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1,467,044

E. F. KIEFER

ELECTRIC FURNACE

Filed June 11, 1920

Fig. 1

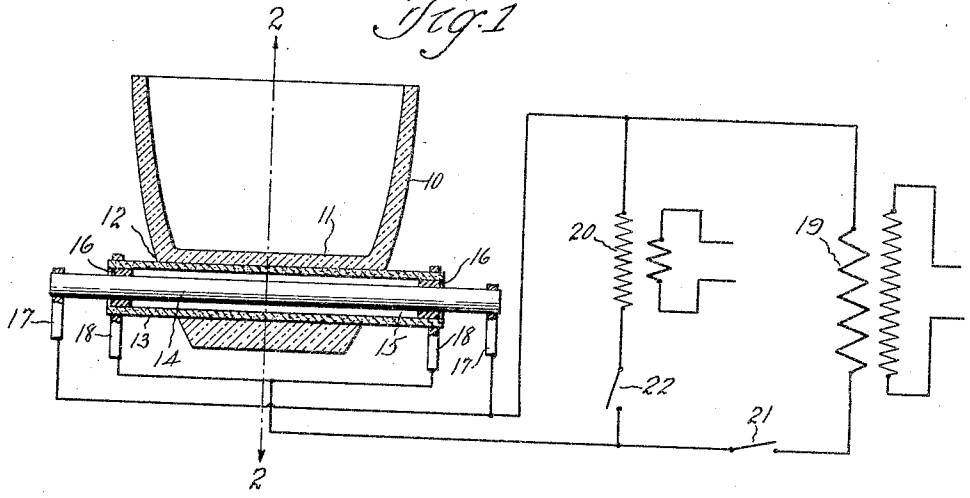



Fig. 3

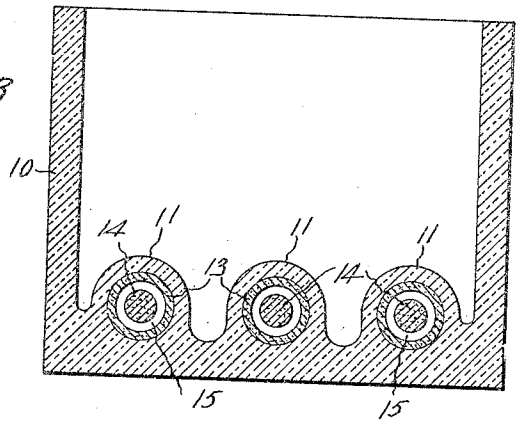
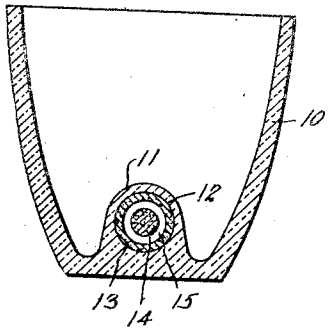



Fig. 2




Inventor

Edwin F. Kiefer.

By Byrnes Townsend & Brickenstein.

Attorneys

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# UNITED STATES PATENT OFFICE.

EDWIN F. KIEFER, OF CLEVELAND, OHIO, ASSIGNOR TO NATIONAL CARBON COMPANY, INC., A CORPORATION OF NEW YORK.

## ELECTRIC FURNACE.

Application filed June 11, 1920. Serial No. 388,164.

*To all whom it may concern:*

Be it known that I, EDWIN F. KIEFER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a specification.

This invention relates to electrically heated furnaces, particularly those of the crucible type, the object of the invention being to provide a simple and highly efficient construction of this character, well adapted for the melting of metals, the manufacture and melting of alloys, and many other purposes. For a full understanding of the invention reference is made to the accompanying drawing wherein:—

Figure 1 is a vertical central section of a simple construction in accordance with my invention, showing also the appropriate electric circuits;

Figure 2 is a similar section on line 2—2 of Figure 1; and

Figure 3 is a similar view of a modified furnace with multiple heating units.

Referring to said drawing, 10 represents a crucible of refractory material, the nature of which will of course depend upon the operation to be performed and the temperature required. Fire-clay, alumina, magnesia, zirconia, and other non-conductive refractory materials are all suitable. Carbon or graphite may also be used, with the necessary precautions to avoid grounding of the electric circuit.

In the forms chosen for illustration the base of the crucible, or bottom wall of the furnace, is constructed with a transverse portion 11, which projects upwardly into the heating chamber in such manner as to present an extended heating surface therein, this projecting portion being apertured as indicated at 12 to receive the heating element. This latter, in its preferred form, comprises a conductive cylinder 13 which may be of carbon or graphite constituting one electrode, and a rod or cylinder 14 concentric therewith, constructed of similar material, and constituting the other electrode. These electrodes are maintained in their proper spaced relation by annular insulating bushings 16, which may consist of any suitable electrical and thermal insulating material, as for example fire-clay, zirconia, alumina, etc. 17 and 18 indicate respectively the current terminals of the two electrodes.

The furnace is most advantageously operated on the arc principle, the arc striking across the annular interspace between the electrodes 13, 14. The electric circuit which is diagrammatically indicated in Figure 1 comprises an alternating power circuit provided with a transformer 19; and also with a high-voltage transformer 20 for striking the arc. 21, 22 represent the switches in the respective transformer circuits.

Figure 3 illustrates a modified construction with multiple heating units, indicated as three in number. These units may be multiplied as desired and the furnace chamber may be given any form appropriate for its intended use.

The constructions shown possess many advantages, among which the following may be mentioned:

1. The heating units are wholly shielded from the charge by a thin refractory wall which presents an extended heating surface to the charge and may have a very high thermal conductivity. The contamination of the charge by carbon from the electrodes is thus wholly avoided.

2. The heat is advantageously applied at the bottom of the charge, which in case of fluid melts is thoroughly mixed by the resulting convection currents.

3. The heating units are simple in construction and may be readily removed and replaced.

4. The heating elements of the preferred form illustrated are quite uniformly heated and are not subject to rapid deterioration. Since the electric discharge occurs within the closed annular interspace 15, this interspace quickly becomes filled with highly heated neutral gas, whereby the heat is not only evenly distributed, but oxidation of the electrodes is prevented.

5. The construction lends itself to a ready and accurate control of the furnace temperature.

I claim:—

1. An electric furnace of the arc type, comprising a refractory wall provided with an aperture, and a heating element insertable in such aperture, said heating element comprising electrodes in arcing relation to each other in a closed interspace therebetween.

2. Construction according to claim 1,

wherein the electrodes consist of concentric members separated by a closed annular interspace.

3. An electric furnace comprising a heating chamber provided with a bottom having a portion projecting upwardly into said chamber to present an extended surface within said chamber, and electric heating means within such projecting portion.

4. Construction according to claim 3 wherein said heating means comprises electrodes in arcing relation to each other.

5. An electric furnace comprising a heating chamber provided with a wall having a plurality of inwardly projecting portions presenting an extended heating surface within said chamber, and electric heating means within each of said portions.

6. An electric heating element comprising the combination of a hollow electrode, and an electrode projecting into and having a portion enclosed in said hollow electrode and in arcing relation to the inner surface thereof.

In testimony whereof, I affix my signature.

EDWIN F. KIEFER.