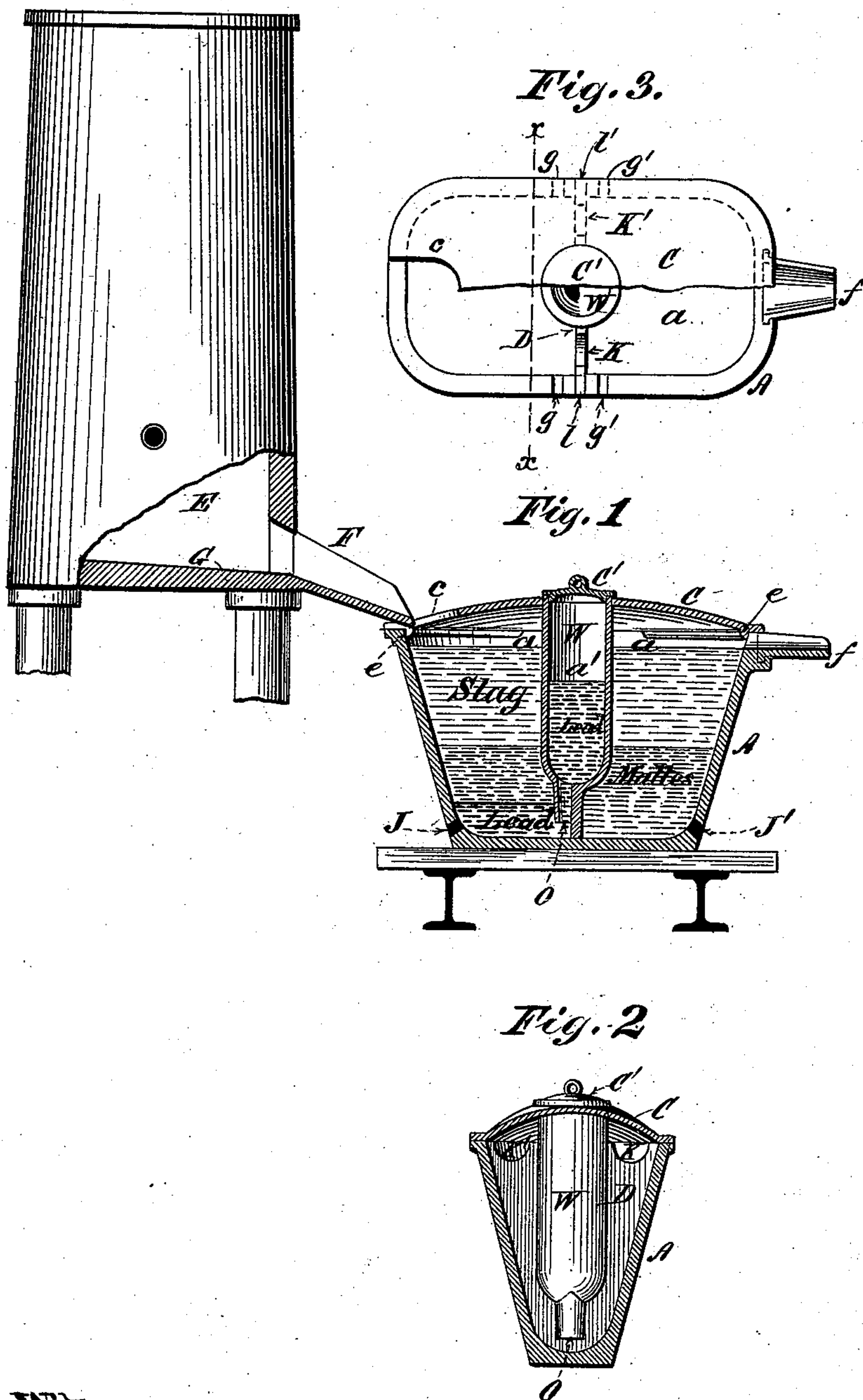


(No Model.)

W. B. DEVEREUX.
APPARATUS FOR SEPARATING LEAD OR BASE BULLION IN SMELTING
FROM SLAG, &c.

No. 377,802.

Patented Feb. 14, 1888.



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UNITED STATES PATENT OFFICE.

WALTER B. DEVEREUX, OF ASPEN, COLORADO.

APPARATUS FOR SEPARATING LEAD OR BASE BULLION IN SMELTING FROM SLAG, &c.

SPECIFICATION forming part of Letters Patent No. 377,802, dated February 14, 1888.

Application filed February 25, 1886. Serial No. 193,200. (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 or Base Bullion in Smelting from Slags, 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 ores of such metals; and the object of the same is to effect the said separation outside of the furnace in one and the same operation, while the materials to be separated are still in molten condition and while the furnace is still running, in a more convenient manner than has hitherto been possible.

It has heretofore been the practice in smelting silver and lead ores to make use of a 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 from the crucible while the same is still liquid and for tapping off the mattes and slags from the furnace either together or separately. The most usual method of tapping off the base bullion is to connect the furnace-hearth with an exterior basin, in which the molten base bullion or lead gradually rises by reason of the static pressure of the column of liquid material in the crucible of the furnace, and from which the base bullion is removed as it accumulates by means of a ladle. The automatic or so-called "siphon-tap," in use throughout the western portion of the United States, is merely a modified form of the old-fashioned exterior basin, and is too well known to require description in this connection.

All of the various methods heretofore made use of for tapping off bullion from furnaces are open in practice to very many and serious objections. The principal objection 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 furnace-

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 of keeping the passage open through the walls of the furnace-hearth. The accretions, which are usually 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 manner as to entirely do away with the ordinary form of crucible, and by tapping the entire fluid contents of the furnace directly into an exterior and removable receptacle provided with exterior means for separating the lead or bullion from the mattes and slags, I am able to effect a much more convenient and economical separation of base bullion or lead from the mattes, speiss, and slags than has heretofore been possible, and also to prevent the formation of accretions, and at the same time to effect great economy in furnace construction and much more favorable results in smelting ores by reason of the greater regularity in working, and consequently to produce campaigns of much greater length.

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

Figure 1 is a vertical section of the apparatus; Fig. 2, a vertical section on the line xx of Fig. 1, and Fig. 3 is a plan view of the apparatus.

Similar letters refer to similar parts throughout the several views.

As above stated, my invention consists, to a certain extent, although not necessarily, in absolutely dispensing with the ordinary form of crucible used in lead-smelting furnaces and in tapping the furnace directly into a portable receiving-vessel. In cases, however, of furnaces already built it is possible to apply the invention successfully either by lowering the tap-hole of the furnace, so as to tap from the extreme bottom of the crucible, or by filling up the bottom with refractory material and using the same tap-hole.

In the views, E represents an ordinary shaft-

furnace, in which the crucible is entirely eliminated, as shown, and the bottom G made slightly inclined toward the point at which the same is tapped.

5 F represents the ordinary form of furnace tap-hole and 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 of a
10 receiver or well, A, which is made of metal, preferably of cast-iron, of any convenient size or shape. In practice the receiver will be preferably rectangular, with rounded corners, as shown in the views. In each case the side
15 walls are made to flare slightly outward from the bottom toward the top, in order to facilitate dumping, and at any convenient point in the rim of the receiver is placed a discharge-spout, *f*, of any convenient size. This spout
20 may be cast in one piece with the receiver, or made separate and attached thereto in any convenient manner. In practice it is advisable to arrange the spout so that it will discharge the slag at a point as far as possible
25 from that at which the same enters the receiver. The separation is effected in this vessel by means of a combination of the devices described and claimed in applications for separate Letters Patent filed contemporane-
30 ously herewith.

In the views, D is a movable diaphragm, of cast-iron or other convenient metal, which divides the receiver A into two separate compartments. Upon one side of this diaphragm
35 is attached a lead-well, of any convenient shape or size, provided, as before, with an opening, O, in its bottom. The opening in the bottom of the diaphragm (shown in the above-mentioned applications) is dispensed
40 with in this case, and at the top of the diaphragm, on either side of the lead-well, are placed openings *k k'*, in the form of grooves or nicks, through which the column of mattes and slags will overflow from one compartment
45 to the other upon reaching the height of the openings in the diaphragm. The compartment *a'*, into which the slag overflows over the diaphragm, is provided with a discharge-spout, *f*, slightly below the level of the nicks
50 in the diaphragm, through which the slag in the compartment *a'* is discharged when full. The diaphragm and lead-well may be held in position in the receiver in any convenient manner, preferably by means of lugs *l l'*, fitting into grooves *g g'* in the side walls of the
55 vessel, as shown in the views; and the apparatus is provided with a cover, C, provided with an interior flange, *e*, whereby the same is held in place, and an opening, *c*, to admit of
60 the entrance of the fused material from the furnace-spout. The lead-well W extends upward through an opening in the cover C, and is provided with an independent flanged cover, C'.

65 Two openings, J and J', are provided in the lower side walls of the vessel A—one in each

end wall—whereby the contents in the bottom of the two compartments may be drawn off at pleasure in cases where the receiver be-
70 comes choked up with shells. When the vessel is running, these openings may be closed with fire-clay, or with iron plugs, or in any other convenient manner.

The operation of the apparatus is substantially as follows: When the furnace is tapped
75 into the compartment *a*, the lead and bullion, as above stated, will settle to the bottom, and as the hydrostatic pressure of the column increases the lead will rise in the well W, from which it will be removed by a ladle as it ac-
80 cumulates. When the column of molten material in the compartment *a* is full, it will overflow into the compartment *a'*, in which the mattes and speiss will settle to a large extent. The slags, however, being lighter and floating
85 upon the top of the mass, will flow off through the spout *f*, from which they may be collected in any convenient form of vessel and separated in any desirable manner; or the compart-
90 ment may be tapped from time to time through the opening J when the mattes begin to run in large quantities from the spout *f*. In this way a complete separation of the lead or base
bullion is effected, and the mattes and speiss may be collected to some degree, free from
95 slag.

The advantage of this form of combined lead-well and diaphragm over the method of separation by means of a lead-well or a dia-
100 phragm alone, combined with a movable receiver, lies in the fact that by means of the form of apparatus a large amount of mattes and speiss may be collected in the vessel free from slags. In addition to this, the apparatus
105 possesses all of the advantages claimed for the other forms described in the aforesaid separate applications.

The advantages are as follows:

First. The removability of both the receiver and the lead-well. By collecting the products
110 of the furnace in an exterior receiving-vessel it is possible to handle the entire mass with ease and convenience and to so regulate the smelting as to avoid the formation of accretions, as above referred to. By making the
115 combined lead-well W and diaphragm removable at pleasure all stoppages in the receiver are avoided, and it is possible to dump the entire contents for the purpose of cleaning out the same at a moment's notice.
120

Second. The position of the lead-well surrounded by the liquid mass of slag and mattes enables the lead in the same to be kept uni-
125 formly hot, and obviates all danger of chilling.

Third. The use of a cover upon the vessel
125 enables a uniform temperature to be maintained and prevents the escape of fumes, which are deleterious to the health of the workmen.

The value of this method of tapping and separating over the old form of tapping smelt-
130 ing-furnaces will be obvious when it is remembered that in cases where the furnace be-

comes, for any reason, choked the only remedy is to allow the furnace to go out of blast and to remove the same by chiseling.

I am aware that attempts have been made to separate slags and mattes from bullion or lead by means of a stationary diaphragm connected with the furnace-crucible, as in the case of the ordinary siphon or automatic tap above referred to, and also to separate copper from slags in copper-smelting by means of a stationary diaphragm placed in a movable or permanent vessel outside of the furnace-hearth. I am also aware that it is not new to smelt lead ore in a furnace without a crucible, nor to tap from a furnace into a movable receiving-well having in its side walls openings for the purpose of effecting a separation of the materials contained therein; but I believe that it is new to smelt lead ores in a furnace having no crucible proper, and to tap continuously into a movable receiving-well, provided in its interior with a movable diaphragm which divides the vessel into two compartments, to which diaphragm a lead-well open at the bottom is attached, so that when the smelted mass enters the receiving-well the lead will accumulate in the bottom of the first compartment, and will rise in the lead-well and be separated from the remainder of the mass, and the molten material will flow over from the first compartment into the second compartment, in which the mattes and speiss will settle, the former to a large extent at the bottom, allowing the slag to flow off from the top of the same through openings provided therefor. I have heretofore—upon the 24th day of February, 1885—filed three separate applications for Letters Patent for method 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.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, with a smelting-furnace, of a portable receiver-well into which said furnace discharges, a lead-well and diaphragm, constructed and arranged so that they may be raised, lowered, or removed at pleasure, placed in said vessel, whereby the same is subdivided into two compartments, an opening at the base of said lead-well, whereby the lead or base bullion tapped into the first compartment is caused to rise in said lead-well in proportion to static pressure in said compartment, and

one or more openings at or near the top of said diaphragm, whereby the contents of the one compartment, when the same becomes full, may overflow into the other compartment.

2. The combination, substantially as hereinbefore described, with a smelting-furnace, of a portable receiving vessel or well into which said furnace discharges, a diaphragm placed in said receiving-well, so constructed and arranged that it may be removed from or shifted therein at pleasure, whereby the same is divided into two compartments, a lead-well attached to said diaphragm, so constructed and arranged that it may be removed from or shifted therein at pleasure, one or more openings at or near the top of said diaphragm, whereby the contents of one compartment may overflow into the other, and means, substantially as described, for attaching and holding said lead-well and diaphragm and discharging said receiving-vessel.

3. The combination, substantially as hereinbefore set forth, with the portable receiving-vessel subdivided interiorly into two compartments, of a discharge-spout attached to either of said compartments at such a point that the contents of the same may be discharged automatically upon reaching any desired height.

4. The combination, substantially as hereinbefore set forth, with the receiving-well subdivided interiorly by a diaphragm having a lead-well thereto attached, so constructed and arranged that it may be removed therefrom or shifted therein at pleasure, of the flanged cover C, covering said vessel, having an opening therein through which said well projects upward, and the movable cover C', covering said lead-well.

5. The combination, substantially as hereinbefore set forth, of a portable receiving-well, a diaphragm having a lead-well thereto attached, placed in said receiving-well, so constructed and arranged that it may be removed therefrom or shifted therein at pleasure, whereby the same is subdivided in two compartments, one or more openings in the side wall of said receiving-well at or near the bottom, whereby the contents thereof may be discharged, and means for closing the same, substantially as described.

Signed at New York, in the county of New York and State of New York, this 20th day of February, A. D. 1886.

WALTER B. DEVEREUX.

Witnesses:

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