Nov. 12, 1940. P. S. TONEY 2,220,982

CLEANING ANODE

Filed July 11, 1936 2 Sheets-Sheet 1

Fig. 1,

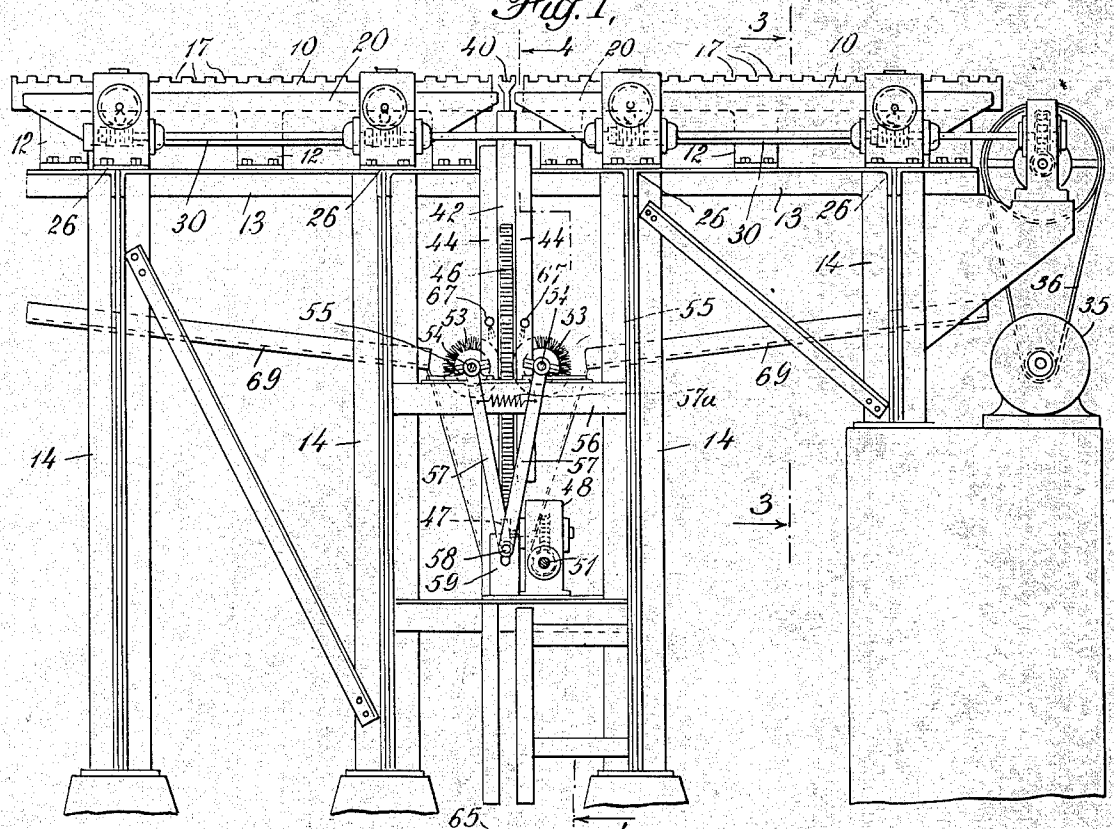
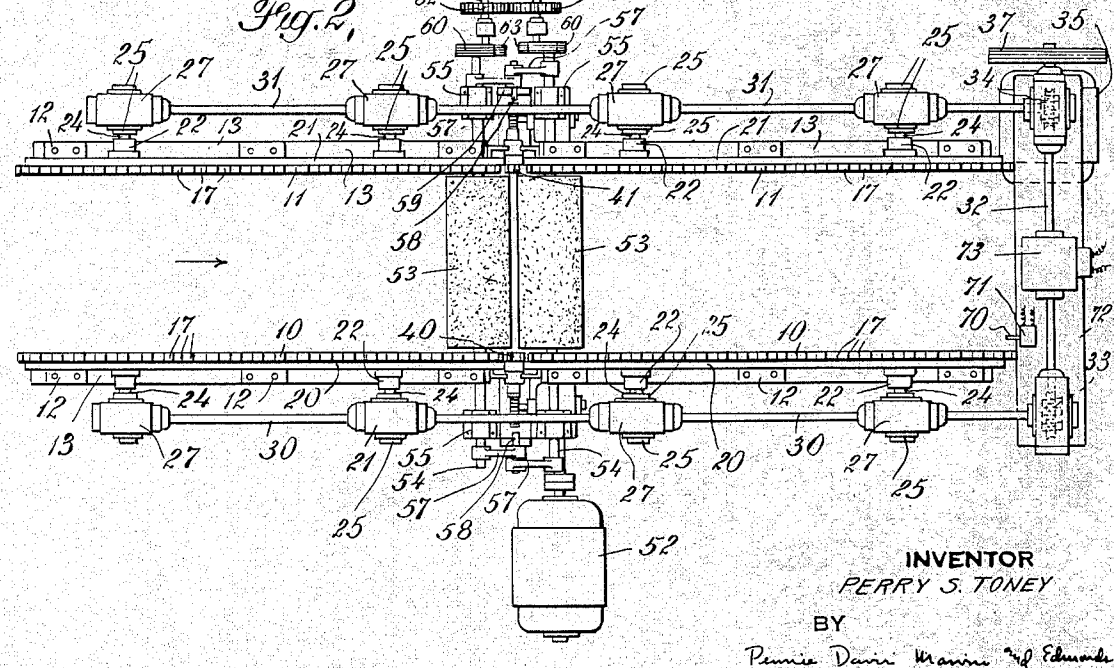


Fig. 2,



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Fig. 3,

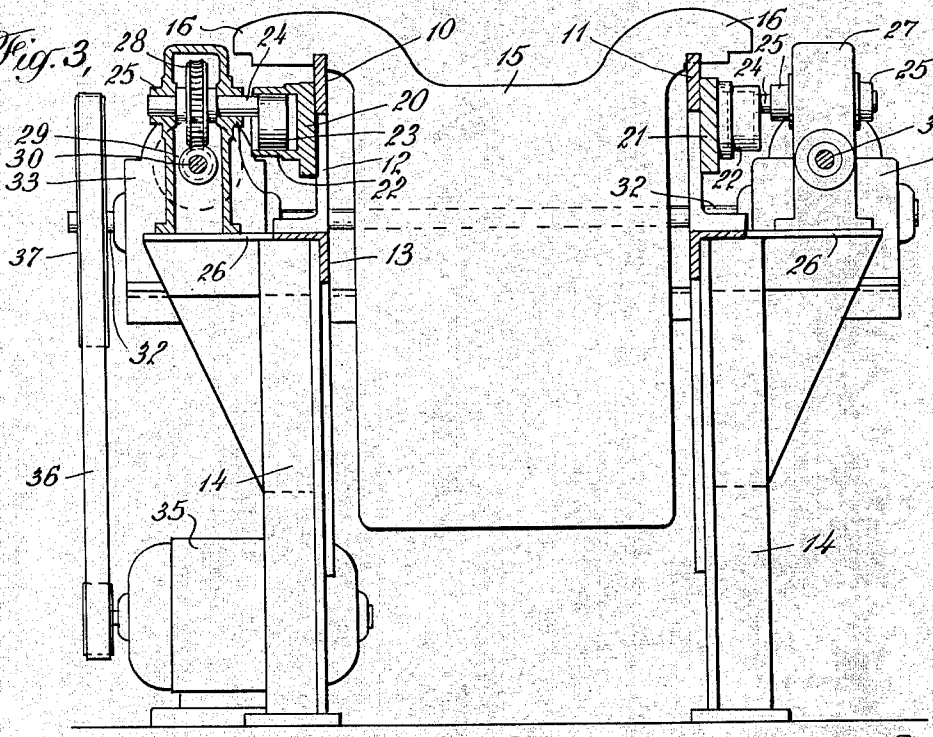


Fig. 4,

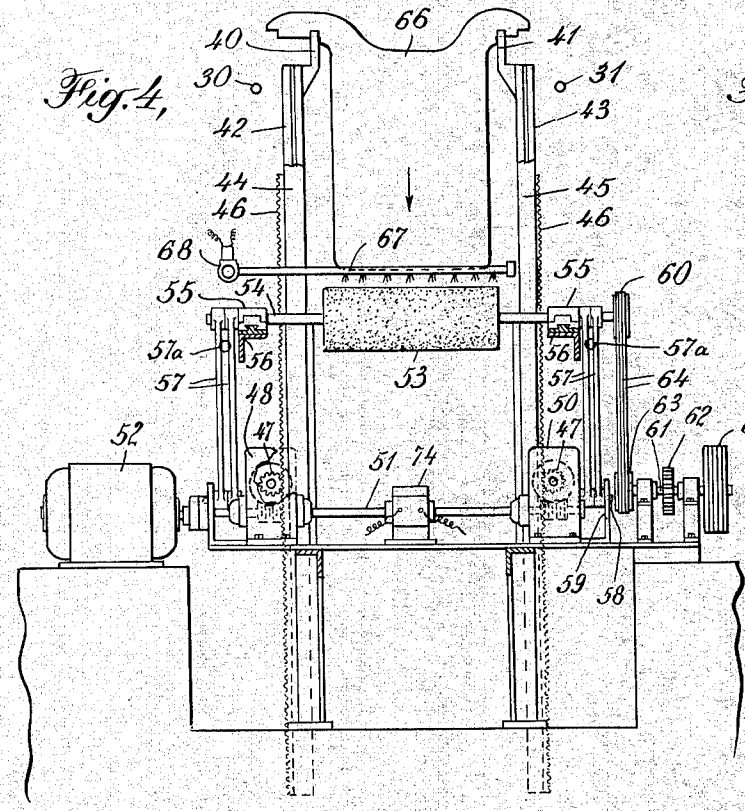
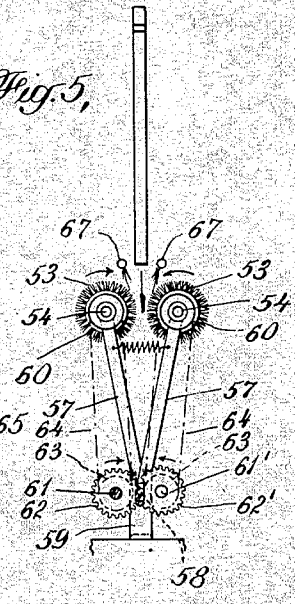


Fig. 5,



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UNITED STATES PATENT OFFICE

2,220,982

CLEANING ANODE

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Application July 11, 1936, Serial No. 90,104

14 Claims. (Cl. 15—77)

This invention relates to apparatus for handling materials in the form of sheets, such, for example, as metal electrodes employed in electrolytic processes. A particular object of the invention is to provide an improved apparatus for cleaning anodes to remove slime therefrom.

In the electrolytic treatment of metals in the form of soluble anodes for refining purposes, it not infrequently happens that, as the electrolysis proceeds, adherent slime forms upon the surfaces of the anodes. This slime generally is electrically non-conductive, and, if it builds up to any considerable extent, the power efficiency of the electrolysis drops appreciably. This evil has been recognized, and, when it has occurred, it has been customary periodically to remove the anodes from the electrolytic cell and wash or scrub them to remove the slime, after which the anodes have been replaced in the cell and the electrolysis has been continued.

The washing operation, as heretofore conducted, has been primarily manual. The brushes usually employed in the washing operation have on occasion been power driven, but the handling of the anodes themselves, after removal from the cell, has been almost wholly by hand. In even small commercial electrolytic refining operations, large numbers of anodes are undergoing treatment simultaneously, and if slime is forming upon each anode and must periodically be removed, the labor costs have been very considerable. In fact, subjecting the anodes to a washing operation more than once in each twenty-four hours heretofore has been regarded as impractical for economic reasons.

As might be expected, this state of affairs has hampered somewhat the free development of electrolytic refining processes. When in the past an electrolytic operation has been shown to involve fairly rapid formation of an adherent slime upon the anodes which would necessitate washing at frequent intervals, it has been deemed necessary to alter the conditions prevailing during the electrolysis to retard slime formation, to change the character of the slime so that it no longer adheres to the anode, or to seek other means of accomplishing the end desired. Recently, a process was developed at the East Chicago plant of the Anaconda Lead Products Company for electrolytically refining lead containing considerable quantities of bismuth. In the course of the operation, an adherent, bismuth-containing slime formed on the surfaces of the anodes at such a rapid rate that to secure a reasonable power efficiency, it was necessary to wash the anodes at intervals of not more than about eight hours. This entailed very high labor costs until the apparatus of the invention was adopted in the washing operation, whereupon these costs were greatly reduced.

Briefly, the apparatus of the invention enables simultaneously removing a plurality of anodes from an electrolytic cell, automatically introducing the anodes thus removed into operative relationship with the chosen washing means, preferably power driven brushes between which the anodes are automatically introduced, and thereafter returning the plurality of anodes to the electrolytic cell. By use of the apparatus of the invention, the spatial relationship of the plurality of anodes is preserved intact during substantially the entire washing operation, so that when the anodes are returned to the cell, they may be replaced therein en masse.

The invention provides a novel combination of elements with apparatus including a stationary support comprising a pair of fixed, substantially parallel and substantially horizontally disposed supporting beams of such length and spaced apart sufficiently to permit a plurality of anodes to be supported thereon by means of ears projecting from the side edges of the anodes, with the ears in contact with the upper surfaces of the beams and with the bodies of the anodes extending downwardly between the beams, and washing means disposed below the pair of supporting beams. In the combination of the invention, an elevator is disposed adjacent the same end of the pair of supporting beams as the washing means, means are provided for advancing anodes along the supporting beams to the elevator and for discharging the anodes from the elevator, and means also are provided for operating the elevator to move the anodes thereon downwardly into contact with the washing means below the supporting beams.

Speaking in greater detail, the preferred form of supporting means for the anodes comprises a rack formed of substantially parallel beams adapted to support a plurality of anodes by the supporting ears or lugs thereof. The beams preferably are notched or grooved, each notch or groove being adapted to receive an ear or lug of an anode. Walking beams positioned adjacent the supporting means serve to advance the anodes along the supporting means. The walking beams are mounted eccentrically and connected with a suitable drive; the mounting of the walking beams is so designed that with each cycle through which the walking beams pass anodes

may be lifted from the supporting means, advanced therealong, and lowered again thereto.

The elevator is operatively positioned with respect to the beams forming the supporting means for anodes to provide means for introducing the anodes into operative relationship with the washing means. To this end short midportion sections of the supporting beams are separate from the main portions of these beams and are associated with vertical members adapted to be lowered and raised by suitable elevator-operating means.

In normal operation, with anodes placed upon the supporting means, the apparatus operates as follows: The walking beam is set in motion to advance anodes along the supporting means to the elevator and from the elevator along the supporting means. With each cycle of the walking beam, the anode upon the elevator is removed therefrom and advanced along the supporting means, and another anode is placed upon the elevator. The driving means for the walking beam is correlated with the driving means for the elevator so that upon the completion of each cycle of the walking beam, the operation thereof is suspended while the operating means of the elevator is set in motion to drive the elevator through a complete cycle of down and up. When the elevator has passed through a complete cycle, its operation is suspended while the walking beam again passes through its cycle. This alternate operation of walking beams and elevators continues until each anode placed upon the supporting means has had its turn upon the elevator and has been introduced into operative relationship with the washing means.

The invention will be understood more clearly from the following description, considered in conjunction with the accompanying drawings, in which:

Fig. 1 is an elevation of an anode washing machine constructed in accordance with the invention;

Fig. 2 is a view looking down upon the machine shown in Fig. 1;

Fig. 3 is an enlarged cross-section through the machine taken substantially along the line 3—3 of Fig. 1;

Fig. 4 is a cross-section through the machine, showing the elevator and its relationship with respect to the washing means, taken substantially along the line 4—4 of Fig. 1; and

Fig. 5 is an elevation showing the mounting of the rotating brushes.

The anode washing machine shown in Figs. 1 to 4 comprises substantially parallel anode supporting beams 10 and 11 forming a rack adapted to support a plurality of anodes by the supporting ears or lugs thereof and supported themselves by frame members 12 and 13 mounted upon suitable posts or pillars 14. The spacing of the beams 10 and 11 is such that an anode 15 (Fig. 3) may easily be received between them and be supported on them by the ears or lugs 16 with which anodes are generally provided for hanging them in electrolytic cells, with the ears of the anode projecting outwardly beyond the outer surfaces of the beams. Notches 17 are provided in the upper surfaces of the beams 10 and 11. The width of the notches 17 is such that each notch will easily receive an ear of an anode. The notches serve to insure proper spacing of anodes supported by the beams 10 and 11.

Walking beams 20 and 21 are eccentrically mounted adjacent the supporting beams 10 and 11 so as to be movable in a substantially circular path of travel with respect to the supporting beams. The mounting of the walking beams is as follows: Bearings 22 are rigidly secured to the outer surfaces of the walking beams and a cam 23 is housed within each bearing. The cams are secured eccentrically to rotatable shafts 24 which are suitably journaled in bearings 25 supported by a frame member 26. The shafts 24 and the bearings 25 in which they are journaled thus support the walking beams through the cams 23 and the bearings 22 secured to the walking beams.

The shafts 24 advantageously form a part of reduction gears 27, each comprising a worm gear 28 mounted upon the shaft 24 and engaging with a worm 29. The worm 29 of each reduction gear is mounted on one of two line shafts 30 and 31 flanking the walking beams 20 and 21 respectively. A drive shaft 32 is connected to each of the line shafts 30 and 31 through reduction gears 33 and 34. A motor 35 provides means for driving the drive shaft 32 through a belt 36 engaging a pulley 37 mounted on the drive shaft.

When the motor 35 is running, it drives each of the line shafts 30 and 31 through the drive shaft 32, and through the line shafts and the worms 29 mounted thereon a turning moment is applied to the shafts 24 supporting the walking beams. The cams 23 are thereby rotated in their bearings 22, and owing to the eccentric mounting of the cams, the walking beams 20 and 21 move in such a manner that any point on the beams travels in a circle of diameter equal to the throw of the cam, each rotation of the shaft 24 and the cam 23 secured thereto actuating the walking beams through a complete cycle. The position of the walking beams with respect to the supporting beams 10 and 11 is such that when a line drawn through the center of any shaft 24 and the true center of the cam 23 mounted thereon is horizontal, the top surface of the walking beam is even with the bottom surfaces of the notches 17 in the supporting beams 10 and 11. Hence during half of each cycle of the walking beams, the top surfaces thereof rise above the bottom of the notches 17 and the beams move forward (say from left to right in Fig. 1) and during the other half of the cycle the top surfaces of the walking beams fall below the bottom of the notches and the beams move backward (i. e. from right to left in Fig. 1). The center to center distance between successive notches 17 is substantially equal to the throw of the eccentrics actuating the walking beams; hence it will be seen that with each cycle, the walking beams come up under the projecting ears 16 of anodes slung between the supporting beams 10 and 11, lift the entire burden of anodes, carry it forward a distance of one notch, lower it again to the supporting beams, and then retreat into position to repeat the cycle. If no other action intervened, the anodes would simply be advanced, one notch with each cycle of the walking beams, from one end of the supporting beams to the other.

It will be noted, however, that short sections 40 and 41 of the supporting beams 10 and 11 adjacent the mid-portions thereof are separate from the main portions of the supporting beams. Each of these short sections 40 and 41 is of a width to include one of the notches 17 formed in the supporting beams 10 and 11, and, when in the position shown in Fig. 1 (except for the fact that they are separated from the main portions of

the supporting beams 10 and 11), they comprise simply portions of the supporting beams over which anodes may be advanced by the walking beams 20 and 21.

These short sections 40 and 41 are mounted upon the upper end portions of vertical members 42 and 43. Each of the vertical members 42 and 43 fits snugly between a pair of guides 44 and 45 which permit down and up movement of the vertical members but restrain them from lateral movement, the guides themselves being held immovable by adjacent frame members. A rack 46 is mounted upon each of the vertical members 42 and 43, and a pinion 47 engages with each rack. The pinions 47 are mounted on the shafts extending from worm reduction gears 48 and 50, and the reduction gears are connected with a drive shaft 51 which is coupled with a reversible motor 52. When the motor is driven in one direction, the turning movement transmitted through the drive shaft 51 and the reduction gears 48 and 50 to the pinions 47 acts upon the racks 46 to lower the vertical members 42 and 43, and where the motor is driven in the opposite direction, the turning movement transmitted to the pinions 47 is such that the vertical members are raised. The above-described assembly of short sections 40 and 41, vertical members 42 and 43, racks 46 and driving mechanism therefor is referred to herein as an elevator.

Washing or scrubbing means comprising a pair of rotary brushes 53 is positioned with respect to the elevator so that an anode on the elevator may be lowered between the brushes. Each of the brushes is mounted for rotation on a brush shaft 54. It is desirable that the brushes be movable toward and away from each other to accommodate anodes of various thicknesses, and to this end the brush shafts, are journaled in bearings 55 slidably mounted on a frame member 56. The mounting is such that the bearings may slide toward and away from each other, thereby permitting the brushes 53 mounted on the brush shafts 54 journaled in the bearings to slide toward or away from each other.

It is desirable that the brushes act with equal force on opposite sides of an object introduced between them, and to this end pantograph arms 57 are journaled on the ends of the brush shafts 54 projecting beyond the slidable bearings 55. The pantograph arms are pivotally connected at their lower ends by a pivot pin 58 projecting through them and into engagement with a vertically slotted member 59. Springs 57*a* are connected to the pantograph arms adjacent their upper end portions to urge the brushes toward one another. The mounting is such that if one brush is forced toward or away from the other, the other brush moves correspondingly toward or away from the brush to which the force is applied.

Each of the brush shafts 54 is provided with a pulley 60 for driving purposes. A brush drive shaft 61 is mounted in suitable bearings and carries a gear 62 engaging a corresponding gear 62′ mounted on a second brush drive shaft 61′. A pulley 63 is mounted on each of the brush drive shafts 61 and 61′ in substantial alignment with the pulleys 60 on the brush shafts 54. Belts 64 connect the pulleys 63 on the brush drive shafts with the pulleys 60 on the brush shafts, and by virtue of the engaging gears 62 and 62′, the brushes are driven in opposite directions by means of the belts and pulleys. A pulley 65 mounted on one of the brush drive shafts 61 is suitably connected to a motor (not shown) for driving the brushes. It will be observed that with the brushes mounted as described, they may be moved toward or away from each other, within reasonable limits as set by suitably placed stops, even while rotating without affecting their operation.

When an anode 66 has been advanced along the supporting beams 10 and 11 into the notches provided in the short sections 40 and 41 thereof the motor 52 is set in operation and the vertical members 42 and 43 are lowered, carrying the anode with them. As the anode is lowered it passes between the revolving brushes 53, which are drawn against it by the action of the spring 57*a*, and the slime is thereby scrubbed from it. To facilitate the washing operation, water or a suitable cleaning solution is sprayed on the anode and the brushes during the washing operation from conduits 67 positioned above each of the brushes 53. The supply of water or solution passing through the conduits 67 is controlled by a magnetic valve 68 which opens only when the elevator is in operation. A sump may be provided below the brushes to collect the slime washed from the anodes, and it is advisable to shield the various bearings and gears of the machine from the slime and washing solution. Drip pans 69 may also be provided to catch solution dripping from the anodes and to protect underlying portions of the machine.

When substantially the entire length of the anode 66 has been lowered between the brushes 53 (as shown by the dotted lines in Fig. 4) the motor 52 is reversed and the elevator with the anode supported upon it is again raised to its original position, whereupon the motor 52 is stopped and the elevator comes to rest.

The operation of the machine as a whole is as follows: A plurality of anodes is slung by their ears between the supporting beams 10 and 11, an ear of each anode being received in one of the notches provided in the beam, so that the entire burden of anodes is to one side of the short sections 40 and 41 of the supporting beams, say to the left thereof. A starting switch is closed and the walking beams 20 and 21 thereupon commence to operate, lifting the entire burden of anodes and advancing them each one notch toward the right. The anode in the notches immediately to the left of the notches in the short sections 40 and 41 of the supporting beams are advanced into these notches, and this anode is thus in position to be lowered between the brushes 53. Upon completion of the cycle of the walking beams, their operation is suspended by shutting off current to the motor 35 driving them and setting a magnetically operated brake associated with the motor, and at the same time a magnetically operated brake associated with the motor 52 is released and this motor is set in motion to actuate the elevator. The elevator is driven downwardly, carrying the anode slung between the short sections 40 and 41 between the revolving brushes 53, and the magnetic valve 68 controlling the flow of liquid sprayed upon the anodes from the conduits 67 is opened. When the elevator has reached its lowermost position, the motor 52 is reversed and the elevator is driven upwardly. The anode is carried up between the brushes until it has been lifted above them and has been returned cleaned to its original position. At this point operation of the elevator is suspended, the magnetic valve 68 closes, and the walking beams commence another cycle, lifting

the cleaned anode from the elevator and advancing it one notch to the right and advancing an anode to be cleaned into the notches on the short sections 40 and 41 of the supporting beams. Again the walking beams come to rest, and again the elevator passes through its cycle. This operation continues until the first anode to be washed has been advanced to the notches at the extreme right of the machine, where it depresses a finger 70 projecting from a limit switch 71 mounted on an end member 72 of the machine frame to stop the machine.

It will be apparent from the foregoing description that means must be provided to correlate the functioning of the walking beams and elevator if operation of the machine is to be wholly automatic. To this end a drum controller 73 is geared to the walking beam drive shaft 32 so that it passes through one complete cycle with each cycle of the walking beams. A second drum controller 74 is similarly geared to the elevator drive shaft 51 to pass through a complete cycle with each cycle of the elevator.

The apparatus may be operated as follows: The walking beam motor 35 is energized, starting the cycle of the walking beams 20 and 21. The drum controller 73, geared to the walking beam drive shaft 32, is so arranged that with the completion of the walking beam cycle, power is cut off from the motor 35 and a magnetic brake is set to hold the walking beams from moving. As this cycle is completed, the drum controller 73 acts to energize the elevator motor 52, which starts the elevator in operation. When the motor 52 is energized, the pinions 47 are operated through the drive shaft 51 and reduction gears 48 and 50, driving the racks 46 mounted on each of the vertical members 42 and 43, the upper ends of which form the short sections 40 and 41 of the supporting beams 10 and 11. The action of the pinions 47 on the racks 46 causes the elevator to descend, and to rise when the motor 52 is reversed by action of the drum controller 74, which takes place when the elevator reaches substantially the bottom of its travel. It is advantageous to include a timing relay in the control circuit to determine the length of time the elevator stays at or near the bottom of its travel before starting to move up, as this allows for adjustment by the operator of the amount by which the elevator drifts, assuring complete scrubbing of the anodes, and it also prevents overloading the elevator motor through too sudden reversing. As the elevator approaches the upper limit of its travel, its rising speed may be slowed, and as it comes to rest a brake is set by a relay, preferably one designed to keep the brake released as long as the motor 52 is energized. The magnetically operated valve 68 preferably is connected to the brake so that the valve 68 remains opens while the brake is off but closes when the brake sets. This prevents waste of the fluid while the walking beam mechanism is in motion. When the elevator stops at the upper limit of its travel, thus completing its cycle, the drum controller 74 so acts as to energize the walking beam motor 35, thus starting the complete cycle over again.

A separate motor is used to drive the washing brushes 53. The brushes are rotated continuously throughout the performance and for that reason no particular control apparatus is necessary for their separate motor.

It is understood that various modifications may be made in the construction of the machine described above and in its operation. For example, by suitably altering the control circuit, the elevator can be made to pass through two or more complete cycles between each cycle of the walking beams. This may be advantageous when a particularly adherent slime is to be removed from anodes. Furthermore, the elevator may be designed to carry two or more anodes at a time, and the walking beam may in such case be so designed as to advance the anodes two notches along the walking beam with each cycle.

In the foregoing description, particular reference has been made to electrical operation and control of the machine. In general this is preferred, but if desired, mechanical operation and control may be employed. Thus, for example, the elevator may be operated hydraulically instead of electrically.

The machine described above is particularly well suited to cleaning anodes, but it may be adapted to other uses as well. For example, it may be employed in painting or pickling metal sheets or plates by eliminating the brushes and brush mechanism adjacent the elevator and substituting painting or pickling means in place thereof. Or the brushes may be replaced by rolls on the platens of a hydraulic press and the machine may be used to straighten metal sheets or plates. Other modifications of the machine to adapt it to other uses will also be apparent to those skilled in the art.

As pointed out above, use of the machine described above for washing anodes, makes possible lifting a plurality of anodes simultaneously from an electrolytic cell, automatically passing them successively in operative relation with washing means, and returning the anodes en masse to the cell without substantially altering their spatial arrangement with respect to one another. It will be apparent from the foregoing description how the anodes may be automatically passed successively in operative relationship with washing machines.

In employing the apparatus of the invention, a plurality of anodes preferably are lifted simultaneously from an electrolytic cell without disturbing to any substantial extent their spatial relationship with respect to one another, and are then automatically passed in operative relationship with washing means, for example by depositing them upon the supporting members of the anode washing machine described above (the notches on the supporting members being such that the spatial relationship of the anodes with respect to one another which on the machine is substantially the same as in the electrolytic cell). Thereafter the anodes are returned cleaned to the cell, still without substantially altering their spatial relationship, and are replaced en masse in the cell. The slime washed from the anodes may, if it is of value, be collected and subjected to suitable treatment.

In accordance with the invention it is possible to wash anodes more economically and much more speedily than has heretofore been possible. Electrolytic refining processes involving the rapid formation of an adherent slime on the anodes may be dealt with expediently by means of the invention, and at a cost that may well fall below the costs entailed heretofore, even when washing at relatively infrequent intervals, in washing operations involving a substantial amount of hand labor.

I claim:

1. In apparatus of the character described, a

brush assembly comprising a frame member, bearings slidably mounted thereon and so arranged as to remain in contact with the frame while sliding thereon, a pair of substantially parallel brush shafts supported by said bearings, a brush mounted on each brush shaft, a pair of arms pivotally connected together at one end and each connected pivotally at its other end to one of the brush shafts, means for guiding linear movement of said arms at their point of pivotal connection in a direction substantially perpendicular to the direction in which the brush shaft bearings slide on the frame, whereby motion of either brush shaft toward or away from the other is accompanied by corresponding motion of the other brush shaft, and spring means urging the brush shafts toward each other.

2. In apparatus of the class described including a stationary support comprising a pair of fixed, substantially parallel and substantially horizontally disposed supporting beams of such length and spaced apart sufficiently to permit a plurality of anodes to be supported thereon by means of ears projecting from the side edges of the anodes with the ears in contact with the upper surfaces of the beams and with the bodies of the anodes extending downwardly between the beams, and washing means disposed below the pair of supporting beams adjacent one end, the combination of an elevator disposed adjacent the same end of the pair of supporting beams as the washing means, means for advancing anodes along the supporting beams to the elevator and for discharging the anodes from the elevator, and means for operating the elevator to move anodes thereon downwardly into contact with the washing means below the supporting beams.

3. In apparatus of the class described including a stationary support comprising a pair of fixed, substantially parallel and substantially horizontally disposed supporting beams provided with grooves in their upper surfaces for the reception of ears projecting from the side edges of anodes and of such length and spaced apart sufficiently to permit a plurality of anodes to be supported thereon with their projecting ears disposed in the grooves and with their bodies extending downwardly between the beams, and washing means disposed below the pair of supporting beams adjacent one end, the combination of an elevator disposed adjacent the same end of the pair of supporting beams as the washing means, means for advancing anodes from groove to groove along the supporting beams and to the elevator and for discharging the anodes from the elevator, and means for operating the elevator to move anodes thereon downwardly into contact with the washing means below the supporting beams.

4. In apparatus of the class described including a stationary support comprising two pairs of fixed, substantially parallel and substantially horizontally disposed supporting beams mounted in end-to-end vertical and horizontal alignment with a space therebetween, the beams of each pair being of such length and spaced apart sufficiently to permit a plurality of anodes to be supported thereon by means of ears projecting from the side edges of the anodes with the ears in contact with the upper surfaces of the beams and with the bodies of the anodes extending downwardly between the beams, and washing means disposed below the pairs of beams in vertical alignment with the space therebetween, the combination of an elevator disposed in the space between the pairs of beams comprising a pair of short beam sections spaced apart and disposed in vertical and horizontal alignment with the pairs of anode supporting beams, means for advancing anodes along one pair of supporting beams to the elevator to place the anode ears in contact with the short beam sections and from the elevator along the other pair of supporting beams, and means for operating the elevator to move the short beam sections downwardly, whereby anodes thereon are moved downwardly into contact with the washing means below the supporting beams, and to return the short beam sections to their positions of alignment with the anode supporting beams.

5. In apparatus of the class described including a stationary support comprising two pairs of fixed, substantially horizontally disposed supporting beams mounted in end-to-end vertical and horizontal alignment with a space therebetween, the beams of each pair being provided with grooves in their upper surfaces for the reception of ears projecting beyond the side edges of anodes and of such length and spaced apart sufficiently to permit a plurality of anodes to be supported thereon with their projecting ears disposed in the grooves and with their bodies extending downwardly between the beams, and washing means disposed below the pairs of beams in vertical alignment with the space therebetween, the combination of an elevator disposed in the space between the pairs of beams comprising a pair of short beam sections provided with grooves in their upper surfaces and spaced apart and disposed in vertical and horizontal alignment with the pairs of anode supporting beams, means for advancing anodes from groove to groove along one pair of supporting beams to the elevator to place the anode ears in the grooves in the upper surfaces of the short beam sections and from the elevator from groove to groove along the other pair of supporting beams, and means for operating the elevator to move the short beam sections downwardly whereby anodes thereon are moved downwardly into contact with the washing means below the supporting beams, and to return the short beam sections to their positions of alignment with the anode supporting beams.

6. In apparatus of the class described including a stationary support comprising two pairs of fixed, substantially parallel and substantially horizontally disposed supporting beams mounted in end-to-end vertical and horizontal alignment with a space therebetween, the beams of each pair being of such length and spaced apart sufficiently to permit a plurality of anodes to be supported thereon by means of ears projecting from the side edges of the anodes with the ears in contact with the upper surfaces of the beams and with the bodies of the anodes extending downwardly between the beams, and washing means disposed below the pairs of beams in vertical alignment with the space therebetween, the combination of an elevator disposed in the space between the pairs of beams comprising a pair of short beam sections spaced apart and disposed in vertical and horizontal alignment with the pairs of anode supporting beams, means for advancing anodes along one pair of supporting beams to the elevator to place the anode ears in contact with the short beam sections and from the elevator along the other pair of supporting beams, and means for operating the elevator to move the short beam sections downwardly,

whereby anodes thereon are moved downwardly into contact with the washing means below the supporting beams, and to return the short beam sections to their positions of alignment with the anode supporting beams, the elevator operating means and the means for moving anodes along the supporting beams being arranged to function alternately, whereby anodes are moved along the supporting beams intermittently and only after an anode supported on the elevator has been moved into contact with the washing means and the short beam sections have been returned to their positions of alignment with the supporting beams.

7. In apparatus of the class described including a stationary support comprising two pairs of fixed, substantially horizontally disposed supporting beams mounted in end-to-end vertical and horizontal alignment with a space therebetween, the beams of each pair being provided with grooves in their upper surfaces for the reception of ears projecting beyond the side edges of anodes and of such length and spaced apart sufficiently to permit a plurality of anodes to be supported thereon by means of ears projecting from the side edges of the anodes with such projecting ears disposed in the grooves and with the bodies of the anodes extending downwardly between the beams, and washing means disposed below the pairs of beams in vertical alignment with the space therebetween, the combination of an elevator disposed in the space between the pairs of beams comprising a pair of short beam sections provided with grooves in their upper surfaces and spaced apart and disposed in vertical and horizontal alignment with the pairs of anode supporting beams, means for advancing anodes from groove to groove along one pair of supporting beams to the elevator to place the anode ears in the grooves in the upper surfaces of the short beam sections and from the elevator from groove to groove along the other pair of supporting beams, and means for operating the elevator to move the short beam sections downwardly, whereby anodes thereon are moved downwardly into contact with the washing means below the supporting beams, and to return the short beam sections to their positions of alignment with the anode supporting beams, the elevator operating means and the means for moving anodes along the supporting beams being arranged to function alternately, whereby anodes are moved along the supporting beams intermittently and only after an anode supported on the elevator has been moved into contact with the washing means and the short beam sections have been returned to their positions of alignment with the supporting beams.

8. In an anode washing machine comprising two pairs of fixed, substantially horizontally disposed supporting beams mounted in end-to-end vertical alignment with a space therebetween, the beams of each pair being provided with substantially equally spaced grooves in their upper surfaces for the reception of ears projecting beyond the side edges of anodes and sufficiently spaced apart and of such length as to permit a plurality of anodes to be supported thereon with their projecting ears disposed in the grooves and with their bodies extending downwardly between the beams, washing means including a pair of rotatably mounted brushes disposed below the pairs of beams in vertical alignment with the space therebetween, and means for rotating the brushes, the combination of two pairs of parallel movable bars disposed adjacent the supporting beams in position to engage the bottoms of anode ears disposed in the grooves of the supporting beams during the course of their movement and so mounted on parallel eccentrics that their top surfaces will coincide with the bottoms of the grooves of the supporting beams when the throws of the eccentrics are in their horizontal positions and will remain substantially parallel to the supporting beams during revolution of the eccentrics so that a plurality of anodes supported in the grooves of the anode supporting beams may be lifted simultaneously from the grooves, carried forward and re-deposited in the next adjacent grooves through the upper half revolution of the eccentrics, means for revolving the eccentrics, a lowering and raising device comprising a pair of parallel rack members mounted for vertical movement in the space between the pairs of supporting beams in vertical alignment with the supporting beams, said rack members being provided at their upper ends with grooves corresponding to and in horizontal alignment with the grooves of the supporting beams, whereby continuity of spacing of grooves is provided between the pairs of supporting beams and whereby anodes in their groove-to-groove travel along the supporting beams will be deposited successively on the raising and lowering device with their ears in the grooves of the rack members, pinions engaging the teeth of said rack members, a reversible electric motor for operating the pinions, and means for controlling the operation of the motor automatically so that at predetermined times during the revolutions of the eccentrics the rack members will be lowered and raised and anodes supported in the grooves of the rack members will be lowered into contact with the brushes of the washing means and will be returned again to a position of alignment with anodes supported in the grooves of the anode supporting beams.

9. In apparatus of the class described including a stationary support comprising two pairs of fixed, substantially parallel and substantially horizontally disposed supporting beams mounted in end-to-end vertical and horizontal alignment with a space therebetween, the beams of each pair being of such length and spaced apart sufficiently to permit a plurality of anodes to be supported thereon by means of ears projecting from the side edges of the anodes with the ears in contact with the upper surfaces of the beams and with the bodies of the anodes extending downwardly between the beams, and washing means disposed adjacent the pairs of beams in substantially vertical alignment with the space therebetween, the combination of an elevator disposed in the space between the pairs of beams comprising a pair of short beam sections spaced apart and disposed in vertical and horizontal alignment with the pairs of anode supporting beams, means for advancing anodes along one pair of supporting beams to the elevator to place the anode ears in contact with the short beam sections and from the elevator along the other pair of supporting beams, and means for operating the elevator to move the short beam sections downwardly, whereby the anodes thereon are moved into contact with the washing means adjacent the supporting beams, and to return the short beam sections to their positions of alignment with the supporting beams.

10. In apparatus of the class described including a stationary support comprising two pairs of

fixed, substantially horizontally disposed supporting beams mounted in end-to-end vertical and horizontal alignment with a space therebetween, the beams of each pair being provided with grooves in their upper surfaces for the reception of ears projecting beyond the side edges of anodes and of such length and spaced apart sufficiently to permit a plurality of anodes to be supported thereon with their projecting ears disposed in the grooves and with their bodies extending downwardly between the beams, and washing means disposed adjacent the pairs of beams in substantially vertical alignment with the space therebetween, the combination of an elevator disposed in the space between the pairs of beams comprising a pair of short beam sections provided with grooves in their upper surfaces and spaced apart and disposed in vertical and horizontal alignment with the pairs of anode supporting beams, means for advancing anodes from groove to groove along one pair of supporting beams to the elevator to place the anode ears in the grooves in the upper surfaces of the short beam sections and from the elevator from groove to groove along the other pair of supporting beams, and means for operating the elevator to move the short beam sections, whereby the anodes thereon are moved into contact with the washing means adjacent the supporting beams, and to return the short beam sections to their positions of alignment with the supporting beams.

11. In an anode washing machine comprising a stationary rack adapted to support a plurality of anodes, said rack comprising a pair of substantially parallel supporting beams spaced apart sufficiently to receive the body of an anode therebetween and depending therebelow but being sufficiently close together to receive ears projecting from the sides of the anode and to support such anode by its ears, and washing means arranged below one end of said rack, the combination of anode-carrying elevator means mounted adjacent the end of said rack over said washing means and comprising short beam sections spaced correspondingly to the beams of the rack in a manner to receive the ears of an anode and support the anode thereby, means for advancing anodes along said rack and onto said elevator means and for removing anodes from said elevator means, and means for lowering and raising the elevator means with anode thereon into and from washing position in said washing means.

12. In an anode washing machine comprising a pair of stationary anode supporting racks mounted substantially in end-to-end relation but having their adjacent ends spaced apart, each rack being adapted to support a plurality of anodes by the ears thereof and each rack being provided with a plurality of substantially equally spaced notches for receiving the ears of the anodes in a manner to maintain substantially equal spacing between adjacent anodes on the racks, and washing means arranged below the spaced adjacent ends of the supporting racks, the combination of anode-carrying elevator means mounted between the spaced adjacent ends of the supporting racks, said elevator means including a notched anode-supporting member adapted to receive and support an anode by the ears thereof, the notch with which said anode-supporting member is provided being spaced from the adjacent notches of the anode-supporting racks by a distance substantially equal to the distance between the notches formed on the racks, means for advancing anodes along one supporting rack to the elevator means and from the elevator means along the other supporting rack, and means for lowering and raising the elevator means with anode thereon into and from washing position in said washing means.

13. In an anode washing machine comprising a pair of stationary anode-supporting racks mounted substantially in end-to-end relation but having their adjacent ends spaced apart, each of said racks comprising a pair of substantially parallel supporting beams spaced apart sufficiently to receive the body of an anode therebetween and depending therebelow but being sufficiently close together to receive ears projecting from the sides of the anode and to support such anode by its ears, and washing means arranged below the spaced adjacent ends of the supporting racks, the combination of anode-carrying elevator means mounted between the spaced adjacent ends of the supporting racks, said elevator comprising short beam sections spaced correspondingly to the beams of the rack in a manner to receive the ears of an anode and support the anode thereby, means for advancing anodes along one supporting rack to said elevator means and from the elevator means along the other supporting rack, and means for lowering and raising the elevator means with anode thereon into and from washing position in said washing means.

14. In apparatus of the character described, a stationary rack adapted to support a plurality of anodes, said rack comprising a pair of substantially parallel supporting beams spaced apart sufficiently to receive the body of an anode therebetween and depending therebelow but being sufficiently close together to receive ears projecting from the sides of the anode and to support such anode by its ears, means for advancing anodes along said rock, an elevator adapted to receive one anode at a time and comprising short beam sections spaced correspondingly to the beams of the rack in a manner to receive the ears of an anode and support the anode thereby, said short beam sections being mounted in substantial alignment with the beams of the rack, means for lowering and raising said elevator with anode thereon, and anode washing means positioned below the rack in the path of travel of an anode supported on and moved by said elevator.

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