Feb. 12, 1924. 1,483,722

F. A. EUSTIS

ART OF MAKING ELECTROLYTIC METAL AND APPARATUS THEREFOR

Filed June 13, 1922 2 Sheets-Sheet 1

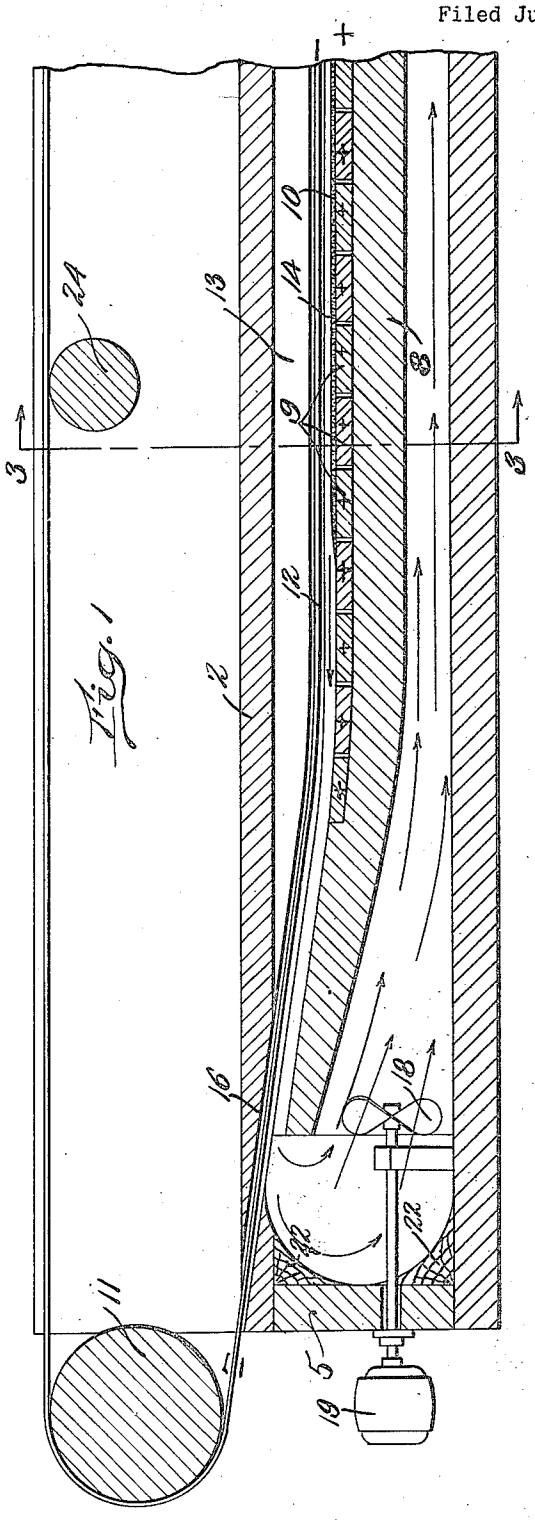


Fig. 1

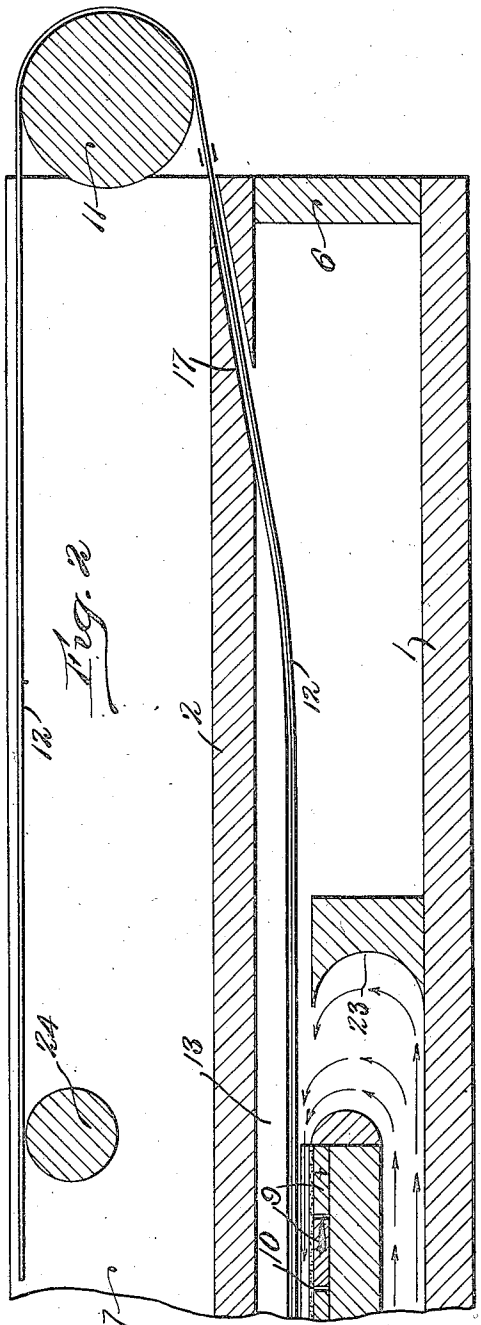


Fig. 2

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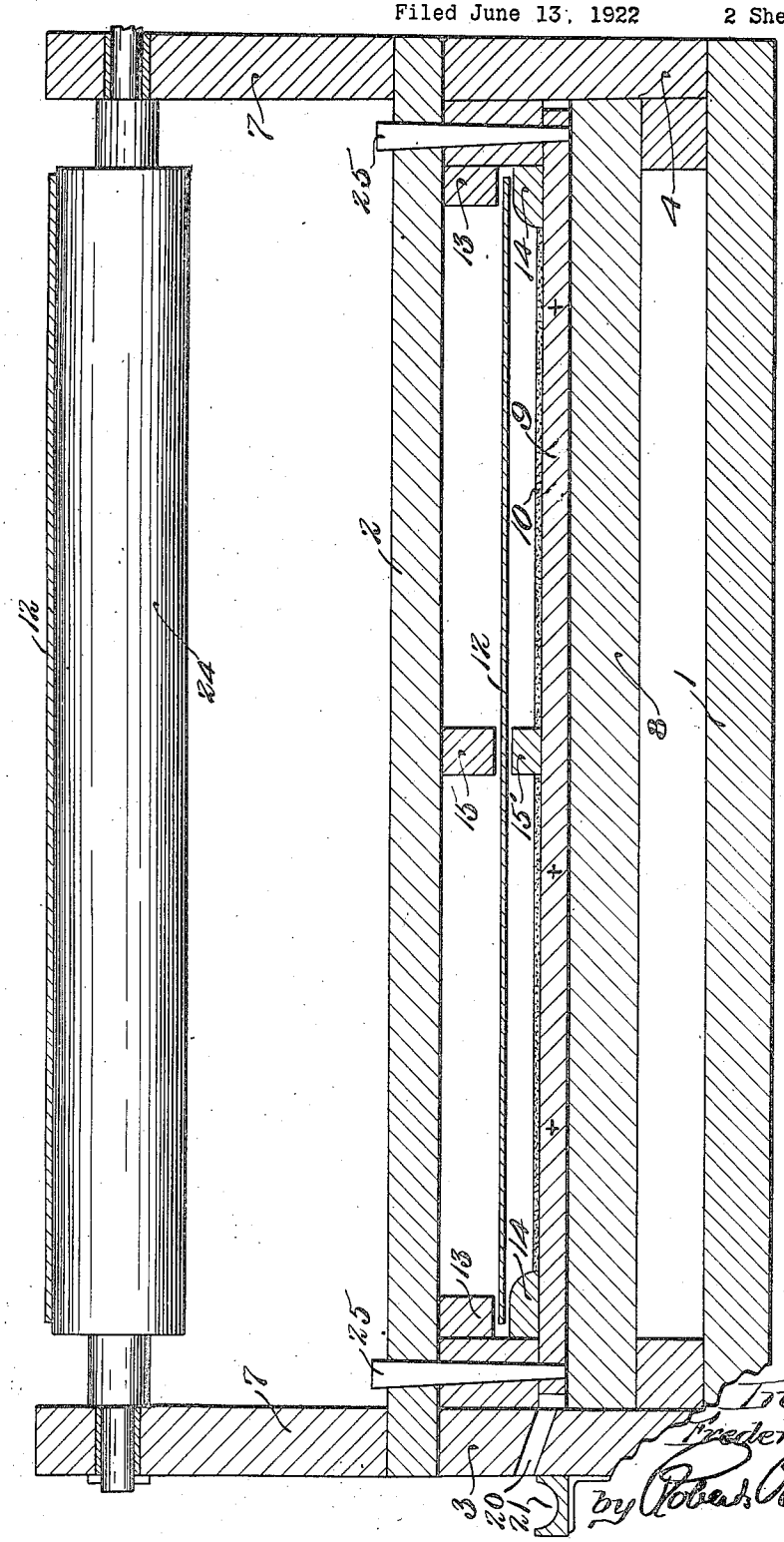


Fig. 3

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UNITED STATES PATENT OFFICE.

FREDERIC A. EUSTIS, OF MILTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO CHARLES PAGE PERIN, OF NEW YORK, N. Y.

ART OF MAKING ELECTROLYTIC METAL AND APPARATUS THEREFOR.

Application filed June 13, 1922. Serial No. 567,948.

To all whom it may concern:

Be it known that I, FREDERIC A. EUSTIS, a citizen of the United States of America, and resident of Milton, in the county of Norfolk and State of Massachusetts, have invented new and useful Improvements in the Art of Making Electrolytic Metal and Apparatus Therefor, of which the following is a specification.

This invention relates to the manufacture of electrolytic metal. Its principal object is to produce a novel method and apparatus by which the metal may be continuously deposited by electrolysis from a suitable electrolyte upon a traveling cathode, and continuously removed therefrom.

While the invention is particularly useful for the manufacture of electrolytic iron, it is also applicable to the electrolytic production of other metals, and such general application is contemplated by the claims. To secure the best results the electrolyte or solution from which the metal is deposited should be of such character as to yield a brittle deposit of the metal. An iron solution such as described in an application filed jointly by Donald Belcher and me June 7, 1922, Serial No. 566,581, is well adapted to the purpose as the iron deposited therefrom contains hydrogen and is brittle. The metal is deposited continuously in the form of a brittle coating on a continuous flexible, sheet metal, traveling belt cathode, which passes through the electrolysis cell and carries the deposit out of the solution and out of the electrolysis cell; then at the place where the belt bends over the pulley or drum outside of the electrolysis cell the brittle deposit will be cracked or broken up and may be conveniently collected on a suitable belt conveyer, or other suitable receiver, and delivered continuously out of the plant. If desired, a suitable scraper at the bend of the belt, or other means to dislodge the deposit from the belt, may be used to facilitate the removal of the deposit.

In the accompanying drawings which illustate the novel electrolysis cell,—

Figure 1 is a longitudinal section through one end of the cell;

Figure 2 is a similar section through the other end of the cell; and

Figure 3 is a cross section of the cell on an enlarged scale on line 3—3 of Fig. 1.

It will be understood that Figs. 1 and 2 illustrate only the ends of the cell, and that the intervening structure, which is of considerable length, is a continuation of, and the same as, that shown adjacent the broken ends of the figures.

The casing of the electrolysis cell is an elongate, shallow structure comprising the bottom wall 1, the top wall 2, the side walls 3 and 4, and the end walls 5 and 6. At each side of the top wall 2, and running lengthwise of the casing, is an upwardly extending support 7, 7, for the rollers which carry and actuate the belt cathode.

A partition 8 extends lengthwise of the casing and terminates short of the end walls thereof at each end. A series of anodes 9, slightly spaced apart and extending crosswise of the casing, are supported on the partition 8; and a sheet of asbestos cloth 10 covers the anodes and forms a diaphragm dividing the anode compartment below from the cathode compartment above.

The flexible cathode as herein shown consists of a continuous band or belt 12 of steel or iron, supported at its ends on rollers 11, 11, one or both of which may be driven to actuate the belt. The lower run of the belt cathode extends through the cathode compartment of the electrolytic cell above the diaphragm 10 and is guided at its side edges by suitable guide strips 13, 14, forming a guide channel between them. Centrally disposed, lengthwise extending strips 15, 15′, spaced apart as shown in Fig. 3, guide the belt at its middle line. Thus the proper electrode spacing is maintained between the belt cathode and the fixed anodes. The upper run of the belt may be supported on idler rolls 24, mounted at intervals between the side supports 7, 7. Suitable inclined slots 16 and 17 are provided in the top wall 2 of the casing, for the passage of the lower run of the belt.

Circulation is maintained of the electrolyte in the cell as indicated by arrows by means of propellers 18, of which there may be several, driven by a motor 19 or other suitable means.

Deflectors 22 and 23 arranged at opposite ends of the partition 8 serve to direct the stream of electrolyte around the ends of the partition.

A number of openings 20 (Fig. 3) through the side wall 3 enter the anode compartment, which is the space between the dia-

phragm 10 and the partition 8, and provide outlets for the anode liquor, discharging into a catch trough 21 on the outside of the casing. Graphite pencils 25 conduct current from a suitable source of electrical energy to the anodes 9.

It will be understood that the belt cathode 12 and the anodes 9 are suitably connected up to a source of electric current. Upon the passage of the current the metallic iron or other metal is deposited in a brittle sheet or layer or coating on the surface of the belt cathode 12 which is opposed to the anodes.

As the traveling belt emerges from the cell it bends around one of the rollers 11 and will thereby crack or break up the brittle metal deposit so that it can easily be removed with the assistance of a scraper if necessary and collected in a receptacle, or on a belt conveyer, or in any other convenient manner for carrying it away.

I claim:

1. The art of producing electrolytic metal which comprises depositing the metal by electrolysis from an electrolyte upon a continuous, flexible, traveling belt cathode while keeping that part of the electrolyte which surrounds the anode away from the cathode, carrying the deposit out of the solution on the traveling belt cathode, and removing the deposit from the belt cathode.

2. The art of producing electrolytic metal which comprises depositing the metal by electrolysis from an electrolyte upon a continuous, flexible, traveling belt cathode while keeping that part of the electrolyte which surrounds the anode away from the cathode by means of a diaphragm, carrying the deposit out of the solution on the traveling belt cathode, and removing the deposit from the belt cathode.

3. The art of producing electrolytic metal which comprises depositing the metal in brittle form by electrolysis from an electrolyte upon a continuous, flexible, traveling belt cathode, carrying the deposit out of the solution on the traveling belt cathode, and flexing the belt cathode to break up or crack the deposit.

4. The art of producing electrolytic metal which comprises depositing the metal in brittle form by electrolysis from an electrolyte upon a continuous, flexible, traveling belt cathode, carrying the deposit out of the solution on the traveling belt cathode, flexing the belt cathode to break up or crack the deposit, and continuously removing the deposit from the belt.

5. Electrolytic apparatus comprising an electrolytic cell, an anode in the cell, a continuous, flexible, traveling belt cathode mounted to move through the cell in spaced relationship to the anode, and a diaphragm between the anode and the belt cathode.

6. Electrolytic apparatus comprising an electrolytic cell, a partition therein, a series of anodes adjacent to the partition, a continuous, flexible, traveling belt cathode mounted to move through the cell in spaced relationship to the series of anodes, and a diaphragm between the anodes and the belt cathode.

7. Electrolytic apparatus comprising an electrolytic cell, a series of anodes in the cell, a continuous, flexible, traveling belt cathode mounted to move through the cell in spaced relationship to the series of anodes, a diaphragm between the anodes and the belt cathode, and means to maintain circulation of the electrolyte between the diaphragm and the belt cathode.

8. Electrolytic apparatus comprising an electrolytic cell, a partition therein, a series of anodes adjacent to the partition, a continuous, flexible, traveling belt cathode mounted to move through the cell in spaced relationship to the series of anodes, a diaphragm between the anodes and the belt cathode, and means to maintain circulation of the electrolyte between the diaphragm and the cathode.

9. Electrolytic apparatus comprising an elongate cell, a partition extending lengthwise thereof, a series of anodes adjacent to the partition, a diaphragm covering the anodes on the side opposite the partition, a continuous, flexible, traveling belt cathode supported at its ends on rollers outside of the cell, one run of the belt passing through the cell in spaced relationship to the diaphragm and anodes, and an outlet through the wall of the cell communicating with the anode compartment between the diaphragm and partition.

10. Electrolytic apparatus comprising an elongate cell, a partition extending lengthwise thereof, a series of anodes adjacent to the partition, a diaphragm covering the anodes on the side opposite the partition, a continuous, flexible, traveling belt cathode supported at its ends on rollers outside of the cell, one run of the belt passing through the cell in spaced relationship to the diaphragm and anodes, and propellers adapted to maintain circulation of the electrolyte around the partition and between the diaphragm and the cathode.

Signed by me at Boston, Massachusetts, this 5th day of June, 1922.

FREDERIC A. EUSTIS.