2 Sheets—Sheet 1.

J. COLLOM.

Ore Separator.

No. 202,995. Patented April 30, 1878.

Fig: 1.

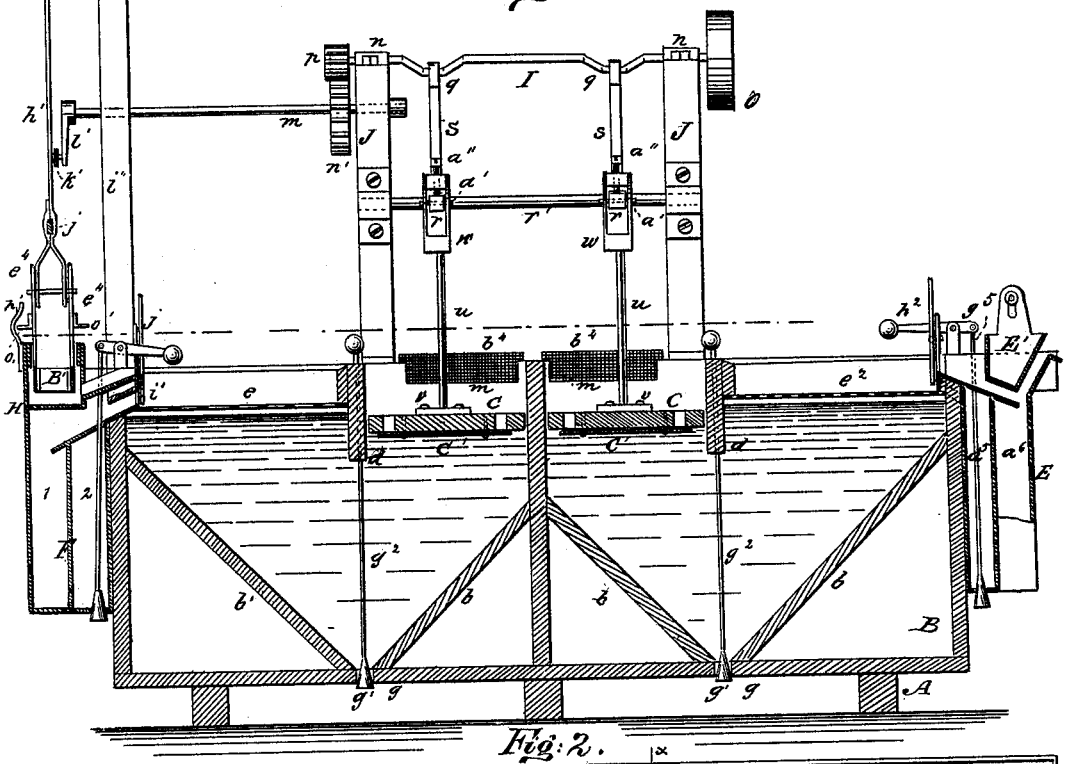
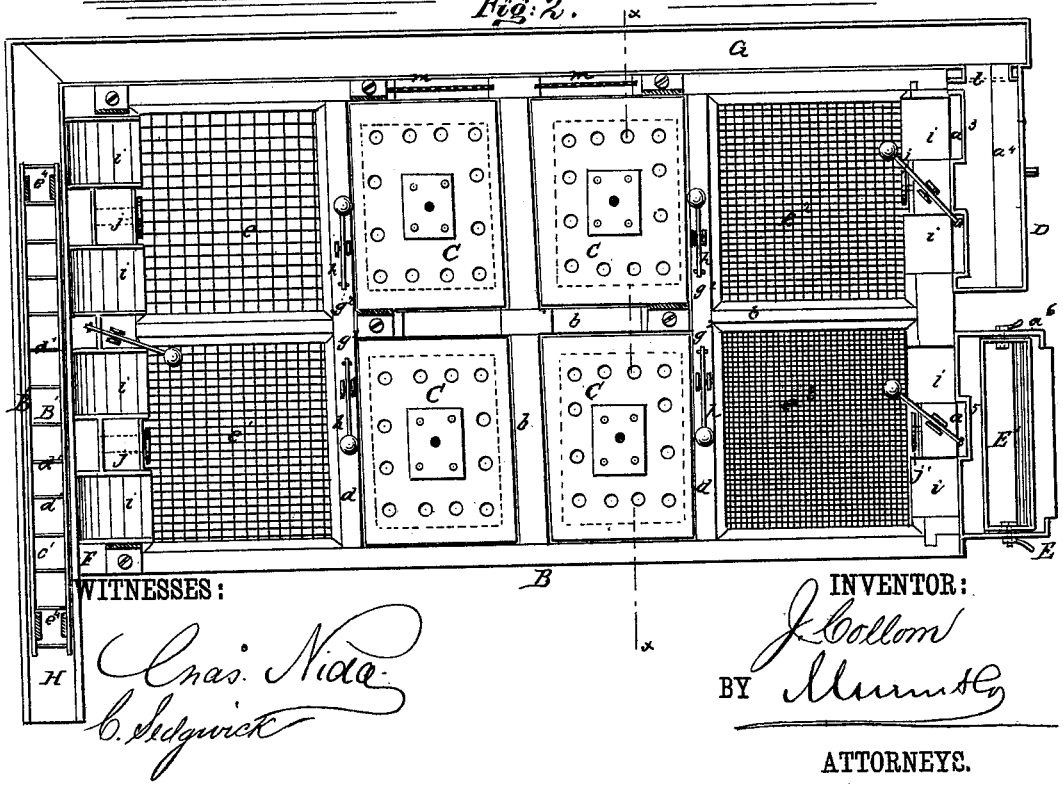


Fig: 2.



WITNESSES:

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C. Sedgwick

INVENTOR:

J. Collom

BY Munn & Co

ATTORNEYS.

2 Sheets—Sheet 2.

J. COLLOM.

Ore Separator.

No. 202,995. **Patented April 30, 1878.**

Fig: 3.

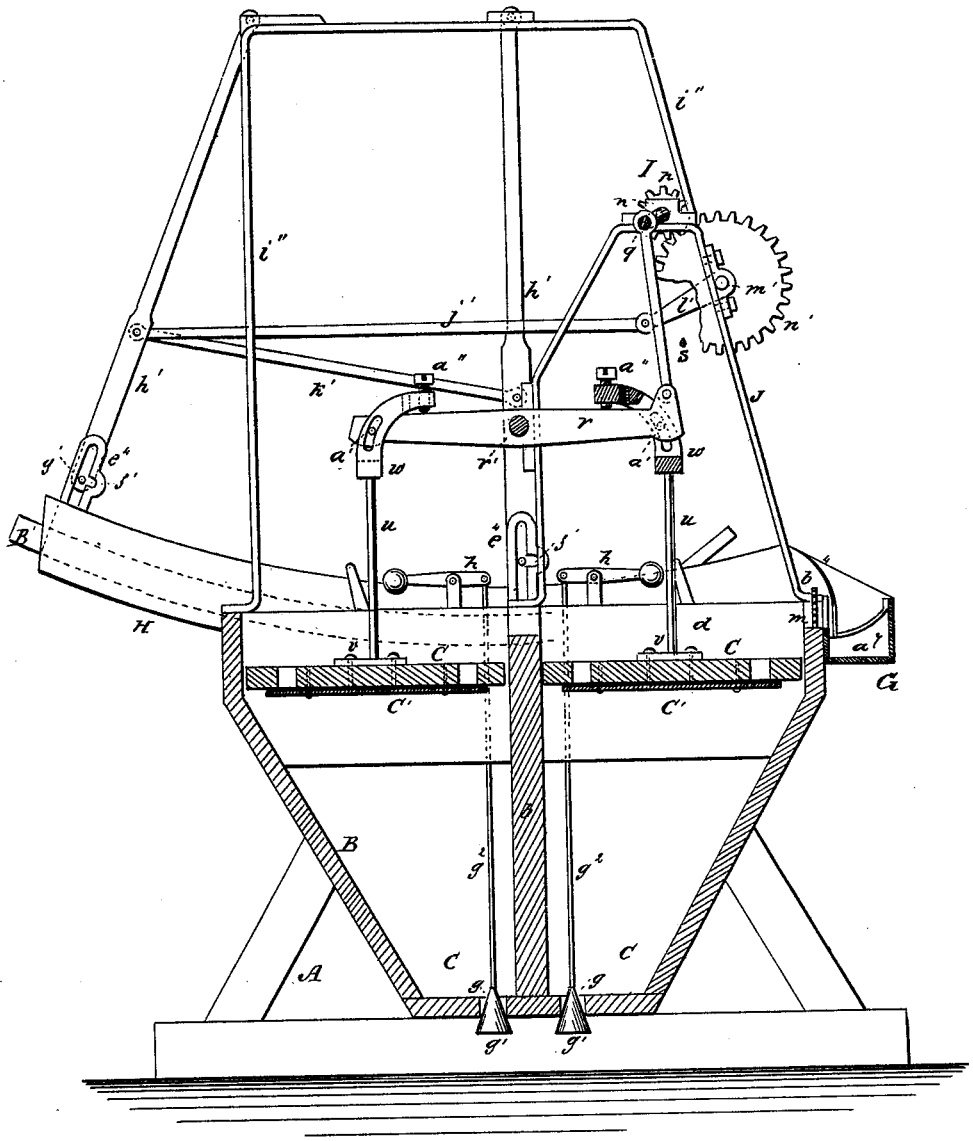


Fig: 4.

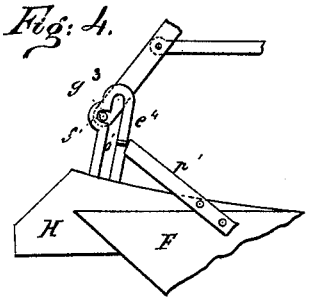
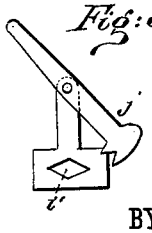


Fig: 5.



WITNESSES:

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INVENTOR:

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UNITED STATES PATENT OFFICE.

JOHN COLLOM, OF GOLDEN, COLORADO.

IMPROVEMENT IN ORE-SEPARATORS.

Specification forming part of Letters Patent No. **202,995**, dated April 30, 1878; application filed January 16, 1878.

To all whom it may concern:

Be it known that I, JOHN COLLOM, of Golden, county of Jefferson, and State of Colorado, have invented a new and Improved Ore-Concentrator, of which the following is a specification:

Figure 1 is a longitudinal section of my improved ore-concentrator. Fig. 2 is a plan view. Fig. 3 is a vertical transverse section taken on line *x x* in Fig. 2. Figs. 4 and 5 are detail views of portions of the apparatus.

Similar letters of reference indicate corresponding parts.

My invention relates to improvements in machinery for separating and concentrating metalliferous ores; and it consists in a combination of devices whereby the following advantages are secured: A larger quantity of ore can be treated in a given time; a greater number of sizes or grades of ore can be worked simultaneously; less water is used; less valuable ore is lost; the operations are less expensive, and capable of more perfect control and adjustment than has been possible with apparatus heretofore in use.

Referring to the drawings, A is a frame, of suitable size and strength to support the several parts of the machine; and B is a tank, of wood or metal, which is divided by partitions *b b*, &c., forming receptacles or pockets *c*. The upper portion of the tank is further divided by the transverse partitions *d d*, and forming four compartments, two at each end, for receiving the four sieves e e^1 e^2 e^3, and also four compartments for the four perforated plungers C. Flexible rubber valves C′ are secured to the under surface of the plungers, and close the perforations in the plungers at every downward stroke.

The tank has four outlet-apertures, *g*, in the bottom, one in each pocket. These apertures are closed by conical valves g^1, secured to rods g^2, which are connected with counterweighted levers *h*, fulcrumed in standards projecting from the partitions *d*. These counterweighted levers tend to keep the valves closed.

At each end of the tank B there are four discharge-sluices, *i*, two in each sieve-compartment, for the discharge of sands; and there are in each end of the tank two outlets, i^1, controlled by sand-gates *j*, for the escape of mixed ore.

The outlets *i′* are of rhombic shape, and the sand-gates *j* are pivoted to standards *j′* that project upward from the ends of the tank, and have V-shaped notches corresponding in form to one-half of one of the outlet-openings *i′*, so that the opening may be contracted to any desired degree, or closed altogether.

At one end of the tank there are two conical receptacles, D E, and at the other end a larger single conical receptacle, F, for receiving a portion of the products of the separation. Along the side of the tank there is a conduit, G, which communicates with the receptacle D through a sluice or opening, *l*, and communicates with the piston-compartments through screen-covered openings *m*, and is in communication with the conical receptacle F, and also with a curved trough, H, that is placed above and secured to the said conical receptacle. The partition *b* is notched, to afford communication between the adjacent plunger-compartments.

A shaft, I, is journaled in boxes *n* on the standards J mounted on the tank B, and has upon one end a pulley, *o*, and upon the other a spur-pinion, *p*, and in it two short cranks, *q*, are made, which are arranged at right angles to each other, and connected with the oscillators *r*, which are supported by the rod *r′*, which is attached to the standards J. Each oscillator is connected, by a pitman, *s*, with one of the cranks *q* in the shaft I.

The plungers C are connected with the oscillators *r* by rods *u*, that are secured to plates *v*, that are bolted to the plungers, and are provided at their upper ends with adjustable heads *w*, whose side pieces are slotted to receive the pins *a′*, that pass transversely through the oscillators *r*, and the heads *w* are curved over toward the axis of the oscillator, and provided with adjusting-screws *a″*, which bear upon the top of the oscillators.

The curved trough H contains a scraper, B′, which consists of curved side pieces *c′* and cross-pieces *d′*. On each side of the scraper, at opposite ends, vertical slotted ears e^4 are secured. At the side of the slots in these ears notches *f′* are made, which receive pins g^3, carried by the swinging arms h^1. These arms are pivoted to a frame, *i″*, which is mounted on the tank B, and they are connected together by a rod, *j′*, and one of them is connected, by

a rod, k', with a crank, l', on the shaft m', this shaft being provided with a spur-wheel, n', which is engaged by the pinion p on the shaft I. Feet o' are formed on the sides of the ears e^4, which rest upon the edges of the curved trough when the scraper makes its forward movement, and supports the scraper a short distance above the bottom of the trough H. When the scraper is moved forward by the crank l' the pins q' in the swinging arms h^1 are received by the notches f' in the ears e^4, so that when the scraper is moved backward it is lifted by the swinging arms, the pivots of which are placed eccentrically in relation to the curved trough. At the end of the stroke of the scraper one of the feet o' is engaged by a spring-latch, p', secured to the side of the curved trough, so that when the arms h^1 again move forward the scraper is retained until the pins g^3 are disengaged from the notches f', when the scraper drops, and is moved forward, carrying with it the sands flowing from the sieves $e\,e^1$. The conical receptacle D is divided by a vertical partition into two compartments, $a^3\,a^4$. The sluices i communicate with the compartment a^3, in the bottom of which there is an aperture, which is closed by a conical valve, which is connected, by a rod, g^5, with the weighted lever h^2.

At the top of the receptacle E there is an adjustable gage, E′, which is supported above the sluices by bolts, that pass through ears formed on the receptacle and on the end of the gage.

The sluices i, that discharge from the sieves $e\,e^1$, deliver the coarse sands to the curved trough H, and the sand-discharge openings i, that are above the sieves $e\,e^1$, communicate with the compartment 1 of the conical receptacle F, which is divided into compartments 1 and 2, as in case of the receptacles D E. In the bottom of the said receptacle there are apertures, which are closed by a counterweighted valve, as in the case of the receptacles D E.

Minerals are separated by my improved machine in the following manner: The crushed and sized crude ore, consisting, for instance, of copper pyrites and quartz, is carried by a current of water through suitable spouts and delivered upon the sieves—the coarser size upon the sieve e, the next finer on the sieve e^1, the next on the seive e^2, and the finest on the sieve e^3—and the tank is filled with water to within a half-inch of the top. The shaft I is driven by a belt running over the pulley o, and the plungers C are moved by the cranks q through the medium of the connecting-rods s, oscillators r, and rods u, having the adjustable heads w. The plungers make a quick downward stroke, and rest while the oscillators rise until they strike the adjusting-screws a', when the plungers are slowly raised, the slow motion being secured by taking the power for the upward stroke from a point between their ends and pivot. The relative length of the downward and upward stroke and the period of rest are regulated by the screws a''.

The plungers, on being rapidly depressed—from one hundred to one hundred and thirty times per minute—cause the water to lift all of the ore on the sieve at each pulsation from one-half inch to an inch. While the striking ends of the oscillators make a stroke of from three to five inches, the plungers make a stroke of from one to two inches only, the stroke of the plungers depending on the fineness of the ore—coarse ores requiring a longer, and fine ores a shorter, stroke. A very rapid and comparatively short downstroke is essential to the proper treatment of both coarse and fine ore, and a slow upward stroke is necessary, especially for fine ore. The period of rest is also important, as it allows of the settling of the lifted ore before the oscillators, by touching the adjusting-screws, raise the plungers.

By this improved device the exact motion required for the perfect separation of both coarse and fine ores of all metals is secured. There are two holes in each head w for receiving the adjusting-screw a''. For coarse ore the screw will be placed in the outer holes, and for fine ores in the inner holes. The perforated and valved plungers assist largely in effecting a ready and complete separation of the minerals, as the water is allowed to pass freely down through the plungers, thereby avoiding all suction upon the ore on the sieve. Ore being in this manner repeatedly lifted by the water, the minerals arrange themselves according to their respective specific gravities. The pure metallic ore sinks below the earthy matters and passes through the meshes of the sieve, and is received by the receptacle c below. The pure quartz rises to the top, and passes out through the sluices i into the trough H, also into the compartments $a^4\,a^5$ of the receptacles D E, while the mixed ore or particles, consisting of ore and quartz, pass out through the sand-gates into the proper compartments of receptacles D E F. The coarse sand that enters the trough H is scraped out of the water by the scraper B′. With well-classified ore there is always more or less very fine ore, that continues suspended in the agitated water; and large particles of rich brittle ores of lead, copper, &c., by striking each other while running through the spouts into the sieves, and while being separated on the sieves, will become more or less pulverized, and will produce such fine ore, which would pass off with the sand and be lost were the gangue and water discharged together in the usual manner. The conical receptacles D E F are designed to prevent the loss of such fine particles of ore. The gangue passes from the sieve e^2 over the sluices i, through a narrow slit into the compartment a^3, while the water does not follow the sand, but passes into the larger upper part of the compartment a^4, and the fine ore, previously held in suspension by the agitation of the water, will settle down with the mixed ore, that passes into that compartment through the sand-gate i, so that in this manner the fine ore will be saved, as it will accompany the mixed ore, when the latter

is recrushed and concentrated by the slime-machinery.

With the less-perfectly sized ore treated on the sieve e^3 there will be a large quantity of such fine ore passing from the sieve with the sand. The object of the V-shaped adjustable gage or space-contractor E′, in the upper part of the receptacle E, is to facilitate the washing of such fine ore from the sand, and the carrying it off with the wash-water to the slime-machinery. By raising or lowering this V-shaped gage, the space between it and the top of the partition will be made wider or narrower, and consequently the force of the water passing down and up through this channel will be proportionately diminished or increased; hence it can be regulated so as to carry off all the fine rich ore contained in the sand. The water used in all of the sieves will finally escape at this place, carrying with it much fine ore that will be saved by the slime-machinery, but which, without this contrivance, would be lost. When necessary, the mixed ore from the compartments a^3, a^5, and 1 can run off continually through the small spouts at the bottom of the conical receptacles to the recrushing-mill. The water used in this concentrator is used repeatedly, and is purified by settling in the trough G and in the receptacles D and F, the trough G communicating with the latter through the spaces a^7 under the end of the curved trough H.

By the peculiar arrangement of the plungers the water is continually circulated throughout every part of the machine.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination of grated openings m with the plunger-chambers, the receptacles D E F, and the trough H, as and for the purpose described.

2. The combination, with the plungers C, of the rods u, plates V, adjustable heads w, and oscillators r, as and for the purpose specified.

3. The combination of the conveyer B′ and curved trough H with the tank B, containing sieves e e^1, as herein shown and described.

4. The combination, in an ore-concentrator, of the comparted tank B, containing sieves e e^1 e^2 e^3 and plungers C, the conical receptacle D E F, the conduit G, curved trough H, and conveyer B′, substantially as specified.

JOHN COLLOM.

Witnesses:
L. J. SMITH,
A. G. SMITH.