No. 842,099. PATENTED JAN. 22, 1907.

G. C. LANDIS.

ELECTRIC MELTING OR REDUCING FURNACE.

APPLICATION FILED SEPT. 21, 1904.

2 SHEETS—SHEET 1.

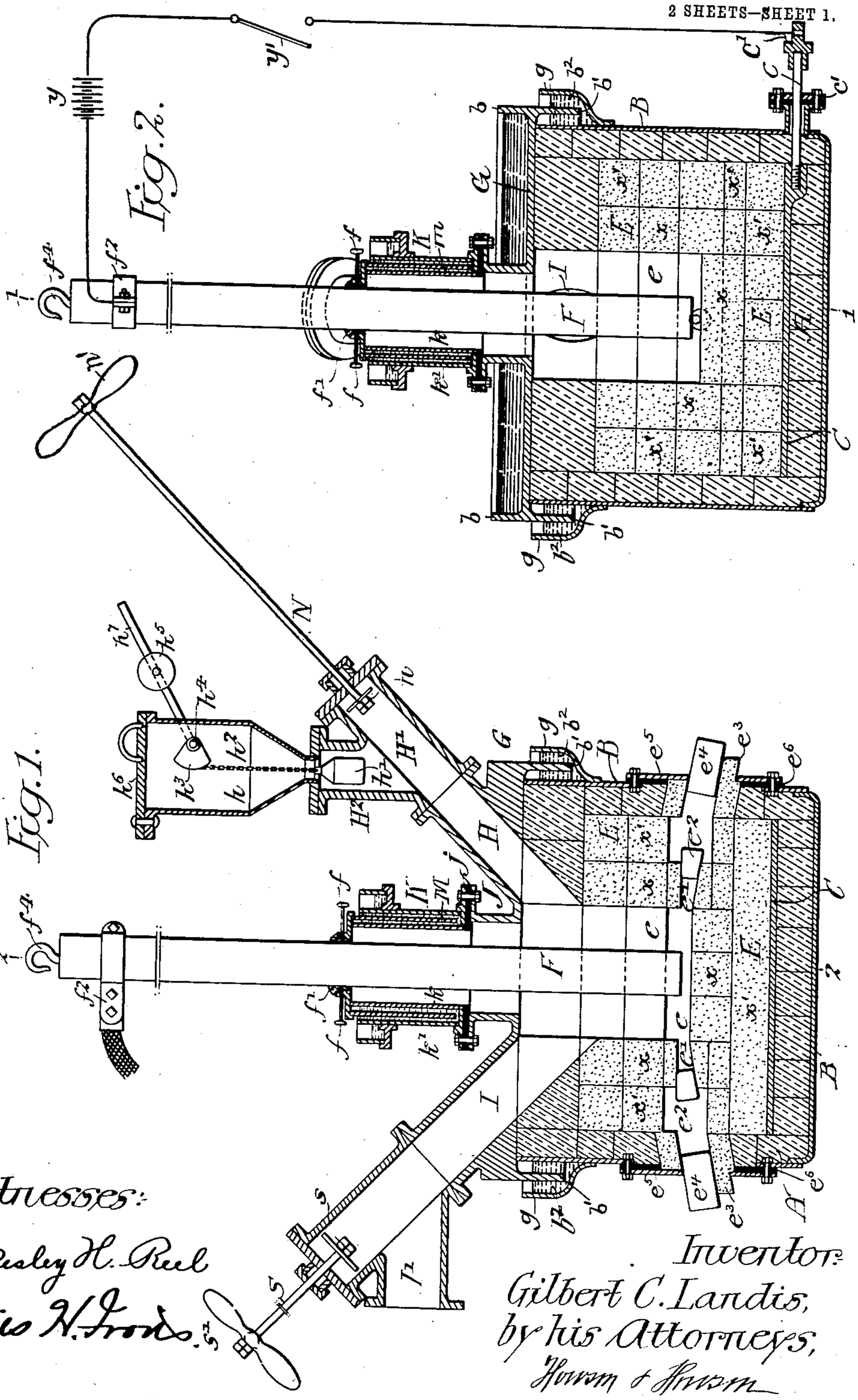

Fig. 1.

Fig. 2.

Witnesses:

Wesley H. Peel

Titus H. Woods.

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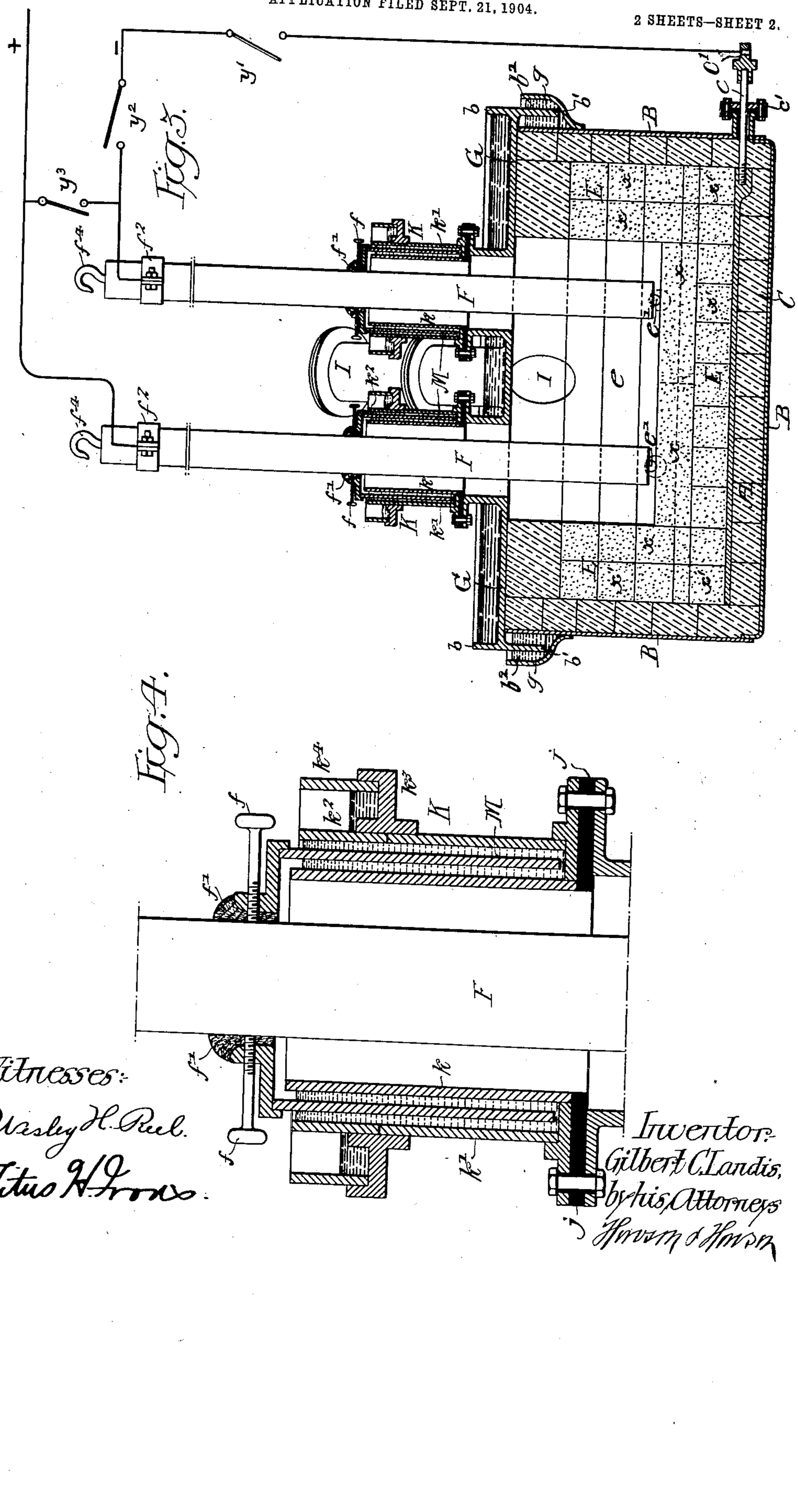

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UNITED STATES PATENT OFFICE.

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ELECTRIC MELTING OR REDUCING FURNACE.

No. 842,099. Specification of Letters Patent. Patented Jan. 22, 1907.

Application filed September 21, 1904. Serial No. 225,361.

To all whom it may concern:

Be it known that I, GILBERT C. LANDIS, a citizen of the United States, residing at Carlisle, Pennsylvania, have invented certain Improvements in Electric Melting or Reducing Furnaces, of which the following is a specification.

The objects of my invention are to so construct the furnace as to prevent fumes, vapors, or gases from escaping therefrom or from being absorbed by the furnace-lining, to permit ready adjustment of the carbon electrode of the furnace, and to simplify and cheapen the repair or replacement of those portions of the furnace which are subject to wear. These objects I attain in the manner hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a view, partly in elevation and partly in section, on the line 1 1 of Fig. 2, the furnace shown being designed for the use of a single carbon electrode. Fig. 2 is a view, partly in elevation and partly in transverse section, on the line 2 2, Fig. 1. Fig. 3 is a view similar to Fig. 2, but illustrating the use of a plurality of carbon electrodes and the electrical connections therefor; and Fig. 4 is an enlarged section of a portion of the furnace.

The metallic casing B of the furnace is preferably of rectangular shape and contains a lining A, the latter being composed of vitrified or other non-absorbent bricks or blocks united by a non-absorbent mortar or cement—such, for instance, as one composed of silicate of soda and powdered asbestos. Within this outer non-absorbent lining A of the furnace is a lining E, composed of bricks or blocks of carbon or other heat-resisting and electric conducting material, and this conducting-lining is preferably composed of an inner set of blocks x and an outer set of blocks x', so that when in the operation of the furnace the inner blocks become worn away they can be replaced without disturbing the outer blocks x', the relining of the furnace being thereby effected more cheaply than if the entire carbon lining had to be removed.

The purpose of constructing the outer lining A of the furnace from vitrified or other non-absorbent bricks or blocks laid in a non-absorbent mortar or cement is to prevent the absorption by said outer lining of gases, fumes, or vapors generated during the action of the furnace, thereby preventing loss of such fumes, gases, or vapors or rendering unnecessary the removal and subsequent treatment of the lining A for their recovery.

The carbon lining E of the furnace rests upon a base-plate C of conducting material, which has a rod c projecting through the lining A and casing B of the furnace and through a cap-plate c', suitably insulated from said casing B, said rod c being provided with a terminal block C′, to which one of the electric conductors is suitably attached.

The furnace has a removable cap-plate G, which is provided at its outer edge with an upturned flange b and a downturned flange b', the upturned flange constituting the cap-plate a tray or vessel for the reception of water or other cooling fluid, whereby its temperature is maintained at a low point, the downturned flange of the plate dipping into a chamber b^2, formed between the upper portion of the casing B and a flange g, which extends around said casing and is secured thereto, this chamber containing water or other suitable liquid or other sealing agent whereby the escape of any fumes from the furnace between the top of the same and the cap-plate is effectually prevented.

The cap-plate G has a central vertical projecting neck J and two inclined necks H and I, the neck H serving for the delivery to the treating-chamber of the furnace of the material to be acted on thereby and the neck I serving for the escape of the fumes, vapors, or gases resulting from the treatment.

The neck H has an extension H′ with branch H^2, upon which is mounted a hopper h for receiving the material to be treated, the bottom of this hopper being normally closed by a valve h', which is suspended by a chain h^2 from a segment h^3 on a rock-shaft h^4, the latter having an operating-lever h^7 with counterweight h^5, whereby the valve h' can be readily raised, so as to close the bottom of the hopper, or lowered, so as to permit of the flow of material from the hopper into the furnace. The top of the hopper h is provided with a pivoted and horizontally-swinging cap or cover h^6.

The neck J has mounted upon it a sealing vessel K, suitably insulated from said neck by means of an interposed mass of non-conduct-

ing material *j*, this sealing vessel having inner and outer walls *k k'*, between which is a chamber containing water or other suitable fluid or other sealing agent, into which dips the depending portion of an inverted cup M, which is secured, by means of transverse screws *f*, to the carbon electrode F, the latter having at its upper end a suitable connection f^2 for an electrical conductor and being also in the present instance provided with a hook f^4, whereby it can be suspended from or otherwise attached to a crane or other supporting and adjusting device, vertical adjustment of the carbon electrode F being necessary in order that its lower end may bear the proper relation to the mass of material contained in the working chamber *e* of the furnace, so that the load or electrical energy may be constant or so that the lower end of the electrode may be held free from contact with such material if the furnace is operating on the arc principle, or can be embedded in the material if the latter is intended to be heated to incandescence by the passage of the current therethrough. Such adjustments of the carbon electrode F are, by reason of the seal K M, readily permitted without any escape of fumes, vapors, or gases from the furnace, and if, because of the wearing away of the lower end of the carbon electrode, vertical readjustment of the latter in respect to the sealing-cup M becomes necessary such vertical readjustment can be readily effected without arresting the operation of the furnace by slackening the set-screws *f* and lowering the electrode through the cup, a luting *f'* of fire-clay or other refractory material closing the joint between the electrode and the cup M, so as to prevent the escape of any fumes, gases, or vapors at that point. By this means I provide a simple and effective substitute for the ineffective stuffing-boxes which have sometimes been employed for forming the joint with the adjustable electrode in an electrical furnace. Stuffing-box packing applied directly to the surface of the carbon electrode is not effective because of the relatively rough and irregular surface presented by the latter, and if the carbon electrode is provided with a metal casing for the purpose of insuring a tighter joint at the stuffing-box said metal is rapidly destroyed by the heat of the furnace.

The outer wall *k'* of the sealing vessel K has, some distance below the top of the same, a projecting flange k^3, with vertically-projecting flange k^4, forming a chamber k^2 for the reception of any water or other sealing liquid which may overflow from the sealing-chamber between the walls *k k'*, thereby preventing such overflow from forming a short circuit between the carbon electrode F and the cap-plate G of the furnace.

The neck I of the cap-plate G is provided with a discharge branch I', and both necks H and I are provided with reciprocating scrapers for the purpose of removing therefrom the products of condensation which accumulate therein, the scraper which operates in connection with the neck H H' being represented at *n* and that which operates in connection with the neck I I' being represented at *s*.

The scraper *n* is carried by a rod N, which passes through a suitable stuffing-box at the outer end of the neck H', said rod having a handle *n'*, whereby the scraper can be readily moved up and down through the neck H H', so as to remove any accumulations therefrom and deliver them into the treating-chamber *e* of the furnace. The scraper *s* is likewise provided with a rod S, having a handle *s'*, said rod passing through a suitable stuffing-box at the outer end of the neck I.

The inner carbon lining *x* of the furnace is provided with oppositely-disposed tapping-openings *e'*, provided with suitable plugs e^2, and the outer carbon lining *x'* is provided with tapping-spouts e^3, which are normally closed by means of plugs e^4 of carbon or other heat-resisting material. The inner plugs e^2 may likewise be composed of carbon, although in practice it has been found sufficient to make these plugs of wood, which are quickly carbonized by the heat of the furnace. By providing inner and outer tapping-openings *e'* and e^3 I am enabled to use a plug e^2 of wood for the inner opening without luting, as it is difficult of access, and I close the outer opening by the plug e^4, which is luted, preventing air reaching the inner wooden plug.

The furnace is continuous in its operation, and the molten slag is tapped therefrom at suitable intervals. The tapping-openings are by reason of the friction of the flowing slag worn away more rapidly than the blocks of the inner carbon lining *x*. Hence the provision of two sets of tapping-openings, so that when one set becomes worn so as to be incapable of further use it can be permanently plugged and the other set brought into action until it also becomes worn out, by which time a renewal of the inner carbon lining *x* of the furnace will be necessary. The outer tapping-spouts e^3 of the furnace are retained in place by external plates e^5, properly insulated from the body of the furnace by means of interposed layers e^6 of non-conducting material.

The carbon electrode F is preferably of rectangular cross-section, so that the unused ends of the electrodes may be utilized to form lining-blocks *x* or *x'* for the furnace, such rectangular form of the electrodes furnishing another reason why an ordinary stuffing-box would not be effective for packing the joint between the same and the cap of the furnace.

In Fig. 2, *y* represents a battery or other suitable generator of electricity, one pole of which is connected to the electrode F and the other to the terminal block C' of the base-

plate C, upon which rests the carbon lining of the furnace, the latter connection having a suitable switch y'.

In the furnace shown in Fig. 3 a plurality of electrodes F are employed, and in this case the electrical connections are provided with three switches y' y^2 y^3, so that if the switches y' and y^3 are closed and the switch y^2 is opened the two electrodes constitute the positive terminal and the carbon lining of the furnace constitutes the negative terminal, while if the switches y' and y^3 are opened and the switch y^2 closed one of the electrodes constitutes the positive terminal and the other the negative terminal, thus providing for the operation of the furnace under different conditions, as may be considered most advisable.

Having thus described my invention, I claim, and desire to secure by Letters Patent—

1. The combination in an electric furnace, of a body portion, a top plate, a neck projecting from the top plate, an extension on said neck forming one portion of a fluid seal, insulating material between the neck and the extension, a movable element of said sealing device, means by which said element is secured to the electrode which passes through the neck into the body of the furnace, and a receptacle on the extension above said insulation for receiving the overflow of sealing fluid from the sealing device, substantially as described.

2. The combination in an electric furnace, of a body portion, a top plate having a flange so as to hold a body of water to cool the said top plate, a neck extending above the water-line, an extension on said neck through which the electrode passes, a seal-joint between said extension and the electrode, and insulation between the neck and the extension above the water-line, substantially as described.

3. The combination in an electric furnace, of a casing having a non-absorbent outer lining, an inner lining comprising inner and outer portions both made of carbon blocks, the inner portion being removable independently of the outer portion, substantially as described.

4. An electric furnace having a carbon lining comprising inner and outer portions, each provided with a plugged tapping-opening, substantially as described.

5. An electric furnace having a carbon lining comprising inner and outer portions, the inner portion having a plugged tapping-opening and the outer portion having a projecting tapping-spout, substantially as described.

6. The combination in an electric furnace, of a metallic casing and a body portion of non-conducting material, a lining of conducting material, a retaining-plate secured to the metallic casing and having an opening, a tapping-spout of conducting material extending through said plate, and insulating material between the plate and the casing, said material also insulating the spout from the casing, substantially as described.

7. The combination in an electric furnace, of a body portion having a conducting-lining, an electrode extending into the furnace, a top plate, an inclined passage therein, said passage extending through the upper portion of the furnace and communicating with the reducing-chamber, said passage being so arranged that a tool may be passed through the inclined passage into the reducing-chamber to break the arch of material being treated above the bath, substantially as described.

8. The combination in an electric furnace, of a casing having a non-conducting lining, an electrode vertically arranged within the furnace, a top plate secured to the body of the furnace having a neck through which the electrode extends, two inclined passages extending through the top plate of the furnace, a feed-hopper connected to one passage and a gas-discharge pipe communicating with the other passage, a scraper in each passage, each scraper having a rod, and a stuffing-box at the end of each passage through which the rod extends, whereby the said passages can be cleaned and the crust over the material to be treated can be broken, substantially as described.

9. The combination in an electric furnace, of a body portion having a carbon lining, a top plate made in a single casting secured to the said body portion, a gas-tight joint between the body portion and the top plate, said top plate having a central neck and two side inclined passages, a flange whereby a body of water may be held on the top plate, an extension above the neck, insulating material between the extension and the neck above the water-line, a carbon extending through the central passage, a seal-joint between the carbon and the extension of the neck, a feed-hopper connected with one of the inclined passages, the other inclined passage being the gas-outlet, and scrapers in each passage, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GILBERT C. LANDIS.

Witnesses:
WILL. A. BARR,
JOS. H. KLEIN.