

Dec. 23, 1947.

D. D. FORBES

2,433,209

BUS BAR CONNECTOR

Filed Sept. 11, 1946

2 Sheets-Sheet 1

Fig. 1.

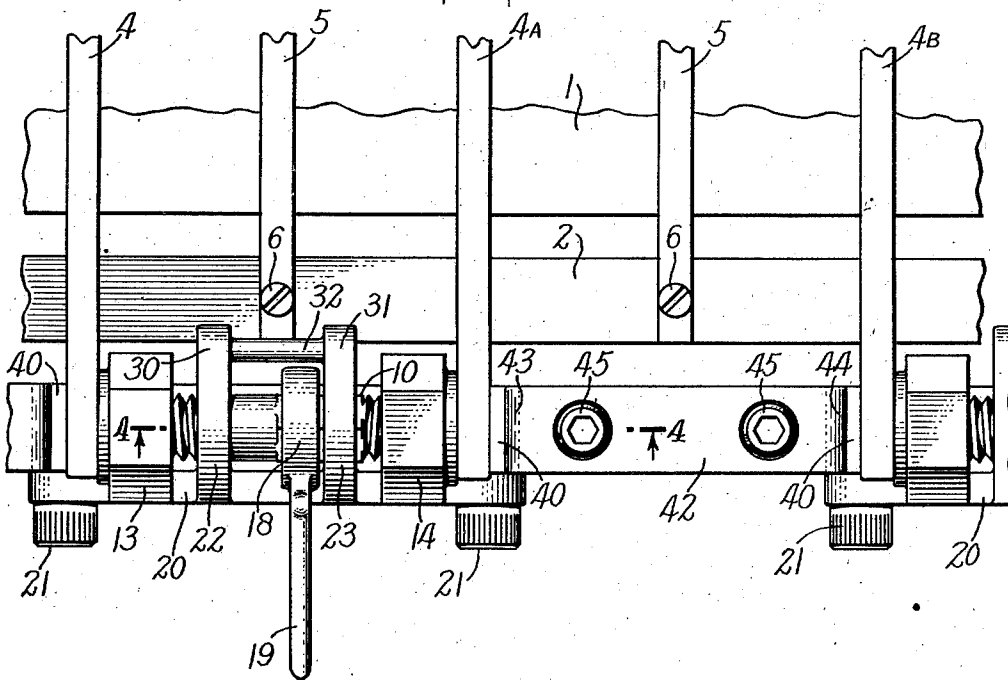
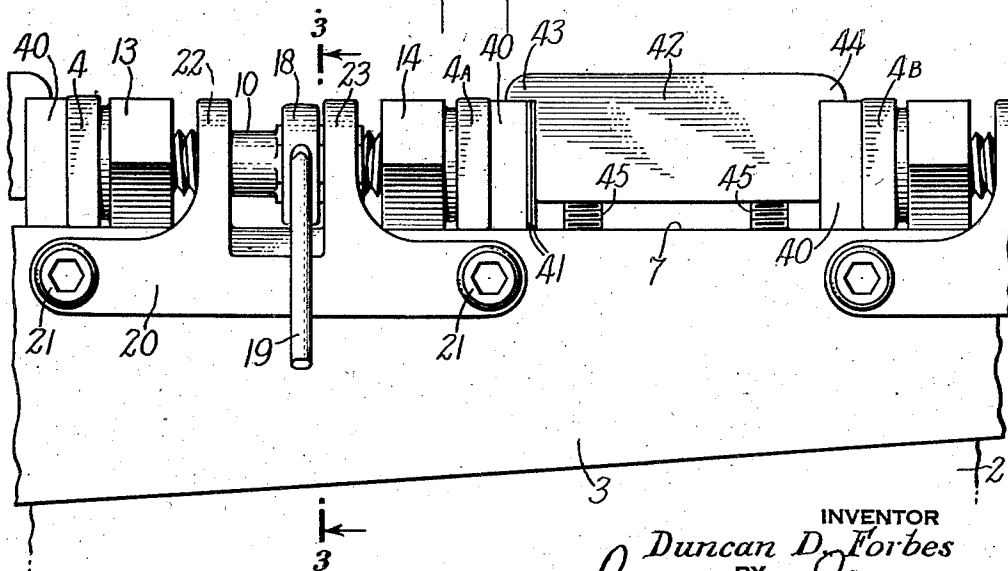


Fig. 2.



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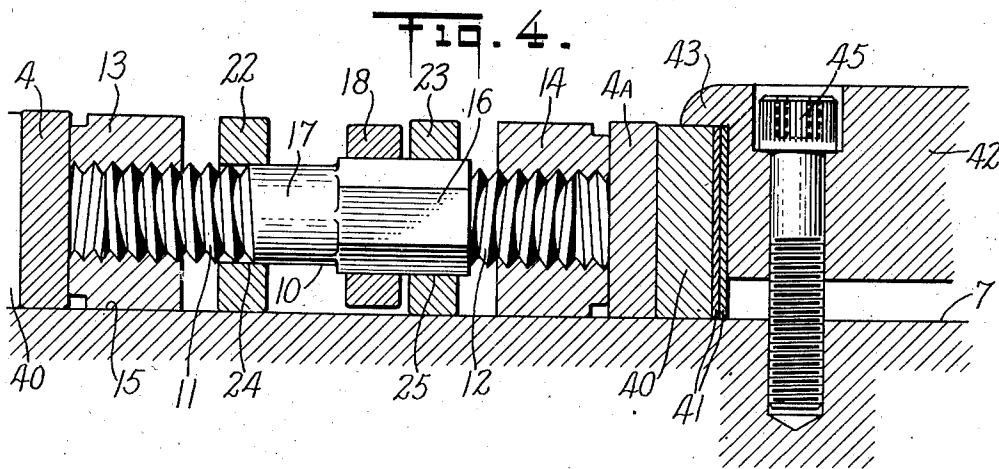
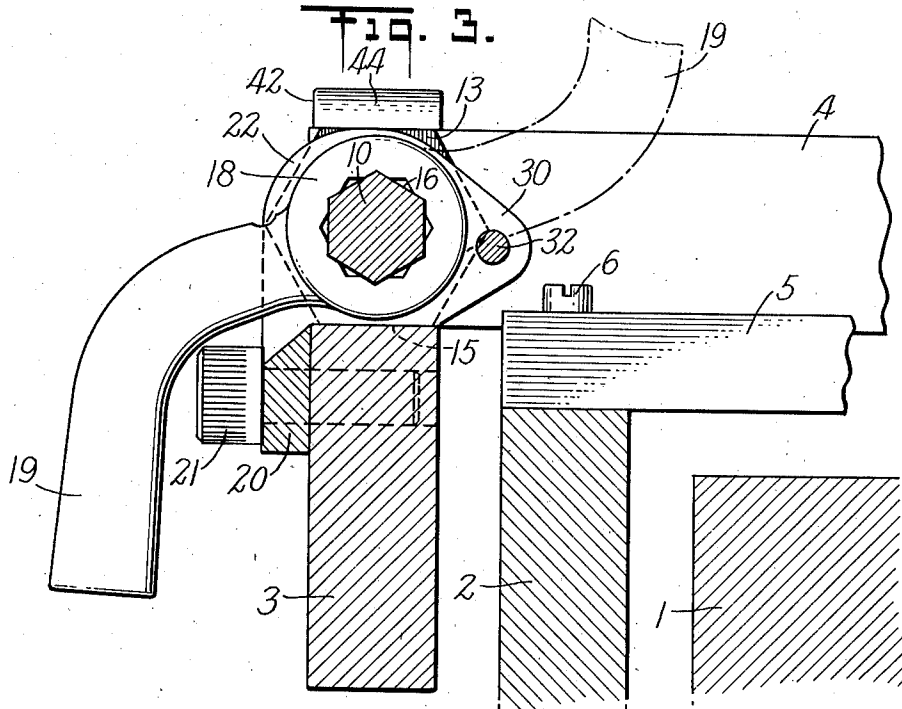
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2 Sheets-Sheet 2



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BUS BAR CONNECTOR

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6 Claims. (Cl. 204—253)

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This invention relates to an improved device for connecting removable electrodes to a bus bar.

The invention may be employed in the electro deposition, including the electrowinning of manganese. In this art, electrolytic cells are employed in which cathodes and anodes are arranged alternately in spaced relation. Electric current passes from the anodes to the cathodes through suitable electrolyte and deposits metallic manganese on the cathodes. The cathodes are made of sheet metallic material on which the metal deposited from the electrolyte is plated during a desired period of electrolysis. At the end of the plating period, the cathodes are removed from the bath or electrolyte and submitted to operations for the purpose of removing the deposited metal, e. g., manganese, and reconditioning the cathode so that it is in proper condition to receive a metallic deposit in the succeeding period of plating. These operations are repeated continuously and may therefore be designated as cycles.

To remove the metallic deposit from the cathode sheet, the latter is subjected to rather strenuous treatment involving bending or flexing and treatment with one or more reagents as an aid in reconditioning the surface, polishing, etc.; in other words, as is well known, the cathodes do not remain in the cell but are periodically removed therefrom and then replaced therein. The anodes on the contrary commonly remain in the cell during the effective life thereof.

To facilitate the handling of the cathodes and the positioning thereof in the cell, each cathode sheet is suspended from a metal cathode bar to which it is rigidly attached mechanically and effectively connected electrically. The cathode bars extend transversely across the cell and at one end are connected to a copper bus bar which extends longitudinally of the cell. By means of the cathode bars, the cathodes are connected electrically in multiple with the cathode bus bar.

The properties or characteristics of cathode bars which the art has striven to obtain have to do with the composition of the bar, its conductivity and chemical resistivity, and also the mechanical means whereby the bar may not only be effectively connected electrically to the cathode bus bar but also be mountable and demountable in relation thereto in the quickest and easiest manner. That there are a number of factors involved in the solution of the problem will be apparent from the following summary.

The bar must have sufficient rigidity and electrical conductivity to adequately support the

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cathodes during the various operations to which it is subjected and to conduct the current from the cathode to the cathode bus bar. The composition of the bar should be such that corrosion products or salts formed by the action of the mist arising from the electrolyte and by the drippage and spillage of the electrolyte incidental to the operation of the electrical process do not harmfully contaminate the electrolyte in the cell. The cathode sheet material is desirably made, in the case of manganese electrowinning, from stainless steel as described and claimed in Chamberlain U. S. Patent 2,325,660, August 3, 1943. The coefficient of thermal expansion of the cathode bar should be sufficiently close to that of the stainless steel cathode sheet to which the bar is rigidly attached so that with changes in temperature, no undue warping or bending occurs, such as is commonly observed in the case of bi-metallic contacts where the contacting metals have different coefficients of expansion. The bar should have the narrowest practical cross section, because at least in the case of manganese electrowinning, the space relation between cathodes is not only small, but each cathode is positioned inside a frame which supports canvas diaphragms interposed between the anodes and the cathodes and any unduly large cross section would interfere with facility of access to the inside of the cathode chambers or frames. Notwithstanding this narrow cross section the cathode bar should have an adequate area of contact between it and the cathode bus bar when, as may be the case, the conductivity of the cathode bar is relatively low. Such relatively low conductivity may be encountered in metals; e. g., aluminum and certain alloys thereof which have a number of properties, other than conductivity, superior to copper. For example, it has been found that aluminum and certain alloys thereof have coefficients of thermal expansion more nearly equal to that of the stainless steel cathode sheet than copper and it has also been found that the corrosion products or salts formed by the action of the electrolyte on aluminum and said alloys thereof do not have the adverse effect of similar products when copper is used. The contact surface between the cathode bar and the bus bar must frequently be polished to maintain conductivity. This polishing or abrasion causes wear and the mechanical characteristics of the connection between the bus bar and the cathode bar should be such that adequate pressure contact can be maintained regardless of changes in dimensions due to the said wear. Moreover,

the spacing of the cathodes in relation to each other and the anodes should be accurately maintained and the cathode bar connecting device should be one which is capable of maintaining this accuracy of spacing regardless of changes of dimensions resulting for example, from the continuous mounting and demounting of the cathode bars with their attached cathodes and the polishing of the contact surfaces of the said bars and the bus bar. Furthermore, the mechanical features of the means by which the cathode bar is connected to the bus bar should be one which permits the cathode bar to be mounted or demounted in the quickest and easiest manner, and the contact device should be one not requiring any tools for operating.

Numerous efforts have been made to arrive at the criteria described above but as far as I am aware, all prior devices and efforts have been lacking in at least some of the above mentioned characteristics.

An object of the present invention is to provide a device meeting with the stated criteria.

The invention will be defined in the claims and in order to specifically describe and illustrate one species embodying the said principles reference may be had to the following description taken in connection with the appended drawings in which:

Fig. 1 is a plan view

Fig. 2 is an elevation view

Fig. 3 is a transverse view partly in section taken on the line 3—3 of Fig. 2

Fig. 4 is a longitudinal section view taken on line 4—4 of Fig. 1

Looking at the drawings and the several figures thereof in which like parts are indicated generally by the same numerals, the cathode bus bar 3 is rigidly supported in any suitable manner in relation to the wall 1 of an electrolytic cell. The anode bus bar 2 is also rigidly supported in any suitable manner. The particular details by which said bus bars are supported, whether on the wall 1 of the cell or otherwise, is not shown since the particular manner of support of said bus bars is not material to the present invention. The bars 4, 4A, 4B, etc., from which the cathodes are suspended and the bars 5 from which the anodes are suspended extend transversely of the electrolytic cell. The anode bars 5 may be connected at one end thereof to the anode bus bar 2 by means of screws or bolts 6. The other ends of the anode bars 5 may be supported in any suitable manner known to the art, and therefore not specifically shown.

Ordinarily each anode consists of a number of rigid strips secured to and suspended from an anode bar. Each strip may be about 30 inches long, about $4\frac{1}{2}$ inches wide and about $\frac{1}{4}$ inch thick and made from suitable metallic material which may contain a preponderating proportion of lead. Instead of a number of strips, the anode may consist of a single plate, solid or perforated, or a grid, etc. As already stated, the anodes and cathodes are disposed in parallel relation and arranged alternately side by side and extend transversely of the anode and cathode bus bars.

The cathode bars 4, 4A, 4B, etc., are preferably made of an aluminum alloy and are connected at one end thereof to the cathode bus bar 3, preferably made of copper, by means which will be described in detail. The cathode bars 4, 4A, 4B, etc., at the other ends thereof are supported on the cell in any suitable manner known to the art and therefore not specifically shown.

In the appended drawings, the said means in-

clude an elongated element having threaded portions and an axis transverse to the axes of the cathode and anode bars. As specifically shown in the drawings, said threaded element is a turn-buckle bolt 10 having a right handed threaded portion 11 and a left handed threaded portion 12. The bolt has a wrench engaging portion 16 which may be hexagonal to receive a twelve point box wrench having a body portion 18 and handle 19. The bolt also preferably has a cylindrical portion 17. The threaded element or bolt may be made of any suitable material preferably stainless steel. On the threaded portions 11 and 12 are mounted gripping elements which may be bronze nuts 13 and 14 respectively. One of the flat faces of each nut (see surface 15 of Fig. 3 for example) rests upon and engages the upper surface 7 of the cathode bus bar 3 and is thus held against rotation when the threaded element is operated. Each pair of cathode bars (see for example 4, 4A of Figs. 1, 2 and 3) is demountably secured or gripped between the end surfaces of nuts 13, 14 and the opposed vertical faces or contact surfaces of blocks 40 made of highly conductive material, e. g., copper. Means are provided whereby a quick turn of the wrench handle 19 through a relatively short arc causes the nuts 13 and 14 either to be retracted toward each other and in spaced relation to the cathode bars 4, 4A or advanced away from each other and into an engagement with said bars. In the former case, the cathode bars 4 and 4A are released from engagement with the nuts on one side and the vertical contact surfaces of the copper blocks 40 on the other side, and may thus be quickly demounted. In the latter case the cathode bars 4 and 4A are gripped in pressure contact between the end surfaces of the nuts 13, 14 and the opposed vertical contact surfaces of the copper blocks 40 respectively, and are thus mounted in firm mechanical and effective electrical engagement with the copper blocks 40 and the cathode bus bar 3. Electrical contact between the cathode bars and the adjacent copper blocks 40 is secured at the opposed and engaging surfaces thereof and the area of this surface engagement may be varied by varying the extent of contact area of the surfaces of the copper blocks 40 which engage the surfaces of the adjacent cathode bars. In Fig. 4 for example, the thickness and vertical height of the copper blocks 40 is clearly shown. Normally the width in a direction parallel to the axes of the cathode bars would be about the same as the width of the cathode bus bar 3. However, where cathode bars of unusually low electrical conductivity are used and where it is therefore desired to increase the area of contact between said bars and blocks 40, the said width of the blocks 40 may be increased to the desired extent. The blocks 40 are maintained in firm mechanical and effective electrical engagement with the bus bar 3 by means of metallic blocks or clamps 42 which are indented as shown to provide overhanging shoulders 43 and 44. By means of cap screws 45 blocks 42 and shoulders 43 secure the blocks 40 with the lower or bottom surfaces thereof in pressure engagement with the bus bar 3. Shims 41 are preferably provided to compensate for any wear on the vertical surfaces of the blocks 40 and opposed surfaces of the cathode bars. This provision makes it possible to maintain a closely controlled spacing between the cathodes and anodes notwithstanding dimensional changes.

The swingably mounted element, e. g., turn-buckle bolt 10, is supported by bracket 20 secured

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to bus bar 3 by means of cap screws 21. The bracket has webs 22 and 23. The web 22 has a hole 24 which receives a portion of the cylindrical and right hand threaded portion 11 of the bolt. The web 23 has a somewhat larger hole 25 which receives the hexagonal portion of the bolt 10. The webs have extended portions 30 and 31 connected by bar 32 which acts as a stop for the wrench handle 19 to prevent the possibility of said handle coming in contact with the anode bus bar 2, and thus creating a short circuit between the anode bus bar 2 and the cathode bus bar 3. The threaded portion 11 of the turnbuckle bolt is made right handed and the threaded portion 12 is made left handed, so that when the wrench handle 19 is turned in a counterclockwise position (with reference to Fig. 3) the nuts 13 and 14 will be forced or advanced away from each other and into engagement with the adjacent cathode bars 4, 4A respectively, and the latter will be squeezed or gripped between said nuts and opposed copper blocks 40. The two positions of the wrench shown in Fig. 3 indicate the maximum arc through which the wrench handle may move. It is not necessary to move the wrench handle through such a wide arc in mounting or demounting the cathode bars. Generally a movement through quite a small arc, for example, 20°, is sufficient to effect release and engagement of the cathode bars respectively because a relatively slight movement of the gripping elements 13, 14 is sufficient for those purposes. The action is rapid because the pitch of the threads 11, 12 may be made greater than standard. When the threads are arranged as described and shown, release of the cathode bars is effected by upward movement of the wrench handle (clockwise with reference to Fig. 3) and mounting or engagement of the cathode bars is effected by a downward movement of the wrench handle (counterclockwise with reference to Fig. 3).

It will also be observed that when the cathode bars 4, 4A, etc., are demounted, the turnbuckle bolt 10 and nuts 13, 14 may be bodily moved to the left or right; i. e., longitudinally in either direction whereby ample spaces are provided between the said nuts and the opposed faces of the blocks 40 so that the contact faces of said blocks 40 may be readily cleaned to provide good contact.

The limit of the swinging movement of the wrench handle does not limit the rotation of the turnbuckle bolt 10 as the wrench may be moved longitudinally on bolt 10 to the cylindrical portion 17, rotated through 30° or multiples thereof and moved back to reengage the hexagonal portion 16 and the bolt 10 rotated further than the limit of the wrench travel permits in either direction to increase the spaces between the faces of the nuts 13 and 14 and the opposed contact surfaces of the blocks 40 when a thicker than normal cathode bar is used or to facilitate cleaning of the contact surfaces, or to diminish said spaces to assure positive pressure contact when a thinner than normal cathode bar is used.

While the device handles two cathodes, should it be desirable to omit one cathode, the other cathode can be securely held by additional turning of the turnbuckle bolt until the nut comes in contact with the other contact block, or by inserting a shim to replace the omitted cathode.

In a modification of the preferred form, suitable for use with a single cathode, one of the nuts can be fixed, and the other used for clamping the cathode bar, or to further simplify the device, the

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thread and nut could be omitted from one end of the turnbuckle bolt which would then be held longitudinally but free to rotate and clamp a single cathode with the nut at the other end.

What is claimed is:

1. A device for connecting a cathode to a bus bar having an upper horizontal surface extending longitudinally of an electrolytic cell, said cathode being secured to a cathode bar extending transversely of said bus bar, said cathode bar having a bottom edge surface and two vertical side surfaces; said device comprising a fixed contact block having a bottom contact surface and a side contact surface, said side contact surface being adapted to engage one of the vertical surfaces of said cathode bar; means demountably securing said contact block to the bus bar with the bottom contact surface of said block in pressure engagement with the upper surface of said bus bar; gripping means arranged for quick movement longitudinally of said bus bar toward said contact block and away therefrom, to grip said cathode bar in position between said gripping means and contact block with a vertical surface of the cathode bar in positive pressure engagement with a side contact surface of the contact block and to release said bar from said gripping engagement; and actuating means swingable about an axis perpendicular to said contact surface of the contact block to effect quick gripping and releasing movement.

2. A device for connecting a cathode to a bus bar having an upper horizontal surface extending longitudinally of an electrolytic cell, said cathode being secured to a cathode bar extending transversely of said bus bar, said cathode bar having a bottom edge surface and two vertical side surfaces; said device comprising an adjustably fixed contact block having a bottom contact surface and a side contact surface, said side contact surface being adapted to engage one of the vertical surfaces of said cathode bar; means demountably securing said contact block to the bus bar with the bottom contact surface of said block in pressure engagement with the upper surface of said bus bar; gripping means arranged for quick movement longitudinally of said bus bar toward said contact block and away therefrom, to grip said cathode bar in position between said gripping means and contact block, with a vertical surface of the cathode bar in positive pressure engagement with a side contact surface of the contact block and to release said bar from said engagement; said gripping means being mounted on and actuated by an element adapted to rotate about an axis perpendicular to a side contact surface of the contact block; and means swingable about said axis to effect quick rotating movement of said element.

3. A device for connecting a cathode to a bus bar having an upper horizontal surface extending longitudinally of an electrolytic cell, said cathode being secured to a cathode bar extending transversely of said bus bar, said cathode bar having a bottom edge surface and two vertical side surfaces; said device comprising a fixed contact block having a bottom contact surface and a side contact surface, said side contact surface being adapted to engage one of the vertical surfaces of said cathode bar; means demountably securing said contact block to the bus bar with the bottom contact surface of said block in pressure engagement with the upper surface of said bus bar; gripping means arranged for quick movement longitudinally of said bus bar toward

said contact block and away therefrom, to grip said cathode bar in position between said gripping means and contact block, with a vertical surface of the cathode bar in positive pressure engagement a side contact surface of the contact block and to release said bar from said engagement; said gripping means comprising a nut having a face engaging the upper surface of the cathode bus bar, said nut being mounted on a bolt adapted to swing about an axis perpendicular to a side contact surface of the contact block; and means swingable about said axis to effect swinging movement of said bolt.

4. A device for connecting a cathode to a bus bar having an upper horizontal surface extending longitudinally of an electrolytic cell, said cathode being secured to a cathode bar extending transversely of said bus bar, said cathode bar having a bottom edge surface and two vertical side surfaces; said device comprising a fixed contact block having a bottom contact surface and a side contact surface, said side contact surface being adapted to engage one of the vertical surfaces of said cathode bar; means demountably securing said contact block to the bus bar with the bottom contact surface of said block in pressure engagement with the upper surface of said bus bar; a bracket secured to and carried by said cathode bus bar, a turnbuckle bolt mounted on said bracket for swinging movement about an axis perpendicular to a side contact surface of said contact block, a nut threaded on said bolt, said nut having a face engaging the upper surface of the cathode bus bar, said nut being adapted by a swinging movement of said bolt for quick advancement toward and retraction away from said contact block to grip said cathode bar in a position between said nut and contact block, with a vertical surface of the cathode bar in positive pressure engagement with said contact surface of the contact block and to release said bar from said engagement.

5. In an electrolytic cell having a series of anodes and cathodes alternately arranged in spaced relation and extending transversely of said cell and connected to anode and cathode bus bars, respectively, extending longitudinally of said cell, each of said cathodes being secured to a cathode bar extending transversely of said bus bars, said cathode bar having a bottom surface adapted to engage the upper surface of the cathode bus bar and opposed side surfaces extending vertically from said bus bar surface when the cathode bar is in engagement with the cathode bus bar; a device for quickly mounting the cathode bars and attached cathodes in the cell with said cathodes in proper spaced relation to the anodes and in effective electrical connection to the cathode bus bar, and for quickly demounting said cathode bars and cathodes, said device comprising a series of copper contact blocks, each contact block having a bottom contact surface and a side contact surface, said side contact surface being adapted to engage one of the vertical surfaces of a cathode bar, said copper contact blocks being arranged in pairs,

said pairs being spaced apart along said cathode bus bar and the members of each of said pairs of copper contact blocks being spaced from each other; means securing the members of each pair of contact blocks to the cathode bus bar with the bottom contact surface of each contact block in pressure engagement with the upper surface of the cathode bus bar; and gripping means disposed between each of said pairs of contact blocks, said gripping means carrying a pair of locking members, each of said locking members being positioned adjacent and in spaced relation to a contact member of one of said pairs of contact members; and means to effect a simultaneous advancement of said locking members in opposite directions through a path perpendicular to the vertical contact surfaces of the copper contact blocks toward said contact blocks to grip each of a pair of cathode bars between each of said gripping members and an adjacent contact block with a side surface of said cathode bar in pressure engagement with a vertical contact surface of said contact block, and to effect a simultaneous retraction of said gripping members in opposite directions and away from said contact blocks to release said cathode bars from said engagement.

6. A device for quickly mounting and demounting cathodes in an electrolytic cell, said cell having a cathode bus bar extending longitudinally thereof and each of said cathodes being suspended from a cathode bar disposed perpendicular to said bus bar, said cathode bar having edge portions and side surfaces, said device comprising a pair of fixed contact blocks, each of said blocks being adapted to be rigidly secured to said bus bar with a bottom edge portion of said contact block maintained in pressure contact with the cathode bus bar and a side contact surface of said contact block perpendicular to said bus bar; a pair of gripping elements adapted to be advanced and retracted in a path perpendicular to said contact surfaces, to grip each of a pair of cathode bars between a gripping element and an opposed side contact surface of a contact block with a side surface of each cathode bar in pressure contact with a side contact surface of a contact block when said gripping elements are advanced, and to release said cathodes from said engagement when the gripping elements are retracted, and means swingable in a plane perpendicular to said path to effect said advancement and retraction.

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