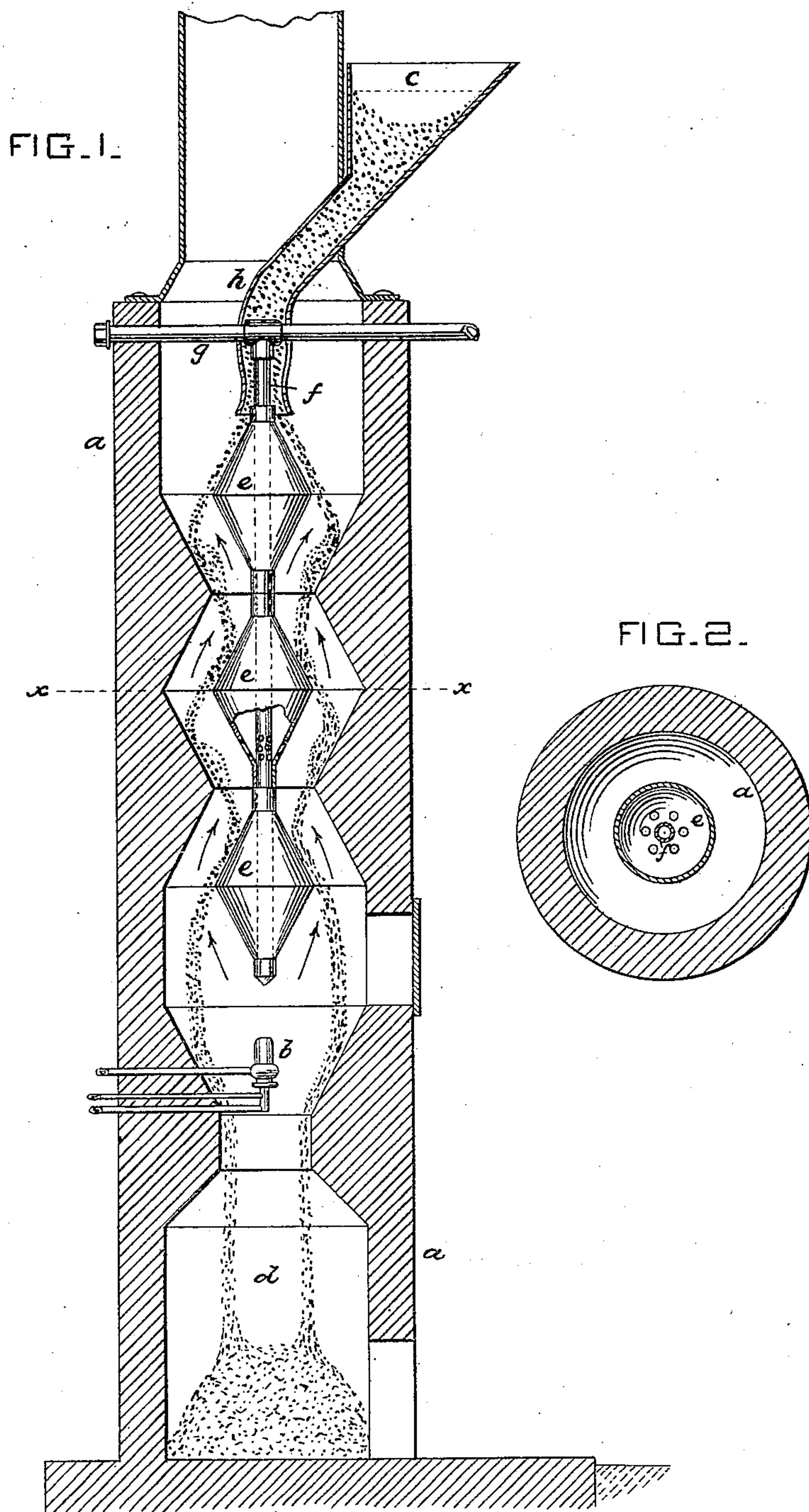


(No Model.)

J. CAMPBELL.  
ROASTING FURNACE.

No. 248,912.

Patented Nov. 1, 1881.



WITNESSES =

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# UNITED STATES PATENT OFFICE.

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## ROASTING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 248,912, dated November 1, 1881.

Application filed August 11, 1880. (No model.)

*To all whom it may concern :*

Be it known that I, JOHN CAMPBELL, of Allegheny city, Allegheny county, Pennsylvania, have invented certain new and useful Improvements in Roasting-Furnaces, of which the following is a specification.

My invention has relation to those furnaces for roasting or desulphurizing ores, or for renovating bone-black, or for similar purposes, in which the granulated ore or other material is showered into an upright shaft having zigzag inclined sides, through which flame passes to purify the falling material by burning out the consumable impurity therefrom; and my invention aims to provide a furnace acting on this principle by which the material will be more effectually exposed to the action of the flame. To this end the leading feature of my invention may be stated to consist in an upright shaft having its internal passage formed with a zigzag series of inclines in the form of cones placed alternately base to base and apex to apex, whereby the passage becomes of annular conical form, alternately converging and diverging, so that the shower of ore falls in a zigzag contracting and diverging course through and across the ascending flame, and thereby effects a more perfect exposure of the material to the flame, and produces an energetic sifting or agitation thereof in falling into and being reflected from the succeeding cones, which causes the more complete consumption and removal of the impurities from the falling matter, and is hence a material improvement over the simple zigzag passages heretofore employed without conical contraction or enlargement.

Figure 1 of the drawings annexed gives a vertical section of my improved furnace, and Fig. 2 a cross-section thereof on line *x x*.

In the drawings, *a* indicates the shaft of the furnace, which rises from a suitable foundation to a height which is determined by the requirements of the material to be treated. Near the base of the shaft a large gas-burner, *b*, emits a column of flame upward through the shaft, and at the top of the shaft a hopper, *c*, delivers the granulated or pulverized ore or other material to be purified centrally into the

top of the shaft, which, falling through the flame, becomes purified and is received into the receptacle *d* in the base of the furnace below the gas-burner, from which receptacle the purified material is removed when accumulated. As may be now observed, the passage through the shaft is not direct, but presents a series of zigzag conical inclines to the falling ore and ascending flame. This zigzag passage is of annular and conical form, and is preferably produced by constructing the interior of the shaft with a series of conical contractions and enlargements, like a series of concave truncated cones placed base to base and apex to apex, and also in arranging centrally within the same a corresponding series of convex cones, *e e*, of smaller diameter, leaving an annular zigzag conical space between the two, as will be readily understood from the drawings. The shaft *a* is constructed either of iron or of fire-brick bound with iron, and the central series of cones *e* is preferably formed of cast-iron, each double cone of the series being cast hollow and secured to a tubular rod, *f*, which extends from a cross-tube, *g*, fixed transversely in the top of the shaft, and by which the central series of cones is thus suspended in the shaft.

The chute *h* of the feeding-hopper *c* discharges centrally in the shaft, over the tip of the inner series of cones, and the gas burner *b* impinges its flame against the tip of the lowermost cone, which is thence spread out and rises in an alternating contracting and expanding column or sheet through the zigzag passage of the shaft.

The granulated or powdered ore, bone-black, or other material to be purified is fed into the hopper *c*, and is thence discharged from the chute *h* in an annular stream over the upper convex cone, and thence descends in a diverging shower across the flame-passage, and, striking the first incline in the shaft, a portion becomes reflected thereby and falls through the flame, and a portion slides down the incline, and these portions, again converging, strike the next of the inner cones, and the descending material thence continues in its zigzag passage in an alternately converging and diverg-



ing shower, alternately passing across and through the flame till it finally falls in a purified condition into the receptacle *d* at the bottom of the shaft.

5 It may be observed that by the means described the falling material is most thoroughly exposed to the flame, for, owing to its zigzag passage and its falling alternately from and onto opposite inclines, its descent becomes momentarily retarded, and it is thus kept longer 10 in the flame, and all sides of the particles are presented in different directions to the flame, while the alternate impact of the particles on the successive inclines and their alternate divergence and convergence produces such a friction 15 between the particles and such an agitating or sifting action as tends effectually to further break up the particles and rub off and remove the lighter adhering impurities which 20 become thrown as fine dust into the flame, by which it is immediately consumed, thereby producing such an energetic action as will remove all perceptible trace of sulphur or arsenic from ores, or other consumable or volatile impurities, from whatever material may be treated. 25

I prefer to admit an air-blast through the cross-pipes *g* and central pipe, *f*, into the cen-

tral cones, from which it is discharged in jets near the lower apex of each double cone into the passage of the shaft, to increase the intensity of the flame therein at certain points, and the air so admitted will also serve to keep the cones from being too highly heated. 30

The gas-burner *b* is preferably of a compound character now largely employed, being supplied with jets of gas, steam, and air, as may be inferred, from the three pipes connecting therewith; but any suitable gas-burner or other source of flame may be employed, a gas-flame being, however, manifestly superior for the purposes described. 35 40

What I claim as my invention is—

A roasting-furnace having a shaft formed with a series of conical concave contractions and enlargements, and a central corresponding series of convex cones of smaller diameter, leaving an annular conical and zigzag passage between the two, substantially as and for the purpose set forth. 45

JOHN CAMPBELL.

Witnesses:

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