R. BAGGALEY.

METHOD OF SMELTING ORES.

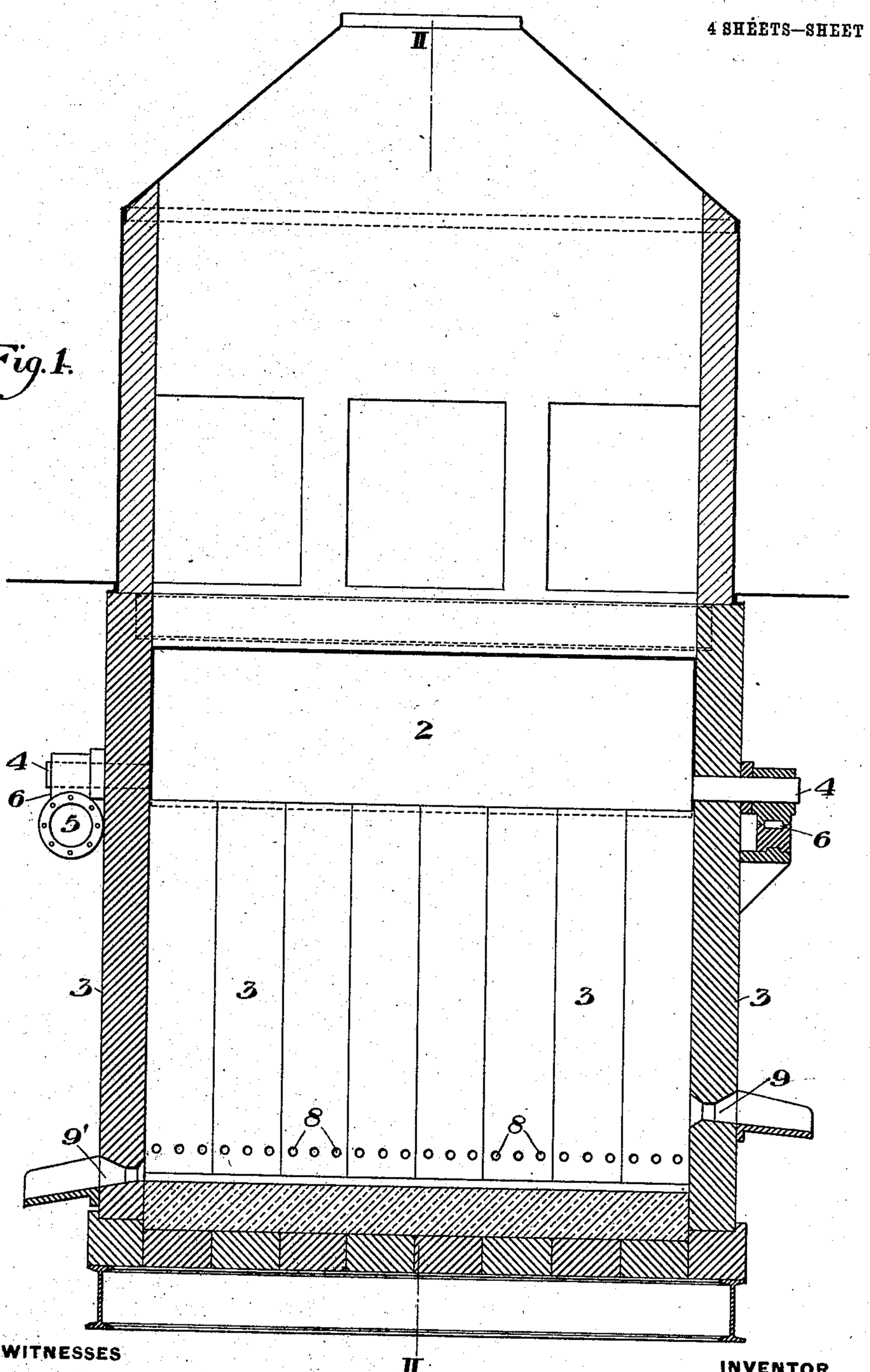
APPLICATION FILED FEB. 8, 1906.

900,466.

Patented Oct. 6, 1908.

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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4 SHEETS—SHEET 2.

Fig. 2

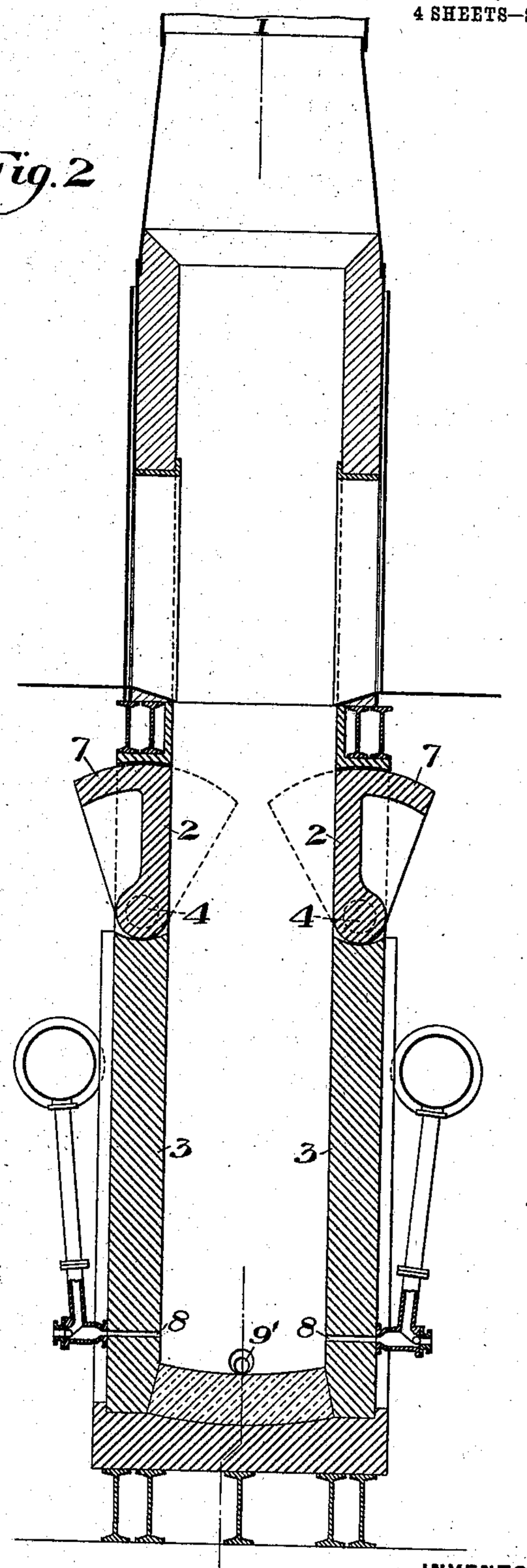
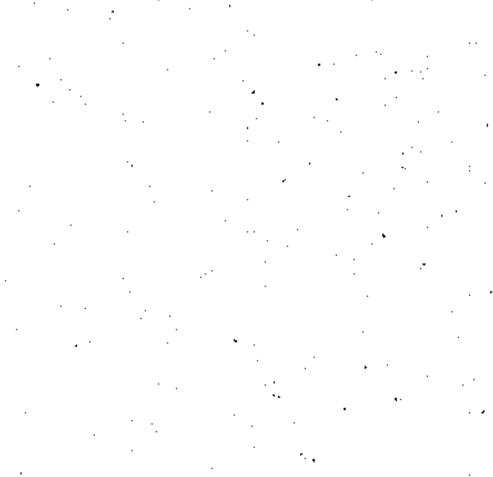


Fig. 3.



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4 SHEETS—SHEET 3.

Fig. 4.

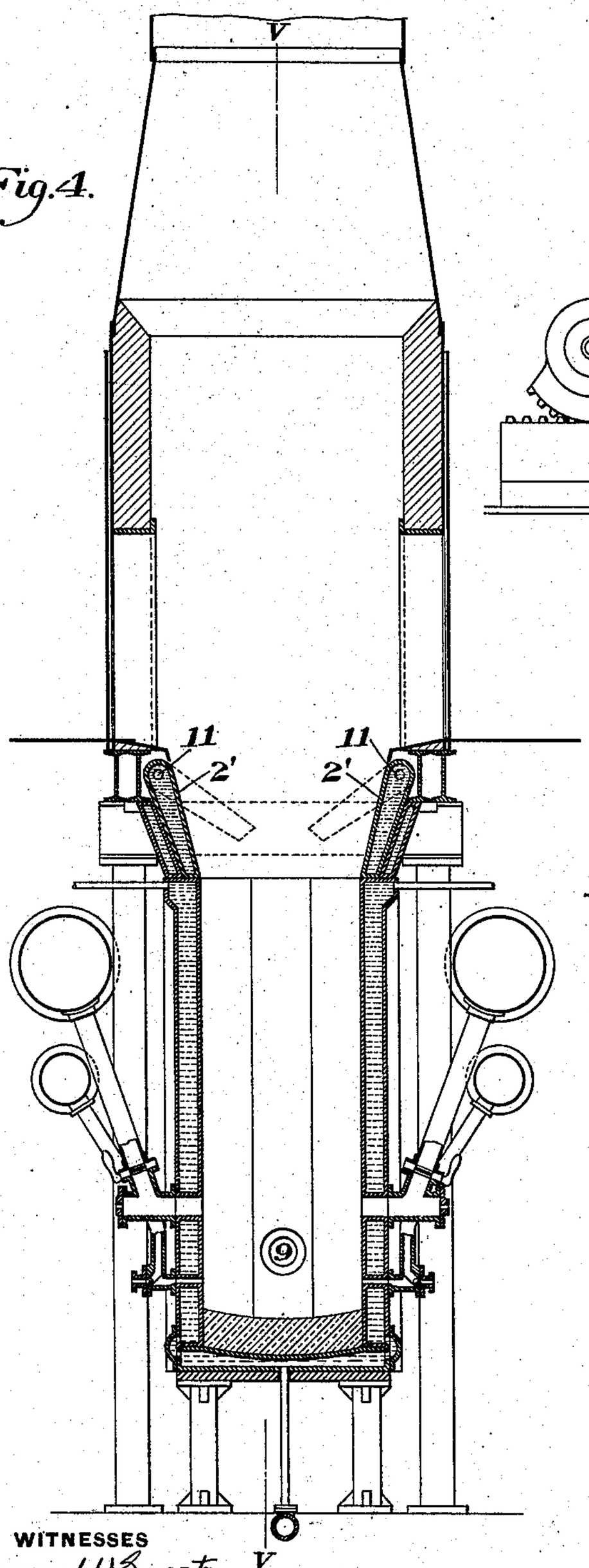
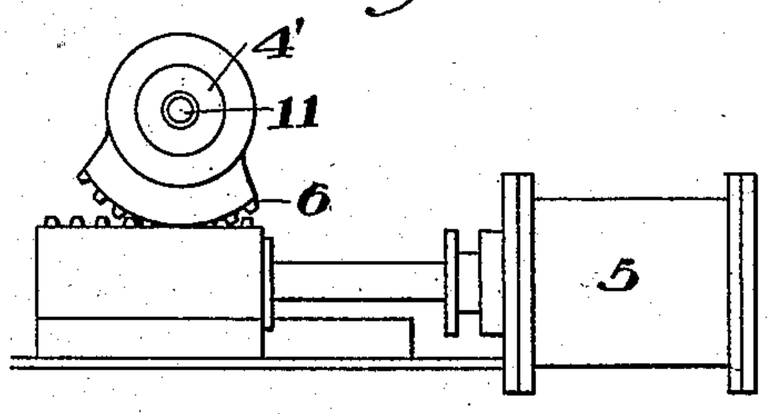


Fig. 6.



WITNESSES

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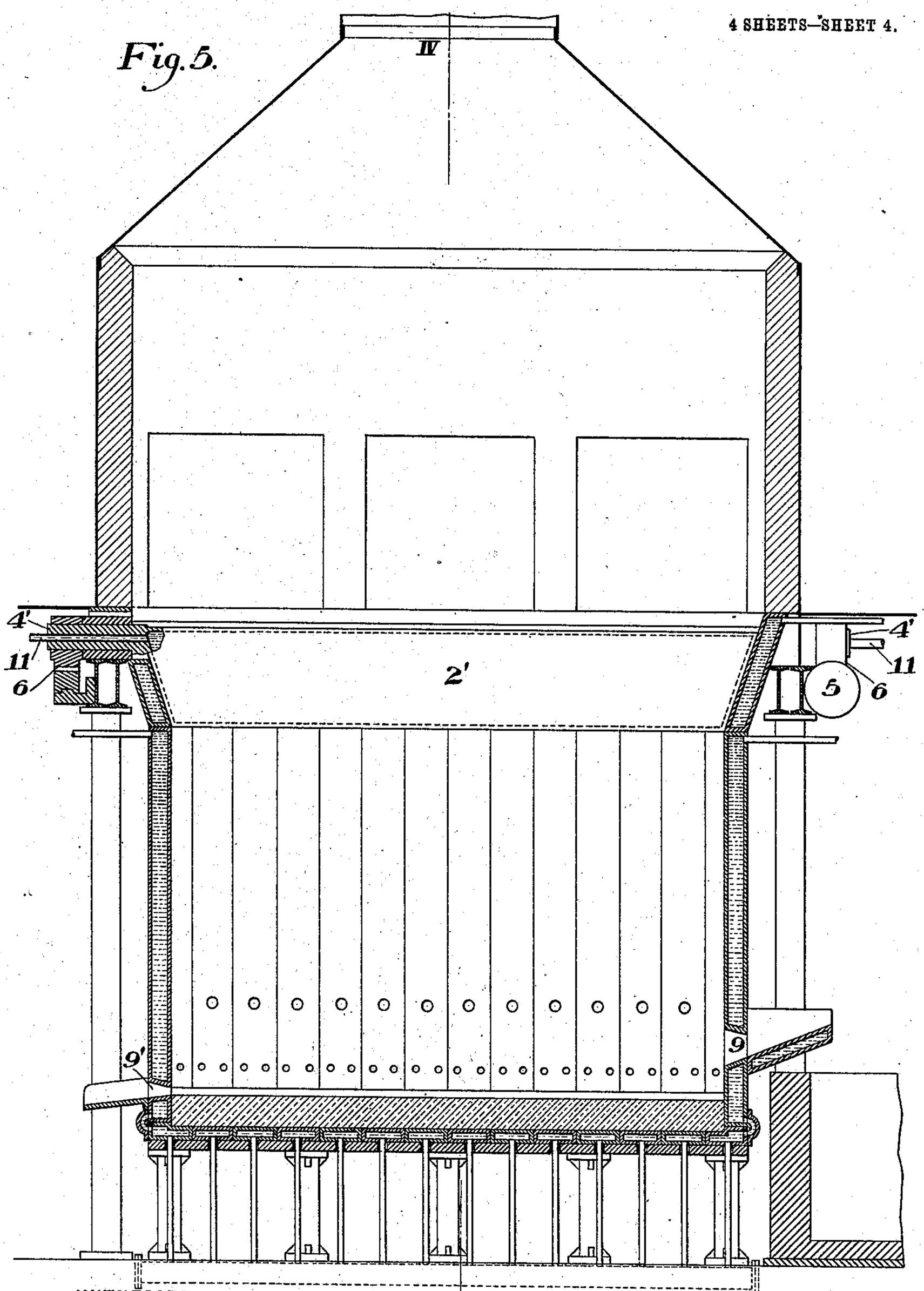
4 SHEETS—SHEET 4.

Fig. 5.



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UNITED STATES PATENT OFFICE.

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METHOD OF SMELTING ORES.

No. 900,466. Specification of Letters Patent. Patented Oct. 6, 1908.

Application filed February 8, 1906. Serial No. 300,071.

To all whom it may concern:

Be it known that I, RALPH BAGGALEY, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Method of Smelting Ores, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a longitudinal section of a furnace suitable for practice of my invention, the section being on the line I—I of Fig. 2; Fig. 2 is a cross-section on the line II—II of Fig. 1; Fig. 3 illustrates the power mechanism that may be advantageously utilized in actuating the damper doors 2 of Fig. 2 which preferably extend the entire interior length of the crucible. Fig. 4 is a cross-section on the line IV—IV of Fig. 5, showing apparatus of modified construction. Fig. 5 is a longitudinal section on the line V—V of Fig. 4. Fig. 6 shows the power mechanism that may be used to actuate the water-cooled dampers 2′ of Figs. 4 and 5.

The object of my invention is to make it possible to dissolve ores in open-top furnaces whether such furnaces be constructed of heavy metal blocks, of refractory material of any kind, or of water-jackets of any kind.

My present invention has been designed primarily for use in the practice of a process of smelting ore wherein the following steps are employed. 1st. Producing a molten bath of clean matte or of molten ores, the distinctive feature of which bath is high fuel values. 2nd. Dissolving thereafter in this molten bath through the intense heat produced by the converting process ores whose distinctive constituents are silica, for releasing and fluxing the iron contained in the molten bath, and mineral values, for yielding valuable metal.

The process employs no carbonaceous fuel of any kind, or practically no such fuel beyond the small amount necessary to start the process into operation. When once started it depends alone for its success upon the heat produced by the oxidation of the various elements and compounds that partly constitute the molten bath, such for instance as iron, sulfur, arsenic, and compounds thereof and many other things. It is therefore necessary in order to practice this art successfully to conserve carefully the heat which is thus produced, and I have discovered that it is practically impossible to use an open-top furnace of any kind for the purpose, because it permits the continuous and almost instantaneous escape of the heat through the hood and out of the stack. By way of illustration I may state, that the converting process as successfully conducted heretofore could not be practiced in a converter that was open at the top to the full area of the converter at its widest part, for in such a converter the escape of the heat would be so rapid that the process itself would fail. On the contrary, it is absolutely essential to success that the converter shall have a narrow contracted nose or throat which will hold the heat produced by the process to the utmost limit before permitting it to escape into the stack. This conservation of the internal heat is carried to such an extent in present practice, that a pressure of the gases is often produced on the interior of the converter.

The process above mentioned involves even more exacting conditions, and demands even greater conservation of the heat produced in the furnace than does the ordinary converting process, because the molten bath in it is compelled to heat up and to dissolve ores that may be primarily cold, or if preheated at all they are still at a temperature much less than the fusion point.

I have found that because of the rapid escape of the heat from an open-top furnace in which the process above referred to, is being practiced, a continuous congealing of the matte and slag will occur on the side and end walls of such open-top furnace and because of this trouble it is only a question of time until these accretions close up the crucible and thus bring the process to a full stop. This difficulty is intensely aggravated where water-jackets are used, because the flow of water continuously abstracts and dissipates the internal heat of the furnace and greatly reduces the temperature of the bath. My present invention makes it possible to use an open-top furnace of almost any kind and constructed of almost any material. It comprises means above the crucible to regulate or govern the escape of the internal heat through the stack, downtake, or otherwise. Many different means may be utilized to accomplish this result.

My preferred form of construction is that shown in Figs. 1, 2 and 3. The furnace shown in these figures is built of heavy metal

blocks 3, as described in an application filed by C. M. Allen on March 31st, 1904, Serial No. 200,943. Such heavy metal blocks will continuously absorb, retain and conserve the internal heat of the crucible and will not wastefully dissipate it as water-jackets are liable to do. The furnace has damper-doors 2, 2, mounted on trunnions 4 arranged to swing, through the action of a cylinder 5, and rack and pinion 6, or other suitable power-mechanism, into the positions shown in dotted lines of Fig. 2, which will have the effect of almost closing the upper portion of the furnace and of thus preventing the escape of its internal heat. The dampers have wings 7 arranged so that while they are in this position, their upper surfaces will constitute a hopper, through which ores may be fed into the molten bath below to be dissolved.

The furnace has the usual twyers 8, slag-outlet, 9, tap-hole 9′ for metal or matte, and charging-openings 10.

When the furnace is in operation, the dampers are moved towards or from each other to vary the width of opening at the upper part of the furnace in conformity to the heat requirements of the bath, which is thus maintained at the temperature proper for effective work in dissolving the additions of ore, but these changes are effected without substantially changing the air-pressure of the blast.

Figs. 4 and 5 illustrate other mechanical means for producing the same result, and in this instance the invention is applied, by way of illustration, to a water-jacketed furnace; although I do not recommend the use of water-jackets for this purpose, for the reasons hereinbefore stated. Still I have found that water-jackets may be used, if ample provision, such as that contemplated in my present invention, is made for preventing or controlling the escape of the internal heat. In practicing this art in a water-jacketed furnace, a much thicker skull or lining forms upon the interior walls of the furnace than where metal blocks are used, because of the rapid extraction of heat by the water.

In Figs. 4 and 5, the dampers 2′ are water-cooled hollow boxes pivoted at their upper ends and adapted to swing inwardly as shown in dotted lines, water being supplied to them by pipes 11 which extend axially through the trunnions 4′.

I consider the method above described of controlling the escape of internal heat from the crucibles of open-top furnaces as broadly new, and I do not wish my invention to be limited to the particular mechanical means illustrated in the drawings. For instance, sliding water-jacketed dampers may be used, such as those illustrated in my application Serial No. 202,391, filed April 9, 1904, for a matte producing furnace, and in other ways the same results which are essential to success may be accomplished.

Various modifications in the apparatus for the practice of this invention will naturally suggest themselves to those skilled in the art, without departing from the spirit of my invention, since

What I claim is:—

1. The method of treating ores, which consists in producing a molten bath high in fuel values, dissolving in the bath ores having constituents for releasing and fluxing the iron and mineral values contained in the molten bath, the process when started being carried out without the use of carbonaceous fuel and by the heat produced by the oxidation of the fuel values of the ore and bath, and during such process varying the area of the escape opening of the vessel in which the process is carried out conformably to the heat requirements of the bath, whereby the heat produced within the vessel may be held therein to a controllable maximum extent; substantially as described.

2. The method of treating ores, which consists in producing a molten bath high in fuel values, dissolving in the bath ores whose distinctive constituents are silica for releasing and fluxing the iron contained in the molten bath, and mineral values, the process when started being carried out without the use of carbonaceous fuel and by the heat produced by the oxidation of the fuel values contained in the ore, and during such process varying the area of the escape opening of the vessel in which the process is carried on conformably to the heat requirements of the bath and without materially increasing the pressure within the vessel, whereby the heat produced within the vessel may be held therein to a maximum extent; substantially as described.

In testimony whereof, I have hereunto set my hand.

RALPH BAGGALEY.

Witnesses:
WILLIAM M. KIRKPATRICK,
FRANK L. RILEY.