F. A. J. FITZ GERALD.

ELECTRIC FURNACE.

APPLICATION FILED MAY 13, 1909.

950,904.

Patented Mar. 1, 1910.

2 SHEETS—SHEET 1.

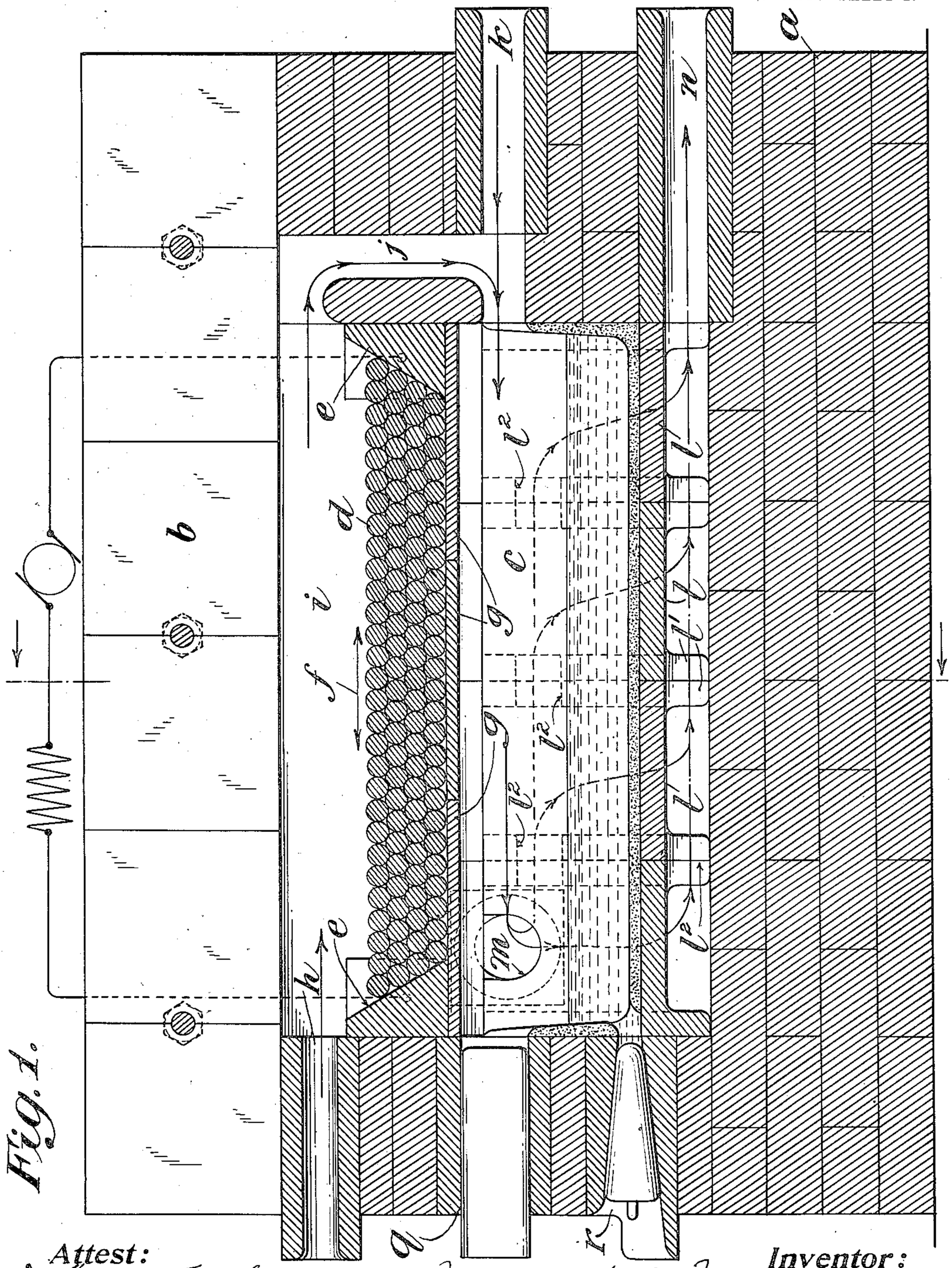

Fig. 1.

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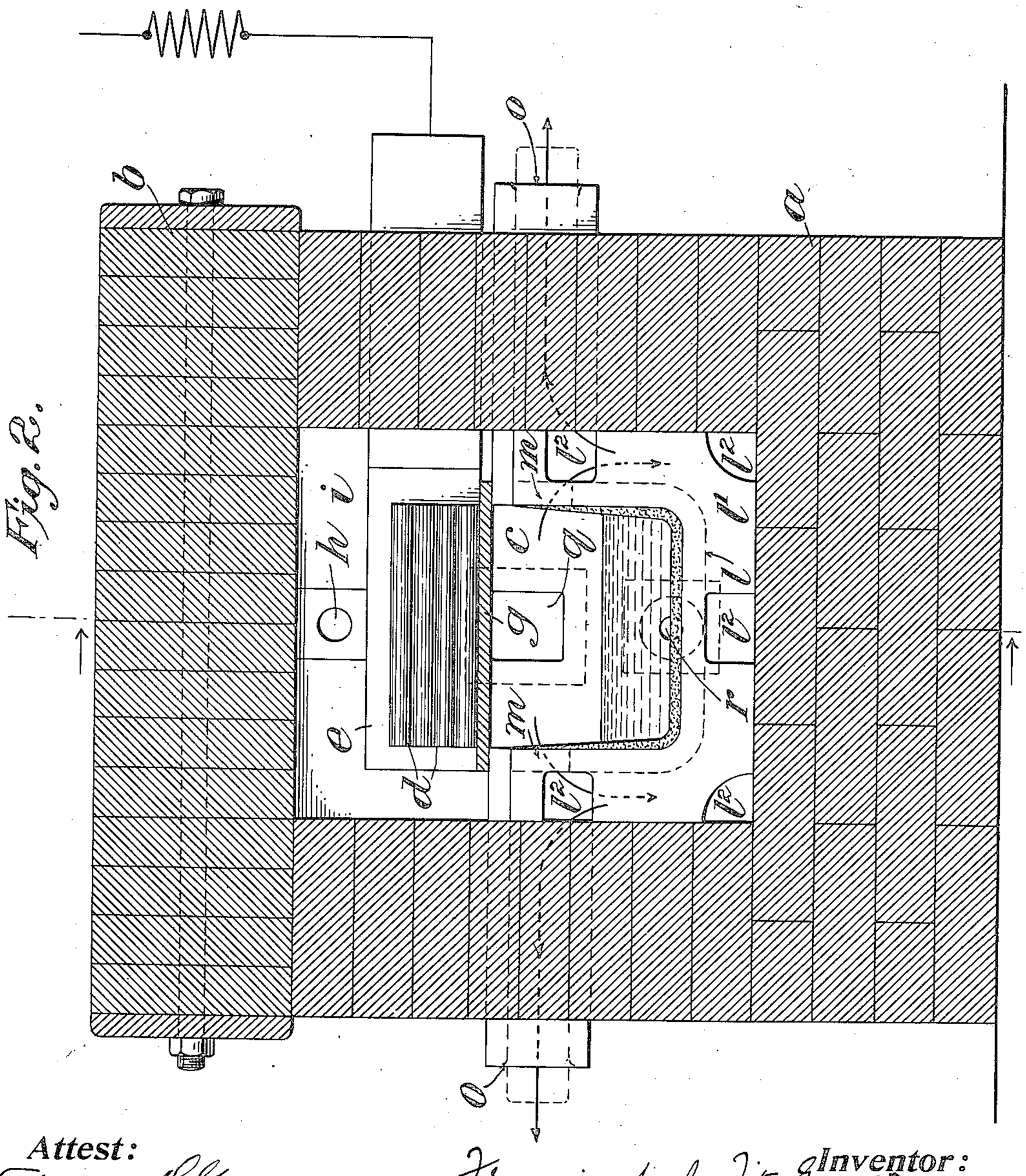

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UNITED STATES PATENT OFFICE.

FRANCIS A. J. FITZ GERALD, OF NIAGARA FALLS, NEW YORK, ASSIGNOR TO IMBERT PROCESS COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ELECTRIC FURNACE.

950,904. Specification of Letters Patent. Patented Mar. 1, 1910.

Application filed May 13, 1909. Serial No. 495,726.

To all whom it may concern:

Be it known that I, FRANCIS A. J. FITZ GERALD, a subject of the King of Great Britain, and a resident of Niagara Falls, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

It is well known that in attaining higher ranges of temperature, electric energy can be used most efficiently when the load, or "peak", is approaching the maximum, and that fuel, on the other hand, can be most efficiently employed to raise the temperature of a mass from the usual normal to a relatively moderately high temperature.

It is the main object of the present invention to provide a furnace in which advantage may be taken of this well known fact, or, in other words, to combine in a single furnace-unit a means for applying fuel to heat the furnace from normal temperatures up to higher temperatures and an electric heating means to attain the higher ranges of temperature.

The invention is also concerned with the provision of means for controlling both the character and application of the fuel heat whereby it may be employed independently of the electric heat to deliver, at will, directly to the furnace chamber, an oxidizing, neutral or reducing flame, or to act concurrently with the electric means to heat the furnace only by conduction and thus serve as a partial resistant to the loss of electric heat.

In the depiction of the invention disclosed in the accompanying drawings, Figure 1 is a view in central longitudinal section of one embodiment thereof and, Fig. 2 is a view in central transverse section.

The furnace, the main body of which is indicated at *a*, is provided with a cover *b*, a melting or furnace chamber *c*, electric heating means such as a carbon resister *d*, and terminals *e* for the resister, the path of the current being indicated by the arrows *f*.

The resister may be formed by aggregating a considerable number of carbon rods in contact, right and left, with the terminals, the details of which need not be here referred to. Suffice it to state, in this connection, that a wide range of resistivity can be obtained as also very uniform and high temperatures. But in the present instance the bottom of the resister is separated from the furnace chamber by an interposed plate or plates *g* of refractory material, preferably of low resistance to heat transmission. The function of this septum will be pointed out farther on. It will be perceived, however, that the furnace chamber can be effectively heated electrically by the superimposed radiant ceiling.

The fuel gas is introduced through a tube *h*, passes along the space *i*, as indicated by the arrows above the resister, and thence into and down the duct *j*. Leading into this duct, at the bottom, is a tube *k* through which air, either cold or recuperated, is forced, as indicated by the arrow, mixing with the gas, thence passing, in combustion, into and through the furnace chamber. The latter is preferably formed of refractory U-shaped sections, as *l*, having flanges *l'* which impinge upon the brick-work. These flanges have a series of openings l^2 whereby the spaces at the sides and below the sections are in communication with each other. Two openings *m* are also provided in the upper sides near one end of the chamber. A tube *n*, moreover, connects with the space surrounding the furnace-chamber sections.

Now, the flame in the chamber will pass therefrom, right and left, through the openings *m* as shown by the arrows, thence into the common spaces around the chamber, the products of combustion finally passing back and out of the furnace, through the tube *n*, having made a complete loop. It will be evident that in this wise a very effective utilization of the fuel-heat units will be obtained; first, by direct impingement of the flame upon the bath and, second, by indirect conduction from the partially exhausted gas and air passing through the extraneous space. Then, whenever the economical apex of the fuel heat is reached, current is switched on to the primarily heated resister and the higher temperature is attained by

electric energy. Moreover, the character of the flame can be readily controlled, but where it is necessarily highly oxidizing, this would act detrimentally upon the carbon resister, if unprotected; consequently, it is the function of the plate, or plates *g* to act as a barrier to protect the resister.

When the furnace chamber is being heated electrically, the fuel gas may also be concurrently employed to advantage. To this end two additional tubes *o* are situated in the side walls of the furnace, these being plugged when the furnace chamber is being normally fuel heated, as described. Thus, by closing the tubes *h* and *k* and introducing gas and air through the tube *n*, the flow of fuel-heat will then be directly opposite to that denoted by the arrows finally passing out of the furnace through the tubes *o* as shown by arrows. The advantage of this application of fuel-heat is to act as a partial resistant to the loss of electric heat by conduction and radiation.

Another advantageous utilization of the fuel gas is to introduce such gas in sufficient volume into the furnace chamber to prevent the entry of air, for when the resister is highly heated and the internal heat pressure in the furnace chamber is less than the external pressure, as might occur, for instance, during the temporary periods of charging, air would be drawn into the furnace until the internal pressure were equivalent to the atmospheric pressure without. Where, as in the present case, inert producer gas may be introduced into the furnace chamber to maintain the internal pressure at least equal to the external atmospheric pressure, the small amount of carbon monoxid gas left thereby in the chamber would be far less harmful to the carbon resister than the oxygen or carbon dioxid gas which would most likely be present if the fuel gas were not used.

The furnace chamber may be conveniently charged through the plugged opening *q*, and emptied by the tap-spout *r*.

I claim as my invention:

1. An electric furnace having means to permit gaseous fuel to pass in a circuit first through the melting chamber and then around it.

2. An electric furnace provided with a resister directly above the melting chamber and having means to introduce gaseous fuel into and around the melting chamber.

3. An electric furnace provided with a resister directly above the melting chamber and having means to permit gaseous fuel to pass around said resister into the melting chamber and then around the melting chamber.

4. An electric furnace provided with a resister facing the melting chamber and having means to introduce gaseous fuel into the melting chamber, the resister and melting chamber being separated by an interposed plate of refractory material.

5. An electric furnace provided with a resister directly above the melting chamber, and having means to introduce gaseous fuel into and around the melting chamber, the resister and melting chamber being separated by an interposed plate of refractory material.

6. In an electric furnace, the combination of a melting chamber formed with a space therearound and having a resister thereabove, and means to introduce gaseous fuel into the chamber and to direct it around the chamber.

7. In an electric furnace, the combination of a melting chamber formed with a space therearound, a resister directly over the chamber having a space above it communicating with the melting chamber.

8. In an electric furnace, the combination of a melting chamber formed with a space therearound communicating with said chamber, a resister directly over the melting chamber having a space above it communicating with the melting chamber.

9. In an electric furnace, the combination of a melting chamber, and a resister directly over the chamber, there being a space above the resister communicating with one end of the melting chamber and a space around the melting chamber communicating with the other end of the melting chamber.

10. In an electric furnace, the combination of a resister, means to introduce gaseous fuel, and means to protect the resister from the oxidizing influence of the gaseous fuel.

11. In an electric furnace, the combination of a melting chamber and a resister above the same, said furnace having a circuit for gaseous fuel around the resister into the melting chamber and then around the melting chamber to heat the bath up to the economical apex of fuel heat, and a circuit for gaseous fuel around the melting chamber only to act as a partial resistant to the loss of electric heat.

12. In an electric furnace, the combination of a melting chamber, a resister above the melting chamber, an interposed plate of refractory material, means to introduce gaseous fuel above the resister, around one end of the same into one end of the melting chamber and from the other end of the melting chamber around the melting chamber in order to heat the bath up to the economical apex of fuel heat, and means to introduce gaseous fuel around the melting chamber only in order to provide a partial resistant to the loss of electric heat.

13. In an electric furnace, the combination of a melting chamber, means to heat the

melting chamber through the medium of fuel, means to direct the fuel flame into the melting chamber so that it will impinge directly upon the contents thereof, and means to confine the fuel flame around the melting chamber so that it will heat the contents only by conduction.

This specification signed and witnessed this 11th day of May, A. D., 1909.

FRANCIS A. J. FITZ GERALD.

Signed in the presence of—
GRACE MCGRANN,
LUCIUS E. VARNEY.