in which:

Figure 1 is a side-sectional elevation of the apparatus of the present invention;

Figure 2 is a horizontal cross-sectional view thereof taken along the line II-II of Figure 1; and

Figure 3 shows the general form and arrangement of grid frame and discharge electrodes used in the apparatus of Figures 1 and 2.

With particular reference to the drawings, the numeral 2 indicates a strip of tin plate, black plate or the like passing upwardly from a deflector roll 4 through an oiling chamber 6 to a deflector-conductor roll 8. The chamber 6 includes a steel outer shell 10 and an inner shell 12 of an electrically insulating material such as micarta. Disposed within shell 12, one on either side of strip 2 and spaced several inches from the face thereof, are a pair of metal grid frames 14 of inverted U-shape, supported from outer shell 10 but electrically insulated therefrom by insulating hangers 16. Frames 14 may be conveniently fabricated from steel pipe. The distance between the legs of the U should be several inches greater than the widest strip to be oiled. Each frame 14 carries a plurality of vertically spaced wires 18 strung between the downwardly extending frame legs to provide a series of attenuated discharge electrodes extending transversely the width of the strip. While a plurality of

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wires 18 are shown, only the bottom wires 18A of each group are essential; practically all oil deposition in the arrangement of apparatus of the present invention occurring opposite these electrodes. The provision of multiple electrodes however, affords a safety factor and avoids immediate shut-down in case the bottom electrode is broken. Accordingly, provision of at least two electrodes per frame is recommended. Opposed legs of the grid frames are electrically interconnected by metal bars 20 which join the legs adjacent the points of connection of wires 18A. This arrangement extends the electrostatic field completely around the strip at this location and is a particularly important feature of the apparatus. Frames 14 are connected to one side of a high potential D. C. source indicated in general by reference numeral 22. The other side of source 22 is connected to outer shell 10. Connection to strip 2 is made through deflector-conductor roll 8 which is mounted in electrical contact with shell 10. If desired, roll 8 can be provided with a collector ring and connected directly to the source, however, only minute currents are involved in the process and the arrangement shown has proven quite practical and economical. The power source 22 comprises a suitable A. C. transformer, 24 saturable core reactor 26 and a rectifier 28 connected in the conventional manner to supply a D. C. potential which may be varied as needed. For the purposes of the present invention, a source capable of supplying up to 75,000 volts D. C. is satisfactory.

Atomized oil is introduced into the chamber 6 through spray headers 30 which are connected to atomizers 32 by pipes 34. Atomizers 32 and oil reservoirs 36, the latter preferably of clear glass, are located outside chamber 6 to facilitate servicing. Connecting pipes 34 and headers 30 are constructed of a non-conducting material such as "micarta," a phenolic resin type insulating material, to prevent these elements from acting as intermediate collector electrodes and to avoid premature charging of the oil mist. Headers 30 are provided with a plurality of outlet holes 38 spaced and aligned along the length of the headers to afford equal distribution of oil mist across the width of the strip. The rate of supply of oil mist is varied by varying air pressure to the atomizers and pressure regulating valves 40 and gages 42 are provided in air supply headers 44 for this purpose. Atomization is facilitated by heating the oil and heat lamps 46, focused on each of the glass reservoir jars 36, and provided to maintain the temperature of the oil supply at about 160° F. Heating is essential when oiling with palm oil, commonly used for lubricating tin plate, since this material is semi-solid at room temperature.

The location of the headers 30 with respect to their associated discharge electrodes 18A is particularly critical; I have found it essential to the control of oil deposition that the oil mist be introduced out of contact with the discharge electrodes but into the field of maximum electrostatic intensity, i. e., must be introduced as close to wire 18A as possible without contacting the same. Accordingly the headers 30 are disposed parallel to and as close to wires 18A as physical limitations will permit to occupy a position slightly below the wires and slightly toward the strip with their discharge outlets 38 disposed upwardly to direct the oil mist into the space between the electrodes and the strip in a path parallel to and in the direction of strip movement. Positioning headers 30 so that discharge outlets 38 thereof are about 2 inches below wires 18A and about 1/2 inch in therefrom toward the strip provides a particularly satisfactory arrangement. As indicated in Figure 2 the strip 2 moves through a loop of discharge elements formed by wires 18A and bars 20, being maintained centrally disposed in this loop

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by rolls 4 and 8. The bars 20 extend the electrostatic field across the edges of the strip. Thus oil mist which would otherwise be lost to the walls of the chamber by circulating past the edges is forced toward and deposited on the strip. The bars 20 are of relatively heavy cross-section as compared to main discharge electrodes 18A in order to lower the intensity of the electrostatic field adjacent the strip edges. This promotes uniformity of oiling by minimizing oil build-up at the edges. The net offset of the discharge loop and the close proximity of the headers to the electrodes 18A is to force the oil mist in toward the strip so that essentially all of the mist is deposited opposite wires 18A permitting considerable reduction in size of equipment and greatly facilitating control of the amount of oil deposited. The amount of oil deposited can be readily controlled by regulating the air or other gas to the atomizers. The strip width and speed of travel, design of atomizer nozzles, type of oil used, etc. influence the air-oil deposition relationships. In apparatus of given design however, the effect of the factors can be readily determined and operating tables compiled. Oiling apparatus built in accordance with the disclosed principles can be operated at much lower voltages than concerned possibly thereto. With the usual run of sheet and tin mill products a voltage of about 45,000 volts D. C. impressed across the grid and strip is sufficient. Oiling may be conducted as a separate operation by providing conventional uncoilers and drive bristles or coilers, not shown in the drawings, or the apparatus may be incorporated in existing strip processing lines. In any event provision should be made for automatic control of strip speed since operation at constant speed facilitates control and promotes uniformity.

While I have shown and described one specific embodiment of my invention, I do not wish to be limited exactly thereto except as defined in the following claims.

I claim:

1. Apparatus of the class described for depositing a thin controllable film of lubricant upon metallic strip and the like including opposed discharge electrodes extending transversely the width of the strip, means electrically connecting the ends of said electrodes to form a loop around the strip, means for moving the strip centrally through

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said loop, means for impressing a high D. C. potential across said loop and strip to maintain an electrostatic field therebetween, atomized-lubricant distributing headers having discharge outlets along the length thereof, and atomizing means supplying a regulatable flow of lubricant dispersed in a stream of gas to said headers, characterized by said header outlets being disposed on the strip-ward side of the discharge electrodes, parallel to and immediately adjacent the latter, and being positioned to direct streams of atomized lubricant in a plane parallel to the surface of the strip and to discharge said streams immediately into the zone of maximum intensity of the electrostatic field between the strip and the discharge electrodes.

2. Apparatus as in claim 1 in which the atomized-lubricant distributing headers are formed of nonelectrical conducting material whereby atomized lubricant may be shielded from electrical influence and premature charging thereof be avoided while being conveyed to its discharge point.

3. The method for depositing a thin controllable film of lubricant upon metallic strip and the like comprising passing the strip centrally disposed between spaced apart electrodes extending transversely thereof and electrically interconnected at their ends to form a loop, impressing a high D. C. potential across said loop and strip to establish an electrostatic field therebetween, dispersing lubricant in a stream of gas, shielding the dispersed lubricant from electrical influence while conveying the same, and discharging the shielded dispersed lubricant immediately into the zone of maximum electrostatic intensity in the space between the strip and the transversely extending electrodes closely adjacent but out of direct electrical contact with the latter.

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