

No. 696,323.

Patented Mar. 25, 1902.

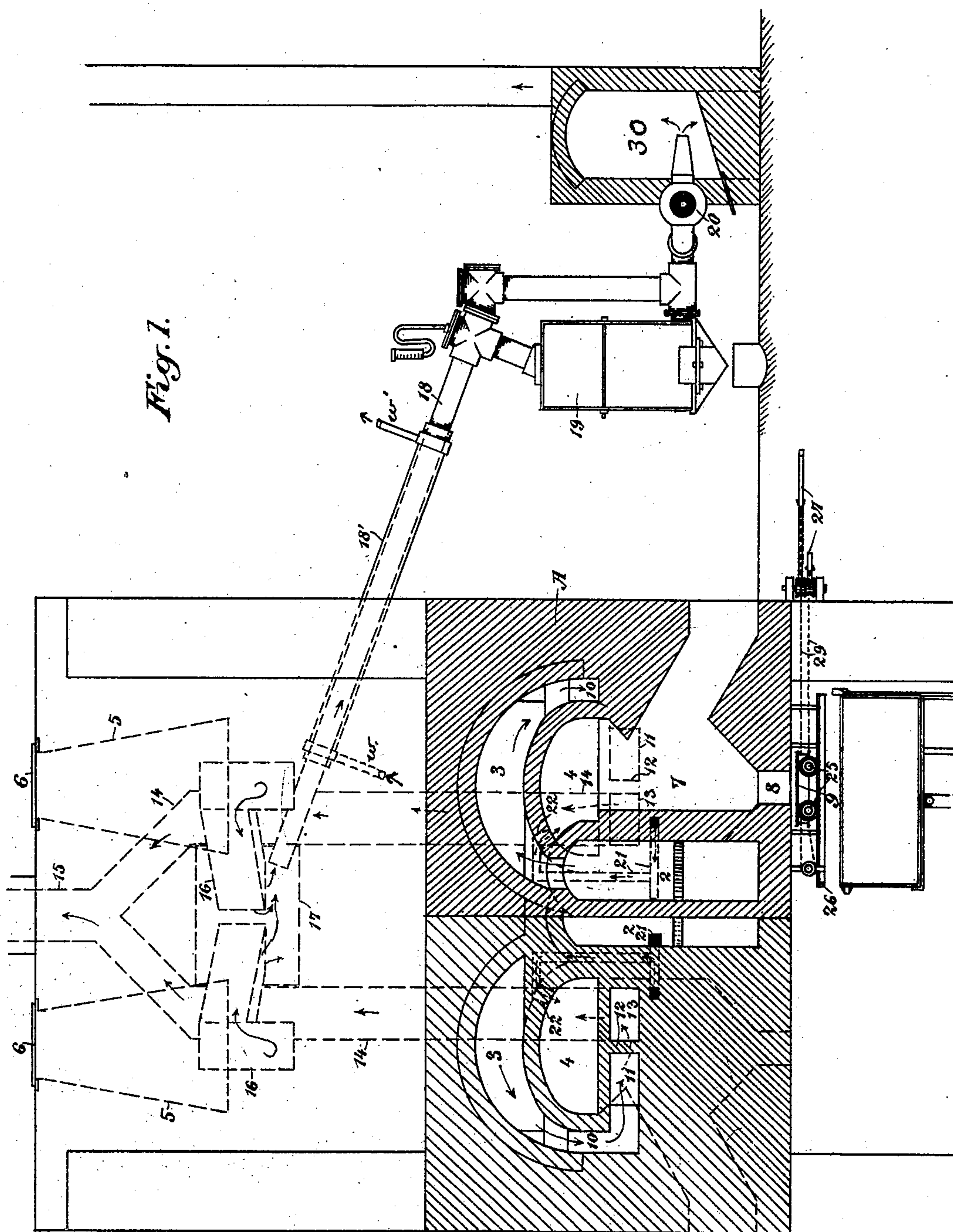
C. FITZGERALD.

QUICKSILVER SEPARATING AND CONTINUOUS ORE FURNACE.

(Application filed Oct. 17, 1901.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses,  
Attest  
J. F. Aschbeck

Inventor,  
Christopher Fitzgerald  
By Dewey Strong & Co. atty



No. 696,323.

Patented Mar. 25, 1902.

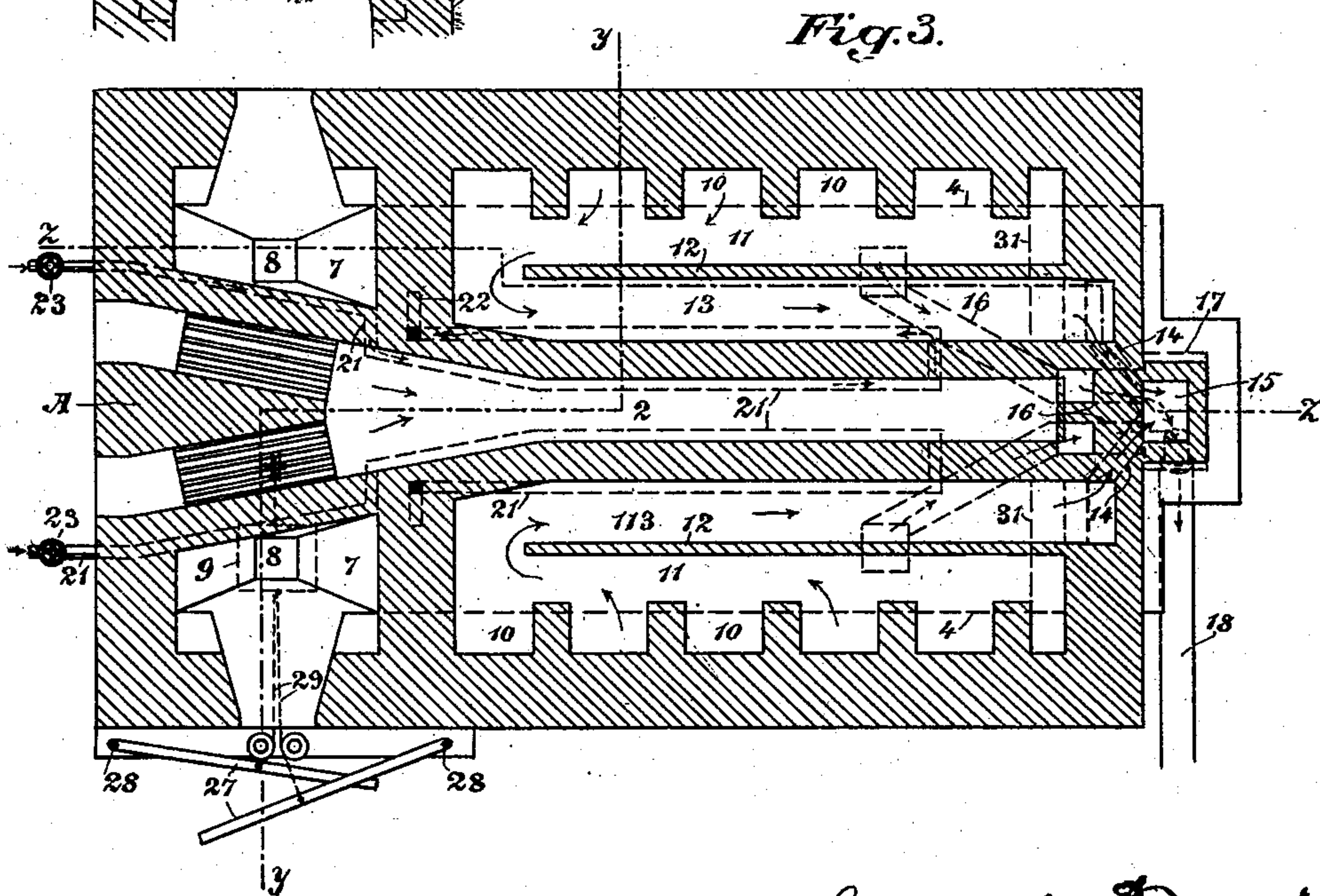
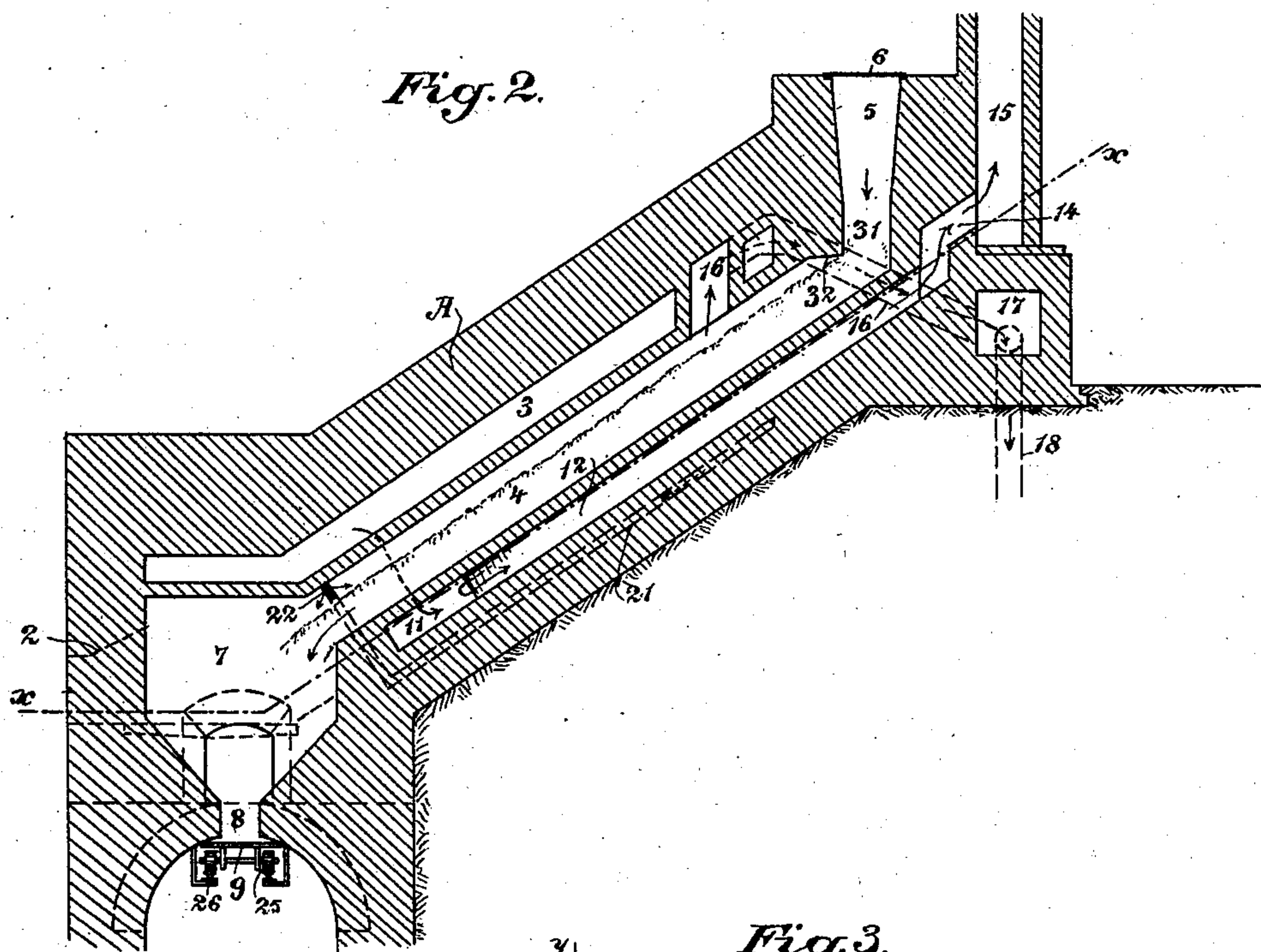
C. FITZGERALD.

QUICKSILVER SEPARATING AND CONTINUOUS ORE FURNACE.

(Application filed Oct. 17, 1901.)

(No Model.)

2 Sheets—Sheet 2.



Witnesses,  
J. H. Moore  
J. F. Aschbeck

Inventor,  
Christopher Fitzgerald  
By D. W. Strong & Co.  
attorneys



# UNITED STATES PATENT OFFICE.

CHRISTOPHER FITZGERALD, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR  
OF ONE-HALF TO WILLIAM B. GESTER, OF NEWCASTLE, CALIFORNIA.

## QUICKSILVER-SEPARATING AND CONTINUOUS ORE-FURNACE.

SPECIFICATION forming part of Letters Patent No. 696,323, dated March 25, 1902.

Application filed October 17, 1901. Serial No. 78,946. (No model.)

*To all whom it may concern:*

Be it known that I, CHRISTOPHER FITZGERALD, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Quicksilver-Separating and Continuous Ore-Furnaces; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to improvements in furnaces for roasting ores, and particularly ores containing mercury. Its object is to afford a cheaper means of working such ores, to give increased capacity over present methods of retorting, and to avoid the waste usual by those methods. These objects are effected by the use of a continuous retort-furnace of the construction herein described.

It consists of the construction, arrangement, and combination of parts, which will be hereinafter described and claimed.

Figure 1 is a lateral vertical section through the furnace on line *y y* of Fig. 3. Fig. 2 is a vertical longitudinal section on line *z z* of Fig. 3 looking toward the outside of the furnace. Fig. 3 is a horizontal section on line *x x* of Fig. 2.

In the ordinary furnaces employed for obtaining metallic mercury from cinnabar it is customary to make a fire in the shaft and over it place a quantity of ore, and the openings of the shaft are covered with tiles and tightly luted. The mercurial vapors, together with the smoke, soot, and other products of combustion, are conducted thence through a series of condensers and purifiers. Redistillation of much of the condensed matter is necessary to finally extract the metal. The result is not only an interruption of the process every time the furnace is recharged, but the extraction of all the mercury is by no means assured. Moreover, the process is a slow one, comparatively, and the cost of installing a plant with a number of condensers sufficient to make a low-grade-ore body profitable is very great.

Having reference to the accompanying drawings, A represents a furnace having a fire-shaft 2 in its forward portion. The interior of the furnace is arched, and through this arched space 3 the flames may circulate

over the interior of the furnace. Within the furnace are the inclined ore chambers or muffles 4, constructed of fire-brick or other suitable material. The movement of the ore through these chambers is accomplished by gravitation. The interiors of these muffles have no communication with the combustion-chamber of the furnace, for it is intended to apply heat exteriorly to the ore contained in the muffles. A suitable ore inlet or hopper 5 upon the exterior of the furnace permits ore to be fed into the muffles as required. The opening of the hopper is provided with a tight-fitting closure 6. The lower end of each muffle opens into a chamber 7, and the outlet 8 in the bottom of the latter is closed by a gate or slide-valve 9 of special construction, which will be described later. In practice the chambers 7 are placed at either side of the fire-pit 2 and outside the furnace proper, and so are removed from the roasting heat. This permits the roasted ore or refuse to cool before being removed through the aperture 8. Along one side, which I shall call the "outer" side, of the muffles are the flues 10, leading from the upper to the lower side of the muffles and through which the heat passes downward around the muffles into the space 11 beneath the muffles. This space is closed at the back. A wall or partition 12 extends beneath and centrally along nearly the entire length of each muffle. The heat in the space 11 is directed to the front of the muffle and thence passes around the end of the partition 12 and through the space 13, beneath the other portion of the bottom of the muffle, to the rear of the latter, whence it is discharged through the passages 14, beneath the hopper 6, and out through the chimney 15, thus having passed around three sides of the muffles and exposed all parts of those sides to an equable and intense heat.

As here shown, I prefer to make my furnace in the form of a twin-muffle furnace, utilizing but a single fireplace and having the smoke-passages 14 from each of the longitudinal flues 13 converging to the common chimney 15. Likewise the pipes 16, which conduct the metallic vapors from the muffles, unite in the box 17, whence these vapors pass through a suitable cooling-pipe 18 into the



condenser 19. The liquid mercury is collected in the bottom of this condenser.

In order to assist in the discharge of the vapors from the muffles, I induce a current of air through the muffles, cooler, and condenser by means of an exhaust-blower 20. Moreover, I have discovered that if this air so induced is first heated a more perfect separation of the mercurial vapors from the other distillates is effected. Accordingly I embed a pipe or form a passage 21 in the lining of the furnace or of the muffles in such a way that while it in no case is in direct contact with the flames it becomes highly heated, so that it does not cause a reduction in the temperature of the interior of the muffle into which it discharges, as at 22. This passage has its outer end terminating exterior to the furnace. A valve 23 regulates the entry of air.

The roasted ore, deprived of its valuable properties in the muffles, falls by gravity into the cooling-chambers 7, from whence it may be withdrawn as desired. As there may be several tons of ore in one of these cooling-chambers and as the fumes arising therefrom are of the most poisonous character, it is essential not only that the gate or valve in the outlet of the chamber should be strong and positive in action, but it should be operated in such a way as not to endanger the lives of the attendants. These results I accomplish by the use of a plate 9, mounted on rollers 25 and movable on a track, as 26, much in the nature of a small flat car, whose surface is adapted to come in close contact with the edges of the opening 8. The to-and-fro movement of this slide-valve is effected at a suitable distance by means of the levers 27, having their fulcrum-points 28 disposed at opposite ends of the levers. To each of these levers attach the ropes or chains 29, leading to either end of the valve or car and adapted to exert a pull thereon in opposition to each other, according as one or the other of the levers is operated. During the process of discharge the air-valve 23 is closed, whereupon the exhauster 20 draws the poisonous vapors incident of these discharges into the muffles, together with an indraft of air through the opening 8 when the gate 9 is open, and so lessens the danger of asphyxiation, salivation, &c., of the operators who may be otherwise too near. The discharged product is removed to a dump or other suitable place by any usual or desired means.

By means of the exhauster a strong draft is induced through the machine, so that the vapors are rapidly removed from the muffles as formed. The cooling-pipe, with its surrounding water-jacket 18', which is supplied with water by any well-known method, as by the pipes *ww'*, (shown in Fig. 1,) serves to condense the mercurial vapor, and the liquid, free from soot, resin, ashes, &c., with which the mercury is often mixed in the ordinary methods, flows into the chamber 19. Any re-

maining metallic vapors drawn through the condenser by the exhauster are finally condensed in a chamber 30, into which the exhaust-pipe nozzle discharges.

The result of actual experience has shown that with furnaces of equal per-ton capacity I am able with two muffles arranged as here shown and with a single cooling-coil and condenser to do the same work of a furnace of the usual construction employing a series of twelve or even more condensers.

Two things combine to regulate and keep uniform the depth of the ore in the inclined ore-chambers: First, the floors of these chambers are pitched at such an angle as barely to overcome the angle of resistance of the ore, whereby a layer of ore generally about nine inches deep can be maintained and still leave circulating-space above the ore and beneath the top of the chamber, the movement of the ore through the muffles by gravitation when the slide 9 is opened comprising the continuous-furnace feature of my invention; second, the depth of the ore is dependent on the shape of the hopper and of the upper end of a muffle where the hopper enters. The hopper has a contracted throat portion 31, while the upper wall of the muffle has a converging or horizontal portion 32, intersecting the front wall of the hopper. The space between the front edge of this wall or apron 32 and the floor of the muffle determines the height of the ore in the muffle.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. An apparatus for treating quicksilver ore comprising an inclined muffle and a furnace the fire-box whereof is directly removed from the ore-chamber said muffle having a parallel floor and roof whereby the surrounding heat is equidistant from all parts of the surface of the ore, said roof having a short horizontal projection at its highest end for regulating the depth of ore in the muffle, an ore-inlet at the upper end of the muffle, a chamber in open communication with the lower end of the muffle, and removed from the direct roasting heat, means by which heated air may be delivered to the muffle, a vapor-outlet for the muffle, and means for condensing the mercurial vapors.

2. The combination in an ore-roasting furnace, of inclined muffles, said furnace having a heat-space above and below the muffles, a partition within said lower space whereby the heat is directed to the front of the muffles and thence passes around the partition and beneath another portion of the bottom of the muffles to the rear of the latter, ore inlets and outlets, and pipes embedded in the walls of the furnace having one end opening to the outer air and the other end entering the muffles.

3. The combination in an ore-roasting furnace of inclined muffles, passages along the top of the muffles, and longitudinally-extend-



ing partitions below the muffles and terminating short of the lower end thereof, and forming passages along the bottom of said muffles, said upper and lower passages connecting, whereby the heat after passing along the top and around the sides of the muffles is returned to the front along one side of the bottom of said muffles, and is then returned to the rear along the other side of said bottom, an ore-inlet at the upper end of each of said muffles, a chamber at the lower end of each muffle, an opening in said chamber, a closure for said opening, a vapor-outlet for said muffles and means for inducing a draft through the muffles and said vapor-outlet.

4. The combination in an ore-furnace, of inclined muffles, longitudinally-extending

partitions below the muffles and forming circuitous heat-passages along the bottom of said muffles, an ore-inlet for the latter, an ore-discharge outlet, a gate by which said ore-outlet may be closed, said gate consisting of a plate having rollers thereon, a track upon which said rollers are supported, means connecting with opposite sides of the plate for operating said gate and a vapor-outlet for said muffles.

In witness whereof I have hereunto set my hand.

CHRISTOPHER FITZGERALD.

Witnesses:

S. H. NOURSE,  
JESSIE C. BRODIE.