No. 676,575. Patented June 18, 1901.

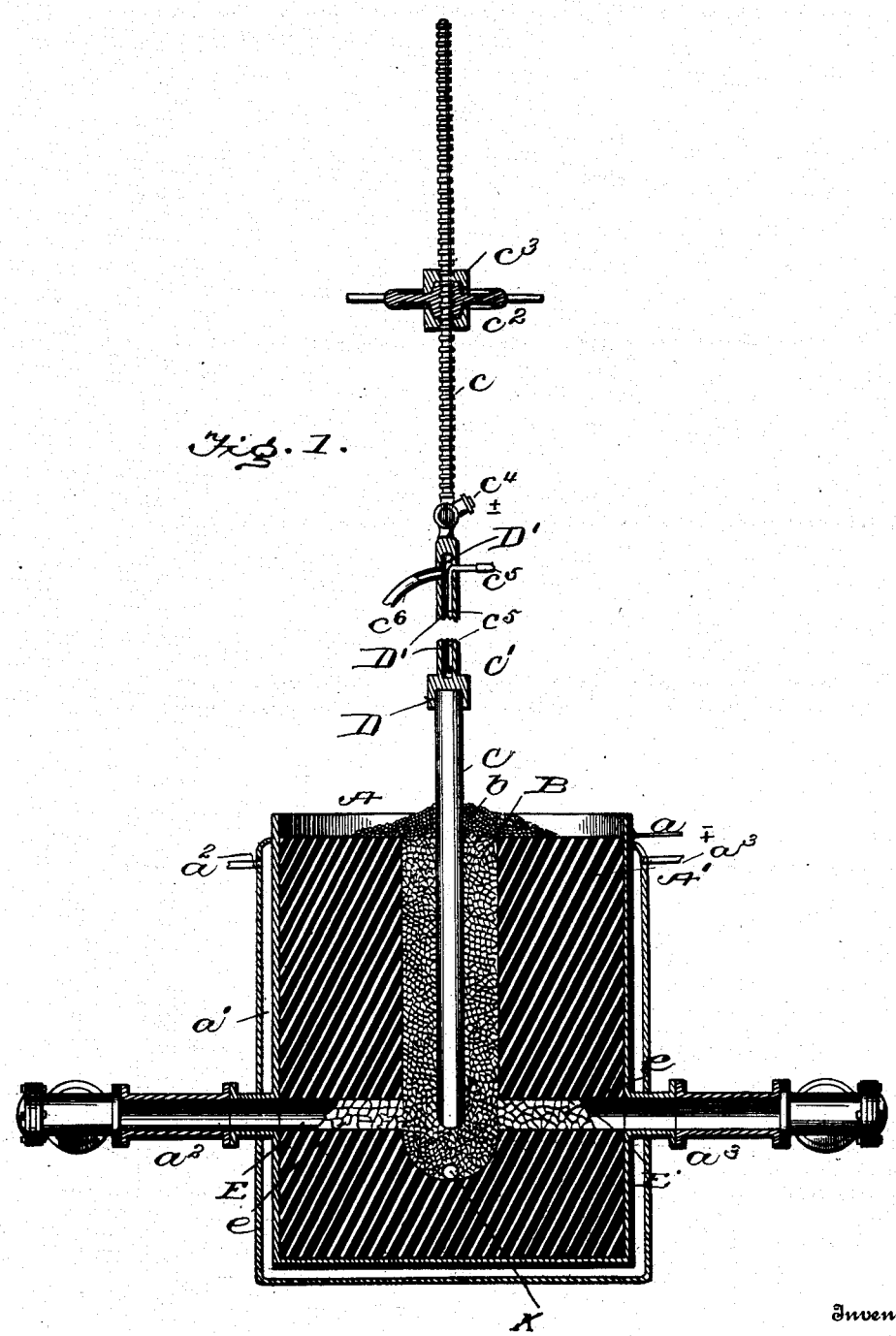
A. H. COWLES.

ELECTRIC FURNACE.

(Application filed Apr. 9, 1897.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



Witnesses

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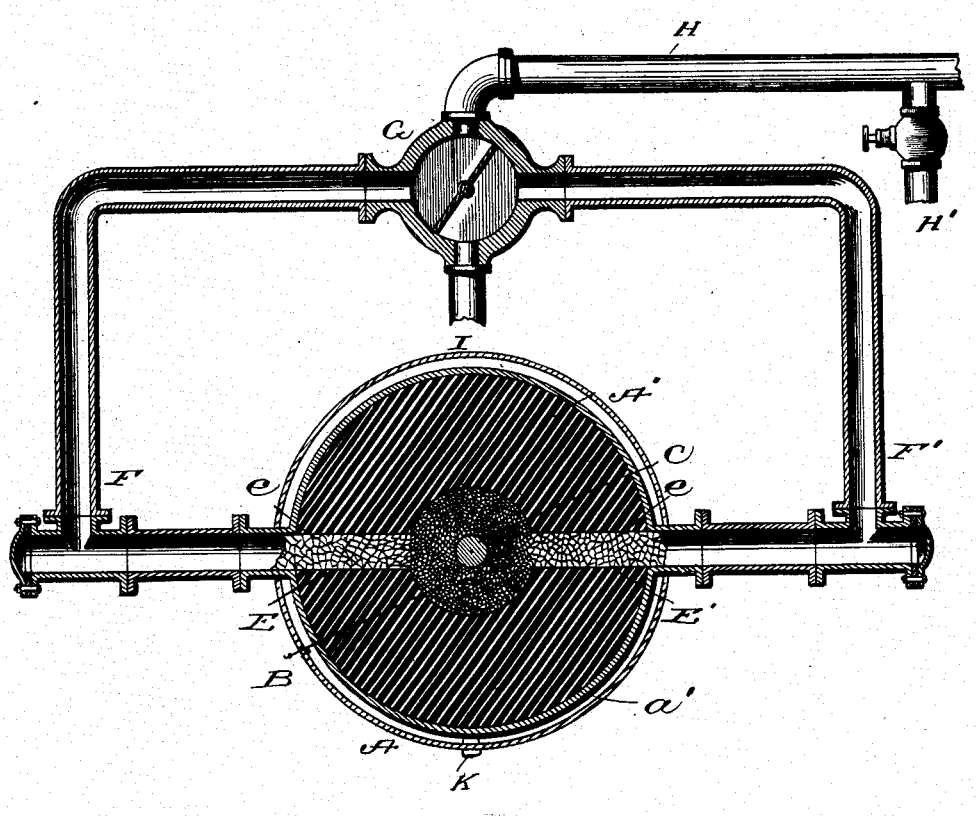
Fig. 2.



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UNITED STATES PATENT OFFICE.

ALFRED H. COWLES, OF CLEVELAND, OHIO, ASSIGNOR TO THE ELECTRIC SMELTING AND ALUMINUM CO., OF SAME PLACE.

ELECTRIC FURNACE.

SPECIFICATION forming part of Letters Patent No. 676,575, dated June 18, 1901.

Original application filed July 6, 1895, Serial No. 555,115. Divided and this application filed April 9, 1897. Serial No. 631,413. (No model.)

To all whom it may concern:

Be it known that I, ALFRED H. COWLES, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Electric Furnaces, (divisional case of Serial No. 555,115, filed July 6, 1895;) 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, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

This invention relates to electric furnaces, and particularly to an electric conductor connection between the carbon stick and electric cable; and it consists of a metallic conductor having a closed chamber for the circulation of a cooling fluid therein in contact with the walls of the conductor and against the end of the conductor which holds the carbon, whereby high and protracted heats may be run without injury to the conductor or the furnace.

In electric furnaces wherein the current is taken in through carbon electrodes or sticks it is difficult to secure such a connection between the carbon stick and the metal holder as will not offer resistance to the flow of the current. This is generally a weak point in the circuit, and the result is that the end of the metal holder is subjected not only to transmitted heat from the furnace itself, but to heat generated by the resistance of the contact at the joinder of the holder with the carbon stick. From this latter cause the heat generated at the junction of the holder and the carbon sometimes partially fuses the metal and still further impairs the connection and increases the resistance. Metal expands more than carbon. Therefore if the metal of the holder or conductor becomes heated at the point of connection between the carbon and the conductor the contraction and expansion of the latter impairs the joint and interrupts the electric current often to such an extent that the operation of the furnace is stopped. It is to overcome and obviate these objections, difficulties, and disadvantages that my invention is particularly intended.

In the accompanying drawings, Figure 1 is a vertical section of an electric furnace, and Fig. 2 is a horizontal section of the same.

A is the furnace-chamber, filled with a charge B, and C a carbon stick carried by the holder C′ and constituting one of the electrodes, the bottom of the furnace-chamber constituting the other electrode. The electrode C is adjustably supported in any preferred way. In the present case the upper end c' of the holder is screw-threaded and engages with a hand wheel-nut c^2, properly supported in a girder c^3. One of the electric cables is attached to the holder at c^4 and connection is made by the other terminal of the electric circuit with the outer iron shell of the furnace at a, the current passing through the carbon filling or block A′ to the charge in the furnace-chamber. The holder or conductor connection C′ has a cup end D, fitting the protruding end of the carbon stick or electrode C, and a closed water-tight chamber D′, extending from said end to the opposite closed end of the holder or conductor. The means for carrying the water or other cooling fluid into and out of the chamber consists of an inlet-pipe c^5, extending through the upper portion of the chamber-wall and projecting centrally down into the chamber and terminating in an open end near the bottom of the chamber, so as to discharge the cooling fluid onto or against the end of the chamber-wall which forms the bottom of the cup in which the carbon is held, and a discharge-pipe c^6, secured to the upper portion of the chamber-wall opposite the inlet and in communication with the upper portion of the said chamber. This construction and arrangement will admit of the chamber being kept nearly full of the cooling fluid under circulation therein by the inlet-pipe discharging upon the end of the chamber which is in contact with the carbon, the fluid then rising up around the inlet-pipe and out through the outlet-pipe, maintaining a continuous flow of the cooling fluid not only

through the holder or conductor, but against the end thereof in contact with the carbon electrode. Thus the entire metal of the holder, and particularly the end or cup holding the carbon, is prevented from overheating and the electric current passes through the fluid-filled holder without interruption or impairing the joint between the holder and the electrode. The furnace chamber or crucible is also provided with a water-jacket a' and with water-pipes a^2 a^3 for the inflow and outflow of water therefrom.

For the purpose of this divisional case the other structural features of the furnace are not material; but they are briefly as follows: Extending laterally from the furnace-chamber are flues E E′ filled with granulated or broken carbon *e*, the interstices of which form carbon passages for the gases. Connected with these flues are the gas-pipes F F′, leading to a reversing valve-chamber G, which chamber has a gas-supply pipe H and a discharge-pipe I. The latter may lead to a gas-holder or to such apparatus as may be proper for the subsequent treatment or handling of the product. Connected with the gas-supply pipe there is an air-pipe H′, which admits air under pressure to the gas.

The furnace-chamber, as indicated, is filled to the top with the charge of ore and carbon, with the top covered with a surface covering of fine carbon B. K is a tap for drawing off the molten material collected in the sump. This construction admits of the passage of gases through the material undergoing reduction in the furnace and a reversal of the flow of gas therethrough.

Although I have shown the conductor applied to a vertical electrode, it may be as well used upon a horizontal electrode without the least change in structure by keeping the outlet-pipe uppermost, so that the fluid will not run out until forced by fresh fluid from the inlet-pipe.

What I herein claim as my invention is—

1. A water-cooled device for electrically connecting an electric conductor with an electrode, comprising a hollow shell adapted to hold a body of water or cooling fluid and having a closed end to which the conductor is attached, a cup end closed against the hollow of the shell and carrying the electrode, a pipe within the shell and opening against the cup, and a pipe from the shell opposite the cup, substantially as set forth.

2. In an electric furnace, the combination of the cooling-jacket surrounding the furnace-chamber, a lining for said chamber, gas-passages leading from the center of the chamber through the lining and the jacket, a carbon electrode, and a holder for the electrode composed of material the coefficient expansion of which is greater than that of the carbon, and having a closed chamber for the circulation of a cooling fluid against the end of the holder carrying the electrode and in contact with the walls of the said chamber.

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

ALFRED H. COWLES.

Witnesses:
S. A. TERRY,
STORY B. LADD.