No. 716,008. Patented Dec. 16, 1902.

A. DORSEMAGEN.

WORKING ZINC AND SUBSTANCES CONTAINING SILICIC ACID IN ELECTRIC FURNACES.

(Application filed Aug. 24, 1901.)

(No Model.) 2 Sheets—Sheet 1.

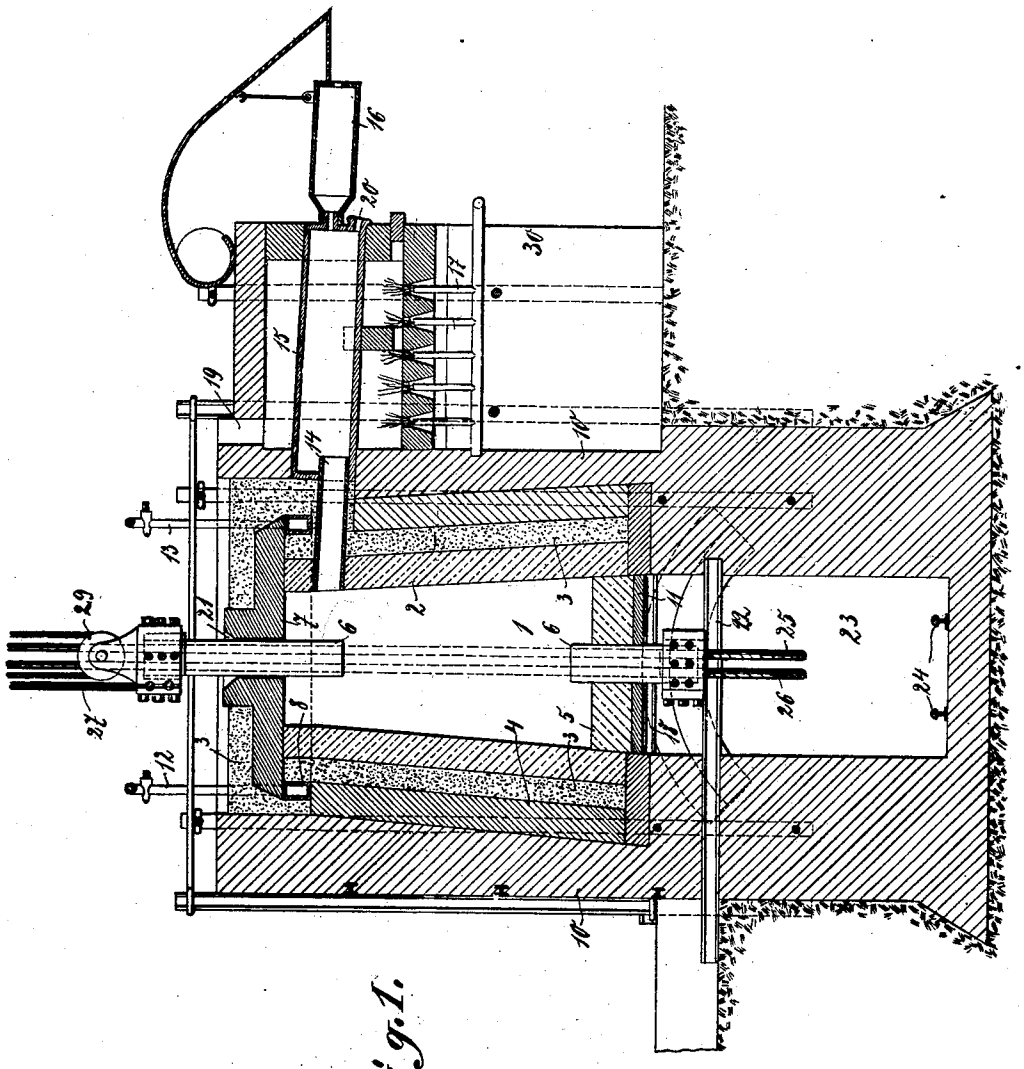


Fig. 1.

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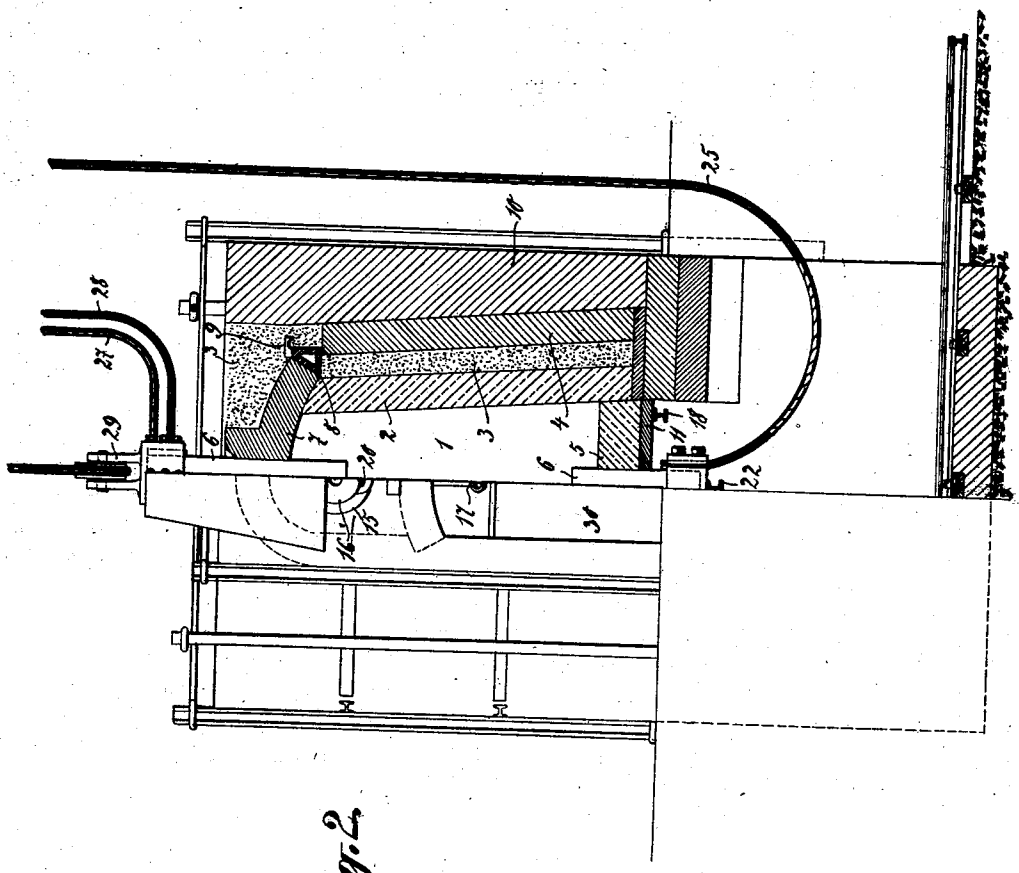



Fig. 2.

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# UNITED STATES PATENT OFFICE.

ALFRED DORSEMAGEN, OF WESEL, GERMANY.

## WORKING ZINC AND SUBSTANCES CONTAINING SILICIC ACID IN ELECTRIC FURNACES.

SPECIFICATION forming part of Letters Patent No. 716,008, dated December 16, 1902.

Application filed August 24, 1901. Serial No. 73,188. (No specimens.)

*To all whom it may concern:*

Be it known that I, ALFRED DORSEMAGEN, mining engineer, a subject of the Emperor of Germany, residing at 608 Baustrasse, Wesel, in the German Empire, have invented a certain new and useful Method of Working Zinc and Substances Containing Silicic Acid; and I do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement.

It is well known that if a mixture of silicic acid and carbon be heated in an electric furnace carbid of silicon will be produced.

The object of the present invention is to combine this method with that for extracting zinc in such a manner that for the purpose of extracting the zinc only such an addition of electric energy to the ordinary process of producing carbid of silicon is necessary as substantially represents the reaction

$$ZnO+C=Zn+CO.$$

Thus the large quantity of heat which is otherwise required for the distillation of the zinc is economized. The economy of heat energy consists in the combination of the process for distilling zinc with the so-called "carborundum" process—*i. e.*, therein that both processes are carried out at the same time and in the same furnace. It is therefore only necessary to heat but one furnace and to replace the heat lost by the radiation of only this single furnace during the entire work of it, whereas if zinc and carborundum are produced separately according to the methods hitherto known two furnaces are to be heated and the radiation of both of them will have to be replaced during the entire time of work. Moreover, according to the present combined process the heat is saved which is necessary for heating the silicic acid of the silicic-zinc ore to the temperature of distillation of the zinc.

According to the new process the naturally-found silicic-zinc ores, as willemit, as well as artificial mixtures of sufficiently pure roasted blende or burnt calamin and arenaceous quartz, may be advantageously treated. The ore, suitably pulverized, is mixed with a small theoretical surplus of dry anthracite coal, and this mixture is subjected to the reduction, as described. The reaction is the following:

$$Zn_2SiO_4+5C=Zn_2+SiC+5CO.$$

Therefore it will require 26.9 per cent. of carbon to one hundred per cent. of ore. The anthracite containing about five per cent. volatile substances and five per cent. ashes, the charge will have to consist of one hundred parts, by weight, of ore and thirty parts of reduction-coal, which mixture will yield 58.5 parts of zinc and in the remainder 18.2 parts of carborundum. The yield is not always the same. It increases to a certain extent according to the age of the furnace. Thus according to my improved method the necessary energy for previously heating the furnace and its charge and the energy supplied to the furnace during the time of working to compensate for the radiation is not applied separately for the zinc process and for the silicon-carbid process, but at one and the same time for both.

The peculiarity of this method is that the gangue, which is unnecessarily heated in the ordinary process of zinc distillation, undergoes a simultaneous reaction, silicon carbid being formed, so that the whole charge undergoes reaction and is converted into two products, each of which has hitherto been the object of a separate extraction process at a great expense of energy.

As illustrating a furnace by which my improved method can be carried out, reference is had to the accompanying drawings, in which—

Figure 1 is a vertical sectional view of a furnace; and Fig. 2 is an elevation, partly in vertical section.

Referring to the drawings by reference-numerals, 1 is a furnace-shaft, which is filled with a mixture of silicic-zinc ore and the theoretical quantity of a suitable reducing-carbon. This mixture either may be previously brought into briquets by means of tar, or it may be caused to conglomerate in the furnace by the addition of sawdust or a suitable fat coal. The side walls 2 of the reaction-chamber consist of coal bricks, as also the bottom 5. Between the inner lining 2 and the fireproof

brickwork 4 a layer of very fine sand is rammed in. Sea-sand is especially suited for this purpose.

6 is the coal electrodes.

7 is the furnace-cover, of fireproof bricks, mounted upon the hollow ring 8, of cast-iron, which can be cooled by water, 13 being the water-inlet, and 12 the outlet.

9 represents shoulders by means of which the cover may be lifted by a suitable crane.

10 is an external furnace-wall; 11, the bottom plate, of cast-iron.

14 is the tube, of magnesite, for connecting the furnace and condensing-chamber.

15 is the receptacle in which the major quantity of zinc-vapors entering from the shaft 1 through pipe 14 are condensed to liquid zinc in the same manner as in the known zinc-distilling furnaces.

16 is the condensing-chamber for the zinc-vapors not condensed in the receptacle 15.

18 are bars of T-iron, upon which the bottom and 22 denotes T-rails upon which the lower electrode are mounted respectively.

19 is the outlet for the gaseous products formed by heating the receptacle.

20 is the tap-hole for the outlet of the condensed zinc.

23 denotes a chamber in the bottom of the shaft to receive a suitable car or receptacle, (not shown,) which is adapted to receive the material discharged from the furnace. The car or receptacle is moved upon the rails 24.

25 and 26 are the electrical connections for the lower electrode, and 27 28 indicate connections for the upper electrode.

29 denotes a suitable hoist for the upper electrode.

30 denotes one of the walls of a casing in which is arranged the burner 17.

Before lighting the furnace the cover and both electrodes are taken out, a provisional grate is arranged, and the furnace is first heated to dryness and then to a high temperature. The provisional grate is then taken out. The bottom and the lower electrode are mounted in the furnace. The latter is charged by continuously ramming in the middle a core of coke. At length the cover is laid upon the furnace and tightened by means of sand 3, whereupon the upper electrode is mounted. In the grooves 21 a layer of asbestos is arranged and then covered with sea-sand. The furnace is now ready for use.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

A method of working a zinc-silicate ore consisting in preparing a charge of zinc silicate and carbon, then subjecting the charge to the action of an electric current sufficient to determine the reduction and volatilization of the zinc and the formation of carbid of silicon, and then suitably condensing the products of reduction and volatilization, substantially as set forth.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ALFRED DORSEMAGEN.

Witnesses:
CHARLES LESIMPLE,
CARL SCHMITT.