H. W. HIXON.

ELECTRIC FURNACE.

APPLICATION FILED NOV. 30, 1909.

957,058. Patented May 3, 1910.

Fig. 1.

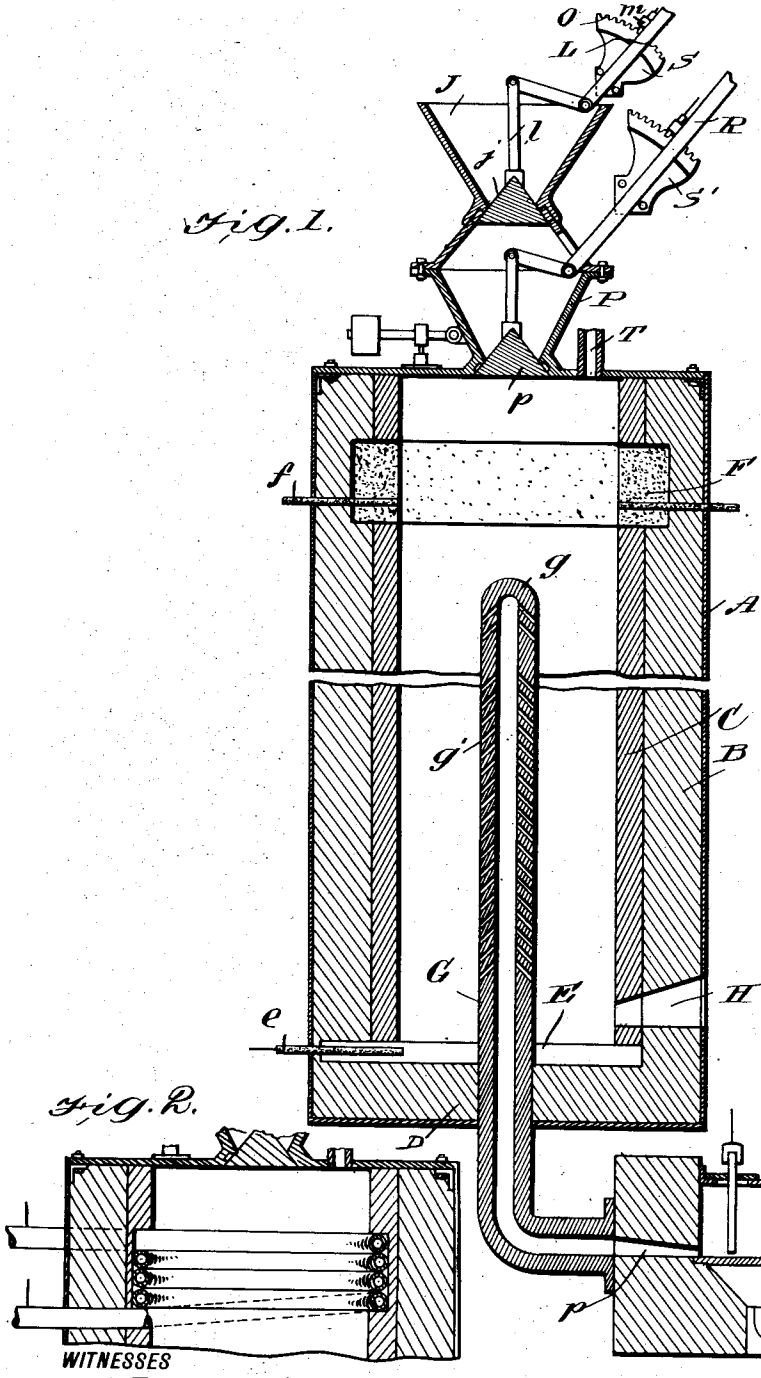

Fig. 2.

WITNESSES

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ELECTRIC FURNACE.

957,058. Specification of Letters Patent. Patented May 3, 1910.

Application filed November 30, 1909. Serial No. 530,575.

To all whom it may concern:

Be it known that I, HIRAM W. HIXON, a citizen of the United States, and a resident of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have made certain new and useful Improvements in Electric Furnaces, of which the following is a specification.

My invention relates to electric furnaces, more particularly to those furnaces used in the smelting of zinc ores, and it consists in the combinations, constructions and arrangements of parts herein described and claimed.

The present invention is an improvement on the device disclosed in a prior application No. 501,466, and is also designed as an improvement on the device shown in the patent to Johnson, No. 920,473, dated May 4, 1909.

An object of my invention is to provide a furnace in which the zinc is fed in at the top, which is kept closed by means of a top of double construction so arranged that an upper door may be opened and a charge fed in while the lower door is shut.

A further object of my invention is to provide a novel means for the exit of the zinc vapor while hot, so as to eliminate the chances of the zinc being reduced to the form of a blue powder, by means of certain diluting gases such as CO_2 and moisture from the charge. This I attain by means of a central tube of refractory material provided with inclined passages leading from the interior of the tube and communicating with the interior of the furnace, in connection with means for withdrawing the diluting gases.

Other objects and advantages will appear in the following specification and the novel features of the device will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawing which is a central vertical section through the device.

In zinc smelting operations when conducted in electric furnaces, the vapors of zinc which arise from the smelting process often meet the cold charge coming in at the top of the furnace which results in the formation of refractory compounds of zinc, to the detriment of the smelting operation. In order to overcome these obstacles and to keep the vapor away from the upper part of the furnace, I have designed the apparatus shown in the figure. This consists of a steel shell A, preferably of a cylindrical shape, and forming the inclosing casing of the furnace. Within the steel shell A is a non-conducting refractory lining B which may be of any appropriate dimensions and is preferably one and one-half to two feet thick. A second interior lining C having greater heat resisting power may be used. At the lower end of the furnace is a layer D of the refractory lining upon which is a base or plate E of carbon which connects with a source of electricity by means of a conductor *e*. Toward the top of the furnace is a similar plate of carbon F which is connected to the source of electricity by means of the conductor *f*. The interior of the furnace may be filled with zinc ore to a point above the upper carbon electrode F, the bottom of the charge resting directly upon the lower electrode E.

Projecting through the bottom D of the furnace is a central tube G of highly refractory material such as carborundum or magnesite. This tube terminates at the closed end *g* below the upper electrode F. The tube is provided with a series of upwardly inclined passages *g'* which afford communication between the interior of the furnace and the interior of the tube. These passages it will be seen from the figure terminate above the slag hole H near the bottom of the furnace. The lower end of the tube G extends downwardly through the bottom of the furnace and is connected with a condenser K. The latter may be of any suitable form but is preferably closed to prevent the entrance of air. The form herein shown is similar to that disclosed in my prior application Serial No. 501,466, above referred to. It will be understood however that this is for purposes of general illustration and that other forms of condensers might be used in connection with my invention without departing in the least from the spirit and the scope of the invention.

In order to prevent the escape of any of the vapors from the top of the furnace when the latter is being charged, I have arranged the double feeding hopper shown in the figure. This consists of an upper funnel-like

receptacle J having a conical closure *j* at its bottom arranged to be drawn upwardly by means of a bell-crank lever L which is attached to the closure by means of a link *l*. The extended handle L is provided with a locking member *m* which is adapted to engage the notches *o* on a locking segment S. A second hopper P is located immediately beneath the hopper J and is provided with a closure *p* which is operated by means of a bell-crank lever R which may be locked to the segment S′ in the manner described in connection with the lever L.

At the top of the furnace is an exhaust pipe T which may be connected with any suitable pump and which is designed to draw out certain vapors and gases from the furnace while the latter is being operated.

From the foregoing description of the various parts of the device the operation thereof may be readily understood.

The charge, which is a mixture of roasted zinc ore and sufficient fine coal to reduce it, is fed into the top of the furnace until the furnace is full, both closures *j* and *p* being lowered to permit the free entrance of the charge. Owing to the presence of the coal an electrical connection is established between the top electrode F and the bottom electrode E. The current is now turned on and the heat developed in the charge by the resistance and the arcing of the current from piece to piece of the carbon in the charge, roasts the charge. As the temperature rises the zinc vapor and other gases will be given off. The closures of the double hopper arrangement are locked and the exhaust pump leading to the tube T is started. The partial vacuum thus created results in drawing off the CO_2 and the moisture so as to leave the vaporized zinc free to enter the tube G. This tube it will be noticed is practically at the same temperature as the inside of the furnace and the vapor therefore will not be condensed but will pass on out of the furnace and will be condensed in the condenser K. No air or moisture can be drawn in at the top, due to the fact that one or the other of the hoppers is always closed. As the pressure is reduced the moisture and other gases pass out through the pipe T while the zinc vapor passes through the openings *g* into the central tube and thence downwardly into the condenser. The zinc vapors are kept in their heated state owing to the fact that the tube is in the center of the furnace at its hottest part. The passages *g′* terminate as stated before above the bottom *e* so that the slag may be drawn off through the slag hole H and will not enter the tube G.

In place of a carbon electrode F the upper electrode may be a copper coil through which a cooling medium such as water is constantly flowing when the furnace is in use. This would tend to prevent the gases passing it from carrying zinc vapor out of the furnace.

I claim:

1. In an electric furnace for smelting zinc, a casing, a non-conducting refractory lining for said casing, upper and lower electrodes, a central tube of refractory material projecting through the bottom of said casing and extending upwardly into said furnace, communicating passages between the interior of the furnace and the interior of the tube for the passage of zinc vapor, an exit pipe at the upper part of the furnace for withdrawing certain diluting gases, and charging means arranged to prevent the escape of vapors, and the entrance of air.

2. In an electric furnace, a casing, a non-conducting refractory lining for said casing, upper and lower electrodes, a central tube of refractory material projecting through the bottom of said casing and extending upwardly into said furnace, upwardly inclined passages in said tube establishing communication between the interior of the furnace and the interior of the tube, an exit pipe for withdrawing certain gases, a two-compartment hopper provided with closures for preventing the escape of gases or vapors from the furnace or the entrance of air and means for locking and unlocking each of said closures.

3. An electric furnace comprising a casing, a refractory lining therefor, upper and lower electrodes, the lower electrode constituting the interior bottom of the furnace, and a central tube of refractory material projecting upwardly through the bottom of said furnace, said tube being closed at its upper end and being provided with upwardly inclined passages establishing communication between the interior of the furnace and the interior of the tube, that portion of the tube near the electrode being solid to prevent the entrance of slag or other foreign matter.

4. In an electric furnace, a casing, a refractory lining therefor, upper and lower electrodes, a central tube of refractory material having passages establishing communication between the interior of the furnace and the interior of the tube, a condenser communicating with said tube at the lower end thereof, an exit pipe at the top of the furnace above said upper electrode for withdrawing gases and a double compartment hopper, each compartment having a conical closure arranged to project into the bottom of the compartment and operated independently of the other closure for preventing the escape of the gases or the entrance of air during the charging operation.

5. In an electric furnace, a casing, a refractory lining therefor, upper and lower

electrodes, means for preventing the entrance of air during the charging operation, means for withdrawing certain diluting gases from the furnace, and separate means for withdrawing the zinc vapor.

6. In an electric furnace, a casing, a refractory lining therefor, upper and lower electrodes, means for preventing the entrance of air during the charging operation, means for creating a partial vacuum and for withdrawing certain diluting gases and a central tube projecting through the bottom of the furnace for withdrawing the zinc vapor.

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