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METHOD OF HEATING MATERIAL BY ELECTRICITY.

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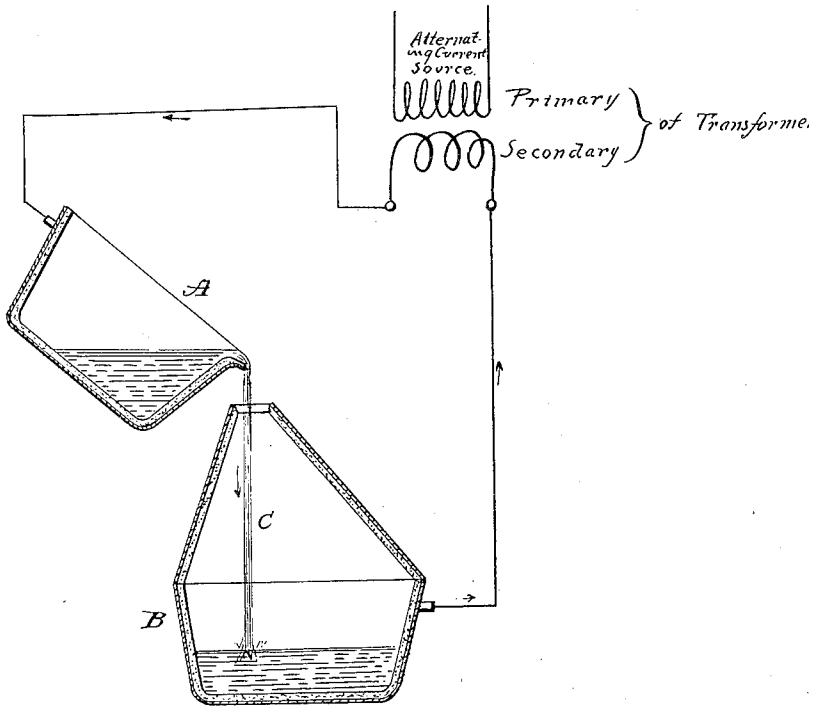

WITNESSES

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METHOD OF HEATING MATERIAL BY ELECTRICITY.

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Application filed March 2, 1906. Serial No. 303,828.

To all whom it may concern:

Be it known that I, WILLIAM S. FRANKLIN, of South Bethlehem, in the county of Northampton, and in the State of Pennsylvania, have invented a certain new and useful Improvement in Methods of Heating Material by Electricity, and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing, in which the figure shows a furnace or apparatus which may be used in the practice of my invention.

The object of my invention is to enable the heating of materials by electricity which will make unnecessary the employment of carbon or metal electrodes, and, indeed, the use of any electrodes in direct contact with the material to be heated, and to this end my invention consists in the method substantially as hereinafter specified and claimed.

In making my invention I have availed myself of the fact that the refractory linings of clay, sand, or magnesia of the iron or metal-bound ladles or pots used in smelting operations become fairly good electrical conductors at the temperatures which ordinarily exist in the use of such ladles or pots, it being possible to have a very considerable volume of current pass from the lining to the pot contents or melt, or vice versa, without generating an excessive amount of heat in the lining. Satisfactory results, however, cannot readily be secured by passing the current through so large a body or mass as constitutes the ordinary melt, and I, therefore, reduce the body or quantity of the melt in proportion to the volume of current, so that the temperature may be raised to the desired degree. One way of doing this is to employ two of the pots or ladles that, respectively, are the terminals of the circuit, the conductors, of course, being connected to the metal exterior of the pots or ladles, and I pour from one ladle to the other, thereby securing a constricted stream from one to the other, through which the current passes, and by reason of which heat is generated by the passage through it of the current. Of course, the size of the stream or jet from one pot to the other may be regulated at will by pouring more or less rapidly from one pot to the other. The material to be heated may be delivered in a melted form into the pot from which it is to be poured, or a suitable melted slag, raised to any desired high temperature, may be placed in the pot, and the material to be heated may be introduced into this slag, with which it will flow from one pot to the other.

I, of course, do not limit myself to the employment of any particular kind of apparatus for the practice of my invention, that which I have shown and described having been selected merely as one arrangement by which my method may be practiced. Thus, instead of pouring or delivering the stream into another ladle or pot, such as the ladle B, it might be delivered to, say, a large casting having a crack or flaw in it to be filled or repaired, the casting being connected with one of the terminals of the source of current, and the stream being directed into the crack or flaw.

Some of the uses to which my invention is applicable are the following:—

1. In ordinary iron foundry work it is sometimes desirable to melt a small charge of chromium or other refractory metal preparatory to its admixture to the cast iron in the large ladle. For this purpose a small amount of melted cast iron or slag may be drawn off into the ladles A and B of my jet furnace, heated up to any desired temperature, after which the chromium or other metal may be added and the electric treatment continued, if necessary, before the melt is poured into the main mass of cast iron.

2. It may be used as in the procedure described in the previous paragraph, in conjunction with the Bessemer or open hearth process for making steel. That is, refractory substances may be treated electrically before being added to the steel.

3. For the treatment of platinum or other metals which must be treated at very high temperature in the absence of carbon. In such a case, a suitable slag could be melted in an auxiliary furnace, poured into the jet furnace ladles and brought to any desired temperature. The platinum or other metal to be treated could then be introduced and the electric heating continued *ad libitum.*

4. It can be used on a large scale for the manufacture of high grade steel. For this purpose, it would be best to melt a suitable slag (basic slag for example) in an auxiliary furnace, pour it into the ladles A and B, both made as large as desired. With this slag the jet furnace could be gotten into operation. Then either molten cast iron or cold scrap could be introduced and the heat treatment continued until the desired composition has been reached. Then, instead of discharging the entire melt a portion could be left in the furnace ladles to start the operation anew, and so on.

5. My invention can be used for the melting of high grade glasses, the operation being once started by a melt from an auxiliary furnace. For glass melting this jet furnace would be particularly suitable, inasmuch as carbon electrodes are absolutely out of the question here, and inasmuch as the glass jet could be drawn out very long (and covered by a protecting hood) and a small current at any desired high voltage could be used.

6. And, in general, my invention can be used for the electric heating of any metallic or vitreous substance.

The advantages of my invention are, the entire absence of carbon electrodes; the possibility of using any one of a great variety of refractory linings for the furnace pots, an acid lining of sand, or a basic lining of lime or magnesia, or a neutral lining of refractory clay, this wide choice of lining material (which lining material is virtually the electrode material of the furnace) making it possible to suit the electrodes of the furnace to any substance, glass or metal, that is to be treated; the heat is produced in the material that is being treated, not in an auxiliary resistance material; and in its being adapted, even in small sizes, to the use of small currents at high voltages which, of course, means necessarily a reduction of every variety of difficulty which can possibly be associated with the delivery of current to and the taking of current from the furnace.

The disadvantage arising from the free radiation from the jet where the extreme temperatures in the furnace are reached is largely compensated by the possibility of preventing the loss of heat elsewhere. Thus, in the ordinary electrode furnace, an enormous amount of heat is carried off by the electrodes. Furthermore, the radiation from the intensely heated jet may be, to a great extent, prevented by a protective hood or cylinder of refractory material which surrounds the jet without touching it.

Having thus described my invention, what I claim is:—

1. The method of electrically heating a material, which consists in placing the same in a receptacle or holder having a metal exterior and a refractory lining, and passing the material in a stream from such receptacle or holder to a receiver, these two being the terminals of a circuit which includes the refractory lining and the material to be heated, the current being passed directly between the lining and the material.

2. The method of electrically heating a material, which consists in causing the same, in a heated condition, to pass in a stream from a holder or receptacle having a refractory lining to a receiver having a similar lining, these two being, respectively, the terminals of an electrical circuit.

3. The method of electrically heating a material, which consists in causing the same, in a heated condition, to pass in a stream from a holder or receptacle having a refractory lining and a metal exterior to a receiver having a similar lining and exterior, these two being, respectively, the terminals of an electrical circuit, the conductors of the circuit being attached to said metal exteriors.

4. The method of electrically heating a material having a high melting point, which consists in forming a stream of a material having a low melting point, having mixed therewith particles of the first-mentioned material and causing an electric current to pass through said stream.

5. The method of electrically heating a material having a high melting point, which consists in mixing said material with a body of melted material having a low melting point, forming a stream of said mixed materials between two receptacles, and including said receptacles in series in an electric circuit.

6. The method of electrically heating a material, which consists in passing the material from one point to another, in a stream, the stream being included in or forming part of an electric circuit and preventing the radiation of heat from the stream.

In testimony that I claim the foregoing I have hereunto set my hand.

WILLIAM S. FRANKLIN.

Witnesses:

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