No. 610,540. Patented Sept. 13, 1898.

H. KAEMMERLING.

FURNACE FOR SMELTING ORE.

(Application filed Dec. 9, 1897.)

(No Model.) 2 Sheets—Sheet 1.

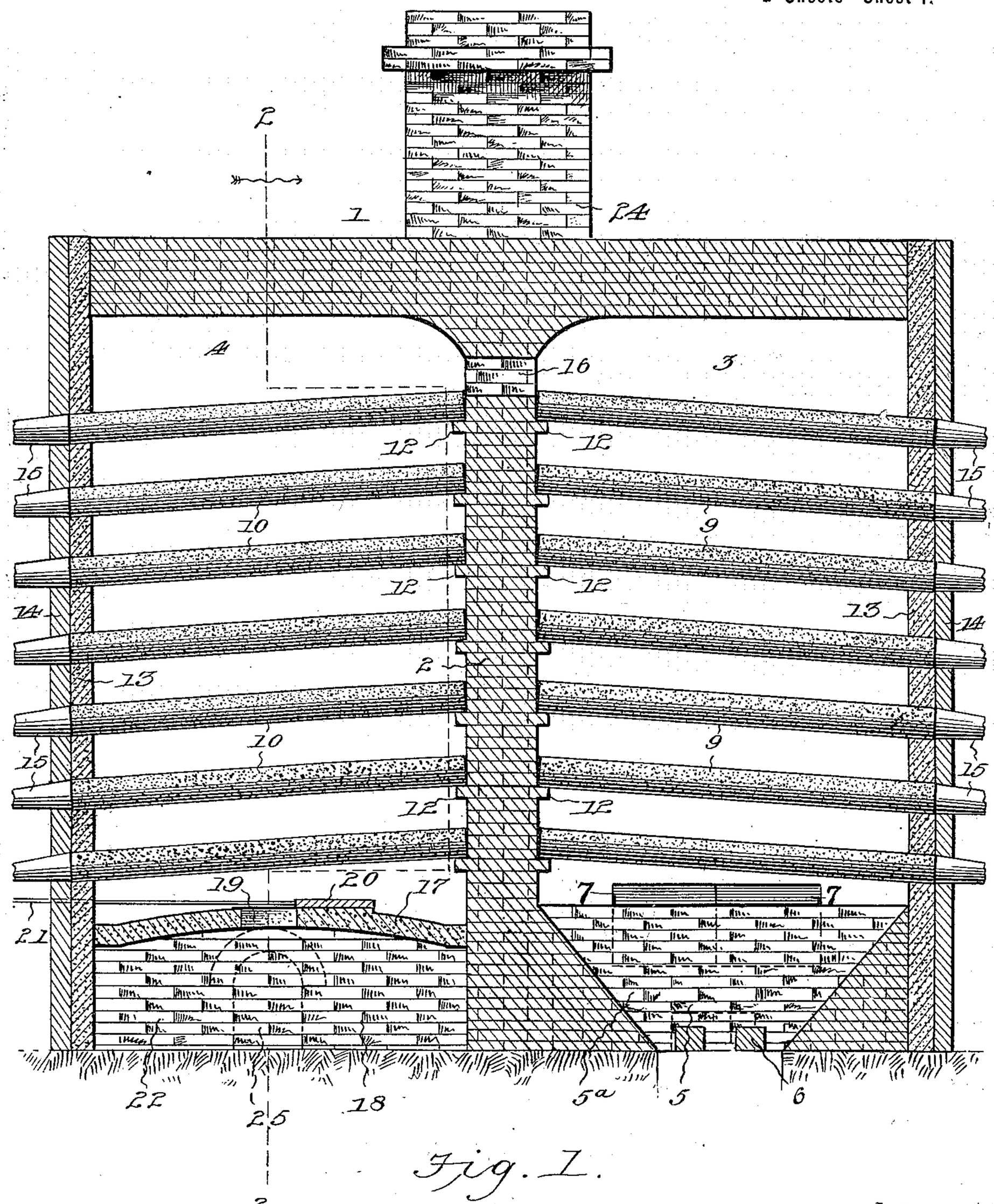

Fig. 1.

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Fig. 2.

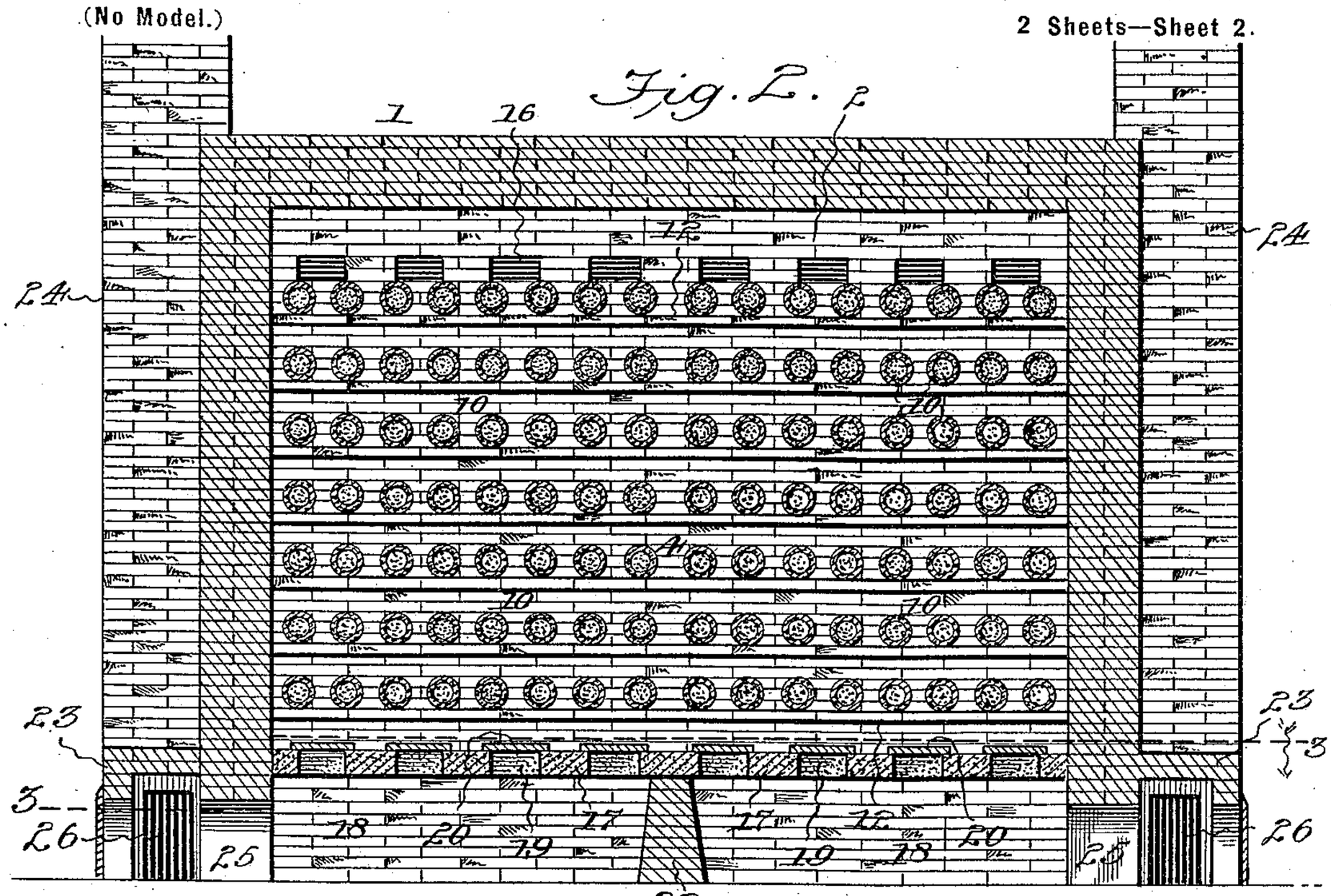
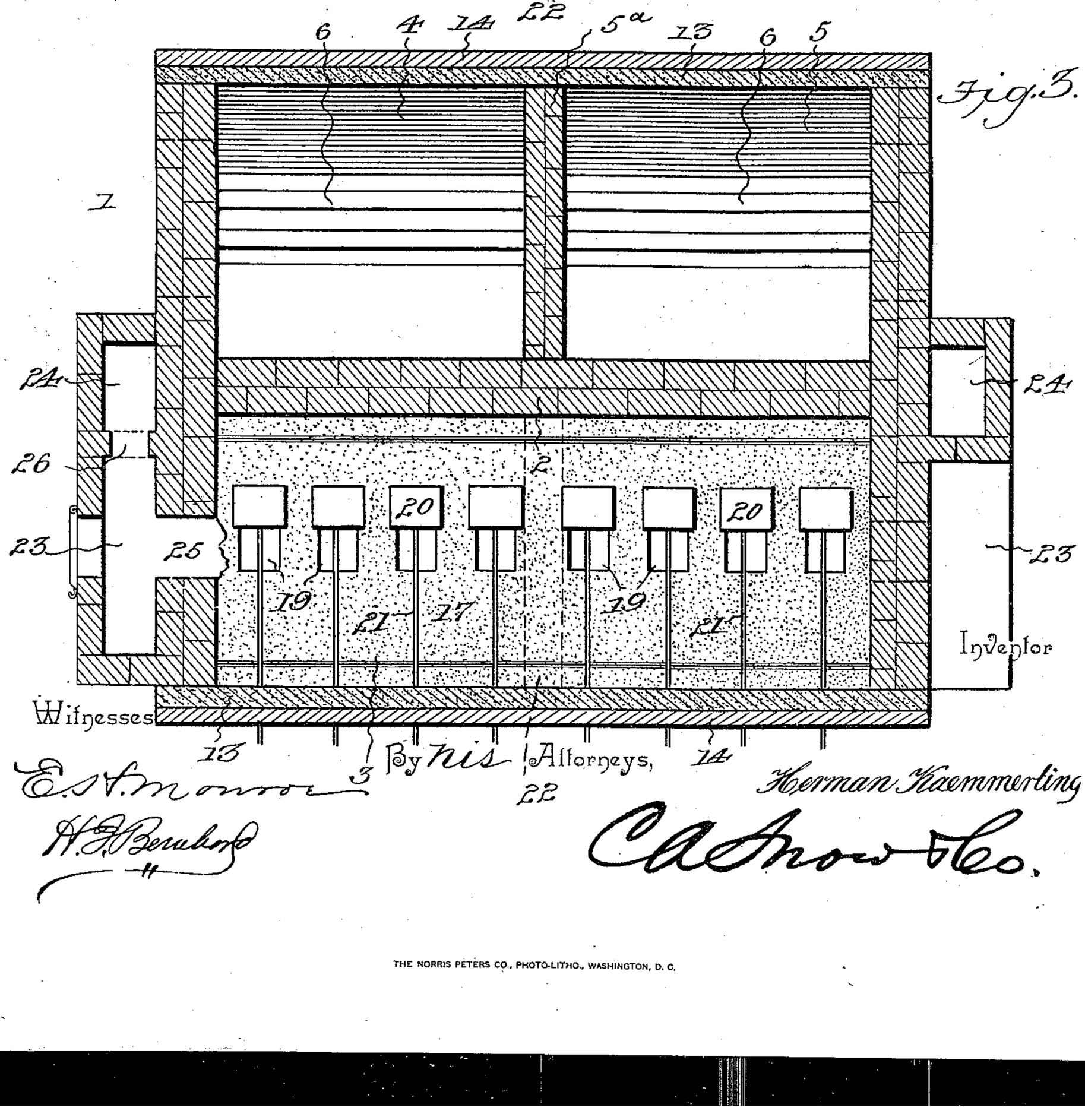


Fig. 3.



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FURNACE FOR SMELTING ORE.

SPECIFICATION forming part of Letters Patent No. 610,540, dated September 13, 1898.

Application filed December 9, 1897. Serial No. 661,263. (No model.)

To all whom it may concern:

Be it known that I, HERMAN KAEMMERLING, a citizen of the United States, residing at Girard, in the county of Crawford and State of Kansas, have invented a new and useful Furnace for Smelting Ore, of which the following is a specification.

My invention relates to an improvement in furnaces for smelting ore especially designed for the reduction of calcined zinc ores, although it may be used for smelting other kinds of ore; and the object that I have in view is to effect economy in the consumption of the fuel required to furnish the heat necessary for the operation of the furnace, as well as to economize the labor of attendants to feed the furnace with fuel and charge the ore therein.

The present invention is designed more especially as an improvement in that class of ore-smelting furnace known to the art as the "Belgian" furnace for the smelting of zinc ores.

In the present invention the furnace is constructed to provide a primary heating-chamber, a combustion-chamber below the same and discharging thereto, a secondary heating-chamber communicating with the primary chamber, two independent series of retorts in said chambers, a tunnel situated in the bottom of the secondary heating-chamber and divided by a transverse bridge-wall into non-communicating compartments, a series of damper-controlled openings from the secondary heating-chamber to the respective compartments of the divided tunnel, and stacks or uptakes situated at opposite sides of the furnace and connected with the respective compartments of the divided tunnel, whereby the waste heat and products of combustion from the primary heating-chamber are utilized in the secondary heating-chamber in a manner to consume the smoke and to heat the retorts in said secondary chamber and also whereby the downdraft through the secondary chamber is controlled by the series of dampers; and the invention consists in the novel construction and arrangement of parts, which will be hereinafter more fully described and claimed.

To enable others to understand my invention, I have illustrated the same in the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a vertical longitudinal sectional elevation through an ore-smelting furnace embodying my invention, the plane of the section being indicated by the dotted line 1 1 of Fig. 2. Fig. 2 is a vertical transverse sectional view through the secondary heating-chamber of the furnace, the plane of section being indicated by the dotted line 2 2 of Fig. 1. Fig. 3 is a detail horizontal sectional view through the smoke-arch of the secondary heating-chamber on the plane indicated by the dotted line 3 3 of Fig. 2, looking in the direction indicated by the arrow.

Like numerals of reference denote like and corresponding parts in the several figures of the drawings.

The structure of the furnace (indicated in a general way by the numeral 1 in the drawings) is built up of fire-brick or other suitable material, and the interior of this furnace structure is divided by a division-wall 2, also of fire-brick, which is built in the structure 1 transversely across the same. This division-wall extends from the base or floor of the structure to the roof of the furnace, and it provides therein two heating-chambers 3 and 4, preferably of equal cubical capacity. The heating-chamber 3 constitutes the primary chamber of the furnace, because the smoke and products of combustion from the fire-box or combustion-chamber are conducted directly into said chamber 3, while the chamber 4 constitutes the secondary heating-chamber, as it is not provided with a combustion-chamber or fire-box, but on the other hand it is operatively connected with the primary heating-chamber to receive the heat, flame, and other products of combustion therefrom and to utilize the waste heat and gases for the purpose of heating the retorts in the said secondary heating-chamber.

The furnace is constructed with a single chamber or fire-box, (indicated in a general way at 5 in Figs. 1 and 3,) and it is divided by a transverse division-wall 5^a. Within this furnace-chamber is an ordinary double grate 6, arranged at the bottom of the division-wall, and said grate may be charged from either end by the usual doors 7, situated at the ends of the furnace, one of the door-openings be-

ing indicated in Fig. 1. The fire-box is built with sloping walls at the sides thereof, so that it is quite narrow at the bottom, and the grate only requires two bars on each side of the furnace. The grate-bars are laid lengthwise of the furnace at a suitable distance above the usual ash-pit and for the admission of air to the combustion-chamber below the grate, and this chamber is in all substantial respects similar to ordinary Belgian furnaces.

The primary heating-chamber 3 contains a series of inclined retorts 9, while a like series of inclined retorts 10 are provided in the secondary heating-chamber 4. The retorts in each heating-chamber are arranged in rows one above the other and at suitable distances apart to provide spaces between the retorts for the circulation of the heat and gases through and around the retorts. Each row of retorts is arranged transversely across the heating-chamber to extend from the division-wall to and through the front wall of the furnace structure 1, and, as is usual in the art, I provide a horizontal ledge 12 to support the rear or inner ends of the retorts of each row or series. The front ends of the retorts of each row extend through a fire-brick wall 13, constituting a part of the furnace structure 1, and they also extend through a metallic face-plate 14. The protruding or extended ends of the retorts receive the condensers 15. Each retort is made of fire-clay or other suitable fire-resisting material, but the detailed construction of the retort, its condenser, and the means for supporting the same within the furnace structure are not material, as they are made of the usual construction known to those skilled in the art.

The secondary heating-chamber 4 of the furnace structure communicates with the primary heating-chamber 3 through a series of passages 16, which are formed in the division-wall 2, at the upper part thereof, adjacent to the roof of the furnace structure. These transverse passages 16 of the division-wall are spaced at suitable intervals apart, and they are of sufficient size to provide for the free and unobstructed passage of the heat, smoke, and waste gases from the chamber 3 into the chamber 4.

As before indicated, the secondary heating-chamber 3 is not equipped with a fire-box or combustion-chamber; but it receives the heat, smoke, and waste gases from the primary heating-chamber 3 for the purpose of consuming the smoke in said secondary heating-chamber and of utilizing the waste heat for raising the temperature of the retorts 10 therein sufficiently to smelt the ore contained in said retorts. The lower part of the secondary heating-chamber 4 is equipped with a smoke-arch 17 and with a smoke-tunnel 18. The arch and tunnel extend transversely across the secondary heating-chamber from one side wall to the other of the furnace structure, thus taking in the entire width of the secondary heating-chamber, and the smoke-arch 17 is situated above the smoke-tunnel 18 for the purpose of receiving the waste heat from the secondary heating-chamber before it passes into the smoke-tunnel, which is in direct communication with the uptakes or stacks 24 of the furnace. The smoke-arch lies below the last tier or row of the retorts in the chamber 4, and it is in direct communication with said chamber. The roof of the smoke-tunnel 18 constitutes the floor of the smoke-arch 17, and through this floor or roof is formed a series of spaced openings 19, by which communication between the tunnel and the arch is established. On this roof of the smoke-tunnel is fitted a series of slidable dampers 20, one of which is provided for each of the openings 19, leading to the smoke-tunnel, and each damper is equipped with a suitable operating-rod 21. Each damper is constructed of fire-brick or other suitable fire-resisting material designed to withstand the intense heat of the furnace, and the operating-rod 21 for said damper is attached to the same in a suitable way, said operating-rod extending through an aperture in one of the furnace-walls to be readily accessible from the exterior and to furnish the means for adjusting a damper as may be required.

The smoke-tunnel 18 is divided by a transverse division-wall 22, arranged substantially across the central line of the channel and adapted to direct the escaping heat and gases in opposite directions toward the sides of the furnace.

The stacks or uptakes 24 are preferably situated at about the middle of the furnace structure, and to establish communication between the smoke-tunnel 18 and said uptakes 24 I provide the longitudinal exterior smoke-tunnels 23, situated on opposite sides of the furnace structure, each exterior smoke-tunnel having communication by a port or neck 25 with the transverse smoke-tunnel 18 inside of the secondary heating-chamber, while a port or opening 26 connects the longitudinal exterior smoke-tunnel 23 with its proper stack or uptake.

In the operation of my furnace the calcined zinc ore with the proper quantity of coke is charged in the retorts 9 10 of the primary and secondary heating-chambers. The smoke, flame, and gases from the single combustion-chamber or fire-box 5 are conducted directly into the primary heating-chamber and circulate around the series of retorts 9 therein. The heat and other products of combustion ascend through the primary heating-chamber 3 and find their exit through the ports 16 in the upper part of the division-wall 2. The exit-openings for the heat and products of combustion admitted to the secondary heating-chamber are situated at the bottom of said secondary heating-chamber, and thus the downdraft is obtained through the secondary heating-chamber, the heat and products of combustion circulating around the series of re-

torts 10 in said chamber 4. As the heat, smoke, flame, and waste gases pass from the chamber 3 through the ports or openings 16 the smoke and waste gases are consumed in the secondary heating-chamber 4 to generate a sufficient quantity of heat therein for heating the series of retorts 10. As the heat and gases pass through the secondary heating-chamber 4 they circulate around the series of retorts 10 and pass into the smoke-arch 17, through the openings 19, thence into the tunnels 18 23, and finally find their exit through the stacks or uptakes 24.

By adjusting the dampers 20 the draft through the secondary heating-chamber may be regulated as required to check the progress of the heat and products of combustion through said chamber 4, and in this connection I desire to state that the dampers 20 may be operated independently of each other, as shown, or the entire series of dampers may be adjusted simultaneously by the provision of suitable means to secure uniform adjustment of all the dampers.

From the foregoing description it will be seen that the furnace is comparatively simple in construction to utilize the heat from a single fire-box in heating the retorts in both chambers, thus effecting economy in the consumption of fuel necessary to maintain the fire for the proper operation of the furnace. The furnace does not require as many attendants as ordinary furnaces, and economy is also effected in the service and operation of the furnace.

I am aware that slight changes in the form and proportion of parts may be made without departing from the spirit or sacrificing the advantages of the invention, and I therefore reserve the right to make all such changes and modifications as properly fall within the scope of the invention.

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

1. In an ore-smelting furnace, the combination with a primary heating-chamber and a single combustion-chamber, of a secondary heating-chamber communicating with said primary chamber, two series of retorts in said chambers, a divided tunnel situated in the bottom of the secondary heating-chamber and having a series of damper-controlled openings which establish communication between said tunnel and the secondary chamber, and stacks or uptakes communicating at opposite ends with the respective compartments of the divided tunnel, substantially as described.

2. In an ore-smelting furnace, the combination with a primary heating-chamber and a combustion-chamber discharging thereto, of a secondary heating-chamber communicating with said primary chamber, two independent series of retorts within the said chambers, a tunnel situated in the bottom of the secondary heating-chamber and divided by a transverse bridge-wall into non-communicating compartments, a series of damper-controlled openings from the secondary heating-chamber to the respective compartments of the divided tunnel, and stacks or uptakes situated at opposite sides of the furnace and connected with the respective compartments of the divided tunnel, substantially as described.

3. In an ore-smelting furnace, the combination with a primary heating-chamber and a combustion-chamber discharging directly thereto, of a secondary heating-chamber separated by a partition-wall from the primary chamber, the transverse ports, 16, in the upper part of the partition-wall and establishing communication between the secondary and primary chambers, a smoke-tunnel arranged transversely of the furnace at the bottom of the secondary heating-chamber, a partition, 22, erected within said tunnel and dividing the same into non-communicating compartments, an arch over said tunnel having a series of vertical openings, dampers fitted to said arch to vary the area of said openings and control the passage of the waste gases from the secondary heating-chamber to the tunnel, and stacks or uptakes situated at opposite sides of the furnace and connected with the respective compartments of the divided tunnel, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

HERMAN KAEMMERLING.

Witnesses:

MYRON A. WOOD,

F. W. STUECK.