(No Model.)

S. L. TRIPPE.

APPARATUS FOR AMALGAMATING AND SEPARATING GOLD, &c., FROM THEIR ORES.

No. 264,422. Patented Sept. 12, 1882.

Fig. 1.

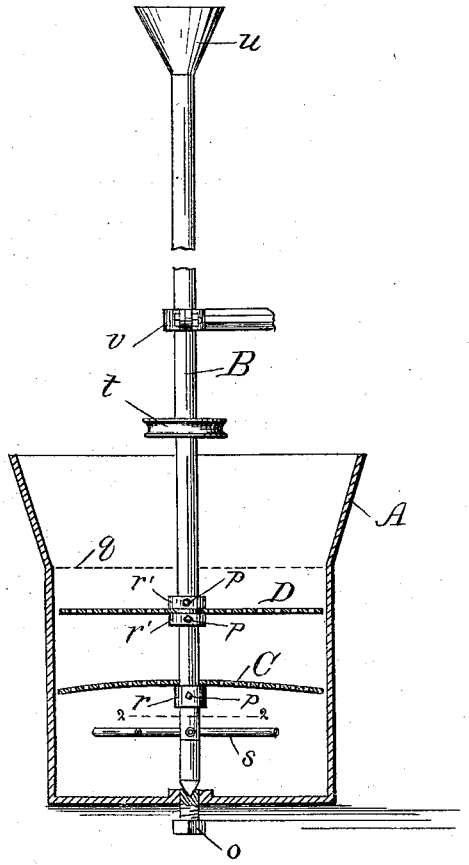
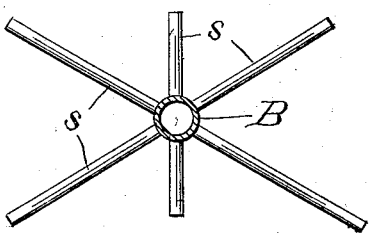


Fig. 2.



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UNITED STATES PATENT OFFICE.

SYLVANUS L. TRIPPE, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO ABEL H. BLISS, OF SAME PLACE.

APPARATUS FOR AMALGAMATING AND SEPARATING GOLD, &c., FROM THEIR ORES.

SPECIFICATION forming part of Letters Patent No. 264,422, dated September 12, 1882.

Application filed July 22, 1882. (No model.)

To all whom it may concern:

Be it known that I, SYLVANUS L. TRIPPE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and Improved Apparatus for Amalgamating and Separating Gold and other Metals from their Ores by Means of Mercury; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates mainly to the treatment of the ores of metals having a greater specific gravity than mercury, and therefore pertains more especially to the ores containing gold, platinum, and their alloys.

Most of the processes heretofore in use for separating minerals from ores with the aid of mercury have been based upon the theory that amalgamation is an essential requisite to such separation, and expensive operations are frequently resorted to for the purpose of rendering the amalgamation as nearly perfect as possible; but all these are in many cases and under many conditions inadequate to produce the desired result.

My invention is founded, however, upon the hypothesis that effectual separation is not dependent upon amalgamation, but that the former may be brought about irrespective of the degree to which the latter is carried by relying also upon the natural law of gravity—that is to say, if the ores containing metals having a greater specific gravity than mercury are reduced to a fine powder and mixed with mercury in a vessel, the metal, whether attacked by the mercury or not, will, by virtue of its superior specific gravity, sink to the bottom, and the foreign substances, owing to their inferior specific gravity, will rise to the surface. In this way I obtain not only the gold which amalgamates, but also the rusty gold, or gold which, from any cause, fails to amalgamate. Hence with my process operations for desulphurizing become unnecessary.

The theory that gravity, as well as amalgamation, operates in the separation of metals from their ores by means of mercury is not a new one, but has been recognized and adopted in the art more or less extensively. In reducing it to practice heretofore, however, the method generally employed has been to introduce the ore in a triturated condition into the mercury, at its upper surface, and carry off the foreign substances by washing and overflow, whereby many of the fine mineral particles are washed away before sinking beneath the mercury or amalgamating with it. This is a general statement of the method without reference to any of the mechanism employed for securing the most desirable results. With this method the force of gravity and the unavoidable currents in the water are necessarily in conflict, the latter tending, in opposition to the former, to carry off more or less of the finer particles of the metal. It is this defect mainly which it is the object of my invention to overcome.

I have found by experiment that by introducing the triturated ore into the body of mercury near the bottom of the same, and thus requiring the foreign substances to pass (not by forcing them, but only by reason of their inferior specific gravity) through the superincumbent mercury, they become, before reaching the surface, (where they are washed away in the usual manner,) almost absolutely divested of all metal having a greater specific gravity than mercury, so that the water currents are no longer capable of creating material loss, as such metals once placed beneath a body of mercury must remain beneath unless they are lifted up by currents or by lighter material attached to them; but in the practical application of this method of introducing the triturated ore into the base of the mercury bath and allowing the lighter constituents to rise to the surface several important subordinate details must be observed in order to secure the best results. First, the comminuted ore must be thoroughly mixed with the mercury at and about the plane of introduction; and, secondly, the rising particles must be prevented from creating upward currents in the mercury, since the effect of this would be to carry the material up in columns or masses, and to a considerable extent, without reference to its specific gravity, whereby more or less of the precious metal would be carried to the surface with the foreign matter and washed away. This also is one of the difficulties encountered

with those methods which, while passing the ore through the mercury from below, use force sufficient to hold the mercury in suspension. In my process, it will be observed, the force of gravity is allowed to operate naturally without the aid of artificial means for forcing the substances through the mercury.

To obviate the difficulties above named I provide means for thoroughly disseminating the comminuted ore through the mercury and mixing it therewith at and about the plane of its introduction, and also providing perforated diaphragms above the level at which the ore enters, through which the rising particles are required to work their way in their upward passage.

A mechanical device by which the ore is injected into the base of the mercury bath, and by which the requisite agitation and mixing are effected, as well as an arrangement of perforated diaphragms, are essential in some form or other to the successful carrying of the process into effect. Therefore I have constructed an apparatus, which is fully described below, possessing all the required characteristics and adapted to effect the desired result.

In the drawings, Figure 1 is a central vertical section of my apparatus; and Fig. 2, a cross-section of the pipe, taken on the line 2 2 of Fig. 1.

A is a vessel, preferably made flaring toward its upper end and cylindrical elsewhere, as shown, and B a pipe standing in a seat in the bottom of the vessel and stayed by a suitable bearing, *v*, above the vessel. This pipe is provided with a hopper, *u*, at its upper end, and also with a fixed pulley, *t*, or some analogous contrivance to permit it to be revolved.

Near the lower end of the pipe a series of lateral branches, *s*, project from it, leading from the interior of the pipe and opening into the interior of the vessel; and I prefer to make the branches of varying lengths, as shown in Fig. 2, for reasons that will appear later. The tubular portion of the pipe B terminates at or just below these branches.

C is a convex perforated diaphragm, supported by a collar, *r*, on the pipe B a short distance above the branch pipes, and which I generally mount loosely upon the shaft, so that the latter revolves within it. The diaphragm must not reach quite to the wall of the vessel. D is a horizontal perforated diaphragm, (the perforations in which may with advantage be made larger than those in the diaphragm C,) supported upon the pipe B, and which I prefer to have rigidly fixed to the shaft and revolve with it. For this purpose I employ two collars, *r'*, at this point. While advisable, it is not absolutely necessary that the diaphragm D be rigidly fixed to the shaft A, and hence one collar only may be used, if desired. The diaphragm D should be a short distance below the surface of the mercury, which is indicated by the dotted line *q*.

It is an advantage to have the branch pipes and each diaphragm adjustable to different levels, and I therefore fit the collars *r* and *r'* to the pipe B by means of set-screws *p* and use for the seat of the pipe B an adjusting-screw, *o*, passing through the bottom of the vessel. Thus the turning of the screw *o* raises or lowers the pipe B, and with it the branch pipes *s*, while the diaphragm may be adjusted as desired by shifting the positions of the collars. All the internal parts can be removed by lifting out when desired.

To use the device, the comminuted ore, wet to a pulp, is fed into the hopper *u* and the pipe B slowly rotated. The pipe B being of sufficient length to overcome the hydrostatic pressure of the mercury, the pulp is forced out of the branches *s* into the bath at different points in the same horizontal plane, owing to the different lengths of the branches, while the rotation of the branches causes a thorough mixing of the mercury and ore. Most of the metals which have a greater specific gravity than mercury immediately take a downward course. A part, however, will be carried up with the foreign substances through the perforations in the diaphragm C into the mercury intervening between the two diaphragms. The diaphragm C serves not only to distribute the rising particles, and thus bring them into a more intimate association with the mercury, but it also prevents the effect of the stirrers from reaching above it. Amalgamation takes place more or less both above and below the diaphragm, and all the amalgam, with gold, which forms between the two diaphragms descends upon the convex surface of the diaphragm C, and thence, by reason of the convexity, passes over the edges to the bottom of the vessel. Any metal that may amalgamate above the upper diaphragm finds its way through the perforations in that diaphragm and descends to the bottom of the vessel in the same manner. Amalgamation will also take place between any particles of metallic silver contained in the ore, and, although not sinking to the bottom, will be retained with the mercury, and may be separated in the usual way.

The great effectiveness of my invention is due largely to the fact that the rising matter under treatment, after leaving the comparatively turbulent stratum of mercury below the diaphragm C, enters a stratum which is in a state of nearly perfect quietude, while the final stratum through which it rises (that above the diaphragm D) is even less disturbed than the second. This quiescent state of the upper strata of the mercury is due in a great measure to the diaphragms, but even without the diaphragms it would follow to a considerable extent from the inherent property of mercury, by which internal disturbance is rendered almost wholly local, producing no general currents, and but little movement outside the immediate point of agitation.

Under ordinary circumstances I find two perforated diaphragms to be sufficient; but if it be desired to supply the bath very rapidly with comminuted ore, the number may be in-

creased to three or more. In fact the number of diaphragms within reasonable limits is a mere matter of choice. Where three are used I generally have the intermediate one only revolve with the shaft.

When the apparatus is to be stopped the feeding of pulp into the hopper should be discontinued and the pipe emptied of pulp before the revolution ceases, to prevent packing by the settling at the bottom of the heavier and coarser particles. The emptying may be effected by running in water, or in any other convenient way.

Devices other than the gravity-pipe B with branch tubes may be used for feeding the ore into the base of the mercury bath and for agitating the mixture at the proper place. If it be desired to feed the ore dry instead of wet, some suitable means would of course have to be substituted.

An endless carrier, properly arranged, might be used for feeding either wet or dry materials.

I am aware that devices for separating metals have been devised in which the ore has been introduced into the bottom of a receptacle containing mercury, and mixed with mercury, and the tailings discharged from the top after passing through a perforated diaphragm; but

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination of the vessel A, vertical pipe B, having means for rotating it, and having a hopper at its upper end, arched perforated diaphragm C, supported within the vessel A above its bottom, horizontal perforated diaphragm D, above the diaphragm C, and fixed to the pipe B, whereby it revolves with the pipe, and one or more lateral discharge-tubes projecting from the pipe B between the bottom of the vessel and the diaphragm C, substantially as described.

2. The combination of the vessel A, pipe B, having the hopper *u* and branches *s*, mechanism for revolving the pipe B, perforated diaphragms C and D, adjustable collars *r* and *r'*, for permitting the diaphragms to be raised and lowered on the pipe B, and screw-seat *o*, for permitting the raising and lowering of the pipe B, substantially as described.

3. The combination, with the vessel A, of the pipe B, having distributing-tubes of varying lengths, as set forth, mechanism for rotating the same, and one or more perforated diaphragms supported within the vessel A above the distributing-tubes, substantially as described.

SYLVANUS L. TRIPPE.

In presence of—
WM. H. DYRENFORTH,
EDWARD BECKWITH.