June 5, 1923.

1,457,688

C. F. H. BOHNHARDT

PROCESS OF AND APPARATUS FOR RENOVATING COATED METAL SHEETS

Filed March 8, 1919

3 Sheets-Sheet 1

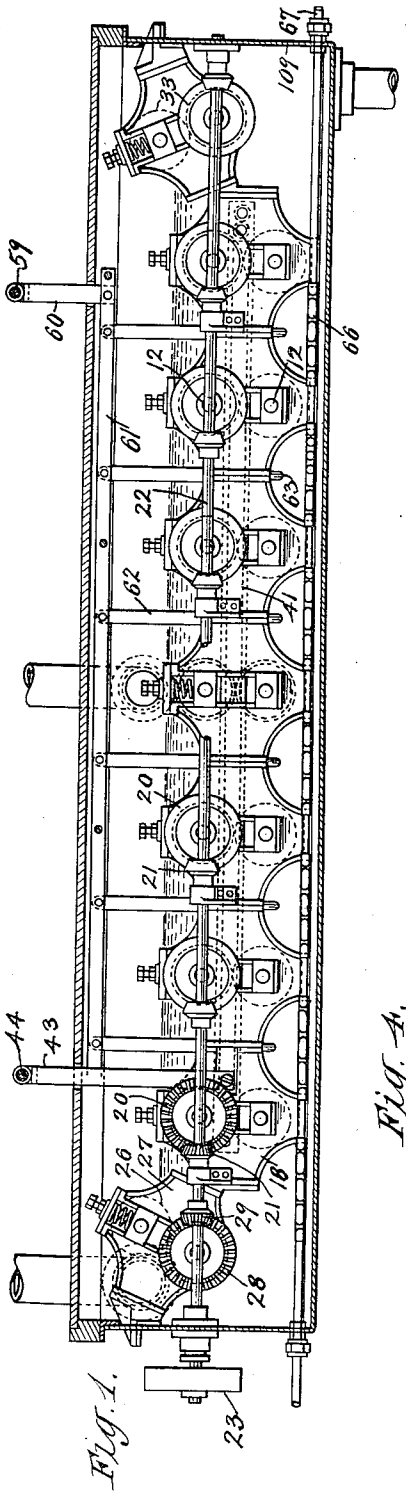


Fig. 1.

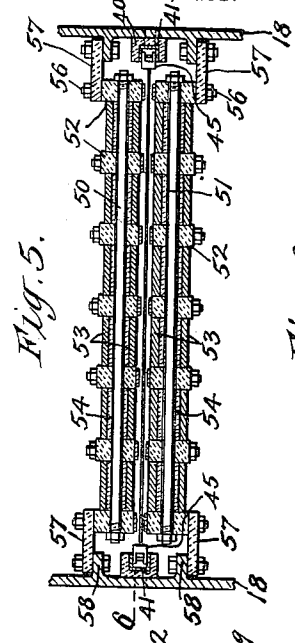


Fig. 5.

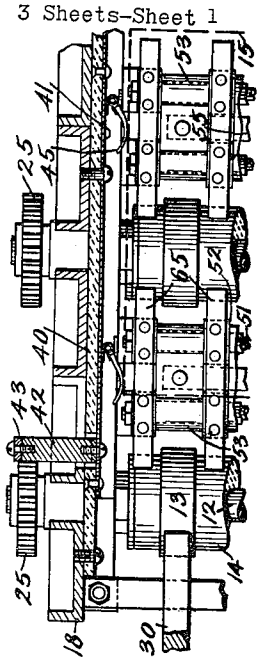


Fig. 6.

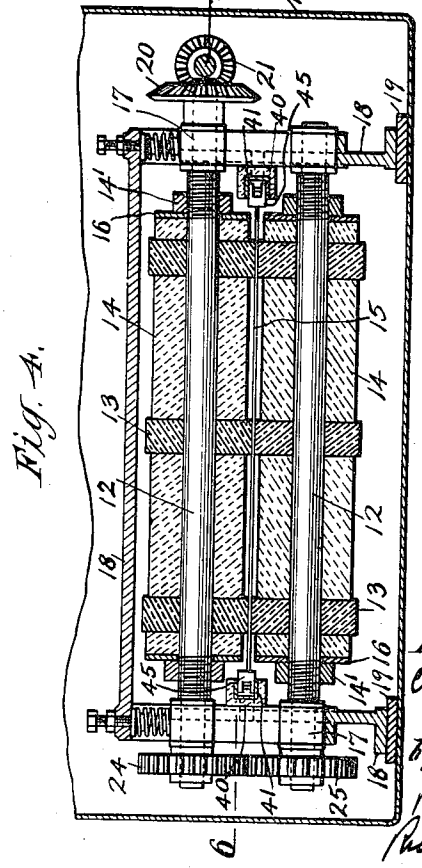


Fig. 4.

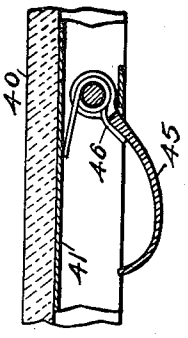


Fig. 7.

Inventor:
Charles F. H. Bohnhardt
by his Attys:
Philipp, Sawyer
Reid & Kennedy

June 5, 1923.

C. F. H. BOHNHARDT

1,457,688

PROCESS OF AND APPARATUS FOR RENOVATING COATED METAL SHEETS

Filed March 8, 1919

3 Sheets-Sheet 2

Fig. 2.

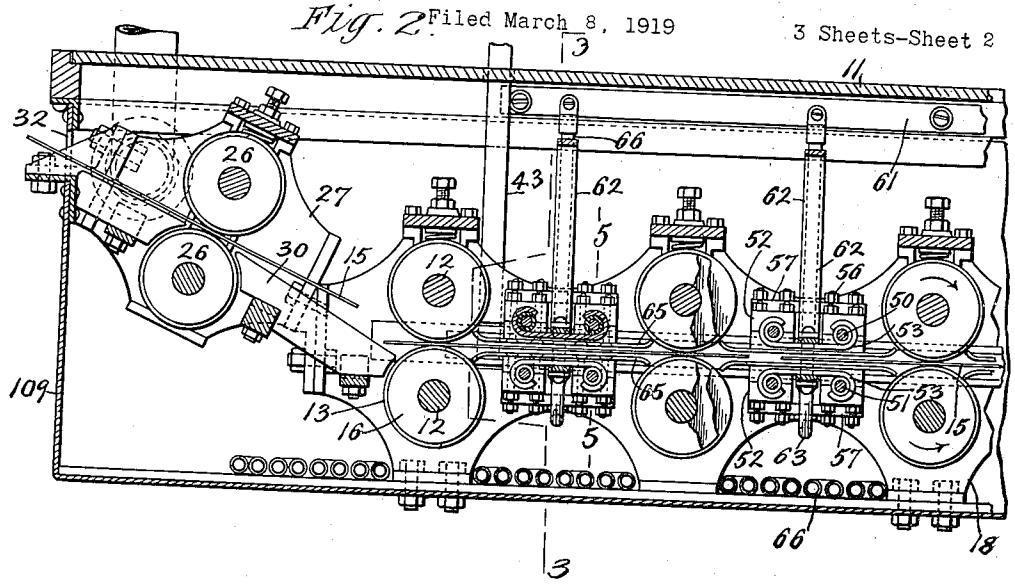
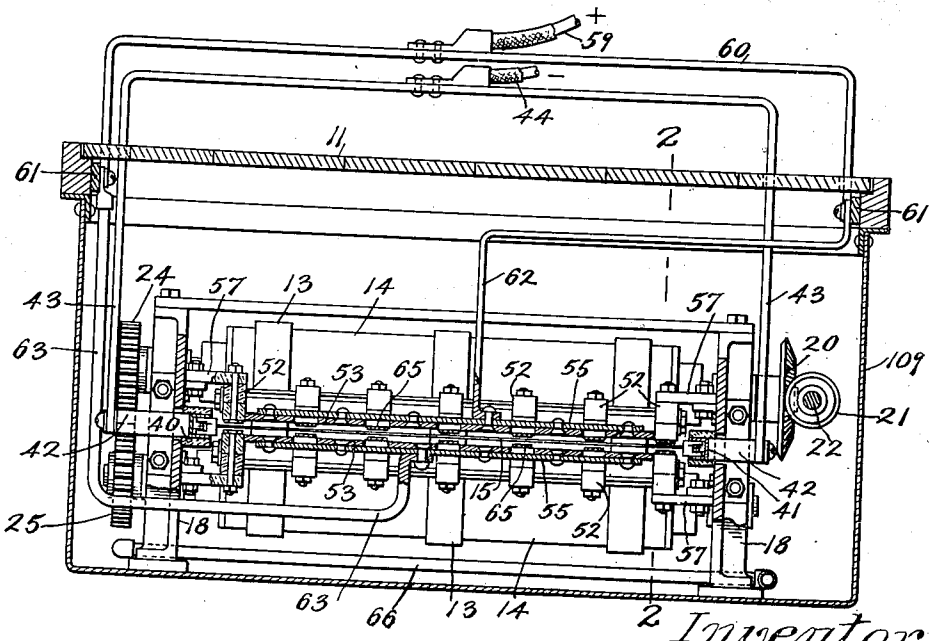


Fig. 3.



Inventor.

Charles F. H. Bohnhardt

by his Attys:

Philipp, Sawyer, Rice & Kennedy

June 5, 1923.

1,457,688

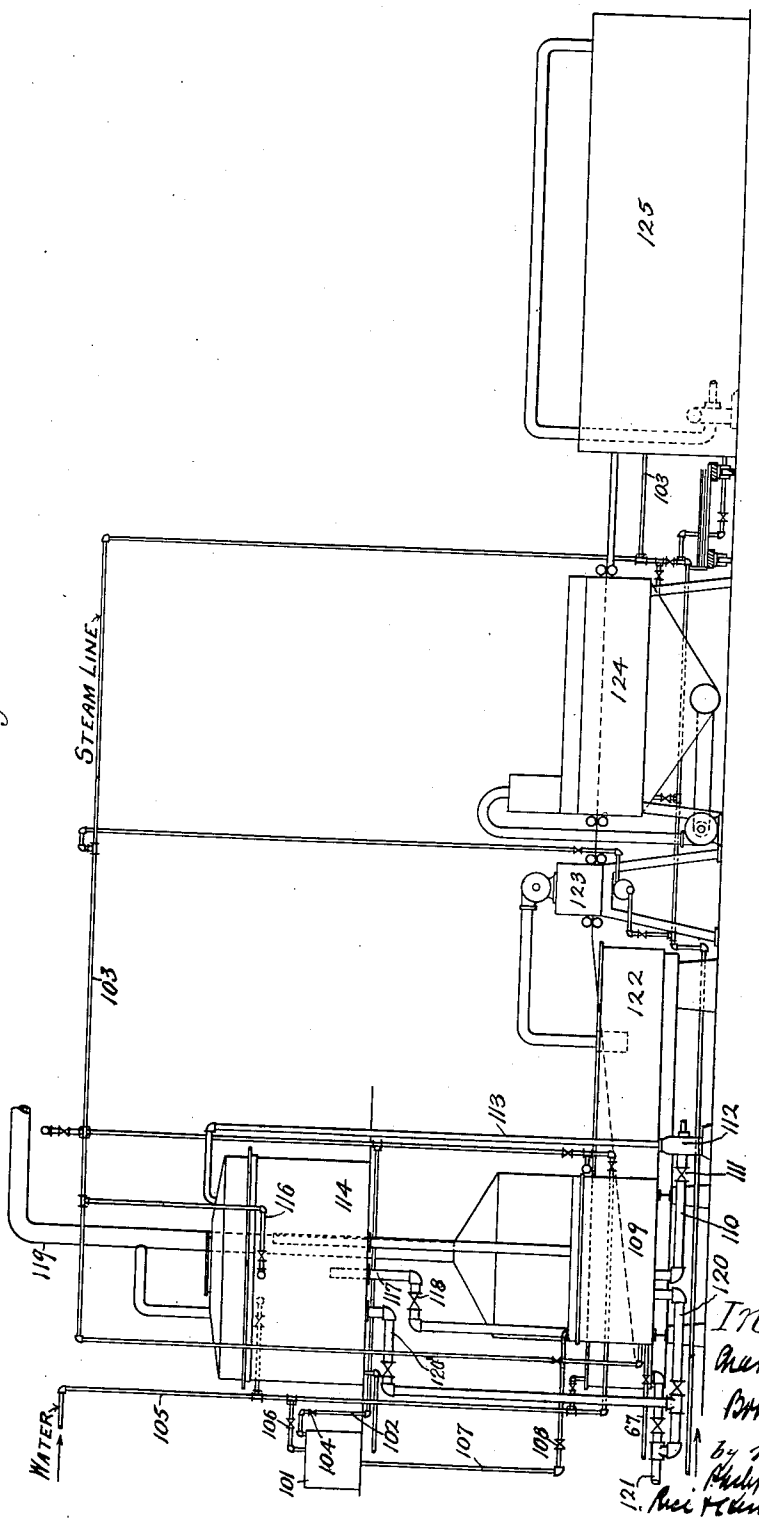
C. F. H. BOHNHARDT

PROCESS OF AND APPARATUS FOR RENOVATING COATED METAL SHEETS

Filed March 8, 1919

3 Sheets-Sheet 3

Fig. 8.



Inventor:
Charles F. H. Bohnhardt
by their Attys:
Philipp Thayer
Rice & Kennedy

Patented June 5, 1923. 1,457,688

UNITED STATES PATENT OFFICE.

CHARLES F. H. BOHNHARDT, OF BALTIMORE, MARYLAND, ASSIGNOR TO THE CROWN CORK AND SEAL COMPANY OF BALTIMORE CITY, OF BALTIMORE, MARYLAND, A CORPORATION OF MARYLAND.

PROCESS OF AND APPARATUS FOR RENOVATING COATED METAL SHEETS.

Application filed March 8, 1919. Serial No. 281,366.

To all whom it may concern:

Be it known that I, CHARLES F. H. BOHNHARDT, a citizen of the United States, residing at Baltimore, and State of Maryland, have invented certain new and useful Improvements in Processes of and Apparatus for Renovating Coated Metal Sheets, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to a process of and apparatus for renovating coated metal articles, and particularly sheet tin, this renovation comprising the removal of japan, lacquer, paint or the like in order that the renovated sheet may be again coated.

In some arts, such, for example, as the art of making decorated bottle caps, it is customary to apply such coating to large sheets of tin, that is, tinned sheet iron or steel, the caps being formed from these sheets. It sometimes happens that mistakes are made in the coating and lithographic processes with the result that such sheets have to be rejected as defective. In a plant producing such articles on a large scale the accumulation of such rejected sheets may be considerable. Attempts have been made from time to time to remove the coating from the sheet metal in order that the rejected sheets may be saved by being recoated. So far as known, these attempts have not been successful, for the reason that either the cost of removing the coating has been greater than the value of the defective sheet, or the tinned surface of the treated sheet has been so injured as to make the sheet useless for lithographic purposes.

An object of the present invention is to provide a process for economically removing the coating of lacquer, japan, paint, varnish, or the like, from a sheet of metal and particularly from so-called sheet tin, in order that the sheet may be recoated.

A further object of the invention is to provide an apparatus for carrying out such a process.

With these general objects in view the invention consists in the process and the combinations, details of construction and arrangement of parts which will first be described in connection with the accompanying drawings and then more particularly pointed out.

In the drawings,—

Figure 1 is a view, in vertical cross-section, with parts broken away, of the electrolytic tank of an apparatus constructed in accordance with the invention.

Figure 2 is a sectional view taken on the line 2—2 of Fig. 3 showing (enlarged) a part of the electrotype tank.

Figure 3 is a cross-sectional view taken on the line 3—3 of Fig. 2.

Figure 4 is a transverse sectional view of the tank, the section being taken through a pair of rollers;

Figure 5 is a cross-sectional view taken on the line 5—5 of Fig. 2.

Figure 6 is a cross-sectional view taken on the line 6 of Figs. 4 and 5.

Figure 7 is an enlarged view of a portion of the negative electrode element as shown in Fig. 6.

Figure 8 is a diagrammatic view showing a layout of a complete plant for carrying out the process.

In carrying out the process of the invention, the coated sheet is immersed in an electrolytic bath which is charged with chemicals of such character as to soften the coating, the metal of the sheet being connected to the electric circuit so as to form one of the electrodes, preferably a cathode, for the bath. During the electrolytic process the liquid of the bath is strongly agitated. By the use of a suitable current, the coating of lacquer, or the like, is blistered or broken up, while the agitation of the bath removes the coating from the sheet. The bath comprises an aqueous solution of such chemicals as will soften the lacquer or other coating quickly, at the same time rendering the bath properly conductive of the electric current. With tin sheets about 24 inches by 36 inches, having the usual coating used in decorating bottle caps, it has been found that the process may be effectively carried out with a current of about fifty amperes and about eleven and one-half volts. It will be found that some variation of the amperage and voltage must be made to suit the varying coatings. As the coating is usually of non-conductive material, a thick coat of little porosity will require higher voltage than a thin, porous coat. As the character of the coating depends largely on the details of manufacture, which details are known, it is

usually possible to sort the sheets so that all the sheets of a grade can be run through the bath with the same solution and the same current.

While the bath may have various constituents, to accomplish the desired result, most advantageously the bath comprises an aqueous solution of a mixture of sodium salts, and particularly a mixture comprising sodium sulphate, sodium silicate and sodium carbonate. It has been found in practice that a bath consisting of four hundred gallons of water, thirty-five pounds of soda ash, twenty-four pounds of silicate of soda, and fifteen pounds of sulphate of soda, is suitable for the process described. It is advisable to thoroughly agitate the bath prior to use in order to rapidly dissolve the chemicals.

While the temperature of the bath may be varied, the best results are obtained by heating the bath considerably above the usual room temperatures. In practice, the bath is maintained in the neighborhood of the boiling point of water, generally from 200° to 212° F. With these temperatures the coating of lacquer or the like is rapidly softened and removed so that the tin coating is not injured as might be the case with a long, slow treatment. This rapid treatment is particularly important when the treated sheets are to be again decorated since with a slow treatment the tin sometimes becomes roughened and does not look well when lithographed.

In carrying out the process the sheets to be treated are immersed in the bath and are at the same time included in the direct circuit in such a way that each sheet forms a cathode for the current. Meanwhile the bath is agitated, so that, as the coating is loosened, it is carried away. This loosening or separation of the coating is probably due to the fact that, as the coating is softened by the chemical action, aided by the heat, it no longer serves to keep the electrolyte from the tin. Hence, it is likely that gas accumulates, or is formed, at the metal surface of the tin and loosens or blows off the lacquer. Whether or not this is the true explanation, the fact remains that the coating is rapidly loosened from the sheet and is washed away by the agitated liquid. Furthermore, this occurs rapidly over the entire sheet. As soon as the coating is removed the sheet is withdrawn from the bath, washed and dried.

The accompanying drawings illustrate a form of apparatus by means of which the process may be carried out on a practical scale.

Referring more particularly to Fig. 8, which illustrates diagrammatically a complete plant, there is provided a mixing tank 101, steam heated by means of a pipe 102 leading to a steam main 103 which is connected with a suitable source. Pipe 102 is controlled by a valve 104. Water for the solution is supplied to the mixing tank by pipe 105 connected with a source and controlled by valve 106. This mixing tank may be provided with the usual form of mechanical stirring device (not shown). Connected with the mixing tank by pipe 107, which is controlled by valve 108, is an electrolytic tank 109 described more fully hereinafter. The solution is drawn through the pipe 107 into the electrolytic tank after thoroughly mixing. In the embodiment here illustrated, the mixing tank is small in comparison to the electrolytic tank, thus requiring the separate mixture of several batches of solution and in this way a more intimate mixture is insured.

To agitate the solution in the electrolytic tank, the liquid is circulated through the tank at a relatively rapid speed and is thereby drawn into a renovating tank. To this end, a pipe 110 leads, through a valve 111, to a circulating pump 112 of any suitable construction. From the pump the solution is conducted by a pipe 113 to the top of a renovating tank 114. This tank receives water from the pipe 105 and is heated from steam pipe 116. The renovating tank may be provided with a screen for absorbing the particles of coating from the solution. From the renovating tank a pipe 117, returns the solution to the electrolytic tank, this pipe being provided with a suitable circulating valve 118. The electrolytic tank and the renovating tank are connected with a vent pipe 119 for conducting away gases. In order that the two tanks may be cleaned at suitable intervals, they are respectively provided with waste pipes 120, 120′, connecting with a waste main 121.

From the electrolytic tank the treated sheets are delivered to a wash tank 122 which is provided with a suitable washing means, such as a clear water spray, for washing off the particles of coating that may adhere to the sheets. From this wash tank the sheets are conducted through two wiping or drying devices 123, 124, which may be of any suitable construction, and lastly they pass into an oven 125 preferably heated to about 300° F. The sheets are thus thoroughly dried and rusting is prevented.

With the exception of the electrolytic tank the above mentioned elements are per se all of well-known construction and no detailed description is necessary.

Referring more particularly to Figs. 1 to 7, the electrolytic action is carried on, in the present embodiment, in a watertight tank 109 preferably constructed of sheet steel and provided with a wooden cover or lid 11. The metal sheets are fed

through the tank by a series of insulated rollers arranged in vertical pairs. In the present embodiment there are seven pairs of these rollers, extending along the bottom of the tank so as to be below the liquid level which is maintained substantially constant. Each roller comprises a steel shaft 12 on which is mounted a plurality of bakelized micarta roller-rings 13, and a plurality of stone separators 14. In the present instance, there are three roller rings and four separators. These parts are clamped together on the shaft 12 by lock nuts 14' bearing against washers 16. Each shaft is journaled in a bearing block 17 supported by a frame 18 preferably made of cast iron and resting on a wooden base 19. To rotate these rollers to feed the sheets, the upper shaft of each pair is provided, in the present embodiment, with a bevel gear 20 meshing with a pinion 21 secured to a shaft 22 which extends from end to end of the tank. This shaft 22 has, at one end, a pulley 23 to which power is applied in any suitable manner. In order that both rollers of a pair may be positively driven, thereby to avoid slipping of the sheets, the upper shaft of each pair is provided, at its opposite end, with a gear 24 meshing with a similar gear 25 on the lower shaft. The sheets are delivered from the tank by a pair of delivery rollers 26 similar to those described. In order, however, that the sheets may be delivered at a point near the top of the tank, these delivery rollers 26 are carried by a bracket 27, secured to the frame 18 and to the end of the tank, in an oblique position, as clearly shown in Fig. 2. Owing to this position of this pair of rollers, it is the lower one that is directly driven, being provided with a bevel gear 28 which meshes with a pinion 29 on the main shaft 22. Between the last pair of tank rollers and the delivery rollers 26 is a guide block 30 which directs the sheets upwardly, and beyond the delivery rollers 26 is a second guide block 31 which directs the sheets through an exit opening 32. As appears in Fig. 1, the sheets are fed to the tank rollers by means of an oblique positioned pair of feed rollers 33, this feeding mechanism being a duplication of the delivery mechanism just described.

From Fig. 4 it will be seen that the roller-rings 13 are of a diameter to make contact with the metal sheets 15, whereas the separators are of a smaller diameter to allow circulation of the solution. By means of the construction described, the metal sheets are fed one by one through the solution in the electrolytic tank.

Means are provided for causing the sheets to travel in contact with one of the electrodes, preferably the cathode. This may be accomplished, for example, by providing a two-part cathode with resilient portions which make contact with opposite edges of the sheets. Although capable of various constructions, in the embodiment illustrated, extending along each side of the tank is an insulating bracket 40 carrying a cathode bar 41. Connected to each cathode bar is a conductor bar 42, connected in turn to a leader 43, which is connected with a negative terminal 44. At intervals, determined by a line midway between each pair of tank rollers, each cathode bar is provided with a rounded contact member 45. These members 45 are pressed outwardly by a spring 46 so as to make contact with the edges of the metal sheets, as appears in Fig. 6 (the sheet being represented in broken lines). In order to complete the circuit the spring 46 is made of conducting material and is in contact with both the contact members 45 and the cathode bar 41. The negative electrode (or cathode) element may advantageously be in electrical connection with the frame of the tank.

There is provided a second electrode arranged to be out of contact with the sheets and at a given distance therefrom. This may comprise, for example, a series of two-part electrode members forming a succession of gaps through which the sheets pass, as, for example, a pair of anodes (or positive electrodes) between each two sets of rollers. Although capable of various constructions, in the embodiment illustrated, extending transversely of the tank above and below the path of the metal sheets in each space between adjacent sets of tank rollers, is a pair of supporting rods 50, 51. Carried by each of these rods is a plurality of porcelain insulating clamps 52, seven being shown in the present instance. Between each two clamps is a positive electrode member in the form of a plate 53 extending in the direction of travel of the sheets. The upper plates 53 have their ends turned upwardly around the supporting rods 50, and the lower plates 53 have their ends turned downwardly around the supporting rods 51, (Fig. 2) these plates 53 being insulated from the rods 50, 51 by sections of porcelain tubing 54. As appears in Fig. 3 for example, these plates 53, in the present embodiment, form gaps through which the metal sheets are fed, the sheets being out of contact with the electrode plates. Secured to the several electrode plates 53 of both the upper and lower series and extending transversely of the tank is a conducting plate 55. The end porcelain clamps 52 are supported by bolts 56, the upper bolts 56 being suspended from, and the lower ones supported on, insulating brackets 57 which are in turn secured to lugs 58 on the frame 18. Current from a positive terminal 59 is conducted by a leader 60 to two bus bars 61 one on each side of the tank, which are carried

by the tank lid. From one of these bus bars, the one shown on the right in Fig. 3, a plurality of leaders 62 connects the bus bar with the conducting plate 55 of the upper unit and a second series of leaders 63 connect the other bus bar with the conducting plate 55 of the lower unit.

To serve as guides for the sheets, bolted or otherwise secured to each of the procelain clamps 52, is a strip 65 of steel or the like, positioned lengthwise of the tank, the upper strips having their ends turned slightly upwardly, and the lower strips having their ends turned downwardly (Fig. 2).

To heat the bath, there is provided in the bottom of the tank a set of steam coils 66 connected by a pipe 67 with the main supply pipe 103.

In operation, the tank 109 being charged with the bath, previously prepared in mixing tank 101, the coated sheets are fed one by one to the feed rollers 33. These rollers and the associated guide blocks deliver the sheets to the first pair of tank rollers and the sheets are passed through the tank by the successive pairs of rollers. During this travel the opposite side edges of each sheet make contact with the spring pressed members 45 and the sheet becomes, in effect, a cathode member for the electrolytic bath. While in contact with the members 45 the sheets are passing between the gaps formed by the upper and lower positive electrode elements. The electric circuit is traced from the positive terminal 59, through the leader 60 to the two bus bars 61, from one bus bar 61 through the several leaders 62 to the upper conducting plate 55, and thence to the upper electrode members 53; from the other bus bar 61, through the several leaders 63 to the lower plate 55 and the lower electrode members 53. From the spaced positive electrode members 53 the current passes through the bath to the metal plate 15, thence to the spring pressed contact members 45, through the springs 46 to the two side cathode bars 41, the conducting bars 42 and the leader 43 to the negative terminal 44.

During this travel of the sheets the circulating pump 112 causes a rapid circulation of the bath in a direction opposite to the travel of the sheets. As before described the coating is softened and loosened and carried away. From the last pair of tank rollers, the sheets are directed upwardly by guide block 30 to the delivery rollers 26 which deliver them through the opening 32. The sheets are then conducted to the washing tank 122; from there to the wiping or drying devices 123, 124 and finally to the oven 125 where they are thoroughly dried as described.

While the invention has been described with relation to flat sheets of tin plate it is to be understood that it is adapted to renovating other forms of coated articles, the word "sheets" being used in a comprehensive sense.

What is claimed is:

1. The herein described process of renovating coated tin-plated metal sheets and the like, which comprises immersing the sheets in an electrolytic bath charged with chemical ingredients of a character to soften the coating, and removing the softened and loosened coating from the tin-plate.

2. The herein described process of renovating coated tin-plated metal sheets and the like which comprises immersing the sheets in an electrolytic bath charged with chemical ingredients of a character to soften the coating, and agitating the bath to remove the softened and loosened coating from the tin-plate.

3. The herein described process of renovating coated tin-plated metal sheets and the like, which comprises immersing the sheets in an electrolytic bath charged with chemical ingredients of a character to soften the coating, heating the bath, and removing the softened and loosened coating from the tin-plate.

4. The herein described process of renovating coated tin-plated metal sheets and the like, which comprises immersing the sheets in an electrolytic bath charged with chemical ingredients of a character to soften the coating, heating the bath to approximately the boiling point of water, and removing the softened and loosened coating from the tin-plate.

5. The herein described process of renovating coated metal sheets and the like, which comprises immersing the sheets in an electrolytic bath charged with chemical ingredients of a character to soften the coating, and causing a rapid circulation of the bath to remove the softened and loosened coating.

6. The herein described process of renovating coated tin-plated metal sheets and the like, which consists in immersing the sheets in an electrolytic bath charged with chemical ingredients of a character to soften the coating, in contact with an electrode member, and removing the softened and loosened coating from the tin-plate.

7. The herein described process of renovating coated, tin-plated metal sheets and the like, which consists in immersing the sheets in an electrolytic bath charged with chemical ingredients of a character to soften the coating, in contact with a cathode member, and removing the softened and loosened coating from the tin-plate.

8. The herein described process of renovating coated, tin-plated metal sheets and the like, which consists in immersing the sheets in an electrolytic bath, in contact with a cathode member, and removing the soft-

ened and loosened coating from the tinplate.

9. The herein described process of renovating coated, tin-plated metal sheets and the like which comprises immersing the sheets in an electrolytic bath charged with an aqueous solution containing a sodium salt to soften the coating, and removing the softened and loosened coating from the tinplate.

10. The herein described process of renovating coated tin-plated metal sheets and the like, which comprises immersing the sheets in an electrolytic bath charged with an aqueous solution of a mixture of sodium salts to soften the coating, and removing the softened and loosened coating from the tinplate.

11. The herein described process of renovating coated metal sheets and the like, which comprises immersing the sheets in an electrolytic bath charged with an aqueous solution of sodium sulphate, sodium silicate and sodium carbonate, and removing the softened and loosened coating.

12. The herein described process of renovating coated, tin-plated metal sheets and the like, which comprises immersing the sheets in an electrolytic bath charged with chemical ingredients of a character to soften the coating, agitating the bath to remove the softened and loosened coating from the tinplate, washing the sheets and drying the sheets.

13. In apparatus for renovating coated metal sheets, and the like, and in combination a tank for containing an electrolytic bath, anode and cathode elements, and means for feeding the metal sheets through said tank in contact with one of said electrode elements.

14. In apparatus for renovating coated metal sheets and the like, and in combination a tank for containing an electrolytic bath, anode and cathode elements, and means for feeding the metal sheets through said tank in contact with said cathode element.

15. In apparatus for renovating coated metal sheets and the like, and in combination a tank for containing an electrolytic bath, an anode element, and a cathode element including a portion for contacting with the metal sheets.

16. In apparatus for renovating coated metal sheets and the like, and in combination a tank containing an electrolytic bath, means for feeding the metal sheets through said tank, an anode element, and a cathode element including spring pressed portions for contacting with the metal sheets.

17. In apparatus for renovating coated metal sheets and the like, and in combination a tank for containing an electrolytic bath, means for feeding the metal sheets through said tank, an anode element comprising a plurality of electrode units arranged in pairs, means for feeding the metal sheets between the members of said pairs of electric units, and a cathode element having portions for contacting with the metal sheets.

18. In apparatus for renovating coated metal sheets and the like, and in combination a tank containing an electrolytic bath, an anode element comprising a pair of electrode members arranged to form a gap, means for feeding the metal sheets between said electrode members and out of contact therewith, and a cathode member comprising portions for contacting with opposite edges of the metal sheets during their travel between said anode members.

19. In apparatus for renovating coated metal sheets and the like, and in combination a tank for containing an electrolytic bath, an anode element comprising a pair of transverse plates having connection with a positive terminal, a plurality of electrode members associated with each of said plates, means for feeding the metal sheets between said electrode members, and a cathode element comprising a pair of side bars having connection with a negative terminal and a spring pressed member having connection with each side bar, for contacting with the metal sheets.

20. The herein described process of renovating metal sheets having a decorative coating, which comprises immersing the sheets in an electrolytic bath charged with chemical ingredients of a character to soften the decorative coating, and removing the softened and loosened coating.

21. In apparatus for renovating coated metal sheets and the like, and in combination a tank for containing an electrolytic bath, a plurality of insulated rollers arranged in pairs for feeding the sheets through said tank, said rollers being formed to permit circulation of the bath, an electrode element comprising spaced electrode units arranged in pairs between pairs of the feeding rollers and between which the sheets are fed and a complementary electrode element having a portion for contacting with the metal sheets.

22. In apparatus for renovating coated metal sheets and the like, and in combination, a tank for containing an electrolytic bath, a plurality of insulated rollers arranged in pairs for feeding the sheets through said tank, an electrode element with which the sheets are out of contact, a complementary electrode element comprising an electrode bar extending along each side of the tank and spring-pressed contact members for contacting with the edges of the sheets.

23. In apparatus for renovating coated metal sheets and the like, and in combination, a tank for containing an electrolytic

bath, a plurality of insulated supporting rods transverse the tank and arranged in pairs straddling the path of the sheets, spaced insulating clamps carried by said rods, electrode plates located between said clamps extending in the direction of the travel of the sheets, and having their ends turned away from said path to embrace insulators on the supporting rods, a conductor connected with the set of electrode plates supported by each of said rods, two bus bars, leaders connecting the upper conductors with one bus bar and the lower conductors with the other bus bar, a common terminal for said bus bars, and a complimentary electrode element having portions for contacting with the metal sheets.

24. In apparatus for renovating coated metal sheets and the like, and in combination, a tank for containing an electrolytic bath, means for feeding the sheets through the tank, a plurality of connected electrode elements arranged in pairs to form gaps through which the sheets pass, a complementary electrode element including an electrode bar extending along each side of the tank, insulating supports therefor, spring pressed contact members in electrical connection with said bars for contacting with the edges of the passing sheets, conductors connected with said bars, leaders connected with said conductors, and a common terminal for said leaders.

25. In apparatus for renovating coated metal sheets and the like, and in combination, a tank for containing an electrolytic bath, means for feeding the sheets through the tank, a plurality of insulated supporting rods transverse the tank and arranged in pairs straddling the path of the sheets, spaced insulating clamps carried by said rods, electrode plates located between said clamps and forming gaps through which the sheets are fed, guide strips carried by said clamps and having their ends turned slightly away from the path of the sheets, and a complementary electrode element having portions for contacting with the metal sheets.

26. In apparatus for renovating coated metal sheets and the like, and in combination, a tank for containing an electrolytic bath, a plurality of rollers arranged in pairs for feeding the sheets through the tank, the tank having in-feed and discharge openings near the top thereof, a pair of in-feed rollers obliquely arranged for feeding the sheets from the in-feed opening obliquely downwardly toward said first named rollers, and a pair of out-feed rollers obliquely arranged for feeding the sheets from the first named rollers obliquely upwardly to the discharge opening.

In testimony whereof, I have hereunto set my hand.

CHARLES F. H. BOHNHARDT.