

(No Model.)

E. A. COLBY.
ELECTRIC INDUCTION DEVICE.

No. 428,379.

Patented May 20, 1890.

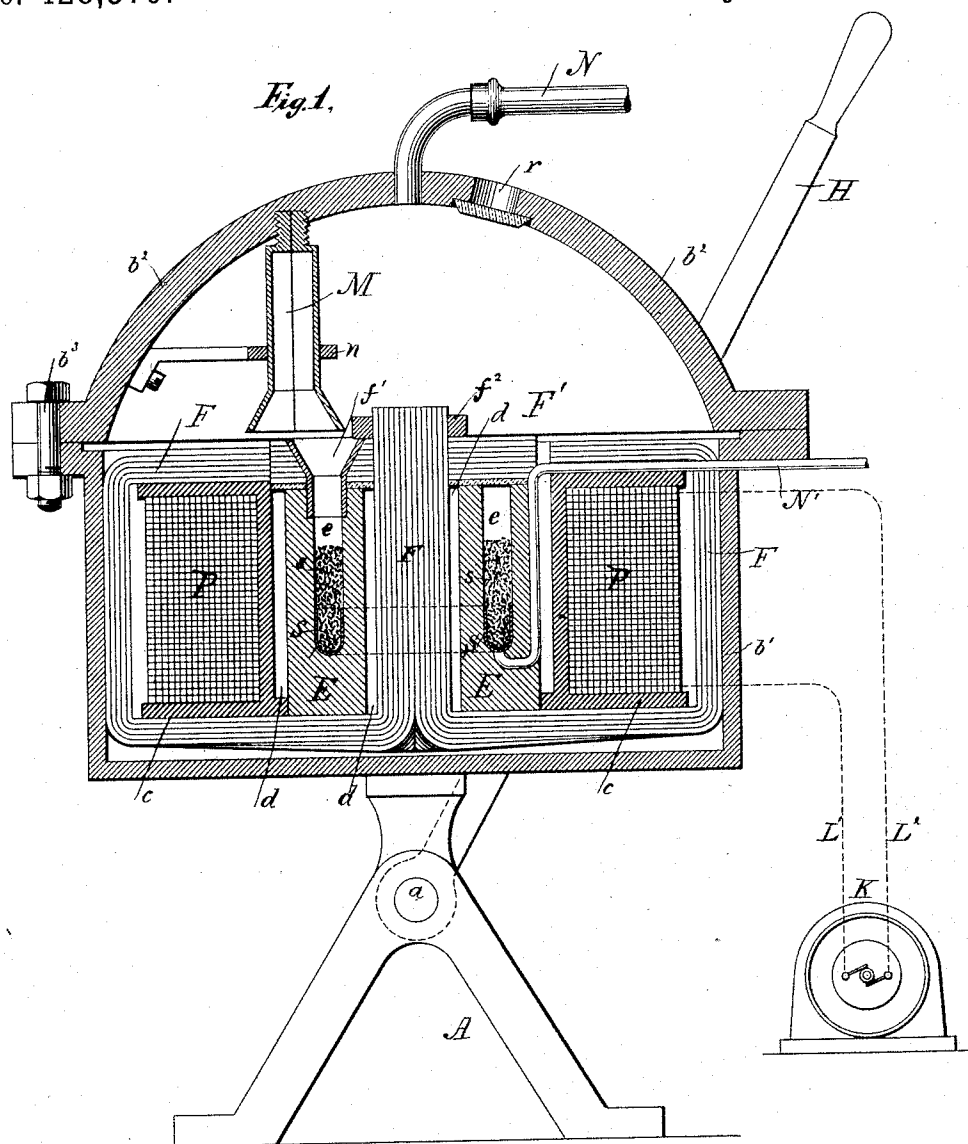
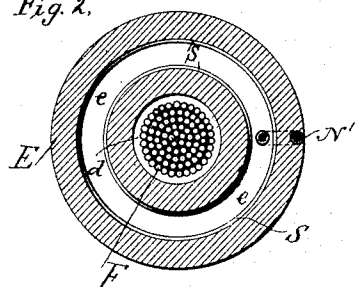


Fig. 2.



Witnesses

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UNITED STATES PATENT OFFICE.

EDWARD A. COLBY, OF NEW HAVEN, CONNECTICUT.

ELECTRIC INDUCTION DEVICE.

SPECIFICATION forming part of Letters Patent No. 428,379, dated May 20, 1890.

Application filed September 19, 1887. Renewed October 21, 1889. Serial No. 327,618. (No model.)

To all whom it may concern:

Be it known that I, EDWARD A. COLBY, a citizen of the United States, residing in New Haven, in the county of New Haven and State of Connecticut, have invented a certain new and useful Improvement in Electric Induction Devices, of which the following is a specification.

The invention relates to a class of devices employed for heating, melting, or smelting metals and non-metallic substances.

The object of the invention is to provide convenient means for heating the various materials to be operated upon through the agency of electric currents, and, if it is so desired, to treat them in a rarefied atmosphere.

The invention consists in providing a receptacle for the substance to be operated upon consisting of an electric conductor closed upon itself and constituting the secondary circuit of an electric induction-coil or converter, the primary of which is designed to be included in a circuit supplied with alternating intermittent or pulsatory electric currents. The receptacle is so constructed and is of such material that it will serve as a conductor of the heat required to fuse or properly heat the contained substance without being fused itself.

The invention will be described more particularly in connection with the accompanying drawings, in which Figure 1 is a vertical transverse section of a device for carrying out the invention, and Fig. 2 is a plan view of the receptacle.

Referring to the drawings, A represents a suitable stand upon which the furnace B is supported. This furnace may be carried upon a trunnion *a*. It consists in this instance of an outer casing *b'*, containing an inductive device presently to be described. The case *b'* is provided with a cover *b²*, which may be securely fastened down by bolts *b³*. The cover and case thus form an air-tight chamber. Within this chamber there is placed the induction device, and this consists of a primary coil P, a secondary conductor S, and a core F. The coil P is designed to be included in the circuit of a generator K, delivering alternating electric currents. This coil consists of suitable conducting-wire insulated with fire-proof material—such, for instance,

as asbestos. It is wound upon a spool *c*, which is preferably of refractory insulating material—such, for instance, as slate.

Within the coil P there is placed an annular block E of non-electric conducting material—such, for instance, as fire-clay or lime—capable of withstanding great heat. This may be separated from the coil P and iron core F by air-spaces *d*. The block E contains an annular groove *e*, in which there is set the annular trough or receptacle S, which is designed to receive the material to be heated or melted or otherwise operated upon. Such materials may be various chemical substances, organic or inorganic, having no chemical affinity for the containing-receptacle. The trough S may be of platinum, nickel, or other suitable conducting material which will not melt easily. The trough S is designed to constitute the secondary coil of the converter or induction-coil; but if the substance to be acted upon is itself a conductor of electricity it also may constitute to some extent the secondary coil.

For the purpose of better conveying the electric energy from the coil P to the conductor S the core F is employed. This may consist of iron wires which are preferably electrically insulated from each other to a greater or less extent. These wires extend through the center of the block E and across the bottom of the coil P, thence around the sides and across the top, as shown. The top of the block E is preferably covered by a disk *F'*, which is removable; but when it is in position it serves to complete the magnetic circuit through the core F. The disk *F'* is also composed, preferably, of radiating insulated soft-iron wires. The under side of the disk *F'* may be lined with some refractory material—such, for instance, as fire-clay or lime. The disk *F'* is constructed with one or more openings *f'*, for the purpose of allowing the material to be operated upon to be readily placed in the annular space *e*. The disk may be secured in place by a nut or washer *f²*, passing around the central portion of the core F.

It is designed that the primary coil P shall be connected in an electric circuit by means of conductors *L'* and *L²*, leading from the generator K or other suitable source of alternating,

intermittent, or pulsatory currents of high potential. Currents will thus be induced in the secondary circuit of the annular trough or receptacle S. Such currents will cause this trough to be heated, and thus any material—such as metals or non-conducting chemical substances or liquids—placed in the trough, as indicated at *s*, will be raised to a temperature dependent upon that of the trough. As there is but a single turn of the secondary circuit, the current will be of low intensity, but of great quantity, and thus the temperature may be raised to any required degree. Complete control of the temperature is secured by any of the usual devices for regulating the current in the primary circuit. Usually it is necessary that the volume of the substance contained in the receptacle S should be such that when heated or fused it shall exceed the capacity of that receptacle, so that no injury will come to it from over-heating.

This device is especially useful in melting non-conductors of electricity; but it may also be employed in connection with conducting materials.

The cover *b*² may be applied to the case *b*¹ after the substance is in position, and if it is desired to treat the substance in a rarefied atmosphere the air may be exhausted by means of a vacuum-pump applied to a tube N, leading through the cover. After the natural air has been exhausted, together with the gas which comes from the substance when heated, additional gas may be forced by a pump into the chamber through an inlet N', preferably leading into the lower portion of the containing-vessel S, and thus up through the melted substance. Gases may be employed which have a chemical affinity for the impurities contained in the substance being operated upon, or which form with the substances under treatment definite desired compounds. The resultant gaseous products are then removed from the chamber by the vacuum-pump.

The physical properties of metals are easily modified by slight variations in the density and chemical composition of the atmosphere in which they are melted and cast. Certain of the more refractory metals, particularly palladium, when heated, combine readily with hydrogen, forming by their union, which is apparently mechanical, alloys possessing specific properties. It is supposed that the hydrogen assumes the solid state, acting as a quasi metal. The volume of gas thus absorbed varies with its pressure and the temperature of the metal. The alloys thus formed generally exhibit increased specific gravity and volume and diminished electrical and calorific conductivity.

When the substance has been sufficiently treated, the entire furnace may be turned upon the trunnion *a* by means of a handle or lever H, and, if desired, the vacuum-pump may still be in operation. The substance will then be caused to flow into a mold M,

which is fastened to the cover and held in position above one of the openings *f*' by means of a support *n*, fastened to the cover. 70

A peep-hole *r*, closed by a glass disk, may be formed in the cover at a suitable point for observing the operation.

The process of treating or refining metals and other substances which is set forth and described in this application I do not claim herein, having made such process the subject of an application, Serial No. 258,172, filed December 17, 1887. 75

I claim as my invention— 80

1. The combination, with a primary circuit and means for supplying currents thereto, of a refractory conducting-receptacle constituting a closed secondary circuit and adapted to receive the substance to be operated upon and placed in inductive relation to the primary circuit, whereby currents may be induced therein by the action of currents in the primary circuit. 85

2. The combination, with a primary circuit and refractory insulating material covering the same, of a core of soft iron under the inductive influence thereof, a mold of refractory conducting material surrounding a portion of the core and adapted to receive the substance to be operated upon, said mold constituting a secondary electric circuit. 90 95

3. The combination, with the primary coil of an electric converter, of electric conducting material adapted to contain metallic or non-metallic substances to be heated or refined, said electric conducting material constituting the secondary circuit of the converter. 100

4. The combination, with the primary coil of an electric converter, of conducting material adapted to contain metallic or non-metallic substances to be refined, said conducting material constituting the secondary circuit of the converter, and an air-tight inclosing-case containing the same. 105 110

5. The combination, with an air-tight inclosing-case, of an electric conducting-receptacle for the substance to be operated upon by heat contained within said air-tight case, a core of soft iron extending through said receptacle, and an insulated conductor disposed about said core. 115

6. The combination, with the primary circuit of an electric converter or induction-coil, of a soft-iron core applied thereto, an electric conducting-receptacle for refining, having an opening for containing the substances to be refined, said receptacle being placed in inductive relation to said core and forming the secondary circuit in whole or in part. 120 125

In testimony whereof I have hereunto subscribed my name this 7th day of September, A. D. 1887.

EDWARD A. COLBY.

Witnesses:

DANL. W. EDGECOMB,
CHARLES A. TERRY.