

(No Model.)

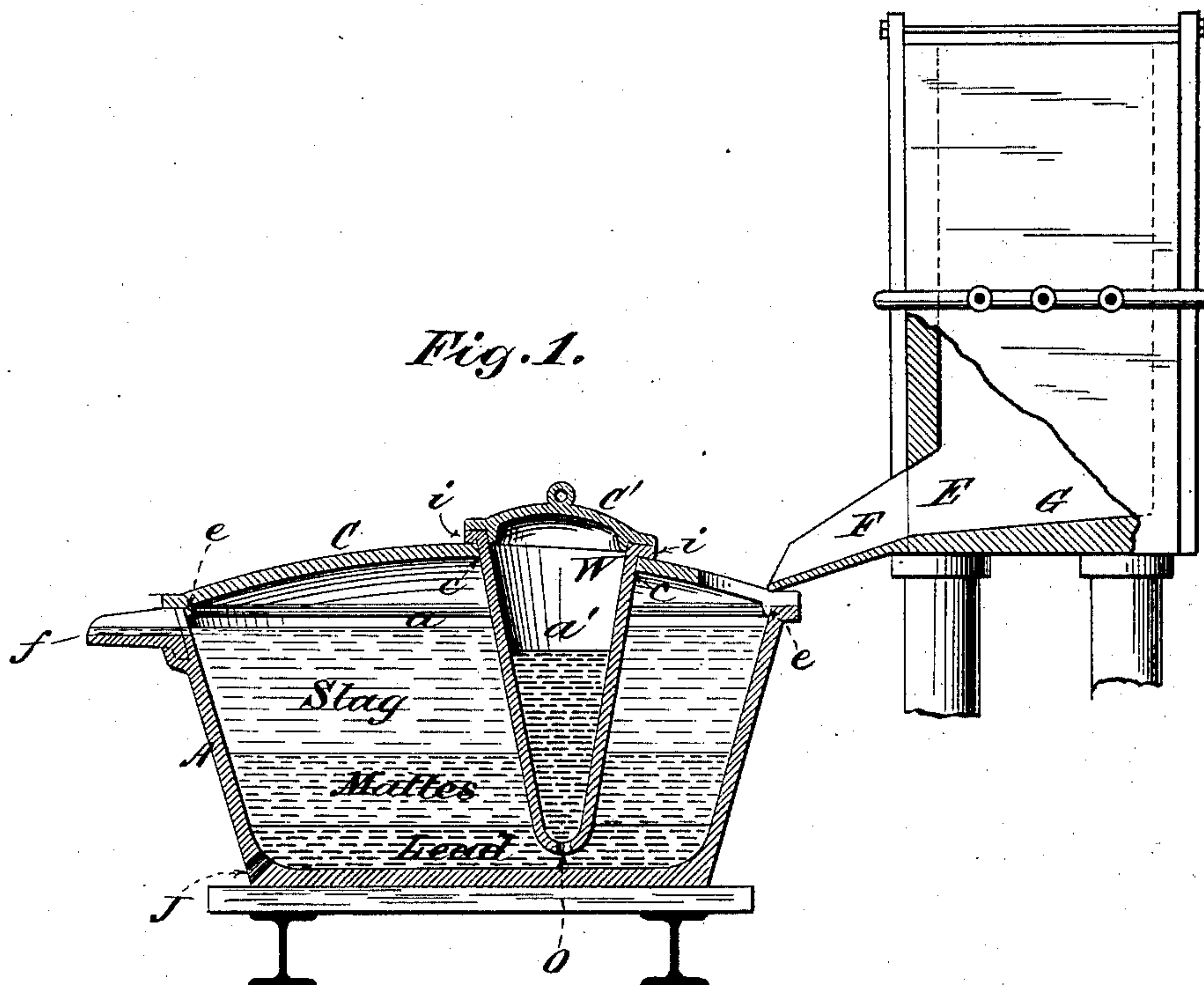
W. B. DEVEREUX.

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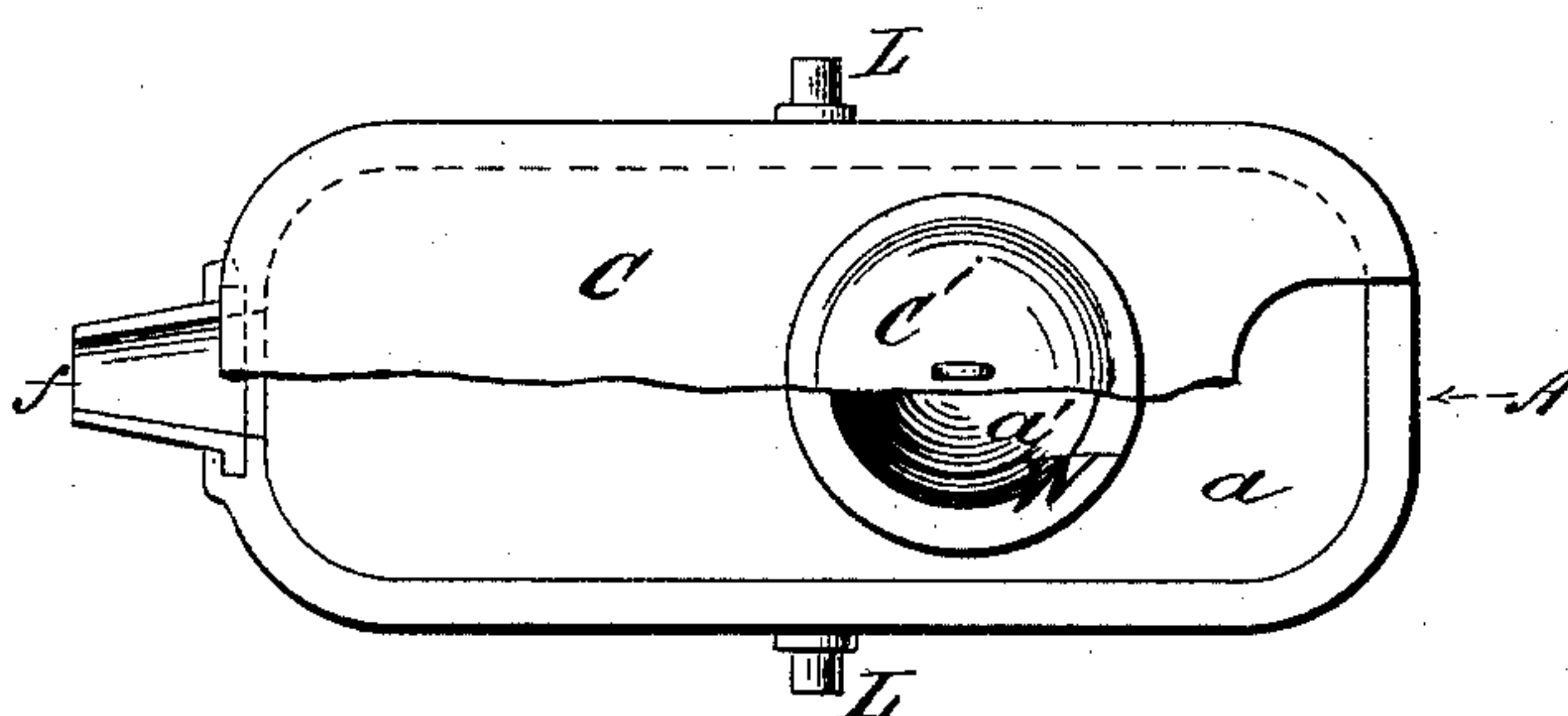
No. 374,239.

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*Fig. 1.*



*Fig. 2.*



Witnesses:

Geo. W. Miath  
Wm. Gardner

Inventor:

Walter B. Devereux  
By his attorney  
Willard Parker Butler



# UNITED STATES PATENT OFFICE.

WALTER B. DEVEREUX, OF ASPEN, COLORADO.

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

SPECIFICATION forming part of Letters Patent No. 374,239, dated December 6, 1887.

Application filed February 24, 1886. Serial No. 193,066. (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 speisses which are formed therewith in the smelting of silver ores; and the object of the same is to effect the said separation outside of the furnace, while the mass of smelted material is still liquid and while the furnace is continuously running, in a more effectual and economical manner than has heretofore been possible.

It has heretofore been the practice in smelting silver ores to make use of a furnace provided with an interior hearth or crucible, into which the bullion, mattes, 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 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 manner of tapping off the bullion is to connect the furnace-hearth with an exterior basin, in which the molten bullion gradually rises by reason of the static pressure of the column of liquid material in the crucible of the furnace, and from which the bullion is removed as it accumulates by means of ladles. The automatic or so-called "siphon" 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 permanent lead-well, and is too widely known and used to need description here.

All of the various methods heretofore used 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 crucible, the formation of which is exceedingly 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 hearth. 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 manner as to entirely do away with the ordinary form of crucible used in lead-furnaces, 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 movable crucible provided with interior 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 the base bullion 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 thus producing campaigns of much greater length.

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

Figure 1 is a vertical section of the apparatus, showing a portion of the furnace; and Fig. 2, a plan view of the same with a portion of the cover broken away, showing the interior 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.

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 receiver or well, A, which is made of metal, preferably rectangular, with rounded corners, as shown in the views. In each case the side walls are made to flare slightly outward from the bottom toward the top in order to facilitate dumping. At any convenient point in the rim of the receiver is placed a discharge-spout, f, of any convenient size. This spout may be cast in one piece with the receiver or made separate or 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 from that at which the same enters the receiver.

The separation of the lead from the slags, matters, &c., in the apparatus shown in Figs. 1 and 2 of the drawings is effected in this vessel by means of a movable lead-well, W, which may be supported in the receiver or well A in any convenient way. In the drawings this lead-well is made in the form of a hollow truncated cone, the lower extremity of which is slightly contracted, as shown. An opening, O, in the bottom connects it with the interior of the receiver A, and it may be supported therein in any convenient manner. 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 means of the interior flange, e.

In the arrangement shown in the views the lead-well terminates at its upper extremity in a flaring flange, i, and passes through the circular opening c in the cover C. The flange i serves to support the lead-well in the receiver in the manner shown, and the well is covered by a separate cover, C', fitting over the flange i, as shown in the views. The lead-well W may be supported in the receiver by means of lugs cast on the sides of the well and fitting into grooves in the rim of the receiver, or in any other manner that will enable the well to be removed from the receiver at any moment, the essential part of the construction being that the well is removable at pleasure. The cross-section of the well need not necessarily be cylindrical. It may be rectangular, elliptical, or even octagonal. In practice, however, it will be most easily made in the form of a hollow frustum of a cone, as shown in the views.

The method of separation effected by the form of apparatus shown in Figs. 1 and 2 and

the mode of operation of the same is as follows: In the smelting of lead ores, as is well known, the various products and by-products of the furnace differ in specific gravity. The lead or base bullion as it issues from the furnace is slightly heavier than the mattes, speisses, and slags which flow out with the same, and will consequently settle to the bottom of any vessel in which all of the furnace products are collected while molten, allowing the mattes, speisses, and slags to float on the top of the lead. Where the entire contents of the furnace-crucible are tapped into one compartment of a vessel divided into two compartments which are connected at the bottom, the lead as it settles into the bottom of the compartment into which the mass is tapped will flow over through the opening between the compartments into the other compartment, and will rise in that compartment in proportion as the static pressure in the first compartment increases. The slag, mattes, and speiss, being but little lighter than the lead, will keep the hydrostatic pressure between the columns of liquid in the two compartments constant. The effect of the insertion of the movable lead-well W into the receiver A is to divide the same into two compartments, *a a'*, which are connected with each other by means of the opening O in the bottom of the movable lead-well, and when the furnace is tapped into the receiver A the compartment *a* will be gradually filled, and when finally a stream of slags and mattes commences to run off from the chamber *a* through the discharge-spout D there will be a column of pure bullion or lead in the interior *a'* of the lead-well, which will be of almost the same height as the column in *a*. The lead-chamber *a'* is emptied by dipping out the bullion with ladles and casting it at once into bars or ingots. The mattes, speiss, and slags as they run over from the chamber *a* may be caught in any convenient vessel and subjected to any desirable method of separation.

The advantages of the movable lead-well in connection with the movable receiver over the old-fashioned form of stationary exterior lead-basin are as follows:

First. The removability of both the receiver and the lead-well. By collecting the products 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 lead-well W 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.

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 uniformly hot and obviates all danger of chilling.

Third. The use of a cover upon the vessel 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 smelting-furnaces will be obvious when it is remembered that in cases where the furnace becomes, 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 is the case in the ordinary siphon or automatic tap hereinbefore referred to, and also, as has been done in copper-smelting, by means of a stationary diaphragm placed in a movable or permanent vessel outside of the furnace-hearth. All such forms of apparatus become useless at times by reason of becoming choked by chilling or from other causes. In the former case the furnace-crucible has to be torn out and rebuilt, and in the latter case either the vessel must be taken to pieces or, when this is impossible, the material which has become chilled must be removed from the vessel through the laborious process of chiseling it out.

I am also aware that it is not new to smelt lead ores in a furnace without a crucible, as this has heretofore been attempted by Herreshoff and others, nor to tap from a furnace into a movable receiving-well containing 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 interiorly with devices which may be both movable and adjustable, which permit of a separation of the smelted mass in the well by means of the specific gravity of its various portions, and which may be adjusted in the well in various positions, according to the exact character of the various portions of the smelted mass; and I believe it to be distinctively new to make use of a movable lead-

well such as is hereinbefore described for that purpose.

Having heretofore, upon the 25th day of February, 1886, made two separate applications for Letters Patent for apparatus for similar purposes, which said applications are numbered 193,199 and 193,200, and claimed certain matters herein shown, but not described, I therefore disclaim the combinations contained in the claims of said applications so far as the present patent is concerned; and

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, with a smelting-furnace, of a portable receiving-well into which the said furnace discharges, and a lead-well, provided with an opening at its base, placed in said receiving-well and constructed and arranged so that the same may be removed at pleasure, for the purposes set forth.

2. The combination, substantially as hereinbefore set forth, with a smelting-furnace having no crucible proper, of a portable receiving-well into which the said furnace discharges, a movable lead-well, provided with an opening at its base, placed in said receiving-well for separating the lead and base bullion from slags, mattes, &c., discharged with the same and constructed and arranged so that the same may be removed at pleasure, and means, substantially as described, for adjusting and holding said lead-well in the receiving-well.

3. The combination, with the receiving-vessel A, the lead-well W, provided with an opening at its base, and the cover C, of the cover C', fitting over the lead-well, whereby the contents of the same may be removed without removing the cover C from the vessel A.

Signed at New York, in the county of New York and State of New York, this 15th day of February, A. D. 1886.

WALTER B. DEVEREUX.

Witnesses:

EDWIN T. RICE, Jr.,

WILLARD P. BUTLER.