No. 846,891. PATENTED MAR. 12, 1907.

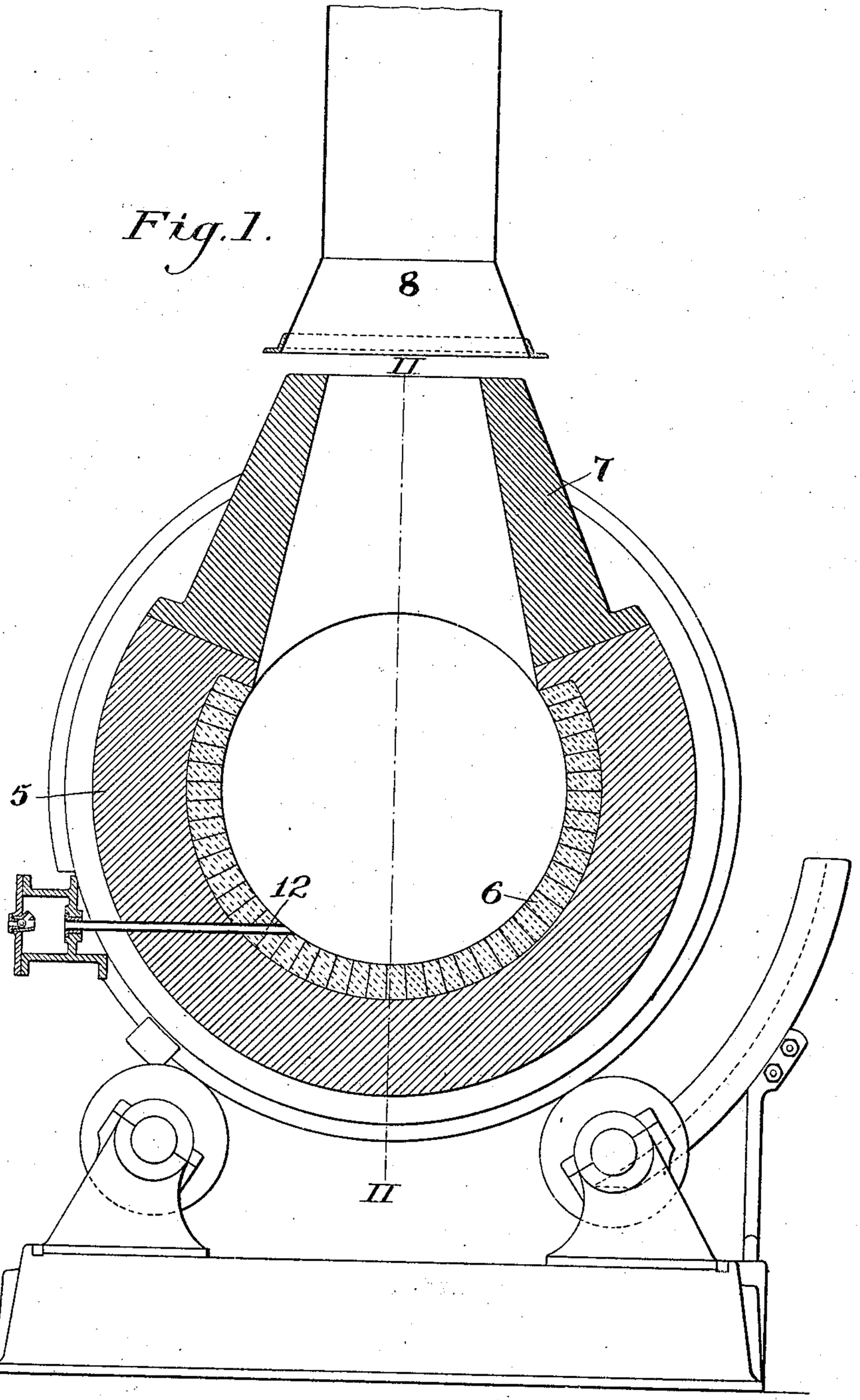
R. BAGGALEY.

COPPER REFINING FURNACE.

APPLICATION FILED AUG. 8, 1905.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

Warren W. Swartz

Richard D. Little

INVENTOR

Ralph Baggaley

by Bakewell Byrnes

his attorneys

No. 846,891. PATENTED MAR. 12, 1907.

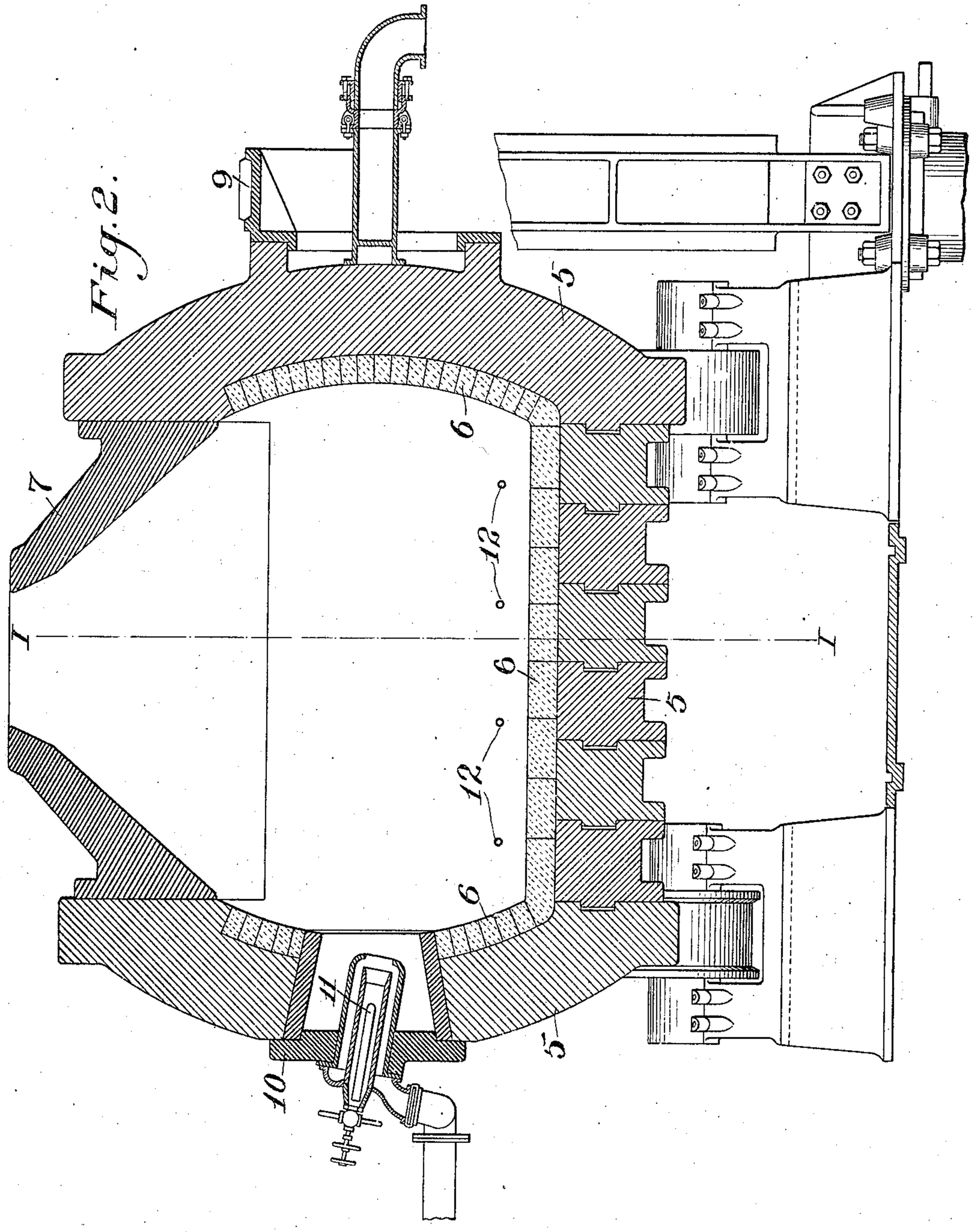
R. BAGGALEY.

COPPER REFINING FURNACE.

APPLICATION FILED AUG. 8, 1905.

3 SHEETS—SHEET 2.

Fig. 2.



WITNESSES

Warren W. Swartz

Richard D. Little

INVENTOR

Ralph Baggaley

by Bakewell Byrnes

his Attorneys

No. 846,891. PATENTED MAR. 12, 1907.

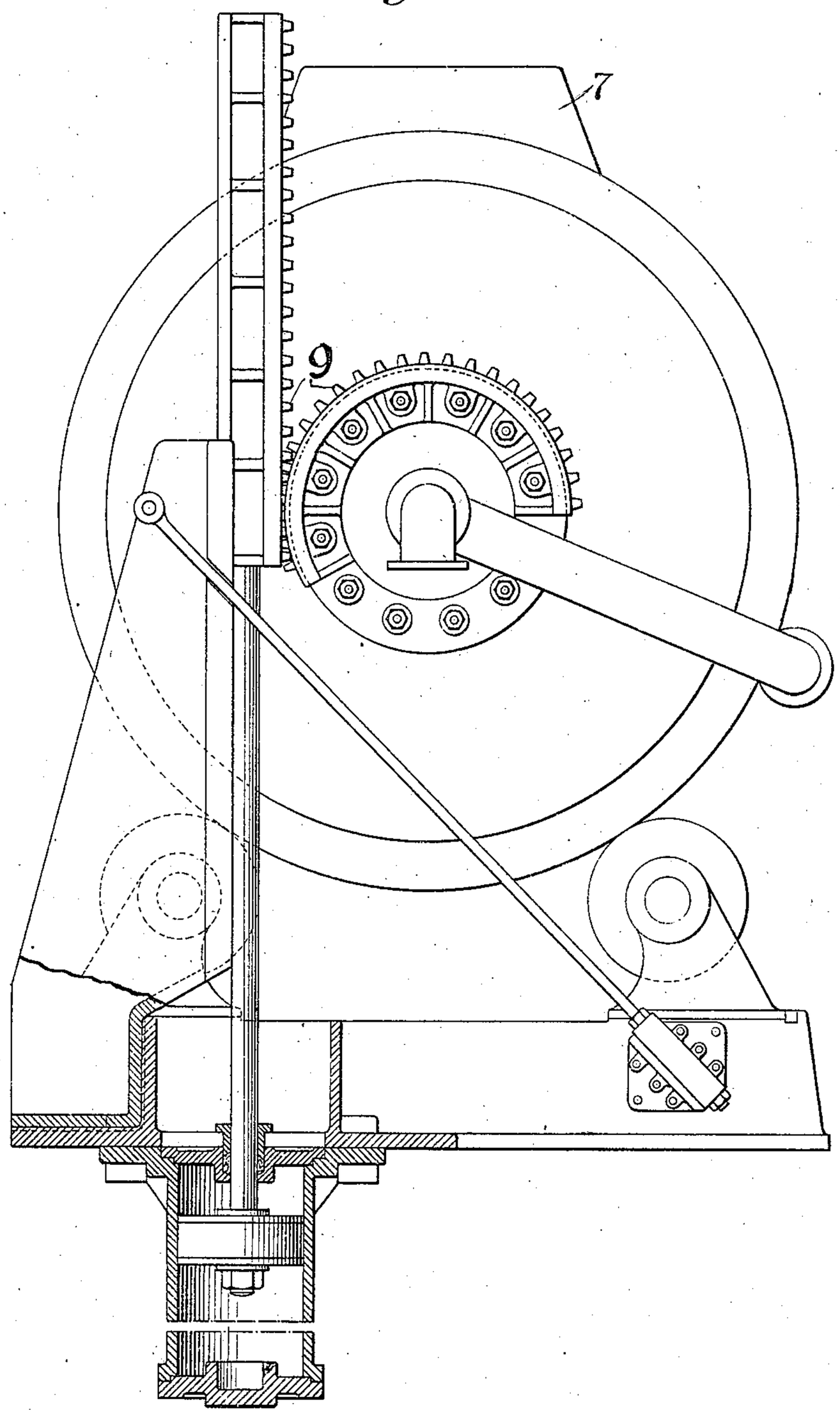
R. BAGGALEY.

COPPER REFINING FURNACE.

APPLICATION FILED AUG. 8, 1905.

3 SHEETS—SHEET 3.

Fig. 3.



WITNESSES

Warren W. Swartz

Richard D. Little

INVENTOR

Ralph Baggaley

by Bakewell Byrnes

his Attorneys

UNITED STATES PATENT OFFICE.

RALPH BAGGALEY, OF PITTSBURG, PENNSYLVANIA.

COPPER-REFINING FURNACE.

No. 846,891. Specification of Letters Patent. Patented March 12, 1907.

Original application filed May 1, 1905, Serial No. 258,152. Divided and this application filed August 8, 1905. Serial No. 273,246.

To all whom it may concern:

Be it known that I, RALPH BAGGALEY, of Pittsburg, Allegheny county, Pennsylvania, have invented a new and useful Copper-Refining Furnace, 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 cross-section on the line I I of Fig. 2. Fig. 2 is a vertical longitudinal cross-section on the line II II of Fig. 1, and Fig. 3 is an end elevation showing the inlet for hydrocarbons and the power mechanism for tilting the furnace.

My present application is a division of an application, Serial No. 258,152, filed by me on May 1, 1905. One of its objects is to make it possible to refine copper in small batches, and especially to refine it in batches as produced by an oxidizing-converter.

In the apparatus shown in the drawings the temperature of the molten bath may be maintained as long as desired and throughout the act of pouring to a point where the congealing of the bath is impossible. The pouring-lip of the apparatus is always open and free and hot. Consequently the bath cannot solidify upon it. During the act of pouring the vessel is tilted by machinery to any desired degree and until after the refined copper has been completely discharged from the vessel.

As shown in the drawings, the furnace is made of heavy metal blocks or segments 5, preferably not less than eighteen inches in thickness, and has a lining 6, preferably made of silica bricks, say four and one-half inches in thickness. The thickness of the metal blocks is greater than or at least equal to the thickness of the lining. The object of this construction is to form a heavy wall that will absorb and conserve the internal heat practically without metal losses from saturation and that will not dissipate such heat, as may be the case where a water-jacket is used. Owing to the extreme tendency of molten copper to congeal, this feature is of importance and will commend itself to those skilled in the art. The intention is to make the silica lining relatively as small a proportion of the wall and the metal blocks as large a proportion of it as possible, to the end that the saturation of the internal lining with copper, gold, and silver will be very small when compared with the saturation that now prevails in all existing forms of refining-furnaces whose walls are composed of great masses of brick or plastic refractory and whose bottoms are usually composed of crushed silica or of a refractory material of some kind. In this furnace owing to the retarding influence of the heavy metal blocks that back up the silica lining on all sides the travel of values from the molten bath will usually not exceed one and one-quarter inches into the interior substance of the silica brick. Sometimes it will be less. I have never known it to exceed one and one-half inches. A wall of this construction will not only retain the heat, but it will last almost indefinitely without repairs, because of the absence of iron in the bath, which alone seriously attacks the acid lining. The slight saturation as above described of the interior surface of the silica wall seems to have the effect of prolonging the life of the lining almost indefinitely. Indeed, this saturation accomplishes in a measure the automatic repair of the internal surface should this become fractured.

7 represents the cover or top of the refining-furnace, and it may be lined, if preferred, either with brick or with plastic material. I prefer to make it of heavy metal, as shown in the drawings, and to use it entirely without lining of any description. In this form it becomes practically indestructible, and I have found that the heavy mass of metal will absorb and conserve the internal heat and will not seriously dissipate it through radiation on the outside surface, providing it be made of sufficient thickness to insure this result.

8 represents an adjustable stack that may closely connect with this solid metal top and which is preferably arranged to cover or to recede from it.

9 in Figs. 2 and 3 represents means for tipping the vessel, similar to that often used on converters. The object in tipping the vessel is to throw the hydrocarbon-gas twyers 12 down under the molten bath when introducing reducing-gases and to regulate the depth of such twyers and their position under the bath at will. In like manner it may be utilized to raise the twyers above the level of the molten bath. The tipping of the furnace is also utilized in receiving the molten charge and at the completion of the refining process in pouring the bath into cathodes, plates, slabs, or whatever form may be desired. The same opening is preferably utilized in

receiving the molten charge into the furnace that is used in pouring it after it has been refined. The bath may, however, be introduced at the end door 10, if desired, by swinging the oil or gas jet 11 away from it. Usually this opening should be kept closed in order to prevent the escape of heat while work is in progress.

10 illustrates the metal-plate door in one end of the vessel, which may be swung aside with the burner when it is desired to practice hand-poling with hardwood poles. By simply tipping the refining-furnace to a point where the gas-twyers will be safely above the level of the molten bath hand-poling can be done. This feature may be useful in the event of any derangement in the hydrocarbon-gas plant in procuring a supply of ligneous material, &c.

11 illustrates a hydrocarbon-gas burner which is preferably mounted on hinged pipes either above or at one side of the furnace. When the gas-burner is turned into position for operation, the pipe carries with it the plate-door 10, Fig. 2, at one end of the furnace in order to prevent the escape of gases and of the internal heat. When this gas-burner is not in use, the opening may be closed by a supplementary hinged door (not shown) or other means. The gas-burner may be utilized in heating the interior of the furnace to incandescence before the reception of the molten copper that is to be refined. The effect of this incandescence is to immediately increase the heat and the fluidity of the molten bath. Thereafter the oil or gas jet may be used in maintaining the heat of the bath to any desired extent and for any desired period. This heat may be increased at will to a silver-white incandescence and is sufficient to melt any ordinary metals or ores quickly.

In refining copper by the method disclosed in my United States Patent No. 746,246, issued December 8, 1903, or by the hand-poling process I preferably cover the molten bath with a layer of powdered charcoal or with carbon in some form in order to prevent the copper from absorbing suboxid from the atmosphere. My present invention may be utilized in practicing the art disclosed in Serial No. 263,393, filed June 5, 1905, for a method of refining copper, by Ralph Baggaley, Charles M. Allen, and Edward W. Lindquist, by the addition of suitable attachments to the wind-box. When so used, it will generally be unnecessary to provide this extraneous covering or carbon, because the process itself will automatically supply the same.

Doubtless many modifications will suggest themselves to those skilled in the art without departing from the spirit of my invention, since

What I claim is—

1. A copper-refining furnace having a metal exterior of a thickness to retain the internal heat of the furnace, and an acid lining thin enough to reduce saturation thereof.

2. A copper-refining furnace having a metallic body and lining proportioned in thickness to retain the internal heat within the furnace and to reduce saturation of the lining.

3. A copper-refining furnace having a metallic body and a non-metallic lining, said body being thick enough to retain the internal heat of the furnace.

4. A copper-refining furnace having a metallic body and lining proportioned in thickness to retain the internal heat of the furnace and to reduce saturation of the lining, and a burner for supplying heat to the interior of the furnace.

5. A copper-refining furnace comprising a vessel having its longitudinal axis disposed substantially horizontally and capable of rotating upon its longitudinal axis, the top of the vessel having a combined feed and pour-out opening, and a burner projecting through one end of the vessel for heating the interior of the furnace, the vessel consisting of a metallic body and a lining proportioned in thickness to retain the internal heat of the furnace and to reduce saturation of the lining.

In testimony whereof I have hereunto set my hand.

RALPH BAGGALEY.

Witnesses:
JOHN G. BROWN,
WILLIAM M. KIRKPATRICK.