

May 8, 1951

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2,552,423

PROCESS FOR THE DIRECT PRODUCTION OF REFINED ALUMINUM

Filed Nov. 30, 1948

FIG. 1

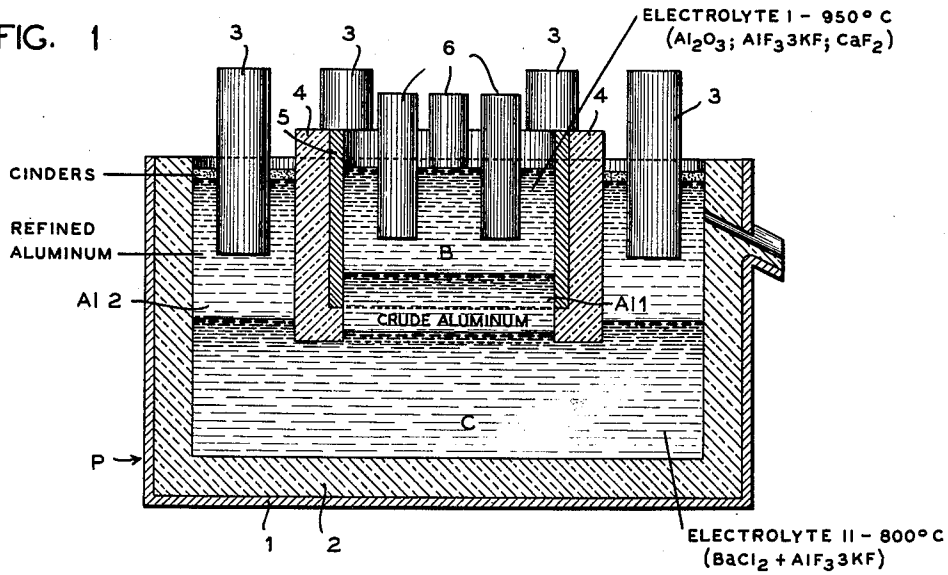
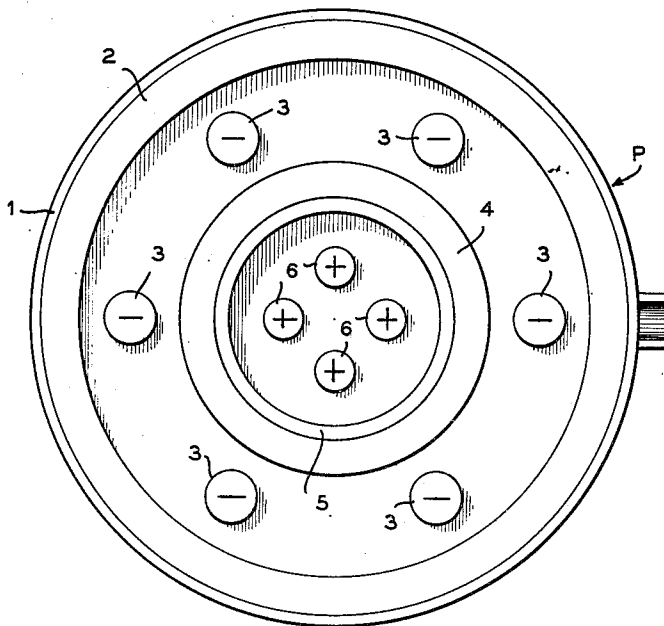


FIG. 2



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# UNITED STATES PATENT OFFICE

2,552,423

## PROCESS FOR THE DIRECT PRODUCTION OF REFINED ALUMINUM

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Application November 30, 1948, Serial No. 62,643  
In Switzerland November 30, 1947

1 Claim. (Cl. 204—67)

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Alloys having the best properties are obtained, when produced from the purest metals. Industrial plants therefore demand the highest possible purity and the problem of refining is becoming more and more important.

Processes for refining aluminum have been known for a long time; among the chief methods employed is that of purification by means of electrolysis, in a furnace. This method is known as the "three layers refining."

The various furnaces employed for this procedure (Hoopes, Pechiney) differ only in the details of their construction; the procedure requires rather complicated and expensive manipulation, as well, as an addition of 30% copper, which increases the specific weight of the lower layer.

The present invention eliminates these difficulties and enables the purest aluminum to be obtained in one furnace, by means of a single operation, starting from  $Al_2O_3$ , without addition of copper, or any other manipulations.

The furnace consists of two containers, communicating at their bases, where two electrolyses may proceed simultaneously.

(a) The first electrolysis of  $Al_2O_3$  dissolved in cryolite and  $CaF_2$  (the usual electrolyte for this operation) produces crude aluminum.

(b) The second electrolysis refines this crude aluminum by means of the electrolyte usually employed in refining furnaces.

The crude liquid aluminum, obtained in the first electrolysis acts as a bipolar electrode, functioning simultaneously as cathode for the first and as an anode for the second electrolysis, since it flows between the two electrolytes.

The annexed drawing indicates one possible rendering of such a furnace, which could, of course, be modified to any appropriate form.

In the drawings:

Fig. 1 is a central vertical sectional view of a furnace embodying my invention; and

Fig. 2 is a plan view of the same.

As shown in the drawing the furnace indicated generally at P includes an outer container 1 preferably provided with a lining 2 of suitable refractory material, such as  $MgO$ , resistant to the corrosive action of the melted salts used for the electrolysis. If desired, the walls of this container may be provided with auxiliary electrodes for the initiation of the procedure within the furnace. As illustrated, the bottom of the container 1 may either be formed from refractory material, like the walls, or it may be partially or completely constructed of an auxiliary electrode, also intended for use in connection with the initiation of the procedure.

Within the outer container 1 is an inner container 4, open at the top and bottom, and spaced from the bottom of the outer container, thus

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forming two compartments. Preferably the inner container is provided with a suitable lining 5, of graphite or the like, which terminates short of the lower extremity of said inner container.

Positive electrodes 6 are positioned within the inner container 4 so as to dip into or be immersed in the solution B of  $Al_2O_3$  in cryolite, an electrolyte normally used for the production of crude aluminum. The negative pole of this electrolysis is composed of melted crude aluminum, indicated at A11 beneath the solution B within the inner container.

The second electrolysis, effected by the electrolyte C which is of higher specific gravity than molten aluminum, has a soluble anode, comprising crude aluminum, as a positive pole and the negative pole comprises the layer of refined aluminum indicated at A12, in contact with the negative electrodes 3 which are positioned in a zone located within the outer container 1, exteriorly of the inner container 4.

I claim:

25 An improvement in the process of producing refined aluminum, which comprises arranging a layer of aluminum refining electrolyte of higher specific gravity than molten aluminum below a layer of crude molten aluminum, placing a layer of aluminum producing electrolyte of lower specific gravity than molten aluminum on the upper surface of the crude aluminum, passing an electrolyzing current from a fixed anode through the aluminum producing electrolyte in contact therewith to the crude aluminum as a bipolar electrode and through the aluminum refining electrolyte to a fixed cathode in contact therewith, feeding  $Al_2O_3$  into said aluminum producing electrolyte, and collecting the refined molten aluminum formed at the cathode at a portion of the upper surface of the refining electrolyte which is in a zone electrically and physically separated from the fixed anode, the aluminum producing electrolyte and the crude aluminum layer.

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