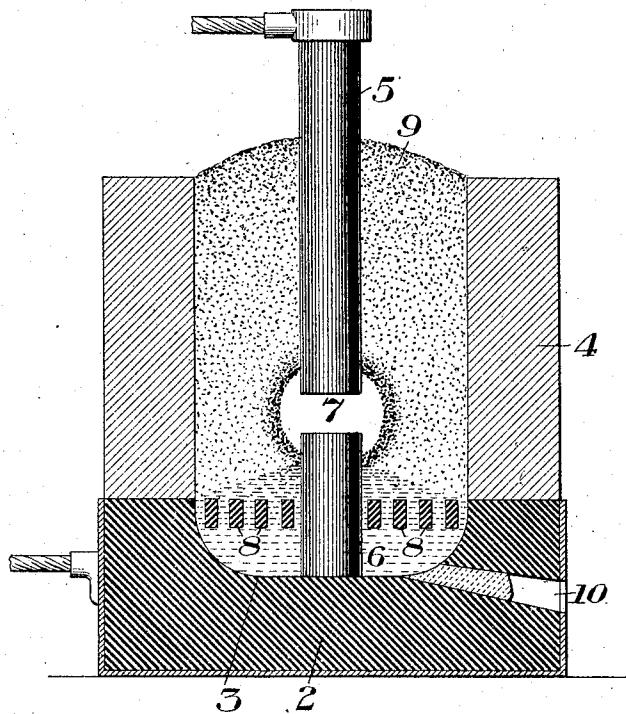


F. J. TONE.  
METHOD OF REDUCING METALLIC COMPOUNDS.  
APPLICATION FILED JUNE 24, 1908.

937,120.

Patented Oct. 19. 1909.



WITNESSES

*R. A. Balderson*  
*W. W. Swartz*

INVENTOR

*F. J. Tone*  
*by Babcock, Byrnes & Painelee*  
*his Attys.*

# UNITED STATES PATENT OFFICE.

FRANK J. TONE, OF NIAGARA FALLS, NEW YORK.

METHOD OF REDUCING METALLIC COMPOUNDS.

937,120.

Specification of Letters Patent. Patented Oct. 19, 1909.

Application filed June 24, 1908. Serial No. 440,124.

*To all whom it may concern:*

Be it known that I, FRANK J. TONE, of Niagara Falls, Niagara county, New York, have invented a new and useful Method of Reducing Metallic Compounds, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which the figure is a sectional side elevation showing one form of an electric furnace suitable for carrying out my invention.

My invention relates to the smelting of refractory ores or materials in an electric furnace and especially to the reduction of those highly unfusible ores where it is desirable to remove the products of reaction from the reduction zone to a point more remote from the arc. In the reduction of many ores, if the products of reaction are allowed to accumulate in the vicinity of the arc, its intense heat will tend to volatilize them, causing a considerable loss of the metal or product.

My invention provides an improved method by which the charge is more effectually supported and the products of reaction separated therefrom while taking the products out of the reduction zone or arc region.

To that end the invention consists in supporting a charge of the compound and a reducing agent in an electric furnace on a supporting hearth which is pervious to the products of reaction, with a collecting space or receptacle beneath this hearth, the hearth being substantially impervious to the charge. An electric arc is thus established within the charge of sufficient intensity to reduce the compound, and the fused product is removed from the reduction zone and allowed to pass through the hearth to a receiving space below.

My process is especially applicable to the reduction of silicon compounds, and the manufacture therefrom of silicon, silicon alloys and silicon products. In the reduction of such ores, it is especially important to remove the product of reduction from the highly heated reduction zone as soon as possible after it is formed and the herein described construction of the hearth fully accomplishes this result.

In the drawings, in which I have shown one form of furnace carrying out my invention, 2 represents the base of the furnace which is shown as constituting one terminal.

This is preferably composed of carbon or other conducting refractory material and is preferably hollowed out to form a receiving space 3 for the molten products of the furnace. Side walls 4 of the furnace proper are preferably of non-conducting refractory material.

5 is the upper electrode which depends within the furnace and constitutes the other terminal, this preferably being of carbon.

6 is the lower electrode which rests upon the central part of the carbon base, the arc being maintained through the region 7 between the upper and lower electrodes.

The charge rests upon a hearth 8 which extends over the collecting receptacle within the terminal 2 and in the form shown is composed of horizontally extending carbon bars which are suitably supported in or on the side walls. These bars are spaced apart a proper distance to allow the molten products to drop between the hearth so formed, while this hearth supports the charge and is practically impervious thereto. The charge is indicated at 9 and preferably fills the space around the upper electrode. The intermediate hearth is placed between the reduction zone of the arc and the receiving space at the base, and is sufficiently elevated above the base to give a receptacle of the desired size. From this receptacle the product may be tapped out through the tap-hole 10.

In the operation of the furnace, the charge is supported upon the hearth, through which the products drop from the reduction zone into the receiving space. The products are thus not liable to be contaminated by the charge which is kept apart by the hearth which supports it. The products are removed from the reduction zone and the vicinity of the arc, and descend by gravity through the hearth into the collecting space, whence they are tapped as desired.

The shape and form of the supporting hearth, and the size of its perforations may be varied without departing from my invention.

I claim:—

1. A process of reducing metallic compounds which are subject to volatilization losses at the temperature of reduction, which consists in supporting a charge of the compound and a reducing agent on a hearth

which is impervious to said charge, but pervious to the products of reduction, establishing within the charge an electric arc of sufficient intensity to reduce the compound, maintaining the temperature of the charge between the hearth and the reduction zone below the volatilization temperature of the metal, removing the fused product from the reduction zone, and allowing it to pass through the hearth to a receiving space below.

2. The process of reducing silicon compounds, which consists in supporting a charge, including silicious material and a reducing agent, on a hearth which is impervious to said charge, but pervious to the products of reduction, establishing within the charge an electric arc of sufficient intensity to reduce the silicon, maintaining the temperature of the charge between the hearth and the reduction zone below the volatilization temperature of the silicon, and removing the fused product from the reduc-

tion zone and allowing it to pass through the hearth to a receiving space below. 25

3. The process of reducing silicon compounds, which consists in supporting a charge, including silicious material and a reducing agent, on a hearth which is impervious to said charge, but pervious to the products of reduction, establishing within the charge an electric arc of sufficient intensity to reduce the silicon, maintaining the temperature of the charge between the hearth and the reduction zone below the volatilization temperature of silicon, removing the fused product from the reduction zone, allowing it to pass through the hearth to a receiving space, and maintaining it therein in a fused condition. 30 35 40

In testimony whereof, I have hereunto set my hand.

FRANK J. TONE.

Witnesses:

ASHMEAD J. RODGERS,  
FRED I. PIERCE.