METHOD AND APPARATUS FOR ELECTROPLATING A METALLIC STRIP

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ABSTRACT OF THE DISCLOSURE

This invention relates to electroplating of a metallic strip and, more particularly, to an improved method and apparatus for continuously electroplating one side of a metallic strip. The improved rotary-type plating apparatus for electroplating a material onto a moving sheet under tension has a tank means adapted to contain an electrolyte. A rotatable member is rotatable in the electrolyte for guiding the sheet along its path of movement through the electrolyte. A contact member is disposed on the periphery of the rotatable member and is engageable with the sheet during its path of movement through the electrolyte. Sealing means are on the rotatable member adjacent the contact member for sealing one surface of the sheet from the electrolyte. Anode means are disposed in the electrolyte adjacent the rotatable member, and power means are connected to the sheet which functions as cathode and to the anode means.

The improved method of this invention for electroplating a material on a moving sheet comprises the steps of:

(a) guiding the sheet onto a rotatable member and into contact with a contact means;
(b) sealing the sheet to the rotatable member;
(c) moving the sheet and the rotatable member through an electrolyte and adjacent an anode means; and
(d) electroplating the material onto the sheet.

Background of the invention

Hereinafore, conventional methods and apparatus for electroplating metallic strip and the like have been of the type shown in the following United States patents:


Referring to such conventional methods and apparatus, U.S. Patent No. 570,125 has insulating bars projecting from a cathode shell and defining a deposition space for material to be deposited therebetween. The metal strip of U.S. Patent No. 1,437,003 passes adjacent the anode plates and the metal is deposited on this adjacent side of the strip. The U.S. Patent No. 1,819,130 plates either two side-by-side sheets on one side only or utilizes a traveling insulating cover on the single sheet to plate only on one side of the single sheet. The electrolyte pans of U.S. Patent No. 2,509,304 are disposed at different elevations to permit electrolyte flow by gravity from adjacent pans thereby simplifying electrolyte supply apparatus and saving electrolyte. The apparatus of U.S. Patent No. 2,569,577 maintains the strip near the surface of the electrolyte thus plating only one side and provides uniform coating density by adding electrolyte to the strip in the center of the electroplating tank. The resilient bridging member and dam mechanism of Reissue Patent No. Re. 23,456 saves electrolyte, reduces the pumping rate and prevents aeration of the electrolyte. The method of U.S. Patent No. 2,844,529 costs a strip on one side or both sides utilizing a temperature differential between the sheet anode and the electrolyte. U.S. Patent No. 2,899,445 utilizes an arcuate conductor for supporting the sheet in the electroplating weir box and for flowing electrolyte to cost metal only on the surface of the sheet.

These conventional methods and apparatus are complicated and expensive to build and maintain, and are not able to plate relatively thin gage strip. Further, such conventional methods and apparatus require large amounts of floor space. In addition, the twisting or sagging of the sheet being plated permits non-uniform cathode-to-anode spacing. Again, it is not possible to coat one or both sides of a strip with one or more metals of varying plating thickness. Poor electrical contact between the strip and the plating power source and discontinuous electric contact with the strip over the entire effective plating length increases the voltage requirements and causes poor cathode current distribution and difficulties in the plating of poor electrical conductor materials, such as stainless steel. Further, the non-uniform current distribution is high at the entrance and exit to the plating tank and low in the middle of the plating tank.

Conventional electroplating methods and apparatus utilizing the contact or conductor rolls to energize the strip or sheet require large amounts of power, such as for example 18 volts to provide 400 amperes per square foot. In addition, the rolling of the contact rolls over the sheet can scratch or dent the sheet. Also the acid in the electrolyte attacks the unplated side of the sheet. It is necessary in the modern industrial world to provide metallic strip which has been plated on one side only, such as in the case of steel strip which strip is zinc coated on one side only for use in the automotive industry.

Objects of the invention

It is the general object of the present invention to avoid and overcome the foregoing and other difficulties of and objections to prior art practices by the provision of an improved method and apparatus for continuously electroplating one side of a metallic sheet or strip, which improved method and apparatus:

(1) Provide constant positive electrical contact by strip tension;
(2) Continuous electrical contact of the strip with the power source over the entire plating length thereby minimizing variations in the cathode current distribution and voltage losses in the plating circuit and facilitating the electroplating of certain materials which are poor electrical conductors, such as stainless steel;
(3) Eliminate twisting and sagging of the strip being coated thereby assuring constant and close cathode-anode spacing;
(4) Eliminate rolling and sliding contact and resultant scratching of the strip surface;
(5) Utilize smaller floor space requirements than conventional apparatus;
(6) Permit the electroplating of one or both sides of the continuous strip with one or more metals of varying plating thickness;
(7) Facilitate the electroplating of relatively thin gage strip;
(8) Are simple and inexpensive to build and to maintain;
(9) Minimize chemical attack on the unplated surface of the sheet; and
(10) Reduce power requirements by 1/4, increase current density by a factor of 2, and provide long effective plating lengths.
3 Brief summary of the invention

The aforesaid objects of the present invention, and other objects which will become apparent as the description proceeds, are achieved by providing an improved rotary-type plating apparatus for electroplating a material onto a moving sheet under tension and having a tank means adjacent to contain an electrolyte. A rotatable member is rotatable in the electrolyte for guiding the sheet along its path of movement through the electrolyte. A contact member is disposed on the periphery of the rotatable member and is engageable with the sheet during its path of movement through the electrolyte. Sealing means are on the rotatable member adjacent the contact member for sealing one surface of the sheet from the electrolyte. Anode means are disposed in the electrolyte adjacent the rotatable member, and power means are connected to the sheet which functions as cathode and to the anode means.

The improved method of this invention for electroplating a material on a moving sheet comprises the steps of:

(a) Guiding the sheet onto a rotatable member and into contact with a contact means;
(b) Sealing the sheet to the rotatable member;
(c) Moving the sheet and the rotatable member through an electrolyte and adjacent an anode means; and
(d) Electroplating the material onto the sheet.

Brief description of the several views of the drawings

For a better understanding of the present invention reference should be had to the accompanying drawings, wherein like numerals of reference indicate similar parts throughout the several views and wherein:

FIGURE 1 is a diagrammatic side elevational view of an electroplating line incorporating the electroplating apparatus of the invention;

FIGURE 2 is an enlarged side elevational view of the electroplating apparatus of the invention shown in FIGURE 1;

FIGURE 3 is a plan view of the electroplating apparatus of the invention shown in FIGURE 2 with the moving sheet eliminated therefrom for clarity;

FIGURE 4 is a vertical sectional view of the electroplating apparatus shown in FIGURE 2 taken along the line IV—IV of FIGURE 2 in the direction of the arrows;

FIGURE 5 is an enlarged fragmentary vertical sectional view of the contact ring and sealing means assembly;

FIGURE 6 is a diagrammatic view of an alternative embodiment of the electroplating apparatus and showing two electroplating stages thus permitting the plating of the sheet on both sides;

FIGURES 7–10 are fragmentary vertical sectional views of alternative embodiments of the contact ring and sealing means assembly, wherein the moving sheet is omitted for clarity;

FIGURE 11 is a side elevational view of an alternative embodiment of a rotating member;

FIGURE 12 is a fragmentary vertical sectional view similar to FIGURE 4 of an alternative embodiment having a sealing means between the drum and tank for improving the flow of fresh electrolyte;

FIGURE 13 is an enlarged fragmentary view of the sealing means of FIGURE 12;

FIGURE 14 is a view similar to FIGURE 6 of an alternative embodiment utilizing contact rolls and having a maximum effective plating length;

FIGURE 15 is a fragmentary vertical sectional view similar to FIGURE 7 of the rotatable member shown in FIGURE 14;

FIGURE 16 is a view similar to FIGURE 14 showing an alternative embodiment of the electroplating apparatus for plating both sides of the sheet;

FIGURE 17 is a view similar to FIGURE 4 of the electroplating apparatus shown in FIGURE 16;

FIGURE 18 is a side elevational view of an alternative conveyor-type apparatus;

FIGURE 19 is a vertical sectional view taken along the line XIX—XIX of FIGURE 18 in the direction of the arrows.

Detailed description

Although the principles of the present invention are broadly applicable to the electroplating of a moving sheet on one or both sides, the present invention is particularly adapted for use in conjunction with the electroplating of a moving sheet on one side and hence it has been so illustrated and will be described.

With specific reference to the form of the present invention illustrated in the drawings, and referring particularly to FIGURES 1, 2 and 5, a moving sheet or strip, such as a cold-rolled carbon steel sheet, is indicated generally by the reference numeral 10.

This strip 10 (FIGURE 1) is moved by a variable speed take-up reel 12 from a pay-off reel 14 and successively through an electrolytic cleaning tank 16 (employing an alkaline electrolytic cleaner of the type similar to MG102, the trade name of a cleaner manufactured by Mangill Chemical Company, Cleveland, Ohio), a hot water rinse tank 18, a sulfuric acid tank 20, and a hot water rinse tank 22 to the electroplating apparatus 24 of this invention.

Referring to FIGURES 2–5 the electroplating apparatus 24 for electroplating a material, such as zinc, on the strip 10 has tank means, such as the electrolytically-insulated tank 26 (FIGURES 2–4). This tank 26 has an inlet 28 (FIGURE 2) and outlet 30 for an electrolyte 32 (FIGURES 2–4), which the tank 26 is adapted to contain. A suitable electrolyte 32 at a temperature of about 115° F. may contain about 10 ounces per gallon of zinc ions, about 12 ounces per gallon of sulfurous acid and the balance water. A rotatable member, such as a drum 34 (FIGURES 1–5) is mounted on a shaft 36 (FIGURES 2–4) journaled in bearings 38 (FIGURES 2–4) on the tank 26. The sheet 10 is passed around rolls 40, 42 (FIGURES 1–3) from the hot water rinse tank 22 to the drum 34. For the purpose of causing the sheet 10 to function as a cathode, a contact member, such as the contact ring 44 (FIGURES 3, 5), suitably nickel or the like, on the periphery of the drum 34 engages the sheet 10. As shown in FIGURES 3–5 and in FIGURE 5 particularly, sealing means, such as the resilient sealing bands 46 formed of polyethylene or the like, are mounted adjacent the contact ring 44 and engage the sheet 10 for sealing one side of the sheet 10 from the electrolyte 32. The sealing bands 46 are mounted in an insulating hard covering 64 (FIGURE 5), suitably polyvinyl chloride or the like. Such contact ring 44 and sealing bands 46 form a contact and sealing means assembly.

As such sheet 10 is pulled into intimate electrical engagement with the contact ring 44, the tension on the sheet 10 depresses the resilient sealing bands 46 and such sheet 10 is sealed at its edges 48 by the sealing bands 46 (FIGURE 5). The edges 48 of the sheet 10 press in on the sealing bands 46 and the back tension on the sheet 10 causes the sealing bands 46 to collapse thereby forming a seal at the edges 48 of the sheet 10.

Anode means, such as the anode 50 (FIGURES 1, 2, 4) suitably formed of about 99.5% lead and the balance tin and mounted on anode supports 52 (FIGURES 2, 4) in the tank 26, are disposed adjacent the sheet 10 on the drum 34. Power means, such as a negative D-C supply 54 (FIGURES 3, 4), brushes 56 (FIGURES 3, 4) and slip rings 58, connect the drum 34 and the sheet 10 negatively to the D-C supply (not shown), while cables 60 (FIGURES 2, 3) connect the positive side of the D-C supply to the anode 50. Wiper means, such as the wiper 61 (FIGURE 2), contact the peripheral surface of the drum 34.
at a location outside of the electrolyte 32, thus minimizing chemical attack on the unplated surface of the sheet 10. The applied negative D-C voltage is about 5.0 to 6.0 volts and flows from the D-C source (not shown) through negative cables 54 (FIGURES 2, 4), brushes 56, slip rings 58, shaft 36, drum 34, contact ring 44 to the sheet 10. These surfaces except the contact ring 44 and sealing bands 46 are electrically insulated with an insulating material 59 (FIGURES 3, 4, 5), such as polyvinyl chloride or the like. The hard backing, such as polyvinyl chloride 64, backs up the sealing bands 46.

After the plated sheet 10 leaves the electroplating apparatus 24 via rolls 42, 40, such sheet 10 passes through hot rinse tanks 62 (FIGURE 1) and is wound upon the take-up reel 12.

In one test, steel sheet 10 was electrogalvanized at current densities of 100 to 685 amperes per square foot with about 0.5 inch spacing S (FIGURE 4) between the anode 50 and cathode sheet 10 thus yielding coating thicknesses of 2 to 65×10⁻⁶ inches. At 685 amperes per square foot, the zinc plating efficiency was 95 percent. The coatings were light colored, smooth, adherent and ductile. In another test, the anode-to-cathode spacing S (FIGURE 4) was reduced to 0.5 inch and the current density increased to 1050 amperes per square foot. At this higher current density, the deposit was unchewed, and there was no "treeing" or excess zinc buildup at the edges of the galvanized sheet 10. Again, there was no deposited zinc or defects of any kind on the unplated surface of the galvanized sheet 10.

Further, buffed 430 Mo stainless steel sheet 10 was chromium plated in a chromium plating electrolyte 32 having about 20 ounces per gallon chromic acid, about 0.8 ounce per gallon of an alkali additive, such as Diamond CPA 1800, the trade name of an additive manufactured by Diamond Alkali Company, Cleveland, Ohio, and about 0.08 ounce per gallon of sulphuric acid at a temperature of about 135° F. and with an anode 50 about 7% antimony lead. At current densities ranging from 110 to 617 amperes per square foot and at 0.5 inch spacing S (FIGURE 4) between the anode 50 and cathode (sheet 10), adherent, mirror-like finishes resulted with thicknesses ranging from 2.5 to 24×10⁻⁶ inches. The coating was smooth, uniform and adherent. The finished coating was then coated with a fine layer of zinc by the Dual Processing method (FIGURE 7).

With the improved electroplating apparatus 24 anode-to-cathode spacings (S) (FIGURE 4) less than about 0.5 inch can be used thereby increasing the current density to about 1500 amperes per square foot.

Alternative embodiments

It will be understood by those skilled in the art that, alternatively, as shown in FIGURE 6, the drum 34 is mounted at 36º substantially within the tank 26 and the non-conducting guide rolls 42 are disposed close together to provide an effective plating length L of about 330º of the periphery of the drum 34. The plated sheet 10 is then fed to a second stage electroplating apparatus 24a where the uncoated side of the sheet 10 is coated either with the same material, such as zinc, but with a different thickness or such sheet 10 may be coated with a different material, such as chromium. For the purpose of improving the circulation of the electrolyte 32 in a cavity 63 between the sheet 10 and the anode 50, an inlet 28 is provided in the tank 26 and in the cathode 34. In FIGURE 7 a single contact ring 44 is employed with adjacent sealing bands 46 to provide adaptability for a wide range of sizes of the sheet 10. The sponge-like sealing bands 46 are backed by a hard covering 64, such as polyvinyl chloride or the like, on the drum 34. Improved current density distribution may be provided by use of the dual contact rings 44 with two sealing bands 46 (FIGURE 8) or the three contact rings 44 and four sealing bands 46 (FIGURE 9). In FIGURE 10 the outside contact ring 44 and sealing strip 46 are employed on one side in this case, the left side, with a sealing strip 46 with a back-up member 64 on the other side. The rotatable member 34 shown in FIGURE 11 is a spoked wheel formed of a light metal, such as aluminum, to provide decreased mass and increased current carrying capacity. It is coated with a corrosion resistant material 66, such as polyvinyl chloride or the like.

To further improve circulation in the cavity 63 between the drum 34, the tank 26 and the anode 50, an electrolyte sealing means 68 (FIGURES 12, 13) is employed. This electrolyte sealing means 68 is formed by the dual contact rings 44 and the resilient annular disc 70 (FIGURE 13) on the drum 34 (FIGURE 13) which disc 70 is engageable by a biased ring 72 to confine circulation by inlet pipe 36 to the cylinder 63. The disc 70 and ring 72 may be polypropylene and Teflon respectively. The biasing means for the ring 72 is, as shown in FIGURE 13, either compressed air through line 74 or a spongy insert 76, suitably rubber. It is understood that the ring 72 may be on either the tank 26 or the drum 34; that the disc 70 on the other, and the biasing means may be associated with either the disc 70 or the ring 72. In the embodiment of FIGURE 14, 15, contact rolls 78 are employed as the cathode source of voltage and are disposed to provide maximum effective plating length L on the drum 34. The contact ring is omitted and the sealing bands 46 (FIGURE 15) seal the sheet 10 as before.

In FIGURES 16, 17, the rotatable member 34 is a reel-like member having a pair of opposed wheels 80, the hubs 81a, 81b, of which wheels 80 are adjustable to telescope within each other to accommodate a variable sheet width W. Each wheel 80 has a guide flange 82 and a contact rail 84. A pair of replaceable anodes 50 are disposed one on each side of the sheet 10 to simultaneously electroplate both sides of such sheet 10. The contact rails 84 serve the same function as the contact ring 44 (FIGURE 15), etc. and also support the sheet 10.

Referring now to FIGURES 18, 19, the rotatable member is a continuous belt 86, suitably polyvinyl chloride plastic or the like, cable reinforced at 87 and mounted on rolls 88, which rolls 88 are positioned on shafts 90 journaling in the side walls of the tank 26. The contacting member is a continuous contact band 44a (FIGURE 18) and the sealing means are the sealing bands 46a. Cathode contact with the contact band 44a is made by means of a conductor roll 91 (FIGURE 18) and an aback-up roll 92. Guides 94 (FIGURE 14) mounted on supports 96 in the side walls of the tank 26 maintain constant anode-cathode spacing S. The belt 86 may be replaced by a link-type conveyor formed of a corrosion resistant material, such as Teflon.

Method

It will be understood from the above description of the electroplating apparatus 24 (FIGURES 1–5) and 24a, 24b (FIGURE 6), 24c (FIGURES 12, 13), 24d (FIGURES 14, 15), 24e (FIGURES 16, 17), 24f (FIGURES 18, 19) that an improved method is contemplated by this invention.

This improved method of electroplating a material, such as zinc, on a moving sheet of for example steel comprises the steps of:

(a) Guiding the sheet 10 onto a rotatable member 34 (FIGURES 1–5), etc. and into contact with a contact means 44 (FIGURES 1–5), etc.;

(b) Sealing the sheet 10 with 46 (FIGURES 1–5), etc. to the rotatable member 34 (FIGURES 1–5), etc.;

(c) Moving the sheet 10 and the rotatable member 34 (FIGURES 1–5), etc. through an electrolyte 32 and adjacent to an anode means 50 (FIGURES 1–5), etc.; and

(d) Electroplating the material (zinc, etc.) on the sheet 10.
Summary of the achievements of the objects of the invention

It will be recognized by those skilled in the art that the objects of the present invention have been achieved by providing an improved electrophating apparatus 24 (FIGURES 1–5), 24b, 24e (FIGURE 6) etc., which provides positive and continuous electrical contact between the cathode (sheet 10) and the contact ring 44 over the entire plating length L (FIGURE 6), thus minimizing variations in the cathode current distribution and voltage losses and facilitating the electrophating of poor electrical conductor materials, such as stainless steel and thin gage sheet. Since the sheet 10 moves on drum 34, the substantial elimination of conventional contact rolls 78 (FIGURE 14) also eliminates rolling and sliding contact between the contact rolls 78 and the sheet 10, thus eliminating scratching of the sheet 10. The full support of the sheet 10 by the drum 34 along the effective plating length L (FIGURE 6) eliminates twisting and sagging of the sheet 10. Use of the drum 34 reduces the space requirements for the improved electrophating apparatus 24 (FIGURES 1–5), etc., over those of conventional apparatus. The apparatus 24 (FIGURES 1–5), etc., permits electrophating of one or both sides of the sheet 10 with one or more metals of varying plating thickness. The use of the wiper 61 and the sealing strips 46 minimizes chemical attack on the unplated surface of the sheet 10. The apparatus 24 (FIGURES 1–5), etc., is simple and rugged in structure and inexpensive to build and to maintain. Such apparatus 24 (FIGURES 1–5), etc., when compared with conventional apparatus reduces power requirements by $\frac{1}{2}$, increases current density by a factor of 2 and provides long effective plating lengths L (FIGURE 6).

While in accordance with the patent statutes preferred and alternative embodiments of the present invention have been illustrated and described in detail, it is to be particularly understood that the invention is not limited thereto or thereby.

1. A rotary-type plating apparatus for electrophating a material onto a moving sheet under tension and having edges which define a surface, said apparatus having:
   (a) tank means adapted to contain an electrolyte,
   (b) rotatable member rotatable in said electrolyte for guiding said sheet along its path of movement through said electrolyte,
   (c) a contact member on the periphery of said rotatable member, extending around said periphery and engageable with said sheet during its path of movement through said electrolyte to make electrical contact therewith,
   (d) resilient sealing means adjacent said contact member on said rotatable member, extending around said periphery, projecting above said contact member and for sealing said edges and said surface of said sheet from said electrolyte,
   (e) anode means in said electrolyte adjacent said rotatable member,
   (f) power means connected to said sheet as cathode and to said anode means,
   (g) said tension on said sheet being operable to depress said sealing means so that said edges press in on said sealing means and said sealing means seal said edges and said surface from said electrolyte and maintains said sheet substantially flat during plating thereby eliminating stressing said material being plated on said sheet.

2. The apparatus recited in claim 1 and having wiper means mounted adjacent the periphery of said rotatable member outside said electrolyte for contacting said peripheral surface to minimize chemical attack on the unplated surface of said moving sheet.

3. The apparatus recited in claim 1 wherein said power means has contact rolls as a cathode source of voltage for said moving sheet and said sealing means has resilient sealing bands mounted on the edges of said rotatable member.

4. The apparatus recited in claim 3 wherein said sealing bands are mounted on a backing member on said rotatable member.

5. The apparatus recited in claim 1 wherein said contact member is mounted on said rotatable member, and said sealing means has resilient opposed sealing bands adjacent said contact member on said rotatable member.

6. The apparatus recited in claim 1 wherein said contact member is on said rotatable member and said sealing means has a backing member on said rotatable member, and opposed resilient sealing bands on said backing member adjacent said contact member and projecting above said backing member.

7. The apparatus recited in claim 1 wherein said contact member is on said rotatable member, and said sealing means has opposed backing members mounted on said rotatable member adjacent said contact member, and said sealing bands on said backing members and projecting above said contact member.

8. The apparatus recited in claim 1 wherein said sealing means has a backing member on said rotatable member, said contact member has opposed contact elements adjacent said backing member on said rotatable member and said sealing means has sealing bands adjacent said contact elements on said rotatable member.

9. The apparatus recited in claim 1 wherein said sealing means has a backing member on said rotatable member and sealing bands disposed on said backing member, and said contact member has contact elements disposed on said rotatable member in alternate relationship with said sealing bands.

10. The apparatus recited in claim 1 wherein said sealing means has a backing member on said rotatable member, and a sealing band on one edge of said backing member adjacent said contact member and another sealing band on the other edge of said backing member.

11. The apparatus recited in claim 1 wherein said rotatable member is a spoked wheel of light mass and high current carrying capacity.

12. The apparatus recited in claim 11 wherein said wheel is provided with a corrosion resistant covering.

13. The apparatus recited in claim 1 wherein said power means has contact rolls as a cathode source of voltage for said moving sheet.

14. A rotary-type plating apparatus for electrophating a material onto a moving sheet under tension and having edges which define a surface, said apparatus having:
   (a) tank means adapted to contain an electrolyte,
   (b) a rotatable member having a pair of opposed wheels, rotatable in said electrolyte and for guiding said sheet along its path of movement through said electrolyte,
   (c) a contact member on the periphery of said opposed wheels and engageable with said sheet during its path of movement through said electrolyte to make electrical contact therewith,
   (d) anode means in said electrolyte adjacent said rotatable member,
   (e) power means connected to said sheet as cathode and to said anode means,
   (f) said tension on said sheet being operable to compress said edges against said contact means so that said edges press in on said contact means and said contact means seals said edges to said contact means.

15. The apparatus recited in claim 14 wherein said wheels have means for varying the axial spacing between.

16. The apparatus recited in claim 14 wherein said contact member is a contact rail on each said wheel for supporting said moving sheet.

17. For a rotary-type plating apparatus for electrophating a material onto a moving sheet under tension and having edges which define a surface, said apparatus hav-
ing tank means adapted to contain an electrolyte, a rotatable member rotatable in said electrolyte for guiding said sheet along its path of movement through said electrolyte, andode means in said electrolyte adjacent said rotatable member, and power means connected to said sheet as cathode and to said anode means, a contact and sealing means having:

(a) a contact member on the periphery of said rotatable member, extending around said periphery and engageable with said sheet during its path of movement through said electrolyte to make electrical contact therewith,

(b) resilient sealing means adjacent said contact member on said rotatable member extending around said periphery, projecting above said contact member and for sealing said edges and said surface of said sheet from said electrolyte, and

(c) said tension on said sheet being operable to depress said sealing means so that said edges press in on said sealing means and said sealing means seal said edges and said surface from said electrolyte and maintains said sheet substantially flat during plating thereby eliminating stressing said material being plated on said sheet.

18. The contact and sealing means recited in claim 17 wherein said power means has contact rolls as a cathode source of voltage for said moving sheet and said sealing means has resilient sealing bands mounted on the edges of said rotatable member.

19. The contact and sealing means recited in claim 18 wherein said sealing bands are mounted on a backing member on said rotatable member.

20. The contact and sealing means recited in claim 17 wherein said contact member is mounted on said rotatable member, and said sealing means has resilient opposed sealing bands adjacent said contact member on said rotatable member.

21. The contact and sealing means recited in claim 17 wherein said contact member is on said rotatable member and said sealing means has a backing member on said rotatable member, and opposed resilient sealing bands on said backing member adjacent said contact member and projecting above said backing member.

22. The contact and sealing means recited in claim 17 wherein said contact member is on said rotatable member, and said sealing means has opposed backing members mounted on said rotatable member adjacent said contact member and sealing bands on said backing members and projecting above said contact member.

23. The contact and sealing means recited in claim 17 wherein said sealing means has a backing member on said rotatable member, said contact member has opposed contact elements adjacent said backing member on said rotatable member and said sealing means has sealing bands adjacent said contact elements on said rotatable member.

24. The contact and sealing means recited in claim 17 wherein said sealing means has a backing member on said rotatable member and sealing bands disposed on said backing member, and said contact member has contact elements disposed on said rotatable member in alternate relationship with said sealing bands.

25. The contact and sealing means recited in claim 17 wherein said sealing means has a backing member on said rotatable member, and a sealing band on one edge of said backing member adjacent said contact member and another sealing band on the other edge of said backing member.

26. A rotary-type plating apparatus for electroplating a material onto a moving sheet under tension and having edges which define a surface, said apparatus having:

(a) tank means adapted to contain an electrolyte,