

(No Model.)

2 Sheets—Sheet 1.

W. B. DEVEREUX.

APPARATUS FOR SEPARATING BASE BULLION FROM SLAG, MATTES,
AND SPEISS.

No. 381,119.

Patented Apr. 17, 1888.

Fig. 2.

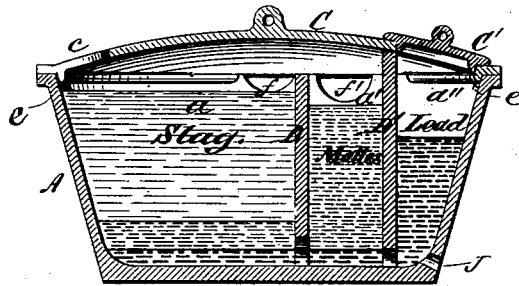


Fig. 1.

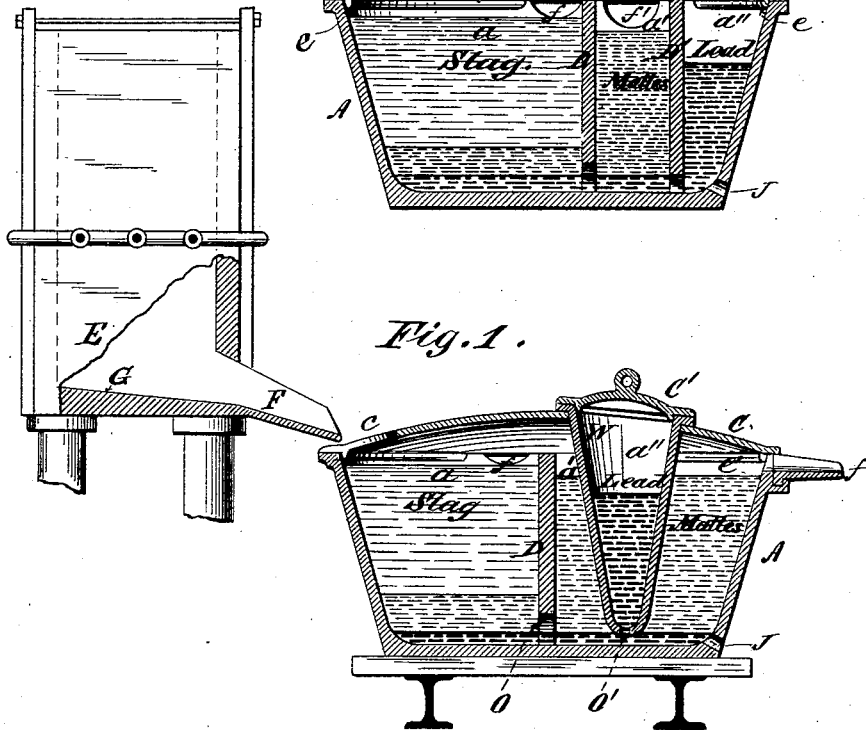
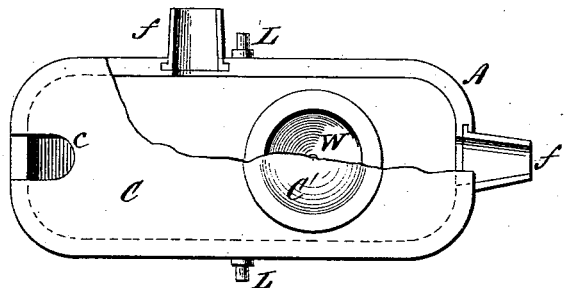


Fig. 3.



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Inventor:
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by his attorney
Willard Parker Butler.

(No Model.)

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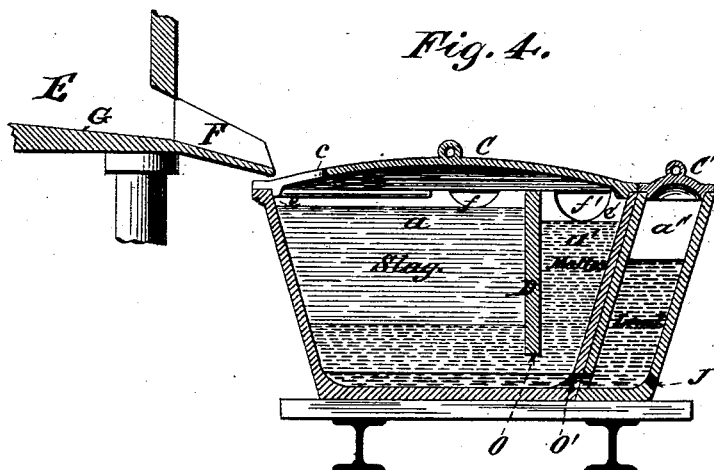
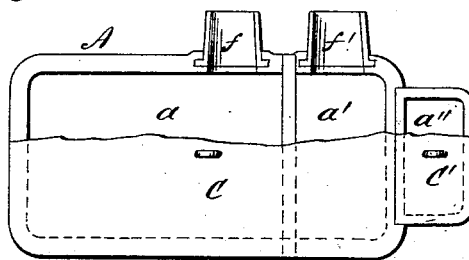


Fig. 5.



Witnesses:

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Inventor:

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UNITED STATES PATENT OFFICE.

WALTER B. DEVEREUX, OF ASPEN, COLORADO.

APPARATUS FOR SEPARATING BASE BULLION FROM SLAG, MATTES, AND SPEISS.

SPECIFICATION forming part of Letters Patent No. 381,119, dated April 17, 1888.

Application filed February 25, 1886. Serial No. 193,199. (No model.)

To all whom it may concern:

Be it known that I, WALTER B. DEVEREUX, a citizen of the United States, and a resident of Aspen, in the county of Pitkin and State of Colorado, have invented certain new and useful Improvements in Apparatus for Separating Base Bullion or Lead from Mattes, Speiss, and Slags, and Slags from Mattes and Speiss, of which the following is a specification.

My invention relates to the separation of lead and the alloys of silver, gold, and other metals with lead, commonly known as "base bullion," from the mattes, slags, and speiss which are formed therewith in the smelting of the ores of such metals, and, also, to the separation of the poor slags from the mattes, speiss, and slags rich in silver, which flow out with the same when the entire liquid contents of the furnace is tapped, the object of the invention being to effect this threefold separation outside of the furnace, while the smelted mass is still liquid and while the furnace is still running, in one and the same operation and in a more economical manner than has heretofore been possible.

It has heretofore been the practice in smelting silver ores and bullion to make use of the ordinary form of shaft-furnace having an interior hearth or crucible into which the bullion, mattes, speiss, and slags fall and settle after reduction, and to use in connection therewith some one of the many forms of devices which are in common use for separating out and removing the base bullion or lead while the same is still liquid, and for tapping off the mattes and slags from the bullion while the same are still running.

Various methods are resorted to for the purpose of separating the valuable slags, mattes, and speiss from the poor slags which run out with the same, and all of the methods and devices by means of which the same has hitherto been accomplished are more or less difficult of manipulation and imperfect in operation.

The most usual device employed for separating lead or bullion from the mass of slags and mattes smelted therewith is the exterior lead-basin, which is connected with the lowest part of the furnace-hearth and in which the molten base bullion and lead, being heavier

than the other molten substances, settle gradually and rise in the exterior basin in proportion as the height of the column of liquid material in the furnace-crucible increases, and from which the lead or base bullion is removed by means of a ladle as it accumulates. The so-called "siphon," or automatic tap, which is largely in use for this purpose throughout the western portions of the United States, is merely a modification of the old-fashioned exterior basin, and is too widely known and used to need description in this connection.

All of the various methods and devices hitherto made use of for tapping off bullion, slags, and mattes from furnaces are open in practice to very many and some very serious objections, and the separation which is effected by them is neither automatic nor perfect. The principal objection to them is that in cases where the ores to be smelted contain copper, zinc, baryta, or other impurities accretions are liable to be produced in the crucible, the formation of which is extremely difficult to prevent and the growth of which almost invariably causes an eventual stoppage of the furnace before it would otherwise be necessary, owing to the stoppage and chilling of the leadwell and the difficulty experienced in keeping the passage open through the walls of the crucible. The accretions, which are hard tough masses, have to be removed by chiseling, necessitating the furnace being put out of blast and cooled off.

Now, I have discovered that by constructing a smelting-furnace in such a form as to entirely do away with the ordinary form of crucible, and by placing the bottom of the furnace close up to the fusion-zone, and by tapping the entire fluid contents of the furnace directly into an exterior and portable receptacle provided with interior means for automatically separating the various ingredients which flow into it, I am able, first, to separate almost completely from each other, first, the mattes and speiss; second, the lead or base bullion, and, third, the slags; second, to render the formation of accretions much less likely to occur, there being no crucible in the furnace and no possibility of chilling; third, to attain great economy of furnace construction; and, fourth, to secure much more regular working and consequently campaigns of much greater length.

My invention, which consists in an apparatus in which the aforesaid separation is conducted, will be best understood by reference to the accompanying two sheets of drawings, in which—

Figure 1 is a vertical section; Fig. 2, a vertical section of a slightly-modified form, and Fig. 3 a plan view of the form shown in Fig. 1.

Similar letters refer to similar parts throughout the several views.

In all of the views where shown, E represents an ordinary shaft-furnace in which the crucible is dispensed with and the bottom G made to slope slightly from all parts of the furnace toward the tap-hole.

F represents the ordinary form of furnace, tap-hole, or spout, through which the entire smelted portion of the charge is drawn off.

The vessel, which in my invention is substituted for the furnace crucible, consists, as is shown in all the views, of a receiver or well, A, which is made of metal, preferably of cast-iron, of any convenient size or shape. In practice it will be found most convenient to make the receiving-well of the oblong form shown in the views, with side walls flaring slightly outward from the bottom toward the top in order to facilitate dumping. The separation is effected in this vessel by means of a combination of the devices, (for which I have already made application for Letters Patent by separate petition,) by means of which the static pressure of columns of liquid of varying specific gravities effects automatic separation.

Figs. 1 and 3 show the receiver or well A combined with a movable diaphragm, D, and a movable lead-well, W, of the character shown in the views and more particularly described in the above-mentioned applications. By means of the diaphragm D the receiver or well A is divided into two compartments of any desirable size, which are connected at or near the bottom by means of an opening, O, of convenient dimensions placed in the bottom of the diaphragm. The diaphragm may be held in place by any convenient form of fastening which will enable it to be removed at pleasure. The movable lead-well W is used in connection with one of the compartments, which are respectively designated as *a* and *a'*, into which the receiver A is divided by the diaphragm D. This lead-well is shown in the drawings as a truncated hollow cone, the lower extremity of which is slightly contracted. An opening, O', in the bottom connects it with the compartment *a'*, and it is supported and held in position in the receiver A in any manner that will permit of its being easily removed.

The receiver is covered with a flanged cover, C, of iron or other metal, which fits tightly over the same, as shown, being held in position by the flange *c*. In the arrangement shown in the views the lead-well is supported in the same manner as shown and described in the specification forming part of one of the aforesaid applications for separate Letters Patent for said lead-well; but any other form of fastening may

be used that will permit of said lead-well being easily removed, the gist of the device being, as stated in said aforesaid specification, in the movability of the lead-well. The cross-section of the well may be of any convenient shape; but in practice it will be found most convenient to make the same circular, giving to the well the shape of a hollow frustum of a cone.

It will be apparent from Figs. 1 and 3 that by means of the lead-well the compartment into which the same is placed is again subdivided into two compartments—an interior compartment within the well *a''* and an exterior compartment around the well *a'*. The upper edge of the receiver A is provided with two discharge-spouts, *ff'*, which are arranged to discharge the contents of the compartments *a* and *a'*, respectively, in the manner herein-after described.

Fig. 2 shows a modified form of apparatus, where a second movable diaphragm, D', is substituted for the lead-well W. This diaphragm is substantially of the same character as that shown in Figs. 1 and 3, the only difference being that in the arrangement shown in Fig. 3 the point of connection between the two chambers is different. The opening in the diaphragm D is vertically much larger than that in the diaphragm D', and there is consequently a much larger flow-space under the diaphragm D than under the diaphragm D', and the connection between the chambers *a'* and *a''*, into which the vessel is further subdivided by the second diaphragm, is at a much lower point in the receiver than the connection between the compartments *a* and *a'*.

In each case the vessel A is provided with an opening, J, at a convenient point at or near its bottom, whereby the lead may be drawn off when the receiver becomes choked up with shells. During the running of the receiver this hole may be stopped up with fire-clay or an iron plug, or in any other convenient manner.

The method of separation effected by the above apparatus and the mode of operation of the same is substantially as follows:

In smelting-ores, as is well-known, the various products and by-products when molten differ in specific gravity. The lead and bullion in this condition are heavier than the mattes and speiss, and these in turn are heavier than the slags which issue from the furnace with them. The result is that the lead or base bullion will settle to the bottom of any vessel in which all of the furnace products are collected at the same moment, while the mattes and speiss will assume a position directly above, leaving the slag which is lighter to float on the top. Where the entire contents of the furnace are allowed to flow through the tap-hole into any form of vessel which is subdivided by a diaphragm into two compartments, connected at the bottom by means of an opening of sufficient vertical dimensions to admit of the passage of the bullion and the superincumbent layers of mattes

and speisses, the poor slags, which float upon the top of the mass in the compartment into which the fluid mass flows, will flow off through any opening which may be provided for that purpose at the upper edge of the vessel, while in the other compartment, into which the lead or bullion and mattes and speiss flow over, these last-mentioned ingredients will rise in the compartment in proportion with the static pressure of the column of liquid in the first compartment. If now the compartment into which the mattes, speiss, base bullion, or lead flow over be further subdivided in a similar manner by means of a wall, under which only the lead or base bullion can flow, a further separation will be effected between the mattes and speiss on the one hand and the lead or bullion on the other. If then the second compartment a' be provided with an overflow-spout, f , at a point to which the mattes and speiss will rise therein, the same will flow off and be separated from the lead and bullion, which in turn will flow under the diaphragm D' and rise in the compartment a'' , in proportion as the static pressure of the columns of liquid in both the compartments a and a' increases. In cases where the second diaphragm is used the lead may be allowed to flow continuously through a spout attached to the chamber a'' ; but in practice it will generally be found desirable to ladle out the lead or bullion in order to prevent the accumulation of semi-liquid alloys, which have separated from the liquid metal by reason of a lowering of the temperature.

In practice one or both of the diaphragms may be made stationary; but in nearly all cases the removability of the same is essential.

In the drawings two methods of subdividing the compartment a' are shown, as shown in Figs. 1 and 2, one by means of an independent and removable lead-well, W , having an opening in its base, another by means of the movable diaphragm D' . These methods are substantially equivalents, one of the other; but in practice the use of the lead-well W will be found preferable for the reason that the lead-well, owing to its being constantly surrounded by a column of hot mattes and speiss, will be kept uniformly hot, and all danger of its contents becoming chilled will be avoided. In the operation of the apparatus it will be obvious that there will be a constant flow of liquid slag from the spout f of the chamber a —a flow of mattes and speiss—which are rich in silver and are saved for retreatment from the spout f' of the compartment a' , and a column of practically pure lead or bullion in the compartment a'' , formed by the lead-well W or the diaphragm D' , which may be removed with a ladle as the compartment becomes full, or in any other convenient manner.

I have heretofore upon the 24th day of February, 1886, filed three separate applications for Letters Patent for methods and apparatus for separating lead and base bullion from slags and mattes by means of some of the agencies herein described, in which applications the

said agencies are claimed separately. I therefore disclaim the various combinations in the claims of said applications contained, so far as the present Letters Patent are concerned; but

I claim as my invention—

1. The combination, with a smelting-furnace, of a portable receiver or collecting-well into which the same discharges, two diaphragms placed in the interior of said receiver, whereby it is divided into three separate compartments, said diaphragms being so arranged and constructed that they may be shifted therein or removed therefrom at pleasure, and openings in the base of said diaphragms of such dimensions that the said compartments are connected with each other, substantially in the manner set forth.

2. The combination, substantially as hereinbefore set forth, with a smelting-furnace, of a portable receiver or collecting-well into which the same discharges, a diaphragm placed in the interior of said receiver, dividing the same into two separate compartments, provided with an opening at or near the base for connecting the compartments, and a lead-well placed in either of said compartments, provided with an opening in its base below the level of the opening in the diaphragm, for the purposes set forth.

3. The combination, substantially as hereinbefore set forth, with a smelting-furnace, of a portable receiver or collecting-well into which the same discharges, a diaphragm placed in the interior of said receiver, dividing the same into two separate compartments, provided with an opening at or near the base for connecting the compartments, and a lead-well placed in either of said compartments, provided with an opening at its base below the level of the opening in the diaphragm, said lead-well and diaphragm being so arranged and constructed that they can be raised, lowered, or shifted in said receiver, or removed therefrom at pleasure.

4. The combination, with a portable receiver or collecting-well subdivided interiorly into compartments, substantially as described, of one or more discharge-spouts placed at or near its upper rim at such points that the material accumulating in each compartment will automatically and continuously flow off from that compartment through a separate spout when the same becomes full.

5. The combination, substantially as hereinbefore set forth, with a smelting-furnace, of a portable receiver or collecting-vessel into which said furnace discharges, a movable diaphragm in said receiver, whereby the same is subdivided into two compartments, an opening at or near the bottom of said diaphragm, whereby the said compartments are connected, a movable lead-well placed in one of said compartments, having an opening in its bottom below the level of the opening in said diaphragm, and means for supporting and adjusting said diaphragm and lead-well in said receiver, substantially as described.

6. The combination, substantially as here-

inbefore set forth, with a smelting-furnace, of
a portable receiver or collecting-well into which
said furnace discharges, a diaphragm in said
receiver, whereby the same is subdivided into
5 two compartments, having an opening at or
near its base connecting said compartments,
a lead-well having an opening in its extreme
base below the level of the opening in said
diaphragm, and independent covers, substan-

tially as described, for covering said receiver 10
and lead-well, respectively.

Signed at New York, in the county of New
York and State of New York, this 18th day of
February, A. D. 1886.

WALTER B. DEVEREUX.

Witnesses:

EDWIN T. RICE, Jr.,
WILLARD P. BUTLER.

Correction in Letters Patent No. 381,119.

It is hereby certified that in Letters Patent No. 381,119, granted April 17, 1888, upon the application of Walter B. Devereux, of Aspen, Colorado, for an improvement in "Apparatus for Separating Base Bullion from Slag, Mattes, and Speiss," an error appears requiring correction as follows: The sheet of drawings marked "Sheet 2" was inadvertently inserted as a part of said Letters Patent, whereas said Sheet 2 had been canceled and was not intended to illustrate any part of the invention covered by said patent and should have been omitted therefrom; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 29th day of May, A.D. 1888.

[SEAL.]

H. L. MULDROW,

First Assistant Secretary of the Interior.

Countersigned:

BENTON J. HALL,

Commissioner of Patents.