(No Model.)

W. E. CASE.

APPARATUS FOR ELECTROLYSIS OF FUSED SALTS.

No. 503,451. Patented Aug. 15, 1893.

Fig. 1.

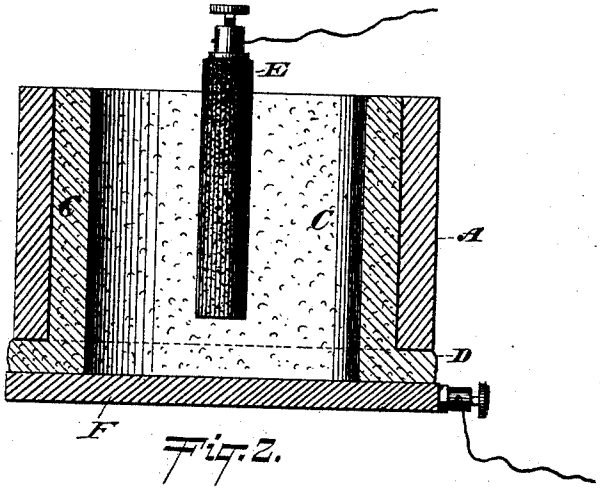


Fig. 3.

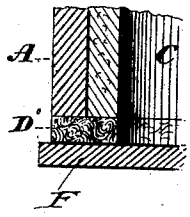
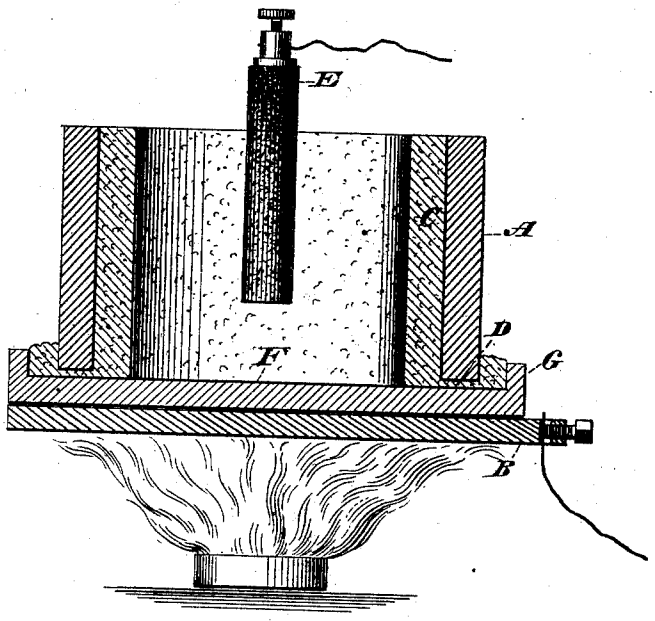


Fig. 2.



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APPARATUS FOR ELECTROLYSIS OF FUSED SALTS.

SPECIFICATION forming part of Letters Patent No. 503,451, dated August 15, 1893.

Application filed January 17, 1891. Renewed January 21, 1893. Serial No. 459,495. (No model.)

To all whom it may concern:

Be it known that I, WILLARD E. CASE, of Auburn, Cayuga county, New York, have invented a new and useful Improvement in Containing Vessels for Fused Salts during Electrolysis, of which the following is a specification.

It is well known that certain metallic salts when brought to a state of fusion, such, for example, as salts of sodium, aluminium, magnesium, besides others, chemically attack and combine with the material of the containing vessel when the latter is made, for example, of porcelain, fire-clay, carbon when combined with attackable materials, iron, and so on, producing new chemical compounds, which operate deleteriously in any succeeding process of electrolysis of the said salt. In order to avoid this difficulty, attempts have been made to produce crucibles of plumbago combined with very small percentages of other materials; but it has been found practically impossible to make such crucibles of sufficient strength and at the same time large enough for the carrying out of processes of extraction of the metals, or of production of other salts, by electrolysis on a commercial scale. The result is that the construction of the crucibles on the one hand and the fouling of the bath on the other, seriously interfere with both the practicability and the economy of the operation.

My present invention relates to a crucible or containing vessel for fused salts, which experiment has shown to be free from the above-named difficulties. It is intended more particularly for use in retaining said fused salt during the operation of electrolysis.

In the accompanying drawings, Figure 1 is a vertical section of my crucible, showing the exterior casing, the inner lining of solidified salt and a bottom of the metal to be deposited. Fig. 2 is a like section showing a double bottom consisting of an inner bottom or lining of the same metal that is to be deposited from the fused salt, and an outer protective bottom. In both of these figures, a layer of the fused salt is shown extending between the outer casing and the bottom. Fig. 3 is a partial section showing in lieu of said interposed body of fused salt a ring of asbestus or other heat-resisting and electrically non-conducting material substituted.

Similar letters of reference indicate like parts.

A is a hollow cylinder of iron.

B is a plate of the same material forming the protective bottom of the vessel.

C is a hollow cylinder of solidified salt which forms the wall of the crucible. I show in the drawings the cylinder C of salt as inclosed in the iron cylinder A. But this arrangement is not essential, because I may use said iron cylinder A simply as a mold to produce the cylinder C of salt, and then, if desired, during the fusing operation may remove the cylinder A altogether. Whether the cylinder A is to be employed during the melting operation, will depend chiefly upon the way in which heat is applied to the crucible. It may be omitted at the discretion of the user. The salt cylinder C may be produced in any desired way, as for example, the salt may be melted and cast in any suitable mold separately. Or it may be melted and poured into the cylinder A, (the bottom F being in place) and allowed to cool; any suitable core being inserted to produce the interior cavity. Or the salt of which the cylinder is composed may be the salt to be fused itself; in which case, it may not be necessary to form the salt cylinder as a separate object, because it will be formed naturally by the cooling of the fused substance in proximity to the cold iron surface of the exterior envelope A. In any event, it is desirable, in order to adapt the vessel for purposes of electrolysis, to produce between the lower edge of the cylinder A and the flat bottom B, a separating layer or flange D of the salt cylinder C in order to insulate these parts the one from the other. But this construction is not essential, because, as shown in Fig. 3, I may interpose between said cylinder A and the bottom F, a layer of any electrically non-conducting and heat-resisting material, such, for example, as asbestus, as indicated at D′ in said figure. The salt cylinder C when the iron envelope A is employed, should completely cover the entire inner wall of said cylinder. And this is of considerable importance.

Attempts have hitherto been made to overcome the difficulties incident to the manufacture of large crucibles of carbon by substituting for them vessels of other material lined with carbon. Wherever the fused salt can reach both the carbon lining and the containing vessel, local action is apt to occur between the metal so exposed and the carbon, to the destruction of the metal. And further, and still more serious, there is also local action produced between the metal deposited by electrolysis from the fused salt and the carbon lining itself.

It will be observed that by using a cylinder of salt, I prevent at once any local action between the walls of the containing vessel and the deposited metal; and by causing the salt cylinder when the iron enveloping cylinder is used completely to cover the inner wall of the iron cylinder, I likewise prevent any attack upon the iron envelope.

The salt of which the cylinder C is composed may be either: first, the salt which is to be fused, and which is to form the electrolytic bath; or second, (where the salt to be fused is composite) any one of the ingredient salts which will simply act as excess in the mass; or third, any other salt which will not operate to prevent the separation of the desired substance in a pure state by electrolysis. Experiment depending upon the nature of the process carried out will readily show which of these three expedients should be resorted to.

In order to use my crucible for purposes of electrolysis I insert therein a carbon anode E, to which one terminal of the source of electricity is connected, and I connect the other terminal to the bottom plate B, or F which thus forms a cathode. The electrolytic action then takes place in a downward direction from anode to cathode, the current not moving in anywise laterally, so that the deposit is produced upon the surface of the cathode only. After a sufficient deposit is formed, it is necessary simply to remove the cathode and to take therefrom the deposited metal. Or, if desired, the said metal, while in fused condition, may be removed by a ladle, or drawn out in any other suitable way. I prefer to use the form shown in Fig. 2, in all cases where the greater portion of the heat is applied to the bottom of the crucible. And it may often be desirable also in such cases, to prevent the possible union of the bottom G with the bottom B, to insert between the two bottoms some heat-resisting, but electrically conducting material, such as plumbago.

In Fig. 2, I have shown the terminal connected to the bottom B; but, of course, this is not essential, as I may connect it equally well to the bottom F. In that case, for the iron bottom B may be substituted a shield of any refractory material, such, for example, as fire-clay; its sole object being the protection of the bottom F from too high heat.

I desire to call particular attention to the fact that in practice I prefer to use the construction shown in Fig. 1, and to depend for heat upon the heating action of the current itself. In such case, the construction shown in Fig. 1 is of special advantage, because no circuit is formed through the wall of the vessel, and hence no heating effect can there occur. The outer envelope of metal A is insulated from the bottom by the interposed layer of salt. If it were not so, the current would pass through said envelope A, heat it, and fuse and speedily destroy the salt cylinder C.

While, as I have stated, I may use the salt cylinder C alone as the crucible, I find it preferable in practice to employ the inclosing cylinder A in order to support the salt cylinder and prevent breakage.

I claim—

1. A containing vessel for fused salts during electrolysis having an inner wall of electrically non-conducting material, and an outer surrounding envelope therefor, and a bottom both of electrically conducting material; the said envelope and bottom being insulated from one another.

2. A containing vessel for fused salts during electrolysis having a wall of metal, a lining of solidified salt, a bottom of metal and a layer of solidified salt interposed between said bottom and said wall.

3. A containing vessel for fused salts during electrolysis having a wall of electrically non-conducting material, a surrounding envelope therefor, and a bottom of electrically conducting material; said bottom and said envelope being insulated from each other.

4. A containing vessel for fused salts during electrolysis comprising a surrounding wall of solidified salt, a bottom of the metal to be deposited, in solid condition the inner metallic surface of said bottom being exposed, and a protecting exterior shield of heat-resisting material outside of said bottom.

5. In an electrolytic bath for fused salts, a containing vessel having a wall of solidified salt, an envelope therefor of electrically conducting material, an anode supported within said vessel, and a bottom of electrically conducting material forming the cathode and insulated from said envelope.

6. The combination in a containing vessel for fused salts during electrolysis of the outer metal envelope A, the metal bottom B, the cylinder C of solidified salt, and the interposed layer of solidified salt D between said envelope and said bottom.

7. The combination in an electrolytic bath for fused salts of the metal envelope A, the bottom F of the metal to be deposited, the cylinder C of solidified salt, the interposed layer D of solidified salt between said envelope and said bottom, the shield or outer bottom B and the anode E: the said bottom F forming the cathode.

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