S. R. KROM.

Ore Separator.

No. 59,509. Patented Nov. 6, 1866.

Fig: 1.

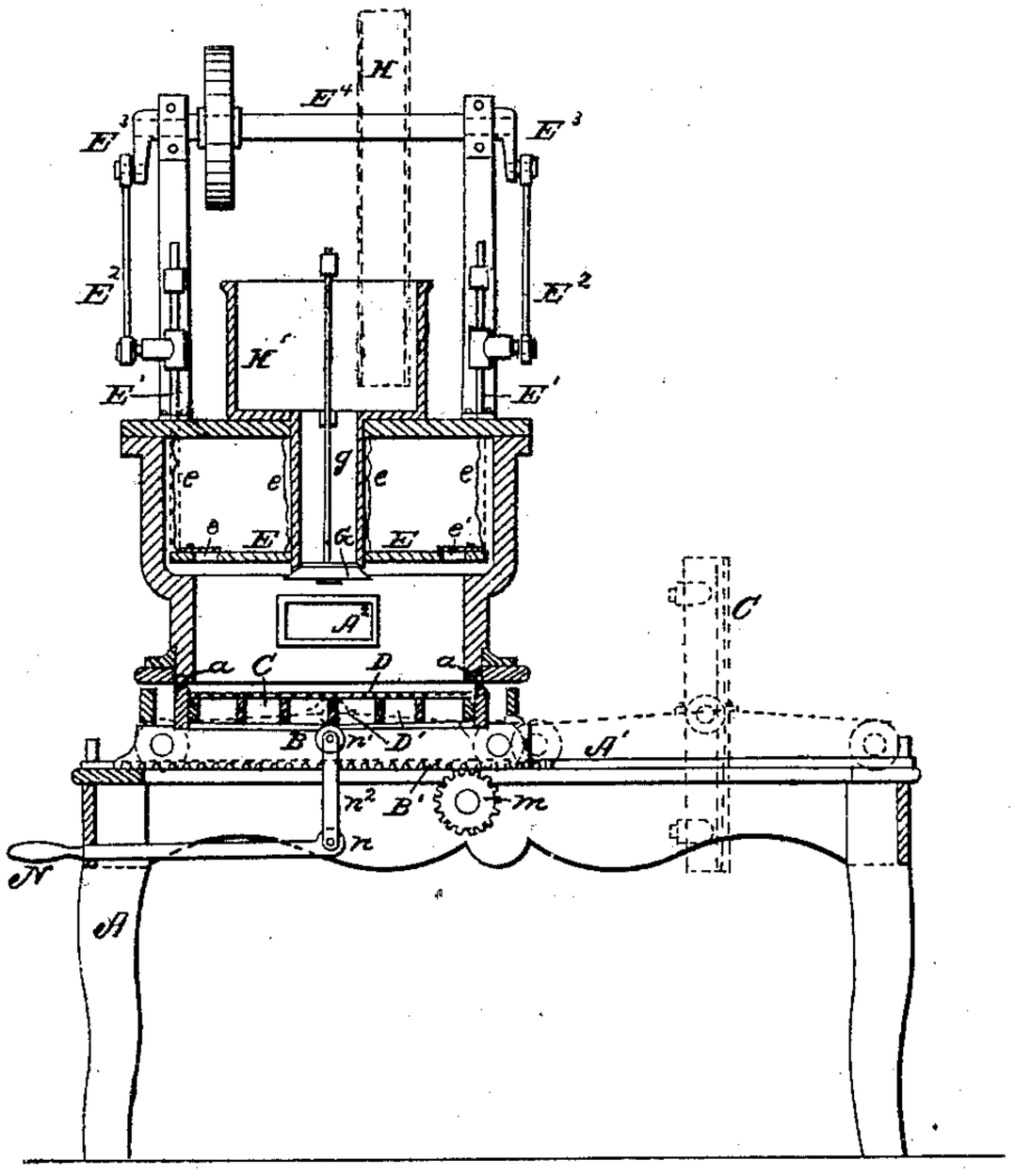


Fig: 3.

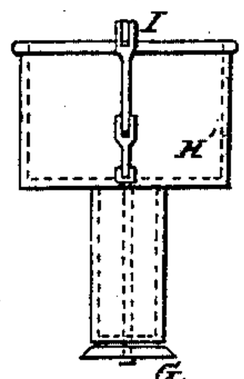


Fig: 4.

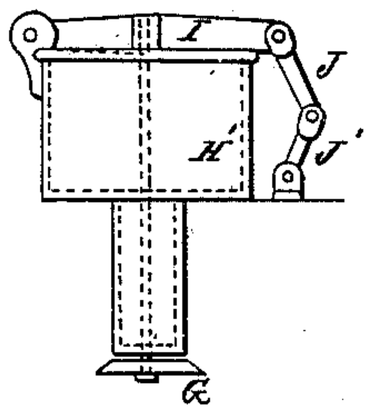


Fig: 5.

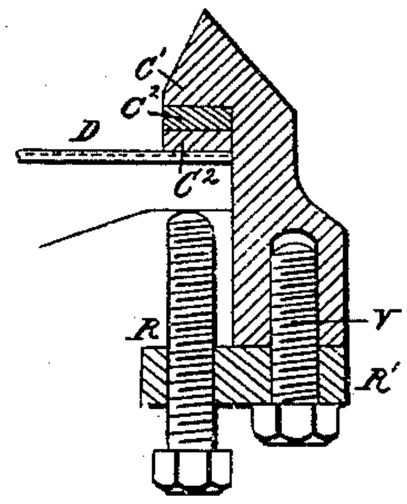
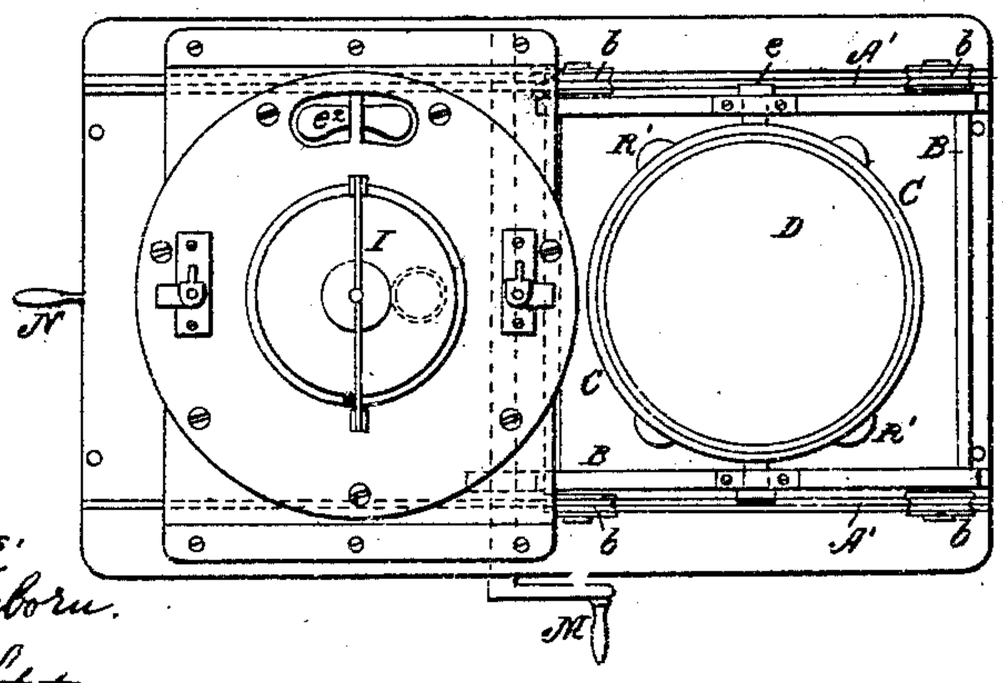


Fig: 2.



Witnesses:

D. L. Freeborn.

D. W. Stetson.

Inventor:

Stephen R. Krom.

UNITED STATES PATENT OFFICE.

STEPHEN R. KROM, OF NEW YORK, N. Y., ASSIGNOR TO LOUIS F. THERASSON, JOHN A. BRYAN, JAMES M. BLACKWELL, AND APOLLOS R. WETMORE, OF SAME PLACE.

IMPROVED APPARATUS FOR SEPARATING METALS FROM ORES.

Specification forming part of Letters Patent No. **59,509**, dated November 6, 1866.

To all whom it may concern:

Be it known that I, STEPHEN R. KROM, of New York, in the county and State of New York, have invented certain new and useful Improvements in Machines for Concentrating or Separating Ores and other Material in a Pulverized or Granular Condition; and I do hereby declare that the following is a full and exact description thereof.

This invention, as also another for which I ask a separate patent, relates to that class of machines in which currents of air or other fluid are passed upward through the material in opposition to gravity and caused to agitate it at intervals. The particles so situated tend to arrange themselves according to their specific gravities, the more dense, or those in which the material is heaviest, lying in a stratum at the bottom and the lighter lying above.

I will first proceed to describe minutely what I consider the best means of working out this invention, and afterward to point out the features which I claim as new.

The accompanying drawings form a part of this specification; and my description will be confined to the treatment of ores, except where other substances are particularly specified.

Figure 1 is a vertical longitudinal section through the center of the bellows and other working parts of my ore-separating machine, showing the perforated bed both in its working position and also when brought out and tilted. Fig. 2 is a plan view of the same with the perforated bed brought out preparatory to tilting. Fig. 3 is a side elevation of a portion of the same, showing the feed-hopper and the toggle-joint J J′. Fig. 4 is a view of these parts at right angles to the view in Fig. 3, and Fig. 5 is a cross-section of a portion on a larger scale.

Similar letters of reference indicate like parts in all the figures.

The tints are employed to distinguish the parts, and not to indicate materials.

A A is the fixed frame-work. A^1 A^1 are ways or rails, adapted to guide the wheels *b b* of the traveling carriage B.

C is a ring, mounted on trunnions *c*, which are supported on the carriage B, so as to allow the ring C to be turned or tilted, as indicated in red outline in Fig. 1.

D is a sieve, of wire-cloth or analogous perforated material, supported on a grate, so as to allow it to support a considerable mass of ore. The sieve and grate are confined within a ring, C, and tilted therewith.

The portion of the framing A which is above the path of the carriage B is made air-tight, and provided with glass windows A^2, through which the working of the ores in the interior can be readily observed. The upper portion is a cylindrical casing, and contains an annular bellows, worked from above, as represented. Through a fixed tube in the center of the bellows the ore is fed down at will. A plane annular face, *a*, is presented on the lower face of the upper portion of the framing, and means are provided for pressing up the traveling ring C into air-tight contact with this fixed ring *a* when required.

E is the lower board of the annular bellows. The leather of the bellows is indicated by *e*. The lower or induction valve of the bellows is indicated by e^1, and the upper or delivery valve of the bellows is represented by e^2. A reciprocating vertical motion is communicated to the lower board, E, through the medium of two vertical rods, E^1 E^1, which are guided in the upright position by the framing, as represented, and are impelled by pitmen E^2, which descend from cranks E^3, fixed on the shaft E^4, which is rotated by a belt or other means. (Not represented.)

G is a conical valve mounted on the rod *g*, and suspended at the lower portion of the fixed feed-spout H, before referred to, which leads down through the center of the bellows E *e*. The valve-rod *g* is attached at its upper end to a lever, I, which extends across the hopper H′. This lever I is supported at its movable end by a pair of links, J J′, arranged to lift the lever I, and to hold it suspended, in the manner known as the "toggle-joint." When the toggle is straightened by hand or otherwise, it lifts the valve G with great force and closes tightly the passage, so that no ore can be fed down through the feed-spout H. The valve G, or the annular surface against which it acts, may be faced with rubber or other

elastic material, to allow particles of ore to be caught and retained between the surfaces without deranging the action.

Operation: The ore, after being broken into minute fragments by any convenient crushing-machine, is introduced in the hopper H′, and keeps the feed-spout H filled. The ring C being turned into a horizontal position and the hand-crank M operated, the two gear-wheels *m m* on the shaft of the hand-crank operate the racks B′ on the under side of the traveling carriage B, and thus carry the ring C under the ring *a*.

Having thus placed the sieve or perforated bed D in the proper position horizontally, I next proceed to lift it, so that the sharp edge at the top of the ring C shall be pressed into air-tight contact with the fixed ring *a*. This ring *a* is faced with india-rubber, in order to make the joints more perfect. I raise the parts by the hand-lever N, which turns on the fixed pivot *n*, and which carries the roller n^1 at the top of its vertical arm n^2, so that the roller n^1 acts against the under surface of the grate D′. The hand-lever N is in its depressed position, and the wheel or roller n^1 is consequently out of the line of the center of the bed D when the latter is being moved into its position under the ring *a;* but after this movement has been effected, the hand-lever N is elevated, so as to carry the roller n^1 to the center of the grate D′. This movement causes the roller N′ to act against the bottom of the grate D′, elevating it, and with it the perforated bed D and the entire ring C, a small distance, sufficient to press the sharp edge of the ring C into air-tight contact with the fixed ring *a*. I now touch the toggle-joint J J′ and draw it out, so as to bend the toggle and depress the lever I. This lowers the valve G, and allows the broken material to flow through the annular opening thus formed, and be poured upon the perforated bed D below. When a sufficient quantity has thus fallen, which is observed through the glass A^1, before described, I press inward the toggle-joint, so as to straighten the links J J′ and raise the lever I. This raises the valve G and closes the aperture.

The annular bellows E *e* is now operated, and at each lifting a partial vacuum is produced over the ore on the bed D, and the external air flows upward through the perforations in the bed D, elevating the ore to a slight extent and agitating it.

It will be understood that the lifting of the bellows E *e* is in fact the closing of the bellows, expelling its contained air through the delivery-valve e^2, which may communicate either directly with the external air, as represented, or through a pipe to any convenient chamber, in which any fine dust it carries may be allowed to deposit; or it may deliver through the walls of the building and deposit the dust upon the earth outside. The lowering of the bellows E *e* by its opening motion will cause it to receive the air through the induction-valves e^1, and during this period the ores on the perforated bed D are allowed to settle quietly. Each lifting of the bellows raises the ores, and each depression allows them to come to rest again, but each time with a rearrangement of the particles or grains, and the heavier particles soon take the lowermost position by reason of their superior gravity.

After this operation has continued a sufficient time to effectually separate the heavier from the lighter material, the ring C and its contents may be lowered by lowering the hand-lever N, the bellows E *e* being stopped, or allowed to continue its operation, as may be preferred. The carriage B and its contents are now run out by operating the hand-crank M. In doing so the uppermost strata of the material is removed by the scraping of the fixed ring *a* across the top of the movable ring C, but carrying the dense matter lying in thin strata within the ring C. The light material thereby removed is allowed to fall upon the floor, or into any convenient receptacle or spout. (Not represented.) When the carriage B and its contents have moved clear of the ring *a*, the ring C and its contents are tilted, as indicated in red outline in Fig. 1, and the contents discharged into a separate pile, or into a separate receptacle, from the light material. The entire round of operations may now be repeated, and so on continuously.

A feed-spout, H^2, (indicated in red outline in Fig. 1,) may lead into the hopper H^1 from a reservoir of pulverized ore at a high level, (not represented,) so as to keep the hopper H^1 constantly supplied without overflowing.

It will be observed that the depth of the strata of dense material preserved and removed on moving out the carriage B from under the ring *a* depends on the depth of the perforated bed D below the upper edge of the ring C. It is desirable to be able to vary the thickness of these strata according to the nature of the material operated on, it being in some instances desirable to retain a very thin layer and in others a quite thick layer. I effect corresponding changes in the depth of the ring C by introducing rings or washers C^2 above the perforated bed D and between it and the fixed shoulder C^1 on the interior of the ring C. By removing all these rings C^2, I bring the perforated bed up into very close proximity to the upper edge of the ring C, so that a very thin stratum, of only one-half of an inch, more or less, will be retained; but by introducing a sufficient number or a sufficient thickness of the rings C^2, I can depress the perforated bed D so as to retain a greater depth of strata—say two inches or more. The grate D′, and, consequently, the perforated bed D, is lowered and elevated to effect these changes by means of the screws R, which are tapped through the turning pieces R′ on the under side of the ring C. These pieces may be turned quite around on the bolts *r*, to allow the rings C^2 to be changed or rearranged.

Success in separating the material, particularly when the specific gravity is but little less

in the earthy matter than in the metallic particles, depends very much on the violence of the puffs or blasts of air and the completeness with which the particles are allowed to come to rest between the puffs. An increase in the capacity of the chamber or space which intervenes between the bellows and the ore reduces the intermittent action. A close approach, on the contrary, as in my invention, increases the suddenness and vigor of the pulsations.

The throw of the crank C^3 may be varied by moving the pins inward or outward in slots (not represented) in the cranks, so as thereby to vary the stroke, and consequently the capacity of the bellows E *e*, in order to blow with more or less force in acting on different kinds or quantities of material.

I can vary the speed or the time in which the bellows reciprocates within any required limit by well-known means, which it is not necessary to represent. I prefer to agitate the ore more violently in first commencing to treat a quantity, and to gradually diminish the violence with which it is lifted by the blast of air until near the close, when it is better to hardly lift it at all, but merely to subject it to a series of gentle concussions. I can do this by the employment of cone-pulleys or analogous devices. I have operated very successfully in this respect by using two pulleys of different sizes and two belts, providing a loose pulley for each, and alternating in the use of the pulleys according as the speed shall be required to be fast or slow.

I do not limit the use of my machine to the separation of earthy matters alone. It can be employed with benefit in separating one kind of grain or seed from another, or from any dirt of less or greater specific gravity, or in separating the grains of the highest or lowest specific gravity from their fellows, in order to procure a uniformity of quality or a superiority of quality for planting or for any choice use.

Some of the advantages due to certain features of my invention may be separately enumerated, as follows:

First. By reason of the fact that the links J J′ and lever I are arranged as represented relatively to the rod *g* and feed-valve G, I am able to open and close the feed-valve at will with little labor, without loss of time, and without a possibility of its clogging. The valve G is held up to its place with great force, and the operation is effected without requiring any considerable muscular strain.

Second. By reason of the fact that I raise the movable ring C in contact with the fixed ring *a*, and lower it again out of contact, as represented, I am able to carry the ring C and its contents under the bellows and remove it therefrom without friction, and to operate the bellows and produce the desired effect on the ore without the loss of effect which accrues from a leakage of air between those rings.

Third. By reason of the fact that the upper edge of the ring C is in the form of an inverted **V**, I avoid the liability, which would otherwise exist, of catching and retaining particles of ore between the rings, so as to prevent their air-tight contact.

Fourth. By the employment of my movable rings C^2, as represented, I am able to vary the depth of the stratum which is retained on the perforated bed, so as to work very different kinds of ores by the same machine with great facility, and with very little labor in adjusting.

Fifth. By reason of the fact that my annular bellows G′ is mounted directly over in close proximity to the upper surface of the ores, I am able to produce the intermittent action of the blast upon the ores with greater effect than when the bellows is at a greater distance, so as to leave a larger chamber to intervene and soften the intermittent action.

Sixth. By reason of the fact that my perforated bed D, with its supporting and tightening ring C, is mounted on the carriage B, and operated by a crank, M, as represented, I am enabled to move the bed with its superimposed stratum with great certainty and steadiness, and to dump or empty the contents into the proper receptacle with very little exertion.

Having now fully described my invention, what I claim as new, and desire to secure by Letters Patent, is as follows:

1. Operating the feed-valve G by means of the double links J J′ and connections, substantially as and for the purpose herein specified.

2. Opening and closing the joints between the fixed ring *a* and the upper face of the traveling ring C, substantially as and for the purpose herein specified.

3. The sharp edge of the ring C, when arranged and operated substantially as and for the purpose herein specified.

4. Varying the depth of the stratum retained on the perforated bed D by the employment of the movable rings C^2, arranged relatively to the bed D and to the shoulder, substantially as and for the purpose herein specified.

5. Mounting the bellows G′ in close proximity to the bed D, substantially as and for the purpose herein specified.

6. The carriage B and crank M, in combination with the bed D and ring C, and with a suitable intermittent suction device, substantially as and for the purpose herein specified.

STEPHEN R. KROM.

Witnesses:
D. W. STETSON,
D. L. FREEBORN.