June 25, 1957 G. H. RENDEL 2,796,845

ELECTROSTATIC COATING APPARATUS

Filed Nov. 24, 1953 2 Sheets-Sheet 1

FIG. 2

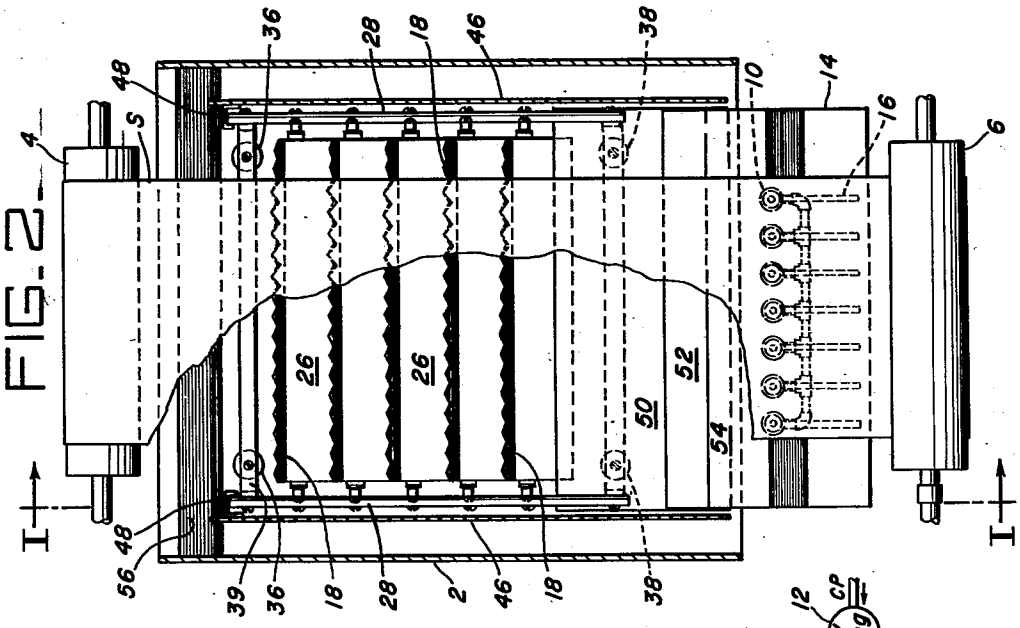
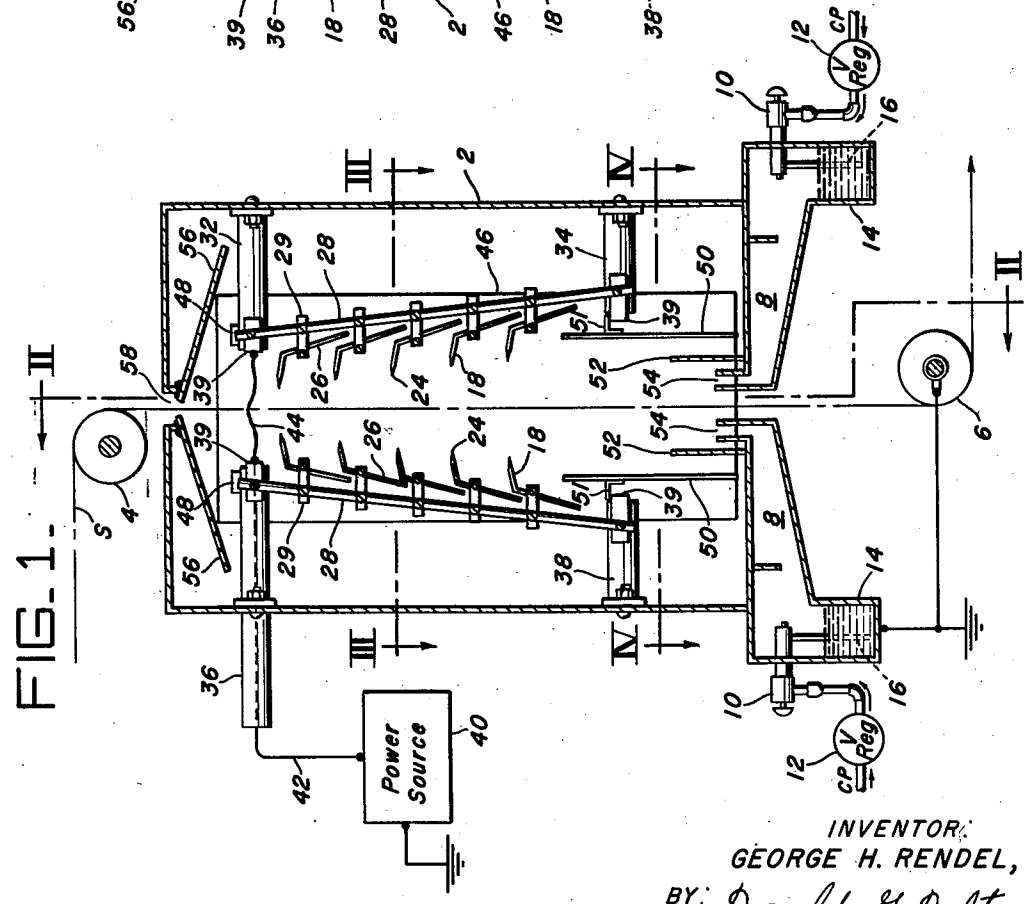


FIG. 1



INVENTOR:
GEORGE H. RENDEL,
BY: Donald G. Dalton
his Attorney.

June 25, 1957 G. H. RENDEL 2,796,845

ELECTROSTATIC COATING APPARATUS

Filed Nov. 24, 1953 2 Sheets-Sheet 2

FIG. 3.

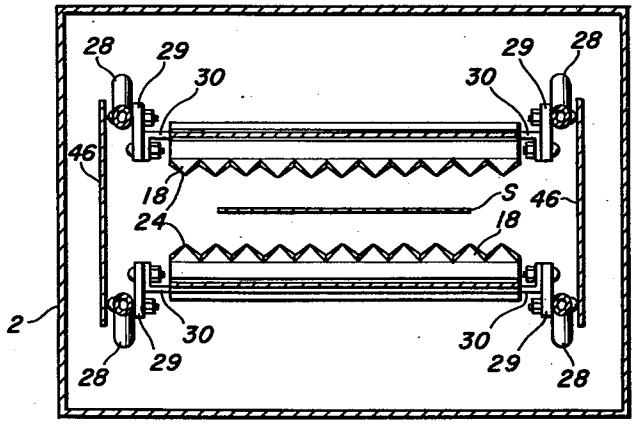


FIG. 5.

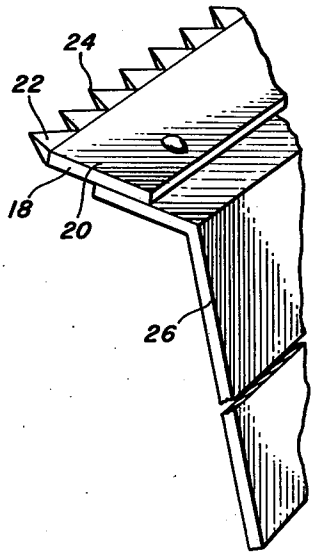


FIG. 4.

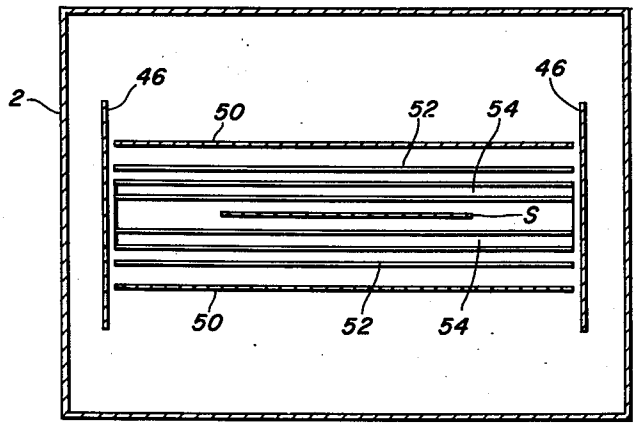


FIG. 7.

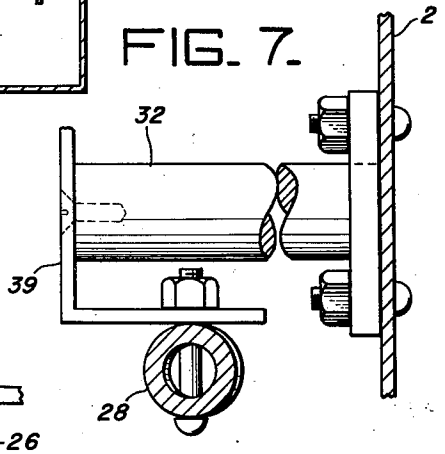
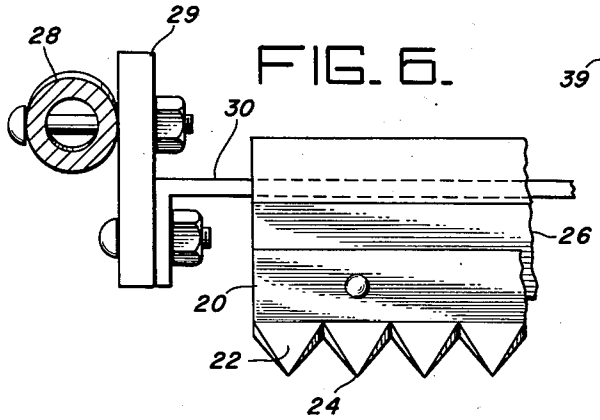


FIG. 6.



INVENTOR:
GEORGE H. RENDEL,
BY: Donald G. Dalton
his Attorney.

United States Patent Office 2,796,845 Patented June 25, 1957

2,796,845

ELECTROSTATIC COATING APPARATUS

George H. Rendel, Pittsburgh, Pa., assignor to United States Steel Corporation, a corporation of New Jersey

Application November 24, 1953, Serial No. 394,033

6 Claims. (Cl. 118—634)

This invention relates to electrostatic coating apparatus and more particularly to such apparatus for applying oil to a moving steel strip. In the apparatus most commonly used for this purpose prior to my invention it was necessary to use collecting electrodes as well as ionizing electrodes because of the relative inefficiency of the coating apparatus. The electrodes most commonly used were circular. Such electrodes have a uniform surface charge over their entire circumference so that when any of the oil mist gets behind the ionizing electrodes it receives an electrostatic charge and is attracted to the steel enclosing cabinet. It is old to use pointed electrodes but those in use are not arranged in the proper manner for the best operation. It is also necessary to use fans for providing booster air to move the oil spray or mist in the desired direction. Another defect of such apparatus is that droplets of oil will be formed when the mist condenses on parts of the oiler. These drops of oil often pass between the ionizing electrodes and the strip, thus receiving an electrostatic charge so that they are attracted to the strip. This results in objectionable oil spots on the strip. Also, with the apparatus previously used, it was not possible to accurately control the amount of oil deposited on the strip.

It is an object of my invention to provide electrostatic coating apparatus which is extremely rugged and which operates so efficiently that practically no oil laden vapors escape into the atmosphere.

Another object is to provide such apparatus which can control the oil film within the range of 0.06 to 0.50 gram of oil per base box which has an area of 217.78 square feet.

Still another object is to provide such apparatus which can operate without the use of booster air.

These and other objects will be more apparent after referring to the following specification and attached drawings, in which:

Figure 1 is a view taken on the line I—I of Figure 2;

Figure 2 is a view taken on the line II—II of Figure 1 with part of the strip removed;

Figure 3 is a view taken on the line III—III of Figure 1;

Figure 4 is a view taken on the line IV—IV of Figure 1;

Figure 5 is a fragmentary perspective view of an electrode;

Figure 6 is an enlarged view of the support for the electrodes; and

Figure 7 is an enlarged view of a detail.

Referring more particularly to the drawings, reference numeral 2 indicates a steel cabinet through which the strip S to be coated travels. Strip S is supported between a roll 4 above the cabinet 2 and a second roll 6 below the cabinet, the roll 6 being connected to ground. Beneath the cabinet 2 are two fog chambers 8, one on each side of the strip. A spray 10 is associated with each of the fog chambers 8 and is provided with compressed air through a pressure regulator 12. Each fog chamber 8 has an oil reservoir or chamber 14 with a pipe 16 extending downwardly from the spray 10 into the oil in chamber 14. The apparatus so far described is conventional. A plurality of ionizing electrodes 18 are arranged within the cabinet 2 on each side of the strip S. As best shown in Figure 5 each of the ionizing electrodes 18 consists of a conducting metal bar 20 having a wedge shaped surface 22 on the side toward the strip S with a plurality of saw teeth 24 thereon which provide points for directing the ionizing effect toward the strip. The bar 20 is fastened to a combined support and baffle plate 26. An elongated tubular support member 28 is provided at each end of the members 26 which are connected thereto in any suitable manner such as by means of bars 29 and brackets 30, as shown in Figure 6. Each of the right hand supports 28 as seen in Figure 1 is supported at its top by means of an insulator 32 fastened to the cabinet 2 and at its bottom on an insulator 34 which is also fastened to cabinet 2. Each of the left hand supports 28 is supported at its top by means of an insulator 36 and at its bottom by means of an insulator 38. As shown in Figure 7 the supports 28 are fastened to the insulators by means of bracket 39. Current to the electrodes 18 is provided from a power source 40 by means of a wire 42 which passes through one of the insulators 36 to the left hand supports 28. An extension 44 from the wire 42 is attached to one of the right hand support members 28. Baffles 46 are fastened to the tops of support members 28 by means of brackets 48. The baffles 46 extend substantially parallel to the edges of the strip S in planes perpendicular to the plane of the strip. Baffles 50 extend between the lower ends of baffles 46 as shown in Figure 4. The baffles 26 extend between the baffles 46 above the baffles 50. The baffles 50 may be supported from insulators 34 and 38 by means of brackets 51. Baffles 52, one on each side of the strip S, are provided at the bottom of the cabinet 2 between the baffles 50. The fog from the fog chamber 8 is discharged through passages 54 adjacent baffles 52. Strip shields 56 are spot welded to the top of cabinet 2, one on each side of the opening 58 at the top of the cabinet.

The operation of my device is as follows:

The compressed air is turned on and the pressure regulated to supply the desired amount of oil in the fog which is discharged through the openings 54. The thickness of the coating can be controlled by regulating this pressure. The baffles 26, 46 and 50 cooperate to form a chimney so that it is not necessary to use a separate blower to provide booster air. As the fog passes between the ionizing electrodes 18 the oil will receive an electrostatic charge and be attracted to the strip. It will be seen that the ionizing electrodes are closer to the strip at the top of the oiler than at the bottom. Since the electrostatic field increases as the spacing between the electrodes is decreased the oil laden mist is subjected to increasing electrostatic field intensity as it travels upwardly between the electrodes and the strip. If the electrostatic field is too intense at the lower ionizing electrodes there is a tendency for the charged oil mist to be driven downwardly but when the electrostatic field is less intense at the lower electrodes the oil particles accept a charge and continue upwardly. The particles of oil that are not attracted to the strip will receive a more intense charge as they pass through the more concentrated electrostatic field so that oil particles that are not charged high enough to adhere to the strip as they pass the lowest electrode continue to rise and receive a progressively more intense charge as they pass each succeeding electrode. Under most conditions the

majority of the oil mist will be deposited on the strip before it rises above the third ionizing electrode and substantially all of the oil will be attracted to the strip before it passes the uppermost eletrodes. Thus the particular arrangement of electrodes enables substantially all the oil to be deposited on the strip without the use of booster air. The arrangement of the drip shields, baffles and ionizing electrodes to slope away from the strip causes all oil that condenses on the parts to drain away from the strip into the bottom of the oiler. Because the electrostatic field is at low intensity except at the points of electrodes this oil will not receive a charge high enough to attract it to the enclosing cabinet of the oiler. The strip may move through the oiler in either direction but as shown moves downwardly through the oiler.

While the vertical arrangement as shown is much preferred, in some instances it is possible to arrange the oiler so that the strip passes horizontally therethrough. In some instances it may be desired to coat only one side of the strip. This can be done by ionizing the electrodes only on one side of the strip or by closing the air valve to the spray nozzles located on one side of the strip.

While one embodiment of my invention has been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. Electrostatic coating apparatus comprising a chimney, means for supporting a workpiece to be coated in its travel through said chimney, a plurality of electrodes arranged in said chimney on each side of the workpiece, each electrode extending the width of the workpiece and having a plurality of points on the side adjacent the workpiece, the electrodes on each side being arranged one above the other with the points on each electrode being spaced closer to the path of the workpiece than the points of the electrode next below, and means for delivering a mist of coating material into the bottom of said chimney.

2. Electrostatic coating apparatus comprising a chimney, means for supporting a workpiece to be coated in its travel through said chimney, a plurality of electrodes arranged in said chimney on one side of the workpiece, each electrode extending the width of the workpiece and having a plurality of points on the side adjacent the workpiece, the electrodes being arranged one above the other with the points on each electrode being spaced closer to the path of the workpiece than the points of the electrode next below, and means for delivering a mist of coating material into the bottom of said chimney.

3. Electrostatic coating apparatus comprising a chimney, means for supporting a workpiece to be coated in its travel through said chimney, a plurality of electrodes arranged in said chimney on one side of the workpiece, each electrode extending the width of the workpiece and having a substantial width extending away from the path of the workpiece, a combined support and baffle for each electrode, the upper surfaces of the electrodes and supports sloping downwardly away from the workpiece, and means for delivering a mist of coating material into the bottom of said chimney.

4. Electrostatic coating apparatus comprising a cabinet, means for supporting a workpiece to be coated in its travel through said cabinet, a plurality of electrodes arranged in said cabinet on one side of the workpiece, each electrode extending the width of the workpiece and having a plurality of points on the side adjacent the workpiece, and means for delivering a mist of coating material to one end of the cabinet, the electrodes being spaced along the path of travel of the workpiece with the points on each electrode being spaced closer to the path of the workpiece than the points of the electrode next closer to the end of the cabinet into which the coating material is delivered.

5. Electrostatic coating apparatus comprising a cabinet, means for supporting a workpiece to be coated in its travel through said cabinet, a plurality of electrodes arranged in said cabinet on each side of the workpiece, each electrode extending the width of the workpiece and having a plurality of points on the side adjacent the path of the workpiece, and means for delivering a mist of coating material to one end of the cabinet, the electrodes on each side being spaced along the path of travel of the workpiece with the points on each electrode being spaced closer to the workpiece than the points of the electrode next closer to the end of the cabinet into which the coating material is delivered.

6. Electrostatic coating apparatus comprising a cabinet, means for supporting a workpiece to be coated in its travel in a generally vertical path through the cabinet, a plurality of electrodes arranged in said cabinet on each side of the workpiece, each electrode extending the width of the workpiece and having a plurality of points on the side adjacent the workpiece, the electrodes on each side being arranged one above the other with the points on each electrode being spaced closer to the workpiece than the points of the electrode next below, a combined support and baffle for each electrode, the upper surfaces of the electrodes and supports sloping downwardly away from the workpiece, means for supporting said baffles, top and bottom insulators on each side of the path of the workpiece for supporting said last named means, a baffle at the bottom of said chamber on each side of the workpiece, baffles extending transversely of said workpiece beyond each end thereof, said baffles cooperating to form a chimney, and means for delivering a mist of coating material into the bottom of said chimney.

References Cited in the file of this patent

UNITED STATES PATENTS

2,384,541	Fruth	Sept. 11, 1945
2,428,991	Ransburg	Oct. 14, 1947
2,437,606	Kaufman	Mar. 9, 1948
2,447,374	Smyser	Aug. 17, 1948
2,447,664	Pegg	Aug. 24, 1948
2,466,906	Miller	Apr. 12, 1949
2,658,472	Ransburg	Nov. 10, 1953