

F. J. TONE.
ELECTRIC FURNACE.

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Fig. 1.

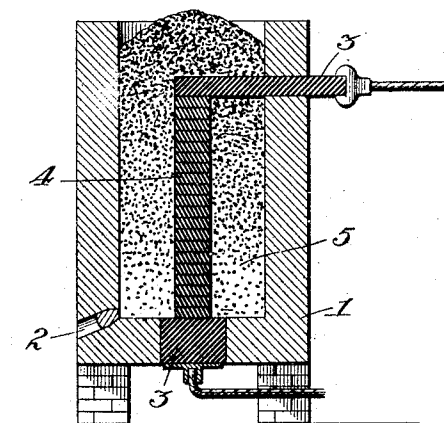


Fig. 2.

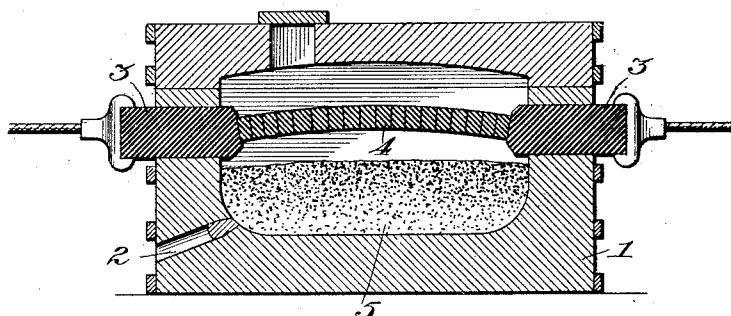
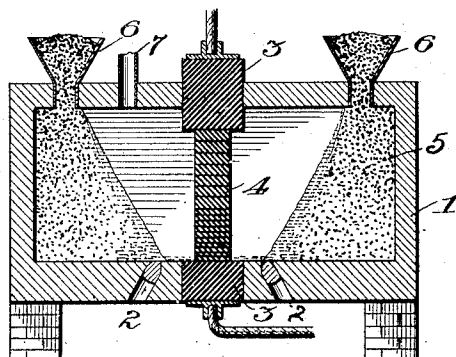


Fig. 3.



Witnesses:

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UNITED STATES PATENT OFFICE.

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ELECTRIC FURNACE.

No. 870,326.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, FRANK J. TONE, a citizen of the United States, residing at 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.

This invention relates to electric resistance furnaces and especially to the form and arrangement of the resistance conductor, or resistor, which serves as the current path. Heretofore it has been usual to construct such resistors either of broken or granular pieces of conducting material such as carbon, which by reason of their irregular shape and imperfect contact have offered a proper electrical resistance, or of continuous rods or bars of carbon or other material which have been made to offer proper resistance to the current by reason of their small cross section or great length. I have discovered that for many operations in the heating of materials and effecting chemical reactions there are many advantages in the use of a resistance conductor composed of regularly formed or shaped blocks assembled in the form of a continuous self-sustaining electrical conductor, and offering resistance to the current both by reason of the resistance of the solid blocks and the resistance at their contact surfaces. One of the chief advantages of such form of conductor is that by making the number of contact surfaces numerous in proportion to the linear dimension of the conductor in the direction of the current, a higher resistance can be obtained, the equivalent of which in a continuous bar would require a small section or a much greater length. By reason of their greater mass, such sectional conductors are more substantial, mechanically, and more resistant to chemical action. The heat is also distributed over a wider area or zone, instead of being localized along a single line as with the carbon rod; this is of great importance in many reactions. Another important advantage which obtains over a pulverized or granular resistance material is that the block conductor can be made self-sustaining and of good mechanical strength.

Referring to the accompanying drawings wherein Figures 1, 2, 3 represent in vertical section various forms of resistance furnaces constructed in accordance with my invention, 1 represents the walls of the furnace chamber, which are made of or lined with a suitable refractory material, and provided with a tap-hole 2 for the removal of the fused products. 3, 3 represent the terminals of the electric circuit, which may conveniently consist of blocks of carbon in contact with the resistance conductor or resistor 4.

In Fig. 1 I show a form of furnace in which the resistor is in contact with the charge or material to be treated 5, and consists of superimposed blocks or plates of resistance material assembled to form a con-

tinuous vertical path for the current between the terminals 3, 3.

In Fig. 2 I show a form of furnace suitable for the fusion of such materials as quartz or glass or for the reduction of metals out of contact with the resistor. The carbon terminals 3, 3 enter the furnace chamber from opposite sides above the level of the charge, and their inner ends contact with and support the resistance conductor 4. This resistance conductor is made up of regularly shaped blocks of resistance material built across from one terminal to the other in the form of an arch, and heat is generated in it mainly by the resistance which the numerous contact surfaces offer to the passage of the current.

In Fig. 3 I show a form of furnace adapted for the continuous treatment of material out of contact with the resistance conductor. The closed chamber 1 of refractory material may be circular in plan, and the charge 5, supplied through hoppers 6, 6, may be so disposed as to assume a sloping face exposed to the action of the heat generated in the resistor. The resistor 4 consists as in Fig. 1 of a series of blocks of resistance material joining each other at common contact surfaces, thus forming a continuous path between the terminals. Volatile reaction products may be withdrawn through the opening 7, and fused products through the tap-holes 2, 2. The blocks of resistance material in the lower part of the column are shown as relatively thin, whereby a higher temperature is generated in this portion of the resistor.

In certain operations, it is desirable to use the arc principle of heating in connection with the resistance conductor. This is readily accomplished by providing additional electrodes at the point desired.

If it is desirable to heat certain portions of the charge hotter than the others, or to subject the charge to an increasing temperature in its progress along the zone of reaction, this may be accomplished by increasing the resistance of the conductor per unit of length at such points. Such increase of resistance may be obtained by decreasing the cross section of the conductor, or by increasing the number of blocks per unit of length, thus increasing the number of contact surfaces, as shown, for instance, in Fig. 3.

It has been proposed to construct resistance conductors in sections for the purpose of increasing their resistance, but such conductors have been supported either by the charge or by the walls or other portion of the furnace structure. In the first case they are subject to the disadvantages that they partake of the movement of the charge and are exposed to chemical actions which may injuriously affect both the resistor and the product; in the second case the structural portions of the furnace are exposed to the full heat of

the resister, which not only endangers the furnace but involves current losses by leakage through the walls or lining. My self-sustaining sectional resister is free from all of these disadvantages, and is moreover particularly adapted for continuous processes.

As a material for the resister I may employ carbon or any carbonaceous mixture.

By the expression "a self-sustaining resistance conductor" I mean a resistance conductor of such form and dimensions that the portions intermediate the ends require no extraneous support.

I claim:—

1. An electric resistance furnace having a self-sustaining resistance conductor composed of shaped pieces of resistance material assembled to form a continuous electrical conductor, substantially as described.

2. An electric resistance furnace having a self-sustaining resistance conductor composed of shaped pieces of resistance material assembled to form a continuous electrical conductor, and a chamber inclosing said conductor and provided with a receptacle for the charge, said charge being out of contact with the resistance conductor, substantially as described.

3. An electric resistance furnace having a self-sustaining resistance conductor composed of shaped pieces of resistance material assembled to form a continuous electrical conductor, and a chamber inclosing said conductor and a charge out of contact with said conductor; said charge being disposed with sloping sides exposed to the heat radiated from the conductor, substantially as described.

4. An electric resistance furnace having a self-sustaining resistance conductor composed of shaped pieces of resistance material assembled to form a continuous electrical conductor, and a chamber inclosing said conductor and a charge out of contact with said conductor; said charge being disposed with a sloping surface conforming

approximately to the surface of an inverted cone and exposed to the heat radiated from the conductor, substantially as described.

5. An electric resistance furnace having a self-sustaining resistance conductor composed of shaped pieces of resistance material assembled to form a continuous electrical conductor, and a chamber inclosing said conductor and a charge out of contact with said conductor; said charge being disposed with a sloping surface conforming approximately to the surface of an inverted cone and exposed to the heat radiated from the conductor; and the furnace being provided with means for removing the products of the charge and for bringing fresh charge material into the sloping zone of reaction, substantially as described.

6. An electric resistance furnace having a self-sustaining resistance conductor composed of shaped pieces of resistance material assembled to form a continuous electrical conductor and disposed so as to heat a charge in proximity thereto; the furnace being provided with means for removing the products of the charge and for bringing fresh charge material into the zone of reaction, substantially as described.

7. An electric resistance furnace having a resistance conductor composed of shaped pieces of resistance material assembled to form a continuous electrical conductor and disposed so as to heat a charge in proximity thereto; said conductor being of ununiform resistance in parts of its length exposed to the charge thereby heating the charge ununiformly, substantially as described.

8. A combined arc and resistance furnace, the resistance element of which is composed of shaped pieces of resistance material assembled to form a self-sustaining electrical conductor, substantially as described.

In testimony whereof, I affix my signature in presence of two witnesses.

FRANK J. TONE.

Witnesses:

ASHMEAD G. RODGERS,
A. P. KYSOR.