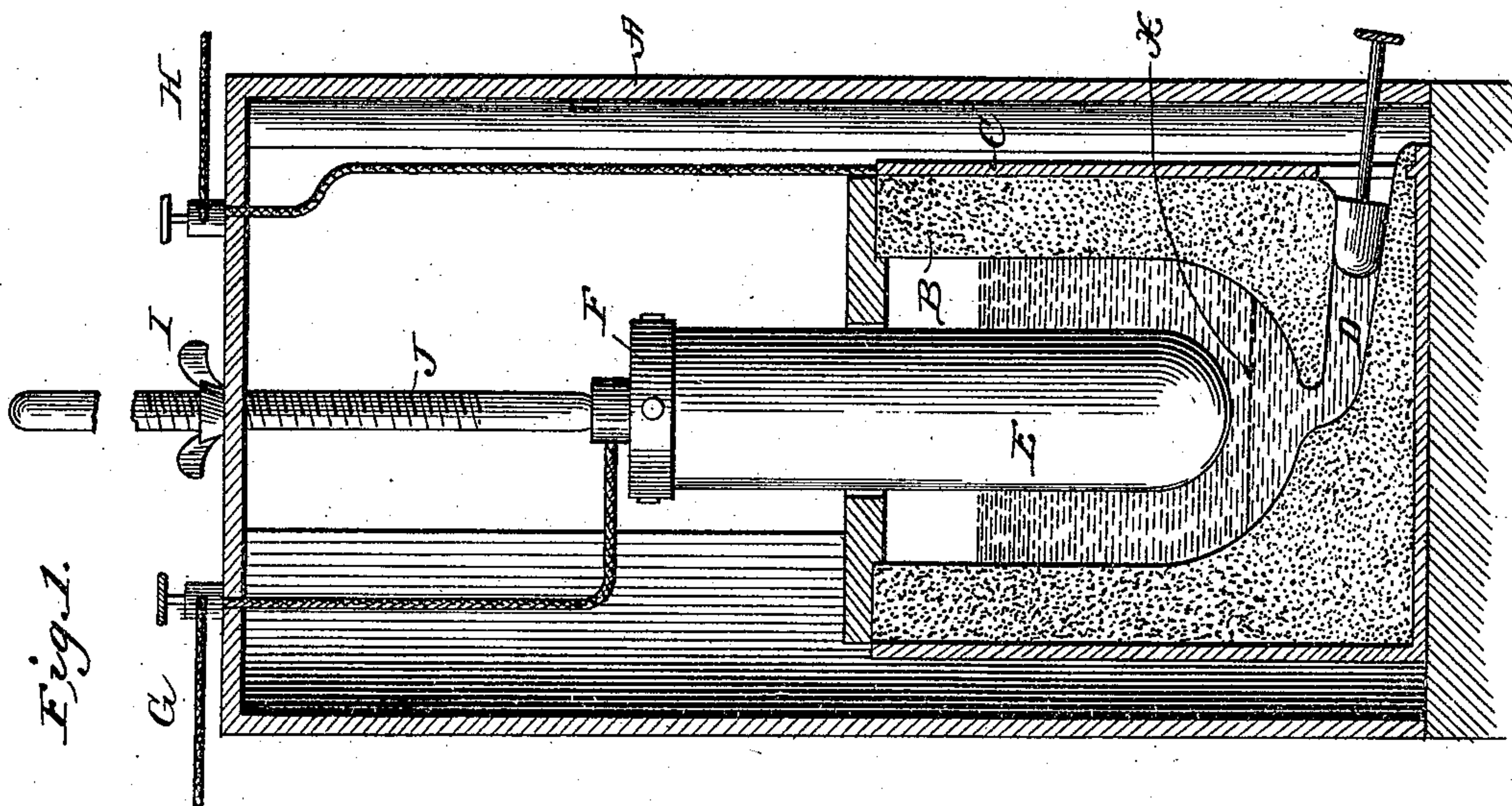
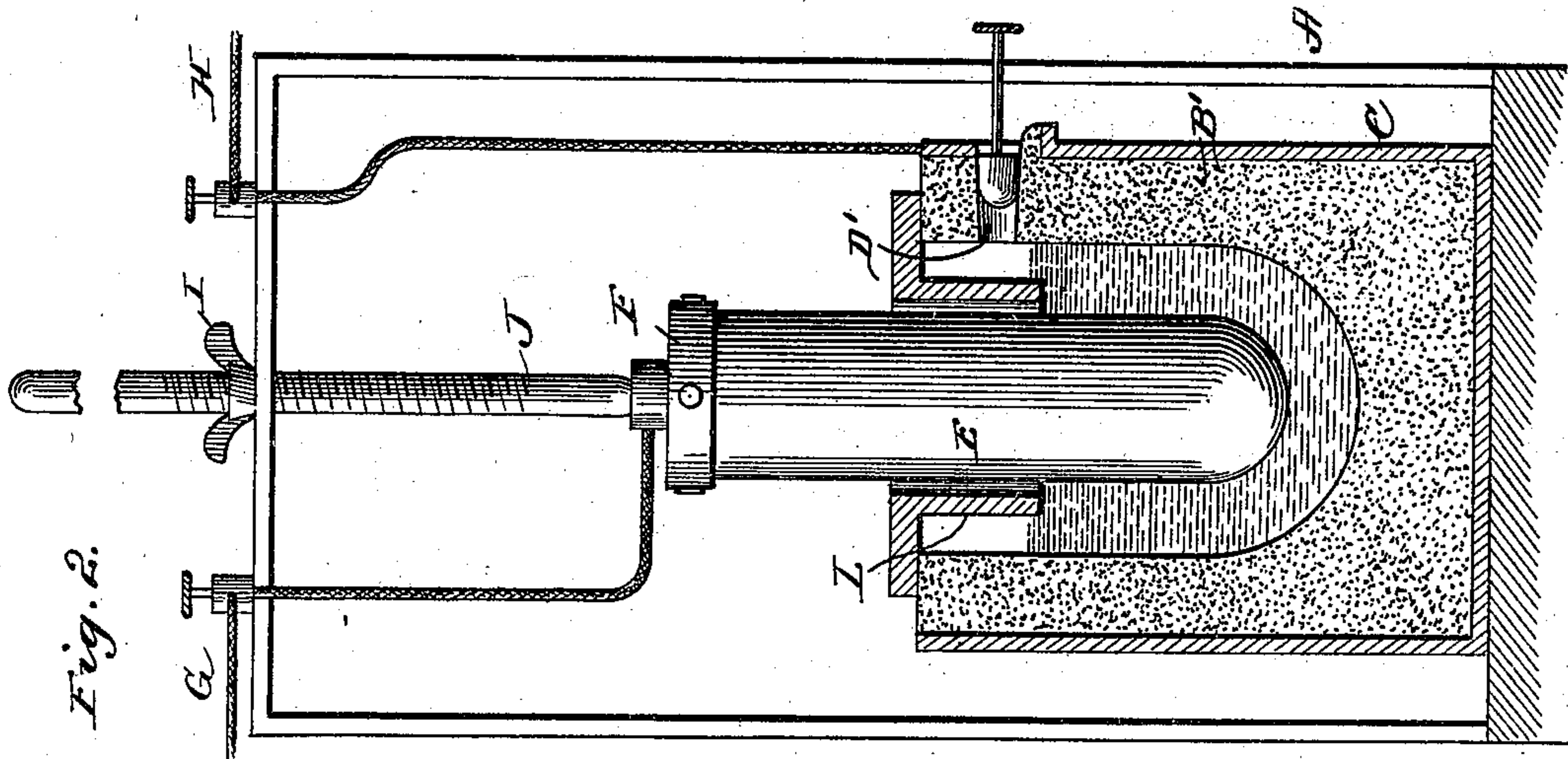


(No Model.)

J. B. HALL.  
METHOD OF PRODUCING ALUMINUM.

No. 503,929.

Patented Aug. 22, 1893.



witnesses:  
Harry S. Rohrer.  
E. H. Broy.

Inventor:  
Joseph B. Hall  
By W. H. Lammie,  
Attorney.



# UNITED STATES PATENT OFFICE.

JOSEPH B. HALL, OF WHEELING, WEST VIRGINIA.

## METHOD OF PRODUCING ALUMINUM.

SPECIFICATION forming part of Letters Patent No. 503,929, dated August 22, 1893.

Application filed August 6, 1892. Serial No. 442,304. (No specimens.)

*To all whom it may concern:*

Be it known that I, JOSEPH B. HALL, a citizen of the United States, residing at Wheeling, in the county of Ohio and State of West Virginia, have invented certain new and useful Improvements in Methods of Producing Aluminum; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object of this invention is to provide means more satisfactory than any heretofore in use for producing aluminum from aluminous earths. To this end aluminous earth is treated with sulphuric acid which combines with the aluminum forming a hydrated aluminum sulphate. The latter is decomposed by heat and yields aluminum oxide, which in turn is reduced by electrolysis, the bath employed being formed by fusing together aluminum chloride, sodium chloride and lithium chloride, and the aluminum oxide being preferably supplied by the constant decomposition of an anode of which the oxide is a constituent.

In the drawings,—Figure 1 is an elevation, partly in section, of apparatus that I have employed in the practical use of the invention. Fig. 2 is a like view of the lower part of the apparatus slightly modified as is hereinafter explained.

In Fig. 1 A is a suitable frame in which is mounted a vessel, or electrolytic cell, B, preferably composed of carbon or of carbon and alumina. For strength, the vessel is preferably inclosed in an iron envelope C, both frame and envelope resting upon a suitable non-conducting base. The vessel is provided with an outlet D near the bottom, and above the vessel the frame bears a holder F (without novelty herein claimed) from which a large anode E depends in the axis of the vessel. This anode is formed from carbon and aluminic oxide intimately mixed and is adjusted in vertical position by suitable devices,—shown in this illustration as a nut I working against the top of the frame upon a rod supporting said holder. The anode and

the vessel B, or its envelope, are connected, respectively, with the positive and negative wires from a suitable source of electricity, e. g. a dynamo, and the vessel is filled to a proper height with a bath of the fused chlorides of aluminum, sodium and lithium. Now if the parts be properly adjusted, the passage of the electric current decomposes the anode and the alumina therein is released and diffused throughout the bath and then reduced and the metal appears at the negative electrode. At the same time the oxygen collects at the positive electrode where it combines with the carbon setting free more of the aluminic oxide. The reduced metal being of greater specific gravity than the bath collects at the bottom of the vessel and may be drawn off through the outlet shown or may be dipped from the vessel by the use of a ladle of non-fusing material. The whole operation is automatic if proper means be employed to regulate the position of the anode, and it is only necessary to renew the anode from time to time as it is consumed and to restore in the bath such loss as may have arisen from volatilization, or from other causes. An insufficient quantity of alumina in the bath increases resistance and carbonous oxide appears and burns at the anode but if the quantity be sufficient, the gas liberated is carbonic anhydride.

While I have found it more satisfactory to diffuse finely divided alumina through the bath by making it a constituent of the anode,—since it seems to pass automatically to all parts of the bath and maintain a uniform resistance to the current,—I have obtained tolerably satisfactory results when omitting the alumina from the anode, in which case the alumina was added and stirred into the bath mechanically, either continuously or at intervals.

The chloride baths may be advantageously used to produce aluminum alloys if we use a fused negative electrode of the metal to be alloyed. For example, in forming aluminum bronze a mass of copper is placed in the bottom of the vessel, as suggested at X, Fig. 1. Now under the conditions existing when the aluminum oxide is reduced, the metal falling

to the bottom of the vessel unites with the molten copper. The process as before is continuous, it being only necessary to remove the bronze and to keep up the supply of copper, in addition to the steps before mentioned.

5 What I claim is—

For the electrolytic production of aluminum from its compounds, a fused bath composed

of aluminum chloride, sodium chloride and lithium chloride.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH B. HALL.

Witnesses:

WALLACE GREENE,  
J. WM. HENRY.