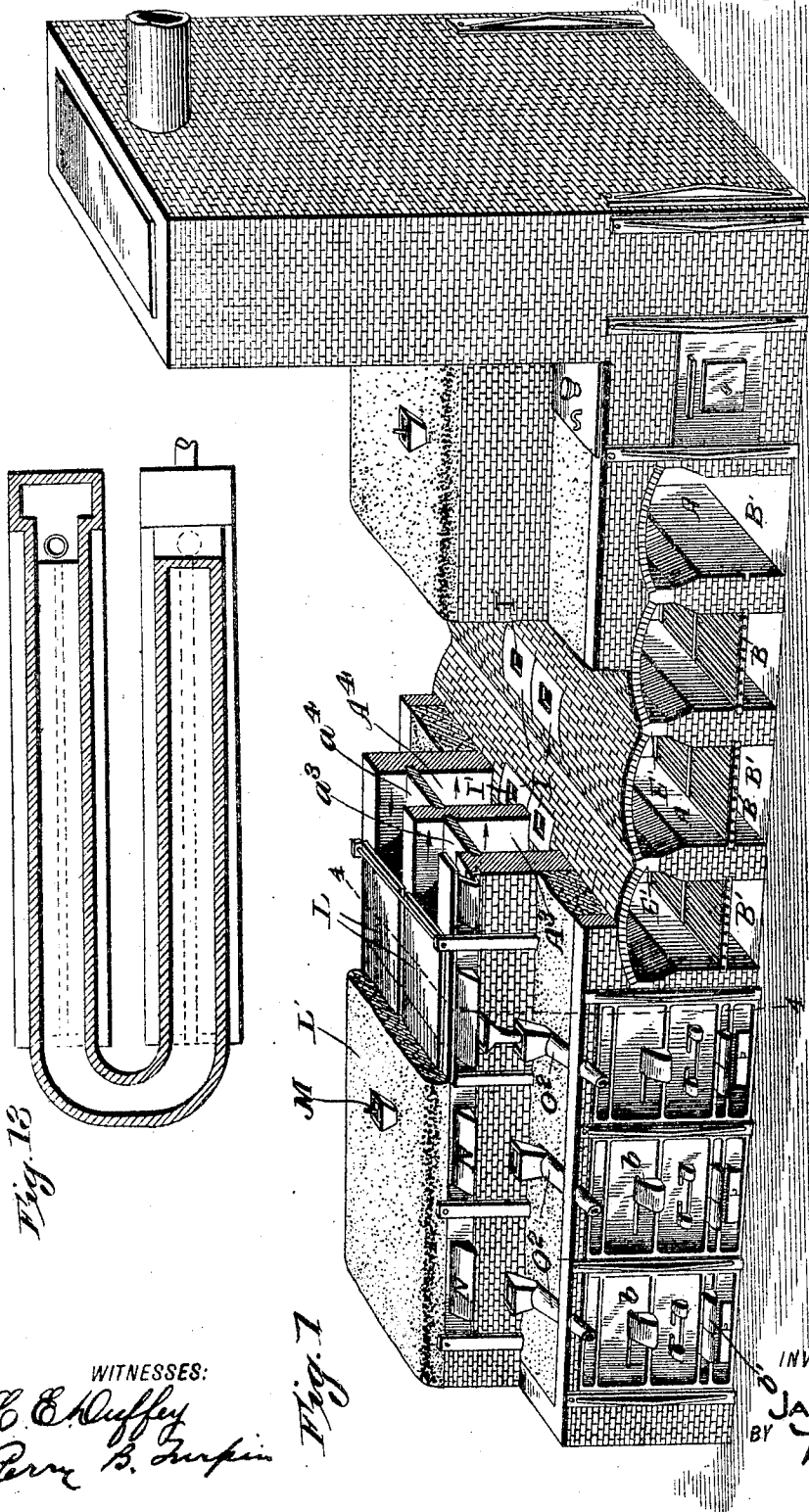


No. 798,524.

PATENTED AUG. 29, 1905.

J. McNAB.
ORE ROASTING KILN.
APPLICATION FILED MAR. 29, 1905.

4 SHEETS—SHEET 1.



WITNESSES:
C. E. Huffer
Per B. Surpin

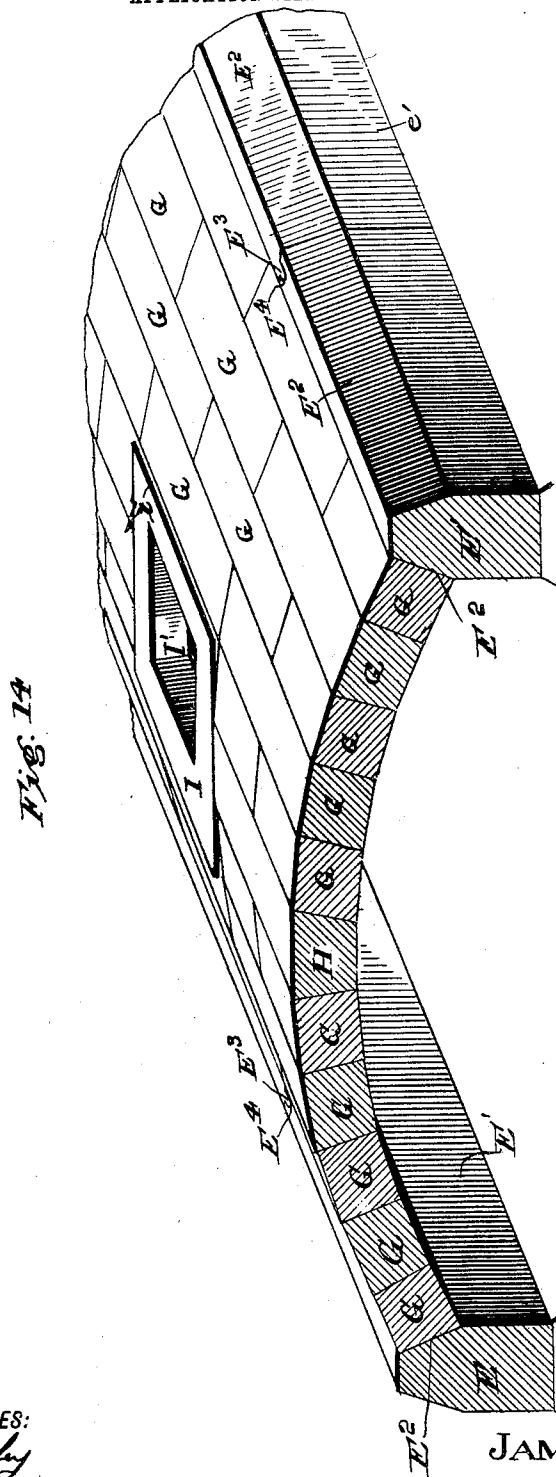
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

JAMES McNAB, OF CATONSVILLE, MARYLAND.

ORE-ROASTING KILN.

No. 798,524.

Specification of Letters Patent.

Patented Aug. 29, 1905.

Application filed March 29, 1905. Serial No. 252,684.

To all whom it may concern:

Be it known that I, JAMES McNAB, a citizen of the United States, and a resident of Catonsville, in the county of Baltimore and State of Maryland, have invented a new and useful Improvement in Ore-Roasting Kilns, of which the following is a specification.

This invention is an improvement in ore-roasting kilns, and particularly in kilns designed for use in extracting sulfur from pyrites in the manufacture of sulfuric acid; and the invention consists in certain novel constructions and combinations of parts, as will be hereinafter described and claimed.

In the drawings, Figure 1 is a perspective view, parts being removed and others shown in section, of a kiln embodying my invention. Fig. 2 is a vertical longitudinal section thereof. Fig. 3 is a sectional top plan view on about line 3 3 of Fig. 2. Fig. 4 is a vertical section on about the line 4 4 of Fig. 2. Fig. 5 is a cross-section on about the line 5 5 of Fig. 2. Fig. 6 is a detail perspective view showing the side slabs for use at the outer side of one of the end fireplaces. Fig. 7 is a detail perspective view showing the side slabs for use between two fireplaces. Fig. 8 is a detail perspective view of the key-block, having an opening for the discharge of the gases. Fig. 9 is a detail perspective view of one of the arch-slabs used in forming the arch of the fireplace. Fig. 10 is a detail perspective view of one of the key-slabs used in forming the fireplace-arches. Fig. 11 is a detail perspective view of the arch end blocks. Fig. 12 is a detail perspective view of one of the door-frames of the fines-burning flue, and Fig. 13 shows a somewhat different arrangement of the fines-burning flues for use in very large plants; and Fig. 14 is a detail perspective view, on a relatively enlarged scale, illustrating the arch.

In carrying out my invention I provide a series of fireplaces A and A', arranged in a battery alongside each other and in two rows, the fireplaces A and A' being arranged back to back, as will be understood from Figs. 1, 3, and 4 of the drawings. The fireplaces A and A' are alike, and a description of one will answer for all. I make each fireplace, as shown in Figs. 1, 2, 3, and 4, with a grate B, an ash-pit B', an ash-door b', and a feed-door b, and I construct the fronts of the fireplaces with a metal door-frame, over the top of which is put a large fire-clay slab B², forming a lintel and operating to prevent the heat inside

of the fireplace from warping and buckling down the upper edge of the door-frame, which is a common objection to kilns now in use. The side walls C and the back wall D of the fireplace may be made of brick in the usual way to a point above the fuel-line, and then the side walls are extended upwardly by means of fire-clay slabs E² or E' e', as shown in detail in Fig. 6 and applied in Figs. 1 and 2, these slabs being beveled on their sides at their upper edges at E² and provided with tongue-and-groove devices E³ and E⁴ at their meeting ends, so they may be fitted and interlocked together, and having at their ends projecting tenons e², by which they may be built into the brick structure at the front and rear of the fireplaces, and so held securely in place. The beveled surfaces E² form the seats or bases from which the arched tops of the fireplaces spring, as best shown in Figs. 1 and 2. The back walls D of the fireplaces are extended upwardly by means of the arched end blocks F and f', curved on their upper sides at F' and f' and provided with tongues F² and grooves f² at their meeting ends, whereby they are interlocked, as will be understood from Figs. 2 and 11 of the drawings.

The fireplace-arches are preferably built of arched slabs G, the key-slabs H, and the key-blocks I, which are shown in detail in Figs. 9 and 10 and are applied as shown in Figs. 1 and 4 and operate to provide an arch which is composed of fewer and larger blocks than those ordinarily employed and which are so arranged and connected as to form a much more durable arch than is provided by the brick construction in ordinary use. A serious defect of the fireplaces now commonly employed in kilns of this character is the general weakness of the side walls and arch, which soon break, being made of ordinary fire-brick with a few left out to form a gas-hole. If one of these bricks becomes loosened, it will readily be seen that the arch is materially weakened and will soon fall down. By my construction the side and back walls which divide the adjacent fireplaces are made at their upper ends of two large fire-clay blocks keyed together at their meeting ends and arranged above the ore-level in the fireplace, which ore is usually banked about thirty inches above the grate-bars of the fireplace. I also construct the arch of large fire-clay slabs G, H, and I, the slabs G being in the form of rectangles and the slabs H being sloped or tapered on one side h to form a key

and the block I being tapered on its sides i and provided with a gas-hole j for the passage of the gas into the main gas-flue, which extends above the fireplace of each row, as will be understood from Figs. 1, 3, and 4 of the drawings. This makes a very strong construction of arch and one which can be more easily built, at less expense, than those commonly used, will last much longer with fewer repairs, and is altogether more desirable than the form of arch now commonly employed in the construction of fireplaces of this character.

The main gas-flues A^3 and A^4 extend, respectively, above the rows of fireplaces A and receive the gases therefrom through openings I' in the key-blocks, these key-blocks being arranged at the inner or rear ends of the arches over their respective fireplaces, as will be understood from Figs. 1 and 4 of the drawings. At their ends the flues A^3 and A^4 discharge at A^5 to the niter-oven A^6 , in which the niter-tubes A^7 may be arranged, as shown in Figs. 2 and 3. From the niter-ovens the gases pass into the flue A^7 , thence they discharge at A^8 to Glover towers, and thence into the large lead chambers, where the gases are condensed into sulfuric acid, as is well known to those skilled in the art. As no improvement is claimed herein in the Glover towers or the lead chambers, it does not seem necessary to illustrate the same in the accompanying drawings. Supplemental flues a^3 and a^4 extend, respectively, above the main gas-flues A^3 and A^4 , are separated therefrom by the fire-clay tiles J , which form a floor for the flues a^3 and a^4 , and are rabbeted together at their joints j to prevent the escape of the gases directly from the flues A^3 and A^4 to the supplemental flues a^3 and a^4 . The supplemental flues a^3 and a^4 are designed for burning the so-called "fines," usually amounting to about ten per cent. of pyrites, made in crushing the pyrites, and which cannot be used in the lump-kilns. The disposition of these fines is a difficult problem where high-grade copper ores are used, as it is not practical to mix these fines with the low-grade ores used in the automatic furnaces for burning the fine ores containing no copper. I therefore provide the supplemental flues a^3 and a^4 , the fines in which are heated from the main gas-flues below to evolve the sulfurous gases which pass from the front end of the flue a^3 to the front end of the flue a^4 and thence back and discharge at a^5 to the rear end of one of the main gas-flues, and, mixing with the gases in said flue, pass forward to the niter-oven at the front of the main flue, as will be understood from Figs. 2 and 3 of the drawings, in which the course of the gases in the supplemental flues is indicated by arrows. The fines are roasted in the supplemental flue a^3 , and the flue a^4 forms a passage by which the gases evolved by the roasting of the ores in the flue a^3 are conducted to the rear end of the main gas-flues, to be car-

ried thence to the niter-ovens. At the front or delivery end of the flues a^3 I provide a dust-chamber K , which operates to purify the gases before they enter the conducting-flue a^4 and pass thence and discharge into the rear end of the main gas-flue to mix with the gases therein. The tops of the flues a^3 and a^4 are shown as consisting of plates L , and on these is put the fine ore L' to be dried before charging the same into the feed-hoppers M of the gas-generating flue a^3 . These hoppers M may be made of sheet-iron and provided with a plug M' , (see Fig. 2,) and after the charge of fine ore is put in the flue a^3 , through the hopper M , the plug M' is quickly inserted and some green ore put in upon the plug, which lutes the hopper and prevents escape of gas. The fines-roasting flue a^3 is provided at its front with discharge-openings N on a line with the bottom of the rabbeted floor J of the said flue and provided with a door N' , by which the opening N may be closed when desired. A hopper O may be hooked at O' beneath the opening N and applied whenever it is desired to scrape the burned fines from the fines-roasting flues a^3 , this hopper O discharging to the stationary sheet-iron spout O^2 , as shown in Figs. 1 and 4 of the drawings, such spout discharging into a wheelbarrow or other means for carrying off the refuse.

It will be understood from the foregoing description and illustration that I utilize only about one half of the upper surface of the main gas-flue for actually burning the fines and utilize the other half as a return or dust chamber, making the gas from the fines return back to the rear end of the kiln, where it then drops into the lower or lump-ore gas-flue, thence into the gas-pipes, &c. This is for an ordinary-sized acid plant of, say, three hundred thousand cubic feet capacity; but where it is larger and consists of, say, double the above size plant or more and of course making a much larger amount of fines this plant can be modified by taking two sets of kilns and dividing the upper flue, as shown in plan, except to leave out the dividing-wall in center of dust or fines kiln and use the whole surface of one set of kilns, about four to nine by ninety feet, for a burning-surface for fines and utilize the upper flue in the other set of kilns as the dust-chamber, the gases in the burning-kiln traveling to rear end of kilns and crossing by connecting-flue into rear end of second set of kilns and dust-chambers, as best shown in Fig. 13 of the drawings. This dust or return flue is important, as it operates to prevent the dust from the fines passing into the towers and choking up and interfering with the process, and the simplicity of the construction and the ease with which the fines-burning flue may be cleaned out at any time and the great economy of construction through the burning of the fines will commend itself to those skilled in the art. In

practice the upper fines-burning and return flues are built of ordinary red brick, lined inside with fire-brick and the sides bound with stays, secured on top with a rod binding front and back, and at the bottom the buck-stay may be secured on the rod which binds the front and back flues of the ore-kilns on top, and on the top of this dust-kiln T-bars may be provided and sand or fines L' be piled to conserve the heat.

In practice the castings for the front doors of the fireplaces may be made about six feet long and suitably set in the walls, the ends of the castings being behind the buckstays and the castings being made with suitably-faced fronts, so that they fit tight to avoid escape of gas and the entry of air.

In practice a set of fireplaces consists of fifteen on each side, placed back to back and making a length of about ninety feet, so that the upper flue having the fines-burning section will be about ninety feet long, thus utilizing a considerable surface above the main gas-flue, and the fireplaces arranged side by side, as will be understood from the drawings and foregoing description.

The slabs forming the arches of the fireplaces may be made of fire-clay, soapstone, or similar material.

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

1. The improvement in ore-roasting kilns herein described comprising the series of fireplaces arranged in a battery side by side and extending in two rows with the opposite fireplaces back to back, said fireplaces being provided with the crown-arch composed of arched slabs, key-slabs having tapered sides, and a key-block having tapered sides and an opening for the escape of gas, the main gas-flues extending above the fireplaces of each row and receiving the gas from the key-blocks of the several arches, the niter-oven to which the main gas-flues discharge at one end, the fines-burning flue extending longitudinally above one of the main gas-flues, means for supplying the fines to said burning-flue, and the return or dust flue connecting at one end with the forward end of the fines-burning flue and extending thence rearwardly alongside the fines-burning flue and discharging at its rear end to one of the main gas-flues, substantially as and for the purpose set forth.

2. The ore-roasting kiln having a series of fireplaces, a main gas-flue extending above the fireplaces and receiving the gas therefrom, and a fines-burning flue extending above the main gas-flue and discharge connections between the fines-burning flue and the main gas-flue, substantially as set forth.

3. The combination in an ore-roasting kiln of a series of fireplaces, and a main gas-flue extending above and receiving the gas from said fireplaces, and a fines-burning flue ex-

tending above and heated by the main gas-flue, substantially as set forth.

4. In an ore-roasting kiln, the combination of the main gas-flue a fines-burning flue extending longitudinally above the main gas-flue and having a section in which the fines are burned, and means for supplying fines to said section, and a discharge or dust-collecting section receiving the gas evolved from the fines and conducting the same to a suitable discharge-point, substantially as described.

5. An ore-roasting kiln comprising in combination a main gas-flue, and a fines-burning flue extending above the main gas-flue and having a return-section, and a burning-section and having the return-section communicating at one end with the discharge end of the burning-section and discharging at its other end to the main gas-flue, substantially as set forth.

6. The combination in an ore-roasting kiln of a series of fireplaces, the main gas-flue extending above the same, the fines-burning flue above the main gas-flue, and having an outlet or discharge door, a hopper receiving the discharge from the said door, and a spout to which said hopper discharges, substantially as set forth.

7. In an ore-roasting kiln the combination with the fireplaces having rear and side walls, and arches having gas-discharge openings near said rear walls, a main gas-flue extending above the fireplaces and receiving the gas therefrom and the fines-burning flues extending above the main gas-flue, substantially as set forth.

8. The combination of the fireplace side walls and rear wall extending above the ore-level, the arch-blocks on the rear wall and interlocked at their meeting ends, the top slabs fitting on the side walls and interlocked at their meeting ends and beveled on their sides at their upper edges, the arch springing between the beveled edges of the opposite top slabs, and consisting of the arch-slabs, the key-slabs, and the key-blocks, substantially as described.

9. An ore-roasting kiln having a fireplace whose side and end walls above its ore-level consist of sections or slabs having tongue-and-groove connections at their meeting ends, and an arch springing between the top slabs of the side walls, substantially as set forth.

10. The combination with the body of a kiln-wall extending above the fuel-level of the slabs forming top portions of said walls and interlocked at their meeting ends, substantially as described.

11. The combination of the fireplace having the rear and side walls the slabs forming the top portions of said walls, and the arch-slabs G, key-slabs H, and key-block I having an opening for the escape of gas, the said slabs G and H and the block I constituting an arch

springing between the top slabs of the side walls of the fireplace, substantially as set forth.

12. A fireplace having a top arch composed of arch-slabs G, key-slabs H, and a key-block I having an opening for the escape of gas, substantially as set forth.

13. The combination in an ore-roasting kiln of a battery of fireplaces consisting of two rows ranging side by side, the niter-oven at one end of the battery of fireplaces, the main gas-flue extending above the rows of fireplaces and discharging at one end to the niter-oven, the fines-flue having a burning-section extending above the main gas-flue and a return or dust-collecting section receiving the gas from the burning-flue and discharging at its rear end to one of the main gas-flues, substantially as set forth.

14. In an ore-roasting kiln the combination with the main gas-flue of the fines-flue above the same and comprising a fines-burning sec-

tion having baffle devices adjacent to its discharge end, and a dust-collecting or return flue communicating at one end with the discharge end of the fines-burning flue and discharging at its other end to the main gas-flue, substantially as and for the purpose set forth.

15. An ore-roasting kiln having a series of fireplaces, a main gas-flue receiving the gas from the said fireplaces, and a fines-burning flue heated from the main gas-flue, substantially as set forth.

16. The combination of a series of fireplaces, a main gas-flue receiving the gases discharged from said fireplaces, and a fines-burning flue extending longitudinally parallel with the main gas-flue and adjacent thereto and heated by the said main gas-flue, substantially as set forth.

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Witnesses:

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GEO. W. D. WIGHT.