

Dec. 26, 1950

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ELECTROLYTIC APPARATUS FOR CLEANING STRIP

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2 Sheets-Sheet 1

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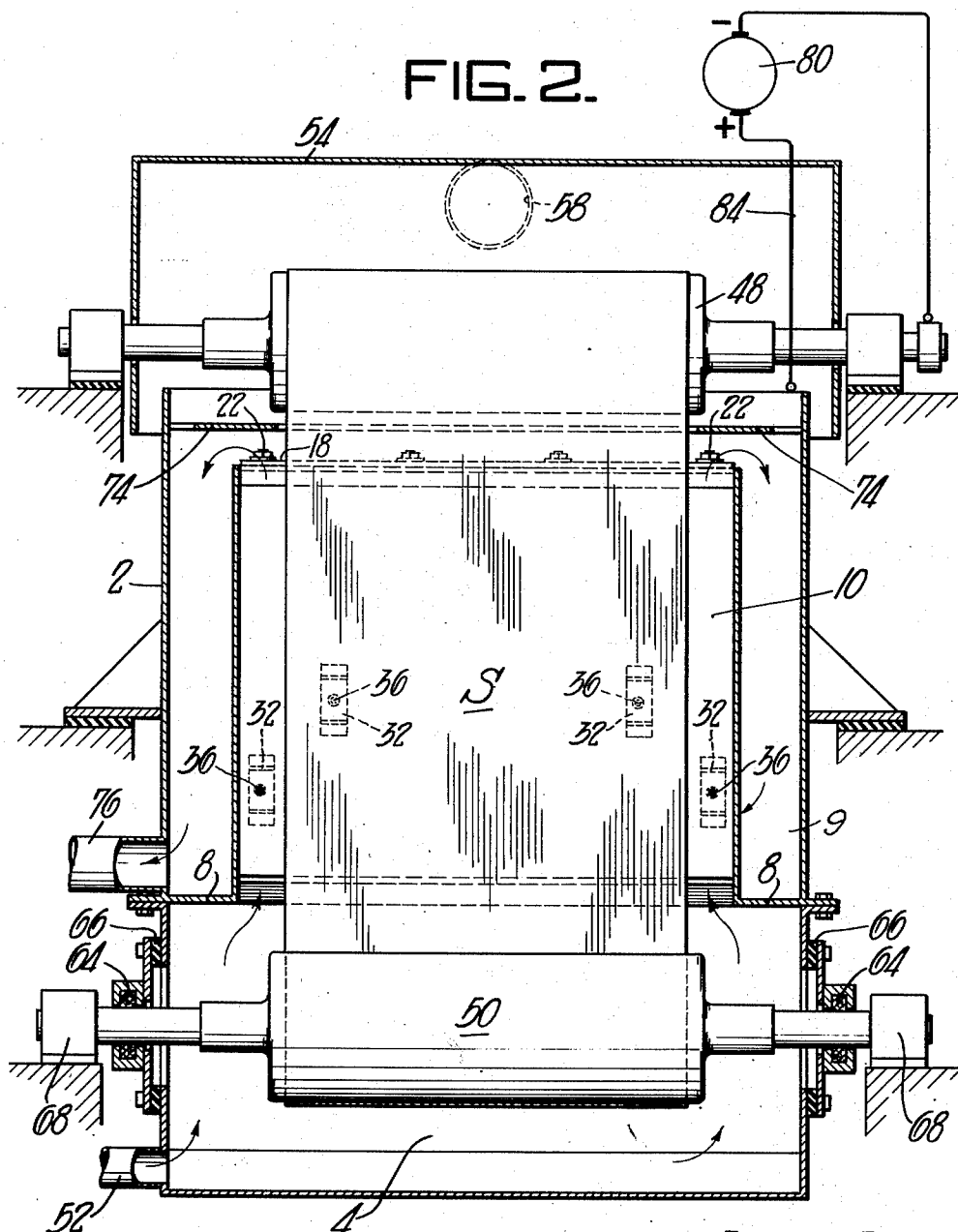
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UNITED STATES PATENT OFFICE

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ELECTROLYTIC APPARATUS FOR CLEANING STRIP

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Application February 7, 1947, Serial No. 726,995

4 Claims. (Cl. 204-206)

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This invention relates to apparatus for electrolytically cleaning metallic strip and more particularly to cleaning such strip in vertical passes. Most of the electrolytic cleaning of metals in strip form is performed in horizontal passes which method possesses inherent disadvantages, chief of which are:

1. Equipment utilized requires a great deal of floor space.

2. Clearance required between the strip and the electrodes between which the strip passes are great in order to avoid short circuits resulting from vertical whipping of the moving strip. This excessive clearance increases the resistance of the electrical circuits, limits current density and lowers operating efficiency.

3. Current density and cleaning action are limited due to blanketing of the electrodes by evolved gases.

4. Stray current losses due to the arrangement of the electrical circuits.

Vertical cleaning passes have been used to a slight extent, but those in use also have various disadvantages. For example, the maximum cleaning action is not obtained at all times because of entrained gases in the electrolyte and the type of electrical hook-up. In addition, it is difficult to vary the operation to suit variable conditions. Another disadvantage is that the current density is limited because the gas bubbles evolved blanket the electrode surfaces, thus increasing the electrical resistance and causing high voltage drops.

It is an object of my invention to provide an electrolytic tank which operates uniformly at a high efficiency.

Another object is to provide means for carrying off the gas bubbles evolved.

Still another object is to provide means for releasing the entrained gases in the electrolyte.

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

Figure 1 is a schematic longitudinal section through the electrolytic tank;

Figure 2 is a sectional view taken on the line II-II of Figure 1; and

Figure 3 is an enlarged detail of the electrode adjusting means.

Referring more particularly to the drawings, the reference numeral 2 indicates an electrolytic tank having a chamber 4 in the lower part thereof and a pair of restricted passageways 6, 6 leading upwardly from said chamber to the top of the tank. Plates 8 form a substantially hori-

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zontal wall separating the tank 2 into the lower chamber 4 and an upper chamber 9. Mounted in each of the restricted passageways 6 is a pair of electrodes 10, each of which is mounted for movement toward the other as shown in detail in Figure 3. The top of the wall of the passageway 6 is bent outwardly to provide a horizontal flange 12 having a threaded hole 14 therein communicating with the threaded opening in a nut 16 welded to the under side of the flange 12. The electrodes 10 are removable and the upper part thereof is bent outwardly to provide a horizontal flange 18. A slot 20 is provided in this flange for receiving a stud bolt 22 which is threaded downwardly through the hole 14 in the nut 16 to hold the electrode 10 in place. A threaded hole 24 is provided in the electrode 10 some distance from its top and has a nut 26 positioned thereover which is welded to the electrode. A hole 28 is provided in the wall of passageway 6 and a hole 30 in axial alignment therewith is provided in the wall of the tank 2. A bracket 32 is welded or otherwise fastened to the outside of tank 2 and is provided with an opening 34 which is in alignment with openings 28 and 30. A threaded stud bolt 36 passes through these aligned openings and is threaded into the nut 26 and hole 24. Nuts 38 and 40 are screwed on the bolt 36 between the bracket 32 and the wall of the tank 2 with a washer 42 being provided between the nut 40 and the wall of tank 2 to prevent leakage of electrolyte from the tank. It will be apparent that the electrode 10 can be moved toward and away from the center of the passageway 6 by changing the position of nuts 38 and 40.

Fastened to the outside of passageways 6 and to the sides of tank 2 are cascade plates 44. An entry conductor roll 46 is mounted above one of the passageways 6 and a delivery conductor roll 48 is mounted above the other passageway 6. A rubber covered sink roll 50 is positioned in the chamber 4, which is provided with an inlet 52 for the electrolyte. A hood 54 surrounds the rolls 46 and 48 in the top of the tank and collects the fumes from the cleaning operation. A conduit 56 leads from the hood 46 to an exhaust fan (not shown). The strip S enters the tank 2 over the entry conductor roll 46 and passes downwardly between one pair of electrode liners 10 which are arranged so that the clearance between the electrodes and the strip will give the most effective cleaning action. The strip then passes under the sink roll 50 upwardly between the other pair of electrode liners 10 and over the

exit roll 48, the second pair of electrode liners also being arranged so that the clearance between the electrodes and the strip will give the most effective cleaning action. Hold down rolls 60 are provided at each conductor roll to insure good contact between the rolls and the strip with the hold down roll for the exit conductor roll 48 also preventing electrolyte drag out.

As shown in Figure 2, the shaft 62 of the sink roll 50 passes through the shaft seals 64 at each end of the tank, the shaft seals being insulated from the tank 2 by means of insulation 66. The shaft 62 is mounted for rotation on bearings 68.

The electrolyte is circulated by means of a pump 70 which delivers it from a reservoir 72 to the chamber 4 through the opening 52. The electrolyte passes upwardly through the restricted passageways 6 and over the surface of the strip S at a high velocity due to the restriction of the passageways, thus carrying the evolved gases out of the electrically active zone and preventing blanketing of the electrode by these gases. Deflector plates 74 at the top of the tank confine the electrolyte within the tank. The electrolyte solution then flows over the top of the passageways 6 and cascades downwardly over the plates 44, which aid in releasing the entrained gases in the electrolyte. The electrolyte leaves the tank through conduits 76 which lead to the reservoir 72. The reservoir 72 is preferably provided with means for cleaning and conditioning the electrolyte.

The electrical arrangement for supplying current to the system consists of two generators 78 and 80 having identical characteristics and which are driven from a common motor 82. The negative terminal of generator 78 is connected to the roll 46 and the negative terminal of generator 80 is connected to the roll 48. The positive terminals of generators 78 and 80 are connected through a common lead 84 to the tank 2. By this arrangement any small stray currents in the tank do useful work and there are three possible circuits for the current:

1. From the generator 78 to the tank 2 and anodes 10, through the electrolyte to the strip S, to the conductor roll 46 and back to the generator 78.

2. From the generator 80 to the tank 2 and anodes 10, through the electrolyte to the strip S, to the conductor roll 48 and back to the generator 80.

3. From the generator 78 to the generator 80, to the conductor roll 48, through the strip S, to the conductor roll 46 and back to the generator 78.

However, no current will flow through the third circuit since the voltage of generators 78 and 80 are equal and opposite. Therefore, all the current flowing must pass through the strip S into the electrolyte and in so doing evolve gas, which evolution constitutes the cleaning action. Thus maximum efficiency is obtained and any need for internal insulation of the tank or its component parts is eliminated. However, the tank and its external attachments should be insulated from their supporting structures since the strip being cleaned will normally be grounded by contact with various machines and if the tank is grounded, a current loss will occur.

In the arrangement shown, the strip is of negative polarity. This is preferable since two volumes of hydrogen are evolved from the negative electrode for each volume of oxygen evolved from the positive electrode. Thus, the cleaning

action is double that obtained when the polarity of the strip is positive.

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. Electrolytic cleaning apparatus comprising a vertical tank, a pair of conductor rolls over which a strip passes into and out of the tank, a sink roll at the bottom of the tank around which the strip passes, a chamber in the bottom of said tank containing said sink roll, a pair of restricted passageways in said tank leading upwardly from said chamber, said passageways forming the only outlets from said chamber, a pair of electrodes in each of said passageways, said strip passing downwardly between one of said pairs of electrodes and upwardly between the second of said pairs, means for introducing the electrolyte into the chamber and causing it to flow upwardly in each passageway, cascade plates above said chambers and adjacent said passageways over which the electrolyte flows after passing between the electrodes to release gases entrained therein, and means below said cascade plates for returning the electrolyte to the bottom of the tank.

2. Electrolytic cleaning apparatus comprising a vertical tank, a pair of conductor rolls over which a strip passes into and out of the tank, a sink roll at the bottom of the tank around which the strip passes, a chamber in the bottom of said tank containing said sink roll, a pair of restricted passageways in said tank leading upwardly from said chamber, said passageways forming the only outlets from said chamber, a pair of electrodes in each of said passageways, said strip passing downwardly between one of said pairs of electrodes and upwardly between the second of said pairs, means for introducing the electrolyte into the chamber and causing it to flow upwardly in each passageway, deflector plates above the electrodes between which the strip passes, cascade plates above said chamber and adjacent said passageways over which the electrolyte flows after passing between the electrodes to release gases entrained therein, and means below said cascade plates for returning the electrolyte to the bottom of the tank.

3. Electrolytic cleaning apparatus comprising a vertical tank, a pair of conductor rolls over which a strip passes into and out of the tank, a sink roll at the bottom of the tank around which the strip passes, a chamber in the bottom of said tank containing said sink roll, a pair of restricted passageways in said tank leading upwardly from said chamber, said passageways forming the only outlets from said chamber, a pair of electrodes in each of said passageways, said strip passing downwardly between one of said pairs of electrodes and upwardly between the second of said pairs, a second chamber above said first named chamber adjacent said passageways for receiving electrolyte as it leaves said passageways, cascade plates in said second chamber over which the electrolyte passes, and means for returning the electrolyte from the bottom of the second chamber to the bottom of the tank.

4. Electrolytic cleaning apparatus comprising a vertical tank, a substantially horizontal wall separating said tank into upper and lower chambers, a pair of conductor rolls adjacent the top of the tank over which a strip passes into and

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out of the tank, a sink roll in the lower chamber around which the strip passes, a pair of restricted passageways in said upper chamber leading upwardly from said horizontal wall to a point adjacent the top of the tank and opening into said lower chamber, a pair of electrodes in each of said passageways, said strip passing downwardly between one of said pairs of electrodes and upwardly between the second of said pairs, an inlet into the lower chamber, an outlet from the upper chamber adjacent the bottom thereof, and means for circulating the electrolyte from said outlet to said inlet and through said passageways to said upper chamber.

ALFRED TEPLITZ. 15

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