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No. 852,613. PATENTED MAY 7, 1907.

W. G. PERKINS.

SMELTING FURNACE.

APPLICATION FILED FEB. 5, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

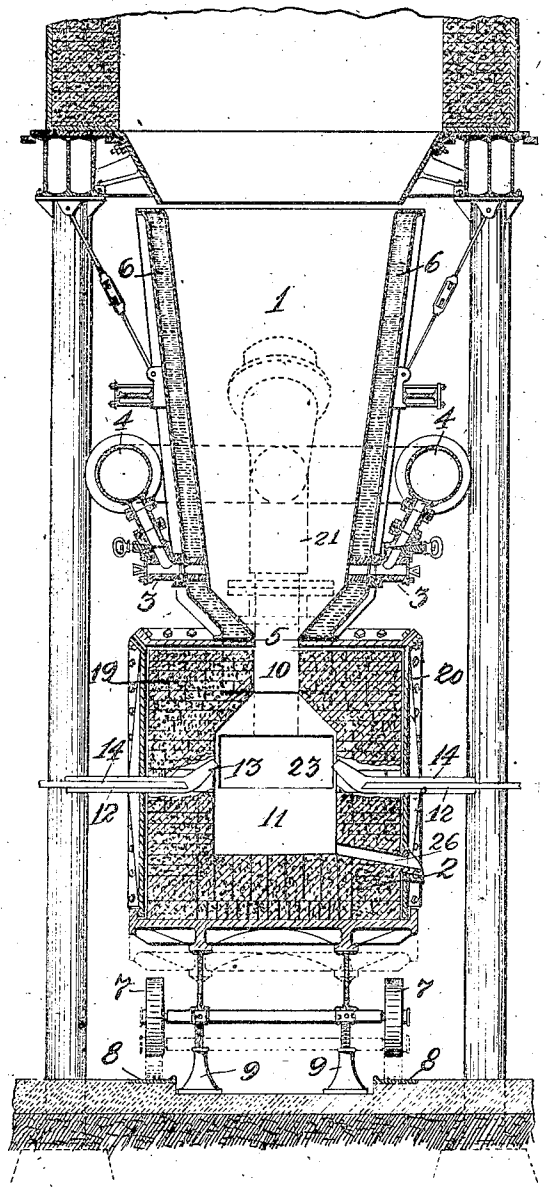
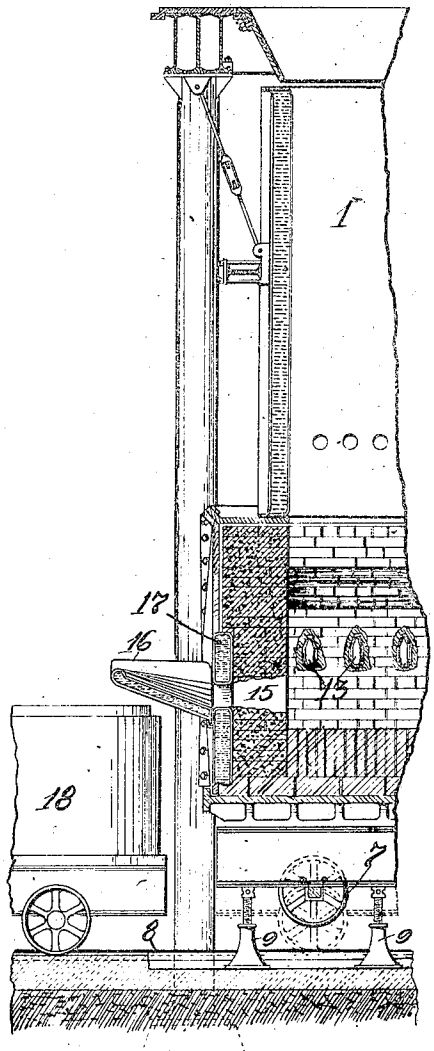


Fig. 2



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Fig. 3.

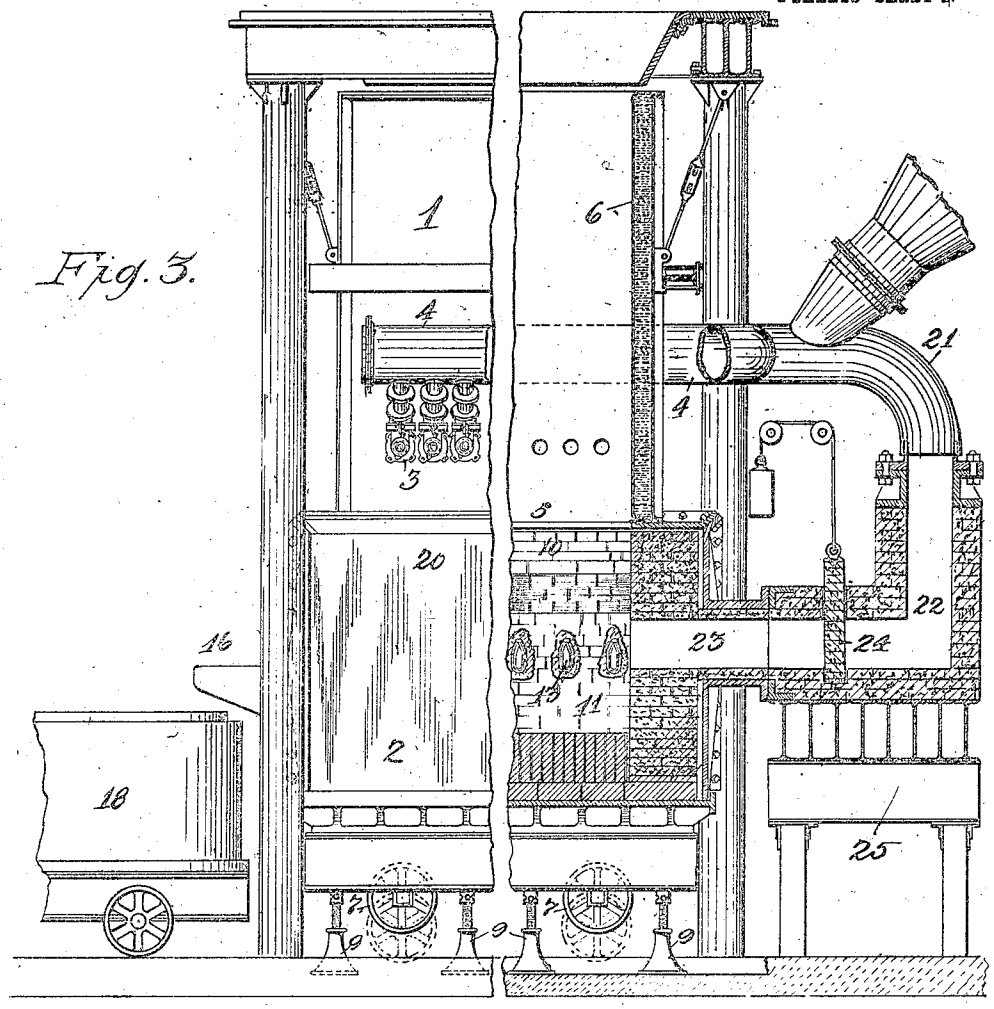
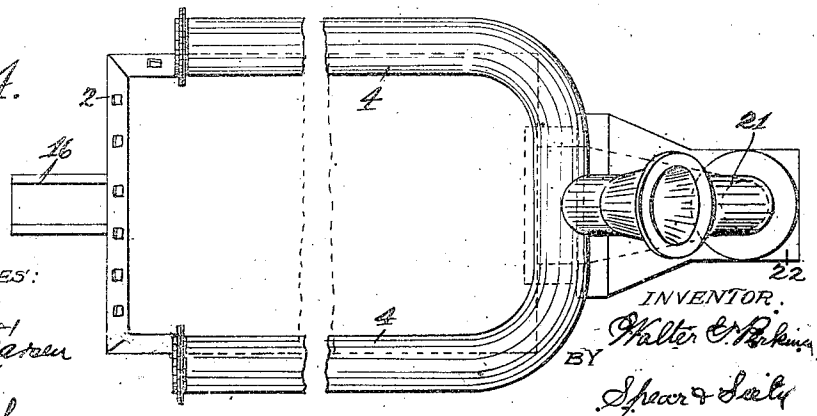


Fig. 4.



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SMELTING-FURNACE.

No. 852,613. Specification of Letters Patent. Patented May 7, 1907.

Application filed February 5, 1906. Serial No. 299,605.

To all whom it may concern:

Be it known that I, WALTER G. PERKINS, a subject of the King of Great Britain, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Smelting-Furnaces, of which the following is a specification.

This invention relates to smelting furnaces and more particularly to a continuous process furnace in which pyritic ores, or substances containing combustible material, as sulfur, etc., are roasted and smelted, by a continuous process first having the pyritic or combustible material eliminated by a continuous process in which the extraneous heat is derived from an oil or gaseous fuel.

In treating pyritic or similar ores, chemical substances, etc., it is desirable to first partly eliminate the combustible material and then smelt the residue. This has generally been performed in two separate steps or processes. In the case of fine ore, it has required separate handling, besides losing the benefit of the heat which is generated by the first process, that of roasting or desulfurizing the material by decomposing or burning the combustible portion. In carrying out the process for combining these two operations in one continuous process of roasting and smelting of such ores and substances, I prefer to use an apparatus of smelting furnace in which the upper portion is used for roasting and the lower portion for smelting. In this apparatus the material is fed in at the top, or sides and as it passes downward it is gradually heated and desulfurized, passing into the lower portion where it is completely fused or melted by heat which is introduced from the exterior by means of a liquid or gaseous fuel. To prevent the material from passing through the upper portion too rapidly, the furnace is contracted so that it virtually forms a double furnace, or one having two chambers or compartments, one above the other, with a throat or passage connecting them.

The lower portion of the furnace is preferably removable and has its chamber arched on top, in the nature of a reverberatory furnace with the fire jets projecting inward and the outlet or discharge in the form of a continuous or trapped overflow. Provision is also made for heating the air that is introduced through the twyers or windbox by conveying a portion of the heat from the bottom of the furnace thereto and introducing it into the air blast just before it enters the furnace should it be deemed advisable to do so.

An embodiment of the invention is shown in the accompanying drawings in which:

Figure 1 is a vertical sectional view of my furnace, Fig. 2 is a similar view of a portion of the furnace taken at right angles to Fig. 1, Fig. 3 is a broken view, partly in section and partly in elevation, of the furnace, showing a by-pass at one end thereof, Fig. 4 is a plan view of the bustle pipe and by-pass.

Referring more particularly to the drawings 1 indicates the upper and 2 the lower portion of the furnace. The upper portion is supported in the usual manner and is provided with a twyer or windbox 3 near the bottom on each side, through which air from the bustle pipe 4 is introduced to the interior of the furnace. Below the twyers the interior of the furnace is contracted more or less abruptly, to prevent the too rapid descent of the material toward and through the opening 5. The usual water jacket 6 surrounds the furnace and preferably has its lower end flat or terminating abruptly so as to fit upon or engage with the top of the lower portion 2. The lower portion, or section 2, is preferably mounted upon wheels 7, so as to be removable from under the upper section, upon the rails or track 8. The section is also movable vertically by means of jack screws 9, so that it can be lifted up until its top is made to engage with the lower end of the upper section and thereby cause an opening or throat 10 to register with the opening 5. The throat extends up from the top of the chamber 11, which throat is formed in the lower section and is only of sufficient size to permit of the contents from the upper sections passing through it as they become fused or melted. The roof of the chamber is preferably arched, so that the heat will be reflected to a certain degree upon the molten material in the bottom of the chamber and thereby assist in keeping it in a liquid condition.

The fuel for generating the heat is preferably introduced in the form of an inflammable gas, which enters through the pipes 12, said pipes being provided with ordinary valves, not shown, having their inner ends contracted as shown at 13 and preferably pointed upward toward the throat 10. A supply of air is introduced through a pipe 14, which preferably terminates to the rear of the tip or inner end of said pipe, so as to

give the air an opportunity of mingling with the gas before it escapes into the furnace. If desired, the tips of the pipes 12 may extend otherwise than upward, as for instance, they may project downward, so as to cause the heat to impinge directly upon the material in the bottom of the chamber 11.

The discharge of molten material from the chamber 11 is continuous and is effected by means of an opening 15 and a spout 16, the outer end of the spout being higher than the top of the opening 15, which will cause the material in the chamber to rise above the top of the opening before it can run out of the end of the spout, thereby causing the opening to be trapped or closed. A water jacket 17 surrounds the opening 15 so as to prevent the excessive heat of the molten metal from destroying the furnace at that point. From the spout 16 the material is discharged into a receiver 18 in which the heavier portions, or metals, sink to the bottom and are drawn off in the usual manner.

The lower section is preferably formed from fire-brick 19 silica or magnesite and is inclosed by a metal shell or covering 20, so that the shell may be relined whenever the old lining becomes corroded or burned out to such an extent as to be defective or incapable of giving the best results.

For the purpose of securing better control of the heat and thereby rendering it more efficient I prefer to provide a conduit or bypass from the chamber 11 in the lower section to the supply pipe 21 that communicates with the bustle pipes 4. This conduit is preferably made in the form of a separate structure 22 which communicates at one end with an opening 23 of the furnace and at the other end with the supply pipe 21, and a damper 24 is provided near the lower end. The conduit is supported on a suitable base 25 and has its lower end abutting against the furnace so as to permit of the movement that must take place during contraction and expansion of the parts. The upper end and the supply pipe are joined together on an angle whereby the heated air is drawn through the conduit and forced into the furnace on the principle of an injector.

By producing an excess of heat in the chamber 11 the surplus can be transferred to the bustle pipes and there used for warming the inrushing air which renders it more effective than introducing cold air into the furnace for carrying on the process of partial desulfurization of the material; and by increasing the amount of air introduced into the chamber 11 to such an extent that all of it cannot be consumed the excess will become heated, which will pass into the mass from the bottom through the throat, or more or less of it can be transferred to the bustle pipes and then introduced after it has been commingled with the air from the supply pipe. Or the amount of air may be less than sufficient to combine with all the fuel or gas introduced, in which case the excess of fuel is transferred to the mass through the bustle pipe and then consumed or caused to unite with the material being treated.

By constructing the furnace in this manner an absolute control of the heat can be had in the mass and the most desirable results can be obtained with ores of different character, for the heat can be changed from one place to another and can be increased or decreased to suit the conditions of the ore being treated at any particular time.

In operating my improved furnace the lower section is placed in position below the upper one and elevated until its top engages with the bottom of the upper section and forms a tight joint therewith, an asbestos calking being preferably arranged between them for effecting a closer union. The charge is then fed into the upper chamber in the usual manner, and the gas is turned on and lighted in the lower chamber. The heat passes up through the throat, or chimney, at the top of the lower section, into the upper section and there comes in contact with the material to be treated. The heat gradually heats the mass and passes on up through it to the top, heating as it goes. As soon as the lower portion of the mass becomes heated to such a degree that the combustible substance in the mass, as the sulfur, is ready to burn, or become decomposed, air is admitted through the twyers which will furnish the necessary oxygen to combine with the sulfur and cause it to burn, and thereby add its heat to the mass and permit of the heat in the lower chamber being decreased as by shutting off part of the fuel. As the mass is thus roasted, or desulfurized, it gradually settles to the bottom of the upper section, where it is subjected to the heat from the gas and is quickly fused and drops into the chamber of the lower section. From said chamber the melted material passes through the discharge into the receiver, where the metallic or valuable portions are separated from the dross or worthless portions in the ordinary manner or can be drawn out through the tap hole 26 as indicated in Fig. 1.

From the foregoing it will be seen that metalliferous ores or chemical substances of widely different qualities or characteristics, either fine or coarse, can be successfully treated in the furnace, owing to the control which can be had of the air either cold or heated that is introduced into the upper chamber and of the air and fuel into the lower chamber. Whenever it is desired to remove the lower section the fuel pipes are removed and the section is lowered onto the tracks, after which it is hauled out of the way, and another section is put in its place

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and the fuel pipes are inserted, and the process is continued. If desired, the furnace may be used only for smelting, in which case the draft of air into the upper section could be dispensed with, or, if the air were introduced it could be heated to a greater or less degree, so as to warm the mass before it came in contact with the heat from gaseous fuel in the lower portion of the chamber.

Instead of forming the throat in the top of the lower section the lower end of the upper section may be extended down into the lower section with its water jacket, thereby preventing damage to the lower section by the excessive heat at that point.

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

1. In a smelting furnace a hollow structure formed in two sections, the lower end of the upper section being contracted and provided with an opening, and the lower section being provided with a chamber which communicates with said opening, means for introducing a blast of air into the upper section above the contracted portion, means for connecting said air introducing means with the chamber of the lower section and means for introducing an inflammable gas into the chamber of the lower section.

2. In a smelting furnace a hollow structure formed in two sections, the lower end of the upper section being contracted and provided with an opening, and the lower removable section being provided with a chamber and a throat leading therefrom to said opening, means for introducing a blast of air into the upper section above the contracted portion, means for connecting said air introducing means with the chamber of the lower section and means for introducing an inflammable gas into the chamber of the lower section.

3. In a smelting furnace a hollow structure formed in two sections, the lower end of the upper section being contracted and provided with an opening, and the lower section being provided with a chamber and a throat leading therefrom to said opening, means for introducing a blast of air into the upper section above the contracted portion, means for connecting said air introducing means with the chamber of the lower section and means for introducing an inflammable gas and an air-blast into the chamber of the lower section.

4. In a smelting furnace a hollow structure, formed in two sections, the lower section being removable and provided with an arched chamber and a throat leading from the top of the arch and adapted to register with the lower end of the upper section, a discharge outlet and gas pipes projecting into said chamber, the ends of which are contracted and curved.

5. In a smelting furnace a hollow structure, formed in two sections, the lower section being removable and comprising an outer shell and an inner lining, said lining being removable and forming a chamber having an upwardly extending throat adapted to communicate with the lower end of the upper section, and means for introducing inflammable gas into said chamber.

6. In a smelting furnace a hollow structure formed in two sections, the lower section being removable and comprising an outer shell and an inner lining, said lining being removable and forming a chamber having a throat adapted to communicate with the lower end of the upper section and means for introducing gas into said chamber.

7. In a smelting furnace a hollow receptacle, means for applying heat and introducing air, and means for varying the heat zone within the mass by transferring a portion of the heat from the bottom of the mass to a point above the bottom.

8. In a smelting furnace means for generating heat at or near the bottom of the furnace, means for introducing air to the interior at the side of the furnace, and a conduit from the means at the bottom to the means at the side for conveying heat from the bottom to the interior of the furnace without passing it up through the mass of material.

9. In a smelting furnace means for generating heat at the bottom of a mass of material and means for creating a forced draft upon the exterior of the mass, thereby withdrawing heat units, and introducing them into the mass at a point above the bottom.

10. In a smelting furnace, means at the bottom thereof for generating heat from a gaseous fuel, means for introducing air through the side of the upper receptacles, and a valved conduit leading from the heating means at the bottom to the means for introducing said air for conveying said heat and introducing it into the receptacle above.

In testimony whereof I have affixed my signature, in presence of two witnesses, this 24th day of January, 1906.

WALTER G. PERKINS.

Witnesses:
M. R. SEELY,
F. M. BARTEL.