Sept. 8, 1936. H. A. FOSBURG 2,053,279

METAL PROCESSING APPARATUS

Filed May 22, 1933 2 Sheets-Sheet 1

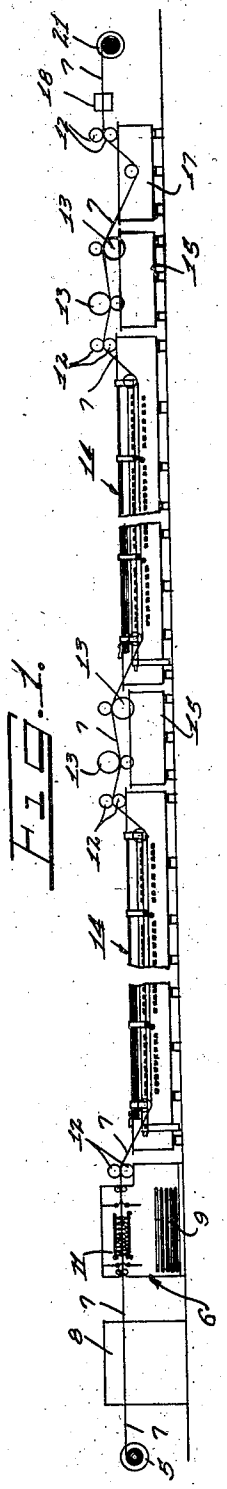


Fig. 1.

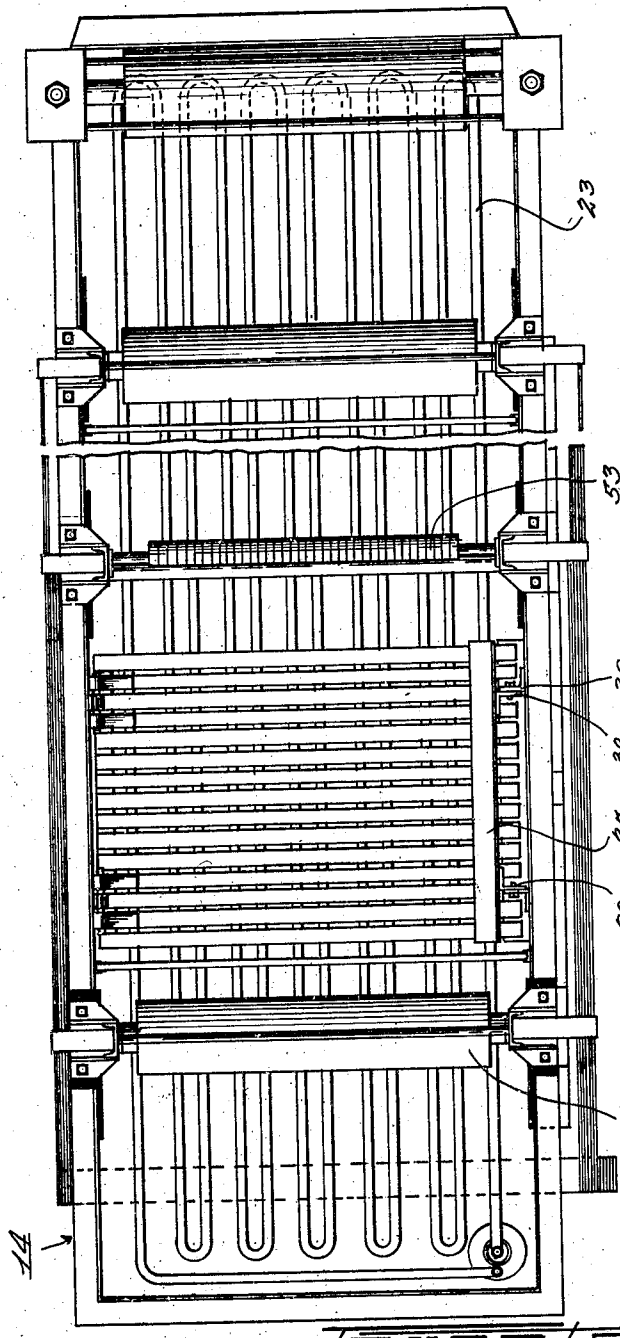


Fig. 2.

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Filed May 22, 1933 2 Sheets-Sheet 2

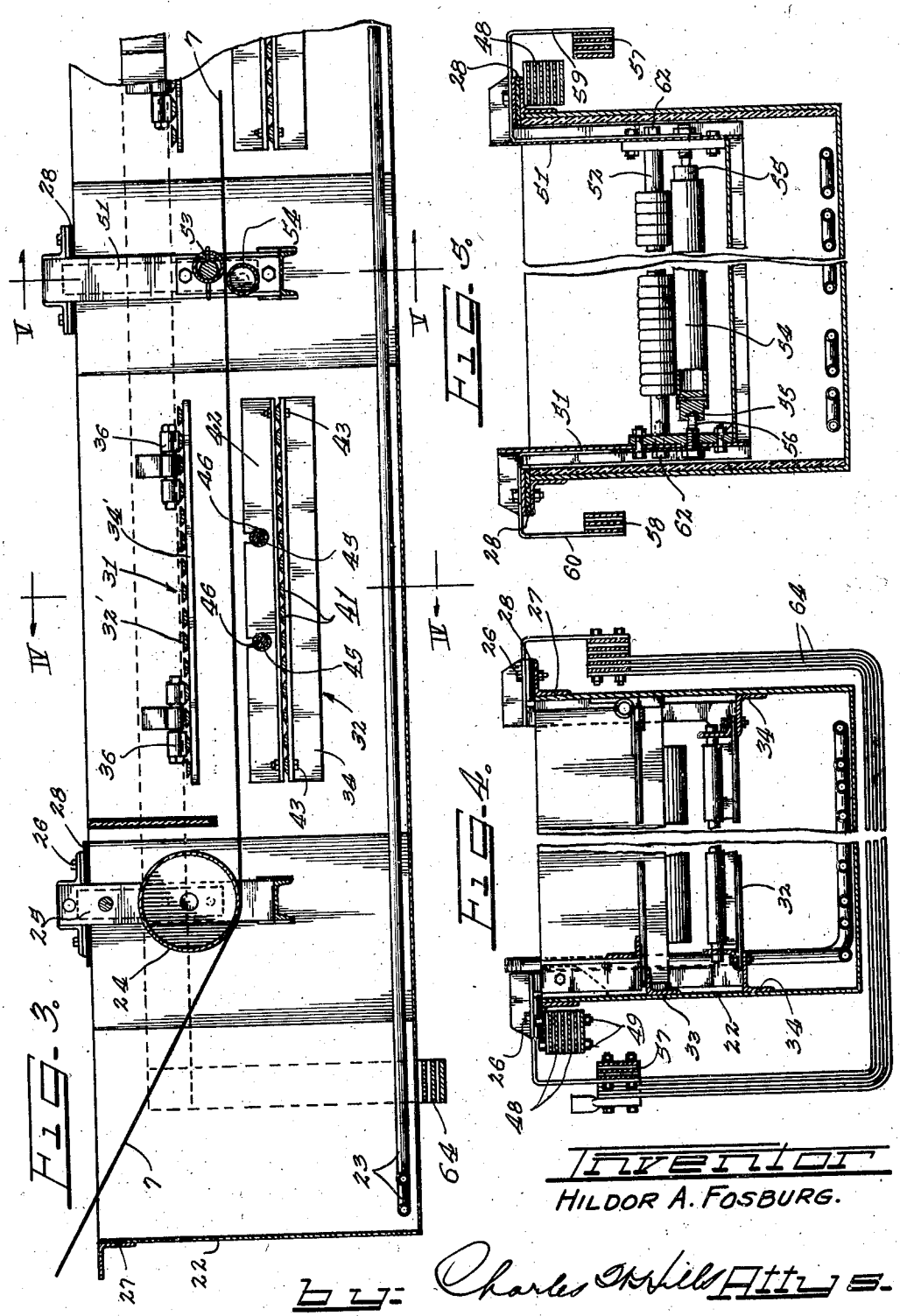


FIG. 3.

FIG. 5.

FIG. 4.

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Patented Sept. 8, 1936 2,053,279

UNITED STATES PATENT OFFICE

2,053,279

METAL PROCESSING APPARATUS

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Application May 22, 1933, Serial No. 672,097

6 Claims. (Cl. 204—5)

This invention relates to metal processing apparatus and will be described as incorporated in an apparatus which is adapted to operate upon a continuous strip of metal, particularly for the removal of oil therefrom, and subsequently etching, washing, and drying the metal to prepare it for a subsequent plating or tinning operation. In the process of cold rolling of sheet metal, oil used on the rolls becomes forced into the surface of the metal, and must be removed before the metal is annealed to prevent smudging and permit the metal to be successfully plated. Also, metal sheets with etched surfaces will not stick together when annealed in a stack.

An object of this invention is the provision of apparatus capable of processing a strip of metal passing through the apparatus at a relatively high speed, for the purpose of removing oil from the metal and subsequently etching the metal to facilitate subsequent annealing and plating operations.

A further object is the provision of an improved electrolytic device for operating upon a continuous strip of metal passing therethrough whereby etching and oil removing operations may be carried out with extreme uniformity and in a minimum of time.

A further object is the provision of such an electrolytic device which is adapted for operation by the use of a low voltage, the construction of the anode being such that polarization is obviated, thereby reducing the necessary voltage and insuring uniformity of operation upon the metal strip.

Other objects and advantages of this invention will become apparent to those skilled in the art, from the following detail description with reference to the accompanying drawings.

On the drawings:

Figure 1 is a diagrammatic illustration of a metal processing apparatus incorporating this invention.

Figure 2 is a top plan illustration of one of the electrolytic devices employed in the processing apparatus.

Figure 3 is an enlarged longitudinal vertical section of a portion of the device shown in Figure 2.

Figure 4 is a vertical section taken on the line IV—IV of Figure 3.

Figure 5 is a vertical section taken on substantially the line V—V of Figure 3.

As shown on the drawings:

A general diagrammatic layout of the processing apparatus for the treatment of a strip of rolled metal is illustrated in Figure 1. The strip of metal 7 to be treated is mounted in rolled condition on the reel 5 from which it passes through a splicing machine 8 which may be utilized for connecting together strips of metal to make a continuous strip for passing through the subsequent units of the processing apparatus. The strip of metal 7, as it enters the processing apparatus, is coated with oil from the machine by which it was rolled. In order that the strip 7 may be successfully plated, it is imperative that the oil be completely removed before the strip is annealed; otherwise, the oil is burned into the sheet, leaving a carbon smut which will prevent plating or tinning of the sheet.

For the purpose of removing a large proportion of the excess oil, there is provided a power washer 6 which comprises a tank adapted to contain a suitable washing fluid maintained at a desired temperature by heating coils 9 and sprayed upon the strip 7 from spray pipes 11 which also support brushing elements for washing and scrubbing the metal as it passes therethrough. At the exit of the washer are disposed cooperating wringer rolls 12 for removing the excess washing fluid from the strip 7.

After passing through the preliminary washer 6, where it is subjected to a preliminary washing operation, the strip metal passes through an electrolytic device designated generally by numeral 14. In this device the strip metal passes through a second washing fluid which acts upon the metal by electrolysis for completely removing all of the remaining oil which may have soaked into microscopic pores of the metal in a manner that it cannot be removed by a scrubbing operation, but which is sufficient to prevent successful plating of the metal, if not first removed. The strip 7, upon leaving the electrolytic device 14, again passes through a set of rolls 12 for removing excess washing fluid from the metal.

For removing the remainder of the cleaning fluid from the metal 7, it passes over spray rinse brushes 13 disposed above the rinse tank 15. The strip 7 next passes through a second electrolytic device 14 within which it is acted upon by electrolysis, causing the surface of the metal to be etched to facilitate the adherence of plating material and to prevent the sticking together of adjacent sheets of the metal when heated for the purpose of annealing. When the metal strip emerges from the second electrolytic device 14, it passes through another set of wringer rolls 12 and is acted upon by a second set of spray rinse brushes 13 disposed above a tank 15. The metal,

having been cleaned and etched, next passes through a hot water rinse tank 17 and through wringer rolls 12 and a suitable wiping device 18 from which it emerges in a thoroughly dried condition, because of the heat retained by the metal after passing through the hot water rinse tank 17. The strip 7 is now in condition to be rewound upon the reel 21 which, if desired, may also serve as the pulling means for drawing the strip of metal continuously through the entire processing apparatus.

The specific construction of the electrolytic device 14 is illustrated more in detail in Figures 2, 3, 4, and 5. This device comprises a tank 22 which may be of any desired length necessary to provide the required time of operation upon the strip 7 with the strip passing through the tank at a predetermined speed. The tank 22 used for the cleaning operation is preferably supplied with a suitable electrolyte for the purpose and I preferably employ a solution containing three and one-half ounces of soda ash, two ounces caustic soda, and one-half ounce of trisodium phosphate for each gallon of water. The second electrolytic device 14, which is employed for the etching operation, is preferably supplied with a 6% solution of sulphuric acid and water.

For the purpose of maintaining the electrolyte at a desired temperature, a steam heating coil 23 is provided which is disposed adjacent the bottom of the tank. For guiding the strip 7 through the tank 22, there is provided a roll 24 mounted on brackets 25, fixed at their upper ends on the edges of the tank by bolts 26 passing through the horizontal flanges of the angle bars 27 which reinforce the upper edge of the tank. The brackets 25 are preferably insulated from the tank by suitable insulating blocks 28 illustrated in Figures 3 and 4. The roll 24 is disposed in a position to direct the strip 7 horizontally between upper and lower grid type anodes 31 and 32 which are electrically connected with the sides of the tank by engagement with the angle bars 33 and 34 respectively.

The grid type anode 31 preferably comprises a plurality of bars 32' which are flat on one side and convex on the sides disposed toward the strip 7. The bars 32' are rigidly connected together at one end by a longitudinally extending member 34', and at the other end by an angle bar 35. One edge of the anode 31 is hingedly connected to the tank 22 by hinges 36, and the other edge is releasably retained in position by pins 37 passing through cooperating angle elements 38 and 39 on the grid and on the side of the tank respectively.

The lower grid anode, designated as a whole by numeral 32, comprises a plurality of parallel laterally extending bars 41, similar in shape to the bars of the upper anode but reversed in position to be also disposed with their convex faces toward the strip 7. The bars 41 are rigidly held in position by longitudinally extending angle elements 42 secured to the angle bars 34 on the sides of the tank by bolts 43. In order to prevent the strip 7 from engaging the anode bars 41 in case the strip should become slackened for any reason, there is provided a plurality of rollers 45 having a covering 46 of suitable insulating material.

This specific construction of anode above described obviates polarization of the anodes and provides space between the bars for the passage of particles of dust or other foreign materials which may find their way into the tank. For supplying electric current to the anodes 31 and 32, they are electrically connected to the longitudinally extending bus bars 48 through the medium of the metallic side of the tank to which the bus bars 48 are rigidly attached by bolts 49 passing therethrough and through the horizontal flange of the reinforcing angle bar 27 at the upper edge of the tank.

The strip 7 of metal being processed, forms the cathode for the electrolytic process. For electrically connecting the strip 7 with a source of electrical energy, there is provided a bracket 51 having rigidly mounted thereon in a horizontal position a laterally extending rod 52 having a multiplicity of loosely mounted rings 53 thereon adapted to engage the strip 7 as the strip passes over a roller 54 disposed therebelow. The roller 54 is electrically connected to the bracket 51 by blocks 55 of conducting material which serve as supports for the roller 54 by engagement with pin-bearing elements 56. The rings 53 are adapted to roll upon the metal strip 7 and have sliding contact with the rod 52, and the rod 52 is electrically connected to bus bars 57 and 58 by strap conductors 59 and 60 which extend downwardly along the vertically extending arms of the bracket 51 and are engaged by the bolts 62 which extend into the ends of the rod 52. The bus bars 57 and 58 are also electrically connected together by strap conductors 64 passing under the tank as illustrated in Figures 3 and 4. The bus bars 48 and 57 are adapted for connection with a suitable source of electric energy, preferably of a low potential and high current capacity.

It will be understood that the electrolytic tank employed for the etching operation, together with the associated parts which are continuously exposed to the etching solution, should be constructed of material which will not readily be affected by the etching solution; for example, the parts of metal may be constructed of a nickel chromium alloy known as nichrome, or similar material which will serve the same purpose. Also, in the electrolytic apparatus employed for the etching operation, the metal strip is used as the anode and the grid electrodes are used as cathodes in order that metal will be removed from the strip during the operation.

From the foregoing description it will be appreciated that the mechanism herein illustrated and described is susceptible of various changes and modifications without departing from the principle of the invention. It is accordingly desired that the patent to be granted hereon shall not be limited in any manner except as necessitated by the prior art.

I claim as my invention:

1. In apparatus of the class described, an electrolytic cell comprising a tank for containing an electrolyte, spaced upper and lower grid type electrodes of one sign adapted to be submerged beneath said electrolyte, said upper electrode being hingedly supported from one wall of said tank, an electrode of a different sign for rolling contact with strip material and means for drawing strip material through said tank in spaced relation to and between said grid type electrodes and in rolling contact with said other electrode.

2. An electrode for continuous contact with traveling strip material comprising a rod, a plurality of rings loosely mounted thereon and a roller mounted in spaced relation below said rod for supporting the traveling strip material in contact with said rings, said rings being held in con-

tact with said rod by the frictional drag of said rings on said traveling strip material.

3. In an electrolytic cell, a pair of vertically spaced rotatable members, a plurality of rings loosely mounted on the upper of said members, means for passing strip material between said rotatable members for continuous contact with said rings and means for passing an electric current through an electrolyte contained within said cell, said upper rod and said strip material.

4. In an electrolytic cell, grid type electrodes, a pair of vertically spaced rotatable members, a plurality of rings loosely mounted on the upper of said members, means for passing strip material in spaced relation to said grid type electrodes and between said rotatable members for continuous contact with said rings and means for passing an electric current through grid type electrodes, an electrolyte contained within said cell, said upper rod and said strip material.

5. In an electrolytic cell, a pair of superimposed grid type electrodes in spaced vertical relation to each other and hinges connecting the upper of said electrodes to a wall of said cell whereby said upper electrodes may be tilted upwardly.

6. In an electrolytic device, a pair of vertically spaced electrodes of the same polarity, means for guiding a strip of metal between said electrodes, another electrode of the opposite polarity disposed for rolling engagement with the strip of metal at a point spaced horizontally from the ends of the first said electrodes, said other electrode comprising a horizontally disposed rod and a metallic ring loosely mounted on said rod for sliding contact therewith, said ring being disposed for rolling engagement with said strip.

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