No. 846,216. PATENTED MAR. 5, 1907.

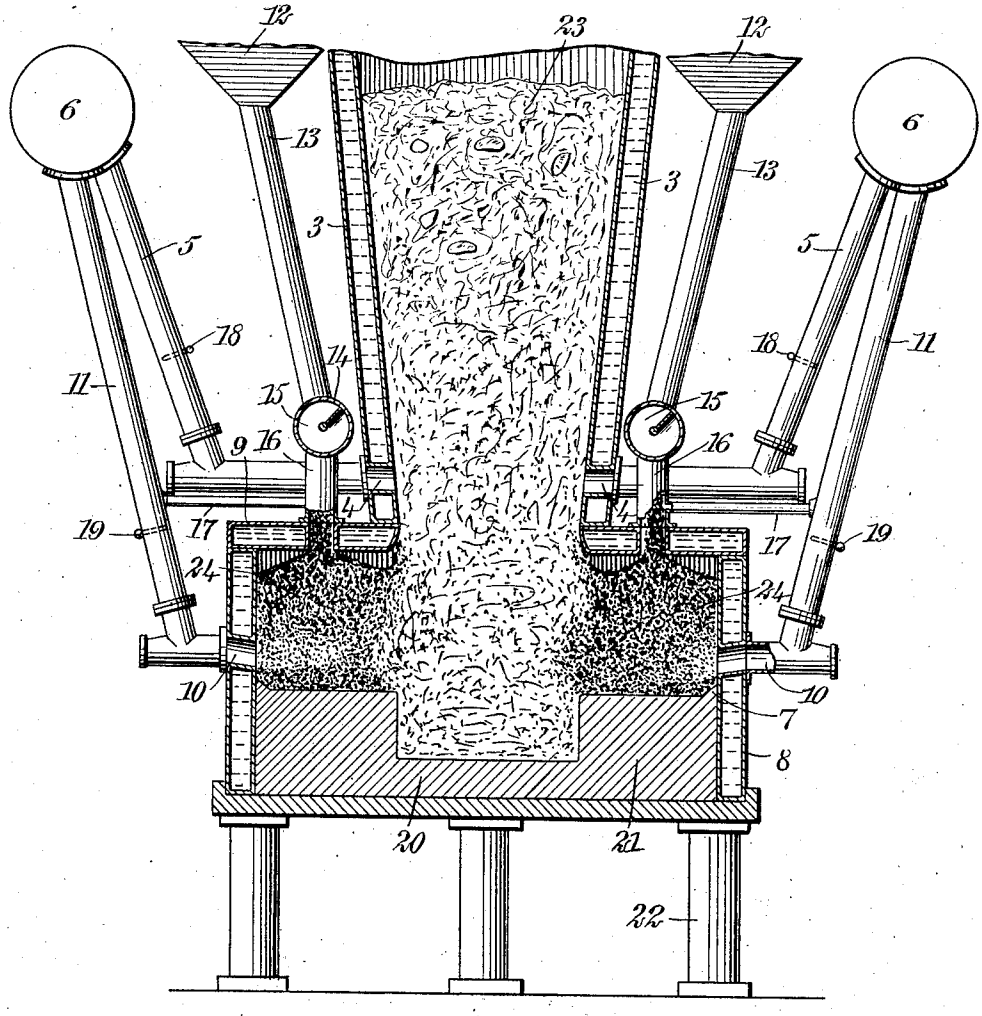
W. KEMP.

METHOD OF TREATING ORES.

APPLICATION FILED JUNE 25, 1906.

2 SHEETS—SHEET 1.

Fig. 1



WITNESSES

J. A. Brophy

Walton Harrison

INVENTOR

William Kemp

BY Munn & Co

ATTORNEYS

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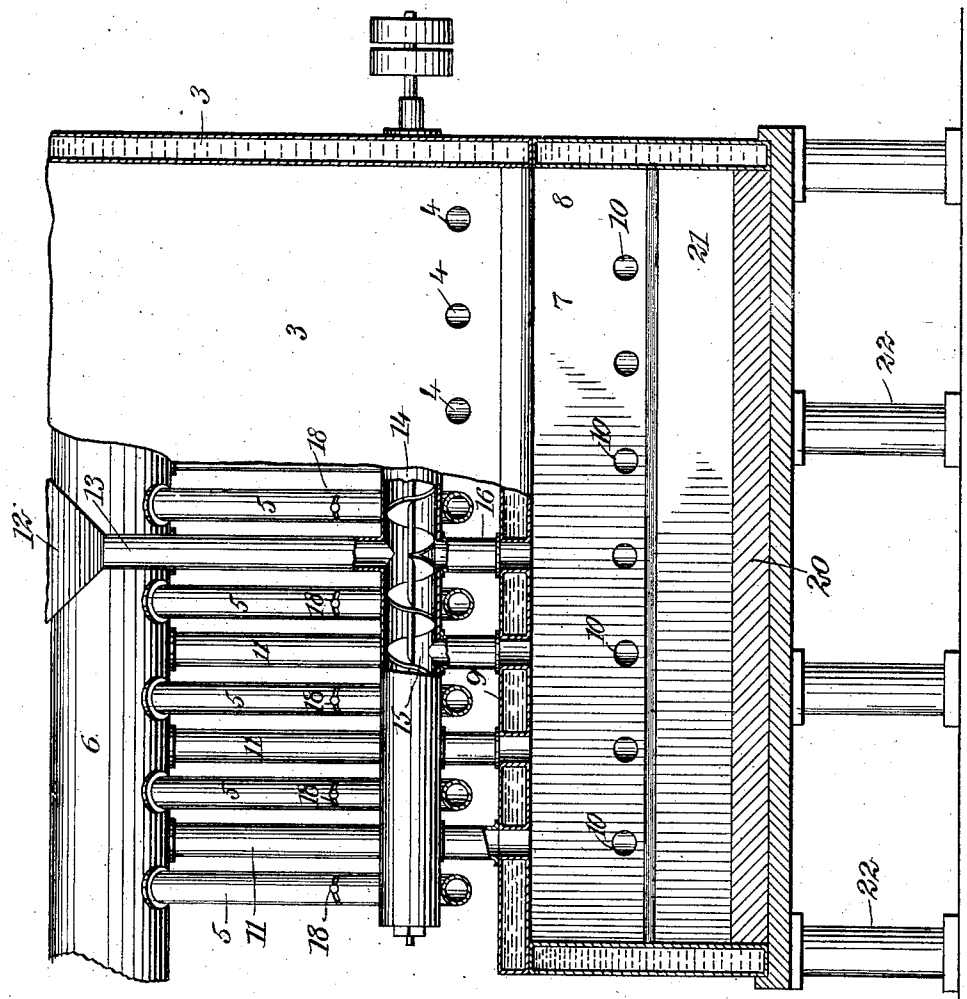

Fig. 2.

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UNITED STATES PATENT OFFICE.

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METHOD OF TREATING ORES.

No. 846,216. Specification of Letters Patent. Patented March 5, 1907.

Application filed June 25, 1906. Serial No. 323,234.

To all whom it may concern:

Be it known that I, WILLIAM KEMP, a citizen of the United States, and a resident of Tucson, in the county of Pima and Territory of Arizona, have invented certain new and useful Improvements in Methods of Treating Ores, of which the following is a full, clear, and exact description.

My invention relates to an improved method for smelting ores, especially ores of copper and iron.

Among the objects of my invention are the following: first, to economize the use of fuel; second, to rid the ore of sulfur should any of the latter be contained therein; third, to supply the fuel directly to the smelting zone of the furnace before the fuel is heated; fourth, to expose the fuel to air-blasts in order to prevent it from heating prematurely while in transit to the fuel-chamber; fifth, to drop the coal abruptly into the fuel-chamber, so as to prevent the premature escape of gases from the fuel; sixth, to burn out the sulfurous components of the ores by oxidizing the same at a point removed from the smelting zone; seventh, to distribute the fuel uniformly throughout practically the entire length of the furnace.

I do not limit myself to the use of any particular apparatus for carrying out my process. Certain particular forms of apparatus are especially suited for this purpose. One of these forms is shown in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a vertical cross-section through the furnace, and Fig. 2 is a longitudinal section through the same.

The ore-chamber is shown at 3 and consists of a water-jacket of substantially frusto-wedge shape, as indicated in Fig. 1. This ore-chamber is open at the top in the usual manner. At the bottom of the ore-chamber are disposed upon each side a series of twyers 4, connected, by means of twyer-pipes 5, with the bustle-pipe 6. The fuel-chambers are shown at 7 and extend practically throughout the length of the furnace. This fuel-chamber is bounded by water-jacketed walls 8 9, forming an angle relatively to each other. A series of twyers 10 tap into the water-jacketed wall 8 for the purpose of supplying air to the fuel-chamber 7 at a plurality of points. These twyers 10 are supplied by air-pipes 11, which communicate directly with the bustle-pipe 6. Hoppers 12 are provided with chutes 13, which extend obliquely downward into conveyers 14, which are provided with spiral screws 15. The hoppers 12 are preferably of the self-feeding type; but this feature is old and forms no essential part of my invention. Each tubular conveyer 14 is, in effect, a conduit for carrying coal from the chute 13 and properly distributing it in the fuel-chamber 7.

A number of branch conduits 16 are connected with the conduits 14 and are spaced equidistant throughout the general length of the furnace. Each branch conduit 16 is connected by a comparatively small air-pipe 17 with one of the air-pipes 11. By means of sliding valves 18 19 the respective pipes 5 and 11 may be opened and closed at will. The metal well is shown at 20, and disposed upon each side thereof are walls 21, of refractory material, preferably quite thick, as indicated. These walls serve to support the fuel, and consequently constitute the bottoms of the respective fuel-chambers 7. The supports 22 and other parts shown are of ordinary construction. The ore is shown at 23 and the fuel at 24.

Preferably I start my furnace in the following manner: In the smelting-chamber I first put the wood and ignite the same and then feed through the branch conduits 16, in the manner above described, coal on the burning wood and start up the blast through the twyers 10 until I have produced an incandescent mass in the fuel-chamber. Then I feed at the top of the ore-chamber the ores desired to be treated. The ore is fed into the ore-chamber 3 at the top in the usual manner. If the ore contains sulfur or its combustible compounds, the valves 18 are left open to a suitable extent. If the ore contains no sulfur, the valves 18 are generally closed. The spiral conveyers 15 being in action, the coal is fed continuously from the hoppers 12 through the chutes 13 and through the several branch conduits 16, so as to fill the fuel-chambers 7. The coal does not stack up in the branch conduits 16, but falls upon the walls 21 and piles up, preferably to a level somewhat below the lower ends of the branch conduits 16. Meanwhile the ore 23 feeds downward and is thus sandwiched between the masses of fuel 24, being in actual contact, but not being commingled—that is to say, the ore body as a whole is almost separate from the fuel body. As the fuel is con-

sumed more is supplied through the branch conduits 16, the supply being so regulated that the branch conduits 16 are always kept free of burning fuel. Air is supplied from the pipes 11, and when the furnace is in operation the valves 19 are always open, at least to a greater or lesser extent. The air-pipes 17 are always open and not only serve to keep up a circulation of air through the branch conduits 16 and downward by a downblast following the fuel-supply into the fuel-chamber, thereby preventing combustion of the fuel while passing through the branch conduits 16, but also serve to supply the fuel 24 with air delivered at a point somewhat difficult of access. The fuel 24 is thus supplied with an upblast from the bottom and a down-blast from its top. In the case of ores containing sulfur when the air-blast is turned on, passing through the twyers 4, the air comes directly into contact with the sulfur and iron in the heated ore, forming sulfurous gases and oxid of iron, thus generating a smelting heat. This heat is due partly to oxidation of the iron, but mainly to the combustion of the sulfur. A great advantage is thus obtained, because the objectionable gases are expelled from the ore and the necessity of roasting as a distinct step is avoided, and the gases themselves in the process of expulsion actually serve the purpose of fuel, and therefore economize the use of coal.

It will be noted that the fuel-chambers 7 are comparatively wide. Each of these fuel-chambers has approximately the shape of an immense fireplace. A comparatively large volume of coal is thus caused to burn in immediate contact with the ore body, and yet there is no danger of any part of the coal being ignited before actually entering the fuel-chamber. It should be borne in mind that the coal drops loosely from the conveyers 15 to the bottom of the fuel-chamber or to the level to which the fuel may be filled therein. It is of course impossible for the coal whether in large lumps or otherwise to ignite while falling this short distance so long as the air-pipes 17 are blowing a strong blast of cold air upon each separate piece of coal as it falls. I prefer to feed the coal by dropping it loosely, as above stated, but do not limit myself to that manner of feeding, as it may sometimes be desirable to feed the coal downward upon the fuel as practically a solid feed from the conduits 14, and this may readily be done, provided the downdraft through the branch conduits 16 is kept up with sufficient power to prevent combustion in those conduits, one important feature of my invention being the use of this downdraft to prevent an updraft through the branch conduits and the combustion of the fuel therein. In order to stop the supply of coal, owing to the fuel-chambers being full, the rotation of the spiral conveyers 15 is simply stopped. The fuel-chambers 7, together with the space intermediate thereof, constitute the smelting-chamber. One of the main purposes of my invention is to feed the ore into the center of the smelting-chamber and to feed solid coal free from combustion into immediate contact with the ore body without admixture therein, so that the coal after being thus placed is ignited—that is to say, the coal is first placed while comparatively cool in the smelting-chamber and is then heated and ignited in the first instance.

It will be seen that the method carried out during the operation of this furnace affords quite a number of distinct advantages. For instance, a sulfid ore containing any percentage of sulfur can be melted by the use of a comparatively small quantity of coal. If an ore contains no sulfur it can be smelted at a much less cost in this furnace than in other furnaces, for the reason that the fuel used is coal and is consumed right at the smelting zone. In most of the ordinary furnaces considerable waste takes place, due to the fact that a large percentage of the heat is lost in the shape of unburned carbonic oxid which passes through the ore body and escapes from the top of the furnace. In my furnace no carbonic oxid can escape, as none is formed above the smelting zone.

I am aware that efforts have heretofore been made to feed the ore and the fuel independently and continuously. I do more than this, in that while feeding the fuel to the ore continuously I also prevent premature combustion from taking place in the fuel thus supplied.

It is obvious that the principles underlying my invention may be applied in various ways, depending upon the diversified needs of the arts and the individual tastes and requirements of the different operators. Neither do I limit myself to the use of coal, for under proper conditions coke, charcoal, and other solid forms of fuel may be employed instead.

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

1. The method herein described of treating ores, which consists in subjecting said ores to the action of solid fuel, continuously replenishing said solid fuel, and supplying air to said solid fuel while in transit to thus replenish the main body thereof.

2. The method herein described of treating ores, which consists in forming a fuel body for the purpose of subjecting said ores to the action thereof, replenishing said fuel body by dropping solid fuel thereinto, supplying air to said fuel body thus formed, and separately subjecting air to the fuel while being dropped.

3. The method herein described of treating ores, which consists in forming an ore body, forming a fuel body in close proximity thereto, continuously replenishing said fuel body by dropping fuel thereinto, applying a blast of air to said fuel thus being dropped in order to prevent the retrogression of the flames and gases relatively to the supply from which said fuel is being dropped, and applying an air-blast to said ore body for the purpose of burning out sulfurous components of the ore.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM KEMP.

Witnesses:
E. W. GRAVES,
M. P. FREEMAN.