

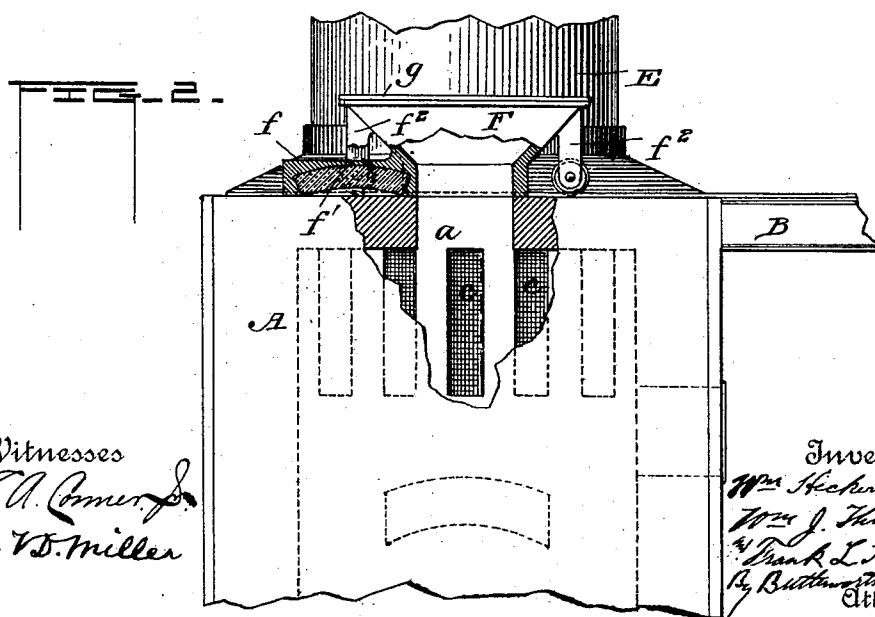
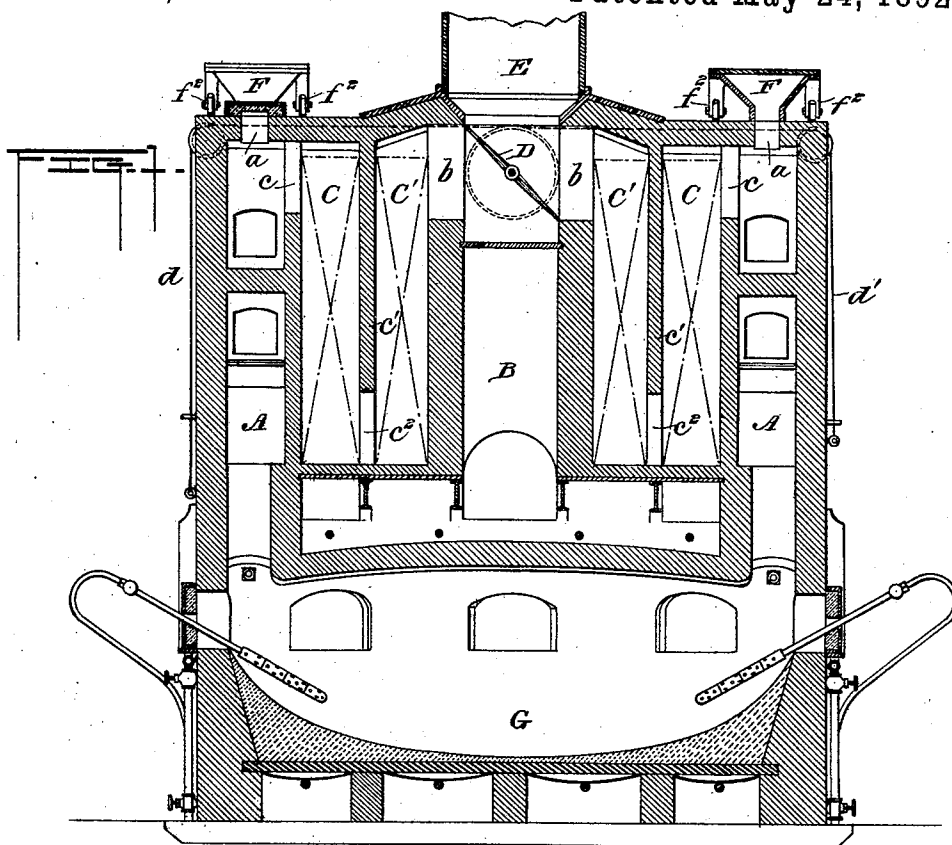
(No Model.)

W. HECKERT, W. J. THOMAS & F. L. HECKERT.

FURNACE FOR IRON WORKING.

No. 475,398.

Patented May 24, 1892.



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UNITED STATES PATENT OFFICE.

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FURNACE FOR IRON-WORKING.

SPECIFICATION forming part of Letters Patent No. 475,398, dated May 24, 1892.

Application filed June 24, 1891. Serial No. 397,271. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM HECKERT, WILLIAM J. THOMAS, and FRANK L. HECKERT, citizens of the United States, residing at Findlay, in the county of Hancock and State of Ohio, have invented certain new and useful Improvements in Furnaces for Iron-Working; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In small plants for iron-working it is desirable to have a furnace of such construction that it can, without material change, be applied to any one of the uses of roasting and reducing the ore, smelting the ore or pig-iron, and refining the same to make steel, and at the same time to have the furnace as economical as possible in the consumption of fuel. To accomplish these results we have heretofore devised a furnace of the construction illustrated in Patent No. 446,971, issued February 24, 1891.

The object of our present invention is to improve the construction of furnaces of the character illustrated in the above-mentioned patent and to provide means by which such furnaces are rendered more economical in the consumption of fuel and made capable of producing better results than can be obtained with furnaces of the construction heretofore in use.

In charging a furnace of the usual construction it is necessary to uncover the opening through which the charge is introduced, thereby permitting the heated air and gases to escape, and thus depriving the furnace of this wasted heat and material and affecting the character of the gases confined therein. In order to produce satisfactory results it is desirable to maintain a uniform temperature, and, as nearly as may be, a uniform quality of gas in each zone of the furnace; and to this end we have devised a furnace of the construction shown in the accompanying drawings, together with improved devices by which the furnace may be charged without subject-

ing the same to the loss of the heated air or gases confined therein during the process of charging the same, as hereinafter described.

Our present invention consists of the improvements set forth in the following description, and particularly pointed out in the claims at the end of this specification.

In the accompanying drawings, in which like letters of reference are used to designate like parts of the apparatus, Figure 1 is a vertical transverse section of a furnace of the general character illustrated in the aforesaid patent, showing certain improvements in the construction thereof, together with our improved feeding devices applied thereto. Fig. 2 is a side elevation of the same with parts of the furnace broken away and the feeding devices shown partly in section, so as to more clearly illustrate the construction.

At the bottom of the furnace is arranged the fire pit or basin G, constructed of suitable refractory material with the arched or crowned roof above the same, forming therewith a smelting or refining chamber, which is arranged below the hot-air chamber B and connects the lower portions of the two combined roasting and reducing chambers A A. The inner walls of the reducing and roasting chambers A are provided with vertical slots or openings *c* at the top, which communicate with the adjacent flues C, and the partitions or division-walls *c'* have similar openings *c*² at the bottom, which communicate with the flues C'. Openings *b* at either side of the hot-air chamber B at the top communicate with the flues C' C' and form conduits leading therefrom into the stack. These conduits are controlled by the reversible valve D, which may be adjusted by means of the pull-cords *d*, so as to cause the air to circulate from the hot-air chamber through either set of flues to the roasting-chamber at one side of the furnace, thence downward through the smelting-chamber and up into the roasting-chamber at the opposite side of the furnace, thence through the openings and flues at that side of the chamber and out through the stack, thus producing the best effects attainable by

the well-known regenerative action. A reversal of the valve D will reverse the circulation in the usual way.

The lower portion of the furnace, the basin 5 G, and its fuel-connections may be, as shown, in all essential respects similar to the construction illustrated in the aforesaid patent, and further description of these parts is not deemed necessary here.

10 Between the roasting-chambers A and the hot-air chamber B the interior of the furnace is partitioned so as to form two divisions or flues C C' at each side of the hot-air chamber, and in which may be arranged checker-work, 15 as indicated in dotted lines. Above the hot-air chamber B is arranged the reversible valve D, by which the openings or conduits leading to the stack E may be controlled. Each roasting and reducing chamber A is provided with 20 a charge-opening α at the top thereof, and above this opening is shown a bottomless receptacle or hopper F, the bottom walls of which (when arranged in position for charging the furnace) are adapted to register with 25 the side walls of the charge-opening. The receptacle or hopper F may be arranged upon a suitable track, so that when charged the material therein will simply rest upon the sheet-iron or other suitably-constructed road-bed, so that the hopper may be pushed back 30 and forth, causing the material to slide along said road-bed until the open bottom of the hopper registers with the charge-opening, whereupon the charge will be dropped into 35 the roasting and reducing chamber upon the inclined shelves thereof. The said hopper is preferably mounted upon friction rolls or wheels $f^2 f^2$, thus forming a movable car, which may easily be pushed back and forth 40 for the purpose of charging the furnace, and at one side or in front thereof at the bottom the car is provided with an extension or projecting portion f , which may be either cast integral with the hopper or detachably connected thereto. The projecting portion f is 45 recessed or cut away on the under side thereof, as shown, so as to receive a filling f' of fire-brick or other suitable refractory material. This extension f of the car or hopper provides a sliding cover for the charge-opening 50 α , so that when the car is drawn back for the purpose of loading the same the extension f will fit snugly over the charge-opening in the furnace and close the same, thereby preventing 55 the escape of heated air and gases and maintaining an even temperature within the furnace, and when the car is moved forward, so as to deliver its load, said extension f is adapted to slide along the road-bed and permit the car to cover the opening and empty 60 its charge, the hopper being provided with a suitable hinged lid or cover which closes the charge-opening and prevents the escape of heated air and gases while delivering a charge to the furnace, or when left standing above

the opening, said cover g being constructed of any suitable refractory material for this purpose.

The roasting and reducing chambers A A are provided with inclined shelves arranged 70 alternately on opposite walls of the chamber G, one above another, as indicated in the aforesaid patent.

The operation of our invention is as follows: Supposing the car or hopper F to be in the 75 position shown in the drawings, when it is desired to charge the furnace the car is drawn back to be filled, in which position the sliding cover or extension f will occupy a position squarely over the charge-opening in the 80 roasting-chamber, so as to cover the same and prevent the escape of heated air and gases therein. The car being filled, it is drawn or pushed forward with its charge resting upon and sliding along the smooth road-bed until 85 the car is brought over the charge-opening, whereupon its contents will fall into the roasting-chamber and lodge upon the inclined shelves therein. In this position of the car its tightly-fitting cover will prevent the es- 90 cape of air and gases, and the same result will be accomplished by the combined action of the car and its extension in the various positions it may occupy between the filling and emptying points, so that during the en- 95 tire operation of charging the furnace the charge-opening is kept tightly closed. The valve D being arranged so that the upper portion of the flue connecting with the previously-charged roasting-chamber is connected 100 with the stack, while the upper portion of the other flue is connected with the hot-air chamber and air-inlet, (the roasting-chamber at that side of the furnace being supposed to contain a charge of ore already heated and 105 partly or wholly roasted,) and the chamber or basin G being also filled with a charge of reduced ore or pig metal, combustion is begun by admitting fuel-gas through nozzles having their outlets arranged to deliver the gas be- 110 neath the chamber charged with the heated ore. The air drawn in through the hot-air chamber and circulating down and up and down again through the checker-worked flues and mass of heated ore in the roasting-chamber 115 will be highly heated and the heat in the smelting-chamber will be intense. The hot gases escaping up through the other roasting and reducing chamber and circulating down and up through the checker-worked flues will 120 heat the same and partially roast the ore in said chamber, and the heat of these parts will be utilized when the furnace is reversed in accordance with the well-known regenerative principle. For reducing and refining pur- 125 poses the air and gas supply pipes and connections are manipulated in the manner indicated in the above-mentioned patent, and as the operation of the furnace in other re- 130 spects and in so far as our present invention

is concerned is fully explained above further description of the patented process or improvements is not deemed necessary.

What we claim as new, and desire to secure by Letters Patent, is as follows:

1. In combination with the furnace having the charge-opening therein, the bottomless receptacle or hopper, having a suitable cover and an extension or cover for the charge-opening connected therewith, substantially as described.

2. In combination with the furnace, the vertical roasting and reducing chamber, the charge-opening at the top thereof, and the bottomless receptacle or hopper having a suitable extension which forms a cover for said charge-opening when the hopper is drawn from over the same, substantially as described.

3. In combination with the furnace having the charge-opening at the top thereof, the road bed or track, and the bottomless receptacle mounted upon suitable rollers arranged to slide back and forth upon said track connecting with the charge-opening in the furnace, said hopper being provided with a suitable refractory cover, and a sliding extension which forms a cover for the charge-opening when the hopper is moved from over the same, substantially as described.

4. In a furnace, the combination of the roasting-chamber having the charge-opening at the top thereof, the road-bed arranged above said charge-opening, and a sliding receptacle or bottomless hopper mounted on said road-bed and having a hinged cover and a recessed extension having a filling of re-

fractory material adapted to form a cover for the charge-opening, substantially as described.

5. In a furnace, the combination of the stack, the two roasting and regenerating chambers, a smelting-chamber arranged below said roasting-chambers and connecting the lower portions thereof, the intermediate hot-air chamber arranged above the smelting-chamber, flues arranged above the smelting-chamber between the roasting-chamber and the hot-air chamber and forming conduits connecting the roasting-chambers with the stack, and suitable valve mechanism controlling said conduits, substantially as described.

6. In a furnace, the combination of the stack, the two roasting-chambers, the smelting-chamber arranged below said roasting-chambers and connecting the lower portions thereof, the intermediate hot-air chamber arranged above the smelting-chamber, the flues arranged above the smelting-chamber at the sides of the hot-air chamber and having checker-work therein, conduits connecting the roasting-chambers with the stack, and valve mechanism controlling said conduits, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

WILLIAM HECKERT.
WILLIAM J. THOMAS.
FRANK L. HECKERT.

Witnesses:

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