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54 **Busbar arrangement for transversely disposed electrolysis cells.**

57 A potline for the electrolytic production of aluminium which provides compensation for the unwanted magnetic influence between two or more rows of transversely arranged aluminium electrolysis cells. Electric current is conducted from the rear side of a cell in a row to the next cell and also around or under the short ends of the cell. The busbars are arranged unsymmetrically relative to the centre line of the cell row and one or more of the busbars underneath the cell are disposed at an angle ( $\alpha$ ) to the centre line of the row of cells.

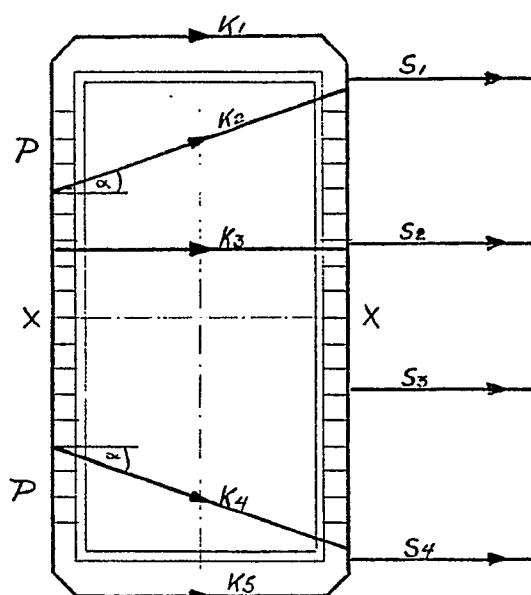


Fig. 2

**EP 0 371 653 A1**

## BUSBAR ARRANGEMENT FOR TRANSVERSELY DISPOSED ELECTROLYSIS CELLS

This invention relates to a potline for the electrolytic production of aluminium which provides compensation for the unwanted magnetic influence between two or more rows of cells in the potline.

It is common in aluminium potlines to arrange the electrolytic cells transversely in rows, the distance between the centre line of two adjacent rows being around 30 to 50 metres. The cells are connected in series, one after another, and electric current is conducted from the rear of one cell in a row to the next cell via two or more busbars which pass under the cell and also around or under the short ends of the cell.

A cell in a row is magnetically influenced by the electric current in the neighbouring row(s). Due to the relatively long distance between the rows, the effect of the magnetic field is essentially vertical and overlaps with the magnetic field being created by the electric current in the cell itself and neighbouring cells in the same row. This overlapping magnetic field is unwanted because it provides electromagnetic forces, which in turn cause harmful streaming in the electrolytic bath and the deposited aluminium in the cell and also reduce the stability of the cell.

From the applicant's Norwegian Patents Nos 139829 and 140602, it is known to compensate for the unwanted vertical magnetic field by conducting more current in an unsymmetric busbar system around or under the short end of the cell which is closer to the neighbouring row or rows. With this known technology it is thus possible to provide a vertical magnetic field which is symmetrical with respect to the longitudinal and transverse axes of the cell. However in large electrolysis cells or more than 150 kA, there is a disadvantage with the known solutions as long busbars are needed to conduct the current from the rear side of the cell to the next cell in a row, and as the vertical magnetic field has large absolute values at the corners of the cells.

The present invention aims to provide a busbar arrangement which is not encumbered with the above disadvantages, i.e. which substantially compensates for the magnetic influence from the neighbouring row(s) of cells and which has low absolute values for the vertical magnetic field at the corner of the cells. Such a busbar arrangement is essentially cheaper than the known solutions.

In accordance with the invention a potline for the electrolytic production of aluminium comprises at least two rows of electrolytic cells with the cells arranged transversely in each row, the electric current being conducted from the rear side of each cell in a row to the next cell via two or more

busbars which pass under the cell and also around or under the short ends of the cell, the busbars being arranged in an unsymmetrical fashion relative to the centre line of the row of cells and is characterised in that one or more of the busbars beneath the cell are disposed at an angle to the centre line of the row.

Preferably each cell is provided with five busbars whereof at least one busbar is disposed at each short end of the cell, one busbar is disposed on the side of the centre line of the row which is closer to the neighbouring row, and two busbars are disposed beneath the cell symmetrically with respect to one another on either side of the centre line and stretch outwards from the cathode collecting busbar to the riser on the next cell at an angle to the centre line of the row.

The angle between the inclined busbars and the centre line of the row of cells is preferably between  $15^\circ$  and  $45^\circ$  and suitably approximately  $26^\circ$ .

The invention will now be further described by way of example with reference to the accompanying drawings in which:

Fig. 1 shows schematically a cross section of two cells in a row of aluminium electrolysis cells,

Fig. 2 shows the same two cells from above,

Fig. 3 a, b and c respectively show the isogauss curves determined for the field vectors  $B_x$ ,  $B_y$  and  $B_z$  for the cells shown in Fig. 1.

Figures 1 and 2 show an example of a busbar arrangement for a 180 kA cell in an aluminium potline. The cell has four risers, S1 - S4, and five busbars k1 - k5 which conduct electric current from the cathode collecting busbar P to the risers. Three of the busbars, K2, K3 and K4 are disposed underneath the cell, while two of the busbars k1 and k5 extend around the short ends of the cell. The busbars k1, k2 and k4, k5 respectively are symmetrically arranged relative to one another on each side of the centre line of the row, whereas the busbar k3 is disposed on the side of the centre line which is closer to the neighbouring row. Such an arrangement where a larger part of the electric current is conducted towards the end of a cell which is closer to the neighbouring row, is denoted to be unsymmetric.

However, as opposed to common practice, two of the three busbars underneath the cell, namely k2 and k4 are disposed at an inclined angle with respect to the cathode collecting busbar P and the risers S1 and S4. Such arrangement has the advantages that the electric current path is shorter and that the absolute values for the vertical magnetic field at the corners of the cells are low.

Figures 3a, b and c show the isogauss curves of the magnetic field vectors  $B_x$ ,  $B_y$  and  $B_z$  determined for the cell shown in Figure 1. The horizontal field  $B_x$  has little influence on the running of the cell, but the other horizontal field  $B_y$  and especially the vertical field  $B_z$  have great impact.

The curves for  $B_z$  show that the absolute value of the vertical field lies below 10 gauss for nearly the entire cell. Further, the maximum values are not above 20 gauss, compared to 130 gauss for a similar cell which does not have any busbars disposed underneath in an unsymmetrical manner.

The current distribution in the five busbars  $k_1$  -  $k_5$  is, in the example shown, optimised with regard to providing the best possible magnetic field, but normally the inclined busbars are given a cross section such that an essential part, such as more than 40%, of the current is conducted from the rear side of the cells, via these inclined busbars  $k_2$  and  $k_5$ .

The position of the busbars  $k_1$  -  $k_5$  is also optimised with regard to the number of busbars underneath the cells, their positioning and the angle  $\alpha$  the two inclined busbars  $k_2$ ,  $k_4$  have relative to the centre line  $X$  of the row. In the example of Figure 2, which as previously mentioned concerns a cell of 180 kA, the angle  $\alpha$  between the inclined busbars and the centre line is approximately  $26^\circ$ . Theoretically figures show, however, that significant achievement can be obtained with an angle  $\alpha$  between  $15^\circ$  and  $40^\circ$ .

Although the invention has been described with reference to five busbars, it may, within the scope of the invention and depending on the size of the cells, be possible to use more or fewer busbars underneath each cell, and to provide more or fewer busbars with an inclined position between the cathode collecting busbars and the risers.

## Claims

1. A potline for the electrolytic production of aluminium comprising at least two rows of electrolytic cells with the cells arranged transversely in each row, electric current being conducted from the rear side of each cell in a row to the next cell via two or more busbars which pass under the cell and also around or under the short ends of the cell, the busbars being arranged in an unsymmetrical fashion relative to the centre line of the row of cells, characterised in that one or more of the busbars beneath the cell ( $k_1$ ,  $k_5$ ) are disposed at an angle ( $\alpha$ ) to the centre line of the row.

2. A potline as claimed in Claim 1, characterised in that each cell is provided with five busbars ( $k_1$  -  $k_5$ ) whereof at least one busbar ( $k_1$ , respectively  $k_5$ ) is disposed at each short end of

the cell, one busbar ( $k_3$ ) is disposed on the side of the centre line of the row which is closer to the neighbouring row, and two busbars ( $k_2$ ,  $k_4$ ) are disposed symmetrically with respect to one another on either side of the centre line and stretch outwards from the cathode collecting busbar ( $P$ ) to the rise ( $S$ ) on the next cell at an angle to the centre line ( $X$ ) of the row.

3. A potline as claimed in either claim 1 or 2, characterised in that the angle ( $\alpha$ ) is between  $15^\circ$  and  $45^\circ$ .

4. A potline as claimed in either claim 1 or 2, characterised in that the angle ( $\alpha$ ) between each of the inclined busbars ( $k_2$ ,  $k_4$ ) and the centre line ( $X$ ) for the row is approximately  $26^\circ$ .

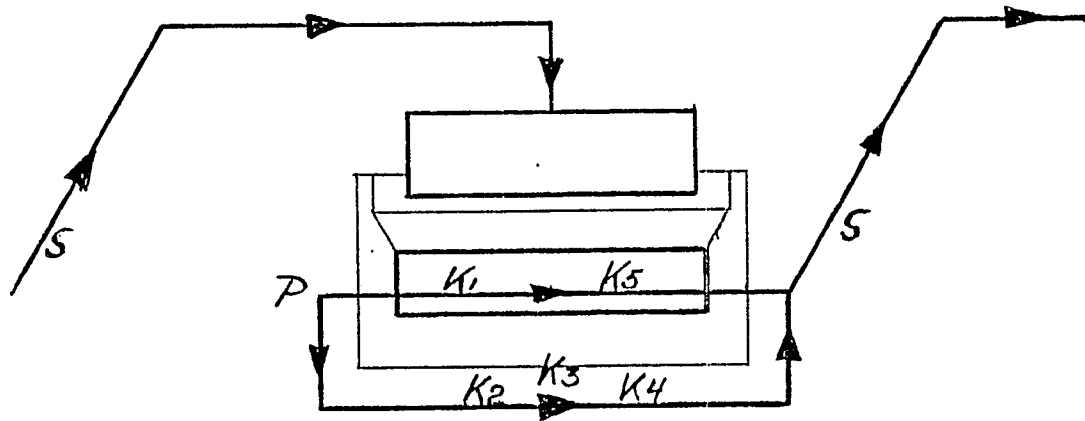


Fig. 1

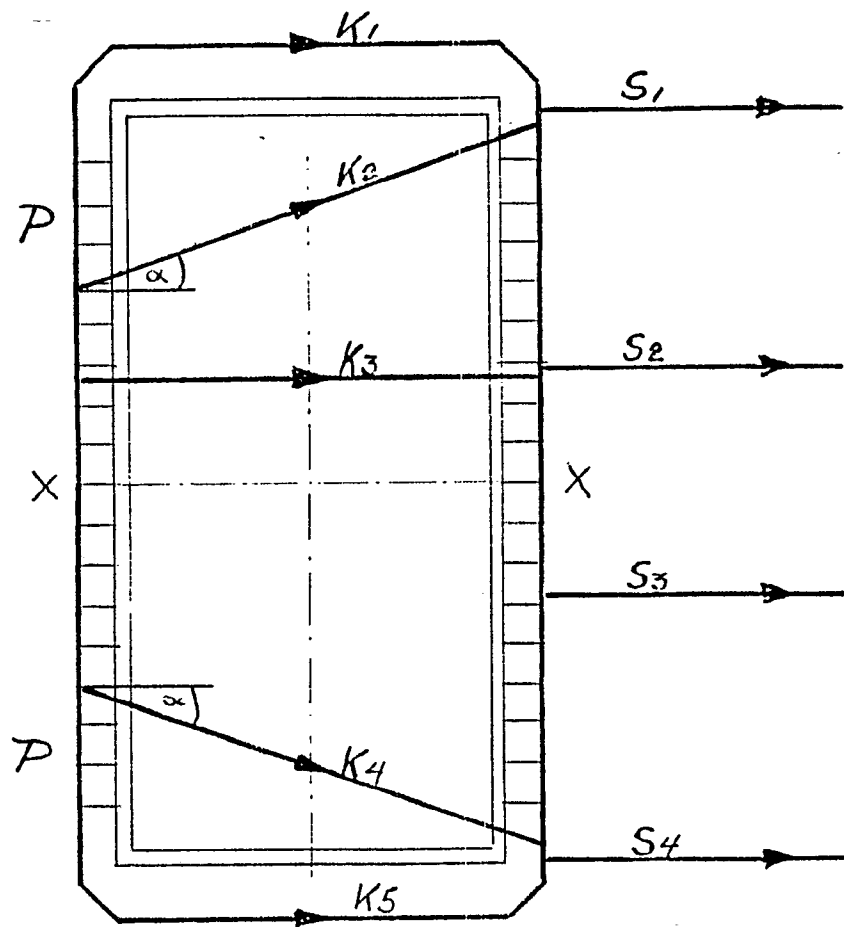
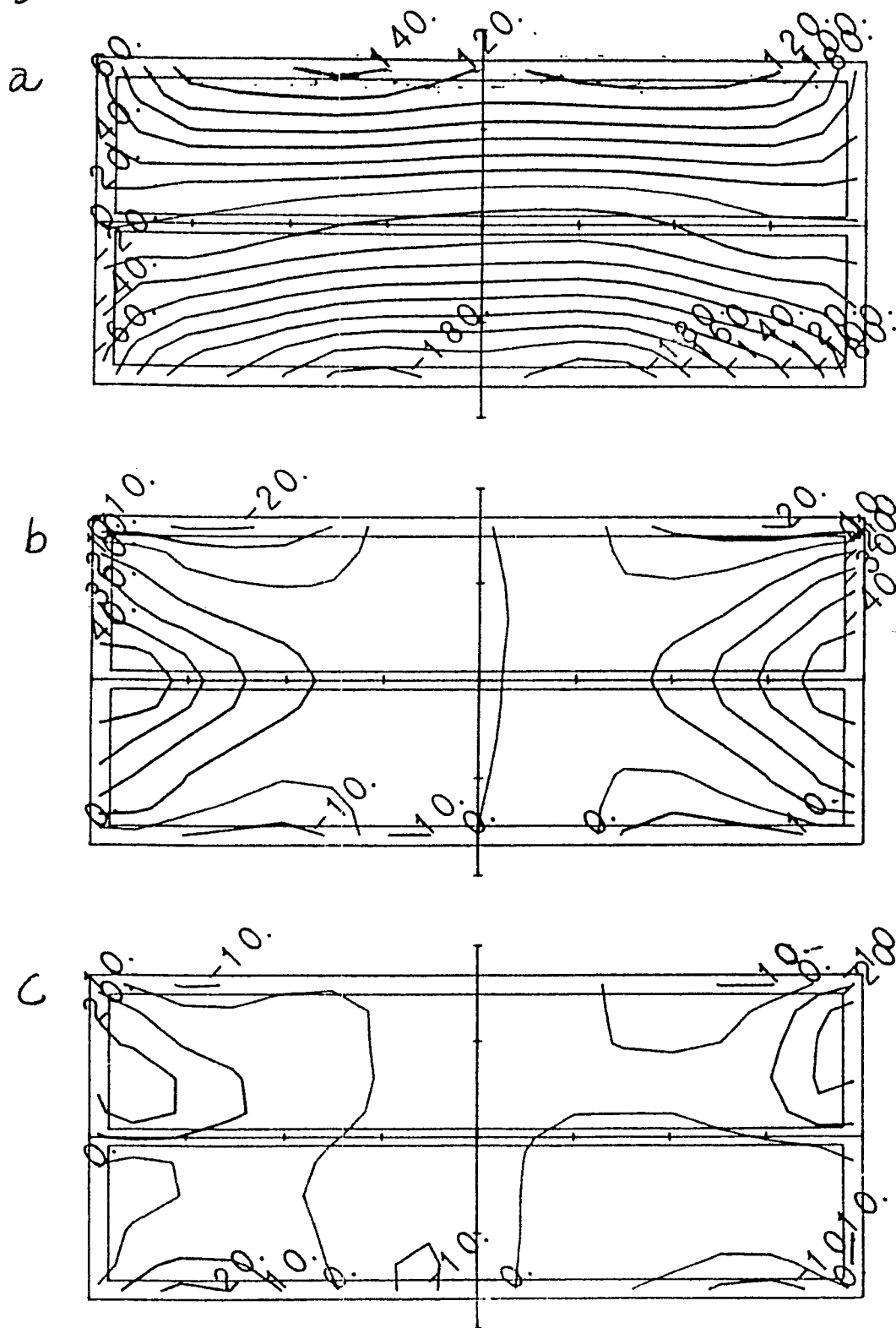


Fig. 2

Fig. 3





DOCUMENTS CONSIDERED TO BE RELEVANT			EP 89311793.7
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl <sup>3</sup> )
A	FR - A - 2 416 276 (VSESOJUZNY) * Fig. 2 * ---	1	C 25 C 3/16 C 25 C 3/06
A	EP - A1 - 0 072 778 (SCHWEIZERISCHE ALUMINIUM) * Fig. * ---	1	
D,A	US - A - 4 194 958 (NEBELL) * Abstract * -----	1	
			TECHNICAL FIELDS SEARCHED (Int Cl <sup>3</sup> )
			C 25 C
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 01-03-1990	Examiner LUX
<b>CATEGORY OF CITED DOCUMENTS</b>			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	