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McNamara et al.

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## [54] METHOD OF STRIPPING DEPOSITED SHEETS OF METAL FROM CATHODES AND WASHING, STACKING AND WEIGHING THE SHEETS


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[52] **U.S. Cl.** ..... **53/3**, 53/14, 204/12

[51] **Int. Cl.** ..... **B65b 13/00**

[58] **Field of Search** ..... 53/3, 14; 204/12, 281, 13



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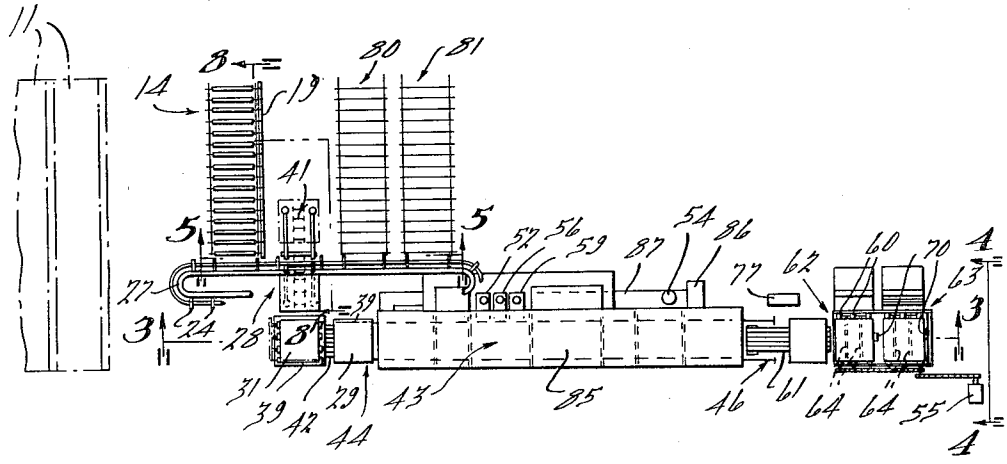
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[57] **ABSTRACT**

A plurality of cathodes having sheets of electroplated material on opposite faces thereof are removed from a plating tank and placed on an advancing rack which delivers the cathodes seriatim to a stripping station where the sheets of deposited metal are removed and placed upon conveyors moved to spaced vertical position and advanced through a plurality of washing stations. The sheets are deposited on a horizontal conveyor and stacked vertically on a car on a weighing scale. When approximately 5 tons of sheets have been stacked on the car, they are secured in a bundle and a label with the weight printed thereon is attached thereto.


**10 Claims, 9 Drawing Figures**



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SHEET 1 OF 4

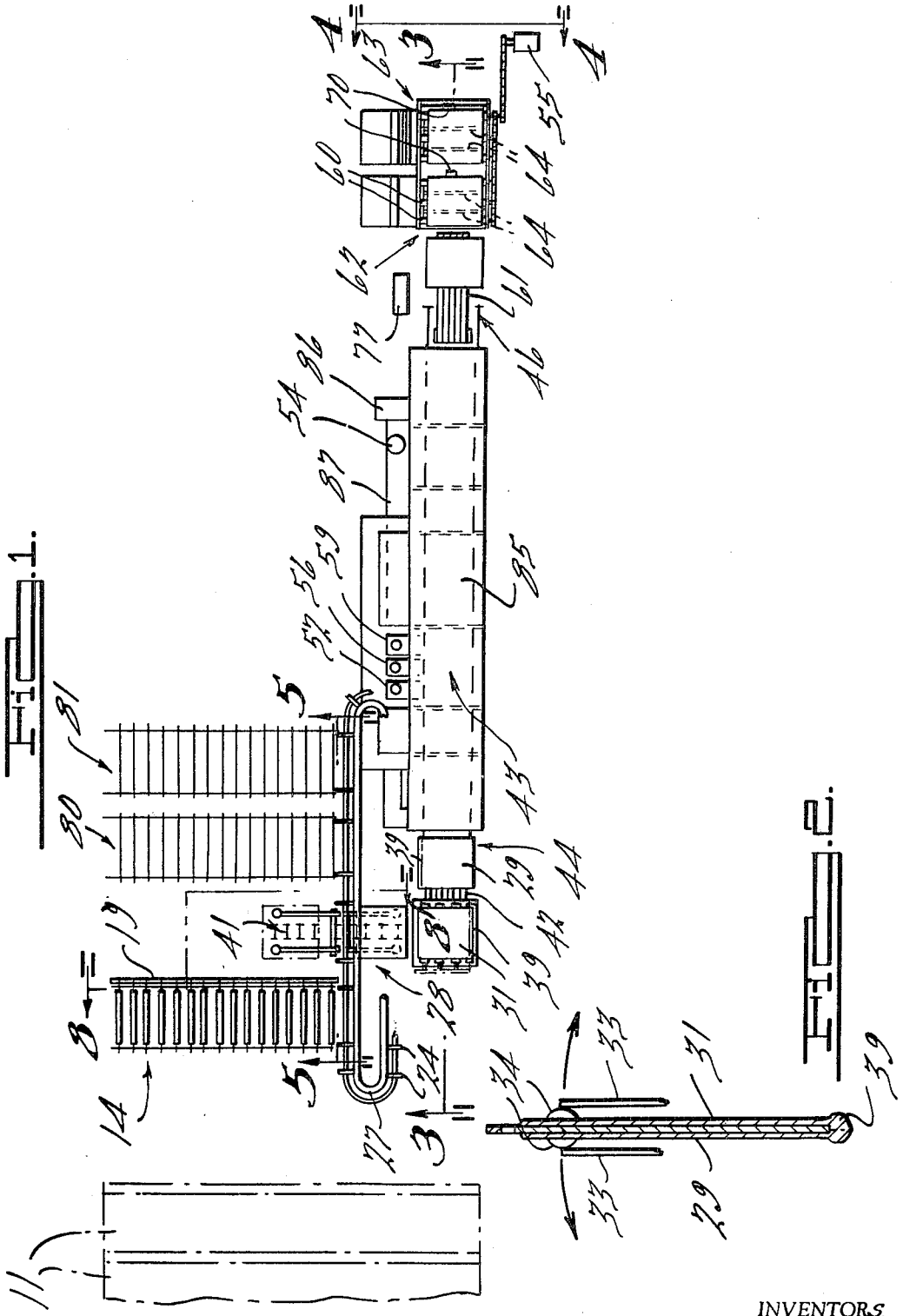


Fig. 1.

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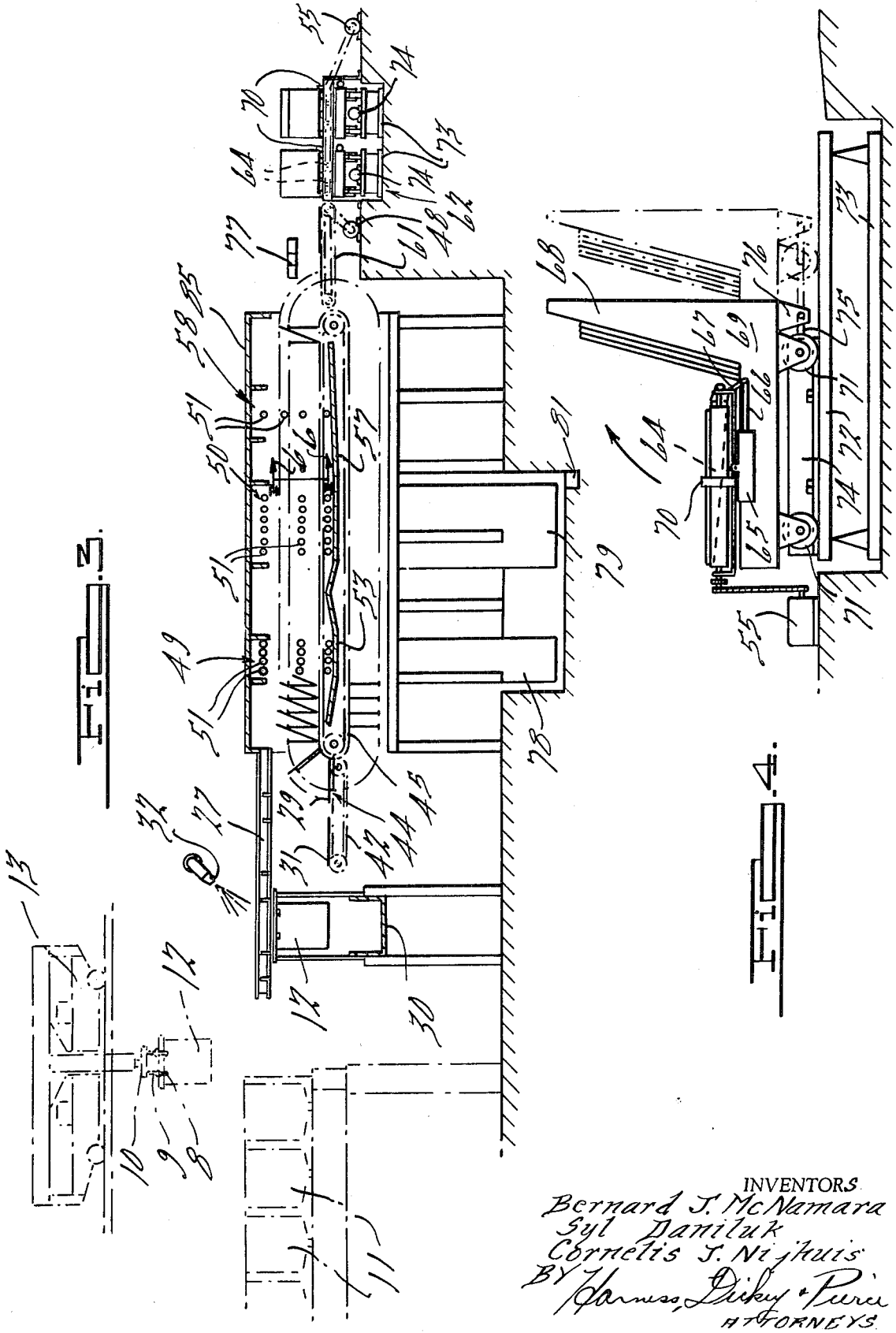


Fig. 3.

Fig. 4.

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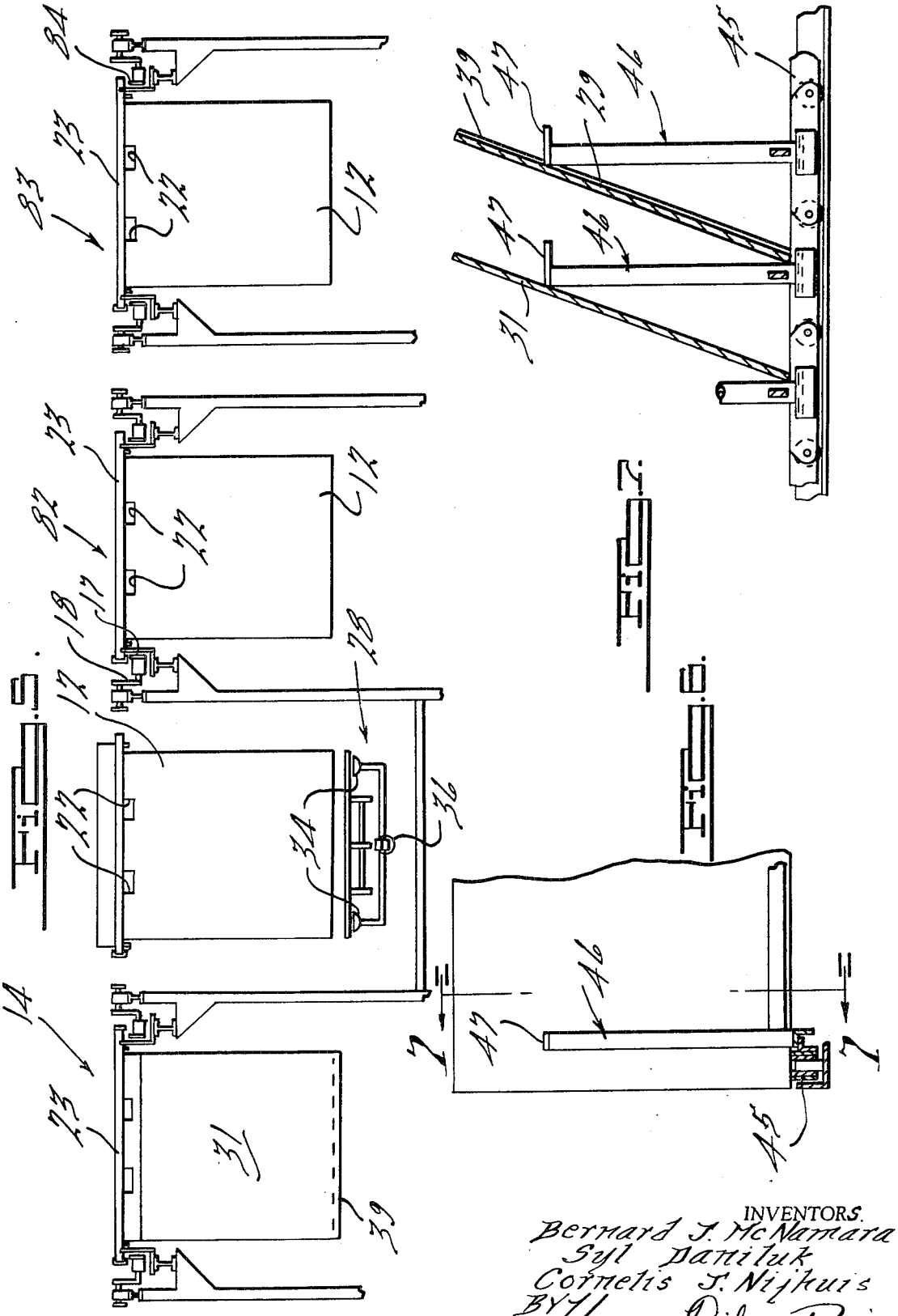
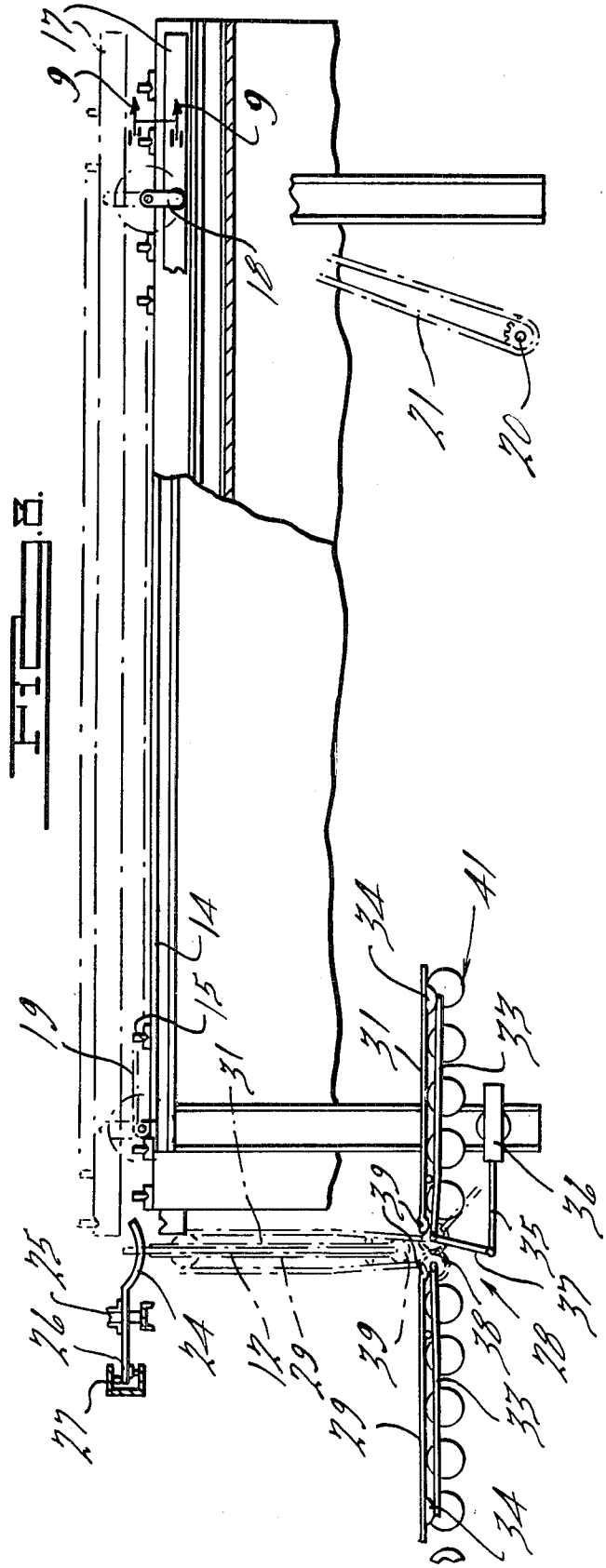


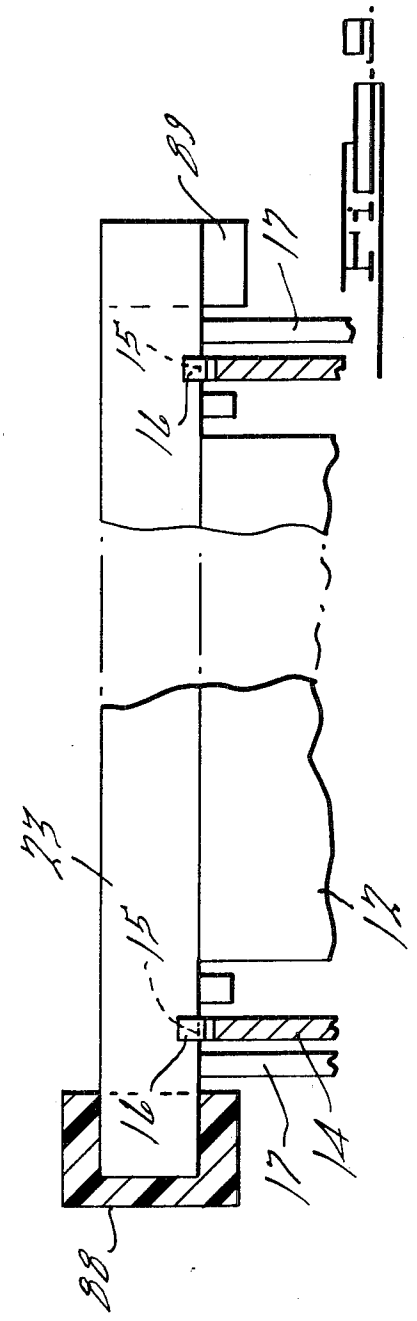

Fig. 5.

Fig. 7.

Fig. 6.

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# METHOD OF STRIPPING DEPOSITED SHEETS OF METAL FROM CATHODES AND WASHING, STACKING AND WEIGHING THE SHEETS

## SUMMARY OF THE INVENTION

The invention pertains to a method of stripping sheets of electrically deposited metal from opposite faces of cathodes which are suspended within a plating tank. A large number of tanks are employed in the present arrangement, each tank having a 64 cathode capacity. After the plating operation is complete in a tank, a plurality of alternate cathodes are raised therefrom and transported to a rack on which they are advanced progressively as a group. The foremost cathode is delivered to a conveyor and moved to a stripping station at which pivoted frames having suction cups on the outer ends engage the top ends of the plated sheets on opposite faces of the cathode. After a vacuum is applied to the cups, the frames are hinged downwardly breaking the deposited sheets from the opposite faces of the cathode, splitting the bulbous bottom section and depositing the sheets upon a conveyor. The conveyor advances the sheets to a second conveyor disposed at right angles thereto which advances the sheets with the bulbous bottom edge alternately disposed on opposite sides of the second conveyor. The sheets are tilted upwardly to a vertical position in spaced relation to each other and advanced through a plurality of washing stations each of which has a plurality of nozzles which delivers steam under pressure to the edges of the sheets for washing the electrolyte therefrom. After passing from the last washing area, the sheets are completely cleaned and are quickly dried by the residual heat left therein. During this passage through the washing stations, the bulbous edges of the sheets are located at the sides of the conveyor and are directly washed by the spray of steam from the nozzles which are located closely adjacent thereto.

After the sheets are cleansed and dried, they are again moved onto the horizontal conveyor and advanced to a weighing station having a scale on which an advanceable wheeled car is supported and on which the plates are raised to substantially vertical position against a wall at the front of the car. As the plates are stacked in this manner, the car is moved outwardly in increments substantially the thickness of the sheet and after the stack reaches substantially the weight desired, a label is printed and applied to the sheets which are secured together. The car is advanced so that a second car on a scale can receive the advancing sheets and by the time one car is filled the other car is in position to again receive the sheets, otherwise, the system will be shut down. The weight indicator and label printing device is usable with either of the two scales.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a cathode stripper and sheet-handling device which practice the method of the present invention;

FIG. 2 is an enlarged broken sectional view of a cathode in position to have the plated sheets removed from the opposite faces thereof;

FIG. 3 is a sectional view of the structure illustrated in FIG. 1, taken on the line 3—3 thereof;

FIG. 4 is an enlarged sectional view of the structure illustrated in FIG. 1, taken on the line 4—4 thereof;

FIG. 5 is an enlarged broken view of the structure illustrated in FIG. 1, as viewed from line 5—5 thereof;

FIG. 6 is an enlarged broken sectional view of the structure illustrated in FIG. 3, taken on the line 6—6 thereof;

FIG. 7 is a sectional view of the structure as illustrated in FIG. 6, taken on the line 7—7 thereof;

FIG. 8 is an enlarged broken view of the structure illustrated in FIG. 1, as viewed from the line 8—8 thereof, and

FIG. 9 is an enlarged broken sectional view of the structure illustrated in FIG. 8, taken on the line 9—9 thereof with the insulating end block in section.



## DESCRIPTION OF THE PREFERRED EMBODIMENT

A series of plating tanks 11, each having a plurality of cathodes 12 disposed therein, alternate ones of which are lifted from the tank when all are to be removed after a predetermined thickness of metal has been plated thereon. A crane 13, as illustrated in FIG. 3, has an elongated carrier 10 from which pairs of chains 9 with a hook 8 on the ends raise a series of cathodes from one of the tanks and advances them to a stationary rack 14. The cathodes are supported on the rack in notches 15 in adjustable plates 16 by which the spacing thereof is changed. The cathode 12, as more specifically illustrated in FIG. 9, is a sheet of conducting material such as titanium.

Walking beams 17 on each side of the rack 14 are driven by crank arms 18 in an orbital path the diameter of which may be varied by changing the effective length of the arms conforming to the spacing of the notches 15. This raises all of the cathodes from the rack 14 and advances the series to the next adjacent notches 15 upon each operation of the crank arms. Sprockets on the shafts of the drive for the crank arms are connected by a chain 19 which is driven by a second sprocket on a driven shaft from a chain 21 and a motor 20. The motor is driven intermittently to produce the step-by-step advancement of the cathodes. The rack and walking beams are of extended length so it can be loaded while a previous load is being advanced. The cathodes have a pair of rectangular apertures 22 beneath a supporting bar 23 through which the hook 8 on the chains 9 extend in engagement with the bar 23 when supported by the crane 10. The bar 23 has an insulation block 88 on one and a contact knife blade 89 on the other end from which the current passes during the plating operation.

A pair of spaced cantilever arms 24 supported at the center on a conveyor 25 are in position to receive the end portions of the bar 23 on the forwardmost cathode 12 when advanced from the end of the rack 14, as illustrated in FIG. 8. The opposite ends 26 of the arms 24 stabilize the arms when confined within a channel 27. The last part of the orbital movement of the walking beam 17 disposes all of the remaining advanced cathodes 12 in the next forwardly disposed notches 15 on the rack 14.

The conveyor 25 advances the cathode 12 on the arms 24 transversely of the rack 14 to a stripping station 28 as the next adjacent pair of arms 24 move into alignment with the rack. The plated sheets 29 and 31, which may be referred to herein as of copper, are stripped off of the front and back faces of the cathode. After the cathodes are placed upon the rack 14 by the crane, a spray of cold water from nozzles 32 may be directed thereover for warping the deposited sheets and weakening the bond between the surface of the cathode faces and that of the deposited metal. The sprayed water and any pieces of loose copper are caught by a catch pan 30 supported below the cathodes and of a depth to receive a sheet 29 or 31 in case it should drop therefrom without interrupting the advancement of the series of cathodes.

Hinged frames 33 having vacuum cups 34 on the outer end are pivoted upwardly toward each other by the operation of a piston rod 35 in a pivotedly mounted ram 36 which actuates an arm 37 and a pair of gears 38 on the shafts of the frames.

The vacuum cups 34 are preferably made of neoprene and are forced into engagement with the upper end of the sheets 29 and 31, as illustrated in dot and dash line in FIG. 8. Vacuum is applied to the cups and the ram 36 is reversely operated to pull the upper end of the sheets outwardly from the faces of the cathode breaking the friable bulbular bottom end 39 and depositing the sheets upon a conveyor 41 with the bulbous ends in adjacent relation, as illustrated in FIG. 8.

The conveyor 41 advances the sheets to a conveyor 42 which moves the sheets in a path at right angle thereto toward a washing area 43. The conveyor 42 is tilted upwardly intermittently to pick the sheets upwardly from the conveyor 41. It will be noted that by advancing the sheets from the conveyor

41 to the conveyor 42 that the bulbous ends 39 are deposited alternately on opposite sides of the conveyor.

The sheets 29 and 31 are advanced to a tipup station 44 where driven link chains 45 advance frames 46 having arms which swing upwardly through the conveyor 42 and tilt the advancing sheet 29 or 31 seriatim to a vertical angular position. The sheets are moved beyond vertical positions by the extending fingers 47 on the upper ends of the arms of the frame 46 causing the sheets 29 and 31 to assume a forward tilted position, as illustrated in FIG. 7. In this position, the sheets 29 and 31 are carried through the washing area 43 where the first station section 49 has a plurality of nozzles 51 directed toward the edges of the sheets. The nozzles have a capacity of 37 gallons per minute at 55 pounds per square inch pressure operated by a 250 gallons per minute pump 52 driven by a 20 hp. motor. The water is collected in a catch basin 53 from which it drains into a tank 78 having a thousand gallon capacity and is heated to produce steam from a water heater associated therewith.

A second washing section 50 has a greater number of nozzles 51 and is substantially twice the length of the section 49 so that the sheets 29 and 31 are subjected to the water for twice the length of the time as when in the first section 49. The nozzles have a capacity of 4.19 gallons per minute at a pressure of 110 pounds produced by a pump 56 delivering 550 gallons per minute at 140 pounds pressure driven by a 40 hp. motor. The water is collected in a catch basin 57 from which it drains into a tank 79 having a 1,500 gallon capacity and is heated to deliver steam for the second stage of washing for the sheets 29 and 31.

A fresh water rinse is applied in a third washing section 58 from nozzles 51 which deliver 1.7 gallons of water per minute at 30 pounds pressure from a pump 59 which is heat to steam from an instantaneous water heater 54. The water from the rinse is directed into the catch basin 57 and into the tank 79. As the sheets pass from the washing area 43, the frames 46 swing downwardly, as illustrated in FIG. 3, depositing the sheets 29 and 31 on a conveyor 61.

The conveyor 61 is driven by a motor 48 and advances the sheets onto rollers 60 driven by a motor 55 to one or the other upender station 62 or 63 whichever is in operation. The sheets 29 and 31 are dried by the residual heat retained therein by the time they reach the weighing station. At each station 62 and 63 arms 64 are swung upwardly from between the rollers 60 by a pivotedly mounted ram 65 having a piston rod 66 which actuates an arm 67 which pivots the arms 64 and moves the sheets 29 and 31 beyond a vertical position against a sloping back 68 of one or the other stacking car 69 which is supported on wheels 71 on one or the other platform 72 of scales 73. Each stacking car 69 is advanced seriatim by a ram 74 mounted on the platform 72 having its piston rod 75 secured to a bracket 76 on the bottom of the car by the use of an electric eye. The car is advanced in increments substantially the thickness of the sheets which weighs approximately 150 pounds. When the scale registers substantially 5 tons, the car is advanced and a stop element 70 which stopped the advancing sheets is lowered permitting the sheet to advance to the stop element 70 at the end of the conveyor 61 in position to deliver the sheets 29 and 31 to the second stacking car 69. The sheets are stopped at either weighing station 62 or 63 depending upon which car is emptied and in position to receive the advancing sheets. A label printing and weight device 77 provides indications for the weight and also for printing a label of the final weight which is attached to the stack of sheets when bound together to form a bundle for indicating the weight thereof. The circuit to the device 77 is shifted from one to the other platform to read the weight of the car which is being loaded. The water from the catch basin 53 and tank 78 is preferably pumped back into a leaching tank or one of the tanks 11 while the water from the catch basin 57 and tank 79 passes into a drain 81. The water from the catch pan 30 may be directed to either the leaching tank or to a drain depending upon the percentage of electrolyte contained therein.

After the sheets 29 and 31 are stripped from the cathode, the conveyor 25 advances the stripped cathode to a rack 82 where an indication may be provided that it is defective or has plated portions of a sheet adherred thereto. The cathode is then manually removed from the arms 24 and placed upon the rack 82. A sensing device may be provided employing metal thickness gaging elements, limit switches and the like for providing an indication that a defective cathode is present and is to be manually removed.

If the cathode is not defective or has parts of a plated sheet thereon, it will advance to a rack 83 having a walking beam 84 which is similar to but operates in a reverse direction from the walking beam on the rack 14. The walking beam 84 will move in a clockwise direction and will engage and remove the cathode from the arms 24 and deposit it upon the rack 83 while advancing the other cathodes along the rack to the next adjacent notches. After a predetermined number of cathodes have been collected in this manner on the rack 83, the crane will have the hook 8 on the chains 9 of the carrier 10 pick up the series of cathodes and deposit them in a tank in which plating will occur.

The washing area 43 is enclosed within a housing 85 which employs baffles and dampners to prevent the steam and overspray from escaping into the surrounding atmosphere. An exhausting fan 86 in a conduit system 87 connected to the housing 85 removes the steam and exhausts it to atmosphere.

The conveyors and other moving parts as well as those within the corrosive area are preferably made from stainless steel which includes the conveyor chains, the disc and roller type conveyor elements, the tanks, the housing, and the elements at the washing sections. The tracks for the chains within the washing area have drain openings through which the fluid passes and during the advancement through the area the sheets 29 or 31 automatically shift sidewardly so that the point contact of the supports move relative to the sheets so that all points on the surface become thoroughly washed. The washing area thoroughly cleans the sheets, prevents the inclusion of foreign particles while the contaminants on the faces are completely removed.

The nozzle feed lines may have high and low-pressure switches therein which will produce a signal when a pump failure or nozzle blockage occurs. The nozzles are preferably staggered when provided around the perimeter of the sheet so that all portions of the area thereof are contacted by the delivered steam. The various conveyors are driven by motors having variable-type pulley thereon so that the speeds can be synchronized. Clutches are preferably provided in the drives so that any or all the conveyors can be stopped or started independently or collectively permitting the system to be shut down when necessary.

At the weighing stations, indication may be had on the scale when a predetermined weight has been reached which may be one-half the ultimate weight to signal the need for the car being unloaded to be returned to its scale in position to receive the sheets 29 and 31 when the other car is loaded. A switch is provided by which the operator may shut down the line if the car is not in position in time to receive the next advancing sheet after the other car is loaded. When the first of the two cars is returned to its scale, the stop element 70 will be raised to intercept the advancing sheets 29 and 31 at the time the second car is loaded so that it can have the sheets bundled and removed. The standard type of electric control panel is provided for the circuits to the motors, relays, switches and the like for operating the various components of the devices making up the stripping, washing, stacking and weighing unit.

We claim:

1. The method of removing and treating plated metal sheets from a cathode which includes the steps of: placing a series of cathodes having the plated sheets thereon spaced in face to face relation a predetermined distance apart on a rack, simultaneously advancing the group of cathodes in steps along said rack in an amount equal to the spacing thereof, and delivering the endmost cathode during each advancement to a support-

ing means of a first conveyor disposed at right angle relation to the direction of advancement of the cathode on said rack.

2. The method of removing and treating plated metal sheets from a cathode as recited in claim **1**, including the further step of advancing the first conveyor to a stripping station where the deposited sheets are removed from the opposite faces of the cathode, and placing the sheets upon a second conveyor with the bottom portions of the sheets disposed in adjacent relation.

3. The method of removing and treating plated metal sheets from a cathode as recited in claim **2**, including the further step of removing the sheets seriatim from the second conveyor to a third conveyor located at right angle to the second conveyor to have the bottom edges of the sheets disposed on opposite sides of said third conveyor.

4. The method of removing and treating plated metal sheets from a cathode as recited in claim **3**, including the step of having the sheets raised by a fourth conveyor to a substantially vertical position from said third conveyor and advances them through a washing area.

5. The method of removing and treating plated metal sheets from a cathode as recited in claim **4**, including the steps of advancing upstanding sheets through a first washing section where heated steam is directed toward the edges thereof, to a second washing station where less contaminated water is pressurized and directed toward the edges of the sheets, and to a third station where fresh water is directed toward the edges of the sheets as they are advanced.

6. The method of removing and treating plated metal sheets from a cathode as recited in claim **5**, including the step of advancing the sheets on a fifth conveyor to a weighing area having a pair of scales with a stacking car on each scale toward which the sheets are advanced.

7. The method of removing and treating plated metal sheets from a cathode as recited in claim **6**, including the steps of upending the sheets on the cars for standing the sheets on edge thereon and incrementally advancing the car as it is being weighed.

8. The method of removing and treating plated metal sheets from a cathode as recited in claim **7**, including the step after a sufficient number of the sheets have been stacked on the car by weight indication of printing a label and securing the sheets in a bundle with the label with the weight thereon applied thereto.

9. The method of removing and treating plated metal sheets from a cathode as recited in claim **8**, including the step of moving a stop element on the fifth conveyor from its stop position to permit the sheets to advance to a stop position at the end of the conveyor to have the sheets stop at the second weighing station so that the car thereon may be loaded and weighed while the sheets on the first car are being bundled.

10. The method of removing and treating plated metal sheets from a cathode as recited in claim **9**, including the step of returning the unloaded car to a position on its platform scale to receive the sheets before the second car therebeyond is loaded at which time the sheets will be delivered to a stop position at a point for loading the first car.

* * * * *