No. 746,251. PATENTED DEC. 8, 1903.

R. BAGGALEY.

METHOD OF ARRESTING ARSENIC FUMES.

APPLICATION FILED APR. 23, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

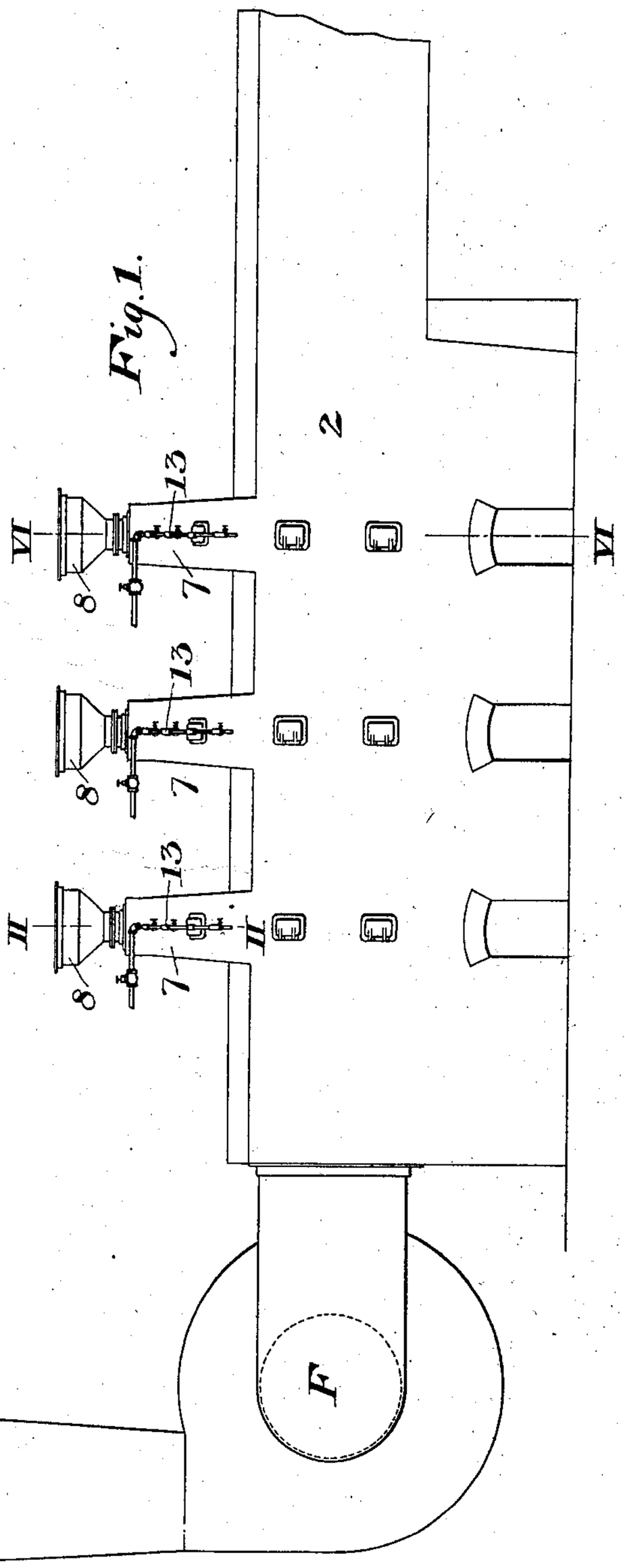
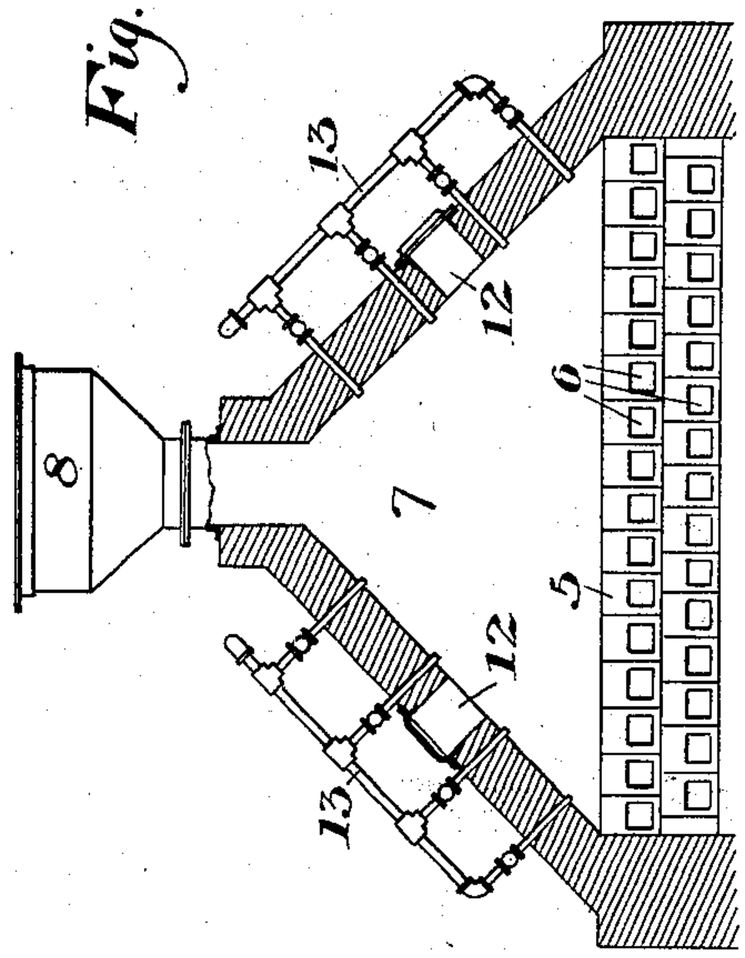


Fig. 2.



WITNESSES

L. A. Connett

H. M. Corwin

INVENTOR

Ralph Baggaley

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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 3.

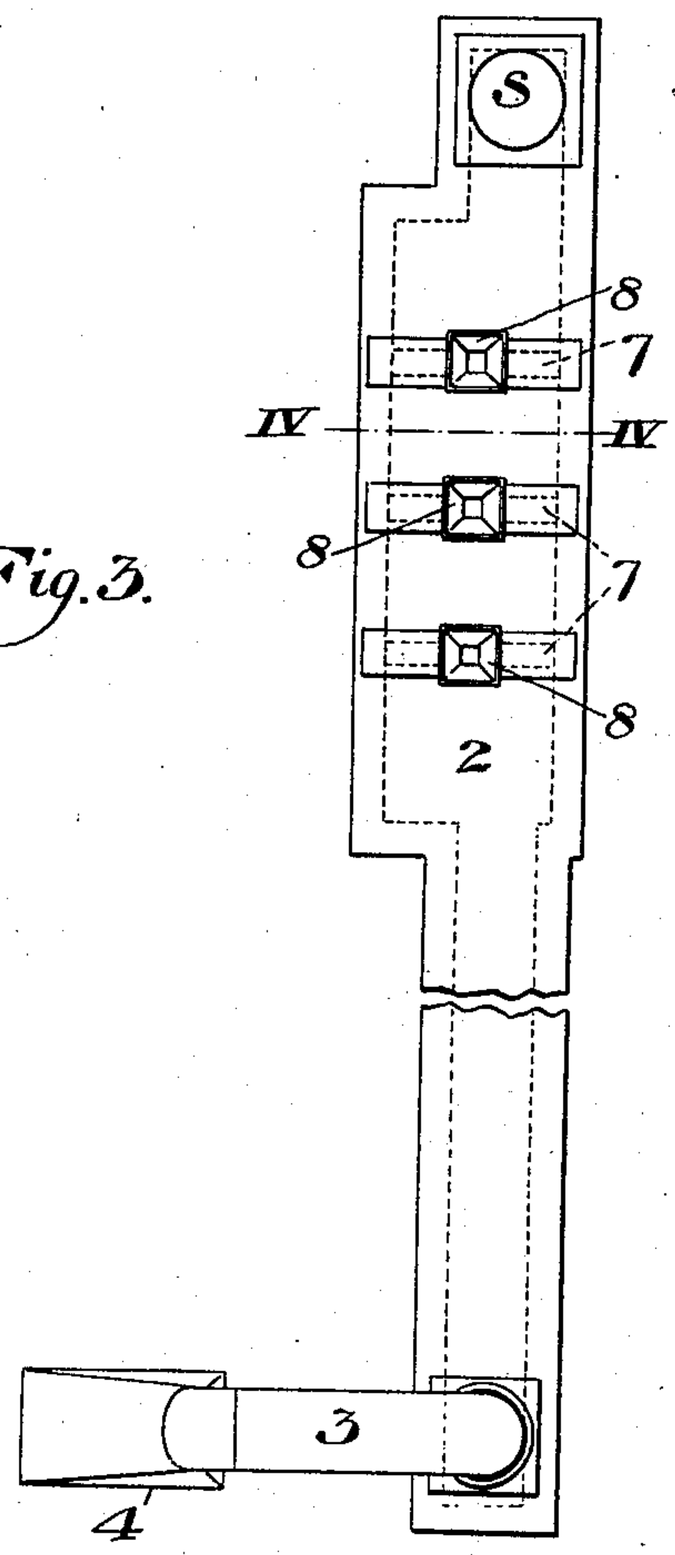


Fig. 5.

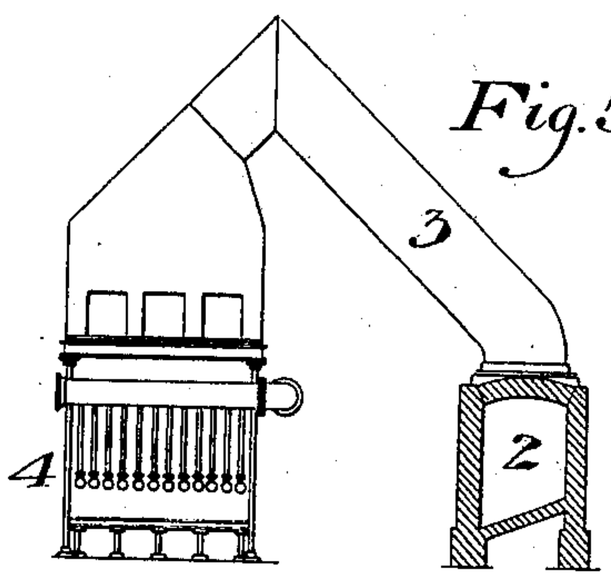
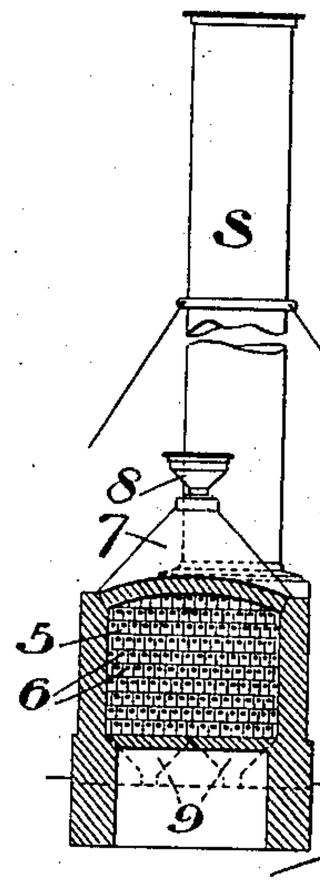


Fig. 4.



WITNESSES

L. A. Sommers

H. M. Corwin

INVENTOR

Ralph Baggaley

No. 746,251. PATENTED DEC. 8, 1903.

R. BAGGALEY.

METHOD OF ARRESTING ARSENIC FUMES.

APPLICATION FILED APR. 23, 1903.

NO MODEL. 3 SHEETS—SHEET 3.

Fig. 6.

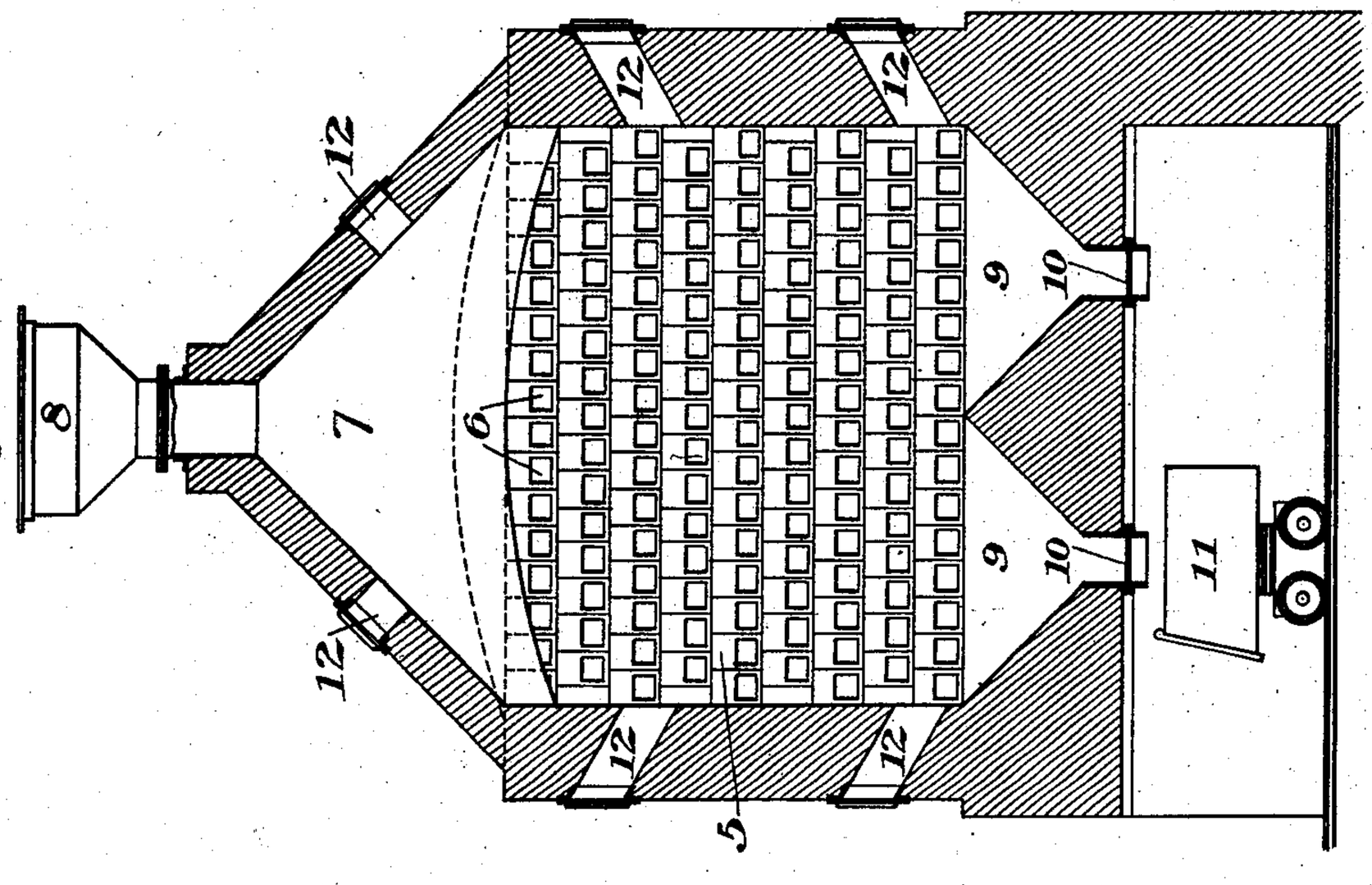
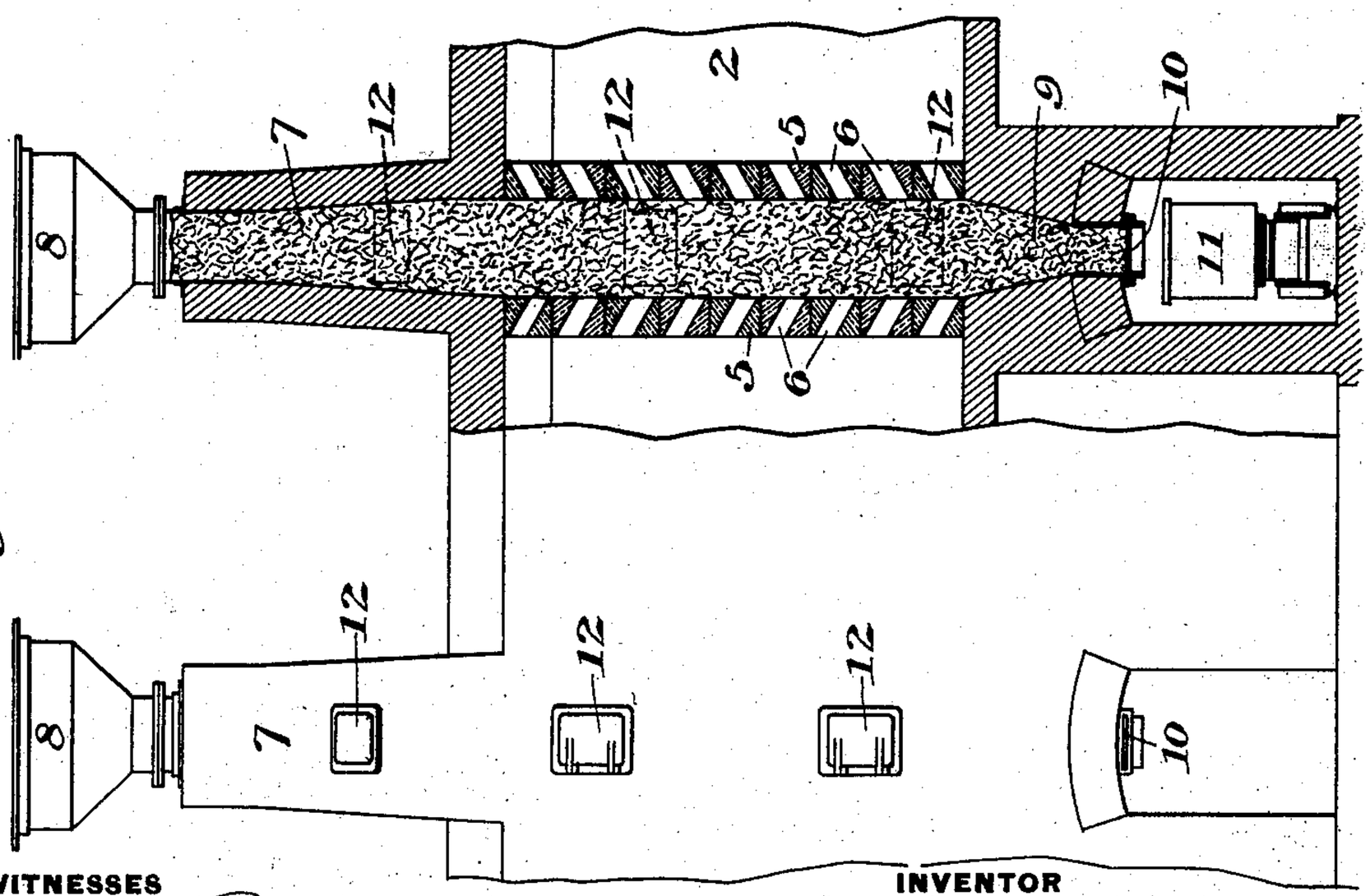


Fig. 7.



WITNESSES

L. A. Bonnell

H. M. Corwin

INVENTOR

Ralph Baggaley

No. 746,251. Patented December 8, 1903.

UNITED STATES PATENT OFFICE.

RALPH BAGGALEY, OF PITTSBURG, PENNSYLVANIA.

METHOD OF ARRESTING ARSENIC FUMES.

SPECIFICATION forming part of Letters Patent No. 746,251, dated December 8, 1903.

Application filed April 23, 1903. Serial No. 153,942. (No specimens.)

To all whom it may concern:

Be it known that I, RALPH BAGGALEY, of Pittsburg, Allegheny county, Pennsylvania, have invented a new and useful Method of Arresting Arsenic Fumes, of which the following is a specification.

Figure 1 of the accompanying drawings is a side elevation of apparatus for carrying out my invention. Fig. 2 is a vertical section of the upper part of the apparatus on the line II II of Fig. 1. Fig. 3 is a plan view of the apparatus, on a smaller scale, showing the same connected with a stack S for creating a draft therethrough. Fig. 4 is a vertical cross-section on the line IV IV of Fig. 3. Fig. 5 is an end elevation, partly in section, showing the connection of the smelter-furnace 4 with the chamber of my apparatus. Fig. 6 is a vertical cross-section, on a larger scale, on the line VI VI of Fig. 1. Fig. 7 is a partial side elevation, partly in central longitudinal section.

My invention relates to a new method of preventing the devastating effects to vegetation and to the streams arising from the smelting of ores containing sulfur, arsenic, &c. It is well known that the country surrounding smelting plants sometimes for many miles distant is devastated through the destruction of vegetation by the fumes inseparable from the fusion of sulfid ores.

In a furnace smelting three hundred and sixty tons of ore that contains, say, twenty per cent. of sulfur from sixty to seventy-five tons of sulfur are volatilized and of course deposited in the surrounding country. On damp or rainy days the sulfur will fall within a short distance of the smelter-stack. On clear days it will often be carried for a distance of fifteen or twenty miles. The result is the same wherever it falls. Vegetation is destroyed, and the sulfur is carried by the surface drainage into the streams and ponds and the water is polluted and rendered unfit for use. A still more injurious effect is produced when the ores contain arsenic, which is also volatilized and when carried into the stream renders the water poisonous. So serious has this become that it is impossible to operate smelting plants and to conduct agriculture successfully in the same district.

My invention is intended not only to prevent in an economical manner these objectionable features of the smelting industry as at present practiced, but at the same time when desired to collect as by-products sulfur and arsenic that have heretofore been wasted.

My invention is founded on the fact that charcoal will absorb from forty to fifty times its volume of sulfur and sulfur-dioxid gases. In the smelting of sulfid ores approximately one-half the sulfur contents of the ore pass off in the form of free sulfur. The remaining gases contain from fourteen to fifteen per cent. of sulfur dioxid and are practically identical with the gases produced by roasting pyrites in the kilns employed in sulfuric-acid manufacture.

I have found that by interposing charcoal screens or filters within enlarged chambers located between the smelting-furnace and the stack or located between the smelting-furnace and a suitable fan or other mechanical device for producing an induced draft these obnoxious sulfur fumes will be absorbed effectually up to the point where the charcoal has been increased approximately twenty per cent. of its weight. Above this point the sulfur fumes are not entirely arrested. Therefore if it is desired in practicing my invention to remove all of the sulfur from the fumes the charcoal must be changed whenever its weight has been increased by such deposit and absorption approximately twenty per cent. of its weight. In ordinary practice it will not be necessary to eliminate all of the sulfur. If twenty per cent. of the sulfur fumes, for example, is allowed to escape, the fumes will be so dilute as to readily become dissipated in the atmosphere without serious injury to the surrounding country.

In a furnace that smelts three hundred and fifty tons of ore in twenty-four hours containing, say, twenty per cent of sulfur the daily output of sulfur released, either in the free state or as sulfur-dioxid gas, will approximate sixty tons. Theoretically this would require for purification of the gases a ton and a half of charcoal daily. In my apparatus I provide successive filters, preferably three in number, each containing from two to two and a half tons of charcoal. These should be located far enough from the smelting-furnace to prevent ignition from the hot gases.

I have found that charcoal is subject to what is called in the trade "spontaneous combustion," which I believe to be caused by the occurrence of red-hot centers protected from the atmosphere by a casing of cold non-conducting charcoal and which when exposed to air burst into flame. It is therefore of importance that provision be made for drenching the charcoal screens from above with water. After the charcoal in each screen has absorbed sulfur up to its limit I discharge it below into a car for removal to a suitable steam retort or tank, where the contained sulfur is melted out by means of steam under a pressure of approximately fifty pounds to the square inch. This yields a temperature of approximately 300° Fahrenheit, and as sulfur melts at 239° Fahrenheit it is apparent that the sulfur is thus removed from the charcoal and the charcoal rendered capable of being used again for the same purpose. The third screen provided in my apparatus also contains charcoal which is constantly drenched or saturated either with a dilute solution of sulfid of calcium or with a simple alkaline solution of any kind that can be cheaply and readily obtained. Such solution can be used many times and will effectually throw down and arrest the arsenic contained in the gases.

In the drawings, 2 is a chamber which, as shown in Figs. 3 and 5, is connected at one end with the downcomer-pipe 3 of the smelter-furnace 4 and at the other end is connected to a fan F for producing an induced draft, as shown in Fig. 1, or with a stack S, as shown in Fig. 3.

The chamber 2 is intersected at intervals by the screens above mentioned. Each of these screens is formed by vertical double walls 5 5, made of bricks or tiles, having perforations 6, which are upwardly inclined in order to prevent loss of the charcoal contents and which offer free passage to the smelter-gases. At the upper end each space or chamber between the walls 5 5 communicates with a feeding-chamber 7, preferably having upwardly-converging walls and communicating with a feed-hopper 8, and at its lower end it has discharge-openings 9, preferably formed with downwardly-converging sides fitted with valves 10 and adapted to discharge into cars 11, which travel on tracks beneath the chamber. At the ends of the screen spaces or chambers are openings 12, fitted with suitable doors and adapted to permit the admission of a poking-tool when it is desired to facilitate the discharge of the contents.

At the upper end of each screen-chamber are pipes 13, by which water or alkaline solution may be introduced in quantities as desired.

In use of the apparatus the screen-chambers between the perforated walls are filled with charcoal introduced through the hoppers, and the charcoal of the third screen is kept drenched from the pipes 13 by a simple alkaline solution or a solution of sulfid of calcium for the sole purpose of precipitating any remaining arsenic.

In order to present fresh charcoal surfaces to the gases from time to time, a part of the charcoal is withdrawn at the bottom of the screen-chambers, its place being taken by charcoal fed through the hoppers. The charge of the charcoal is governed by the percentage of impurities contained in the ores under treatment.

I do not claim herein the method above described for arresting sulfur fumes, since I have made it the subject of another patent application.

I claim—

1. The method herein described of arresting arsenic fumes from smelter-gases which consists in passing the gases containing such fumes through a filter containing an alkaline compound; substantially as described.

2. The method herein described of arresting arsenic fumes from smelter-gases, which consists in passing the gases containing such fumes through a filter charged with charcoal and wetting the charcoal with an alkaline solution; substantially as described.

3. The method herein described of arresting arsenic fumes from smelter-gases, which consists in passing the gases containing such fumes through a filter containing sulfid of calcium; substantially as described.

In testimony whereof I have hereunto set my hand.

RALPH BAGGALEY.

Witnesses:

GEO. B. BLEMING,

JOHN MILLER.