June 8, 1948. F. A. MORIN 2,443,112

CONTACT STRUCTURE FOR ELECTROLYTIC CELLS

Filed May 30, 1942 3 Sheets-Sheet 1

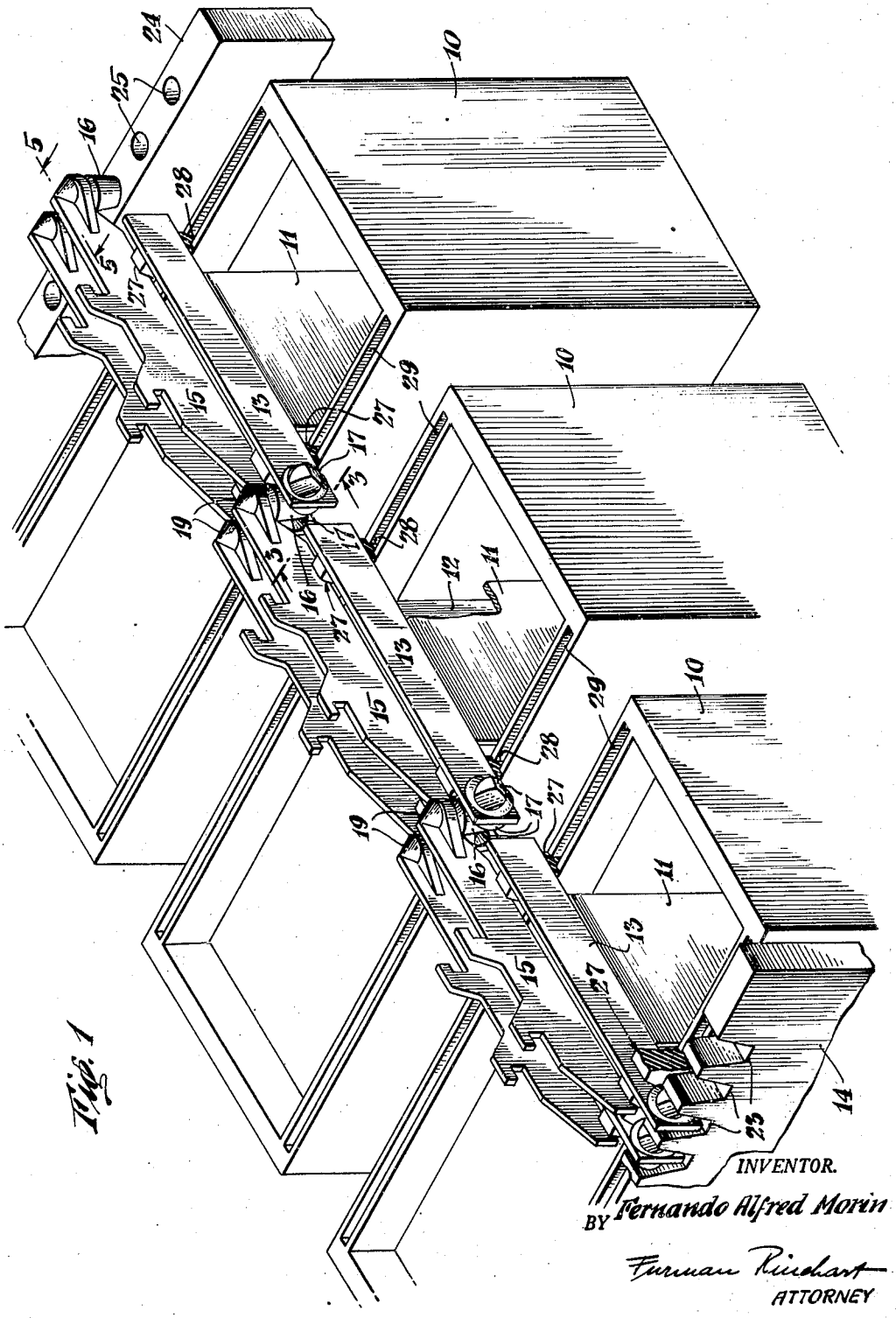


Fig. 1

INVENTOR.
BY Fernando Alfred Morin
Furman Rinehart
ATTORNEY

June 8, 1948. F. A. MORIN 2,443,112

CONTACT STRUCTURE FOR ELECTROLYTIC CELLS

Filed May 30, 1942 3 Sheets-Sheet 2

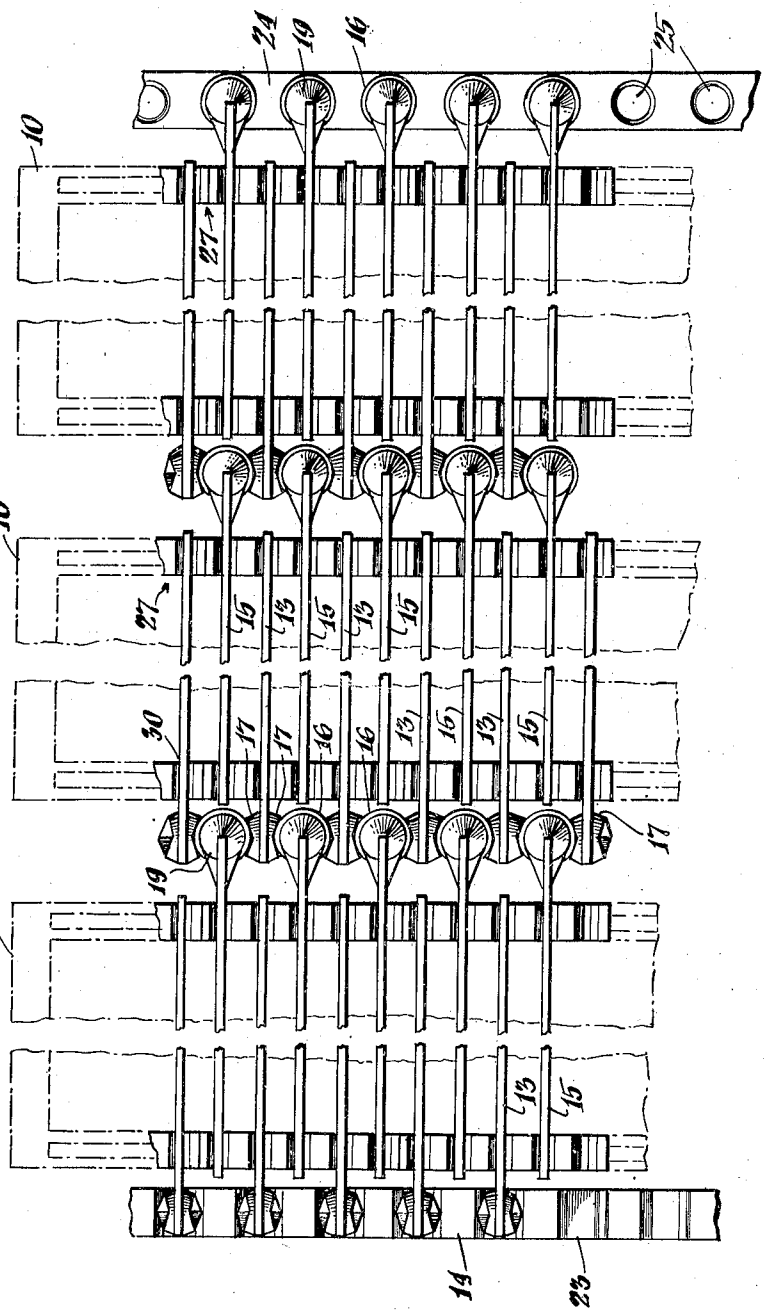


Fig. 1a

INVENTOR.
Fernando Alfred Morin
BY
James K. Kent
ATTORNEY

June 8, 1948. F. A. MORIN 2,443,112

CONTACT STRUCTURE FOR ELECTROLYTIC CELLS

Filed May 30, 1942 3 Sheets-Sheet 3

Fig. 2

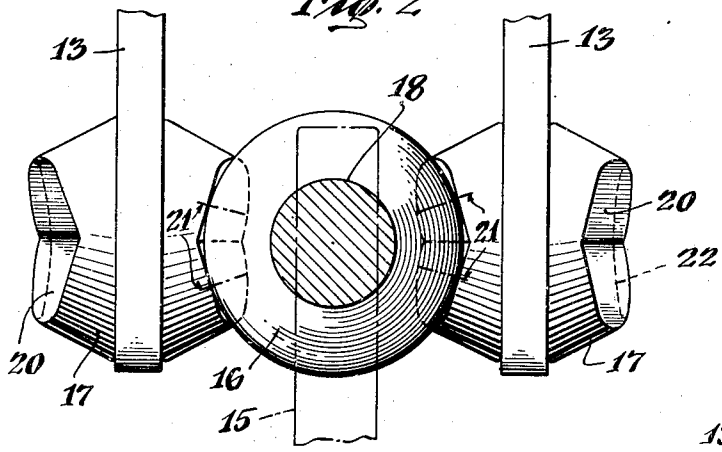


Fig. 3

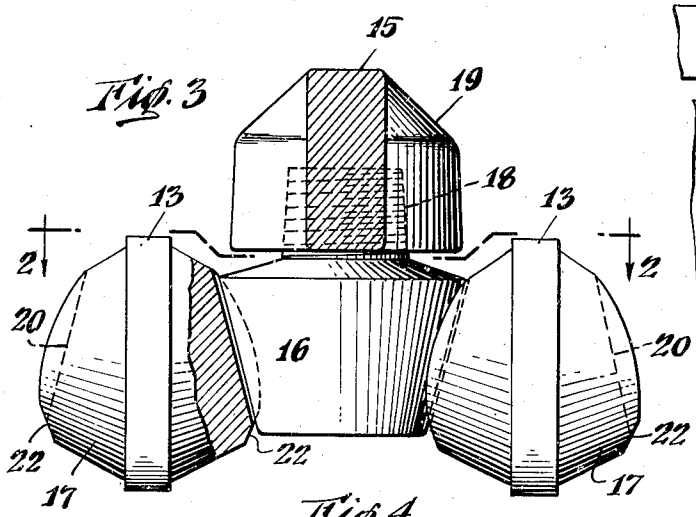


Fig. 4

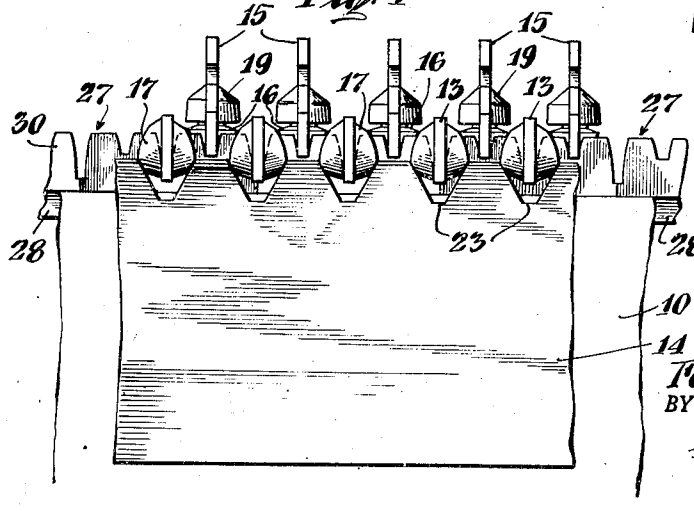


Fig. 5

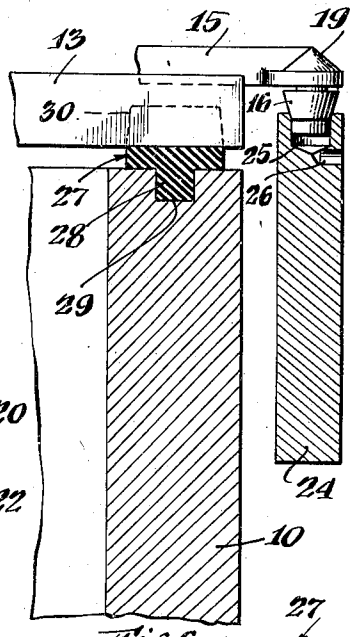
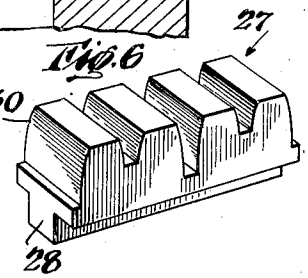


Fig. 6



INVENTOR.
Fernando Alfred Morin
BY
Furman Rinehart
ATTORNEY

Patented June 8, 1948

2,443,112

UNITED STATES PATENT OFFICE

2,443,112

CONTACT STRUCTURE FOR ELECTROLYTIC CELLS

Fernando Alfred Morin, Baltimore, Md., assignor to American Smelting and Refining Company, New York, N. Y., a corporation of New Jersey

Application May 30, 1942, Serial No. 445,149

6 Claims. (Cl. 204—267)

1

My invention relates to electrolytic apparatus, and more particularly to new and improved contact structure for connecting electrodes in an electrolytic cell or group of cells, such as used in refining metals and their alloys.

One object of this invention is to provide an improved contact structure for electrolytic apparatus of this character, wherein the interconnected elements, through which current is conducted, are so arranged that a firm and intimate metal-to-metal contact is produced at the joints whereby a minimum of resistance is offered to the passage of electric current.

Another object is to devise an improved arrangement for making electrical connection with the electrodes to provide maximum current-carrying capacity between the various parts while permitting the ready removal and replacement of individual electrodes.

Still another object is to provide a contact joint structure for electrodes which is easily cleaned of electrolyte salts or foreign matter which tend to collect between the surfaces of the joints increasing the resistance of the flow of electric current causing heating with resultant loss of current efficiency.

These and other objects and advantages of my invention will become apparent as the description proceeds, and the novel features will be more distinctly pointed out in the appended claims. For purposes of illustration and description, my invention is shown and described in connection with the electrolytic refining of zinc.

Although the electrode contact structure of this invention has been found to be particularly useful in the construction and operation of electrolytic zinc cells employing aluminum head bars, it will be obvious the improved contact arrangement is adapted for use with other types of head bars and in different electrolytic apparatus, such as utilized in the recovery or deposition of copper, cadmium, tin and the like.

Referring to the accompanying drawings, Figure 1 is a general view in perspective showing a bank of electrolytic cells wherein the electrodes are connected in series utilizing the improved contact structure of this invention;

Figure 1a is a plan view of a bank of electrolytic cells, such as those of Figure 1, illustrating the inter-cell and cell-to-bus bar connections;

Figure 2 is an enlarged fragmentary plan view, partly in section illustrating the anode-cathode contact joint structure, and taken substantially on the line 2—2 of Figure 3 looking in the direction of the arrows;

Figure 3 is a view in elevation of the contact means shown in Figure 2 and taken substantially on the line 3—3 of Figure 1 looking in the direction of the arrows;

Figure 4 is a fragmentary and elevational view illustrating the construction and arrangement of

2

the anode and cathode electrode spacer means and anode bus bar;

Figure 5 is a fragmentary sectional view taken substantially on the line 5—5 of Figure 1 illustrating the method of connecting the end cathode electrodes to the negative bus bar; and

Figure 6 is a perspective view of a section of the electrode insulating and spacer means which is suitably positioned on top of the side walls extending lengthwise of the tanks.

Referring to the drawing in detail, Figure 1 shows a bank of electrolytic zinc cells comprising tanks 10 for holding the electrolyte. The tanks are made of suitable material and preferably lined with lead or the like acid resistant substance. Anode and cathode electrodes, generally designated 11 and 12 respectively, are arranged in each tank and connected in series. The size of the electrodes and number in each cell may be varied to suit the particular conditions under which the process is carried out.

In the production of electrolytic zinc the anode electrodes are insoluble in the electrolyte. Lead or silver-lead alloy electrodes may be used for this purpose. The anodes 11, in the apparatus illustrated are in the form of sheets each supported by a head bar 13 which spans the tank. These head bars are preferably made of copper or similar material having high electrical conductivity properties and the anodes are cast around, riveted or otherwise firmly secured thereto. On one side of the bank of cells the anode head bars 13 are arranged to make electrical contact with a bus bar 14 which in turn is connected to a source of electric current.

The cathode electrodes, in this instance, are made of high purity aluminum sheet so that the zinc deposit can be readily stripped therefrom. Each cathode comprises a head bar 15 which is formed of aluminum or aluminum alloy. The head bars span the tank in alternate arrangement with the anode head bars 13. Between adjacent tanks the anode and cathode head bars are extended and electrically connected as shown in Figure 1. To provide a jointure having maximum current-carrying capacity a metal, inverted frustrum-like, member 16 is attached in dependent position to the extended end portion of a cathode head bar and is adapted to make wedging contact with a grooved mushroom-head like metal member 17 fixed on the adjoining extended end portion of an anode head bar. The detail construction of the contact structure is shown in Figures 2 and 3.

In the improved contact structure illustrated the contact member 16 is preferably cone-shaped and made of high electrical conductivity metal such as copper or the like. An integral taper threaded male section 18 is adapted to be screwed into a flared outer end female portion 19 of the

aluminum head bar 15 as shown in Figure 3. By this construction the metal contact member 16 is firmly secured to the cathode head bar and the bright surface of the copper is brought into intimate pressure contact with a corresponding bright surface of aluminum and, when the parts are screwed together tight, oxidation or infiltration of electrolyte salts between the contact surface of the two metals is substantially prevented. If desired the aluminum head bar may be tinned or brazed where the copper contact member passes through it to increase the resistance to infiltration of electrolyte salt. Preferably the member 16 and head bar 15 are threaded together, as illustrated, but as an alternative method the freshly prepared surfaces may be sweated or drivingly fit together or otherwise joined in intimate metal-to-metal contact and wherein the joint is sealed against the entrance of electrolyte. In this way a particularly good electrical contact is made between the aluminum head bar 15 and the cone-shaped copper contact piece 16 producing a joint having sufficient current-carrying capacity to avoid heating.

As shown in Figures 2 and 3, similar shaped copper mushroom-head like contact members 17 are positioned back-to-back on each anode support bar 13. The cone-shaped copper piece 16 affixed to the cathode head bar 15 is arranged to be wedged in between opposed copper mushroom-head like members 17 on adjacent anode bars. The surface contact face of each of the copper mushroom-head like protuberances 17 comprises an outward sloping V-shaped groove 20 which provides two double line electrical contact surfaces between the parts as indicated by the dotted lines 21 on Figure 2. These contact surfaces are so located that the electrolyte salts, which tend to collect therebetween, causing heating, can be readily and effectively removed by applying a jet of steam or water along the line of electrode contacts between adjacent cells.

A flat surface portion 22 on the face of the contact head members 17 beneath the V-shaped groove section, provides a proper contact surface with the positive current-carrying bus bar 14. Opposed flat surfaces 22 on the heads 17 are inclined in a manner to fit snugly against the side walls of the notches 23 in the bus bar 14. The slidable wedging action between the contacting surfaces of the joints tends to keep the same clean and the adjoining surfaces are pressed into intimate contact by gravitational force so that electrical resistance therebetween is extremely low.

The contact members 16 and 17 are preferably made of copper, copper alloy or the like, however, if desired these parts may be shaped from other materials which possess high electrical conductivity such as silver or a suitable alloy thereof.

Current is conducted from the cathodes in the end tank back to the voltage source through the bus bar 24 which is suitably positioned adjacent the last tank or cell as shown to the right in Fig. 1. A series of taper reamed holes 25, having drain openings 26, are provided in the bus bar to receive the cone-shaped contact members 16. The lower part of the cone-shaped contact members form a wedge-like fit in the upper taper portion of the drilled holes as shown in Figures 1 and 5. This construction provides a markedly improved electrical contact arrangement and permits the efficient removal of electrolyte salts as described.

In order to accurately space the electrodes lengthwise of the tanks so that they will hang true and insure even distribution of current, electrode spacer means 27 is arranged along on top of the tanks on the opposite ledges as illustrated in Figures 1, 5 and 6. The electrode spacer members 27 are formed of electrical insulating material and are preferably made up in sections as shown in Figure 6. These sections are adapted to be fitted together to accommodate the number of electrodes employed in each tank. For mounting the electrode spacer members on top of the tanks a depending portion 28 is shaped to fit in the slot 29 extending along lengthwise of the tank on top of the side walls. Alternate deep and shallow notches are provided in the uppermost body portion 30 of the member 27 to receive the outer ends of the anode and cathode head bars, respectively, as illustrated in Figure 4.

While certain novel features of the invention have been illustrated and described, it will be understood the invention is not limited to the specific details of construction shown, and that various omissions, substitutions and changes in the forms and details may be made by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. In combination with a plurality of electrolytic cells having anodes and cathodes, means for positioning said electrodes in predetermined spaced relationship in said cells, said anode and cathode electrodes being provided with engaging electrical contact members at their outer ends for connecting the electrodes in adjacent cells in series, said contact members on electrodes of one polarity comprising a cone-shaped metal member attached in dependent position adjacent the outer end of each such electrode and said contact members on electrodes of the opposite polarity comprising a pair of mushroom-head like metal members attached one on each side of each such electrode adjacent its outer end, said cone-shaped member in one cell being seated in wedging contact between two opposed mushroom-head like members secured to adjacent electrodes in an adjacent cell, each of said mushroom-head like members having a central groove therein forming two single lines of electrical contact with said engaging cone-shaped metal member.

2. Apparatus for producing electrolytic metal comprising a plurality of electrolytic cells arranged in side-by-side relation, spaced anode and cathode electrodes in said cells, conductor head bars for said anodes and cathodes extending across the cells, means for supporting said electrodes in predetermined spaced relationship, said anode and cathode electrode head bars being provided at their respective ends between said cells with engageable electrical contact members for connecting the anodes of one cell with the cathodes of the adjoining cell, one of said contact members comprising a dependent cone-shaped metal member arranged to make electrical connection with another contact member secured to an electrode head bar of opposite polarity supported on an adjacent cell, said last mentioned contact member comprising a grooved mushroom-head like metal member protruding from the side of its head bar and constituting, with a diametrically opposed grooved mushroom-head like contact member protruding from the side of another electrode head bar of the same polarity, a seat wedgingly engaging said cone shaped

contact member, a bus bar along side one of the cells and provided with V-shaped serrations along its upper portion, and oppositely inclined surfaces on the lower portion of each of a pair of grooved mushroom-head like contact members on the same electrode seated in a serration of the bus bar aforesaid.

3. Apparatus for producing electrolytic zinc comprising a plurality of electrolytic cells arranged in side-by-side relation, spaced electrodes in said cells forming anodes and cathodes, conductor head bars for said anodes and cathodes extending across the cells, said cathode head bar being made of aluminum, cone shaped electrical contact means secured to the cathode head bars and dependent therefrom, contact means comprising a mushroom-head like protuberance having a grooved face portion positioned on the sides of said anode conductor head bars to receive said cone shaped contact means attached to cathode head bars of an adjacent cell, said anode grooved contact means having the groove inclined downwardly and outwardly to define wedge-shaped spaces between opposed grooved contact members, said cathode contact means on one cell being adapted to form a frictional wedging engagement in the opposed groove spaces formed between two adjacent anodes of the adjoining cell for removably securing the cathodes in proper alignment with the anodes.

4. Apparatus for producing electrolytic zinc comprising a plurality of side-by-side tanks for holding zinc containing electrolyte, anode and cathode electrodes positioned in said tanks, conductor head bars for said electrodes extending across the respective tanks, said cathode electrode head bars being made of metal selected from the group consisting of aluminum and aluminum-base alloy, dependent cone shaped metal contact means at one end of said cathode head bars of higher electrical conductivity than the latter and firmly secured thereto by means of tapered male and female threaded portions forming an intimate metal-to-metal contact connection which virtually prevents the entrance of electrolyte salts therebetween and substantially inhibits oxidization between the aluminum head bar and said metal contact means, grooved mushroom-head like metal contact means for said anode electrode head bars secured to the sides thereof at one of their ends, an oppositely disposed pair of said last mentioned contact means on adjacent anode head bars in one tank forming a V-shaped seat for receiving a cone-shaped contact means on a cathode head bar in an adjoining tank, and a cathode bus bar alongside one of the tanks and provided with tapered holes for receiving cone-shaped cathode contact means in wedging engagement.

5. Apparatus for the electrodeposition of metal comprising a plurality of electrolytic cells arranged in side-by-side relation with anode and cathode electrode head bars spacedly positioned transversely of the cells, contact members for the head bars of one polarity comprising grooved mushroom-head like metal protuberances, one each being provided on each side of the individual head bar of that polarity adjacent one end thereof, and contact members for the head bars of opposite polarity comprising cone like metal bodies, one each being provided at one end of the individual head bar of polarity last mentioned and depending therefrom, said head bars being so arranged in the respective cells that the cone like body of one head bar in one cell wedgedly engages a pair of oppositely-disposed grooved mushroom-head like protuberances of two adjacent head bars in an adjoining cell, whereby a plurality of direct metal-to-metal lines of contact are provided between an electrode head bar of either polarity and a plurality of electrode head bars of the other polarity.

6. Apparatus for producing electrolytic zinc comprising a plurality of tanks positioned alongside each other for holding zinc-containing electrolyte, anode and cathode electrodes positioned in said tanks, conductor head bars for said electrodes extending across said tanks, said cathode electrode head bars being made of metal selected from the group consisting of aluminum and aluminum-base alloy, metal cone-shaped contact means of higher electrical conductivity than said cathode head bar dependent therefrom at one end thereof and firmly secured thereto by means of a taper threaded male section screwed into a flared outer and female portion of the head bar yielding a metal-to-metal contact connection which substantially inhibits the entrance of electrolytic salts therebetween, grooved mushroom-head like metal contact means protruding from the sides of the anode head bar at one end thereof, an oppositely disposed pair of said grooved mushroom-head like contact means on adjacent anode head bars constituting a seat for receiving a cone-shaped cathode contact means, anode and cathode bus bars positioned, respectively, alongside the two outer tanks, one of said bus bars comprising notches for receiving a pair of said mushroom-head like contact means on a single anode head bar and the other bus bar comprising holes for receiving the cone-shaped contact means attached to a cathode head bar, said anode and cathode contact means, respectively, providing a freely interchangeable metal-to-metal wedging contact with a bus bar of its own polarity or a contact means of the opposite polarity.

FERNANDO A. MORIN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
315,266	Farmer	Apr. 7, 1885
687,800	Walker	Dec. 3, 1901
789,353	Betts	May 9, 1905
1,284,403	Malm	Nov. 12, 1918
1,287,156	Whitehead	Dec. 10, 1918
1,464,689	Allan	Aug. 14, 1923
1,745,348	Aubel	Feb. 4, 1930
1,764,650	Scott	June 17, 1930
2,115,004	Bitner	Apr. 26, 1938

FOREIGN PATENTS

Number	Country	Date
22,884	Great Britain	1898
513,290	Germany	Apr. 12, 1929

OTHER REFERENCES

Webster's New International Dictionary, G. and C. Merriam Co., Springfield, Mass., (1940), page 2155.