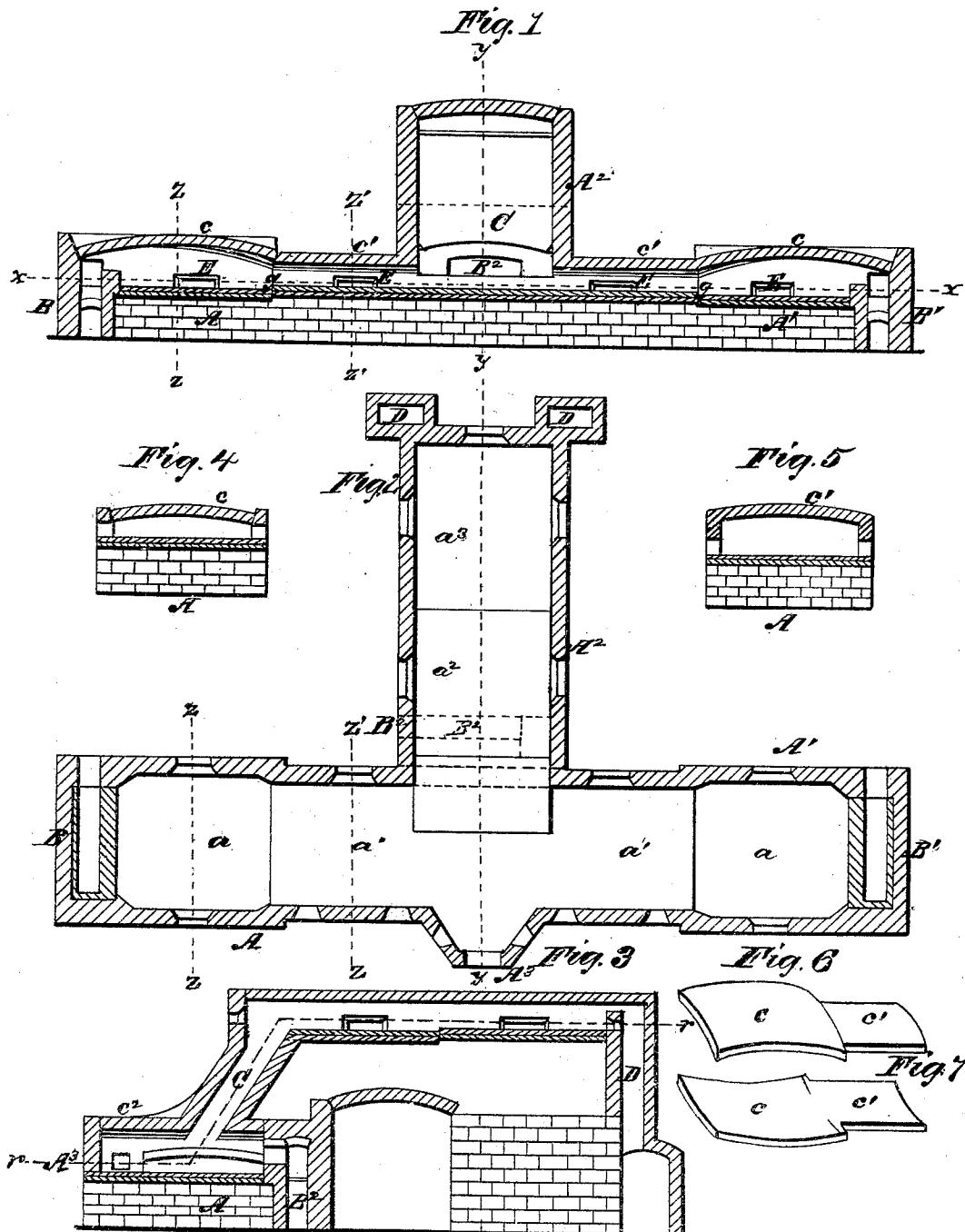


J. O. STEWART.

Reverberatory Furnaces for Roasting Ores, &c.
No. 148,096.

Patented March 3, 1874.



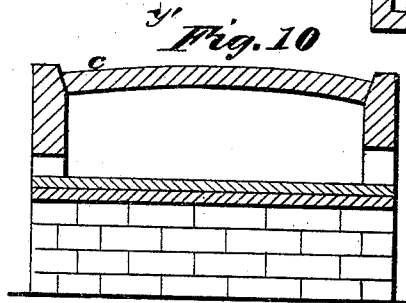
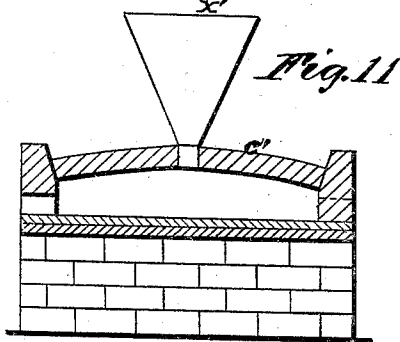
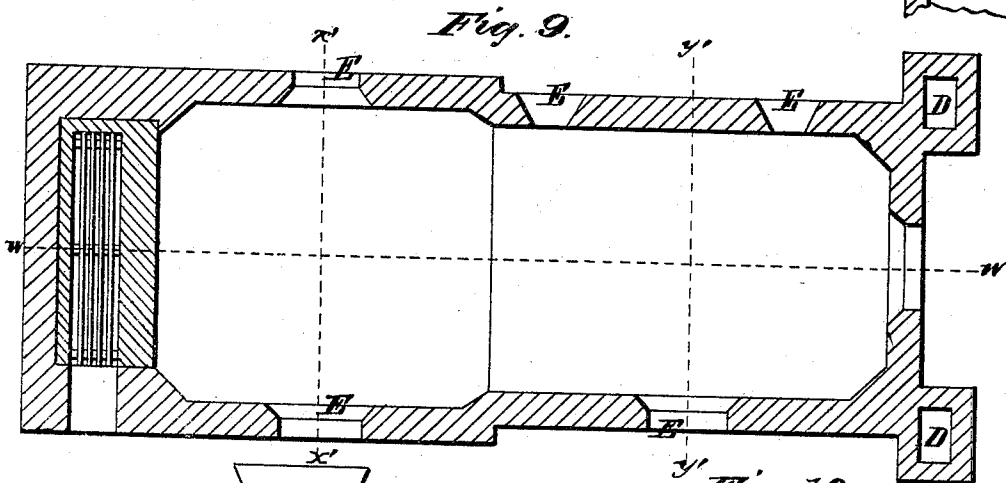
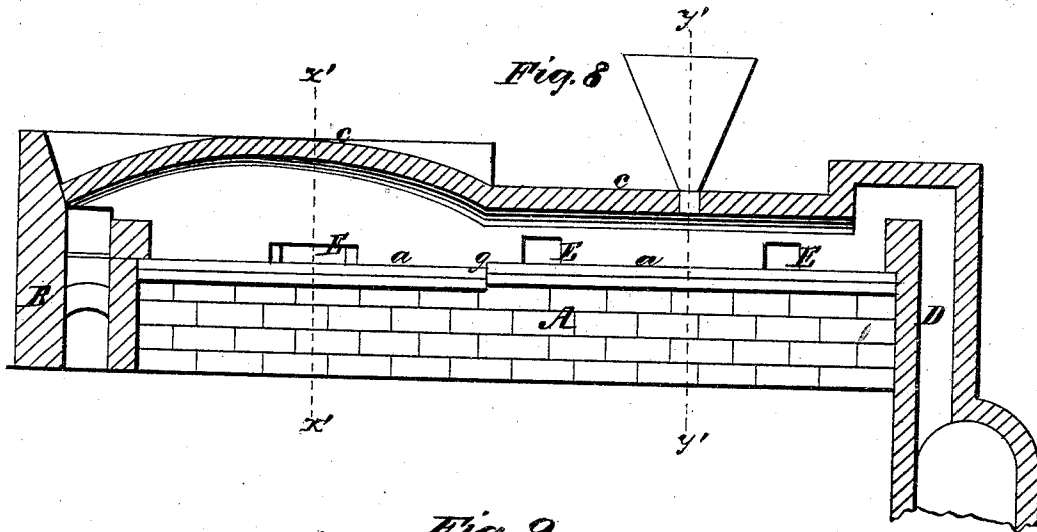
Witnesses.
James Martin Jr.
B. S. Hedrick

Inventor.
James O. Stewart
by his atty
Mason Stewart Lawrence

J. O. STEWART.

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UNITED STATES PATENT OFFICE.

JAMES O. STEWART, OF GEORGETOWN, COLORADO TERRITORY.

IMPROVEMENT IN REVERBERATORY FURNACES FOR ROASTING ORES, &c.

Specification forming part of Letters Patent No. 148,096, dated March 3, 1874; application filed January 15, 1874.

To all whom it may concern:

Be it known that I, J. OSCAR STEWART, of Georgetown, county of Clear Creek, Territory of Colorado, have invented a new and useful Improvement in Reverberatory Furnaces for Roasting, Desulphurizing, or Chloridizing Ores and Minerals or metallic products; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1, Plate I, is a vertical longitudinal section of my improved furnace, constructed with three roasting or treating chambers in communication with one another. Fig. 2 is a horizontal section of the same in the line xx of Fig. 1. Fig. 3 is a vertical transverse section in the line yy of Figs. 1 and 2. Fig. 4 is a cross-section in the line zz of Fig. 1. Fig. 5 is a similar section in the line $z'z'$ of Fig. 1. Figs. 6 and 7 are perspective views of the upper and under sides of the combined cylindric and spherical top or arch of the roasting or treating chambers. Fig. 8 is a longitudinal section of my improved combined cylindric and spherical top applied to a furnace with a single roasting or treating chamber, the section being in the line ww of Fig. 9. Fig. 9 is a horizontal section of the same. Fig. 10 is a cross-section in the line xx' of Figs. 1 and 2. Fig. 11 is a similar section in the line yy of Figs. 8 and 9.

My invention is designed for that class of reverberatory furnaces which is adapted for roasting, desulphurizing, or chloridizing ores, minerals, or metallic products.

The nature of my invention consists, first, in varying the length and width of the roasting or treating chambers of each furnace relatively, and combining with the same an arch or crown, which is in form of a segment of a hollow sphere, where it overhangs or covers the first hearth of the roasting-chamber, and in form of a segment of a cylinder where it overhangs or covers a second, or a second and third, hearth of said chamber. This construction, as will hereinafter be made to appear, enables the operator to utilize the heat in a more proper manner and to a greater extent than can be done with other forms of furnace tops or crowns in use. It consists, second, in

combining an elevated furnace in a peculiar manner with one or more low-down furnaces, so that an auxiliary fire-box is employed, from which heat passes over a hearth, which is underneath the flue which connects the lower furnace with the upper furnace.

By this arrangement, as will hereinafter be made to appear, a fresh supply of heat to the ore is provided at a point where the main-furnace heat is losing its temperature, and this fresh heat, combining with the heat from the main furnaces, heats the charge of ore which is on the hearth directly adjoining the auxiliary fire-box, and, passing through the flue to the upper furnace, is sufficient to ignite and keep the sulphur burning in the ores of said furnace. Thus all the heat is utilized to the best advantage, and hence the expense for fuel reduced. Labor is also saved, inasmuch as the ore can be very expeditiously handled or moved from hearth to hearth.

The construction of the crowns, together with the combination of furnaces, enables the operator to roast a greater number of tons of material in a given time than has heretofore been accomplished with furnaces with which I am familiar.

To enable others skilled in the art to understand my invention, I will proceed to describe it.

A A¹ represent two furnaces on a plane (for instance) with the horizon. A², a furnace elevated above this plane. B B¹ are the fire-boxes of the furnaces A A¹, and B² is the fire-box of the furnace A². The furnace B² is placed at right angles to the furnaces A A¹, and the side walls of its front end are carried over to the front wall of said furnace, and also made to unite with an extension or bulging front portion, A³, of said furnaces, as shown. The portion of the furnace A² which extends over the meeting ends of the furnaces A A¹ forms a flue, C, which connects with the fire-box B², which is just in rear of the meeting ends of the furnaces A A¹, as shown. The furnaces A A¹ have hearths $a a^1$, and the furnace A² hearths $a^2 a^3$, as shown. The hearth a is considerably broader than the hearth a^1 , and consequently the walls upon which the crowning portion of this hearth rests are set farther apart. The hearth a is nearly square,

while that of a^1 is oblong. The part a of the furnace is crowned with an arch, c , which presents the form of a segment of a hollow sphere, while the part a^1 is crowned with an arch, c^1 , which is in the form of a segment of a cylinder. This combination crown is shown clearly in Figs. 6 and 7 of the drawings. At the point where the flue of the auxiliary fire-box is employed the bulged-out portion of the front wall of the main furnace or furnaces is connected to the flue-wall by means of a crown, c^2 , which is a segment of a hollow sphere. D D are the draft-flues, and E E E the work-doors to the hearths of the furnace, and g steps between the hearths.

In Figs. 8 and 9 the same construction of furnace in all respects to the one just described is maintained, except that only one roasting-chamber, A , with its own fire-box and draft-flues D , is adopted in the erection and working of the furnace. This single furnace may have three hearths like those a a^1 , and in that case the cylindric portion of the crown will be double the length of the spherical portion, and another step like g will be constructed between the two hearths which come under this cylindric arch.

To facilitate the description, I will first describe the operation of the single furnace, Figs. 8 and 9, and I shall speak of it as having three working hearths instead of two. A charge of ore being placed upon the third hearth which is nearest the draft-flue, the sulphur begins to ignite, and, after about three hours' stirring, is moved upon the hearth a^1 , or No. 2, by means of spades or hoes through the back and front side work-doors. Another charge of ore is now placed upon the vacated hearth just referred to. The ore on both hearths is stirred for about three hours more, when it is found that ore on hearth a^1 is nearly desulphurized—that is, the raw sulphur has been burned out, and the metals, having taken up oxygen from air admitted to the furnace through the fire-box and work-doors, are formed into sulphates, so that the ore has changed its color, and gives off a light sulphurous-acid odor. This charge of ore, then, on the hearth a^1 is moved forward, as before stated, to hearth a , or No. 1, and the ore on hearth No. 3 (not shown) is moved to hearth a^1 , or No. 2, and a new charge of ore takes its place. As soon as these manipulations are ended, about four to ten per cent. of common salt is thrown in and intimately mixed with the ore on the hearth No. 1, and, as the sulphuric or sulphurous acid present does decompose the salt, the chlorine is liberated from the salt, which chlorine, in part, is absorbed by the metals present, such as gold, silver, and a portion of lead, zinc, and iron, formed into chlorides of these metals. Just for this reason the ore must be at a good heat, above a high red heat, but not to a white heat, and at the same time it is of the utmost importance that a large supply of fresh undecomposed air be admitted to this ore on this hearth a , in order to get rid

of the last traces of sulphurous acid; and to accomplish this chemical reaction I have found the arch, with the peculiar combination of spherical and cylindric form, to be very important, because it admits (by being highly curved over the hearth a) of a large full fire, so that plenty of cold air can be used and still not chill the charge on the hearths beyond this first charge; and, at the same time, while such heat under any other shaped crown to the hearth a would sinter or bake and spoil the ore on hearth a ; this allows the heat to pass along this crown to the transverse or cylindric crown, with which it is combined and united, where the heat is depressed down upon hearth a^1 and the hearth No. 3 (not shown) without being chilled by the admission of so much air to the ore on the hearth a . When all the charges of ore are stirred about three hours from the time of moving the ore on hearth a , it is found that this last-mentioned ore has become chloridized, having changed its color again and become spongy or woolly, and it gives off a sweet chlorine smell. It is now withdrawn from the furnace and the manipulation continues as before stated.

The relative proportions of the hearths of the furnace, whose operation has been just described, may be as follows: Hearth a , 9 x 9 in clear; hearth a^1 , 8 x 10 in clear; and hearth referred to as No. 3, but not shown, 8 x 12 in clear.

The operation of the combined furnace, Figs. 1, 2, and 3, is as follows: The ore is admitted on the last hearth a^3 of the elevated furnace; it is stirred for an hour or an hour and a half; the sulphur here ignites as on hearth No. 3 of single furnace; the charge is then moved forward to the hearth a^2 , and a new charge takes the place of it. Both charges are stirred about one hour and a half, or less, and the charge on this second hearth is drawn down upon the hearth in the lower furnace where the auxiliary fire is located, and the charges in the elevated furnace proceed as before. The charge which is under the auxiliary fire having lost a large portion of its sulphur before it reached the hearth, requires an increased amount of heat to keep its remaining sulphur ignited or burning, and for this purpose this auxiliary fire at this point is very essential. This charge of ore, after stirring about one and a half hours, is moved upon either one of the intermediate hearths a^1 of the furnaces A A^1 , and is in a short time ready to take salt, as heretofore stated, and be treated in all respects the same as in the operation of the single furnace. Other charges of ore constantly taking its place, it in due time is finished by chloridizing it under the high curved crown, when it is withdrawn from the furnace.

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

1. The furnace for roasting, desulphurizing, or chloridizing ores, as described and shown, with a roof constructed as at c c' , and with the

part *c* of said roof nearest to the fire-box B and the part *c'* farthest therefrom, substantially as described.

2. The chamber of the furnace A² constructed on a higher plane than the chamber of furnace A, combined with the fire-box B and B² and connected with the chamber of the furnace A by flue C, substantially as and for the purpose described.

3. The elevated furnace A², with its flue C and fire-box B², as described, in combination with the furnaces A A¹, constructed with the roofs *c c'* and fire-boxes B B¹, substantially as described.

JAMES O. STEWART.

Witnesses:

ANTHONY J. AUGUST,
JERRY G. MAHANY.