F. MEYER.

METALLURGICAL FURNACE.

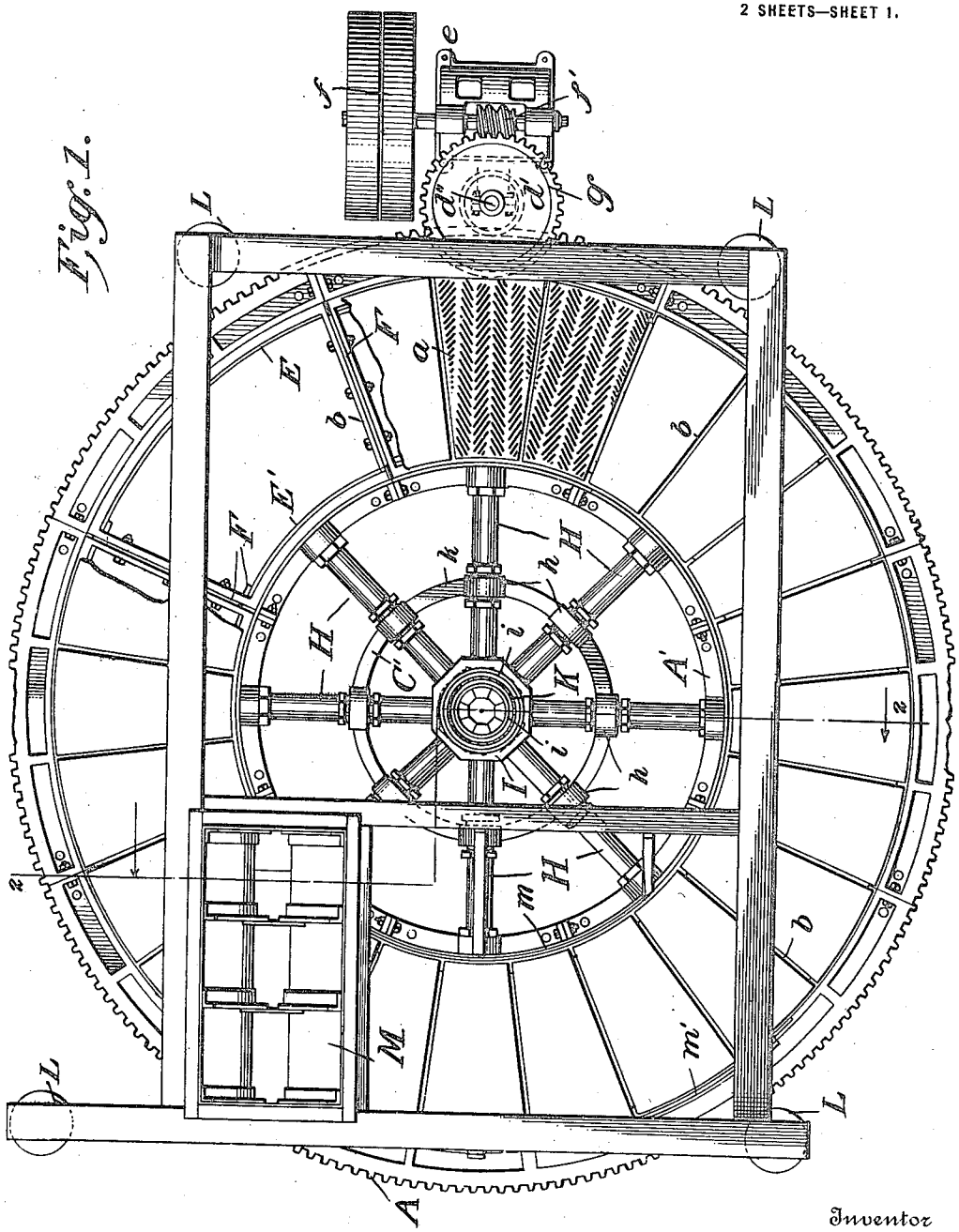
APPLICATION FILED JAN. 13, 1911. RENEWED APR. 24, 1915.

1,162,634.

Patented Nov. 30, 1915.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

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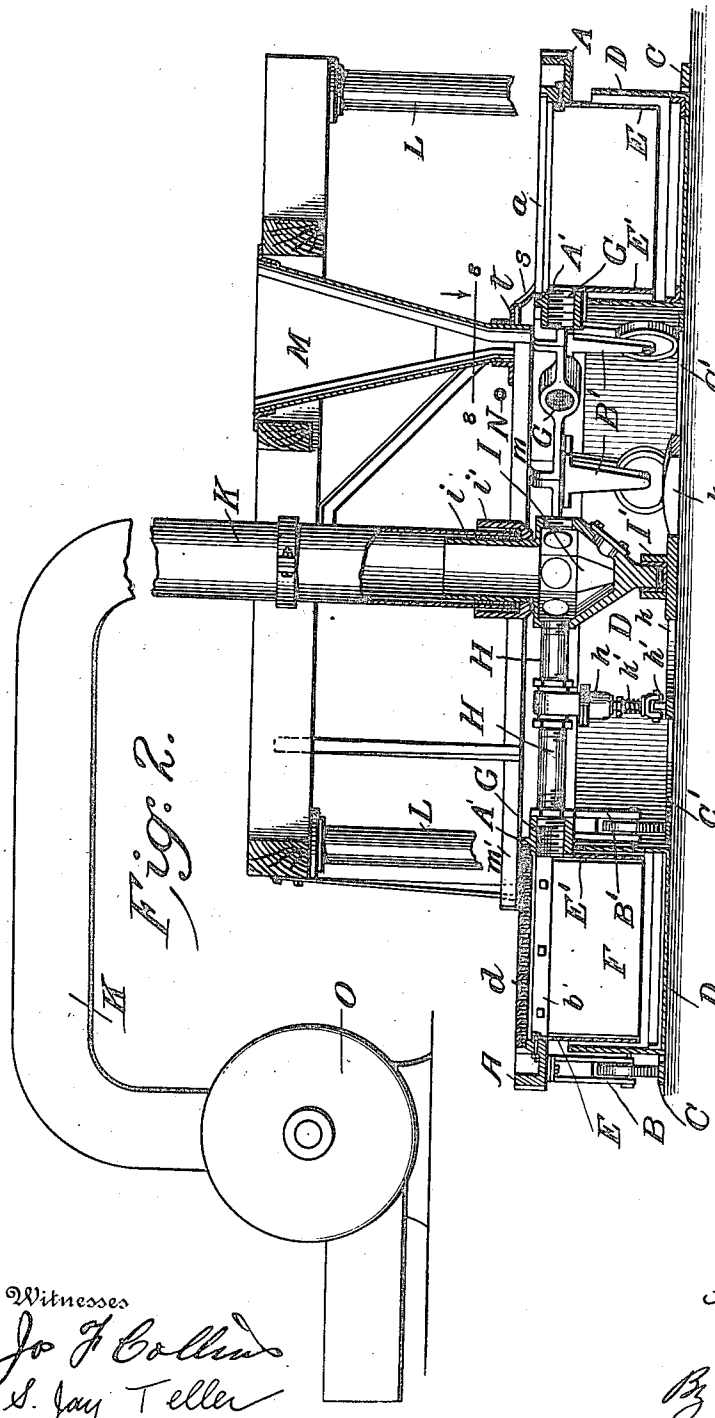


Fig. 2.

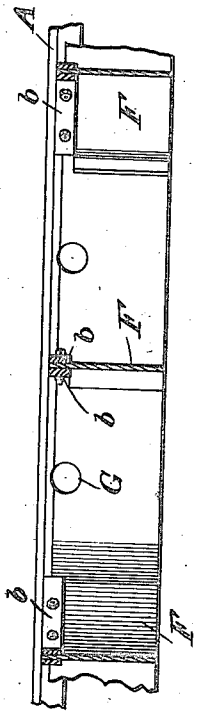


Fig. 3.

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UNITED STATES PATENT OFFICE.

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METALLURGICAL FURNACE.

1,162,634. Specification of Letters Patent. Patented Nov. 30, 1915.

Original application filed November 9, 1907, Serial No. 401,476. Divided and this application filed January 13, 1911, Serial No. 603,037. Renewed April 24, 1915. Serial No. 23,770.

To all whom it may concern:

Be it known that I, FRANZ MEYER, a subject of the Emperor of Germany, residing at Uerdingen, Prussia, Germany, have invented certain new and useful Improvements in Metallurgical Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings.

This case is a division of my application No. 401,476, filed November 9, 1907.

The invention covered by this case relates to the calcining, desulfurizing, agglomerating and volatilizing of ores and like materials, and more particularly to an apparatus wherein the charge is fed in a uniform layer upon an annular grate rotatable bodily about an upright axis, the arrangement being such that the charge will be spread out upon the upper flat grate surface, and when so spread and ignited is subjected to the action of air or other suitable aeriform fluid drawn or forced through it. The air or other aeriform fluid drawn or forced through the charge is preferably controlled in such manner that the desired quantity appropriate to each particular section of the grate may be supplied thereto. For instance, at the initial section of the grate, where the raw ore is fed and ignited, it will, in general, be desirable to furnish the minimum quantity of air to the charge; whereas, as the charge progresses toward the more advanced sections of the grate, it will usually be convenient to gradually or successively increase the supply of air. Finally, at the discharge section of the grate, it should again be wholly or substantially cut off. The control of the air supply is preferably automatic and may conveniently be effected by dividing up the space beneath the grate into separate compartments, each having its individual communication with the exhauster or compressor; and each having a controlling valve slightly open when the section occupies its initial position immediately in advance of the ore feed, closed when said section occupies its final or discharge position, and at varying degrees of closure between the two extremes. This automatic, gradual closing and subsequent re-opening of the valves of the individual grate compartments may be accomplished by means of a stationary cam track operating upon the stems of the spring seated valves, as will hereinafter more fully appear.

In the preferred embodiment of my invention the radial grate is carried by a central mast, which is itself hollow and which communicates with the several grate compartments by radial conduits in which the controlling valves are located. These radial conduits may themselves carry the grate and their carrying function may be in part relieved by supplementary supporting wheels for the grate body. The individual compartments beneath the grate surface are formed by annular plates dipping into a water seal and cross partitions likewise dipping into the sealing body of the water.

Other features of construction and arrangement will be hereinafter more particularly described with reference to the accompanying drawings, wherein—

Figure 1 represents a general plan view of an apparatus embodying the main features of my invention, said view being partly in section and with certain of the parts shown as broken away, for clearness of illustration of the remainder. Fig. 2 represents a section and partial elevation on the line 2—2 of Fig. 1. Fig. 3 represents a fragmentary sectional view through the upper part of the rotatable grate.

Referring to the drawings it will be noted that the rotatable grate or carrier consists conveniently of a series of slotted plate sections *d*. These plates or grate sections are supported upon an annular framework which is made up of the concentric frames A, A′, and these frames are connected together and braced by the radial ribs or projections *b*, the frames themselves being preferably made up of a number of sections, as shown more fully in Fig. 1. The grate, as thus constructed, is carried by a central mast, as shown, but a great part of its weight is likewise sustained by means of the trucks B, B′, which travel on the annular tracks C, C′. The outer periphery of the frame A is cut or cast to form a gear which meshes with the pinion *d′* journaled in a bracket extending from the standard *e*. The pinion *d* is driven from the pulley *f* which drives the worm *f′* intermeshing with the worm

gear g fastened to the upper end of the shaft d'', on which is secured the pinion d.

Immediately beneath the grate is an annular trough D for the reception of a body of water, and depending from the walls of the annular frames A, A′ are the annular curtains E, E′, which dip well within the water contained in the trough. The sealed inclosure thus formed beneath the grate is further divided into individual compartments by the radially extending curtains F depending from the ribs b. From each of the individual compartments so formed there is an exit passage G from which a pipe H extends to the hollow interior I of the central mast, which mast is journaled in a step bearing I′ at the axial center of the apparatus. The upper portion i of the mast extends within a stationary tube K, and a cup i' adapted to receive a suitable sealing material, such as water or sand, insures against the exit of gases at the sealed joint thus provided. The pipe K either communicates with the air blower or compressor for forcing air upwardly through the charge on the grate, or preferably, with an exhausting device, such as an air exhauster O or a chimney flue, so as to draw air downward through the charge on the grate. I prefer the latter arrangement for the reason mainly that it avoids the necessity of providing a hood for conveying away the fumes from the burning ore charge, and it permits the operators to more carefully supervise the proper working of the apparatus.

In each of the pipes H, between its grate compartment and the hollow mast, is a gate valve h whose stem is provided with a spring k' tending to hold the valve open. The stem terminates in a roller h' traveling upon an annular cam track k, the arrangement being such that when the roller h' is at the summit of the maximum rise of the cam track, the valve will be closed, or practically closed, thereby cutting off the passage of aeriform fluid through the pipe H.

A suitable framework is supported above the apparatus by the posts or standards L. This framework supports the hopper M, one of whose walls is carried down to substantially the upper surface of the grate, whereas, the opposite wall terminates at a distance above the grate equal to the thickness desired for the layer of ore to be supplied thereto. With the parts arranged as shown, a counter-clock-wise rotation is given to the grate so that the ore is fed from the hopper in a uniform layer of the desired thickness. It will, of course, be apparent that by providing an additional hopper in the rear of the hopper shown and having its discharge aperture at a suitable elevation with respect to the discharge aperture of the first hopper, a second layer of material may be deposited upon the first layer. This is of particular service when in drawing an aeriform fluid through the grate the layer first supplied to the grate contains little or no combustible material and where it is desired to supply a combustible material from a separate source. In forcing an aeriform fluid upward through the grate, the layer first supplied must, of course, contain the combustible material. An instance of this would be furnished by the treatment of zinc ores for the manufacture of zinc oxid, the pulverized coal, or other combustible, being fed from the first hopper, and the zinc ore or mixture of the ore and of coal being supplied from the second hopper, so as to form a layer of ore superimposed upon the layer of coal. Where zinc ore is to be treated, it will, of course, be understood that the apertures in the grate plates are to be suitably restricted in area as in the grates of the ordinary Wetherill furnaces for like purposes, and that, if zinc oxid is to be made by forcing air through the charge a suitable hood is to be arranged over the grate, which hood is to be connected with a bag-house or similar means to collect zinc oxid formed.

In order to prevent the ore or other material from falling off the sides of the grate, especially during the early part of the operation, and when the material treated contains insufficient agglomerating constituents, guards m, m' are provided which extend from the hopper along the edges of the grate for a suitable distance.

For the purpose of calcining, desulfurizing and agglomerating such ores as contain sufficient sulfur, or other combustible material, it is only necessary to ignite the layer as it is deposited upon the grate from the feed hopper, and to draw or force air through the grate and the layer of ore thereon. In calcining carbonates, or in agglomerating ores or like material, containing no sulfur, or very little sulfur, (as, for example, pyrites cinder) the ore is mixed with enough fuel to accomplish the calcination or agglomeration. And, if need be, then a suitable quantity of fluxing material is added to the charge before it enters the feed hopper. In roasting agglomerating sulfids, containing enough sulfur to complete the roasting reaction after it has been started no admixture of fuel is necessary. In either case, however, the charge must be ignited, and, when blowing air through the charge, I prefer to ignite it by spreading a thin layer of glowing coal, or of hot calcines from a previous charge on the grate and by feeding the new charge upon this hot layer. When air is drawn through the charge the charge is preferably ignited by an oil or gas flame from the pipe N. When the air is drawn through the grate by a fan O or chimney draft connected to the pipe K, the operation is as follows: The charge is fed continuously

in a uniform layer from the hopper M upon the grate, which revolves in a counter-clockwise direction. When the charge arrives beneath the pipe N it is ignited by the flame from that pipe. The combustion of the fuel or of the sulfur in the charge is maintained by drawing air through the charge by means of the fan or chimney draft. The quantity of air drawn through the charge in the various stages of the roasting and agglomerating process is automatically regulated by the cam track acting upon the valves in the several radial pipes H. The cam track is so constructed that, at the discharging section of the grate, it is so high that the valves are substantially closed. From this point, the track slopes gradually in opposite directions, so that at the ignition point the valves are partially open and consequently the flame and air are drawn through the charge. In running down the incline the valves open farther until they have reached their full open position, as will be readily understood. If it is desired for any purpose to vary the amount of air drawn through the charge at any particular point in the treatment, it is only necessary to make a corresponding incline at that point upon the track *k*. Regulation of the air current may thus be made at any desired point. In some classes of work, however, the regulation of the air may be dispensed with, and in that case, the valves *h* and the partitions or curtains F may be omitted.

For the purpose of removing the charge from the grate I provide at the discharge section thereof the plow front, consisting preferably of a series of teeth *s* which serve to lift, detach and break up the mass of agglomerated ore, and when so broken up, the mass is diverted or shifted off of the grate by the abutment plate *t*, which may conveniently be attached to the rear of the hopper.

I do not in this case claim means, broadly considered, for regulating the amount of aeriform fluid that passes through individual sections of the grate and portions of the charge; nor the specific regulating means consisting of spring actuated side valves and an annular cam track for operating them, herein disclosed; as such subjects matter are claimed in my aforesaid application No. 401,476, of which this case is a division. Nor do I in this case claim the specific means illustrated for removing the sintered material from the supporting grate, or the guard rails for preventing the material being treated from falling off the sides of the grate, as these subjects matter are also made the basis of claims in my aforesaid application.

What I claim is:—

1. In apparatus for the metallurgical treatment of ores, and the like, a horizontal grate for receiving and supporting the charge, a trough below the grate adapted to contain an air-sealing material, plates below the grate extending into the said sealing trough and arranged to cut off the space directly below the grate from the outside air, and a duct connected with means for causing aeriform fluid to pass through the grate communicating with the said cut off space below the grate, substantially as set forth.

2. In apparatus for the metallurgical treatment of ores and the like, the combination of an annular grate rotatable about a vertical axis, an annular trough below the grate, adapted to contain air-sealing material, annular plates below the grate extending into the said trough, cross plates between the annular plates, said plates forming a series of air or gas chambers below the grate, and means connected with the said chambers for causing aeriform fluid to pass through the grate and the material supported thereby, substantially as set forth.

3. In apparatus for the metallurgical treatment of ores and the like, the combination of a pair of concentric annular frame pieces, grate sections supported thereby and constituting a horizontal annular substantially continuous supporting grate for the material, an annular water trough below the grate, plates carried by the frame and dipping into the water trough to form a series of separate closed chambers below the grate, air ducts communicating respectively with the said chambers and connected with means for causing aeriform fluid to pass through the grate and the material supported thereon, and wheeled supports for the grate carried by the said concentric frame sections exterior to and on either side of the said water trough, substantially as set forth.

4. In an apparatus for the metallurgical treatment of ores, and the like, a horizontal grate for receiving and supporting the charge of material to be treated, a trough below the grate adapted to contain an air sealing material, plates below the grate extending into the said sealing trough, and arranged to cut off the space directly below the grate from the outside air and to divide such space into a series of separate chambers, and ducts connected respectively with said chambers and with means for causing an aeriform fluid to pass through the grate and the charge supported thereon, substantially as set forth.

5. In an apparatus for the metallurgical treatment of ores, and the like, a horizontal grate for receiving and supporting the charge of material to be treated, a trough below the grate adapted to contain an air sealing material, plates below the grate extending into the said sealing trough, and arranged to cut off the space directly below

the grate from the outside air and to divide such space into a series of separate chambers, ducts connected respectively with said chambers and with means for causing an aeriform fluid to pass through the grate and the charge supported thereon, and means for controlling in succession the movements of the said aeriform fluid through the charge of material and adjacent chamber and duct, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

FRANZ MEYER.

Witnesses:

W. VOGEL,

HUGO DÖNNEWEG.