No. 746,235.

PATENTED DEC. 8, 1903.

R. BAGGALEY.

SLAG BOILER.

APPLICATION FILED JAN. 30, 1903.

NO MODEL.

3 SHEETS—SHEET 1.

Fig. 1.

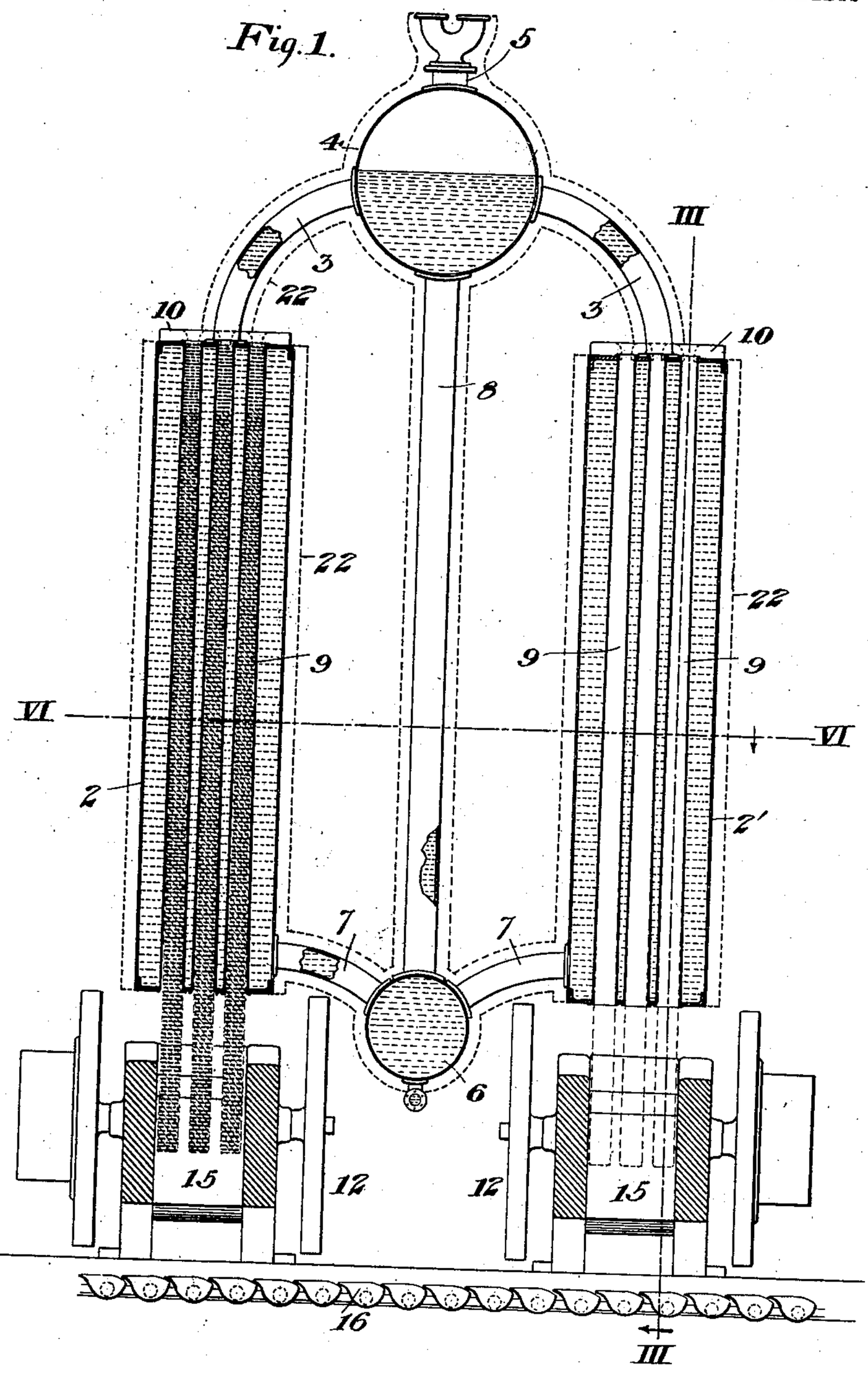
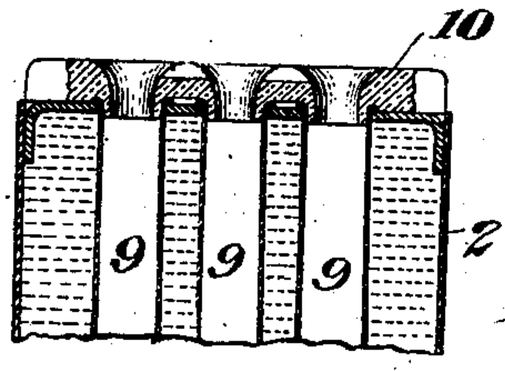


Fig. 2.



WITNESSES

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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 3.

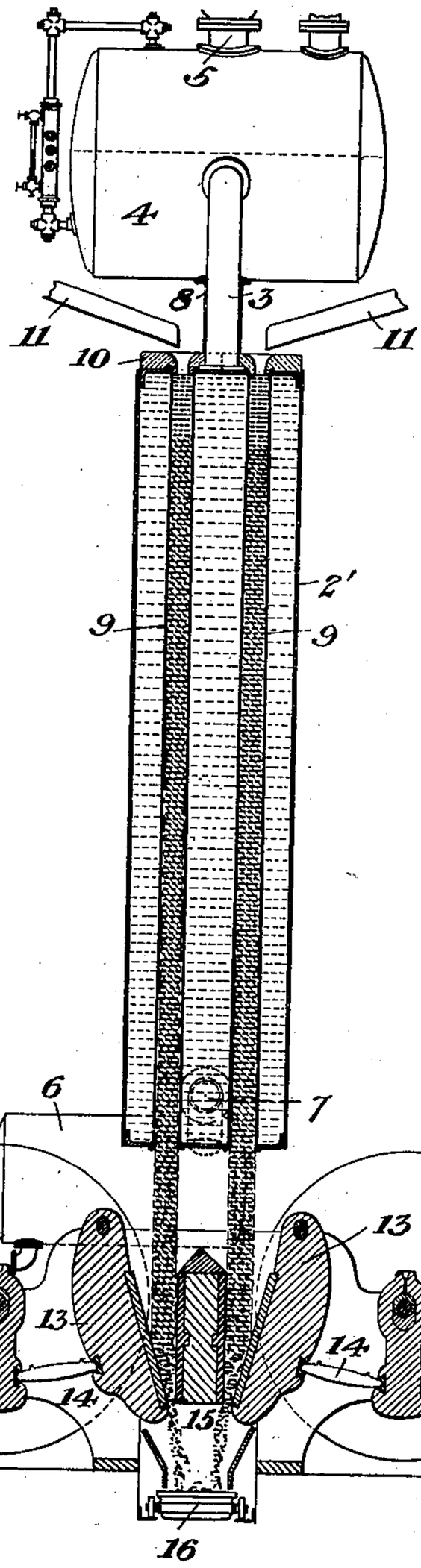


Fig. 4.

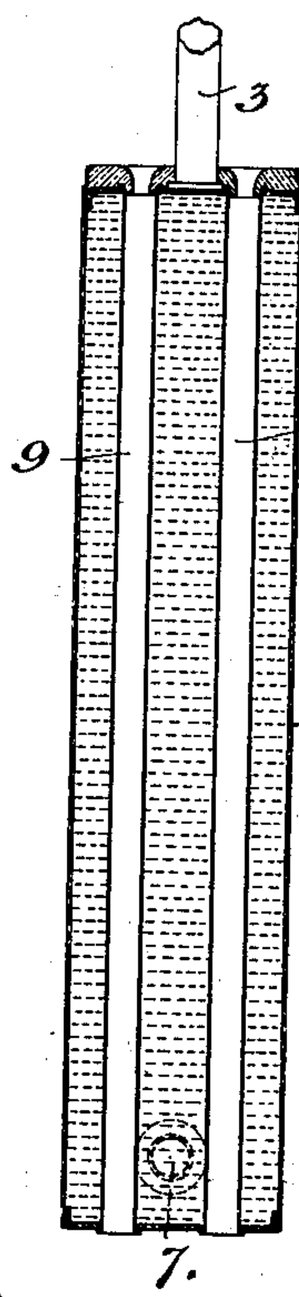
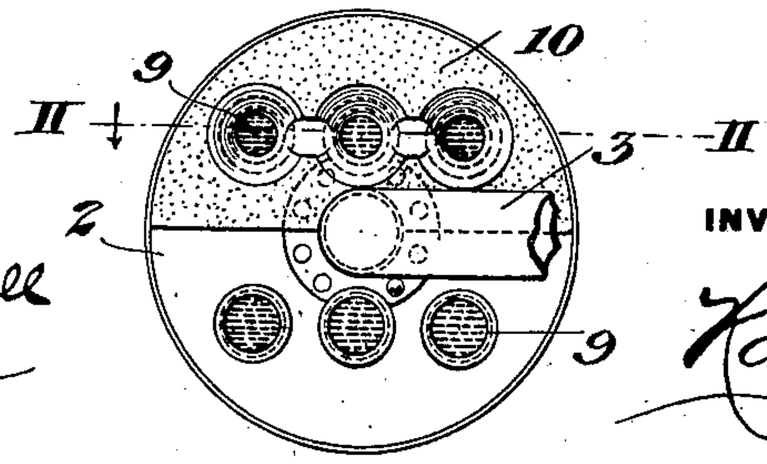


Fig. 5.



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 6.

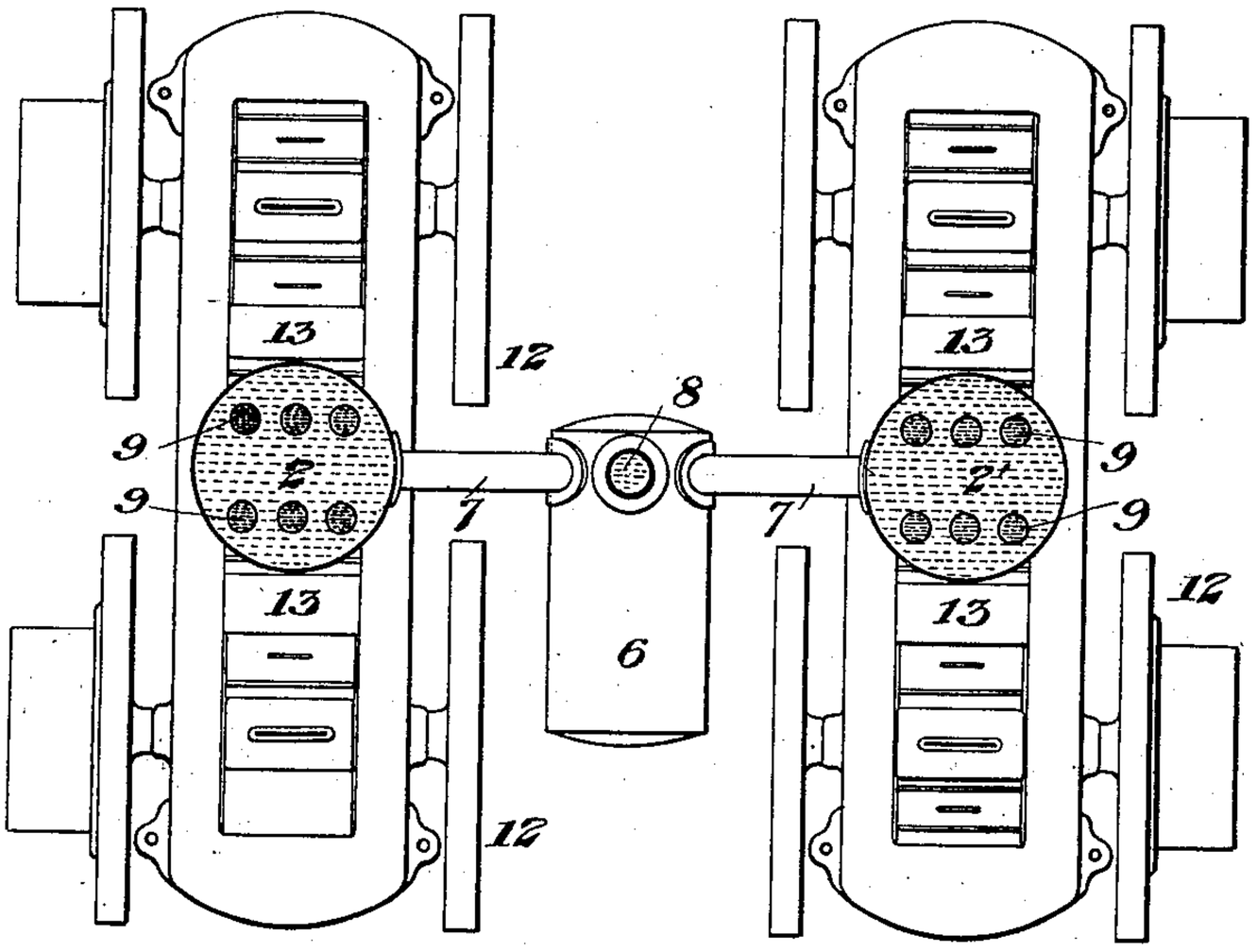
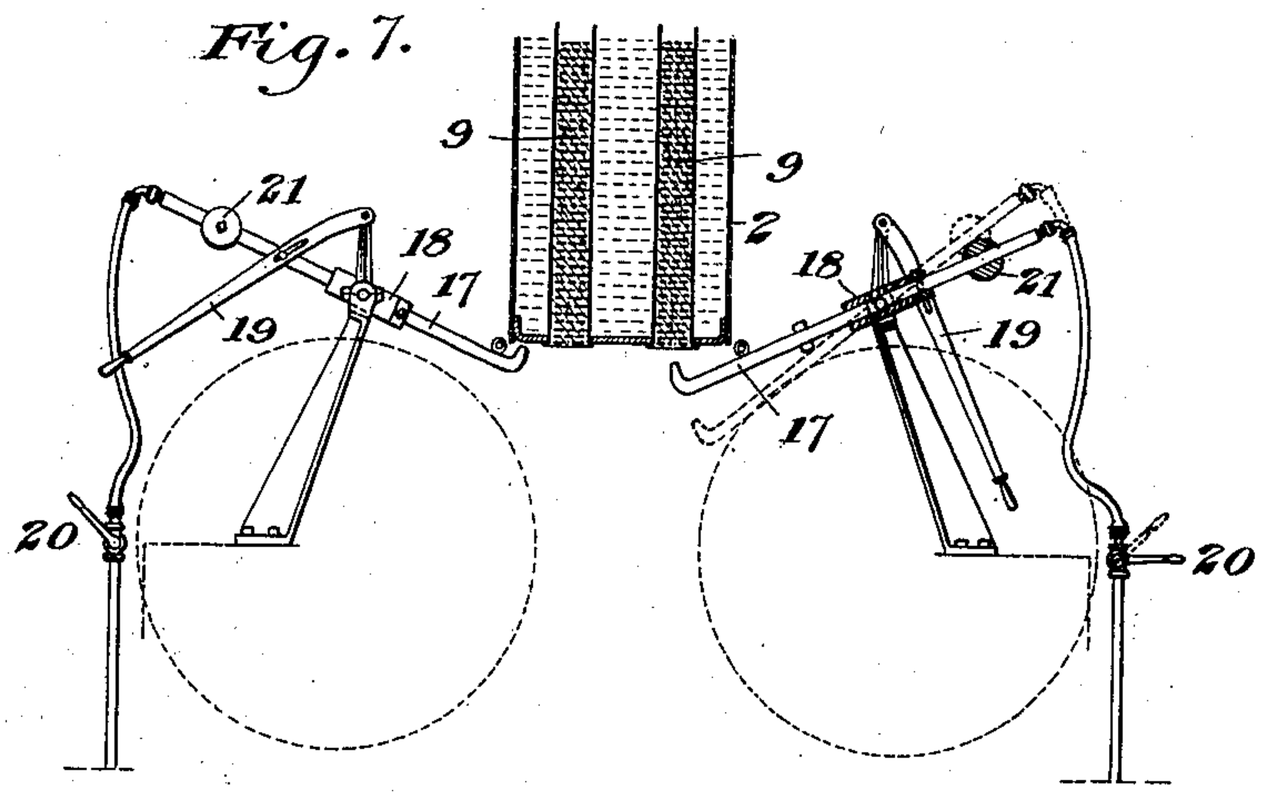


Fig. 7.



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No. 746,235. Patented December 8, 1903.

UNITED STATES PATENT OFFICE.

RALPH BAGGALEY, OF PITTSBURG, PENNSYLVANIA.

SLAG-BOILER.

SPECIFICATION forming part of Letters Patent No. 746,235, dated December 8, 1903.

Application filed January 30, 1903. Serial No. 141,136. (No model.)

To all whom it may concern:

Be it known that I, RALPH BAGGALEY, of Pittsburg, Allegheny county, Pennsylvania, have invented a new and useful Slag-Boiler, 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 vertical section of my slag-boiler. Fig. 2 is a vertical section showing in detail the upper end of the slag-tubes on the line II II of Fig. 5. Fig. 3 is a vertical section on the line III III of Fig. 1. Fig. 4 is a vertical section of the boiler-shell, showing a modified construction of the tubes, which in this figure are of uniform bore from end to end and not tapered, as in the other figures. Fig. 5 is a top plan view of the boiler-shell, the refractory material being removed from one-half thereof. Fig. 6 is a horizontal section on the line VI VI of Fig. 1, showing the slag-crushing mechanism in plan view. Fig. 7 is a vertical section of the lower end of one of the boiler-shells of Fig. 1, showing an additional means for breaking up the slag as it comes from the tubes.

The purpose of my invention is to provide means for generating steam by the heat of the slag which is obtained from furnaces for smelting copper and like furnaces. Such furnaces deliver molten slag in great quantities, and as they are generally in localities where coal is expensive a very material saving can be obtained by using the heat of the slag for generating the steam required in the operation of the smelting plant. The problems involved in such steam generation are, however, different from those which attend the use of ordinary coal-fired boilers, and it is necessary that the boiler should be designed with especial reference to the easy and convenient feeding and discharge of the slag and the effective utilization of its heat without injury to the boiler. My invention fulfils all these conditions and provides a simple, economical, and effective device.

My boiler may be formed with any desired number of boiler shells or cylinders, in which the water is heated. In the drawings I show two of such cylinders 2 and 2′, which are set in upright position and have their water-spaces connected by pipes 3 with a steam and water drum 4, having a steam-eduction pipe 5. 6 is a mud-drum connected by branches or pipes 7 7 to the lower portions of the shells 2 2′ and connected by a vertical pipe 8 with the steam and water drum 4. The boiler-shells 2 2′ are traversed by upright slag-tubes 9 9, which are united by expanding to the upper and lower end plates. These tubes constitute passages for the slag which is delivered to them at the upper end and is discharged in a solid condition at the lower end of the boiler. The upper ends of the boiler-shells are faced with a refractory lining, preferably a flat tile 10, which is perforated in register with the slag-tubes, so as to prevent injury by the slag to the metal. The boiler-shells themselves are filled with water from top to bottom, and the tubes are protected by contact with the water from being burned by the slag.

The boiler shells and tubes are incased in a heat-insulating covering 22, of asbestos or other suitable material.

In using the boiler it is filled with water up to the water-level in the drum 4 and molten slag is poured into the tubes through spouts 11 either directly from the furnaces or from ladles. In this way the tubes are supplied and are preferably filled with slag which as it descends solidifies, giving up its heat to the tubes, and thus to the water in the boiler-shell. The pipes 3 and 7 provide efficient means for circulation of the water and the liberation of steam which accumulates in the drum 4. The circulation is very rapid and causes the sediment from the water to be deposited in the mud-drum. This is of great importance, because it is well known that in places where smelting plants are located the water is very bad, and great difficulty has been experienced in such plants from the corrosion of the boilers and the deposit of injurious sediments.

My boiler is especially adapted to produce a constant circulation of its entire contents of water that will be so violent in its nature as to thoroughly and actually prevent precipitated impurities from attaching them-

selves to the interior of the wall of any portion of such boiler or its tubes, and in lieu of such universal difficulty all such precipitated impurities in my boiler are immediately detached from such internal walls and are deposited in the large mud-drum provided for that purpose, where they can be and must be blown off from time to time.

As the columns of slag solidify in the tubes the slag shrinks somewhat and the lower ends of the columns descend below the boiler-shell. For the purpose of breaking up and removing them I provide below each boiler-shell a crusher 12 of suitable construction. The crusher is supported independently of the shell of the boiler and is set in line with the slag-tubes, so that it will receive the solidified slag discharged therefrom in columnar form and will crush it. It also supports and regulates the delivery of the columns of slag from the tubes; but in this function it may, if desired, be aided by other suitable supporting mechanism. The crusher shown in the drawings has oscillating jaws 13, operated by toggles 14 and working in opposition to a post or stationary abutment 15. As the slag is crushed by the jaws it falls upon a conveyer 16 and is removed to a place of discharge.

In case the nature of the slag is such that it will not discharge freely from the tubes I employ as an auxiliary comminuting device pipes 17, which are slidingly mounted in pivoted sockets 18 and are adapted to be moved by levers 19 or otherwise into the position shown at the right of Fig. 7, so as to direct streams of water against the lower ends of the slag columns at the tubes, suitable valves 20 being employed for the regulation of the water-supply. If the slag should stick in the tubes, these pipes are moved in opposition thereto, as above described, and the jets of water striking the slag and chilling it suddenly disintegrate it rapidly and cause it to drop. As the pipes are pivoted, when the slag columns again begin to descend they will push the pipes out of their path, as shown by dotted lines at the right of Fig. 7, and if the slag again should stick the pipes are automatically brought into working position by weights 21.

In Figs. 1 and 3 I show the slag-tubes tapering from top to bottom. This provides for ready discharge of the slag; but within the scope of my invention the tubes may be cylindrical and of uniform diameter from end to end, as shown in Fig. 4.

The arrangement of the mud-drum and the circulating-pipes which I show in the drawings is desirable because it provides for a rapid and efficient circulation of water through the boiler, and thus favors the liberation of steam and deposit of sediment in the mud-drum, and I intend to claim it specifically; but within the scope of my invention as broadly claimed this arrangement may be modified and instead of using a plurality of boiler-shells, each containing slag-tubes a single boiler-shell may be employed.

I claim—

1. Apparatus for extracting heat from slag and discharging the solidified slag, which consists in the combination with a slag-heated steam-boiler, having a slag tube or tubes extending from the upper to the lower portion thereof and having an opening for the reception of molten slag, of means set below the boiler in line with the tube and adapted to support and crush the solidified column of slag, said crushing means being supported independently of the boiler structure, substantially as described.

2. A slag-heated steam-boiler, having a boiler-shell, a slag tube or tubes therein, surrounded with water throughout their entire length and having a slag-receiving opening or openings at the upper end or ends, and a steam and water space above the tube or tubes and connected with the shell; substantially as described.

3. A slag-heated steam-boiler, comprising a boiler-shell, a slag tube or tubes therein having at the top an opening or openings for the reception of molten slag, and being normally open at the bottom, and means for delivering a jet of water against the solidified slag at the bottom of the tubes; substantially as described.

4. A slag-heated steam-boiler comprising a boiler-shell, a slag tube or tubes extending from the upper to the lower portion thereof and having an opening for the reception of molten slag, and a pivoted pipe placed in line with the tube and in the path of the solidified slag and adapted to deliver water at the lower ends of the tube; substantially as described.

5. A slag-heated steam-boiler comprising a plurality of boiler-shells, each having slag tube or tubes extending therethrough, and having an opening for receiving molten slag, a steam and water drum connected with the upper ends of the shells, and a mud-drum connected with the lower ends thereof; substantially as described.

6. A slag-heated steam-boiler comprising a plurality of boiler-shells, each having slag tube or tubes extending therethrough, surrounded with water throughout their entire length, and having an opening for receiving molten slag, a steam and water drum connected with the upper ends of the shells, a mud-drum connected with the lower ends thereof, and a circulating-pipe connecting the water-space of the steam and water drum with the mud-drum; substantially as described.

7. A slag-heated steam-boiler having a boiler-shell, a slag tube or tubes extending vertically therethrough from top to bottom, surrounded with water throughout their entire length, and having an opening for reception of molten slag, and a steam and water

drum above the shell and connected therewith; substantially as described.

8. A slag-heated steam-boiler having a boiler-shell, a slag tube or tubes extending vertically therethrough from top to bottom, and having an opening for reception of molten slag, a steam and water drum above the shell and connected therewith, a mud-drum connected with the lower end of the shell, and a circulating-passage extending between said drums; substantially as described.

In testimony whereof I have hereunto set my hand.

RALPH BAGGALEY.

Witnesses:
THOMAS W. BAKEWELL,
GEO. B. BLEMING.