No. 710,300. Patented Sept. 30, 1902.

J. A. POTTER & W. C. HARVIE.

METHOD OF TREATING MATTES.

(Application filed Sept. 1, 1900.)

(No Model.) 2 Sheets—Sheet I.

Fig. 1.

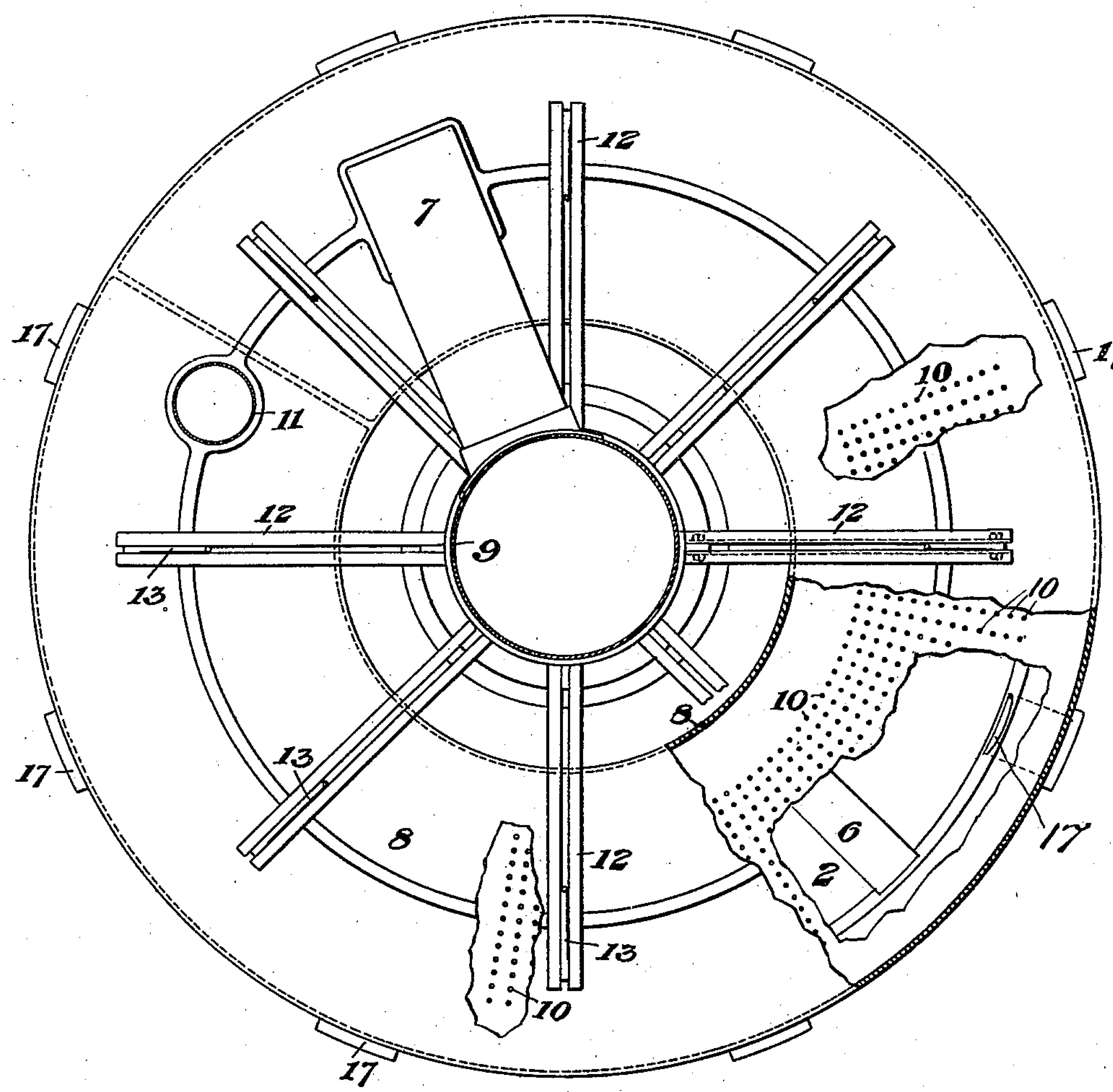

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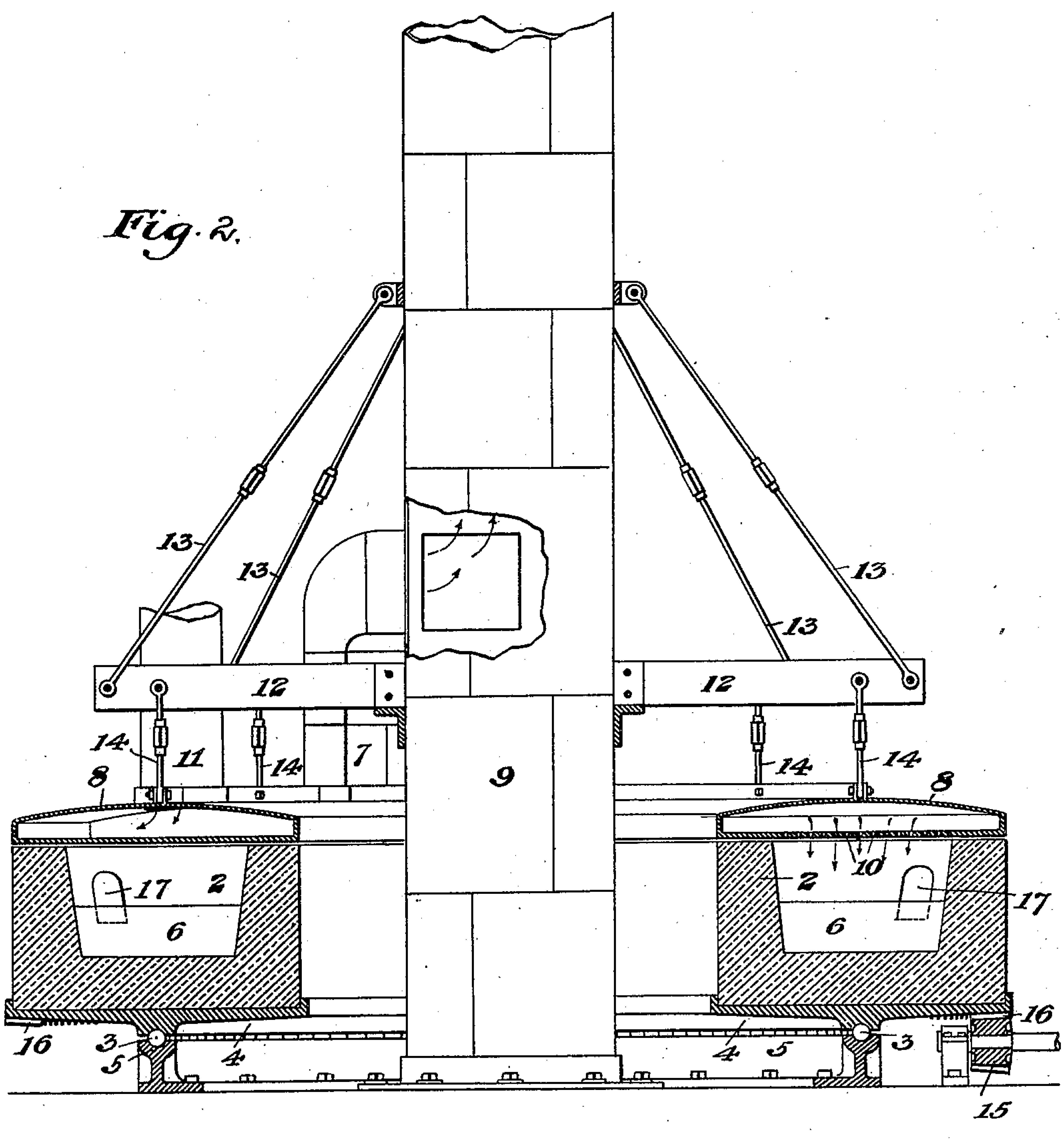
Fig. 2.



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UNITED STATES PATENT OFFICE.

JOHN A. POTTER AND WILLIAM C. HARVIE, OF MONTEREY, MEXICO.

METHOD OF TREATING MATTES.

SPECIFICATION forming part of Letters Patent No. 710,300, dated September 30, 1902.

Application filed September 1, 1900. Serial No. 28,820. (No specimens.)

To all whom it may concern:

Be it known that we, JOHN A. POTTER and WILLIAM C. HARVIE, of Monterey, Mexico, have invented a new and useful Improvement in Methods of Treating Mattes, 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 top plan view, partially broken away, of one form of apparatus for carrying out our improved process; and Fig. 2 is a central vertical section showing the stack in elevation.

Our invention relates to the treatment of mattes which are formed in the smelting of such ores as contain lead, gold, silver, copper, iron, &c. Heretofore these mattes which are formed in smelting the ores have been allowed to cool, then ground to a fine powder, and passed through a roasting-furnace, by which the sulfur is partially removed. The partially-desulfurized matte thus formed is in such fine condition that it gives great trouble from the large amount of flue-dust, from tight charges, &c., and this dust is often made into briquets by mixing with a binder and subjecting to pressure, after which it is dried and then smelted.

Our invention is designed to overcome the above difficulties, to do away with the step of grinding, and greatly cheapen the method of desulfurizing and preparing for the smelting.

To that end it consists in subjecting the matte containing sulfur to blasts of air upon its surface and at the same time agitating the molten bath by a rabble or other means, so as to bring all parts of the mass to the surface, so that the sulfur will be removed.

It further consists in balling up the partially-desulfurized matte as above treated by making use of the pasty condition, thus forming balls which are in excellent condition for blast-furnace smelting; and, further, it consists in using the excess heat which is given off in the early stage of the desulfurizing of one portion of the matte to heat another portion of matte which is in a later stage of treatment and in which the desulfurizing action is not sufficient to keep up the proper heat.

In carrying out our process we preferably use an apparatus such as shown in the drawings and which consists, primarily, of an annular hearth 2, which is revolubly mounted upon bearings 3, which we have shown as formed with antifriction-balls interposed between the angular casting 4, forming the base of the hearth, and the lower track 5. This hearth is divided into separate compartments by a set of radial partitions 6, which may be of any desirable number, these division-walls or dams being of, preferably, about one-half the height of the side walls of the furnace, thus allowing the heat and gases to pass through the furnace and over the partitions to a single common stack-flue 7, which leads through the stationary hollow roof 8 to a central stack 9. The roof 8 is of annular form, covering the revoluble hearth, and for about one-third of its circumference is provided with downwardly-directed air-holes or jet-outlets 10. This portion is preferably of sufficient length to cover three or four of the chambers in the hearth, and the air is supplied to the roof through a pipe 11, which is near the stack-flue, the roof being provided with a partition between the air-inlet and the stack-outlet to compel the air to pass around to the jet-outlets. The roof is preferably supported by channel-beams 12, which radiate from the central stack 9 and are provided with upwardly-extending tie-rods 13, secured to the upper part of the stack. Supporting-rods 14, provided with adjusting-turnbuckles, are preferably used for hanging the roof from the supporting-beam, so that the different parts of the roof may be adjusted to the proper level. The hearth is rotated intermittently by a driving-pinion 15 engaging a rack 16, forming part of the casting 4, and the hearth is provided with a series of outlet-openings, one for each chamber, provided with suitable doors 17. In carrying out our process with such furnace a portion of matte which is still liquid is poured into a chamber beneath that portion of the air-jets most remote from the stack-flue. Air being supplied to the hollow roof impinges upon the surface of this bath and causes desulfurizing of the surface portion. Metallic iron is preferably added to deposit the molten lead. As this continues, a partially-desulfurized crust would form for a small depth—say half an inch in thickness—and prevent the air from reaching and desulfurizing the other portions of the bath. We have found, however, that by rabbling or otherwise stirring the bath this crust which tends to form and float on the bath is broken up and the whole mass is successively exposed to the action of the air. The operation is similar to that of puddling iron, and as the sulfur is removed the mass begins to cool down and change from liquid to a pasty condition. At this point the hearth is turned forward sufficiently to bring a new chamber under the air-jets, and another fresh batch of liquid matte is charged into this chamber. The air acting upon this new batch produces great heat, which passes over the partially-desulfurized and pasty matte in the chamber previously supplied, thus continuing the desulfurizing action and enabling the air to further desulfurize the first batch. This is an important feature, since the heat of the bath decreases as the percentage of sulfur decreases, and we have found that the fresh matte contains more sulfur than is necessary to furnish the heat for its own desulfurizing action, so that we utilize this excess heat for assisting the action upon the previous charge, which has become lean in sulfur. After the second batch becomes pasty, the hearth is turned to bring a third chamber under the air-jets, and fresh matte is charged in, the heat from which passes over the first two batches. After the sulfur has been sufficiently removed from the first batches the partially-desulfurized matte assumes a condition similar to that of iron in the bath of a puddling-furnace, so that it may be welded together in balls. The operator compacts and welds the balls by his rabble, thus forming masses of any desirable shape or size, which are removed from the furnace and are in excellent condition for the smelting operation. As these balls are removed a fresh charge is inserted in another chamber, keeping matte in the chambers which are exposed to the action of the air and making the operation a continuous one.

In carrying out our process upon a copper matte containing, for example, copper, twenty per cent.; iron, thirty per cent.; sulfur, twenty-one per cent.; lead, six to eight per cent.; silver, three per cent., and a trace of gold, the matte after treating will contain metals in something like the following proportions: copper, forty per cent.; iron, forty per cent.; sulfur, four to six per cent.; lead, three per cent.; silver one to two per cent., and gold a trace. The lead is volatilized during the process and is recovered as flue-dust, while the sulfur is partially removed and passes off as a gas. In a lead matte containing, say, copper, four to five per cent.; iron, forty per cent.; lead, twenty per cent.; sulfur, twenty-two to twenty-three per cent.; silver, three per cent., and a trace of gold, the resulting matte would contain, say, copper, six per cent.; iron, fifty per cent.; lead, eight to ten per cent.; sulfur, three to four per cent.; silver, one to two per cent., and a trace of gold.

The advantages of our invention will be apparent to those skilled in the art. The expense and delay from grinding and roasting are done away with and the troubles resulting from the finely-powdered mattes are obviated. The matte is acted upon while still molten and is quickly and easily desulfurized to a considerable extent, the only manual operation being that of rabbling and compacting the balls. The excess heat of one bath being desulfurized is utilized to heat the other, and this may be done by either preheating the air passing to the leaner bath or by allowing the heat to pass directly to and over such bath.

Many changes may be made in the apparatus employed in carrying out our process without departing from our invention as defined in the claims.

We claim—

1. The method of treating matte, consisting in exposing the surface of a bath of liquid matte to the action of an air-blast, breaking up the crust which forms on the surface of the bath, and bringing fresh portions of the bath into position to be acted upon by the air; substantially as described.

2. The method of treating matte, consisting in exposing the surface of a bath of liquid matte to the action of air-jets, and at the same time rabbling the molten mass, thereby breaking up the crust which forms on the surface of the bath and bringing fresh portions of the bath into position to be acted upon by the air; substantially as described.

3. The method of treating matte, consisting in subjecting the surface of a bath of liquid matte to the action of a blast of air, agitating the bath, and then balling the pasty mass; substantially as described.

4. The method of treating matte, consisting in exposing the surface of a bath of liquid matte to the action of an air-blast, breaking up the crust which forms on the surface of the bath and bringing fresh portions of the bath into position to be acted upon by the air, subjecting a second bath of molten matte to a similar operation, and supplying heat from the second bath to the first bath while the latter is in a later stage of desulfurization; substantially as described.

5. The method of treating matte, consisting in introducing a bath of liquid matte into a chamber, agitating the bath and subjecting its surface to the action of a blast of air, moving the chamber to a different point, supplying fresh matte to another chamber, agitating and supplying air to the fresh matte, and supplying heat from the fresh matte to the matte in a later stage of desulfurization in the first chamber; substantially as described.

In testimony whereof we have hereunto set our hands.

JOHN A. POTTER.
WILLIAM C. HARVIE.

Witnesses:
J. W. MYERS,
THOS. R. DEVINE.