E. G. GOOD & J. THORNE.

ORE SEPARATOR.

No. 455,531. Patented July 7, 1891.

Fig. 1.

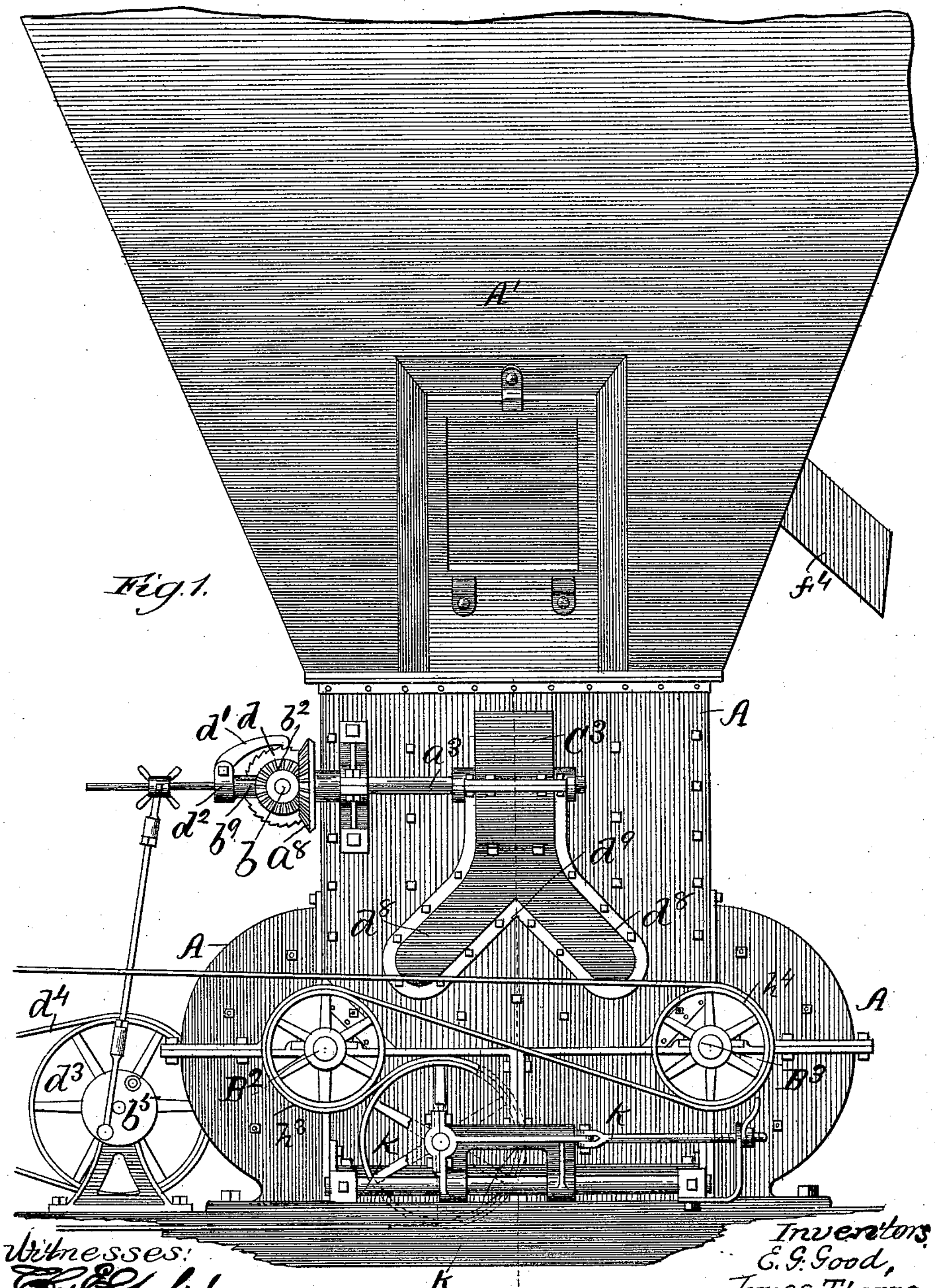

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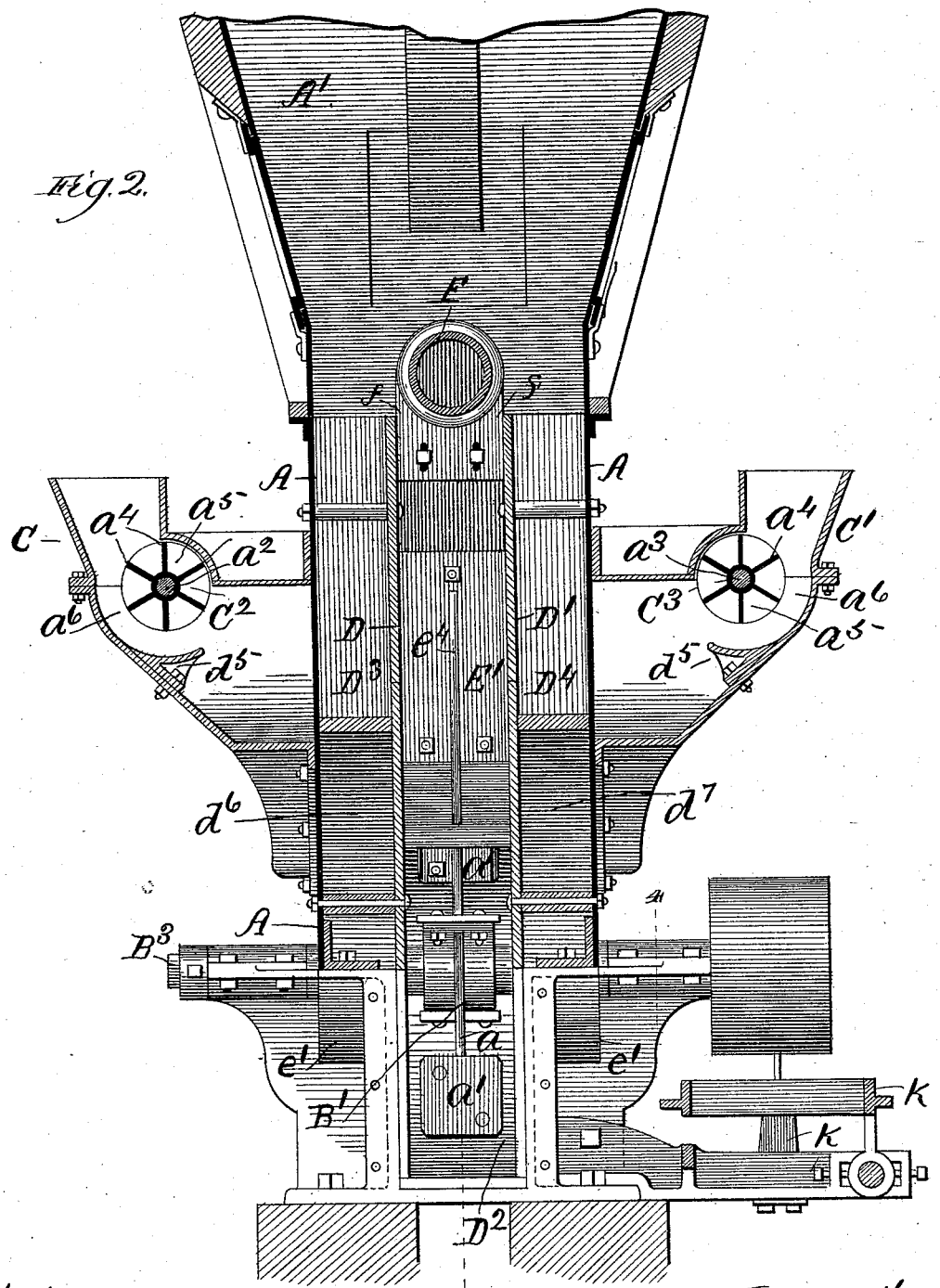
Fig. 2.



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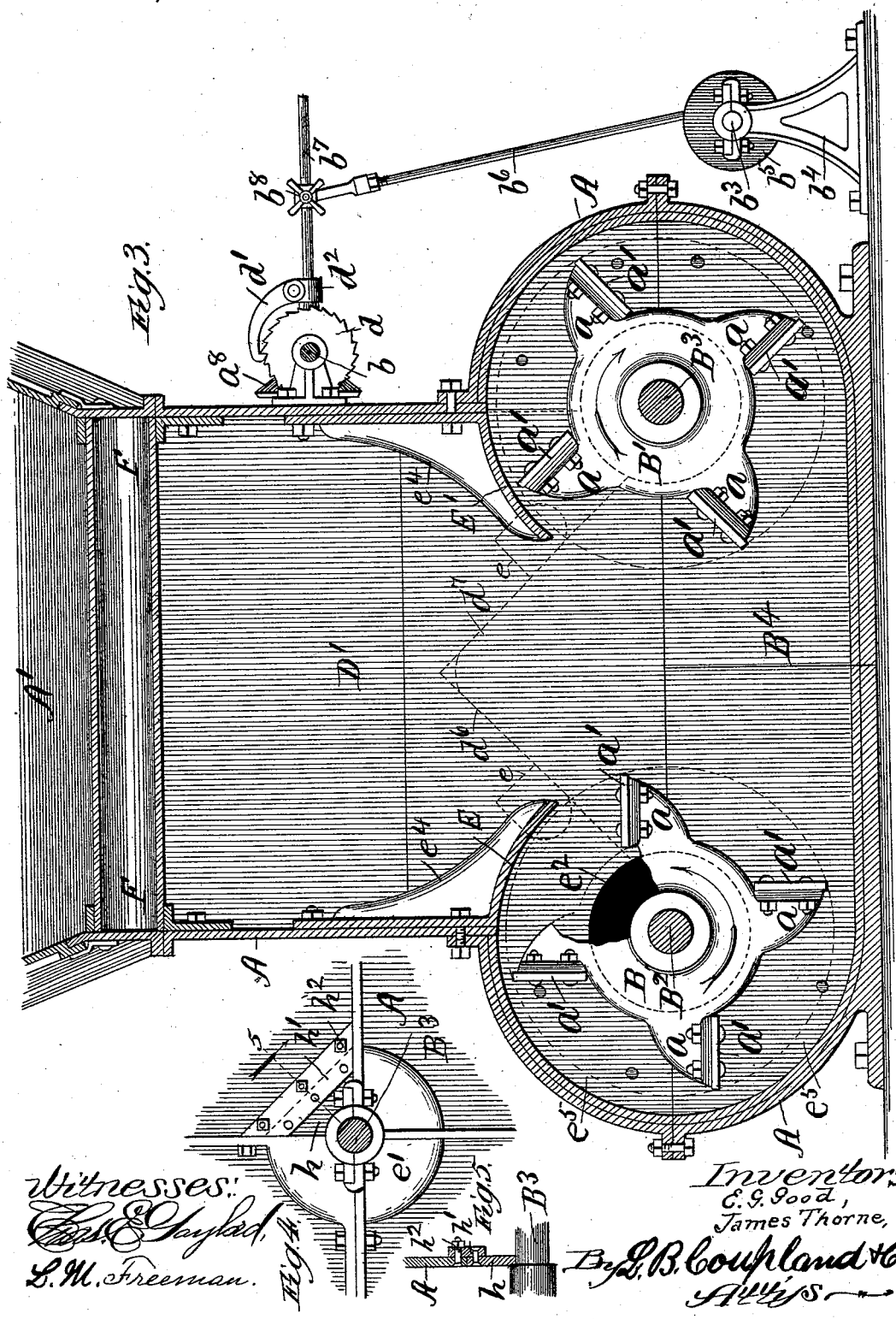

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Fig. 6.

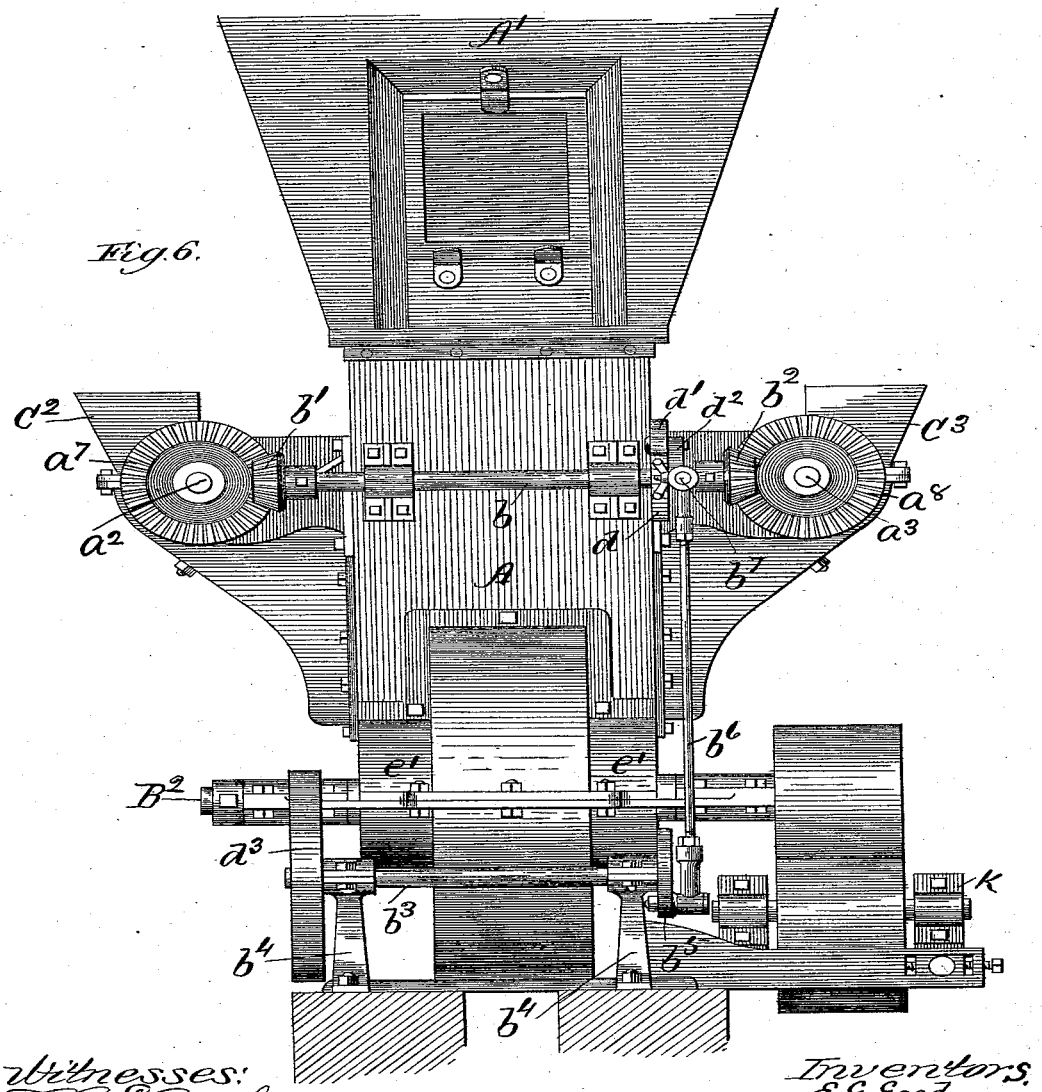

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Fig. 11.

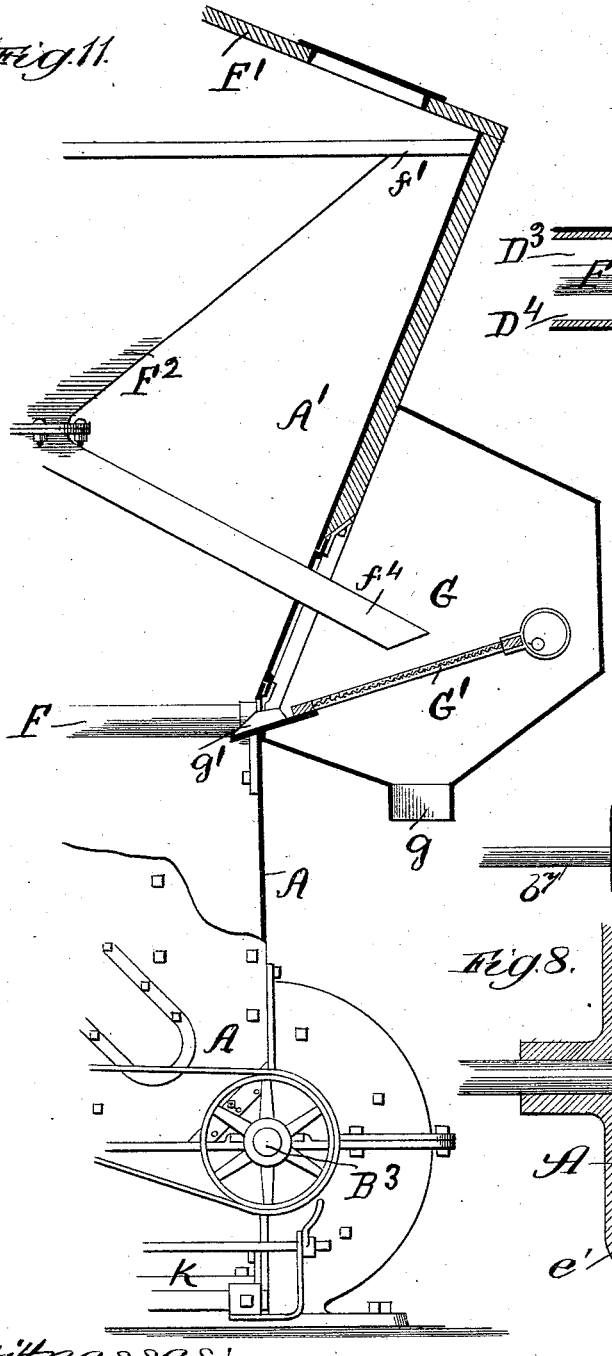


Fig. 12.

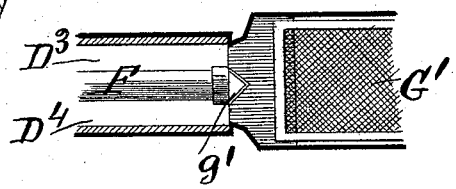


Fig. 7.

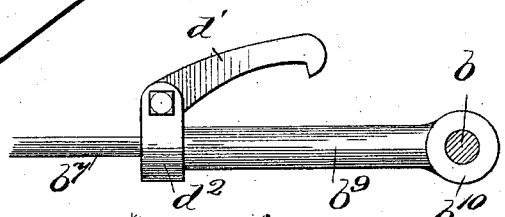
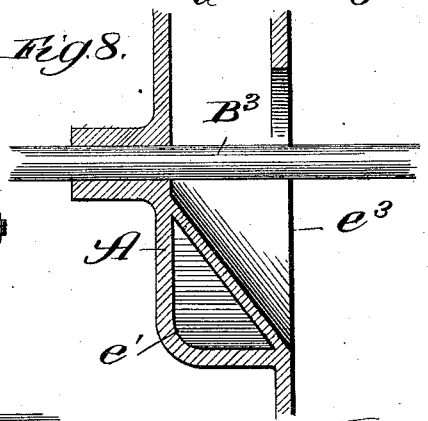


Fig. 8.



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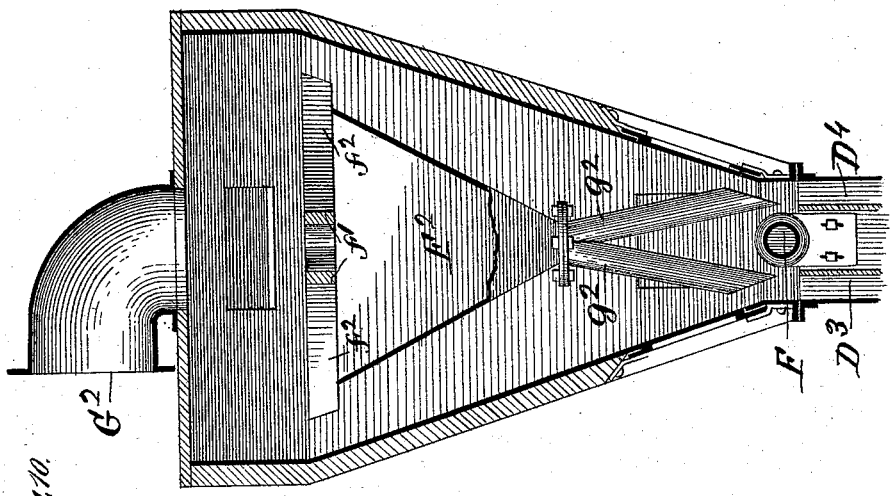

Fig. 10.

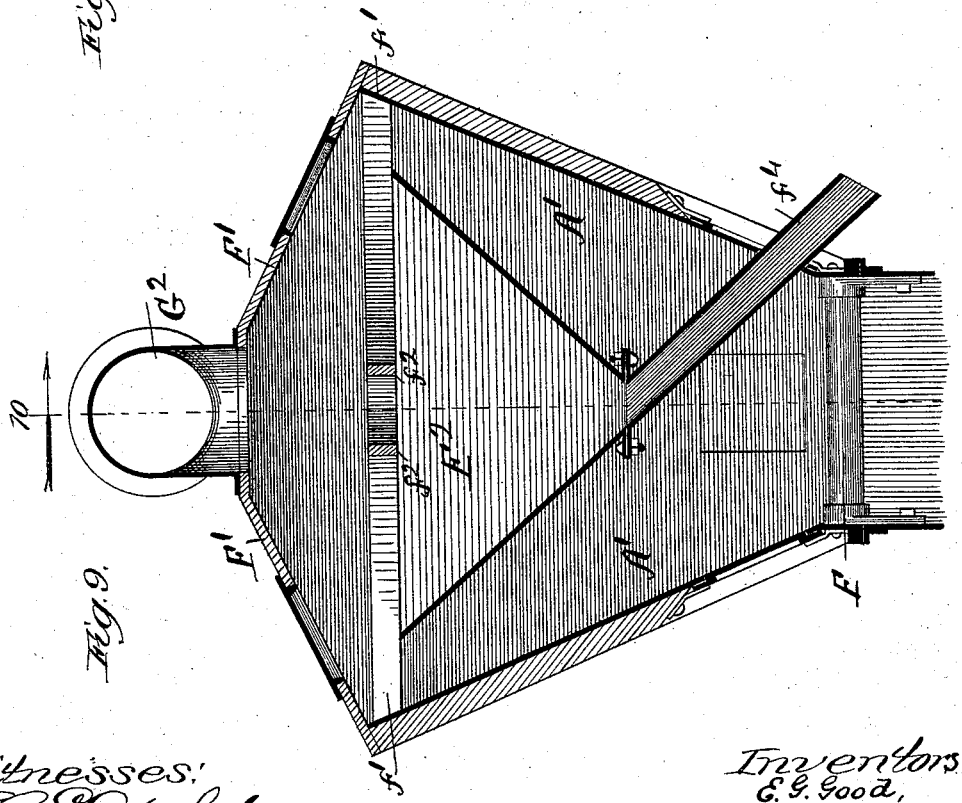

Fig. 9.

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UNITED STATES PATENT OFFICE.

EDWARD G. GOOD AND JAMES THORNE, OF PORTLAND, OREGON, ASSIGNORS OF ONE-THIRD TO EZRA RUST, OF SAGINAW, MICHIGAN.

ORE-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 455,531, dated July 7, 1891.

Application filed March 31, 1891. Serial No. 387,094. (No model.)

To all whom it may concern:

Be it known that we, EDWARD G. GOOD and JAMES THORNE, citizens of the United States, residing at Portland, in the county of Multnomah and State of Oregon, have invented certain new and useful Improvements in an Ore-Separator, of which the following is a full, clear, and exact description, that will enable others to make and use the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a front elevation of the machine proper, the upper part of the expansion-chamber being broken away; Fig. 2, a vertical central section on line 2, Fig. 1, looking in the direction indicated by the arrow; Fig. 3, a vertical central section (at right angles to Fig. 2) on line 3, Fig. 2; Fig. 4, a broken-away vertical section on line 4, Fig. 2; Fig. 5, a broken-away section on line 5, Fig. 4; Fig. 6, an end elevation, the expansion-chamber being broken away; Figs. 7 and 8, broken-away sectional details of construction; Fig. 9, a broken away vertical section of the expansion-chamber surmounting the machine proper; Fig. 10, a broken-away section of the expansion-chamber on line 10, Fig. 9, embodying a modification; Fig. 11, a broken-away part elevation and part section showing structural details, and Fig. 12 a broken-away sectional detail and plan of the shaking-screen.

The object of the invention is to subject mineral substances containing native metals or metallic compounds to a disintegrating operation of such a character as to pulverize or reduce to dust the non-metallic constituents or gangue only, leaving the native metal or metallic compounds in their natural form practically the same as when found in a free state, where the process of disintegration of the gangue has been effected by atmospheric action. This result is accomplished in the manner and by the means hereinafter set forth.

Referring to the drawings, A represents the base structure or casing inclosing the disintegrating-chamber. This base is constructed of metal plates or parts bolted together, as illustrated, and is surmounted by a superstructure forming the expansion-chamber A′.

The companion disk throwing-wheels B B′ are mounted on the shafts B^2 B^3, which are provided with suitable journal-bearings secured to the base structure. These throwing-wheels are provided with a number of projections or arms a, to the shoulder ends of which are rigidly bolted the plates a', as shown in Figs. 2 and 3. These wheels are set in the relative position shown in Fig. 3 and revolve in opposite directions, as indicated by the arrows. The space B^4 between the wheels is where the two conflicting bodies or streams of ore and air come together in the breaking-up process.

The feed-hoppers C C′ are located above the throwing-wheels and are secured to the respective sides of the casing, as shown in Figs. 1, 2, and 3. Inside of and below the mouth of the feed-hoppers are located the feed-wheels C^2 C^3, Fig. 2, mounted on the shafts a^2 a^3, which are provided with suitable journal-bearings. The feed-wheels comprise a number of radial blades a^4, forming pockets a^5 between each pair of blades. These blades extend clear across the feed-opening, the pockets receiving the larger part of the ore or other substance run in. The throat-passage a^6 between the feed-wheels and the front side of the hoppers prevents clogging or interference with the movement of the feed-wheels and also provides for the admission of the required amount of air, the air not being admitted to the disintegrating-chamber at any other point.

The shafts a^2 a^3, on which the feed-wheels are mounted, extend across and project a little beyond the sides of the casing, as shown in Fig. 1. The companion gear-wheels a^7 a^8 are rigidly mounted on such projecting ends, as shown in Fig. 6. The shaft b extends across one end of the machine, Fig. 6, and has the pinions b' b^2 mounted on the respective ends thereof and which engage with the gear-wheels a^7 a^8. The counter-shaft b^3, Fig. 6, is journaled in the brackets b^4 and has the crank-wheel b^5 mounted on one end. To this crank-wheel is secured the lower end of the connecting-rod b^6, the upper end being adjustably connected to the horizontal rod b^7 by the hand-screw b^8. The inner end of the rod b^7 is secured in a socket b^9, having an inte-

gral collar part b^{10}, Fig. 7, mounted on the shaft b. The ratchet-wheel d is also mounted on the shaft b, Figs. 1, 3, and 6, and has the feed-dog d' engaging therewith. One end of this dog is pivoted in the clip d^2 on the socket-piece b^9. The counter-shaft b^3 carries the band-wheel d^3 and receives motion from the motive power by means of the belt d^4. By this arrangement an intermittent rotary motion is transmitted to the feed-wheels. As the rod b^7 is raised and lowered through the medium of the crank-wheel and connecting-rod, the feed-dog engages the ratchet-wheel tooth by tooth and imparts a corresponding movement to the feed-wheels and feeds the ore in gradually. The movement of the feed-wheels may be varied by changing the position of the connecting-rod on the rocking rod b^7.

The shoes d^5 are bolted to the inside of the casing below the feed-wheels, Fig. 2, and form a shelf to check too free a flow, a portion of the ore being dropped in with each movement of the feed-wheel.

The partitions D D′ divide the disintegrating-chamber into three compartments, the disk throwing-wheels being located in the middle compartment D^2 (whose upper portion serves as an uptake for the pulverized material) and the compartments D^3 D^4 at each side, as shown in Fig. 2. The dividing-boards d^6 d^7 are of an inverted-V shape, as indicated by the dotted lines in Fig. 3, and are located in the compartments D^3 D^4 at each side, as shown in Fig. 2.

As shown in Fig. 1, the lower part of the feed-hopper has two branches d^8 d^8, with the inclined dividing-surface d^9 leading to each side. This feature is for the purpose of dividing the body of ore and have it pass into the disintegrating-chamber at two different points, as indicated by the dotted lines at e e, Fig. 3, which shows the relative position of the openings communicating with the bifurcated feed-hopper. By this arrangement the ore, where it strikes the surface of the inclined dividing-boards d^6 d^7, is distributed equally to the throwing-wheels in the disintegrating-chamber.

It must be understood that the ore drops down into the bottom of the compartments D^3 D^4, which are formed by the drums e' e' inclosing the main shaft and which open into the middle chamber D^2 the full size of the circle, as shown at e^2, Fig. 3, a part of one of the disk wheels being broken away to show such opening, the ore being thus discharged into the disintegrating-chamber below the wheel-shafts. The inclined shelf e^3, Fig. 8, in the drums forms a slide for the ore to reach the required point. Thus it will be observed that the ore does not drop onto the top of the throwing-wheels, as is the case in pulverizing-machines in which the ordinary fan-wheels are used.

The peculiar features attending the construction and operation of the disk throwing-wheels will now be described. The backs of the arms a are rounded or curved in the direction in which the wheels revolve, the ends of the arms terminating in a straight shoulder or face, to which the plates a' are bolted. It will be observed that the plates or blades a' have their working faces or surfaces of impact in planes bisecting the wheel outside of its axis. Now, the ore entering below the wheel-shaft, the angle at which the plates are set brings the face of the same, when in their lowermost position, square against and throws the ore in a straight line toward the companion wheel. The wheels will be made to revolve at a high speed, so that the two continuous streams of ore thrown by the companion wheels will come together in the central space with great force, the impact breaking the ore and releasing the metal from its inclosing substances and rendering the after process of separation much easier and cleaner than if the ore had been subjected to the usual grinding or crushing process.

The cut-offs E E′ are bolted to the casing above the disk wheels, Figs. 2 and 3, and extend across the width of the space between the partitions inclosing the disintegrating-chamber proper. e^4 is a strengthening-rib formed in the center of the angle cut-offs. The lower part of the cut-offs is curved to correspond to the curvature of the pathway of the wheels, the plates on the arms of which run very closely thereto for the purpose of preventing any particles of ore from being carried around or leaving sufficient space between the two at this point for the passage of a volume of air, the current being broken at this point with reference to the rotary movement of the wheels. The position of the face-plates on the arms of the disk wheels brings the inner ends in line with the toes of the cut-offs while the outer ends are yet some distance back, which gives the plates a chance to free or clear themselves before they have wholly passed the point of cut-off.

The throwing-wheels are set at one side of the center with reference to the surrounding casing, so that the space e^5 between the periphery of the wheels gradually and uniformly enlarges from the point of cut-off, forming what might be termed a "spiral duct," so that the volume of air will not be contracted, but, on the contrary, expanded, so as to sweep clean and prevent the accumulation of matter at any point in the disintegrating-chamber. The expanding duct will also prevent clogging, should particles of the ore by any chance pass the cut-offs and enter the passage beyond.

At the junction of the inclosing casing with the expansion-chamber is located the stationary cylindrical body F, which may be either tubular or solid, tubular being preferred, as shown, on account of lightness. This body presents a rounded or spherical surface to the matter carried upwardly by the air from the disintegrating-chamber after the impact and

serves to check too rapid a flow and divides the ore matter into two volumes and carries it up through the narrow passages *f f* (see Fig. 2) on the respective sides of the cylinder F. It will be noted that the passages or openings *f f* are between the cylinder F and the inside upper ends of the partitions D^3 D^4.

The expansion-chamber A′, Fig. 9, gradually enlarges or widens clear to the upper end, the top being closed by the roof F′ slanting in the opposite direction with reference to the inclined sides of the expansion-chamber. Centrally inside of the expansion-chamber, with an open space clear around, is placed the hopper F^2, supported by two cross-timbers *f′*, extending clear across the mouth of the hopper, and the two shorter timbers f^2 running at right angles to the companion timbers, as shown in Figs. 9 and 10. The spout f^4 is connected to and runs from the bottom of the hopper F^2 out through the side of the expansion-chamber and into the receiving-chamber G. (Shown in Fig. 11.) In this chamber, and below the open end of the spout f^4, is located the "jigger" or shaking-screen G′, (see also Fig. 12,) which may have the required motion transmitted by any suitable mechanism, no means for this purpose being shown.

In operation the ore substance, broken up by impact in the space between the throwing-wheels, is carried upwardly by the current of air and divided into two volumes by contact with the spherical surface of the cylinder or body F, and passing into the expansion-chamber the volume expands with the increasing area, the lifting-power of the air growing proportionately less, so that such particles of ore as lose their specific gravity drop out of the ascending column and descend along the sloping sides of the expansion-chamber down into the compartments D^3 D^4 and return to the disintegrating-chamber, and are again subjected to the breaking-up process, and so on continuously until all the matter has been reduced to the proper fineness. Such particles of the ore substances as reach the dead-air space above the hopper drop into the same and pass to the screening-surface G′, where the finer particles pass through the meshes and out through the opening *g*, Fig. 11. The particles that are too large to go through the meshes are spouted into the compartments D^3 D^4, as at *g′*, Figs. 11 and 12, and returned to and again subjected to the action of the throwing-wheels, The dust escapes from the expansion-chamber through the pipe-extension G^2, and may be conducted into the receiving or concentrating chambers or allowed to mingle with the atmosphere, as circumstances may determine. The final process of separating the metal from the refuse will be completed by other means.

Fig. 10 represents a modification with reference to the hopper F^2 in the expansion-chamber. In this modification two spouts g^2 g^2 are used, and the matter received into the hopper is spouted back directly into the compartments D^3 D^4, leading to the disintegrating-chamber, instead of being run onto a vibrating screening-surface. This arrangement is more especially intended to be used in the reduction of mineral-paint ores when all the matter is to be reduced to dust.

Figs. 4 and 5 illustrate features of construction relative to a convenient insertion and removal of the disk-wheel shafts. The triangular corner-piece *h* is a separate part of the casing and has the diagonal bar *h′* riveted to the outer edge. This bar covers the line of separation and is secured to the meeting edges of the casing by the bolts h^2. By removing these bolts the corner-piece may be taken out. The pulleys h^3 h^4 are mounted on the shafts of the throwing-wheels, which have a belted connection with the motive power.

K represents the different parts of a belt-tightener; but as no claim is made herein thereto a detailed description is omitted.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In an ore-separator, the combination, with a disintegrating-chamber having an uptake, of companion throwing-wheels having their shafts transverse to the chamber and mechanism for revolving both of said throwing-wheels toward each other and upwardly toward the uptake, substantially as described.

2. In an ore-separator, the combination, with companion throwing-wheels, of a disintegrating-chamber having a common outtake, said throwing-wheels having their shafts transverse to the chamber, and mechanism for revolving said wheels toward each other and toward the outtake on the side opposite the outtake, substantially as described.

3. In an ore-separator, the combination, with companion throwing-wheels, of a disintegrating-chamber having a common outtake, said throwing-wheels having their shafts transverse to the chamber, mechanism for revolving said wheels toward each other and toward the outtake on the side opposite the outtake, and feeding devices discharging on said opposite side in front of the wheel-blades, substantially as described.

4. Apparatus for the disintegration of mineral substances comprising throwing-wheels separated by an intervening free space, said wheels being provided with blades whose working-faces are in planes bisecting the wheel outside of its axis, and mechanism for driving said wheels in opposite directions and upwardly with respect to the intervening free space, substantially as described.

5. In an ore-separator, the combination, with a disintegrating-chamber, of companion throwing-wheels, each having blades whose working-surfaces are in planes bisecting the wheel outside of its axis, and feed shelves or inclines discharging below said axes, substantially as described.

6. In an ore-separator, the combination, with a disintegrating-chamber, of companion throwing-wheels set eccentrically with reference to the inclosing casing, said throwing-wheels being provided with blades whose working-faces are in planes bisecting the wheel outside of its axis, substantially as described.

7. In an ore-separator, the combination, with a disintegrating-chamber having an uptake for the exit of the pulverized material, of companion throwing-wheels located below said uptake and at opposite sides thereof, said throwing-wheels being provided with blades whose working-faces are in planes bisecting the wheel outside of its axis, and cut-offs located close to the path of movement of the blades and above the wheels, substantially as described.

8. In an ore-separator, the combination, with the disintegrating-chamber, of the companion throwing-wheels and the cut-offs, said wheels being set eccentrically with reference to the inclosing casing, whereby the space between the periphery of the same and the inclosing casing gradually enlarges from the point of cut-off, substantially as set forth.

9. In an ore-separator, the combination, with the disintegrating chamber divided into three compartments, of the throwing-wheels located in the middle compartment or disintegrating-chamber proper, the dividing-boards placed in the side compartments, and the inclined shelves in the lower drum ends of the side compartments, said inclined shelves extending below the shafts of the throwing-wheels, whereby the ore is distributed to the companion wheels alike at a point below their axial shafts, substantially as set forth.

10. In an ore-separator, the combination, with the inclosing casing, of the feed-hoppers branching at their lower ends and secured to opposite sides of the casing and communicating with openings therethrough, the feed-wheels provided with a number of pockets and set in the throat of the hoppers, the shoes bolted to the inside of the hoppers below and on the opposite side from the feed-wheels, and the means, substantially as described, for imparting an intermittent rotary motion to said feed-wheels, substantially as set forth.

11. In an ore-separator, the combination, with the expansion-chamber, of a hopper suspended centrally therein and a vibrating screen located in a chamber at one side of the expansion-chamber, a spout leading from said hopper to said screen, whereby the finer matter is separated from the coarser and the latter returned to the disintegrating-chamber, substantially as set forth.

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