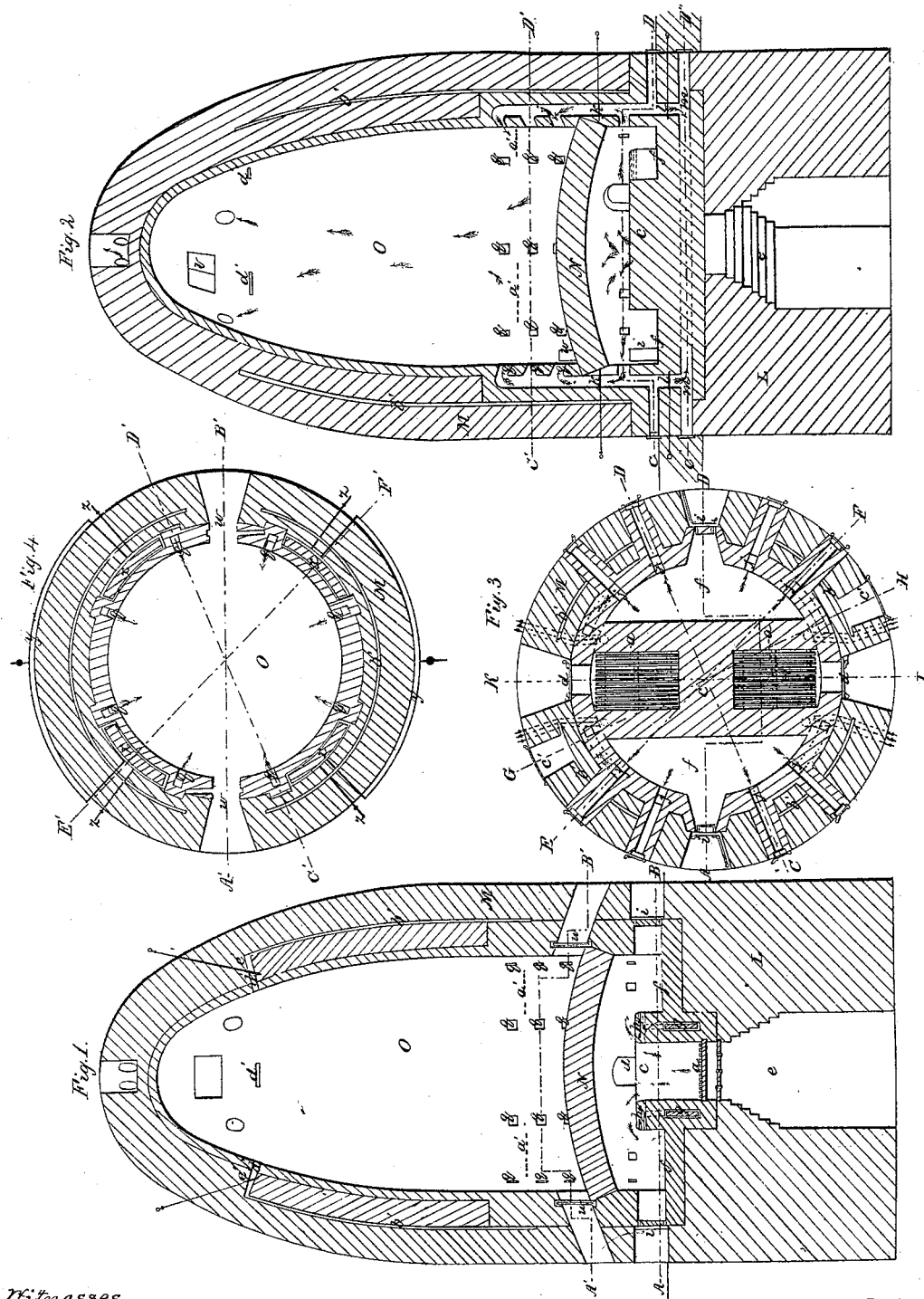


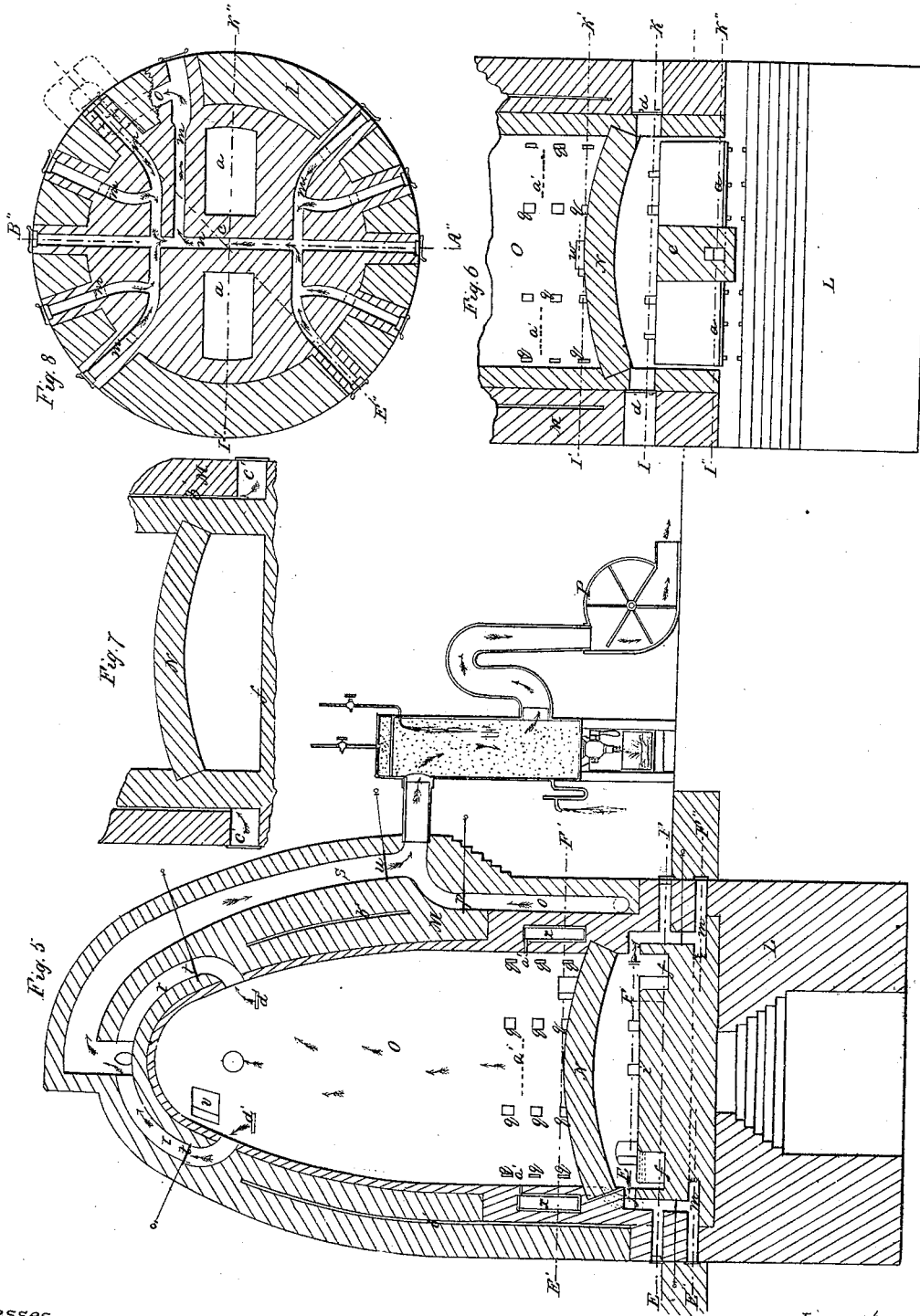
W. Kendrick,
Furnace for Treating Ores,
Patented Oct. 31, 1865.



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W. Kendrick,
Furnace for Treating Ores,
No. 50,717,
Patented Oct. 31, 1865.



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IMPROVED FURNACE FOR TREATING ORES.

Specification forming part of Letters Patent No. 50,717, dated October 31, 1865.

To all whom it may concern:

Be it known that I, WASHINGTON KENDRICK, of the city, county, and State of New York, have invented a new and useful Improvement in Furnaces for Treating Ores; and I do hereby declare that the following is a full, clear, and exact description of the same, which will enable those skilled in the art to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 represents a vertical central section of a furnace with a stack constructed according to this invention, the lines A B, Fig. 3, and A' B', Fig. 4, indicating the plane of section. Fig. 2 is a similar section of the same, taken in the plane indicated by the line C D, Fig. 3, and C' D', Fig. 4. Fig. 3 is a horizontal section of the same, the line A B, Fig. 1, indicating the plane of section. Fig. 4 is a similar section of the same, taken in the plane indicated by the line A' B', Fig. 1, and C' D', Fig. 2. Fig. 5 is a vertical central section of the same, the line E' F', Fig. 8, and E F, Fig. 3, indicating the plane of section. Fig. 6 is a similar section taken in the plane indicated by the line I' K', Fig. 8, and I K, Fig. 3. Fig. 7 is a similar section, the line G H, Fig. 3, indicating the plane of section. Fig. 8 is a horizontal section of the same, taken in the plane indicated by the line C' D', Fig. 2, and E' F', Fig. 5, and I' K', Fig. 6. Fig. 9 is a vertical central section of a furnace without a stack, constructed according to this invention, the line A B, Fig. 12, A' B', Fig. 14, and A'' B'', Fig. 13, indicating the plane of section. Fig. 10 is a similar section of the same, taken in the plane indicated by the line C D, Fig. 12, C' D', Fig. 13, and C' D', Fig. 14. Fig. 11 is a similar section of the same, the plane of section being indicated by the line E F, Fig. 12, E' F', Fig. 14, and E' F', Fig. 13. Fig. 12 is a horizontal section of the same, taken in the plane indicated by the line A B, Fig. 9, C D, Fig. 10, and E F, Fig. 11. Fig. 13 is a similar section, the line A' B'', Fig. 9, C' D', Fig. 10, and E F, Fig. 11, indicating the plane of section. Fig. 14 is a similar section taken in the plane indicated by the line A' B', Fig. 9, C' D', Fig. 10, and E' F', Fig. 11. Fig. 15 is a similar section of the same, the line A''' B'''

Fig. 9, and E''' F''', Fig. 11, indicating the plane of section. Fig. 16 is a similar section of the same, the line A^{iv} B^{iv}, Fig. 9, and C^{iv} D^{iv}, Fig. 10, indicating the plane of section.

Similar letters of reference in all the figures indicate corresponding parts.

This invention relates to a furnace which can be used for roasting, calcining, desulphurizing, reducing, and smelting ores of any description, and which may be built with or without a cone according to the nature of the ore for which it is to be used.

In the following description I will first explain the construction of the furnace with a cone, such as represented in Figs. 1 to 9, inclusive, and afterward I will point out the modifications required if the furnace is built without a stack.

L represents the foundation-wall of the furnace, which contains two grates, *a*, separated one from the other by a partition-wall *c*. These grates are supplied with fuel through two doors, *d*, and the ashes and impurities discharged from the same collect in the cave *e*.

The side walls of the grates or fire-places may be made to rise above the level of the hearth or siege *f* of the furnace, or they may be level with the same, and they are provided with water-chambers *g* and steam and hot-air channels *h*, which are built in the side walls of the fire-places near their top edges, so that the steam and hot air issuing from them is thrown in between the flame and the ores or metal, which may be placed on the hearth or which may be contained in crucibles arranged in suitable number on the sides of the fire-places. By this arrangement the full benefit of steam and hot air is obtained without reducing the temperature of the fire. The combustible gases and volatile parts rising from the fire-places and from the ores are consumed, and what is technically termed a "dead heat" is avoided.

The ores to be treated on the hearth are introduced and removed through doors *i*.

From the ground-wall L rises the furnace-wall M, which is provided with an arched base, N, at a short distance above the fire-places. This arched base is built of fire-brick, and by the heat emanating from the fire-places its temperature is raised to a white heat, so that by its action the heat is evenly distributed through-

out the entire mass of ore contained in the upper part or stack, O. The flames and heated gases rising from the fires in the fire-places, after striking the arched base N, pass off through a series of flues, *j*, which are built in the furnace-wall. Through these flues the heat may be made to pass up or down, dampers *k* *l* (see Fig. 2) being provided to regulate the direction in which the heat circulates. If the dampers *k* are closed and the dampers *l* opened, the heat passes down below the hearth, where it circulates through a series of flues, *m*. (Best seen in Fig. 8.) All these flues communicate with a central horizontal flue, *n*, and they are so constructed that they can be easily swept out and the products of combustion, together with the gases rising from the ores on the hearth, are drawn off through the flue *o* by means of a suction-blower, P, (best seen in Fig. 5,) the flue *o* being built into or outside of the furnace-wall, as may be most convenient. A damper, *p*, closes this flue, if the heat is made to take a different course, and this damper is opened only when the dampers *k*, Fig. 2, are closed and the dampers *l* opened. If it is desired to throw the heat into the space above the arched base the dampers *l* and *p* are closed and the dampers *k* are opened. In this case the heat, after having heated the base N, passes up through the flues *j* and into the cone through a number of apertures, *q*. (See Fig. 2, and others.) After having passed into the cone the heat rises up through the mass of ore contained in the same, and the products of combustion, together with the gases rising from the ores, are drawn off through a series of flues, *r*, and escape-flue, *s*, by the action of the suction-blower P. Each of the flues *r*, as well as the escape-flue *s*, are provided with dampers *t* *u*, and the dampers *t* serve to regulate and equalize the course of the heat through the heated mass of ores in the cone, whereas the damper *u* is opened whenever the heat is made to pass up through the flues *j*, but it is closed when the heat is made to pass down under the hearth, as previously described.

A door, *v*, in the top part of the cone serves to introduce the charge, and doors *w* on opposite sides of the furnace, close above the arched base N, serve to discharge the ores.

In the side wall of the cone, close above the arched base, are built four (more or less) water-chambers, *x*, which are supplied with water through pipes *y*, Fig. 4, and the contents of which can be discharged through pipes *z*. The steam which forms in these water-chambers discharges through a series of small jets, *a*, into the cone between the apertures *q* leading from the flues *j* into the cone, and at some distance above the arched base. By this arrangement the steam is brought in contact with every portion of the ore, and being rapidly absorbed by the same causes a more speedy disintegration and liberates all the impurities from the ores. An air-flue, *b'*, built into the wall of the furnace, gives a chance to

cool off said wall whenever it may be desirable, and also to regulate the temperature of the heated ores in the cone. This air-flue extends all round the furnace-wall, and access is had to it through doors *c*, at its bottom. From its top extend four (more or less) flues, *d*, into the cone, a short distance below the discharge-flues *r*, and dampers *e'* are provided, which serve to open or close the air-flues *d'*.

When it is desired to cool off the furnace-wall or to regulate the temperature of the heated ores the doors *c'* and the dampers *e'* are opened, and a current of cold air passes through the circular air-flue *b'* and into the cone O. Air-channels *f'*, leading from the outside through the furnace-wall into the fire-flues *j*, serve to introduce currents of cold air, which mingle with the flames and assist in cooling or regulating the temperature of the ore in the cone O, and also that of the arched base N. The products of combustion and heated gases which escape from the furnace are passed by the action of the suction-blower P through the condenser Q.

For some classes of ore the high calcining chamber or cone above the arched base is omitted, and in this case the furnace is built as shown in Figs. 9 to 16, inclusive.

The grate arrangement is similar to that previously described, but the oxidizing-chamber is placed above the arched base N*, and the space below that base may be used for similar or other purposes. The heated gases and products of combustion rise from the fire-places through flues *j** in the sides of the furnace-wall and pass into the oxidizing-chamber through openings *q**; and for the purpose of carrying the heat down below the hearth, when desired, the flues *j** connect with a series of ground-flues, *m* n**, as shown in Fig. 13, and these ground-flues communicate with the escape-flue *s**, to which a suction-blower may be applied, as previously described. Suitable dampers, *k* l* p* u**, are provided to cause the heated gases and products of combustion to take the desired course.

From the arched base N rises a partition-wall, *c**, which in the furnace first described is situated between the fire-places. This partition-wall *c** extends diagonally through the oxidizing-chamber, and it rises up nearly to a level with the upper row of openings, *q**, through which the heated gases from the furnace have access to the oxidizing-chamber. In this partition-wall is secured the water-chamber *g**, (best seen in Fig. 16,) and it is also provided with a series of air-chambers, *h*, the steam and hot air being allowed to discharge in small jets into the oxidizing-chamber between the flame and the heated ore. The heated gases, after having done their work in the oxidizing-chamber, pass off through lateral openings 1 in the sides of the partition-wall into flues 2, which communicate with the flues *r** leading to the escape-flue *s**.

The flues 2 are provided with suitable doors,

3, as seen in Figs. 11 and 14, so that the soot and ashes collecting in the same can be readily swept out and other doors give access to the fire-places and to the oxidizing-chamber, and also to the flues $m^* n^*$ below the hearth, and to the flues j^* in the sides of the furnace-wall.

The great advantage of this arrangement of flues, steam and air chambers, and of the manner of regulating the heat and the supply of hot or cold air will be apparent to every practical smelter. For the purpose of calcining and roasting or desulphurizing the furnace with the cone or calcining-chamber is of incalculable value. The mass of ore is gradually heated from below, and the gases rising from the same are carried off as fast as required by the action of the suction-blower. The heat can be regulated so that all danger of burning dead or melting a portion of the ore can be easily avoided, the requisite amount of atmospheric air can be readily supplied to produce oxidation or desulphurization, and when it is desired to treat the ore with steam it is readily supplied by means of the water-chambers in the furnace-wall, (see Fig. 4,) and the operation of charging and discharging the furnace is facilitated. By the effect of the arched base the heat is evenly distributed throughout the entire mass of ore, and by the dampness in the flues r and j the heat can be increased or decreased in any part of the furnace, as may be desired, or if it becomes necessary to cool off, cold air is admitted to the annular air-channel in the furnace-wall and to the flues j , and the temperature can thereby be lowered in a short time.

The operation of oxidizing and of calcining or roasting can be carried on simultaneously in the furnace with the high calcining-chamber or cone and the operation of oxidizing and smelting in the furnace without the high calcining-chamber or cone. In either case the fuel is used to the best advantage. The oxidation is effected by throwing air and steam in between the ore and the flame, (not into the ore, as is usually done,) and in smelting the crucibles can be conveniently arranged below the arched base on the hearth.

What I claim as new, and desire to secure by Letters Patent, is—

1. The arched base N or N^* , between the fire-place or fire-places and the calcining or oxidizing chambers, substantially as and for the purpose set forth.

2. The flues $j m n$ or $j^* m^* n^*$ and dampers $k l$ or $k^* l^*$ in combination with the chambers above and below the arched base N or N^* , constructed and operating substantially as and for the purpose described.

3. Causing jets of steam and hot air to issue between the flames and the heated ores, substantially as and for the purpose specified.

4. The arrangement of a partition-wall, c or c^* , containing one or more water-chambers, g or g^* , and one or more air-chambers, h or h^* , in combination with the fire-place or fire-places, and with the hearth or base on which the ore is placed, substantially as and for the purpose herein set forth.

5. The water-chambers x , with jets a' , in combination with the heated base N and fire-flues q , constructed and operating substantially as and for the purpose described.

6. The arrangement of the radiating-flues r or r^* , in combination with fire-flues q or q^* , escape-flues s or s^* , and with a suitable suction-blower, substantially as and for the purpose set forth.

7. The annular air-flue b' in the furnace-wall M , in combination with the radiating-flues r and escape-flue s , constructed and operating substantially as and for the purpose described.

8. The arrangement of air-flues f' , in combination with the fire-flues q or q^* , partition-wall c or c^* , and with the hearth or base of the furnace, constructed and operating substantially as and for the purpose specified.

9. The employment of one or more condensers, Q , in combination with the escape-flue s or s^* , leading from the furnace, and with a suitable suction-blower constructed and operating substantially as and for the purpose set forth.

Witnesses:

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