No. 792,307. PATENTED JUNE 13, 1905.

A. G. BETTS.

PROCESS OF ELECTRODEPOSITING ANTIMONY.

APPLICATION FILED MAY 20, 1904.

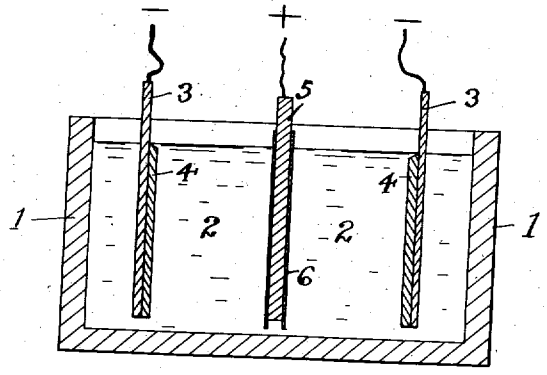


Fig 1

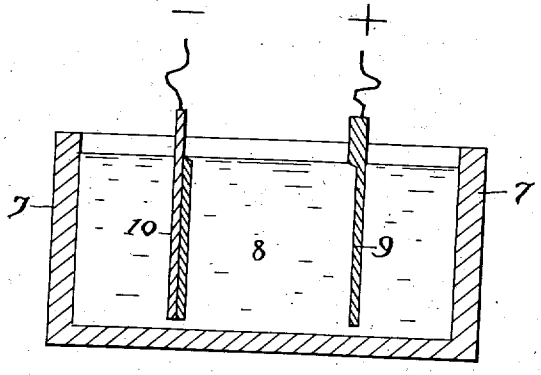


Fig 2

Witnesses

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No. 792,307. Patented June 13, 1905.

UNITED STATES PATENT OFFICE.

ANSON GARDNER BETTS, OF TROY, NEW YORK.

PROCESS OF ELECTRODEPOSITING ANTIMONY.

SPECIFICATION forming part of Letters Patent No. 792,307, dated June 13, 1905.

Application filed May 20, 1904. Serial No. 208,944.

To all whom it may concern:

Be it known that I, ANSON GARDNER BETTS, a citizen of the United States, residing at Troy, county of Rensselaer, and State of New York, have invented certain new and useful Improvements in Processes of Electrodepositing Antimony, of which the following is a specification accompanied by drawings.

Figure 1 is a view in vertical cross-section in which I show apparatus arranged for the deposition of antimony from a fluorid solution with an insoluble anode. Fig. 2 shows in vertical cross-section apparatus arranged for the deposition of antimony, using an antimony anode.

My invention consists, partly, in electrodepositing antimony from solutions containing antimony trifluorid, using either antimony anodes or insoluble anodes.

Antimony trifluorid differs from the ordinary antimony salts in not being decomposed by water into insoluble basic antimony compounds and free acid, so that a depositing solution can be prepared which is only slightly acid. The presence of large quantities of free acids, especially halogen acids, is not desirable.

The fluorid solution has the advantage that if an insoluble anode is used oxygen gas is there given off and hydrofluoric acid formed, which remains in solution. Hydrofluoric acid is a good solvent for antimony oxids and basic compounds, so that the solution after electrolysis with an insoluble anode is in suitable condition for dissolving fresh amounts of basic antimony compounds from which it is desired to prepare metallic antimony.

I prefer to have the electrolytic bath contain in addition to antimony trifluorid salts of metals which will not deposit on the cathodes with antimony. The alkali sulfates and fluorids are most suitable. In case an antimony anode is being used in the electrolysis alkaline chlorids may be used with good results.

The presence of sulfuric acid in the solution is desirable. A suitable solution contains eight per cent. SbF_3, two per cent. Na_2SO_4, and four per cent. H_2SO_4. A current density of ten amperes per square foot gives a good deposit of antimony when the solution is pure—that is, free from metals which would deposit with the antimony. By electrolyzing such a solution with an insoluble anode such a solution can be largely deprived of antimony, oxygen escaping at the anode and leaving a solution containing hydrofluoric acid.

Lead makes the most suitable insoluble anode, which should consist of lead rods to which free access of solution should be prevented by a layer of porous material, preferably by a few layers of cloth surrounding each rod. The antimony has a tendency to become oxidized to the pentavalent form at the anode, in which form it has a dissolving action on the metal of the cathode, being there reduced again to the trivalent form. If the cloth is absent, enough oxidation of the antimony in the solution may occur to reduce the actual yield of metal deposited at the cathode to sixty per cent. of what should be theoretically obtained by the amount of electricity passed, while with anodes wrapped in cloth the yield rises to from ninety to ninety-five per cent.

The anode area should not be over half of the cathode area, because with the higher anode current density the formation of pentavalent antimony compounds is reduced. The voltage required, using insoluble anodes, is usually from 2.5 to three volts.

By the term "sulfate" I mean to include sulfuric acid, as it is a sulfate of hydrogen.

Having reference to the accompanying drawings, Fig. 1 shows in vertical cross-section a tank 1, containing the antimony solution 2, cathodes 3, on which antimony 4 has been deposited, and anodes of lead 5, surrounded by cloth 5. Fig. 2 shows in vertical cross-section a tank 7, containing the antimony solution 8, in which is suspended an antimony anode 9, partly dissolved by electrolysis, while a corresponding amount of purified antimony has been deposited on the cathode 10.

What I claim as new, and desire to secure by Letters Patent, is—

1. The process of electrodepositing antimony which consists in electrolyzing a solution containing antimony trifluorid with a suitable cathode.

2. The process of electrodepositing antimony which consists in electrolyzing a solution containing antimony trifluorid and a sulfate with a suitable cathode.

3. The process of electrodepositing antimony which consists in electrolyzing a solution containing antimony trifluorid with an insoluble anode and with a suitable cathode.

4. The process of electrodepositing antimony which consists in electrolyzing a solution containing antimony trifluorid with a lead anode and with a suitable cathode.

5. The process of electrodepositing antimony which consists in electrolyzing a solution containing antimony trifluorid with a lead anode and with a suitable cathode, and preventing free circulation of the entire solution to the anode by means of a layer of porous material.

6. The process of electrodepositing antimony which consists in electrolyzing a solution containing antimony trifluorid with an insoluble anode having an electrolyzing-surface considerably smaller than the cathode-surface, and with a suitable cathode.

In testimony whereof I have signed my name to this specification in presence of two subscribing witnesses.

ANSON GARDNER BETTS.

Witnesses:
EDWARD F. KERN,
WILLIAM VALENTINE.

Disclaimer in Letters Patent No. 792,307.

DISCLAIMER.

792,307.—*Anson Gardner Betts*, Troy, N.Y. PROCESS OF ELECTRODEPOSITING ANTIMONY.

Patent dated June 13, 1905. Disclaimer filed January 24, 1906, by the patentee.

Enters his disclaimer—

"To claim No. 1, which reads as follows, to wit:

"1. The process of electrodepositing antimony which consists in electrolyzing a solution containing antimony trifluorid with a suitable cathode."—[*Official Gazette January 30, 1906.*]

2. The process of electrodepositing antimony which consists in electrolyzing a solution containing antimony trifluorid and a sulfate with a suitable cathode.

3. The process of electrodepositing antimony which consists in electrolyzing a solution containing antimony trifluorid with an insoluble anode and with a suitable cathode.

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