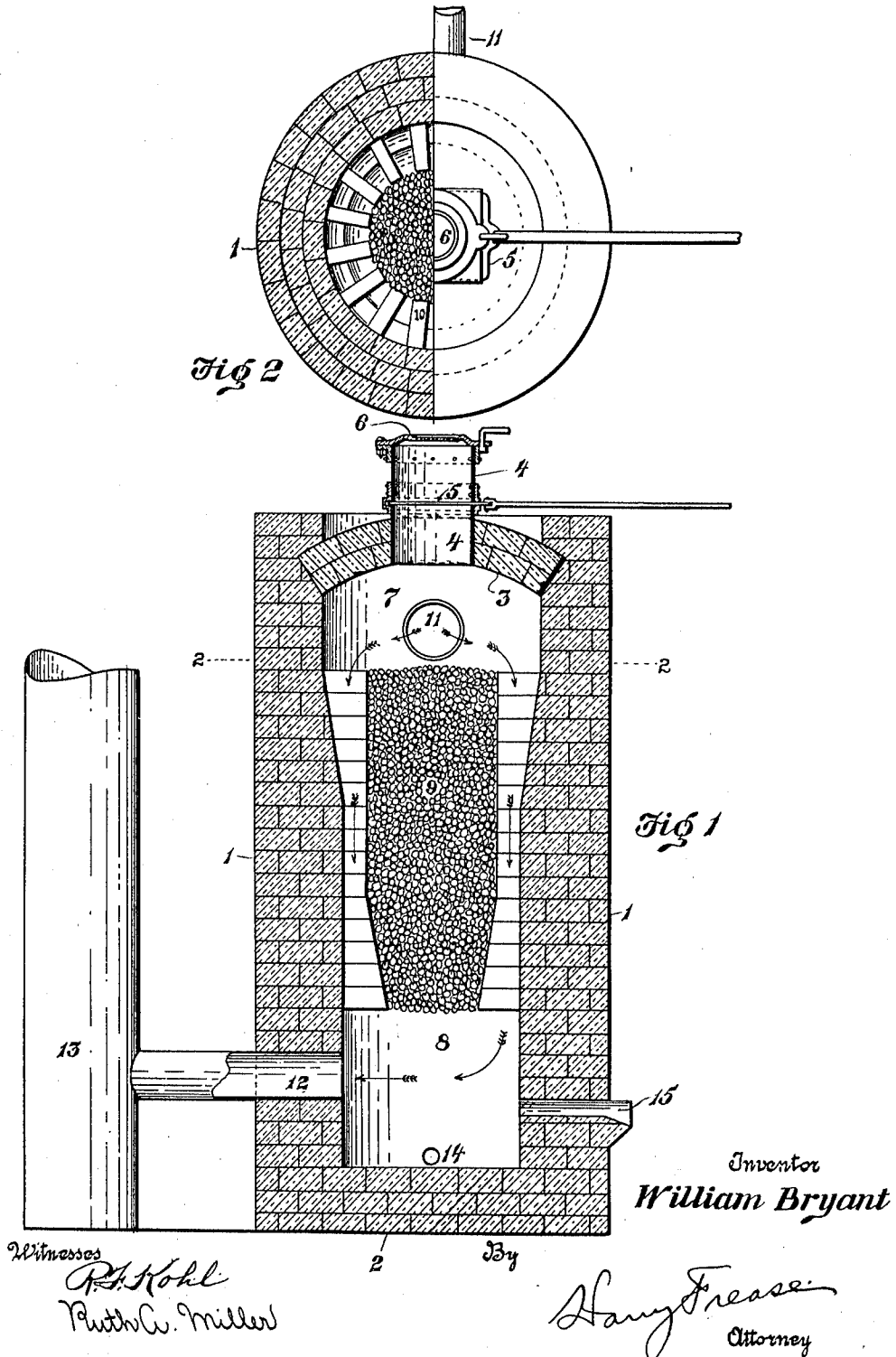


W. BRYANT.
METALLURGICAL APPARATUS.
APPLICATION FILED JAN. 17, 1912.

1,061,446.

Patented May 13, 1913.



UNITED STATES PATENT OFFICE.

WILLIAM BRYANT, OF MASSILLON, OHIO.

METALLURGICAL APPARATUS.

1,061,446.

Specification of Letters Patent.

Patented May 13, 1913.

Application filed January 17, 1912. Serial No. 671,681.

To all whom it may concern:

Be it known that I, WILLIAM BRYANT, a citizen of the United States, residing at Massillon, in the county of Stark and State of Ohio, have invented a certain new and useful Metallurgical Apparatus, of which the following is a specification.

The invention relates to pyrite smelting, or the smelting of sulfid ores carrying gold, silver, copper, or other metallic values, the object being to utilize the sulfur, iron and other fuel elements contained in the ore to furnish heat for self-smelting, without extraneous fuel, as nature has supplied these elements in abundance for this purpose.

The object of the invention, thus stated in general terms, is attained by introducing the ores and fluxes in a mixed state into a heated furnace, wherein they form an agglomerated core, and by subjecting the core thus formed on all sides to the action of the heat caused by the combustion of the self-contained fuel.

A preferred form of furnace for carrying out the improved process is illustrated in the accompanying drawing, forming part hereof, in which—

Figure 1 is an elevation section of the furnace; and Fig. 2, a plan view thereof, showing one side in section on line 2—2, Fig. 1.

Similar numerals refer to similar parts throughout the drawing.

The furnace is preferably formed with a cylindric wall 1 having a solid bottom 2 and an arched cover 3 in which is centrally located the charging hopper 4 which is provided with the gate 5 and the removable cover 6 in the usual manner.

The mixing chamber 7 is formed in the upper part of the cavity of the furnace, and the refining chamber 8 is formed in the lower part thereof, between which chambers is located the smelting chamber 9. Around the wall of the smelting chamber are built inward a series of radial partitions or ribs having their inner or free edges spaced apart, which ribs form a series of flues or channels 10 extending from the mixing chamber above to the refining chamber below. The inner or free edges of the ribs furthermore constitute a vertically slotted retaining wall, forming what may be called the core chamber. It will be understood,

however, that the scope of the invention is not limited to the use of a vertically slotted retaining wall, the essential object of the invention being attained by the use of any form of apertures or openings to give open communication between the flues and the core chamber.

The mixing chamber is preferably of larger diameter than the refining chamber, as shown, and the inside wall of the furnace is preferably tapered from the larger diameter of the mixing chamber at the upper end of the smelting chamber to the smaller diameter of the refining chamber at about the middle of the smelting chamber, thus enlarging the upper end of the vertical flues; and the edges of the lower end portions of the vertical ribs are beveled inward to form a bosh at the lower end of the core retaining wall for sustaining or carrying the ore in the core chamber.

The air inlet tube 11 is connected with means (not shown) for pre-heating the air say to about 1000° to 1200° F. and opens into the side of the mixing chamber; the flue 12 leads from the upper portion of the refining chamber to the stack 13; the tap hole 14 leads from the bottom of the refining chamber, and the slag spout 16 leads from the middle part of the refining chamber. It will be understood that either or both a forced draft through the inlet tube or a natural draft through the stack, may be employed to operate the furnace.

In use, the furnace is first heated to about 1200° F., by a suitable carbonaceous fuel, as wood or coal burned in the refining chamber, and the ore, mixed with the proper fluxes, is introduced through the charging hopper until the core chamber is filled; in which chamber the mixed ores are roasted and agglomerated by the heating and softening of the sulfur contained in the ores to form a core; it being understood that the ore will be temporarily sustained in the core chamber by resting on the wood or coal in the refining chamber, until the core is sufficiently agglomerated to be sustained by the bosh in the core chamber. It will be understood, however, that the furnace may be employed for reducing oxidized ores mixed with carbonaceous fuels, by the same process in the same furnace, in which event the core of ore will not completely agglom-

erate, but the ore will be held in a mass by the retaining wall and the bosh of the core chamber.

The heated volatile gases coming from the ores rise into the mixing chamber wherein they are mixed with the incoming pre-heated air and effect a partial combustion, thereby further heating the incoming air and also heating and roasting the upper and central portions of the core. The draft of the furnace then carries the partially combusted gases downward through the vertical flues or channels surrounding the core, and the tapered shape of the upper part of the smelting chamber serves to positively deflect the gases and impinge the sides of the core therewith; and the further combustion of these gases, coupled with the combustion of the volatile gases coming from the sides of the core, results in a smelting action and; reduces the ores in the peripheral and lower portions of the core, the heating and thereby the smelting action being gradually increased to a maximum at the lower end of the smelting chamber.

The reduced ore from the peripheral and bottom portions of the core runs down in the form of matte, either through the flues or channels, or, when the diameter of the core becomes reduced, from within the core chamber, into the refining chamber; wherein the partially consumed gases drawn down through the vertical flues are more completely combusted, thereby oxidizing and refining the molten matte into metal, it being understood that the consumed gases pass off through the flues, and that the slag, as it is formed, passes off or is removed through the slag spout.

As the metal is refined, it is drawn off through the tap hole, and, as the core is reduced and subsides in the core chamber, the same is re-charged from time to time so that the roasting and smelting operation may be continuously performed, without the use of extraneous fuels after the preliminary heating of the furnace. It will be understood that one of the important features of increased efficiency in the improved process and apparatus is the fact that substantially the whole of the exterior of the mass or core of ores is subjected to the direct action of the gases of combustion arising from the ores, mixed with the pre-heated oxygen supplied through the inlet tube.

In the operation of the furnace, the heat therein causes the ores to become sticky and

smeary, thereby forming an agglomerated mass in the core chamber. At about 250° F. the sulfur gases begin to volatilize, and at about 600° F. the agglomeration takes place. And as the roasting progresses, the incoming preheated air causes a combustion of the sulfuric acid gas coming from the ores, thereby producing the reducing flame for smelting and refining the ores and matte into metal.

I claim:

1. A metallurgical furnace including a mixing chamber above, a refining chamber below, and an intervening smelting chamber, there being channels in the wall of the smelting chamber in open communication with all the chambers.

2. A metallurgical furnace including a mixing chamber above, a refining chamber below, and an intervening smelting chamber, there being a series of spaced radial ribs in the wall of the smelting chamber forming a series of channels communicating with the upper and lower chambers.

3. A metallurgical furnace including a mixing chamber above, a refining chamber below, and an intervening smelting chamber, there being a series of spaced radial ribs in the wall of the smelting chamber forming a series of channels communicating with the upper and lower chambers, the edges of the lower portions of the ribs being beveled to form a bosh.

4. A metallurgical furnace including a mixing chamber above, a refining chamber below, and an intervening smelting chamber, there being a series of spaced radial ribs in the wall of the smelting chamber forming a series of channels communicating with the upper and lower chambers, the wall of the smelting chamber being tapered from a larger upper end to a smaller middle portion.

5. A metallurgical furnace including a mixing chamber above, a refining chamber below, and an intervening smelting chamber, there being a series of spaced radial ribs in the wall of the smelting chamber forming a series of channels communicating with the upper and lower chambers, and there being an air tube opening into the upper chamber and an outlet flue leading from the lower chamber.

WILLIAM BRYANT.

Witnesses:

RUTH A. MILLER,
RAY F. KOHL.