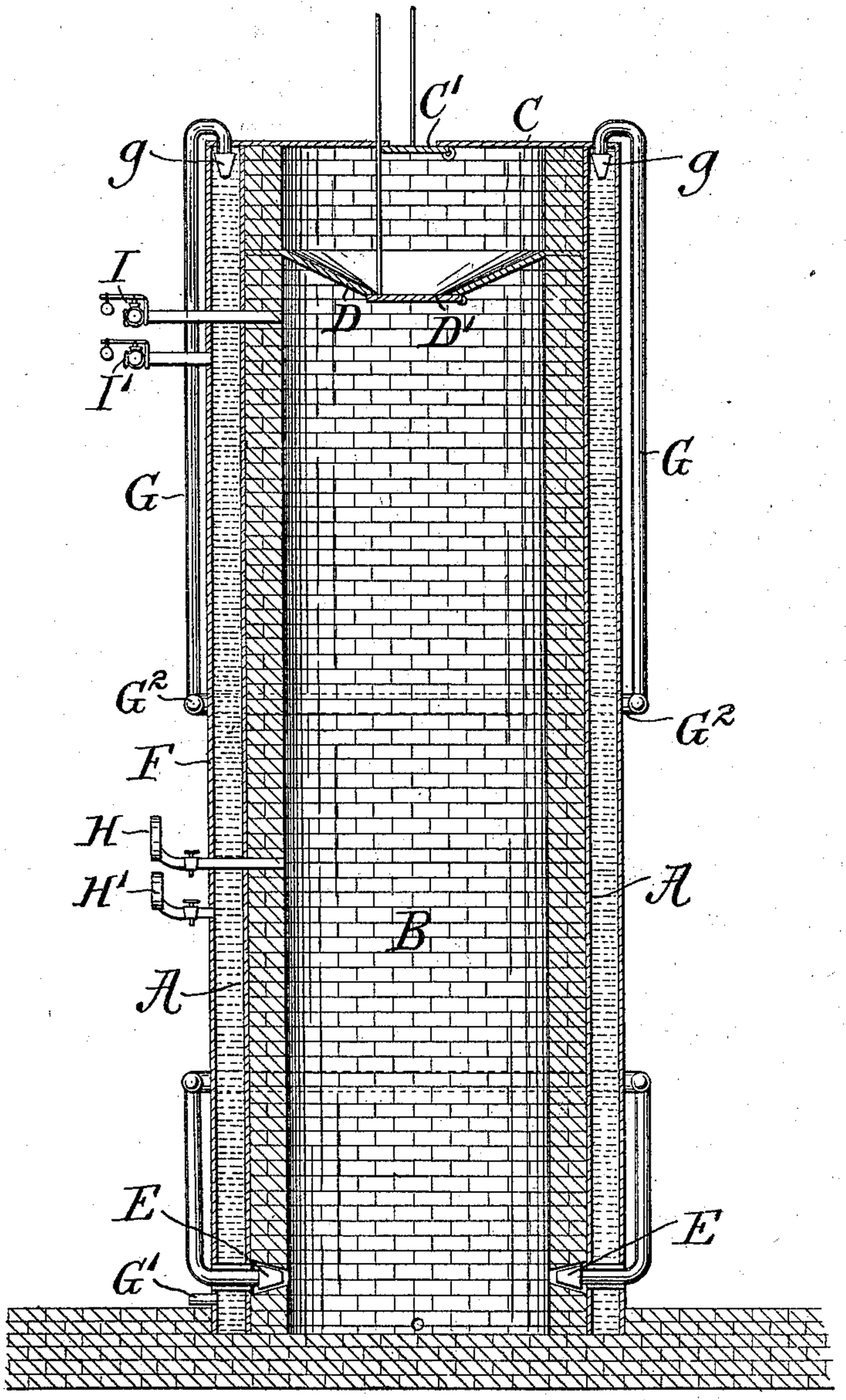
(No Model.)

E. E. LUNGWITZ.

FURNACE FOR SMELTING ORES.

No. 555,961. Patented Mar. 10, 1896.



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FURNACE FOR SMELTING ORES.

SPECIFICATION forming part of Letters Patent No. 555,961, dated March 10, 1896.

Original application filed December 3, 1892, Serial No. 453,993. Divided and this application filed October 1, 1894. Serial No. 524,553. (No model.)

To all whom it may concern:

Be it known that I, EMIL E. LUNGWITZ, a citizen of the United States of America, residing at Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Furnaces for Smelting Ores, of which the following is a specification.

The present invention relates to an improved furnace for smelting ores; and it has for its object to provide means for cooling the walls of the furnace and maintaining an external pressure thereon equal to the internal pressure.

The present case is a division of my application filed December 3, 1892, Serial No. 453,993, in which the process herein described is claimed.

It is well known that the boiling-point of a substance depends upon the pressure exerted upon the liquid, the boiling-point rising with the pressure according to a law governed by the nature of the substance. Sufficient pressure will prevent ebullition of a liquid, even if its temperature be raised considerably beyond its boiling-point under ordinary pressure. To prevent volatilization of the regulus once formed it is only necessary to maintain a sufficiently high pressure in the furnace. In the case of an ore containing lead and zinc oxides, for instance, the zinc would volatilize at the temperature of the furnace—say 1,200° centigrade—if a sufficient pressure were not exerted to raise its boiling-point to this temperature. From the researches of Dr. Carl Barus (Bulletin United States Geological Survey No. 54, 1889, and confirmed by my own investigation) we may conclude that the tension of zinc-vapor at this temperature would be about fifty pounds.

In the accompanying drawing is shown a central vertical section of a blast-furnace illustrating one means for carrying my invention into effect.

A represents the steel or similar casing of the stack supporting and inclosing the fire-brick B. The throat of the furnace is closed by a cap or plate C, having an opening controlled by a trap-door C′, hinged to the under side of the cap. This opening is preferably centrally located, but may be placed toward the side of the throat if desired. The usual hopper D for feeding ore and fuel is inserted in the throat of the furnace. The discharge-opening in this hopper is controlled by a trap-door D′, hinged to the under side of the hopper. The trap-doors C′ and D′ may, if desired, be replaced by ordinary bell-closures. Tuyeres E of the usual construction supply the blast for raising the temperature and also for raising the pressure within the furnace, so that the reduced metal or oxides will not boil under the temperature necessary for conducting the process.

F is a second steel or other casing surrounding the casing A. The space between these two casings forms a water and air tight chamber in which water is kept circulating to cool the casing A, and to prevent injury to said casing, if it should become exposed to the pressure within the furnace through fusing of the fire-brick at any point, the water in said chamber is kept under pressure equal to the pressure within the furnace. Water is supplied to this cooling-chamber through the nozzles *g* of the pipes G, leading from the bustle-pipe G^2, by any suitable pump, the water entering preferably near the throat of the furnace and descending to the hearth, thus cooling the upper portion of the stack first and being heated gradually as it approaches the hearth, where it escapes through a suitable discharge-pipe G′. This hot water may be utilized by feeding it directly to the boiler connected with the engine supplying the blast for the furnace. Suitable pressure-gages H and H′ are applied to the furnace to indicate the pressure exerted within the furnace and the cooling-chamber respectively, in order that said pressures may be kept equal. Safety-valves I and I′ may also be applied to the furnace and the cooling-chamber respectively, to balance the pressures by removing any excess in either. The furnace safety-valve I is preferably located just below the trap-door D′, and through it the waste gases are discharged. The construction of this valve is similar to that of a boiler safety-valve.

The operation of my invention is as follows: A charge of fuel and ore is introduced into the furnace through the openings in the plate

C and hopper D, after which the trap-doors C′ and D′ are closed. After the fires are started the blast is turned on through the tuyeres E until the pressure within the furnace exceeds the pressure at which the metal to be reduced would boil at the temperatures to be created by the blast. As soon as the ore is smelted the reduced metal sinks to the hearth, where it collects and may be drawn off through the tap-hole. Volatilization of the metal or regulus and of the oxides is thus prevented, as the pressure exerted upon the charge is so high that it cannot boil, and hence cannot volatilize and be carried off through the furnace-throat, or over into the flue-dust chamber. This is a feature of great importance, as the metal once reduced sinks to the hearth, and is not carried off by the flue to be returned through the hopper in the form of an oxide and resmelted. Besides, by the expansion of the blast in furnaces as at present constructed the finer particles of the charge are carried over into the flue-dust chamber, as the blast maintains its pressure only at the tuyeres. As any desired pressure is maintained constant throughout the furnace in my invention, however, the formation of flue-dust is almost entirely prevented.

The construction of furnace I have illustrated is especially designed for continuous smelting and roasting without lowering the pressure within the furnace. When it becomes necessary to recharge the furnace the trap-door C′ (or bell, as the case may be) is opened and fuel or ore fed into the hopper, the trap-door D′ (or bell) being kept closed. When a sufficient quantity of the charge has thus been introduced into the hopper, the door C′ is closed and D′ is opened, when the fuel or ore enters the furnace, the door D′ being closed after all the charge has been fed to the furnace by the hopper. It will be seen that while thus recharging the furnace none of its gaseous contents can escape, and the pressure remains undisturbed, as one of the exits is always closed and the inclosed gases cannot get beyond the cap or plate C of the stack.

My process is applicable not only to the smelting and roasting of ores containing a single metallic element, but to ores containing several such elements. The pressure of the blast would of course depend upon the metal or metals to be reduced and to be oxidized from the ore, and where several metals are reduced and roasted simultaneously within the furnace the pressure would be sufficiently high to prevent volatilization of the metal to be tapped.

I do not wish to be understood as limiting myself to any specific means for regulating and balancing the pressures in the furnace and cooling-chamber, respectively, as the means so employed may be modified without departing from the spirit of the invention.

No claim is herein made to the process of roasting ores, as the same forms the subject-matter of an application filed by me June 15, 1893, Serial No. 477,714.

What is claimed is—

1. The herein-described blast-furnace stack closed to the atmosphere, means for maintaining within the stack a pressure higher than that at which the volatilizable metal or metals contained in the ore to be smelted would boil at the temperature of the furnace, a closed casing surrounding said stack and forming with its exterior walls an air-tight chamber, and means for exerting and maintaining in said chamber a pressure substantially equal to the pressure maintained within the stack, as described.

2. The herein-described blast-furnace stack closed to the atmosphere, means for maintaining within the stack a pressure higher than that at which the volatilizable metal or metals contained in the ore to be smelted would boil at the temperature of the furnace, a closed casing surrounding said stack and forming with its exterior walls an air-tight chamber and means for supplying and maintaining in said chamber a fluid at a pressure substantially equal to the pressure maintained within the stack, as described.

In witness whereof I have hereunto signed my name in the presence of two witnesses.

EMIL E. LUNGWITZ.

Witnesses:
ROBERT C. SCHÜPPHAUS,
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