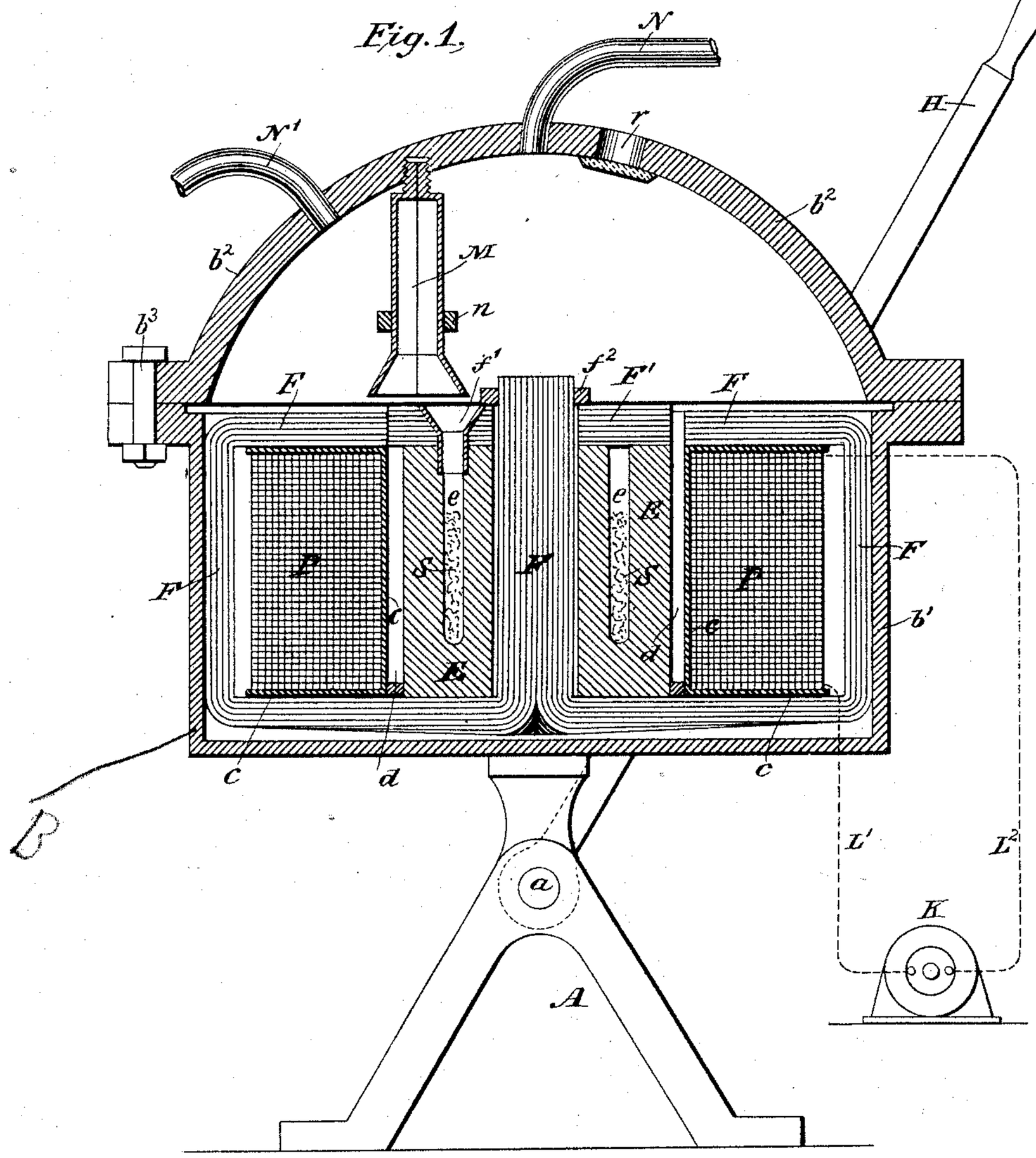
(No Model.) 2 Sheets—Sheet 1.

E. A. COLBY.

ELECTRIC FURNACE FOR MELTING METALS.

No. 428,378. Patented May 20, 1890.

Fig. 1.



Witnesses

Geo. W. Breck.

Edward Thorpe.

Inventor

Edward A. Colby

By his Attorneys

Pope Edgecomb & Terry

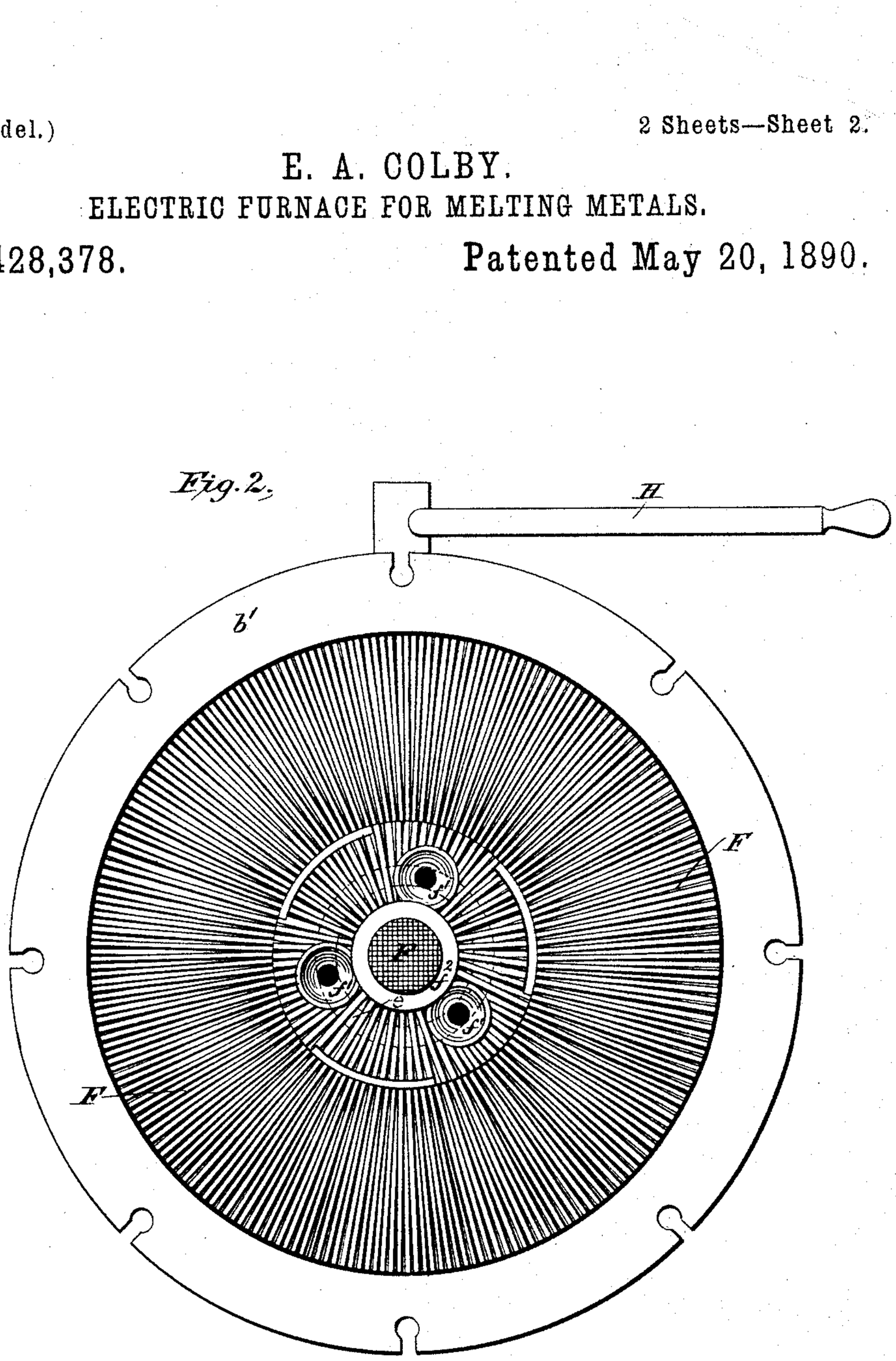
(No Model.) 2 Sheets—Sheet 2.

E. A. COLBY.

ELECTRIC FURNACE FOR MELTING METALS.

No. 428,378. Patented May 20, 1890.

Fig. 2.



Witnesses

Geo. W. Breck.

Edward Tharpe

Inventor

Edward A. Colby

By his Attorneys

Pope Edgecomb & Terry

UNITED STATES PATENT OFFICE.

EDWARD A. COLBY, OF NEW HAVEN, CONNECTICUT.

ELECTRIC FURNACE FOR MELTING METALS.

SPECIFICATION forming part of Letters Patent No. 428,378, dated May 20, 1890.

Application filed April 14, 1887. Serial No. 234,752. (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 certain new and useful Improvements in Electric Furnaces for Melting Metals, of which the following is a specification.

The invention relates to a class of devices employed for smelting, refining, and casting metals.

The object of the invention is to provide means for refining and casting various metals, especially platinum, in such manner that they will be free from blisters, pin-holes, and occluded gases. Many of the metals have a high absorptive capacity for gases. This affinity is especially manifested at elevated temperatures between the more refractory metals and hydrogen. Upon solidification from the molten state a portion of these occluded gases is retained; but the larger proportion is expelled violently if the metal cools rapidly, sometimes ejecting molten particles, and creates in its exit minute fissures, termed "pin-holes," or, in the aggregate, "blisters," throughout the mass. Castings made in the ordinary manner are therefore unhomogeneous in structure. This defect may be greatly magnified in castings of platinum and its allied refractory metals, which are smelted with the oxyhydrogen flame, because, it being impracticable to supply the component gases of the flame in the exact proportion of their affinitive volumes, an excess of hydrogen is generally present free to be absorbed by the molten metals. An unhomogeneous structure, while perhaps of slight importance in any metallic mass, may entail serious consequences when, for example, the metal is drawn into a fine wire, as any defect in structure then becomes a hidden source of trouble. This is especially true where, as in the manufacture of incandescent electric lamps, it is of the utmost importance that the platinum sealed in the glass should be of uniform density. In this specific case the slightest fissure in the platinum wires serves as a reservoir and possibly as a channel for the entrance of gases capable of destructive union with the carbon filaments. Many laboratory experiments have been made to produce a high grade of metallic castings for specific uses; but the beneficial results attained have involved methods too expensive for commercial adoption.

The present invention consists in providing means for heating metals and refining them in a closed and gas-exhausted containing-vessel by means of the inductive action of electric currents and in casting them while so heated and deprived of occluded gases into ingots.

The invention will be described in connection with the accompanying drawings, in which—

Figure 1 is a vertical transverse section, and Fig. 2 is a plan view, of a device adapted to the purpose of the invention.

Referring to the figures, A represents a suitable stand or support for holding the furnace B. The furnace is itself supported upon a trunnion *a*, and consists of an outer casing *b'*, preferably containing an induction device, presently to be described. The case *b'* is provided with a cover b^2, adapted to be securely fastened down by means of bolts b^3, forming a closed air-tight chamber. Within the case *b'*, which may be of brass, there is placed the primary coil P of an induction device, constituting the furnace proper. This coil consists of suitable conducting-wire insulated with fire-proof material—such, for instance, as asbestus. It is wound upon a spool *c*, which is preferably of insulating refractory substance—such, for instance, as slate. Within the coil P, but separated therefrom by an annular air-space *d*, 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 block contains an annular groove *e*, designed to receive the metal which is to be refined and cast. Such metal may be placed in the furnace in the form of scraps in a sufficiently compact form to constitute a closed metallic circuit, as shown at S. The metal S is designed to constitute the secondary coil of the converter or induction-coil, and for the purpose of better conveying electric energy thereto a core F is

employed. This consists of iron wires, which are preferably magnetically separated from each other, extending through the center of the block E, across the bottom of the coils P, and around the side and across the top, as shown. The top of the block E is preferably covered by a disk F′, which is removable, but which when in position completes with the core F a closed magnetic circuit. The disk F′ is also composed, preferably, of radiating soft-iron wires magnetically separated from each other. The under side of the disk F′ is lined with some refractory material, as fire-clay or lime.

The disk F′ is constructed with one or more openings f', for the purpose of allowing the metal to be readily placed in the annular space *e*. The disk is secured in place by a nut or washer f^2, 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 a generator or other suitable source of alternating, intermittent, or pulsatory currents K of high potential, and thereby currents shall be induced in the secondary circuit formed by the scraps of metal contained in the opening *e*. Such currents will circulate in the annular metallic circuit thus formed and cause the metal to be heated. As there is but a single turn, the current will be of low intensity, but of great quantity, and will serve to raise the temperature of the metal until it melts. Complete control of the temperature is secured by any of the usual devices for regulating the current in the primary circuit.

The cover b^2 may be applied to the case b' after the metal is in place, and the air is then to a greater or less extent exhausted from the entire case by means of a vacuum-pump applied with flexible connection to a tube N. The cover is preferably, however, applied after the metal has been melted. After the natural air has been exhausted, together with the gases which come from metals, additional gases may be applied through a second inlet N′, these gases being of such character as to have a chemical affinity for such impurities as may be contained in the molten metal, thus tending to purify the same. The resulting gaseous products are likewise removed by the vacuum-pump and the exhaustion continued to its practical limits.

When the metal has been melted and purified, the entire furnace is turned upon the trunnion *a* by a handle or lever H, the vacuum-pump continually acting, and the molten metal is caused to flow into a mold M, which is fastened to the cover b^2 and held in position above one of the openings f' by means of a support *n*, fastened at different points to the cover.

A hole *r* is formed in the cover at a suitable point for observing the operation of the furnace, and this opening is closed by thick glass.

After the casting has been made the metal may be worked in the usual manner. Marked physical modifications will be observed in such castings, such as change in color, increased homogeneity, malleability, ductility, and electrical conductivity.

The precise form of apparatus here shown and described is not essential in carrying out the invention; but it will be understood that the general plan is to cause the metal which is to be smelted itself to form the secondary circuit of an inductorium or converter, the primary circuit of which is supplied with suitable alternating, intermittent, or undulatory currents for inducing in such secondary circuit currents of a character which will melt the metal contained therein.

I claim as my invention—

1. The combination, with a closed primary circuit and means for supplying electric currents thereto and controlling the same, of a refractory mass adapted to contain metal to constitute a secondary circuit and adapted to place such metal in inductive relation to the primary circuit, whereby electric currents may be induced therein by the action of electric currents in the primary circuit.

2. The combination, with a primary coil of wire and refractory insulating material covering the same, of a core of soft iron under the inductive influence thereof and a mold of refractory material surrounding a portion of the core and adapted to receive metal to constitute a secondary circuit, substantially as described.

3. The combination, with the primary circuit of an electric converter or induction-coil, of a core of soft iron applied thereto and a receptacle for refining metals having an opening for containing the metals, whereby the latter may be brought into inductive relation to said core.

4. The combination, with the primary coil of an electric converter, of a mass of refractory material adapted to contain metal or metals to be refined, which are to constitute a secondary coil, and an air-tight inclosing-case containing the same.

5. The combination, with an air-tight inclosing-case, of a receptacle for metals to be refined contained within the air-tight case, a core of soft iron extending through said receptacle, and a coil of insulated wire disposed about such core.

6. The combination, with the air-tight inclosing-case b', having a cover b^2, of the primary coil P, adapted to be placed in an electric circuit, the soft-iron core F, to which said coil is applied, the disk F′ of soft iron, and the refractory receptacle E, having the opening *e*.

7. The combination of a pivoted air-tight chamber, an induction-coil or converter con-

tained therein, the secondary circuit of which consists of metal or metals to be refined, an infusible receptacle for the same, an inverted mold above the receptacle, means for exhausting gases from the chamber, and means for turning the chamber upon its axis, thereby emptying the contents of the receptacle into the mold.

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

EDWARD A. COLBY.

Witnesses:
MORRIS F. TYLER,
JAMES F. COLBY.