

G. P. HULST.
 APPARATUS FOR REFINING AND DESILVERIZING LEAD.
 APPLICATION FILED NOV. 27, 1908.

965,464.

Patented July 26, 1910.

2 SHEETS—SHEET 1.

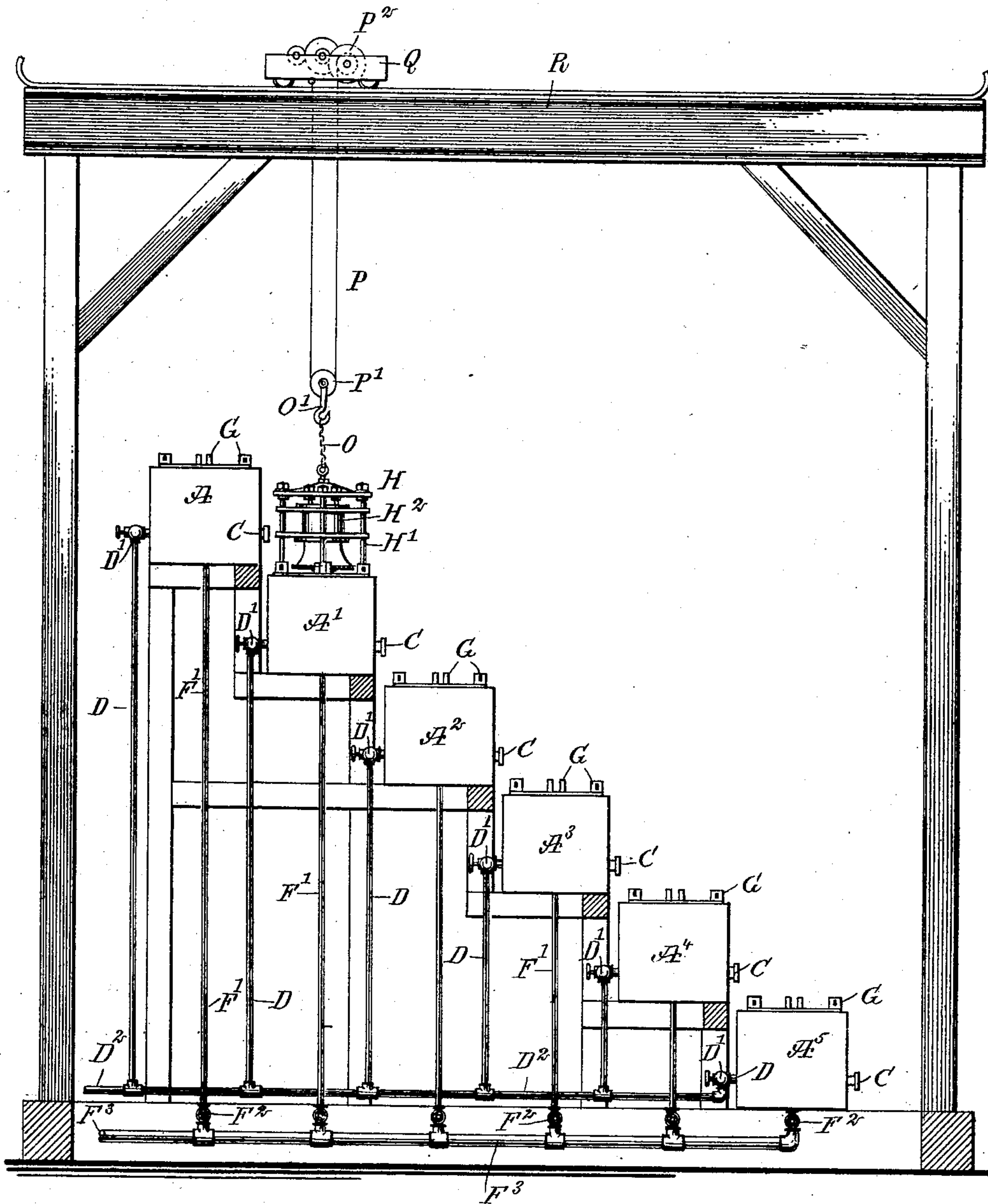


Fig. 1

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2 SHEETS—SHEET 2.

Fig. 2

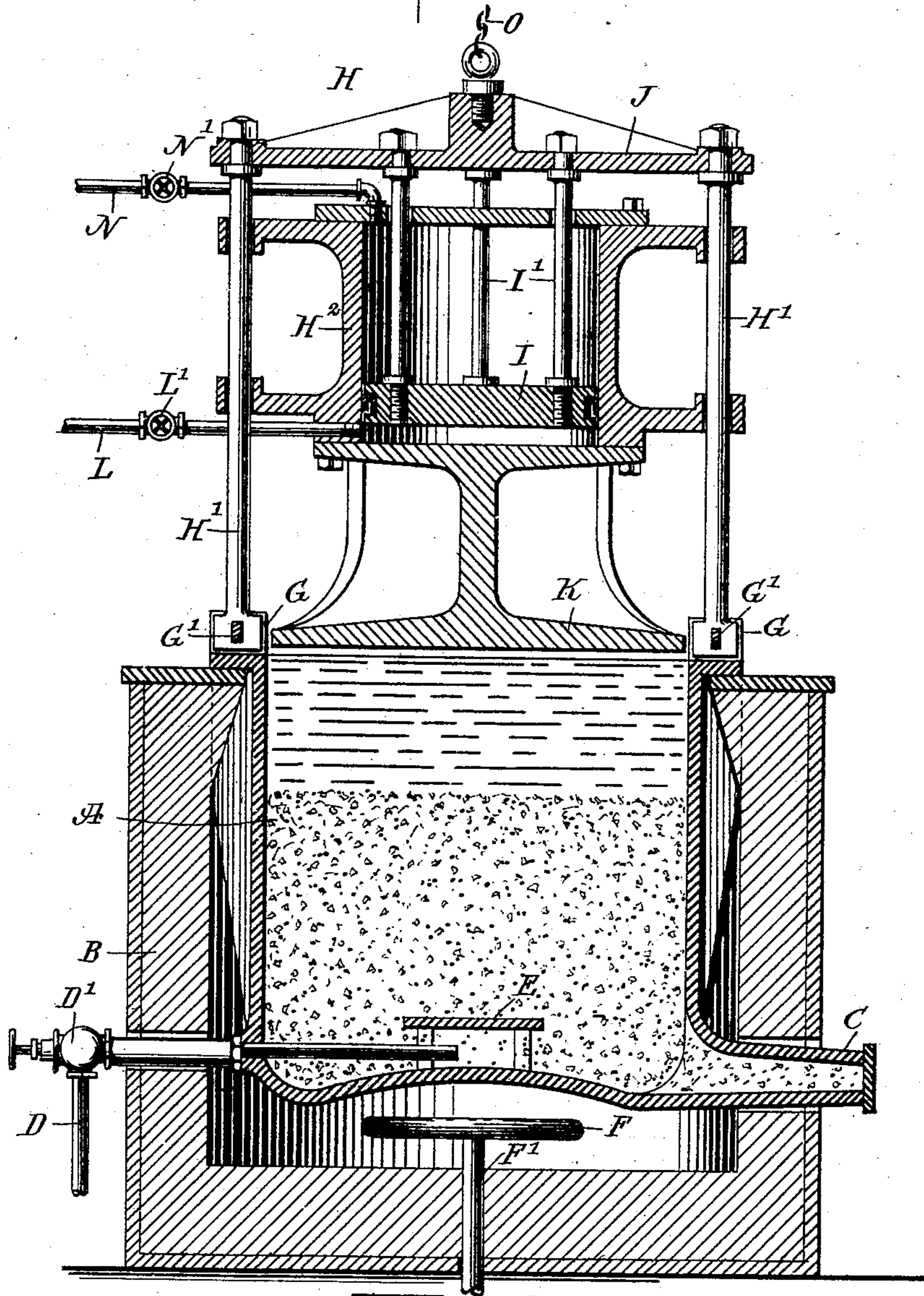
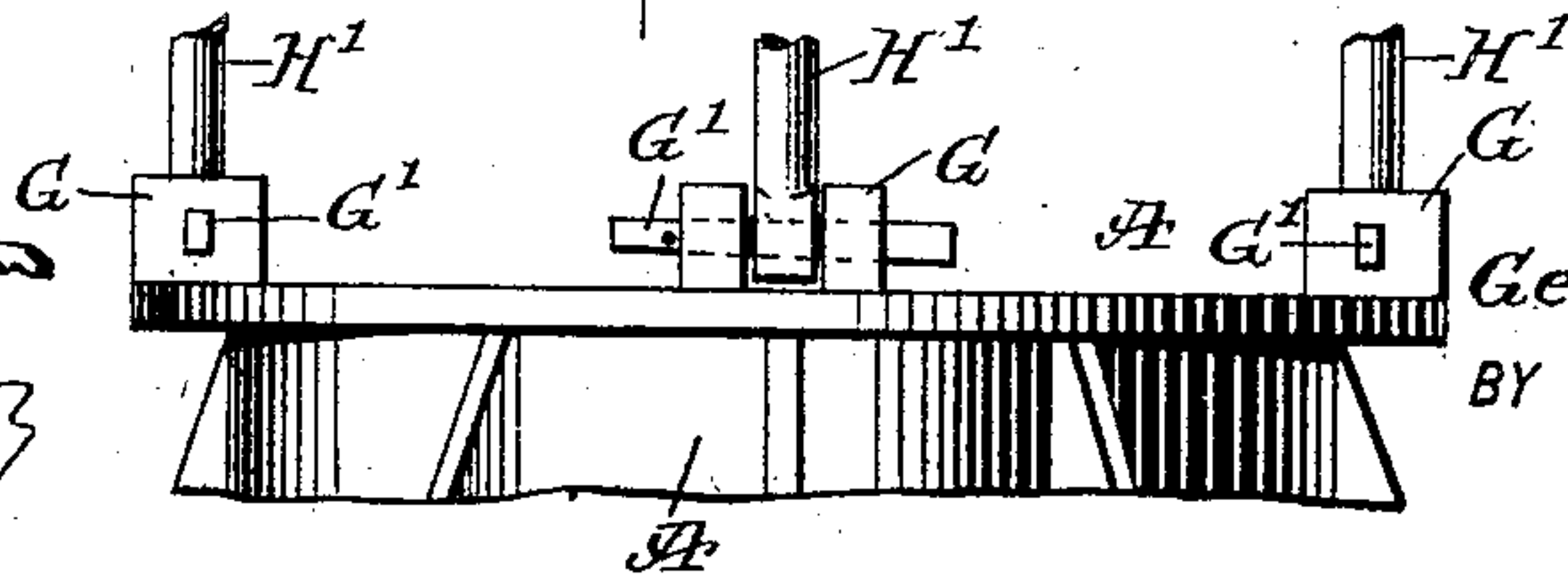


Fig. 3



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APPARATUS FOR REFINING AND DESILVERIZING LEAD.

965,464.

Specification of Letters Patent.

Patented July 26, 1910.

Application filed November 27, 1908. Serial No. 464,765.

To all whom it may concern:

Be it known that I, GEORGE POWELL HULST, a citizen of the United States, and a resident of Omaha, in the county of Douglas and State of Nebraska, have invented a new and Improved Apparatus for Refining and Desilverizing Lead, of which the following is a full, clear, and exact description.

The invention relates to refining and desilverizing lead by the crystallization process, and its object is to provide a new and improved apparatus, for refining and desilverizing lead bullion and impure lead, and whereby the number of crystallizing operations is reduced to a minimum, for the proper production of high grade bullion or metal running five hundred to six hundred ounces silver and a market lead.

The invention consists in an apparatus having a series of kettles arranged in step form, for discharging from one kettle to another, and a pressing device for connection with each kettle to press the uncrystallized liquid out of the mushy crystals.

The invention also consists of novel features and parts and combinations of the same, which will be more fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation of the improved apparatus for carrying the method into effect; Fig. 2 is an enlarged sectional side elevation of one of the kettles and the press in position thereon; and Fig. 3 is a side elevation of the upper end of one of the kettles and the lower ends of the standards of the press fastened in place on the kettle.

The crystallization processes heretofore used are based on the fact that lead or lead bullion carrying silver, gold and other impurities, such as bismuth, copper, arsenic, zinc, antimony and the like, and cooled down to nearly a solidifying point and stirred by hand or mechanically by suitable devices in a crystallizing kettle, form crystals of lead which are freer from silver and other impurities, such as above mentioned, than the liquid lead which permeates the entire mass of mushy crystals. In the crystallization processes referred to the un-

crystallized liquid is strained off by gravity through one or more tap holes in the bottom of the crystallizing kettle, and it takes usually about twelve crystallization operations to produce market lead at one end and five hundred ounces per ton metal for cupeling at the other end. The crystals are granular and mushy and a quantity of uncrystallized lead or a liquid is held in suspension or permeates the whole mass of crystals, and by gravity not all of this uncrystallized lead is drained out in the processes mentioned and heretofore used. With my invention, presently to be described in detail, the crystals are subjected to pressure so as to squeeze out the uncrystallized lead or liquid from the crystals, to render the latter drier, that is, freer from the liquid lead, which latter is higher in silver and other impurities than the crystals.

With my improvement the number of kettles and the number of crystallizing operations are reduced to about six, that is, one-half of that heretofore required, and consequently the quantity of metal to cupel is reduced, thereby obtaining a greater direct output of market lead.

A series of kettles A, A', A², A³, A⁴, and A⁵ are arranged at different levels, preferably in step form, as indicated in Fig. 1, and each kettle is inclosed in a shell B and is provided with a discharge spout C, to permit of running the molten crystals from one kettle into the next following one below, as hereinafter more fully described. Into each of the kettles opens at the bottom a steam supply pipe D directly under a baffle plate E, as plainly shown in Fig. 2, so that steam can be passed into the molten lead with a view to cool the same and to cause agitation thereof for the formation of the crystals, as is well known in the crystallization process. Each of the steam supply pipes D is provided with a valve D' for controlling the steam passing into the corresponding kettle, and the several steam pipes D are connected by a pipe D² with a boiler or other suitable source of steam supply. Under each kettle is arranged a burner F having a pipe F' with a valve F² and connected with a supply pipe F³ connected with a suitable gas supply, so that the kettle may be heated whenever it is desired to do so.

The top of each kettle A, A', A², A³, A⁴ and A⁵ is provided with sets of lugs G, on which are removably fastened by keys G'

the lower ends of standards H' of a press H , having a cylinder H^2 mounted to slide up and down on the standards H' . In the cylinder H^2 is arranged a piston I attached to rods I' extending upwardly and secured to a top plate J carried by the standards H' . On the lower end of the cylinder H^2 is secured a presser plate K adapted to pass into the corresponding kettle with which the press H is connected at the time, so as to subject the crystals therein to pressure with a view to squeeze out of the crystals the uncrystallized liquid, as hereinafter more fully explained. A pipe L connected with an elastic fluid pressure supply opens into the lower end of the cylinder H^2 , and the pipe L is provided with a valve L' , which when opened allows the fluid pressure to pass into the lower end of the cylinder H^2 , to force the latter downward, thus moving the presser plate K into the corresponding kettle for the purpose mentioned. A pipe N having a valve N' and also connected with a pressure supply opens into the upper end of the cylinder H^2 , to force the cylinder H^2 upward after the pressing operation is completed.

The top plate J of the press H is connected by a chain O and a hook O' with a sheave P' of a raising and lowering device, having a cable P passing under the sheave P' and attached at one end to a carriage Q mounted to travel on an over-head track R , as indicated in Fig. 1. The other end of the cable P winds and unwinds on a drum P^2 mounted on the carriage Q and under the control of the operator, so as to raise and lower the press H , and by shifting the carriage Q to allow of bringing the press H in position on any one of the kettles A , A' , A^2 , A^3 , A^4 and A^5 . It is understood that when the press H has been lowered onto the top of any one of the kettles it is readily fastened to the lugs G of this particular kettle by the keys G' , so as to hold the press H temporarily in place on the corresponding kettle. After the pressing operation is finished the keys G' are removed and the press H is lifted to disconnect it from the kettle and to allow of connecting the press with another kettle, in which the next pressing operation is to take place.

The operation is as follows: When the apparatus is in use alternate kettles are empty while others are filled; for instance, the kettles A' , A^3 and A^5 are filled while the kettles A , A^2 and A^4 are empty. Presuming that the apparatus is running with two-thirds crystals, then the steam is turned on, say in the kettle A' , to form crystals therein as indicated in Fig. 2, and then the press H is connected with this kettle A' and set in action, to press the liquid out of the crystals and to discharge the pressed-out liquid through the spout C into a ladle or the like, and which is emptied back into the

first kettle A of the series. In a like manner the crystals formed in the kettle A^3 are pressed out and the liquid is run through the spout C into a ladle, to be transferred back into the kettle A^2 , and a like operation is carried out in the kettle A^5 , and the pressed-out liquid is returned to the kettle A^4 . The two-thirds crystals remaining in the kettles A' , A^3 and A^5 are melted by heating the kettle with the aid of the burner F , and the molten metal from the kettle A' is run into the kettle A^2 , and that from the kettle A^3 is run into the kettle A^4 , and of the two-thirds the molten metal in the kettle A^5 one of the thirds is run off as market lead, while the other third is left in the kettle A^5 , so that the kettle A^5 will be filled at the next crystallizing operation carried on in the kettle A^5 .

When the series of kettles is in full operation, the bullion must be charged when needed into one kettle of respective grade in the series, in order to keep the plant running.

From the foregoing it will be seen that by the arrangement described it requires only six operations to produce market lead at one end and seven hundred ounces per ton enriched metal at the other end.

As is well known with the processes now in use, it requires the use of about twelve kettles and a corresponding number of crystallization operations to make market lead and enriched metal as above described.

Although I have shown one particular way of agitating the molten metal in the kettles for effecting crystallization, it is evident that other means may be employed for this purpose, and it is also understood that I do not limit myself to the particular construction of the press H employed as other means may be used for carrying on the pressing operation.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. An apparatus for refining and desilverizing impure lead, comprising a plurality of crystallizing kettles set at different levels and adapted to discharge from one into the next lower one, and a press capable of attachment to any one of the said kettles, for pressing the crystals therein, to squeeze out the uncrystallized liquid and to discharge the latter into the next preceding kettle.

2. An apparatus for refining and desilverizing impure lead, comprising a plurality of crystallizing kettles set at different levels and adapted to discharge from one into the next lower one, a press capable of attachment to any one of the said kettles, for pressing the crystals therein, to squeeze out the uncrystallized liquid and to discharge the latter into the next preceding kettle, and means for remelting the crystals remaining

in the first-named crystallizing kettle, and running the resultant molten liquid into the next lowermost kettle.

3. An apparatus for refining and desilver-
5 izing impure lead, comprising a plurality of
crystallizing kettles set at different levels
and adapted to discharge from one into the
next lower one, a press capable of attach-
10 ing the crystals therein, to squeeze out the
uncrystallized liquid and to discharge the
latter into the next preceding kettle, and
means for introducing steam into each kettle
for producing crystals in the corresponding
15 kettle.

4. An apparatus for refining and desilver-
izing impure lead, comprising a plurality
of crystallizing kettles set at different levels
and adapted to discharge from one into the
20 next lower one, a press capable of attach-
ment to any one of the said kettles for press-
ing the crystals therein, to squeeze out the
uncrystallized liquid and to discharge the
latter into the next preceding kettle, means
25 for introducing steam into each kettle for
producing crystals in the corresponding ket-
tle, and means for heating the kettle.

5. An apparatus for refining and desilver-
izing impure lead comprising a plurality of
crystallizing kettles set at different levels, 30
each discharging into the next lower one, a
press comprising spaced standards, means
for detachably connecting the standards
with the kettles, a cylinder slidable on the
standards, a piston in the cylinder, and a 35
pressure plate connected with the piston and
movable into and out of the kettle.

6. An apparatus for refining and desilver-
izing impure lead comprising a plurality of
crystallizing kettles set at different levels, 40
each discharging into the next lower one, a
press comprising spaced standards, means for
adjustably connecting the standards to the
kettles, and a pressure plate supported by
the standards and means for operating the 45
plate.

In testimony whereof I have signed my
name to this specification in the presence of
two subscribing witnesses.

GEORGE POWELL HULST.

Witnesses:

CONRAD H. YOUNG,
ARTHUR MEHRENS.