2 Sheets—Sheet 1.

S. H. FOLSOM.

Furnace for Treating Ores.

No. 80,279. Patented July 28, 1868.

Fig. 1.

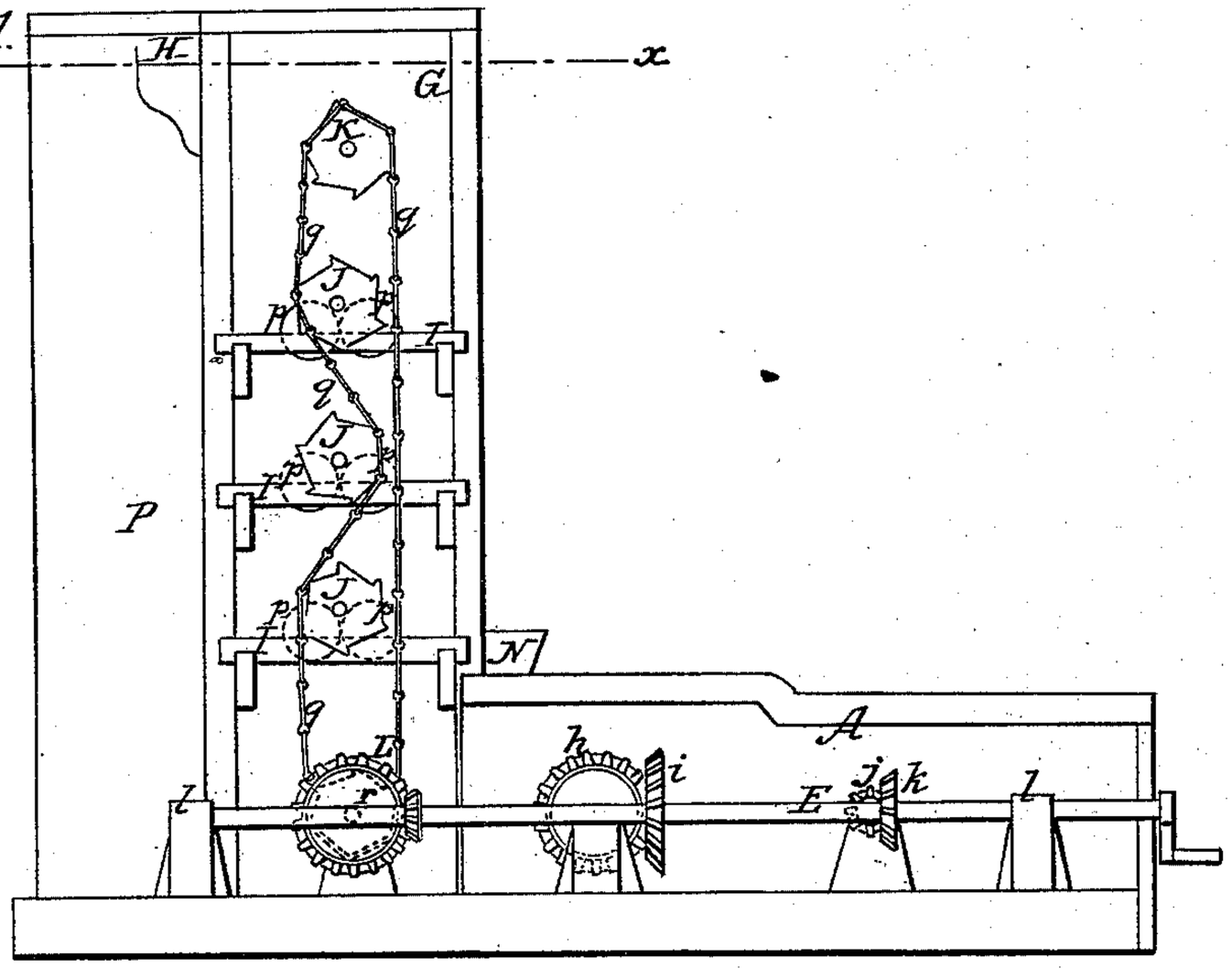


Fig. 6.

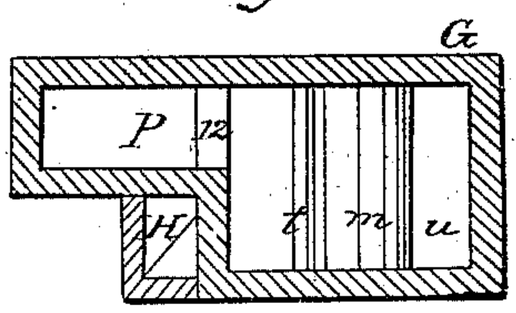


Fig. 2.

Witnesses.
W. J. Cambridge
Mill N Robbins

Inventor
Samuel H Folsom
pr his Attorneys
Teschemacher & Bearns.

2 Sheets—Sheet 2.

S. H. FOLSOM.

Furnace for Treating Ores.

No. 80,279. Patented July 28, 1868.

Fig. 3.

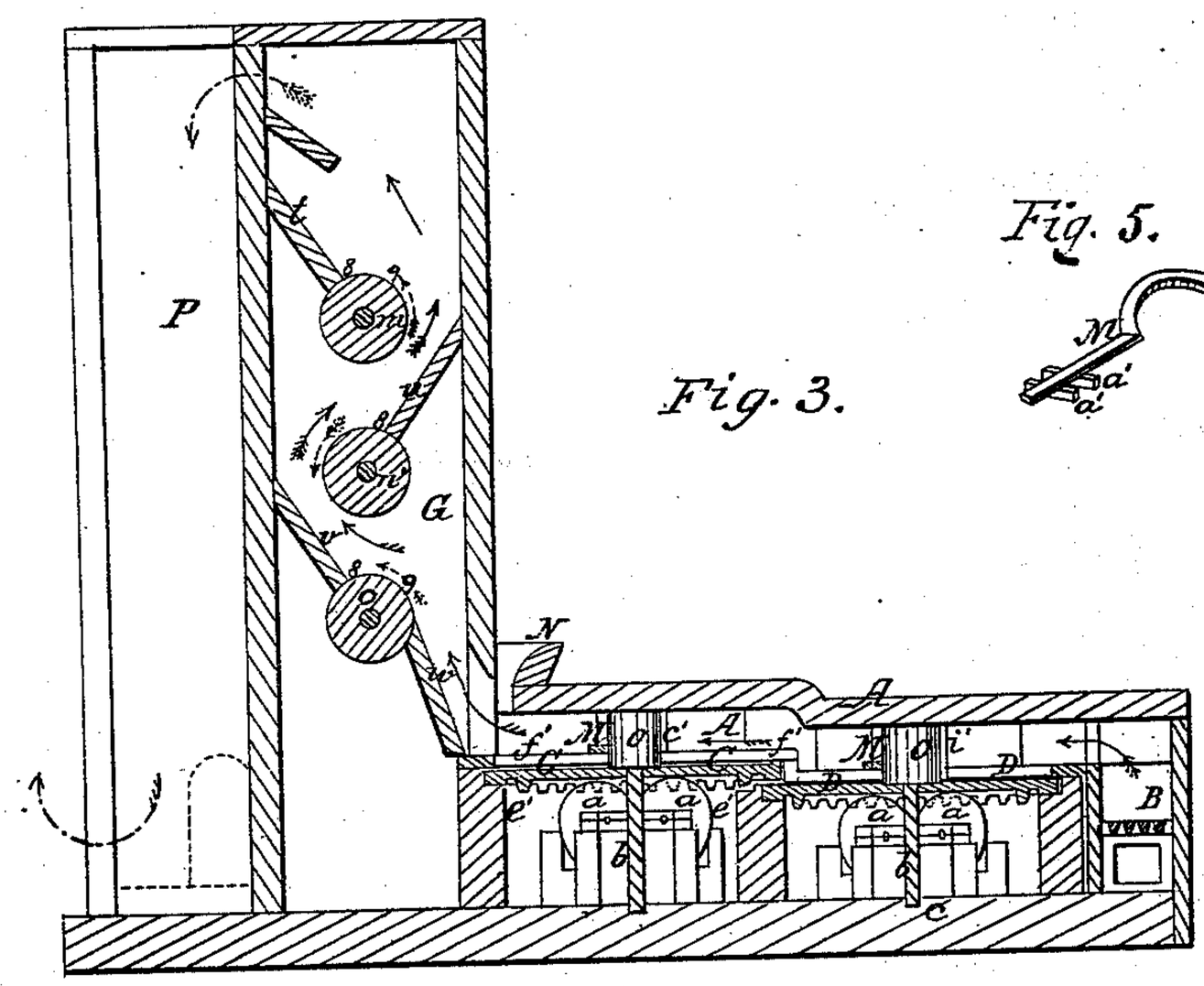
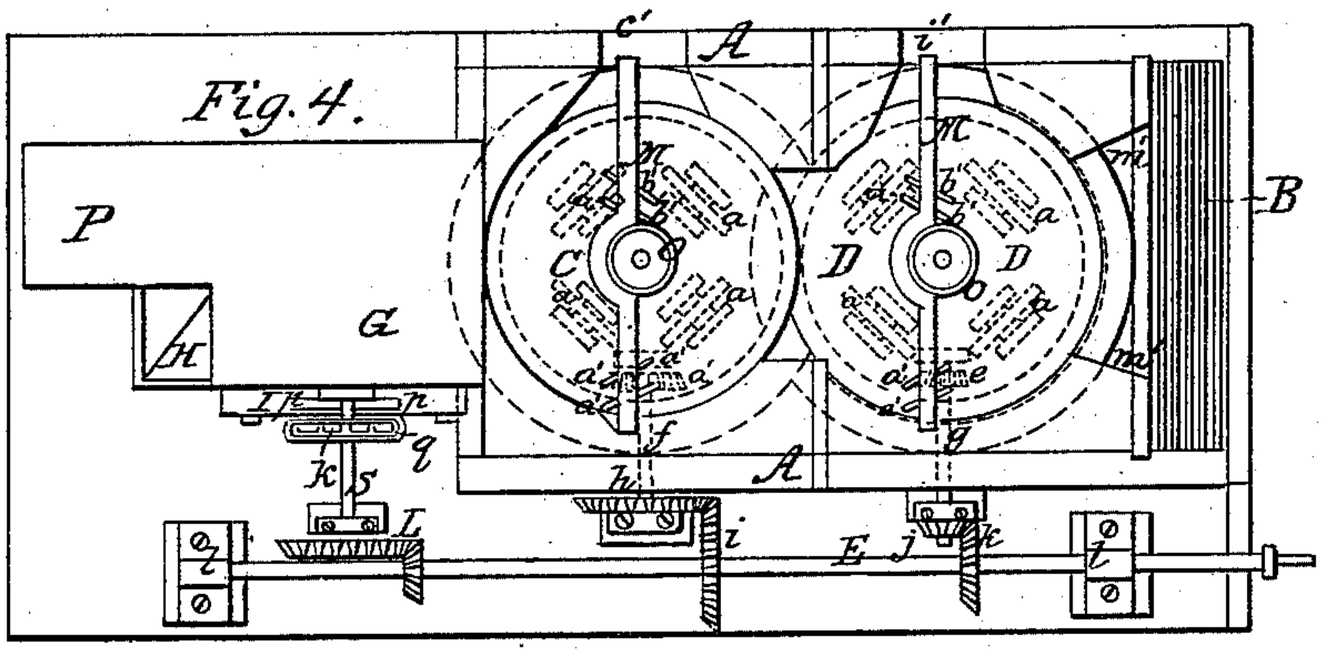


Fig. 5.

Fig. 4.



Witnesses
W. J. Cambridge
M. W. F. Robbins

Inventor,
Samuel H. Folsom
per his attorneys
Teschemacher & Stearns

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

United States Patent Office.

SAMUEL H. FOLSOM, OF WINCHESTER, MASSACHUSETTS.

Letters Patent No. 80,279, *dated July* 28, 1868.

IMPROVED FURNACE FOR TREATING ORES.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, SAMUEL H. FOLSOM, of Winchester, in the county of Middlesex, and State of Massachusetts, have invented certain Improvements in Furnaces for Roasting, Desulphurizing, and Chloridizing Ores, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is an elevation of one side of my improved furnace.

Figure 2 is an elevation of the opposite side.

Figure 3 is a longitudinal vertical section.

Figure 4 is a plan with the roof of the furnace removed, to show the interior construction.

Figure 5 is a perspective view of one of the stationary stirrers.

Figure 6 is a horizontal section on the line *x x* of fig. 1.

The first part of my invention consists in a furnace provided with a series of two or more revolving tables constituting its bottom, said tables being so arranged within the furnace, that the "pulp" or pulverized ore may be transferred from one to the other, whereby it is subjected to a gradually-increased heat, (as is necessary to produce a good result,) as it approaches nearer to the furnace, without the necessity of regulating the heat, as has heretofore been necessary, while the heat is utilized to a greater extent than heretofore, as that which passes over the table nearest to the furnace is further employed to effect the roasting of the ore on the table or tables beyond, instead of passing directly to the flue and being wasted, as in ordinary furnaces, thus economizing fuel and facilitating the process of roasting.

The second part of my invention consists in a vertical flue provided with a series of revolving cylinders, in combination with inclined planes or guides, whereby the ore is uniformly delivered with more or less rapidity, as may be desired, and the time regulated which it occupies in passing through the flue, by which means the ore is subjected to the action of the products of combustion contained in the flue for such length of time as may be necessary to effect the requisite degree of roasting in this part of the process; and my invention also consists in certain details to be fully described hereafter.

To enable others skilled in the art to understand and use my invention, I will proceed to describe the manner in which I have carried it out.

In the said drawings, A is the furnace, composed of brick-work, at the front end of which is the fire-box B.

C D are two revolving tables or platforms, of a circular form, which constitute the bottom of the furnace, and receive the "pulp" or pulverized ore to be roasted. Each of these tables is supported upon a series of friction-wheels, *a*, (see fig. 3, and in dotted lines in fig. 4,) and is steadied and held in place by a vertical shaft, *b*, which revolves in a step, *c*. The tables are provided with teeth upon their under side, and are revolved by bevel-gears *d e* upon the short horizontal shaft *f g*, seen in dotted lines in fig. 4, which extend out through the side of the furnace, where they are connected, by means of bevel-gears *h i j k*, with a long shaft, E, hung in bearings *l*, and revolved by any suitable power.

The products of combustion pass (as indicated by the blue arrows, fig. 3,) from the fire-box B, over and in contact with the ore upon the revolving tables D C, to the vertical flue G, through a hopper, H, at the top of which the "pulp" or pulverized ore is introduced, so that it will pass down in contact with the heated products of combustion within the flue, and thus be subjected to a preliminary roasting before being delivered on to the revolving table C. The ore is not, however, allowed to pass directly from the top to the bottom of the flue, but is carried down uniformly and retained in contact with the products of combustion for a considerable length of time, in the following manner:

m n o are a series of metallic cylinders, which may be covered with fire-brick if desired, and are placed within the flue G, extending entirely across it, their shafts passing through the sides of the flue and resting upon friction-wheels *p*, the journals of which have their bearings in the bars I. Each of the shafts of the cylinders *m n o* carries, at one extremity, a ratchet-wheel, J, and over these wheels, and a guide-wheel, K, passes

an endless chain, q, which also passes over a similar wheel, r, seen in dotted lines in fig. 1, on a shaft, s, carrying at its outer end a bevel-wheel, L, which is driven by a small bevel-gear upon the shaft E, the motion of which is thus communicated to the cylinders m n o, which revolve in the directions indicated by the red arrows, fig. 3. Above these cylinders are fixed inclined plates or guides, t u v, the lower edges of which are on one side of a vertical line passing through the centre of the cylinders, and are raised above the latter only a sufficient distance to allow of their revolution, the length of the guides corresponding to that of the cylinders, as seen in fig. 6. The ore, as it drops from the hopper H, falls upon the inclined guide t, by which it is conducted on to the cylinder m, the lower edge of the guide being, as before stated, on one side, instead of directly over the centre of the cylinder, thus leaving a space upon its upper surface from 8 to 9, for the reception of the pulverized ore, and as the latter is carried by the revolution of the cylinder beyond the point 9, it is discharged on to the incline u, whence it passes on to the cylinder n, from which it is discharged in a similar manner on to the incline v and cylinder o, passing from the latter over an inclined guide, w, to the surface of the revolving table C.

It will thus be seen that the pulverized ore is delivered with uniformity and regularity from one cylinder to another, the speed at which the cylinders revolve determining the length of time occupied by the ore in passing through the flue G, and by this means it may be subjected to the action of the products of combustion for a longer or shorter period of time, as may be found necessary to effect the desired degree of roasting in this part of the process. The quantity of ore fed through the hopper H in a given time should be in proportion to the speed at which the cylinders are revolved, so that the ore will be properly delivered by their revolution.

The flue G, represented in the drawings, contains three revolving cylinders, but it is evident that the number may be varied, if found desirable, and that they may be actuated by any suitable mechanism other than that shown. By the employment of the flue G, constructed as above described, in addition to the advantage secured in roasting by the retention of the ore in contact with the products of combustion, the chlorine gas which may escape from the decomposition of the salt mixed with the ore on the tables C D, is taken up as it comes into contact with the ore in passing up through the flue, thus utilizing the chlorine gas which is ordinarily lost. As the ore is delivered from the flue G on to the revolving table C, it is spread over its surface by means of stationary stirrers a' b', which rest on the table, and are attached to a bar, M. These stirrers consist of plates set at an angle, as seen in figs. 4 and 5, the plates a' on one side being set so as to carry the ore from the circumference toward the centre of the table, and the plates b', on the opposite side of the bar, being set so as to carry the ore from the centre toward the circumference. Any suitable number of these stirrers may be attached to the bar M. It will be seen that by means of these stirrers the ore is continually transferred from one portion of the table to another, and thus thoroughly stirred and exposed to the action of the heat and air, which prevent it from slagging and caking. The stirrers also serve to thoroughly distribute the salt which is introduced through the hopper N. A great amount of manual labor formerly required to stir the ore while being roasted is thus dispensed with by the use of these stirrers, whereby a material saving is effected.

It will be seen that the ore upon the table C being removed a considerable distance from the fire-box B, is exposed to only a moderate degree of heat, and, after being partially roasted, it is transferred to the table D, (a portion of which lies under the table C, as seen in figs. 3 and 4,) by inserting a long bar or other suitable instrument, through the opening c', figs. 2, 3, and 4, at such an angle that as the table C revolves, the ore will be forced over its edge on to the table D, over the surface of which it is spread by means of stirrers similar to those above described, and the ore is thus subjected to a greater degree of heat on account of its proximity to the fire-box B.

The revolution of the tables C and D causes all portions of the ore upon their surfaces to be brought successively to the point where the heat is most intense, but in order to facilitate the process, a circular deflector, O, is placed in the centre of each of the tables C D, which serve to more thoroughly distribute the products of combustion over the surface of the ore. The surfaces of the tables C and D are covered with fire-brick, and beneath the table C is a projecting ledge or shelf, e', which serves to catch any ore which may fall over the edge of the table, a series of scrapers, f', attached to the under side of the table, carrying it round and forcing it on to the table D, and by this means the ore is saved from being wasted, and prevented from accumulating beneath the table and interfering with its revolution.

In a similar manner the ore which falls over the edge of the table D is caught upon a projecting edge or shelf, a series of scrapers on the under side of this table carrying it round and discharging it at an opening, h', fig. 2. After the ore has been exposed upon the table D for a sufficient length of time to effectually complete the process of roasting and chloridizing, it may be removed through the opening i', figs. 2 and 4, by means of a hoe or other suitable instrument, and the ore which has been partially roasted upon the table C transferred to the table D, as before described, and the operation continued as before, the heat employed to complete the roasting of the ore upon the table D, passing over the table C, and effecting the partial roasting of the ore upon its surface, after which it passes to the flue G, and is still further utilized in partially roasting the ore passing down through it, as before described.

The products of combustion pass from the flue G through an opening, 12, fig. 6, into a "settling-chamber," P, which serves to collect whatever ore-dust is carried over into it, and thence by a passage, k', seen in dotted lines in fig. 3, to the chimney-stack.

l' is a door at the bottom of the chamber P, which may be opened to allow of the removal of the ore-dust after it has settled.

m' are openings through which air (previously heated by contact with the lower portions of the furnace) is admitted to the fire-box B, above the fuel, for the purpose of facilitating combustion, and the openings c' and i' are provided with doors, so that they may be closed when necessary.

In the drawings two revolving tables are shown, but in practice I prefer to use three, as a better result is produced; the number may therefore be varied as may be found most desirable. In furnaces as heretofore constructed, the heat required to be regulated, as it was necessary to expose the ore to a moderate heat for a considerable length of time, and afterward to a much greater degree of heat, but in my improved furnace the necessity of regulating the heat is entirely avoided, as the ore is exposed to a gradually-increasing degree of heat from the time it leaves the hopper H, at the top of the flue G, until it reaches the table D nearest to the fire, while all the heat is utilized, as that which completes the roasting of the ore upon the table D, passes over the table or tables beyond, and thence into the flue, effecting the preliminary roasting of the ore in its passage, instead of being wasted, as heretofore; and the ore having been thus partially roasted before it reaches the table D, requires to remain upon the latter for a much shorter period of time than where a single table is used. The process is thus made continuous, and a great saving in fuel and manual labor is effected, and my improved furnace enables me to produce a much greater quantity of roasted ore than has heretofore been possible with a furnace of equal capacity, as the several stages in the process are all conducted simultaneously.

I do not confine myself to the use of a series of revolving tables in connection with the flue G, provided with a series of revolving cylinders and inclined guides, as described, as either of these portions of my invention might be used to advantage separately; a better result is, however, obtained when they are used together, as shown and described.

Claims.

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

A series of two or more revolving tables placed within a furnace, A, and operating substantially as described for the purpose herein set forth.

I also claim the revolving cylinders *m n o*, with their inclined guides, in combination with the flue G, operating substantially as described, for the purpose set forth.

I also claim a central deflector, O, applied to a table, C or D, for the purpose of more thoroughly distributing the flame over its surface, substantially as set forth.

I also claim the inclined stationary stirrers *a' b'*, in combination with a revolving table, C or D, substantially as described.

I also claim the scrapers *f'*, on the under surface of a table, C or D, in combination with a projecting edge or shelf, *e'*, beneath the table, substantially as and for the purpose set forth.

SAM'L H. FOLSOM.

Witnesses:

P. E. TESCHEMACHER,

W. J. CAMBRIDGE.