3 Sheets—Sheet 1.

P. PLANT.

Ore-Separator.

No. 212,051. Patented Feb. 4, 1879.

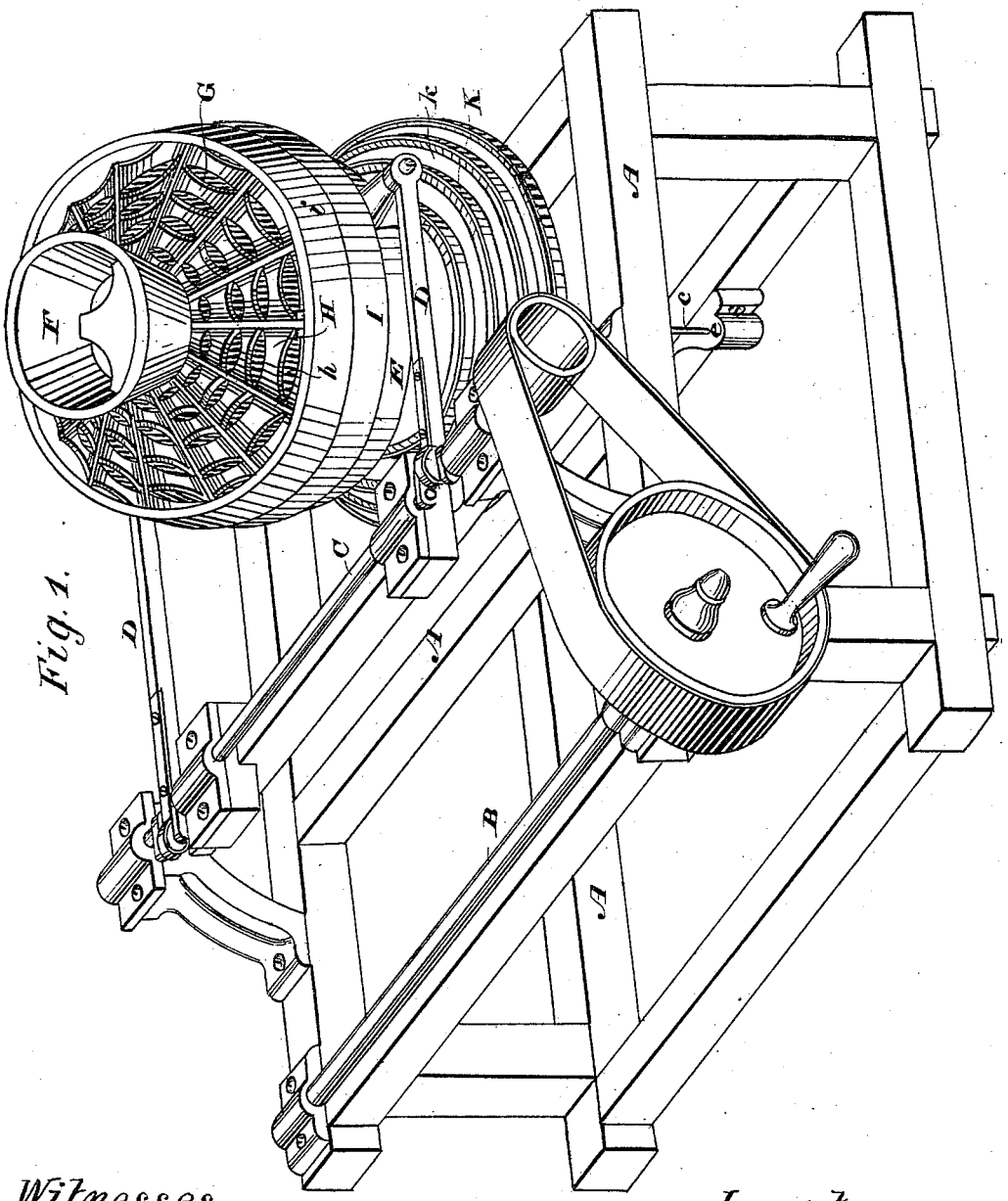

Fig. 1.

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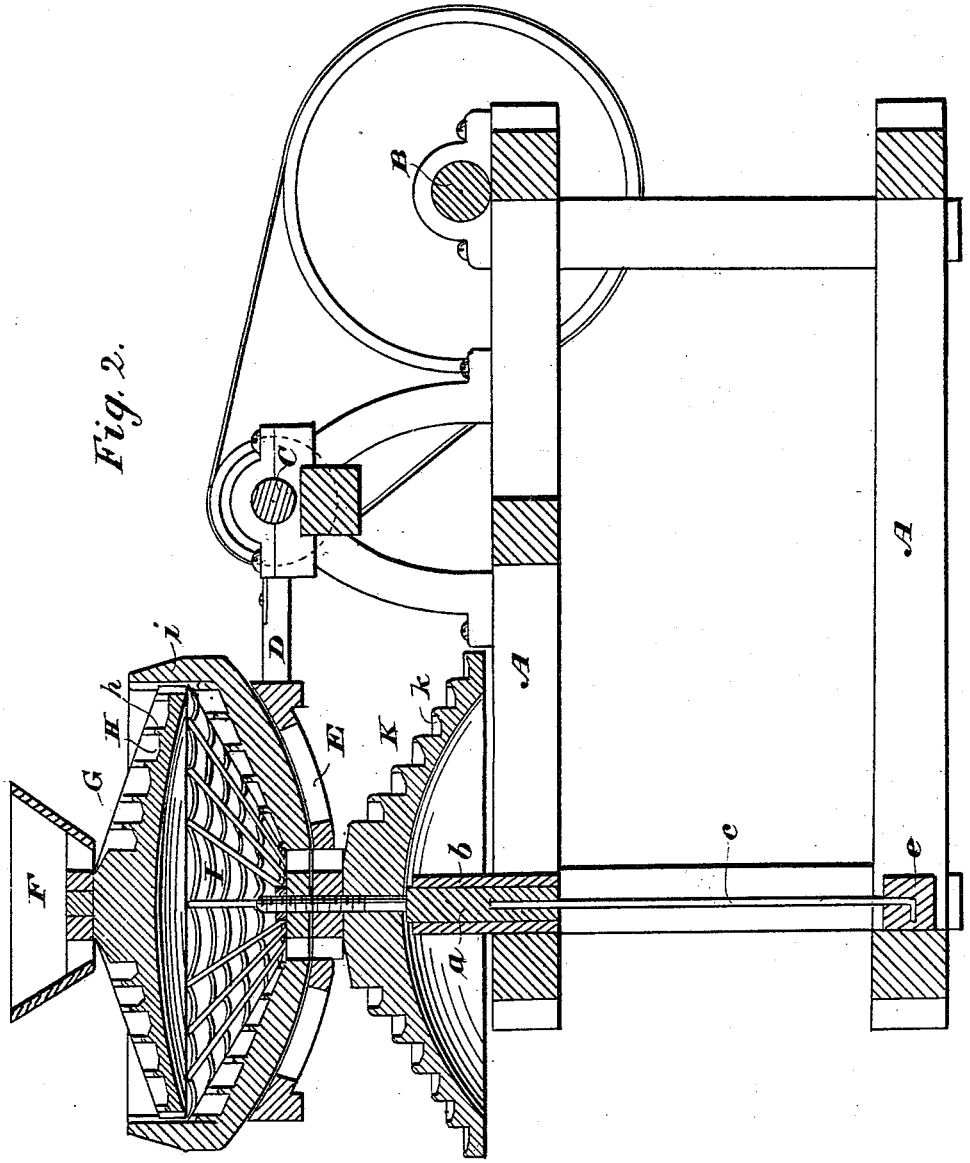
Fig. 2.



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P. PLANT.

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No. 212,051. **Patented Feb. 4, 1879.**

Fig. 4.

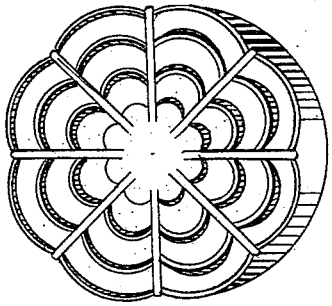
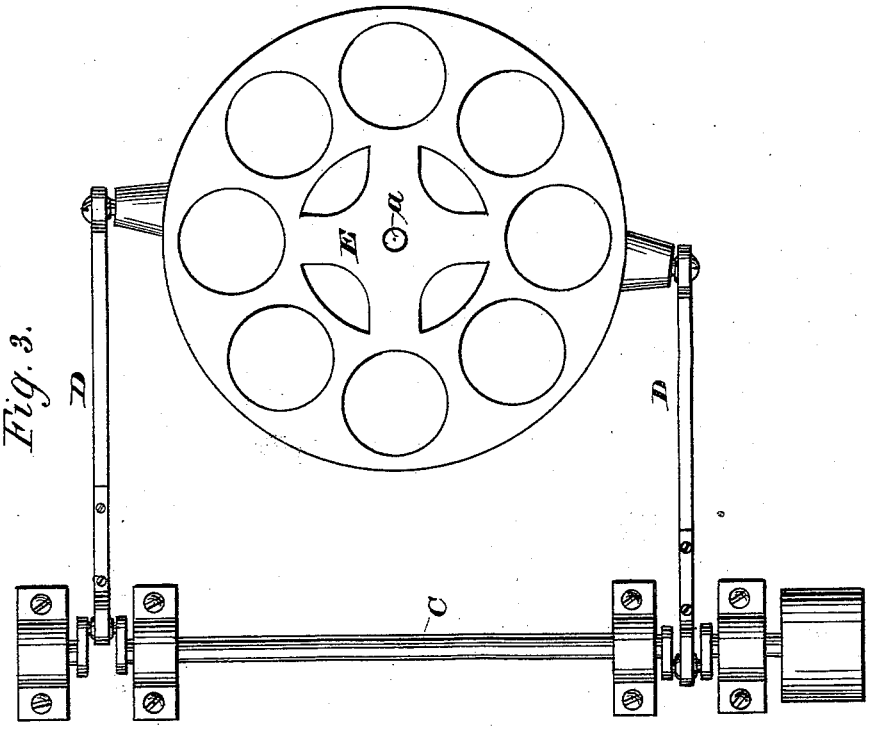


Fig. 3.



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UNITED STATES PATENT OFFICE.

PASCHAL PLANT, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN ORE-SEPARATORS.

Specification forming part of Letters Patent No. **212,051**, dated February 4, 1879; application filed November 27, 1878.

To all whom it may concern:

Be it known that I, PASCHAL PLANT, of Washington, in the District of Columbia, have invented certain Improvements in Apparatus for Dry-Separating Precious Metals from their Ores or from any substances, of which the following is a specification:

My plan is to deposit pulverized quartz or ore in suitable receptacles or separators and subject it to agitation in them on the same general principle, so far as mere primary feeding and agitation are concerned, that I have employed in several inventions, for which United States Patents have heretofore been granted to me; but upon these inventions, after long, patient, and expensive experimentation, I have made important improvements, as I will now proceed to set forth.

I have discovered, first, (and it is a fact capable of practical demonstration,) that when pulverized ore containing precious metals is placed in a receptacle in considerable quantity—such, for instance, that the depth of the layer of ore shall be about an inch or more—and then agitated, the precious metals, notwithstanding their greater specific gravity than the earth or quartz, tend to rise to the surface. I have also discovered, second, (and it is a fact practically demonstrated,) that when the same material is placed in a suitable receptacle in less quantity—such, for instance, that the depth of the layer of ore shall be from an eighth to three-eighths of an inch—and then agitated, the precious metals will penetrate the earthy matter and be collected at the bottom; but the depth of the thin layers of ore in which this penetration and separation will most successfully take place will be found to be somewhat variable with different ores. The lightest particles of metals will generally penetrate about one-eighth of an inch of earthy matter and collect at the bottom, while the heavier particles will penetrate about two, or in some exceptional cases even three, eighths of an inch, and be similarly collected.

It is upon these facts which I have developed by experiment that my present invention is predicated.

I have found that if gold-bearing sand, gold mingled with dry earthy matters in the natural state, pulverized ore, or quartz (and the same is true of any other fine metal-bearing substance) be placed in a thin layer, as described, at the bottom of a receptacle, and then there be placed over it dry earthy matter to the depth of one or more inches, or such that the weight of the earthy matter shall be appreciable in effect, and the whole be then subjected to agitation, the gold particles will inevitably tend to rise to the top, and will not be separated and collected at the bottom, but will gradually pass away with the continuous discharge of the earthy matter if the supply and agitation be continuous. I therefore deem it very important to use the thin layers only, and the discovery of the advantage of using such thin layers of fine dry metal-bearing substance to be deposited and agitated without the disturbing effect of any considerable body of matter to be agitated with it is of the essence of my invention.

The essential condition of practical success is always that the layers shall be so thin that the bulk of earthy matter, as compared with the particles of precious metal, shall be weightless under agitation, and shall leave the fine particles of precious metal undisturbed by any moving substance that will cause them to rise, and subject to their natural downward tendency by gravity, like pure sand in water. Under this condition only is penetration to the bottom by the fine particles and their collection there assured.

I am aware that what might be called, in speaking loosely without knowledge of my present method, thin layers of ore have been agitated in receptacles containing recesses, as shown, for instance, in patents heretofore granted to me and to others; but I am not aware that the real method I have now adopted, or the reasons for its adoption, have been understood and applied, and hence, where water has not been used, either mercury or amalgamators have been employed, wherever any substantial degree of success on a practical scale has been attained in dry separating.

I provide agitating mechanism of any suitable kind to give a reciprocating motion to separators of suitable construction to carry out the mode of operation indicated on a practical scale.

In the accompanying drawings I have illus-

trated the best form of apparatus now known to me for carrying out my method.

Figure 1 represents a perspective view of my apparatus; Fig. 2, a vertical central section of the same; Fig. 3, a plan view, and Fig. 4 a modification of certain parts shown in the other figures.

A indicates the main frame; B, the driving-shaft with a driving-pulley; C, a driven double-crank shaft and pulley; D D, pitmen connecting the cranks with the sides of the agitating basket or support E.

The purpose in using two cranks and driving-pitmen on opposite sides of the basket is to obtain more durable, equable, and efficient action, and to give, as nearly as may be, an exactly-corresponding impulse to each side, so that ore and precious metals in the separators will not greatly tend to gather more upon one side than the other, which, with some constructions, would be the effect if but one crank and pitman were employed. This injurious effect is, however, entirely prevented by the radial partitions in some of my separators, to be presently described, and is only liable to be produced with respect to such separators as are without corresponding partitions. The basket is secured rigidly to a shaft, *a*, which is supported in an elongated bearing, *b*, secured to one of the cross-beams of the main frame. Attached rigidly to the lower end of the shaft *a* is a torsional spring, *c*, which is fastened at its opposite end to a bracket, *e*, on the main frame, and is so adjusted as to resist circular motion of the basket and shaft in either direction during their reciprocations by the operation of the gearing and pitmen just described. The object of this spring is to counteract the momentum of the basket and its superincumbent weights, and prevent shocks and wear and breakage of the machinery.

F is a hopper, with suitable distributing-openings in its bottom, for receiving the ore to be delivered into the separator G below, which is of peculiar and novel construction. As shown in Figs. 1 and 2 of the drawings, it consists of a concavo-convex disk in general outline, and it may be connected in any suitable manner with the basket, so as to be agitated by and with it—as, for instance, by a screw-threaded elongation of the shaft *a*, and a nut to clamp it down to the basket, or by screws near its circumference. On the upper surface of this separator are formed radial curvilinear grooves inclining and flaring outward toward the circumference, and provided at their bottoms with recesses H, separated by lateral partitions *h*. The bottoms of these recesses are curvilinear from one radial partition to another, but horizontal from one lateral partition to another. The lateral partitions, however, are not alike in outline on their opposite sides, their lower or outer sides being perpendicular and their upper or inner sides being curved or inclined from the bottom of each recess to the top of each partition. Each lateral partition, owing to its location in the inclined radial groove in the upper surface of the separator, is lower in position than its adjoining inner partition, so that as the material falls into the recess, and partially fills it, it will, under agitation, pass over the top of the partition, down perpendicularly into the next lower recess, and so on to the outer margin of the separator, the particles of gold collecting successively at the bottom of each recess. In addition to being lower in position, each lateral partition is also lower than its adjoining inner partition, the object being that the inner recesses shall receive a thicker layer of ore for agitation, and secure larger particles of precious metal than the outer ones. By this means every particle of precious metal can be saved.

Where but one separator, such as described, is employed, as it may be in some cases, the entire separation is effected in the manner just indicated, and the excrescent earthy matters pass over the outer edge of the basket to the ground or to a conveyance for removal; but in other cases I may desire to carry on the operation of separating on the same principle to a greater extent, and therefore I provide an additional separator, I, located immediately below the first one, to the outer margin of which the ore already treated by the first separator will be delivered. This second separator may be supported, as shown, in a band, *i*, and rest on the basket, and it is formed upon the same principle as the first, except that it is funnel-shaped, and the ore delivered near its circumference is to pass inward and find its exit through suitable openings in its center, the gold being deposited in similar recesses, with corresponding partitions, except that the curves or inclines of the lateral partitions are on their outer instead of their inner sides.

Where it is desirable to continue the separating operation still further, the ore passing from the second separator is delivered from its center upon the center of a third conical separator, K, of different construction from those already described in that it has no radial partitions, but is provided with circular recesses *k* and circular partitions, one outside of the other, in succession, to the circumference. The ore being agitated in the top recess passes over the circular partition into the next recess, and so on to the outside of the separator, substantially as already described with respect to the first separator, the formation of the circular partitions being the same in side outlines as the first described.

It will be observed that in the operation of the first and second separators the ore and precious metals are given a circular reciprocating and a circular sliding motion—in other words, their absolute motion is from side to side and up and down—and is due to the curvilinear shape of the bottom of each recess between the radial partitions, while in the third separator there is only a reciprocating

circular sliding motion on a horizontal plane. The peculiar formation of the recesses and partitions and the resultant movement of the ore, as described in connection with the first and second forms of separators, are very important in practical effect, because no angles are presented to clog the movement of the ore, which always glides smoothly under agitation and keeps spread out, never striking any shoulders or abrupt obstructions to cause it to pile up, which would be detrimental to the operation of separating. It will also be observed that in the third separator the lateral partitions of the recesses first to receive the ore are the highest, and that the partitions diminish in height both absolutely and relatively, and the recesses consequently in depth from center to circumference, the object being the same as in the first and second separators—viz., to collect in the recesses having the highest partitions and the greatest depth the larger particles of precious metal, which will penetrate a deeper layer of ore than the smaller particles. The larger particles will in the first and third separators described be collected successively in the deeper recesses near the center, while in the second separator described they will be collected in the deeper recesses near the circumference.

From the foregoing it will now be understood that the operation of my improved apparatus for dry-separating precious metals from their ores consists essentially in depositing fine ore, sand, or ground quartz in thin layers, as described, (such that penetration of the larger particles of precious metals under agitation will take place,) in a series of shallow recesses of such form that it will continually glide under agitation without tendency to pile up in continuously feeding it and agitating it in said recesses, so that after separation of the larger particles of precious metal, as described, the ore will glide over and be deposited in still thinner layers in similar but shallower recesses on a lower level, where comparatively finer particles of precious metals will be collected under agitation, and so on successively until complete assortment and separation of all the different-sized particles of precious metals and final delivery over of the earthy matters are effected.

Instead of forming a conical separator like that first described, I may form a similar one of a disk, such as shown in Fig. 4, by cutting out the necessary grooves and recesses and forming the proper partitions in its upper surface.

In the manufacture of these machines it is important to adapt the length of the cranks and the throw of the pitmen and the resulting length of reciprocations of the separators somewhat to the length of the recesses between the radial partitions, so that reciprocations shall not be so great as to be liable to throw the fine ore over the radial partitions.

I do not confine myself to the exact details herein described, either with respect to the separators or the mechanism for agitating, so far as my mode of operation is concerned, because it will be obvious to mechanicians, as soon as my patent is examined, that many variations in mere mechanical construction and mechanical operation beyond that which I have illustrated can be adopted without departure from my method of dry-separating ores of the precious metals. It is my design to apply my method and apparatus especially to separating gold from pulverized ore, auriferous sand, or ground quartz, but it is applicable to other metals and materials.

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

1. A separator provided with a series of shallow recesses with curvilinear bottoms on different horizontal planes, said recesses being divided by partitions curvilinear on one side and perpendicular on the other, and which partitions differ in height both relatively and absolutely, as described.

2. A circular separator provided with radial partitions, with shallow recesses between, and with lateral partitions of substantially the outline described on their opposite sides.

3. A circular separator provided with a series of shallow annular recesses on different horizontal planes, separated by annular partitions perpendicular on one side and inclined or curvilinear on the other, substantially as described.

In testimony whereof I have hereunto subscribed my name.

PASCHAL PLANT.

Witnesses:
JOHN F. PARET,
DELOZIER DAVIDSON.