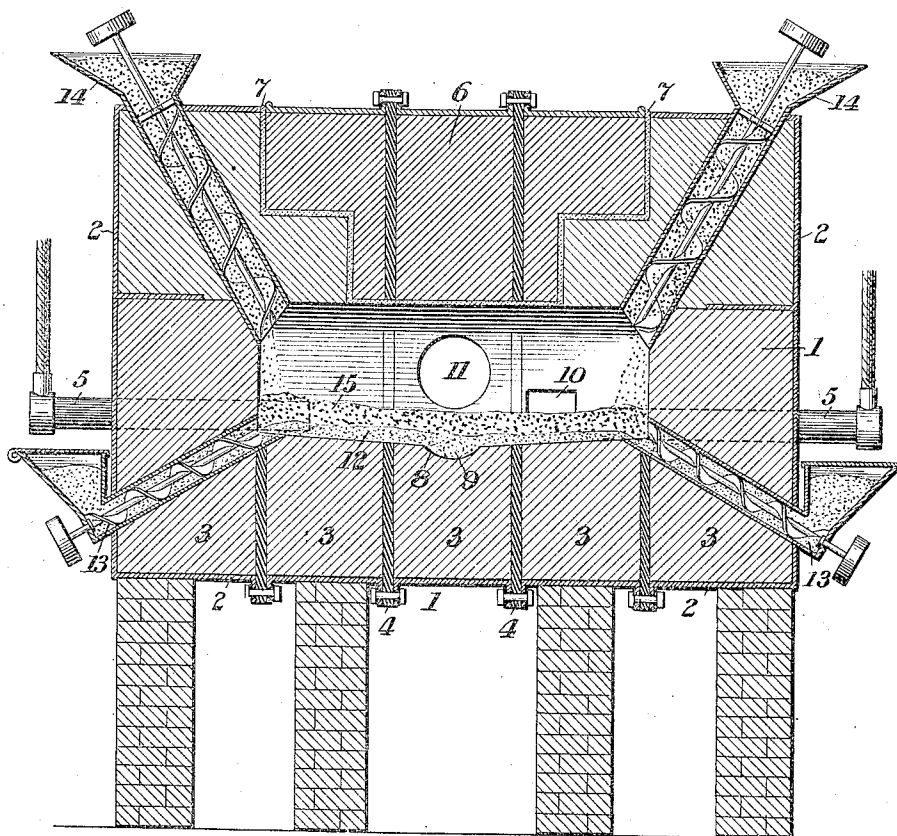


W. McA. JOHNSON.
ELECTRICAL HEATING METHOD.
APPLICATION FILED JAN. 11, 1904.

937,074.

Patented Oct. 19, 1909.



Witnesses:
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UNITED STATES PATENT OFFICE.

WOOLSEY MCA. JOHNSON, OF IOLA, KANSAS, ASSIGNOR TO THE CONTINUOUS ZINC FURNACE COMPANY, OF HARTFORD, CONNECTICUT, A CORPORATION OF CONNECTICUT.

ELECTRICAL HEATING METHOD.

937,074.

Specification of Letters Patent.

Patented Oct. 19, 1909.

Application filed January 11, 1904. Serial No. 188,544.

To all whom it may concern:

Be it known that I, WOOLSEY MCA. JOHNSON, a citizen of the United States, residing at Iola, in the county of Allen and State of Kansas, have invented certain new and useful Improvements in Electrical Heating Methods, of which the following is a specification.

This invention is a method of heating materials by means of the electric current.

In electric furnaces of the type wherein the temperature necessary for an operation of reduction, smelting or melting is developed by the passage of a suitable electric current through a body of material constituting the charge to be treated, it is in general essential that the chamber be provided with a refractory hearth or lining which is substantially unaffected by the charge or by the products of the operation, said refractory lining being acid, neutral or basic, in accordance with the character of the ore or material to be reduced or heated, fire-clay and magnesia being common examples of such materials. These materials are in general poor conductors of electricity at ordinary temperatures, but at high temperatures become capable of carrying considerable current, the heat developed thereby being, however, far less effectively applied than that developed within the charge itself or in immediate proximity thereto. Moreover, as the temperature of the hearth or lining increases, its conductivity also increases, whereby the losses from this source tend to increase very rapidly. I have discovered that such losses may be greatly reduced, or even substantially obviated, by maintaining in contact with the hearth of the furnace a body or layer of material of relatively high resistance, and maintaining above said high resistance body a body of the charge or material to be reduced or treated, said body being of relatively low resistance. Both the high resistance and low resistance bodies are preferably maintained in operative contact with the electrodes, and means are preferably provided for feeding both bodies, continuously or intermittently, to the furnace chamber. The high resistance body which is maintained adjacent to the hearth or lining of the furnace, may, in some cases, be a portion of the charge to be reduced, but is of such composition or of such physical

character as to offer a relatively high resistance, as above described.

For a full understanding of my invention, reference is made to the accompanying drawing, wherein one form of electric furnace suitable for carrying out my method is illustrated in vertical section.

In said drawing the furnace body is shown as constructed of refractory material 1, provided with a sheath or casing 2 which may be of metal. Said sheath and lining are preferably formed of any desired number of sections 3, 3, the planes of section being transverse to the direction of passage of the current through the charge. Layers of asbestos or other suitable refractory insulating material 4 are interposed between the sections in order to render the furnace substantially air-tight and to increase the electrical resistance of the lining.

5, 5 are electrodes, any desired number of which project in opposed pairs into the furnace chamber. The furnace chamber is closed by means of a cover 6, bedded in fire-clay or similar material 7, and preferably also constructed of insulated sections. The hearth of the furnace is shown as inclining slightly from the electrodes to a central, transverse trough or depression 8, at one end of which a tap-hole 9 may be provided.

10 represents the usual draw, and 11 an outlet for vapors; in case the furnace be used for the distillation of zinc, as hereinafter more particularly described, any suitable condenser may be provided in connection with said outlet 11.

Means for feeding the charge or body of high resistance are shown at 12, 12, as comprising suitable conduits, screw conveyers or other mechanical feeding devices therein, and hoppers, which may be fitted with closures. The material is forced in through the conduits 12 by the feeding means therein, either intermittently or continuously, at a sufficient rate to maintain a layer or body of high resistance material between said charge 15 and the furnace hearth or lining 3. Upon this layer the charge of relatively low resistance is fed through the hoppers 14. Similar means 14, 14 are illustrated for the introduction of the charge or body of lower resistance. I have indicated mechanical feeding devices in the charging conduits 14, but these may be omitted if de-

sired, and any suitable means may be substituted for those shown for the introduction of either charge.

It will be noted that by means of the construction shown the bodies of lower and higher resistance are maintained in superposed layers on the hearth, and that both of said bodies are illustrated as in contact with the electrodes. I do not limit myself, however, to the maintenance of the high resistance body 12 in contact with the electrodes. While I prefer to maintain a layer of said high resistance body over the entire hearth of the furnace, this is not essential to my invention.

I will now describe a specific example of my method, it being understood, however, that any suitable charges or mixtures may be used instead of those specified. As one such example, I may treat ores of zinc, substantially as described in my copending application Serial No. 188,545, filed January 11, 1904. According to the operation therein described, a ferruginous blende, or low grade ore containing iron, zinc and sulfur, is roasted, and thereafter subjected to reducing action under such conditions that the iron is reduced to metal in the form of particles disseminated throughout the body of the charge, the zinc being substantially unreduced. The charge is then introduced into the electric furnace and the current transmitted through the same to raise the temperature to such degree as will suffice for the distillation of the zinc, the reduction of the compound of zinc being effected by the iron, or wholly or in part by carbon or a carbonaceous reducing agent mixed with the charge.

A charge of the character above described is relatively conductive by reason of the metallic particles disseminated through it, and may constitute the charge or layer 15 above referred to. The charge or layer 12 of high resistance, to be introduced at 13 and serving as hereinbefore described to preserve the

furnace hearth from the full heating effect of the furnace operation, may consist of carbon in any suitable form, or of a mixture of carbon with a suitable ore, or with a compound such as magnesia or siloxicon which is substantially irreducible at the temperature employed.

As other specific examples I may mention that the body 15 may comprise any suitable ore or material to be heated, the ore being preferably mixed with sufficient carbon for its reduction, while the body 12 may comprise the same or another ore or material, which may or may not be mixed with carbon, it being essential only that the body 12 be of such composition, or degree of comminution, as to be of relatively high resistance as compared with the body 15.

I have described the hearth or lining as composed of a material the conductivity of which increases with the temperature; I desire it to be understood, however, that my invention is applicable to any hearth or lining of material which is capable under any conditions of transmitting an electric current.

I claim:—

1. The method of reducing leakage of current through the walls or lining of an electric furnace which consists in feeding between the charge and the walls of the furnace a granular material having a high electrical resistance relative to that of the charge.

2. The method of reducing leakage of current through the walls or lining of an electric furnace which consists in feeding between the charge and the walls of the furnace a granular material containing the constituents of the charge but having a high electrical resistance relative thereto.

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

WOOLSEY McA. JOHNSON.

Witnesses:

E. T. EWING,

A. M. EWING.