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Fig. 1

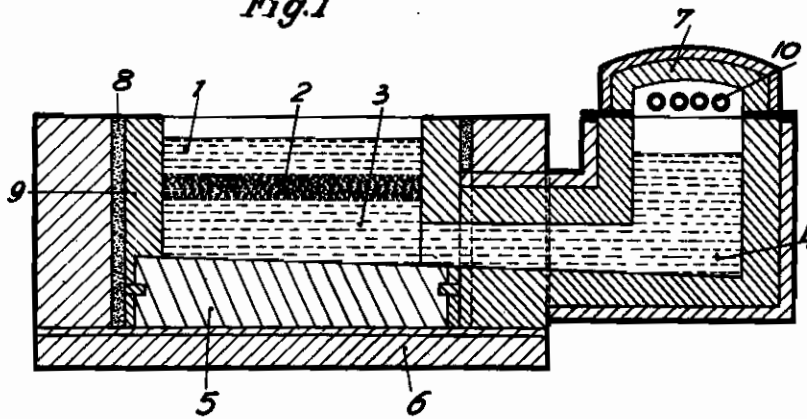
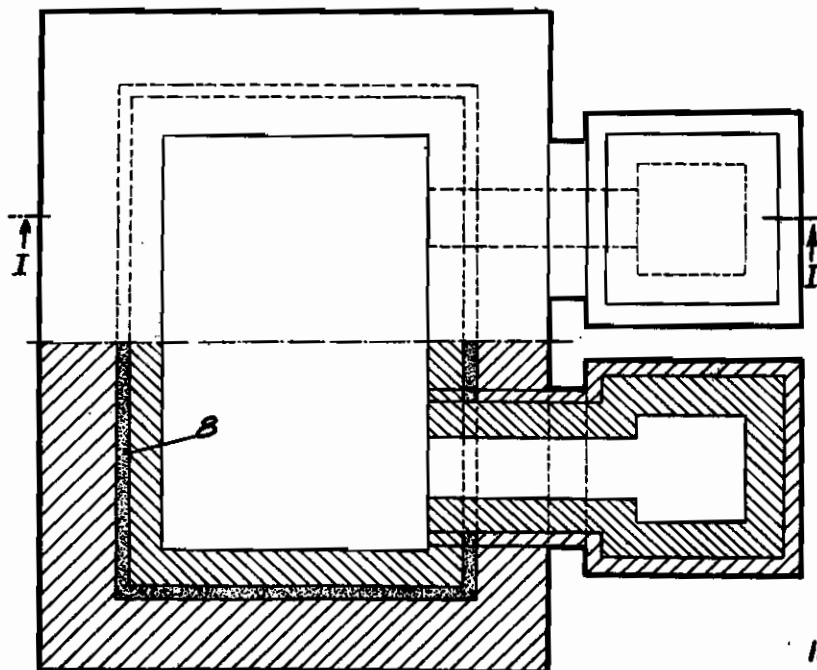


Fig. 2



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# ALIEN PROPERTY CUSTODIAN

## REFINING ALUMINIUM

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The present invention relates to a method of and a device for refining aluminium.

In refining aluminium according to the three layers method an alloy of aluminium with one or more specific heavier elements serves as lower anodic layer. Alloys having about 25-33% of copper are commonly used. Upon this anode metal floats the electrolyte, for instance a fusible mixture of fluorides and/or chlorides, upon which again separates the refined aluminium as the third layer which serves as cathode.

The admixtures of the raw aluminium and the alloy charged in the course of the operation of the cell to replace the aluminium transferred from the anode to the cathode enrich the anode layer. With the enrichment in high-melting foreign metals, for instance iron and manganese, the melting point of the anode alloy rises. To prevent freezing of the anode layer the enriched alloy must be totally or partially exchanged from time to time. The partial exchange of the anode metal may conveniently be carried out by special filling up holes provided in the lining of the cell.

If primary aluminium is used as charge the enrichment of the anode alloy in the elements iron and silicon is so slow that small amounts of contaminated anode alloy only result which without difficulties may be blended to copper containing alloys, for instance duraluminium. If, however, the refining cell is used for treating old metal or alloys resulting from the thermal reduction of aluminium ores, than a more frequent exchange or regeneration of the anode alloy must be effected, because the charge contains larger amounts of high-melting contaminations than the primary aluminium.

If for instance the aluminium, electrolytically withdrawn from the anode alloy, is replaced by an alloy "L" having 1,2% of copper, 0,5% of magnesium, 0,8% of manganese, 0,8% of Si, 0,5% of Fe, and 95,7% of Al, then with a daily output of the cell of 100 kg. refined aluminium and with a corresponding addition of the alloy "L" the anode metal is approximately adjusted to the following composition:

Withdrawal of 100 kg anode metal per cell in	Composition			
	Cu	Fe	Si	Mn
	Per cent	Per cent	Per cent	Per cent
A. 2 days.....	30	1,5	2,4	2,4
B. 4 days.....	30	2,5	4,0	4,0
C. 6½ days.....	30	3,8	6,0	6,0

The magnesium may in this case be neglected, because it is removed according to a special method before the alloy is introduced into the cell.

With a monthly output of 30,000 kg. amounts of contaminated anode metal result in case

	Kg. per month
A .....	15,000
B .....	7,500
C .....	4,600

The number of exchanges necessary to maintain an undisturbed operation of the cell not only depends on the composition of the added alloy but also on the temperature at which the cell is operated. The preferably used electrolytes require a cell temperature of 800° C. If the alloy "L" is introduced in a cell operated at this temperature, then an exchange of the anode alloy is necessary after at least 6½ days, if a disturbing separation of high-melting crystals at the bottom of the cell is to be prevented. In most cases, however, the alloys to be added will have a still larger content on high-melting constituents, so that a still more frequent exchange must be effected.

Now, the frequent withdrawal of anode alloy and the replacement of the latter disturb the mode of working of the already unstable cell operating with three liquid layers. These difficulties are removed by the invention and this mainly by the fact that at certain spots of the cell the anode metal is adjusted to temperatures at which segregation of the foreign metals occurs and furthermore by the fact that the segregation grains are removed continuously or from time to time.

Other features of the invention may be gathered from the following description given by way of the accompanying drawing showing a device for carrying out the method according to the invention.

In this drawing:

Fig. 1 is a vertical section through a cell according to the invention, and

Fig. 2 is a plan view of this cell partially in horizontal section.

In the cell shown in the drawing the layer 1 is formed by pure aluminium, the layer 2 by an electrolyte consisting of a salt mixture, and the layer 3 of anode metal. The bottom 5 of this cell, located above the insulating stones 6, consists of carbon and is connected to the positive pole of a source of current. The side wall 9 consists of magnesite brick and is separated from the brick work located behind this wall by an insulating layer 8 formed of ground magnesite. The pure

aluminium forming the layer 1 is suitably connected to the negative pole of the source of current, for instance by a cathode which is not shown in the drawing and is immersed into this layer. The cell, moreover, is provided with two forehearths 4 connected to the effective space of the cell by channels which during operation, however, communicate with the layer 3 only, so that the anode metal only reaches the forehearths.

As in most cases the temperature range within which segregation may effectively be carried out is very narrow, the forehearths are provided with devices controlling the temperature by which simultaneously freezing of the anode alloy may be prevented in the connecting channels between the cell and the forehearths. The cover 7 with the heating device 10 serves this purpose. In case that, for instance due to the composition of the electrolyte, the cell may be operated at such a temperature that segregation starts already at the bottom of the cell proper or in the connecting channels it has been found preferable to arrange the bottom of the cell downwardly sloping

towards the forehearths and to provide a connection between the forehearths 4 and the cell proper of such dimensions that the entire bottom of the cell may be subjected to the action of rabble tools introduced from the forehearths.

The temperature of the forehearths is so regulated that the foreign metals segregate the proportional amount of which increases in the anode layer in accordance with the progressive refining of the aluminium. After opening the cover 7 the segregation grains are removed from the forehearths preferably in definite not too large intervals of time. Fresh anode alloy and aluminium to be refined respectively are introduced into the forehearths. When using the above mentioned alloy "L" the composition of the segregation grains is about as follows: 18.3% of Fe, 3.8% of Mn, 9.5% of Cu, 3.0% of Si, rest Al.

It may be gathered from the above explanations that by the segregation a very large proportion of the foreign metal may be removed from the anode alloy, whereby the undisturbed continuous progress of the refining may be ensured.

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