

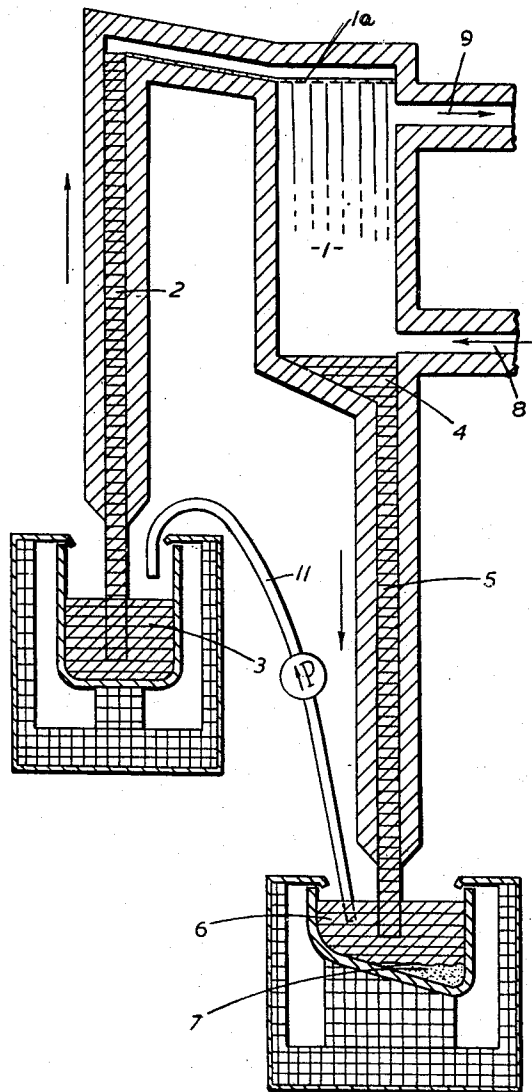
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DISTILLATION OF ALUMINUM FROM ALUMINUM ALLOYS

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DISTILLATION OF ALUMINUM FROM
ALUMINUM ALLOYS

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5 Claims. (Cl. 75-68)

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British patent specification 582,579 discloses a method of separating aluminium from aluminium bearing material, including aluminium alloys, which is based on the reaction of a metal halide vapour, such as aluminium halide vapour, and the said material preferably under reduced pressure.

In the use of this method the aluminium bearing material is brought into a condition in which it presents a large surface to the halide vapour.

The present invention refers particularly to the distillation of aluminium from aluminium alloys or aluminium alloy scrap which are liquid at reaction temperature.

It has been suggested to provide the large specific surface area for such aluminium alloys by means of towers, sprays, columns of trays, and such like. Owing to its high surface tension there are great difficulties in spreading liquid aluminium in very thin layers. On the other hand, most of the methods used, which involve towers and sprays, require a continuous and somewhat rapid flow of the liquid through the reaction chamber. Therefore it is generally not possible to remove all aluminium from the liquid alloy in one passage through the reaction chamber unless this is of a rather impracticably large size, and so the alloy may have to pass through the apparatus more than once, or successively through a series of apparatus. Moreover, as the removal of the aluminium proceeds the melting point of the alloy eventually rises and the alloy ceases to be fully liquid at reaction temperature, which entails the danger of solid metal being deposited in the reaction chamber and obstructing the flow and finally putting the plant out of operation. The alternative is to carry out the various passes with rising temperature, which is most undesirable from the engineering point of view.

The present invention overcomes the before mentioned difficulties in that it avoids any deposits of metal in the reaction chamber and requires only one reaction chamber with stationary conditions of operation.

According to the invention the liquid alloy from which aluminium is to be distilled is repeatedly circulated through a low pressure reaction chamber from two reservoirs which are both accessible and at normal pressure. The accessibility of these reservoirs is also utilised for extracting from the alloy the high melting components which might cause deposits in the reaction chamber.

The accompanying drawing shows by way of example and in vertical section one form of apparatus for carrying out the invention.

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The illustrated apparatus comprises a low pressure reaction chamber 1 of any suitable design into which liquid aluminium alloy is introduced at the top above an apertured plate 1a from a barometric syphon 2 the lower end of which dips into a reservoir 3, e. g. a crucible or induction furnace, containing liquid aluminium alloy.

The liquid aluminium alloy passes through the apertures in the member 1a to fall through the reaction chamber 1 from top to bottom in the form of a shower, and on the way loses part of its aluminium content under the action of the halide vapour which enters the reaction chamber at 8 while the products of the reaction are led off at 9 to a condenser (not shown) for the aluminium. The rest of the alloy passing through the reaction chamber collects in a sump 4 at the bottom of the reaction chamber, which sump is connected by a similar barometric syphon 5 to a second heated reservoir 6. Liquid metal is withdrawn, continuously or periodically, from the reservoir 6 and transferred to the reservoir 3, as through a conduit 10 under drive of a pump P, thus providing an overflow from 2 to the top of the reaction chamber. In order to replace the volume reduction caused by extraction of aluminium in the reaction chamber, new alloy, liquid or solid, is added to the reservoir 6 so as to keep the level of the liquid metal always at the same height.

By adding cold alloy the temperature in the reservoir 6 is lowered and, in case the concentration of the alloying constituents is high, primary crystals of the relatively high melting metal, fraction or constituents will form and sink to the bottom of the bath at 7, from which they can be raked out or removed by other suitable means. The remaining liquid metal in 6 is then ready to be transferred to the reservoir 3 and according to the invention recirculated after re-heating to reaction temperature.

In order to facilitate the liquation step it is possible to provide a separate compartment in the reservoir 6 connected with the compartment into which the syphon 5 dips by an overflow or pumping arrangement, e. g. electromagnetic or centrifugal pumps. It is also possible to transfer all or part of the metal in the reservoir 6 to a separate intermediate furnace for carrying out the liquation step.

The low aluminium alloy of high melting point removed in the liquation step can be further subjected to aluminium extraction by halide vapours, but this is best done at temperatures below its

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melting point in a separate suitable reaction chamber.

I claim:

1. A process for distilling aluminum from molten aluminium containing material comprising drawing molten aluminium containing material from a container maintained at atmospheric pressure, passing it through a reaction chamber in the form of a shower, said reaction chamber being maintained at sub-atmospheric pressure, treating the molten material in the reaction chamber with a stream of metal halide vapour whilst passing through said reaction chamber to remove a part of the aluminium therefrom, collecting the remaining molten material in a second container maintained at atmospheric pressure, cooling said material to cause precipitation of relatively high melting point constituents therefrom and recirculating the remaining molten material to said first container.

2. A process for distilling aluminium from molten aluminium containing material comprising drawing molten aluminium containing material from a container maintained at atmospheric pressure, passing it through a reaction chamber in the form of a shower, said reaction chamber being maintained at sub-atmospheric pressure, treating the molten material in the reaction chamber with a stream of metal halide vapour whilst passing through said reaction chamber to remove a part of the aluminium therefrom, collecting the remaining molten material in a second container maintained at atmospheric pressure, cooling said material to cause precipitation of relatively high melting point constituents therefrom, adding fresh unmelted aluminium containing material during cooling to be melted by and mixed with the molten aluminium containing material in said second container and recirculating the augmented molten material to said first container.

3. A process for distilling aluminium from molten aluminium containing material comprising passing molten material from a container maintained at atmospheric pressure through a tube dipping under the surface of said molten material to the top of a reaction chamber maintained at sub-atmospheric pressure, passing molten material from top to bottom of said reaction chamber in a shower, treating said shower of molten material with a stream of metal chloride vapour whilst passing through said reaction chamber to remove a part of the aluminium therefrom, collecting the remaining molten material in the bottom of the reaction chamber, passing it to a second container through a tube dipping under the surface of molten material in said second container, cooling the molten material in said second container to cause precipitation of relatively high melting constituents therefrom and recirculating the remaining molten material to said first container.

4. A process for distilling aluminium from molten aluminium containing material comprising passing molten material from a container maintained at atmospheric pressure through a tube

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dipping under the surface of said molten material to the top of a reaction chamber maintained at sub-atmospheric pressure, passing molten material from top to bottom of said reaction chamber in a shower, treating said shower of molten material with a stream of metal chloride vapour whilst passing through said reaction chamber to remove a part of the aluminium therefrom, collecting the remaining molten material in the bottom of the reaction chamber, passing it to a second container through a tube dipping under the surface of molten material in said second container, cooling the molten material in said second container to cause precipitation of relatively high melting constituents therefrom, adding fresh unmelted aluminium containing material during cooling to be melted by and mixed with the molten aluminium containing material in said second container and recirculating the augmented molten material to said first container.

5. Apparatus for carrying out the method according to claim 11 comprising a first atmospheric-pressure container for molten aluminium-containing material, a low-pressure reaction chamber having inlet and outlet means for a stream of metal halide vapour, an apertured member extending across the reaction chamber near the top thereof, a barometric syphon means for supplying molten aluminium-containing material to the reaction chamber above said plate, so that said material may fall through said chamber as a shower, a sump in the bottom of said reaction chamber, a second atmospheric-pressure container below said reaction chamber to receive material therefrom, a tube dipping under the material in said second container and entering said sump and means for transferring molten material from said second container to said first container.

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