

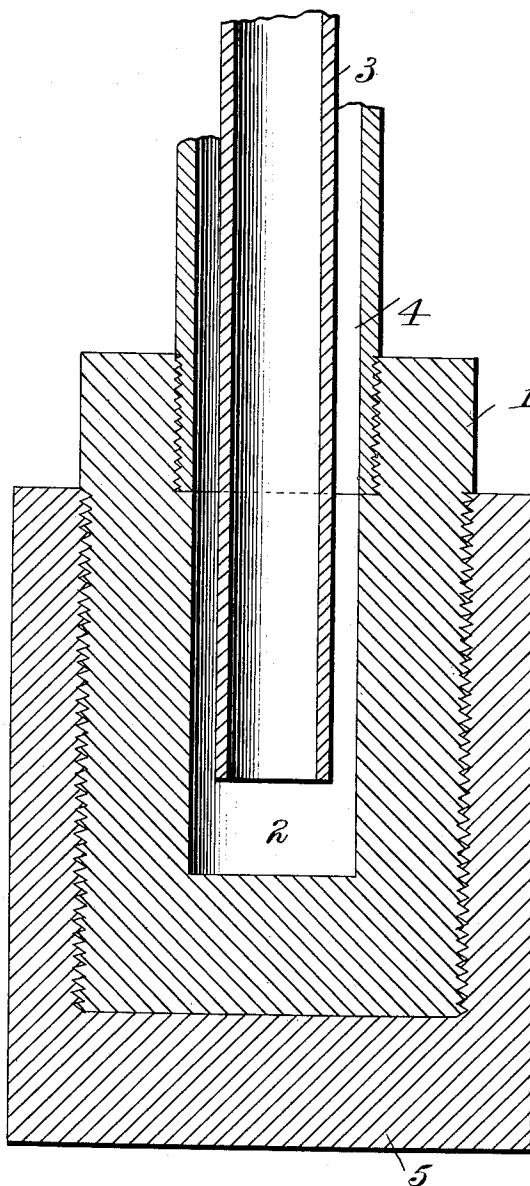
No. 896,429.

PATENTED AUG. 18, 1908.

F. M. BECKET.

ELECTRODE FOR ELECTRIC FURNACES.

APPLICATION FILED NOV. 24, 1902. RENEWED DEC. 22, 1906.



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ELECTRODE FOR ELECTRIC FURNACES.

No. 896,429.

Specification of Letters Patent.

Patented Aug. 18, 1908.

Application filed November 24, 1902, Serial No. 132,682. Renewed December 22, 1906. Serial No. 349,162.

To all whom it may concern:

Be it known that I, FREDERICK M. BECKET, subject of the King of Great Britain and Ireland, residing at Niagara Falls, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Electrodes for Electric Furnaces, of which the following is a specification.

My invention relates to electric furnaces used in the art of electric smelting and in electrolytic reduction processes where fused electrolytes are employed.

The object of my invention is to provide an improved electrode for furnaces of the above-named character possessing advantageous features of construction at less cost and of greater efficiency than those at present employed.

In electric furnaces of the class above mentioned, it has been customary heretofore to use carbon electrodes. These possess many inherent defects and disadvantages, such as cost and rapid deterioration in use. The carbon is not only consumed by gases liberated in the chemical and electrical action which takes place in the furnace, but is also rapidly burned away by the surrounding oxygen of the atmosphere.

I have discovered that by constructing electrodes with a hollow or chambered interior through which a cooling fluid may be circulated, I am able to secure greater efficiency and at a much less expense.

In the accompanying drawing I have illustrated my invention. Said drawing is a vertical section of one embodiment of my invention.

1 represents the body of the electrode constructed, as shown, with a hollow or chambered interior 2, in which a cooling agent may be circulated by means of inlet and outlet pipes 3 and 4.

5 indicates a carbon shell. This carbon shell or coating may be the ordinary or amorphous carbon used for electrodes, the threads being cut in a machine, but it is preferable to form the shell of graphite on account of its great ease in machining. The carbon shell may also be molded on the metal portion or body of the electrode, the latter being provided with threads or corrugations to make the joint or adhesion between the shell and metallic portion secure, the carbon being baked to harden the same.

Any suitable form of electrode may be employed according to the kind of furnace with which it is designed to be used. The form shown in the illustration is especially suited for use in connection with a furnace of horizontal type in which the electrodes are of equal size.

The electrode is formed of any suitable conductive material, preferably of metal or alloys of metals. It may even be constructed of carbon or graphite. It is preferable, however, to employ a suitable metal as the material for the electrode, as thereby great saving in cost is effected. I have found that an electrode constructed according to my invention of cast iron forms a satisfactory and efficient material. Where, however, iron would contaminate the bath or electrolyte, I employ other metals; nickel, for instance, is well suited for the material of which to form my electrodes. Wrought iron forms a satisfactory electrode. By the use of alloys the melting point of the electrode may be considerably increased, and I have discovered that a ferro-titanium alloy forms a most efficient material out of which to construct electrodes. Experiments conducted with a ferro-titanium alloy containing 7.5% titanium showed a raising of the melting point over wrought iron by about 300° C. and over; cast iron by about 500° C. The brittleness of cast iron is a disadvantage; but the ferro-titanium alloy referred to provides an electrode much tougher and less brittle than ordinary cast iron, and which can be machined with comparative ease. Electrodes of this construction are less expensive than if constructed wholly of carbon, and also provide a ready means of circulating therein a cooling agent. All the advantages of a carbon electrode are preserved in this form of construction and at the same time the principal disadvantages and defects are eliminated. The carbon is kept cool and may be preserved from exposure to the air. The advantage derived from the use of electrodes constructed according to my invention lies in the fact that for the same amount of energy consumed the cost of reduction is considerably lowered. A series of experiments and tests have demonstrated that in the reduction of barium carbonate a saving of over \$2. per ton in cost of the product is effected.

The action of a cooled electrode results in

the formation thereon of a solidified coating or film of the electrolyte material. It is well known that most chemical substances are conductors of electricity at a high temperature, but being poor conductors of heat the passage of the heat of the fused material is only slowly conducted to the metal of the electrode, and therefore to the cooling agent circulating therein.

10 The rate of flow of the cooling agent and the current density on the electrode surface should be so adjusted that at all times a thin film of the electrolyte is chilled on the surface of the electrode, thus protecting the latter
15 from the action of the liberated gases or other products of electrolysis at the anode or the cathode when working in direct current electrolysis. By properly regulating the supply of cooling agent in proportion to the current
20 density and temperature on the electrode surface the electrode has an economical range of application from low temperature fused work to the necessarily high temperature used in the manufacture of carbids, silicids, etc.

25 The cooling agent usually employed is water, but any suitable cooling agent, such as oil, mercury, etc., according to the nature of the work and the character of the electrode,
30 may be used.

It is advantageous to supply the cooling fluid under reduced pressure; in other words, to circulate the same through the electrode by means of suction, as by being drawn
35 through by a pump, so that in case of a leak in the electrode, instead of the water or other cooling agent exuding into the bath, the fused material will be drawn into the leak and chilled, thereby completely forming a plug which acts automatically to repair the leak. If pressure were employed

there would be a probability of the cooling agent escaping into the molten bath and causing a very serious explosion.

It is found, in the practical working of the electrode, that the employment of an electrode of the character described, but having its walls of too great thickness, is useless; since where the metal is too thick, (as at the corners for instance,) the action of the cooling agent is insufficient to prevent the melting of the metal. A very important feature of my invention therefore is that the electrode may be made of excessive thickness of metal and then fused down in the bath where it automatically assumes the right thickness.

It will be seen that, by my invention, I have provided an efficient and easily constructed electrode, which effects a considerable saving in the cost of reduction of various materials. Electrodes constructed according to my invention are specially adapted for use in electric furnaces for the reduction of carbonates and sulfates, as, for instance, barium carbonates and sulfates.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. An electrode having a metallic body portion the interior of which is hollow or chambered for the purpose described, and having an exterior coat or shell of carbon thereon.

2. An electrode having a body portion of a ferro-titanium alloy, which is hollowed or chambered for the purpose described, and having an exterior coat or shell of carbon thereon.

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