(No Model.)

W. B. DEVEREUX.

APPARATUS FOR SEPARATING LEAD AND BASE BULLION FROM SLAG.

No. 384,349. Patented June 12, 1888.

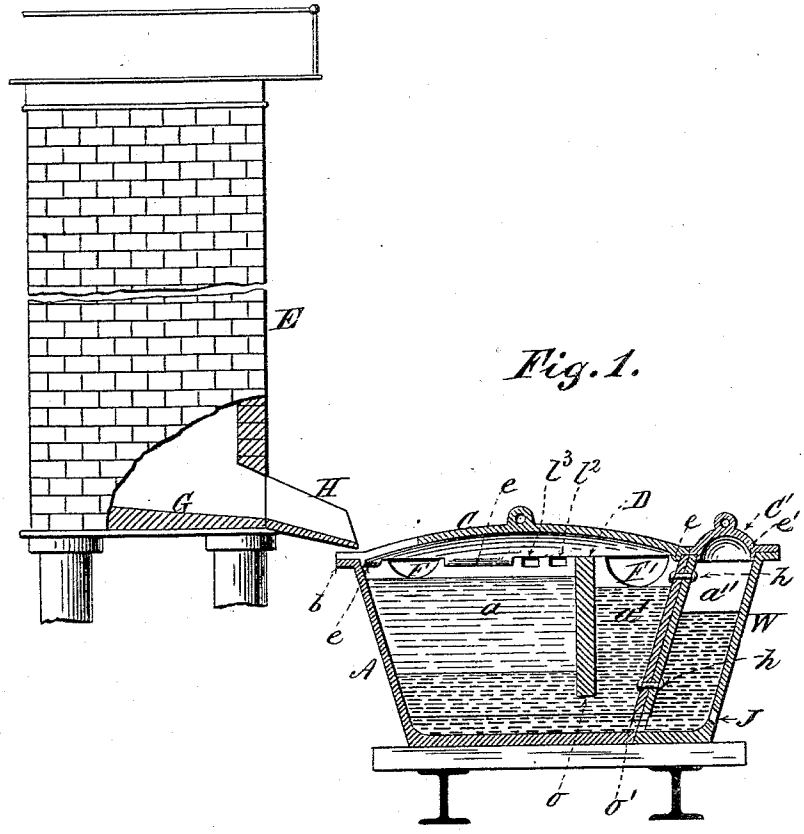


Fig. 1.

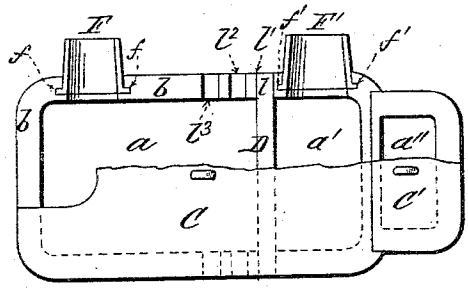


Fig. 2.

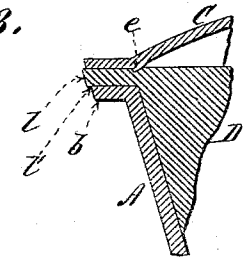


Fig. 3.

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UNITED STATES PATENT OFFICE.

WALTER B. DEVEREUX, OF ASPEN, COLORADO.

APPARATUS FOR SEPARATING LEAD AND BASE BULLION FROM SLAG.

SPECIFICATION forming part of Letters Patent No. 384,349, dated June 12, 1888.

Original application filed February 25, 1886, Serial No. 193,199. Divided and this application filed November 2, 1887. Serial No. 254,073. (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 Lead and Base Bullion from Slag, 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 are 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 ore 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 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 which settle to the bottom of crucible, gradually rise, owing to the pressure of the column of liquid materials in the crucible of the furnace, 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 formed 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 lead-well, and the difficulty experienced in keeping the passage open through the walls of the crucible. The accretions, which are hard and 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, it is possible to separate almost completely from each other, first, the mattes and speiss; second, the lead or base bullion, and third the slag, to render the formation of accretions much less likely to occur by reason of there being no crucible in the furnace, and no possibility of chilling, to attain great economy of furnace construction, and 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 sheet of drawings, in which—

Figure 1 is a vertical section, and Fig. 2 a plan view of the same, and Fig. 3 is a sketch of one of the details.

Similar letters refer to similar parts throughout the several views.

In the views, 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.

H 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 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, and provided with a flange, *b*, at the top, whereby the same may be lifted, removed, or dumped by any convenient form of mechanism. The separation is effected in this vessel by a means of a combination of the devices (for some of which I have already made application for Letters Patent by separate petition, the present case being a division of the application, Serial No. 193,199, heretofore filed) so arranged that the receiver A is subdivided interiorly into connected compartments in which the static pressure of the liquid of varying specific gravities therein contained effects automatic separation of the different materials composing the smelted mass.

Figs. 1 and 2 show the receiver or well A, combined with a movable diaphragm, D, of the character shown in the views, and more particularly described and claimed in the above-mentioned separate applications. By means of the diaphragm D the receiver or well A is divided into two compartments, *a* and *a'*, of any desirable size, which are connected at or near the bottom by means of an opening, *o*, of convenient dimensions, placed at or near 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; but in practice it will be found convenient to provide it at the top with the horizontal lugs *l l*, which are arranged to fit closely into the depressions or grooves $l' l^2 l^3$, &c., in the flange *b*, for the purpose of holding the diaphragm at any convenient point. These depressions may be arranged at convenient distances apart, and by shifting the diaphragm from one to the other the relative size of the compartments *a a'* may be changed at pleasure. Fig. 3 shows the arrangement of the lugs, which are provided on top with a groove or are made sufficiently low to admit of the flange *e* of the cover C passing over them when the latter is placed in position on the receiver A, as shown in Fig. 3.

In the form of apparatus described in the present application the lead-well W is not placed within one of the compartments *a a'*, but is attached to the exterior of the receiving-well A, as shown in the views. This lead-well may be of any convenient shape; but is preferably of that shape shown in the drawings, and must be of equal depth with the receiver. An opening, *o'*, in the wall of the receiver at the extreme bottom, connects the lead-well with the compartment *a'*. This opening is of smaller vertical dimensions than the opening *o* in the diaphragm. It is quite immaterial how the lead-well is attached to the receiver; but in practice it will be attached by bolts *h h*, as shown in the views, passing through the end wall of the receiver and the side wall of the well. The effect of this arrangement is to provide two interior compartments, *a* and *a'*, within the receiver and an exterior or lead compartment, *a''*. The upper edge of the receiver is provided with two discharge-spouts, F F', which are arranged to discharge the contents of the compartments *a* and *a'*, respectively, in the manner hereinafter described. These spouts may be attached to the side walls of the receiver A in any convenient manner. In the drawings they are shown provided with flanges *f f'*, fitting into corresponding grooves in the flange *b* on the upper edge of the receiver, which is cut out to fit the spouts and provided with overflow-openings, as shown in Fig. 1.

The receiver A is covered with a flanged cover, C, of iron or other metal, fitting tightly over the same, and held in its position by means of the interior flange, *e*, fitted to the inner edge of the receiver, as shown. The lead-well W is provided with a separate removable cover, C', provided with an interior flange, *e'*, as before, for the purpose of holding the same in place. The lead-well W is provided with an opening, J, in its exterior wall at its extreme base, whereby the lead and base bullion, and, in fact, the entire contents of the receiver, may, if necessary, 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 by means of 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 are 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. When the entire contents of the furnace are allowed to flow through the tap-hole into a vessel such as is above described, which is subdivided by a diaphragm into 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 layer of mattes and speiss, the poor slags which float upon the top of 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 compartment into which the lead or bullion and mattes and speiss flow over the last-mentioned ingredients will rise in the compartment in proportion to the static pressure of the column of liquid in the first compartment. If, now, the compartment into which the mattes, speiss, and base bullion flow over be connected at its extreme base with an exterior lead-well, such as that above described, by means of an opening, the vertical height of which is slightly less than that of the opening in the diaphragm, a further separation will be effected between the lead and base bullion on the one hand and the mattes and speiss on the other, as the former will be forced over into the lead-well and accumulate therein, and the latter will remain in the second compartment of the receiving-well, and if discharging-spouts be placed at the upper rim of both compartments the mattes and speiss in the one compartment and the slag in the other, as they accumulate therein, will flow off automatically and so be separated one from the other.

As I have heretofore, on the 24th day of February, 1886, filed three separate applications for Letters Patent—among other things for the combination, with a movable receiver, of a movable diaphragm, such as that hereinabove described—(of one of which applications, Serial No. 193,199, the present is a division,) I make no claim to the same in this application, except as an element in the combinations hereinafter claimed, and I disclaim said combination so far as any Letters Patent that may be issued on this application 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, a diaphragm placed in the interior of said receiver, whereby it is subdivided into two separate compartments, an opening in the base of said diaphragm connecting said compartments, a lead-well attached to the exterior of said receiver, and an opening in the wall of said receiver connecting one of said compartments with the extreme base of the lead-well, for the purposes set forth.

2. The combination, 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, whereby it is subdivided into two separate compartments, an opening in the base of said diaphragm connecting said compartments, a lead-well attached to the exterior of said receiver of equal depth, and an opening in the wall of said receiver connecting one of said compartments with the extreme base of the lead-well, said diaphragm and lead-well being so constructed and arranged that either or both may be removed, raised, lowered, or shifted at pleasure.

Signed at Glenwood Springs, in the county of Garfield and State of Colorado, this 26th day of October, A. D. 1887.

WALTER B. DEVEREUX.

Witnesses:

ALEX. ANDERSON,

JOHN R. PLUNKETT.