(No Model.)

M. WADDELL, J. B. ENTZ & W. A. PHILLIPS.

METHOD OF AND APPARATUS FOR DEOXIDIZING METALS.

No. 475,260. Patented May 17, 1892.

Fig. 1.

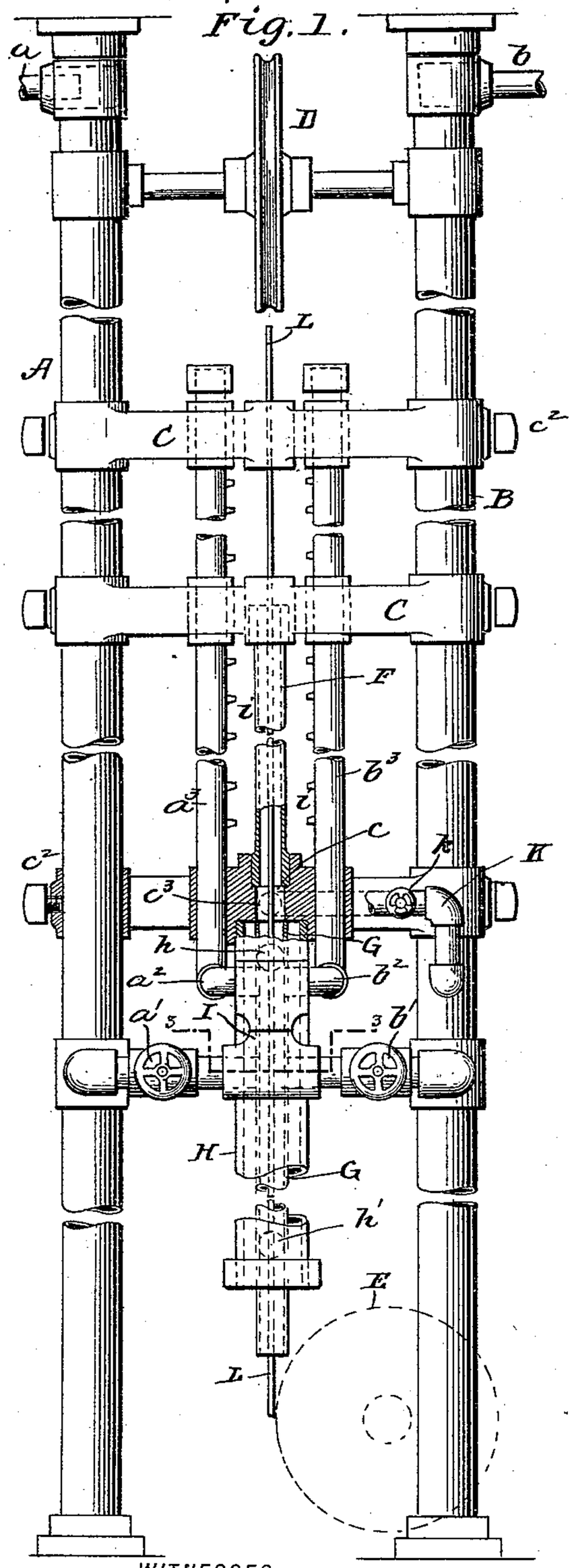


Fig. 2.

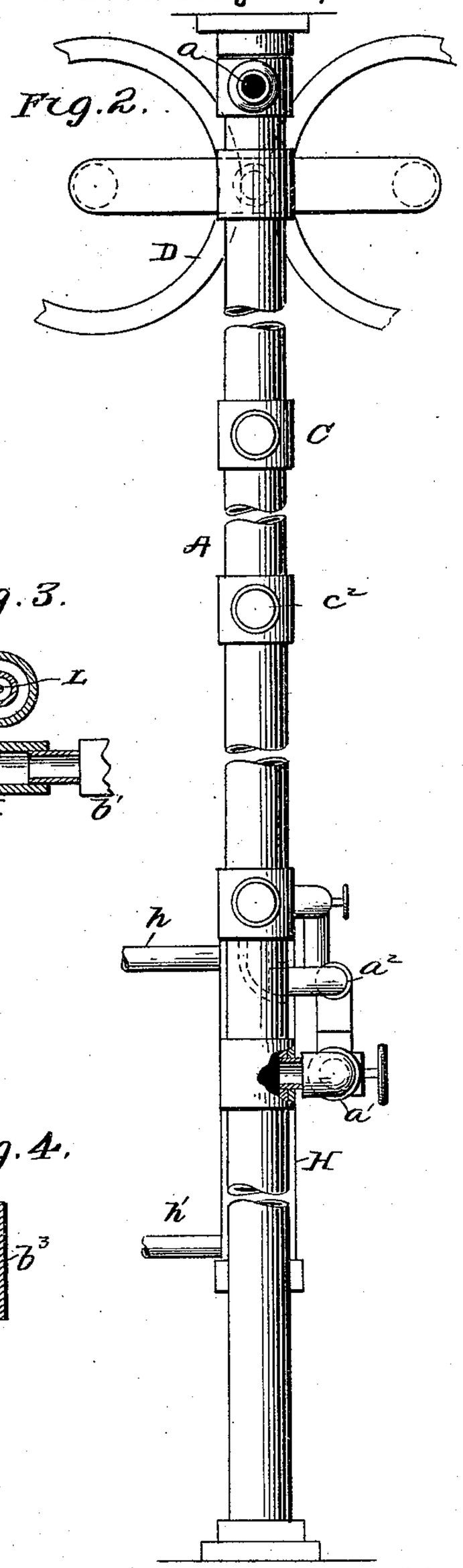


Fig. 3.

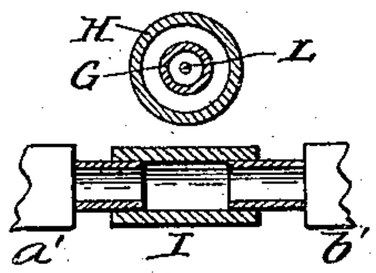
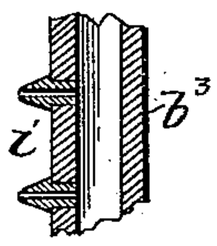


Fig. 4.



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METHOD OF AND APPARATUS FOR DEOXIDIZING METALS.

SPECIFICATION forming part of Letters Patent No. 475,260, dated May 17, 1892.

Application filed November 8, 1890. Serial No. 370,766. (No model.)

To all whom it may concern:

Be it known that we, MONTGOMERY WADDELL, a subject of the Queen of Great Britain, and JUSTUS B. ENTZ, a citizen of the United States, residing at New York, in the county of New York, and WILLIAM A. PHILLIPS, a subject of the Queen of Great Britain, residing at Brooklyn, in the county of Kings, State of New York, have invented certain new and useful Improvements in Methods of and Apparatus for Deoxidizing Metals, of which the following is a specification.

In the manufacture of electric batteries, particularly those called "storage" or "secondary" batteries, oxide of copper is used, and, as described and claimed in the Patents Nos. 440,023 and 440,024, dated November 4, 1890, this material is used in the form of a wire, and to obtain the best results in the use of such batteries it is desirable that the copper, whether in the form of a wire-shaped meshed tube or a solid wire, or in any other shape, shall be as bright, clean, and free from oxygen as possible.

To this end our invention relates to the method of and apparatus for deoxidizing or reducing metal suitable for use in electric batteries; and our invention in the apparatus, as indicated in the drawings, has particular reference to means for treating metal in wire form for the purpose referred to, although it is obvious that by altering the shape of parts of said apparatus it may be adapted for treating oxide of copper or other metal in sheet form.

Our invention consists in the method and apparatus hereinafter described and claimed.

In the accompanying drawings, Figure 1 is an elevation of our preferred apparatus for carrying out our method. Fig. 2 is an elevation of the same apparatus at a right angle to the view shown in Fig. 1, both of said figures having parts broken out to more clearly illustrate the construction. Fig. 3 is a detail section on line 3 3 of Fig. 1, and Fig. 4 is a longitudinal section of a portion of the pipe for supplying gas and air to be burned.

The frame of the apparatus consists of two uprights A and B, suitably secured at top and bottom and having connecting-braces C. These uprights are hollow, and thereby may serve as pipes for conducting air and gas, the supply-pipe for air from a blower being indicated at *a* and the gas-service pipe being indicated at *b*.

In the drawings many breaks are indicated in the uprights in order to show the entire apparatus on one sheet, and for the purpose of facilitating a ready understanding of the operation of the apparatus, as hereinafter described, it is to be understood that the total height of the columns or uprights is far in excess of what appears in said drawings in proportion to their size and distance apart. For instance, the total height may be about nine (9) feet, and of this height the distance between the lower and intermediate braces C, which is occupied by the heating-chamber, may be about two (2) feet, while the length of the cooling-chamber below the lower brace may be about three (3) feet, and yet the distance apart of the two uprights need not exceed nine (9) or ten (10) inches.

Near the upper end of the frame and having bearings in castings secured thereto is a shaft having a guide-pulley D, and near the lower end is a similar shaft and guide-pulley E, their peripheries being in line with the center of the heating and cooling chambers now to be described.

The heating-chamber is formed by a tube F, preferably of porcelain or other vitreous or refractory material, which will withstand the heat to which it is subjected and yet not permit the escape of the heated gas through its sides, and this tube is held by suitable bushings at its ends in the intermediate and lower braces. Below the lower end of tube F and in line therewith, but separated therefrom by a contracted portion *c* of the lower cross-brace, is an iron tube G, the porcelain tube being open at its top and the iron tube being open at its bottom and a free passage existing from one to the other. Surrounding the iron tube G is a water-jacket H, closed at top and bottom and having inlet and outlet pipes *h* and *h'*, respectively. The lower end of pipe G and of the water-jacket may be suitably supported, as desired, by braces. (Not shown.) From the air and gas pipes two short valved pipes *a'* and *b'* approach each other and join with a short vertical pipe I,

which thus forms an air and gas mixing chamber, from which short pipes a^2 b^2 spread and lead to the burners a^3 b^3, which extend from the lower to the upper cross-brace C, are located one on each side of the heating-chamber or tube F and above it, and are provided with numerous perforations *i* on the side toward the tube F and wire through which the mixed air and gas is forced, and which latter on being lighted heats the porcelain tube and the wire in and above it. From the gas-column B a pipe K leads to the aperture c^3 in the space *c* between the adjoining ends of tubes F and G and has a valve *k*. The braces C, as will be noticed, have sleeves at their ends provided with set-screws c^2, this construction enabling the parts to be assembled, or, more particularly, facilitating the placing and securing of the tube F and the burners which pass through the said braces.

In operation with the apparatus described an oxidized wire L or strip, or mesh-work of wire with oxide of copper or other metal embedded in it that it is desired to subject to the described process, is drawn from a coil or other supply over pulley D, led down through the tubes and out, as shown. The mixed air and gas is turned on and directed against the tube F and the wire above it from the perforations of the burners and is ignited, while a supply of reducing-gas is sent through pipe K to the aperture *c* with sufficient force that while, of course, the much larger quantity will pass up through tube F and in contact with the metal strip or wire, yet sufficient will be forced downward by the pressure of supply to prevent access of air to the wire in tube G until the said wire has passed out of the cooling-chamber. The flames from the burners, similar to the flames from a number of Bunsen burners, heat the wire before it enters tube F, and also heat the said tube and that part of the wire inside of the tube. There being nothing but the reducing-gas and the heated wire inside the tube, the former combines with the oxygen of the oxide and the products of combustion pass out at the top of said tube, leaving the reduced metal, while the expansive properties of what gas burns in the tube F aid the pressure of supply in preventing the upward draft in tube F from interfering with sufficient of the gas being forced down through tube G to prevent access of air to the wire before it has been cooled by its continued downward passage through the cooling-chamber formed by the water-jacket around the said tube G. After exit from the latter at a temperature low enough to avoid ready absorption of oxygen in the open air the wire passes around pulley E to any suitable locality or coiling mechanism and is ready for use for the purposes as first above described.

Having now described our invention, we claim—

1. In an apparatus for deoxidizing metals, the combination of two chambers communicating with each other and open at opposite ends, with a gas-inlet placed between the chambers and adapted to fill each chamber with gas, and means for heating the gas in one chamber and means for cooling the gas in the other, for the purpose set forth.

2. In an apparatus for deoxidizing metal, the combination of the chamber F, chamber G, said two chambers being in line with each other and open at the ends nearest each other, an intermediate gas-supply pipe K, leading to the space *c* between the chambers F and G, all arranged so that the gas from the space *c* is adapted to enter both chambers F and G to serve as an air-excluding medium, and means for heating the gas in one chamber and cooling the gas in the other chamber, substantially as and for the purpose set forth.

3. The method of deoxidizing metal, which consists in exposing the same while in motion to a body of gas, cooling one portion and heating the other portion of said body of gas, and causing the two portions to pass in opposite directions in contact with the metal, substantially as described.

4. The combination of the chamber F and chamber G, intermediate space *c*, communicating with both said chambers, gas-pipe K, leading to said space *c* to direct a divided body of gas into each of the chambers F and G, with pipes a^3 and b^3 and gas-burners *i* thereon, arranged to heat the exterior of the chamber F and to heat the wire before it enters chamber F, and means for cooling the chamber G, substantially as herein shown and described.

In witness whereof we have hereunto affixed our seals and signed our names in the presence of two subscribing witnesses.

MONTGOMERY WADDELL.
JUSTUS B. ENTZ.
WILLIAM A. PHILLIPS.

Witnesses:
FRANK S. OBER,
EDWARD A. WAGNER.