Aug. 10, 1943. H. CSANYI 2,326,624

ELECTROPLATING APPARATUS

Filed Jan. 16, 1940 2 Sheets-Sheet 1

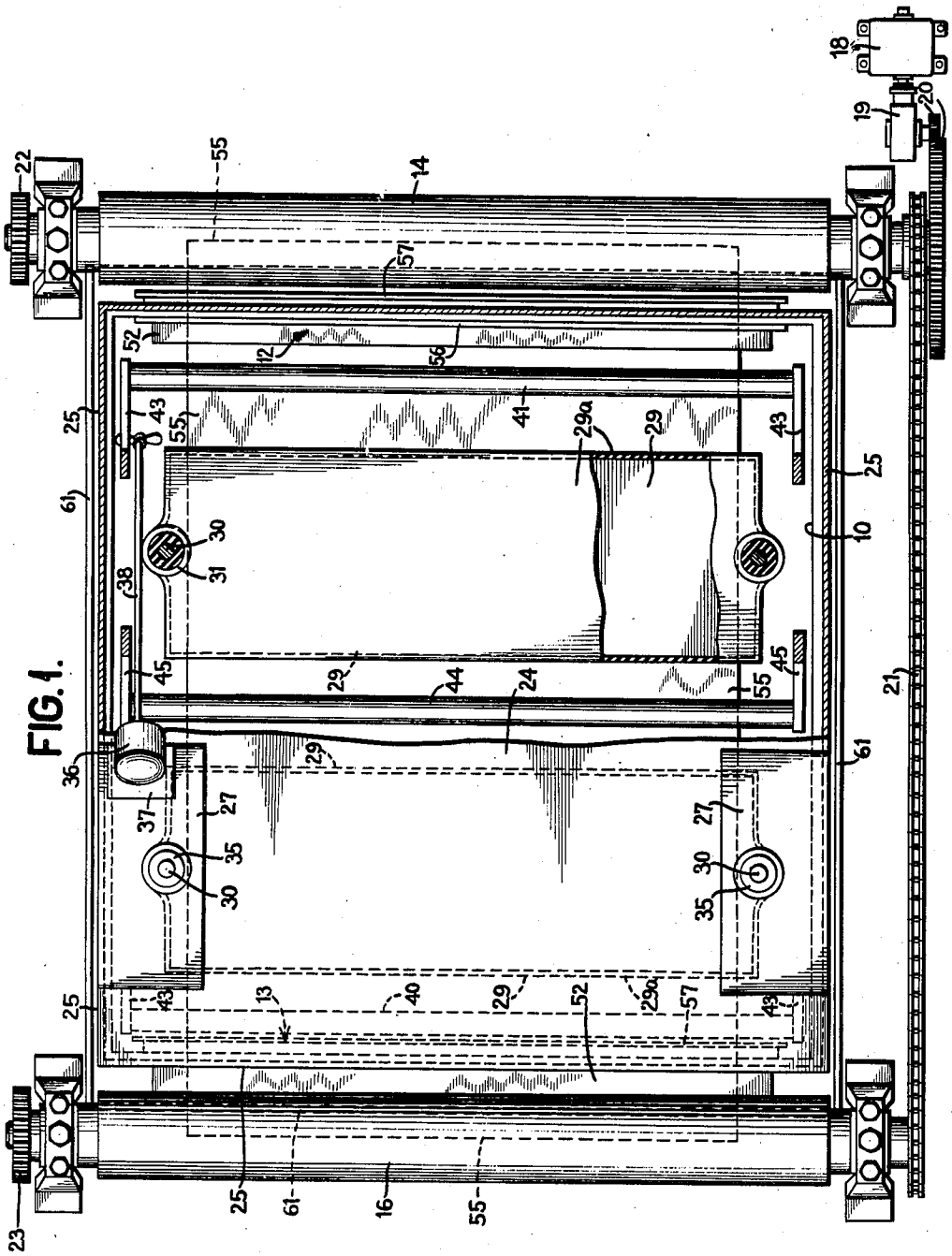

FIG. 1.

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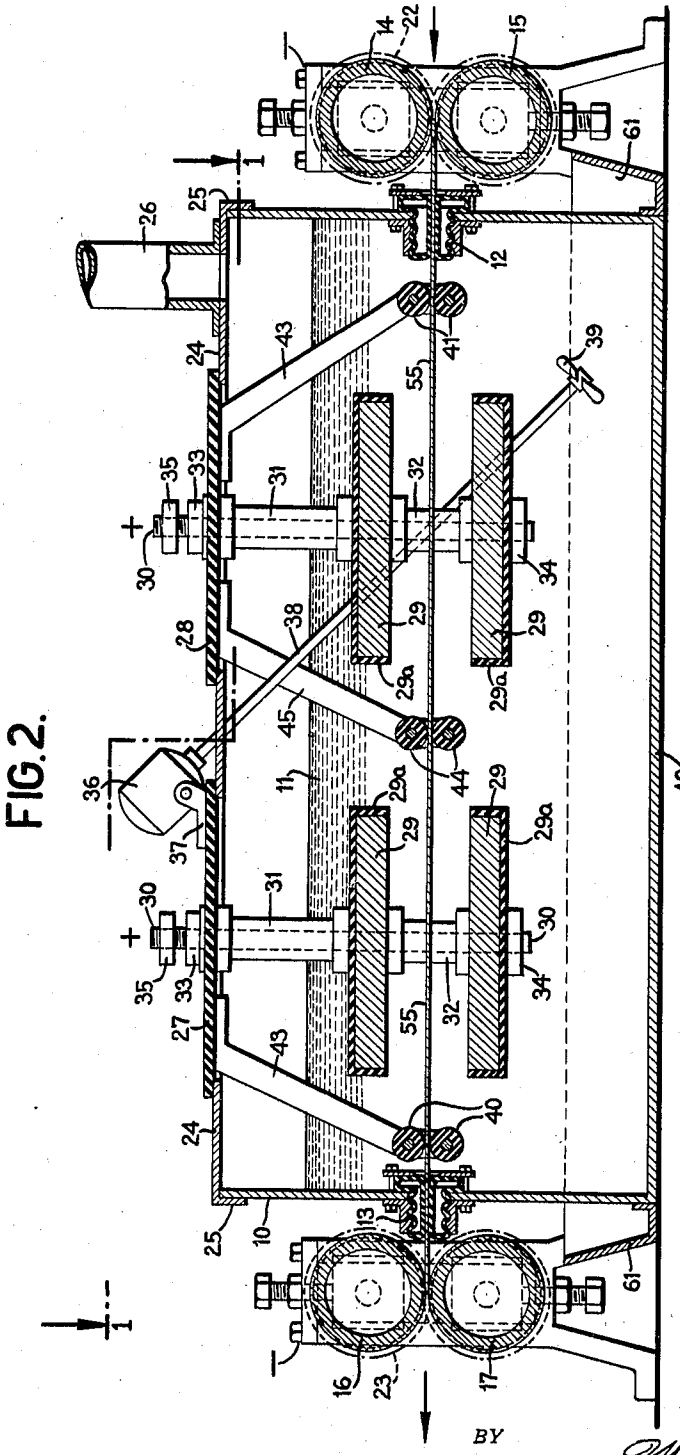
FIG. 2.



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UNITED STATES PATENT OFFICE

2,326,624

ELECTROPLATING APPARATUS

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Application January 16, 1940, Serial No. 314,036

1 Claim. (Cl. 204—206)

This invention relates to method and apparatus for treating sheet and strip material, more particularly sheet and strip metal. This application is a continuation-in-part of my application Serial No. 104,385, filed October 7, 1936, now Patent No. 2,212,588.

In the electro-plating of metal, especially sheet metal, as practiced heretofore, the sheets have been suspended in the electrolyte from clips and either held stationary for batch treatment, or removed about to operate the process continuously. The sheets in this vertical position are frequently bent or curved as they move through or out of the tank and such bending or flexing disturbs the plating. In any event, the tanks used for continuous operation must be very large and even under the best conditions, portions of the sheets are not satisfactorily plated by this method. Another objection to the usual operation of electroplating apparatus is that fumes and obnoxious gases almost invariably escape into the room, causing irritation to and impairing the health of workmen.

One object of this invention is to provide a method and apparatus for electro-plating metal stock which overcomes the aforementioned difficulties.

Another object of this invention is the provision of a method and apparatus for electroplating metal stock continuously by introducing the metal directly into and withdrawing the metal from a plating tank at a point below the level of electrolyte therein.

A further object is to provide for removing gases sticking to metal while such metal is moving through an electroplating bath in a substantially horizontal path.

Another object is the provision of improved apparatus for continuously plating metal stock in an economic manner and with a minimum of fume annoyance.

These and other objects and advantages of my invention will be explained and will be more apparent from a description of the embodiments thereof illustrated in the accompanying drawings, in which,

Fig. 1 is a plan view, partly in section taken along the line 1—1 in Fig. 2, of an electroplating tank embodying my invention.

Fig. 2 is a vertical longitudinal sectional view taken through substantially the center of the tank shown in Fig. 1.

The invention has been illustrated as applied to metal sheets but it is to be understood that the invention is also applicable to other forms of metal such as continuous strip or short lengths of stock with suitable modification.

In the drawings, numeral 10 indicates an electroplating tank which may be made of any suitable material such as metal lined with asphaltum, designed to contain a quantity of electrolyte 11. Sheet or strip material to be plated may be introduced into the tank 10 below the level of liquid 11, and without substantial leakage thereof, through a stuffing box 12, and may be removed therefrom through a similar stuffing box 13 in the opposite wall of the tank 10. Suitable feed rolls such as pusher rolls 14, 15 at the inlet and puller rolls 16, 17 at the outlet may be provided near the stuffing boxes 12 and 13, and are preferably driven by power means such as the motor 18. One suitable form of drive is illustrated in Fig. 1 in which the motor 18 drives roll 14 directly, through the reduction gearing 19 and gear train 20. Roll 14 in turn drives the other upper feed roll 16 by means of sprockets and the chain 21. Upper rolls 14 and 16 are geared directly to lower rolls 15 and 17, by the gears 22 and 23, respectively. Thus all four feed rolls are driven at the same, or a substantially synchronized speed. Each pair of feed rolls may be suitably mounted in adjustable bearings or journal blocks, for adjustment toward or away from each other as is well understood in the art, and each roll is preferably connected to the negative pole of a source of electric current (not shown).

The tank 10 may be provided with a cover 24, having overhanging edges 25, adapted to be placed over the entire top of the tank 10, and provided with an outlet pipe 26 for carrying off any gases or fumes inside the tank 10. Pipe 26 may, for example, be connected to any suitable exhaust fan (not shown). Fixed to cover 24, or merely overlying openings in the cover if desired, are two pairs of plates 27, 27 and 28, 28 made of suitable insulating material such as "Bakelite" or hard rubber. Each pair of these plates supports a pair of anodes 29 for suspension in the electrolyte 11, the composition of the anodes depending on the kind of plating to be performed. The ends of anodes 29 are fixed to rods 30, the anodes of each pair being spaced from each other a suitable distance to allow passage therebetween of the metal to be plated. Each of the anodes 29 is preferably encased within a cup-like insulating member 29a constructed of "Bakelite," hard rubber, or the like and covering all of the anode surfaces except the surface facing the metal to be plated. The upper ends of rods 30 project through their respective plates 27, 28 and the ex-

posed lengths of these rods below the plates are protected by tubular insulating members 31, 32 made of suitable material such as hard rubber. Nuts 33, 34 may be threaded on the ends of rods 30 and tightened to hold plates 27, 28, anodes 29, and insulating members 31, 32 in fixed relation. Nuts 35 may be employed for connecting rods 30 and anodes 29 to the positive pole of a suitable source of electric current (not shown). An electric motor 36 may be mounted on a bracket 37 fixed to one of the plates 27, for driving shaft 38 and fan 39, to provide a constant circulation of the electrolyte 11.

To assist in guiding the sheet material through the stuffing boxes 12 and 13, I prefer to employ two pairs of guide rolls 40, 41 which may be journaled in the ends of brackets 43 also fixed to insulating plates 27 and 28. Because these rolls 40, 41 contact the metal being plated, they are preferably constructed of some suitable material which will not be plated, such as "Bakelite" or hard rubber. Two distinct pairs of anodes 29 have been illustrated, and, although I do not wish to be limited to this embodiment of my invention, I have discovered that where metal being plated is subjected to the influence of two or more successive anodes, greatly improved results may be obtained by removing any gas accumulated on the metal surface during the first portion of the plating and subjecting the cleaned surface immediately to the action of the plating instrumentalities. One way to accomplish this is to provide a pair of rolls 44, made of soft rubber or the like between the pairs of anodes 29 and to pass the metal between these rolls. These rolls 44 may be journaled in brackets 45 fixed to plates 28 in a manner similar to guide rolls 41.

It will be seen that my improved construction of electro-plating tank provides an effective cover 24, with all of the equipment inside the tank such as anodes, guide rolls, gas removing rolls, and agitator, suspended from the cover. This simplifies repairs which can be easily made by simply removing the cover 24 and the equipment carried thereby.

The stuffing boxes 12 and 13 may be substantially alike and mounted in the walls of tank 10 extending in the same direction. The stuffing boxes are preferably composed of pneumatic containers suitably clamped or otherwise fixed in position to seal openings in the tank walls. The metal stock that is plated is forced between flexible surfaces of these pneumatic containers which automatically conform to the shape of the stock to prevent loss of electrolyte from the tank during passage of the stock. The stuffing boxes described in more detail in my said copending application Serial No. 104,385 are preferable for purposes of this invention although other forms of stuffing boxes may be used.

In the operation of the above described embodiment of my invention, a sheet, plate, or strip of metal 55 to be electro-plated is started between the feed rolls 14 and 15 which flatten and smooth out any irregularities therein and push the sheet through stuffing box 12 into the tank 10. The sheet moves continuously along a path through guide rolls 41, between one pair of anodes 29, through rolls 44 for wiping off gas bubbles, between the second pair of anodes, and through guide rolls 40, out of the tank through stuffing box 13 and the puller rolls 16 and 17. Rolls 14, 15, 16, and 17 are preferably made of a material which is a good conductor of electricity to make a good electrical contact with the sheet being treated. The sheet which is thus the cathode, should always be in contact with one of the pairs of feed rolls so as not to interrupt the plating operation, or the movement of the sheet through the tank. If desired, pieces of some porous material such as cheese cloth may be interposed between the sheet 55 and the anodes 29, to prevent the possibility of the sheet contacting one of the anodes and causing a short circuit. As the sheet 55 emerges through stuffing box 13, the surplus electrolyte is wiped off by the action of the soft rubber of the pneumatic containers of the stuffing box 13. The sheet may then be dried, cleaned, buffed, and/or finished in any suitable manner.

As a precautionary measure, I prefer to employ a trough 61 surrounding the outside of the tank below the stuffing boxes 12 and 13, in order to catch any electrolyte which may escape, if the pneumatic containers of the stuffing boxes should be punctured or deflated.

During the electro-plating process, a rapid circulation of the electrolyte greatly enhances the speed of plating. I have found that it is preferable to operate the agitator fan 39 at such a speed that the circulation of electrolyte within the tank is at least 1 foot per second. That is, the rate of flow of a given portion of electrolyte from one portion of the tank to another should be at least 1 foot per second to obtain the best results. A slower circulation can, of course, be employed but this proportionately decreases the thickness of the plate for a given time, or in other words increases the time required to form a plate of a given thickness.

The suspending of the anodes, guides, and agitating mechanism from the cover of the tank greatly facilitates any repairs and replacements which may be necessary. To install a fresh anode in place of a used one, the cover or other member carrying the anodes may be lifted out of the tank, and the replacement effected without removing or interfering with the electrolyte or the other parts of the tank. If desired, however, these members may be fixed to the tank or mounted in any other appropriate manner.

Many modifications of the apparatus shown in the drawings may be made without departing from the scope of my invention. Any number of anodes may be employed and they may be arranged in other ways. Although the rubber rolls 44 are not necessary to the operation of the process, they remove any gas sticking to the sheet, which otherwise seriously hinders the plating action. Additional guide members and/or gas removing members may be employed in the tank, and these members do not need to be rolls. For example, a fixed plate, or pair of plates, may be employed between the anodes, set at an angle to assist in guiding the leading edge of the sheet 55 through the tank.

The insulating casings 29a for the anodes 29 increase the efficiency of the plating operation because they minimize loose plating of metal on metal parts inside the tank other than the stock to be plated. Furthermore, a more concentrated plating action on the stock, itself, is thus obtained making possible a higher rate of travel for the stock passing through the tank.

The terms and expressions which I have employed are used as terms of description and not of limitation, and I have no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described

or portions thereof, but recognize that various modifications are possible within the scope of the invention claimed.

I claim:

Electroplating apparatus comprising a tank for electrolyte having means in the side walls thereof for passing metal stock therethrough along a substantially horizontal path below the level of electrolyte therein, a cover for said tank completely enclosing the upper portion thereof, conduit means for carrying away fumes collecting under said cover, a plurality of anodes suspended in said tank from said cover in pairs at spaced intervals along the horizontal path of the stock and spaced substantially uniformly above and below said path, and means suspended from said cover and contacting the stock for removing gas from the surface of stock after it has passed between one pair of anodes and before it passes between another pair of anodes.

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