No. 632,109. Patented Aug. 29, 1899.

H. C. GRANNATT.

ORE CONCENTRATOR.

(Application filed May 6, 1898.)

(No Model.) 2 Sheets—Sheet 1.

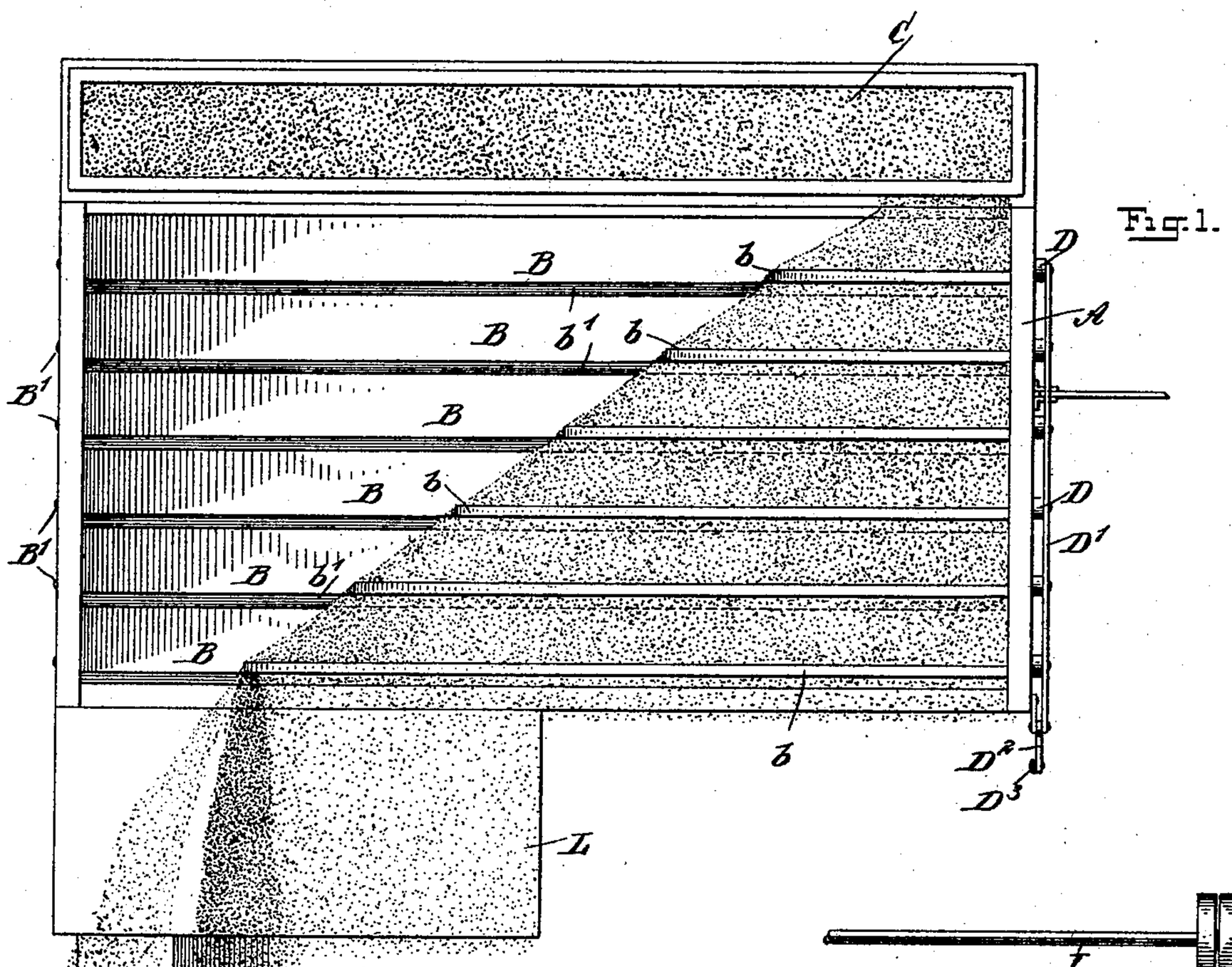

Fig. 1.

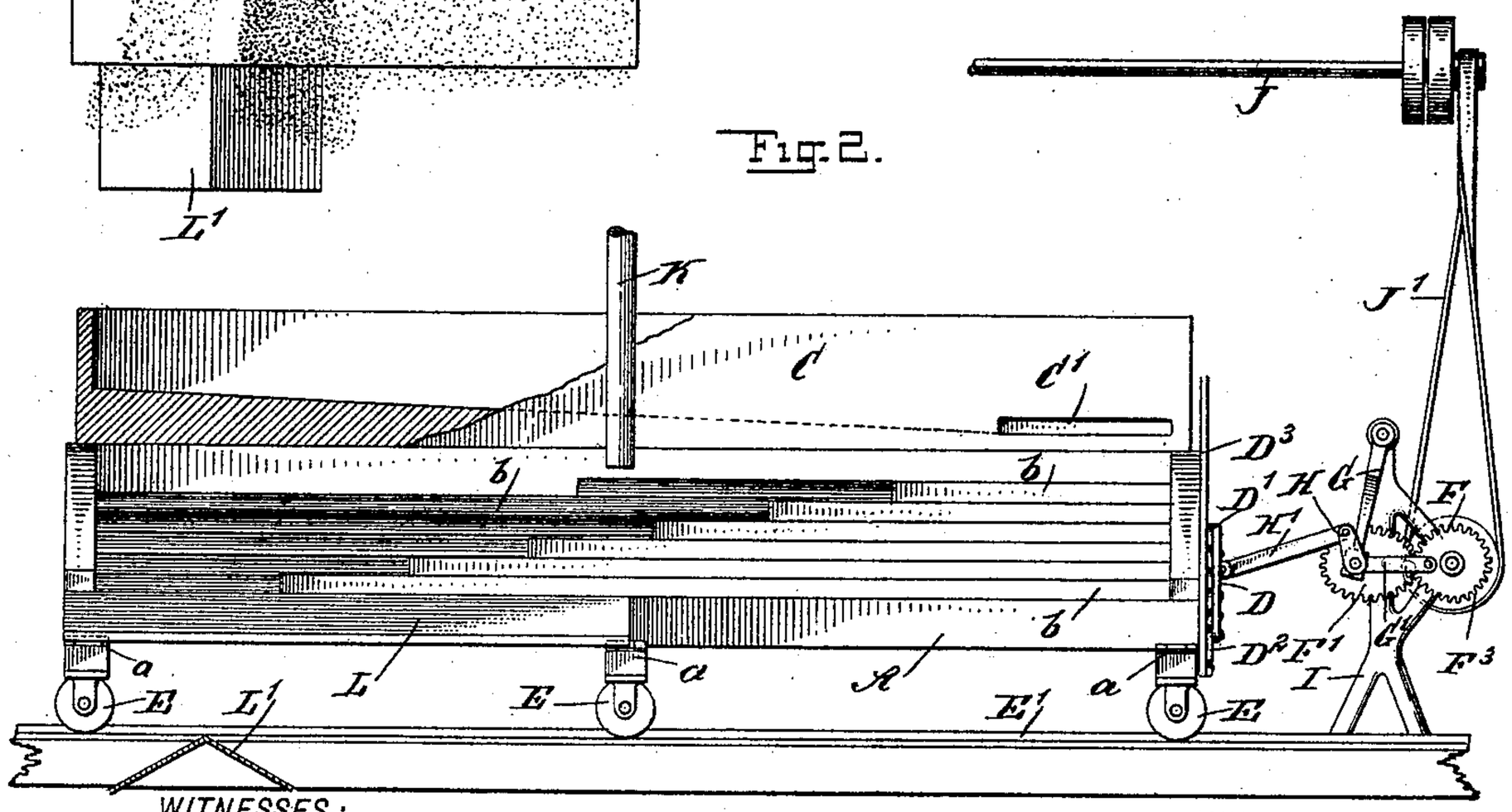

Fig. 2.

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Fig. 3.

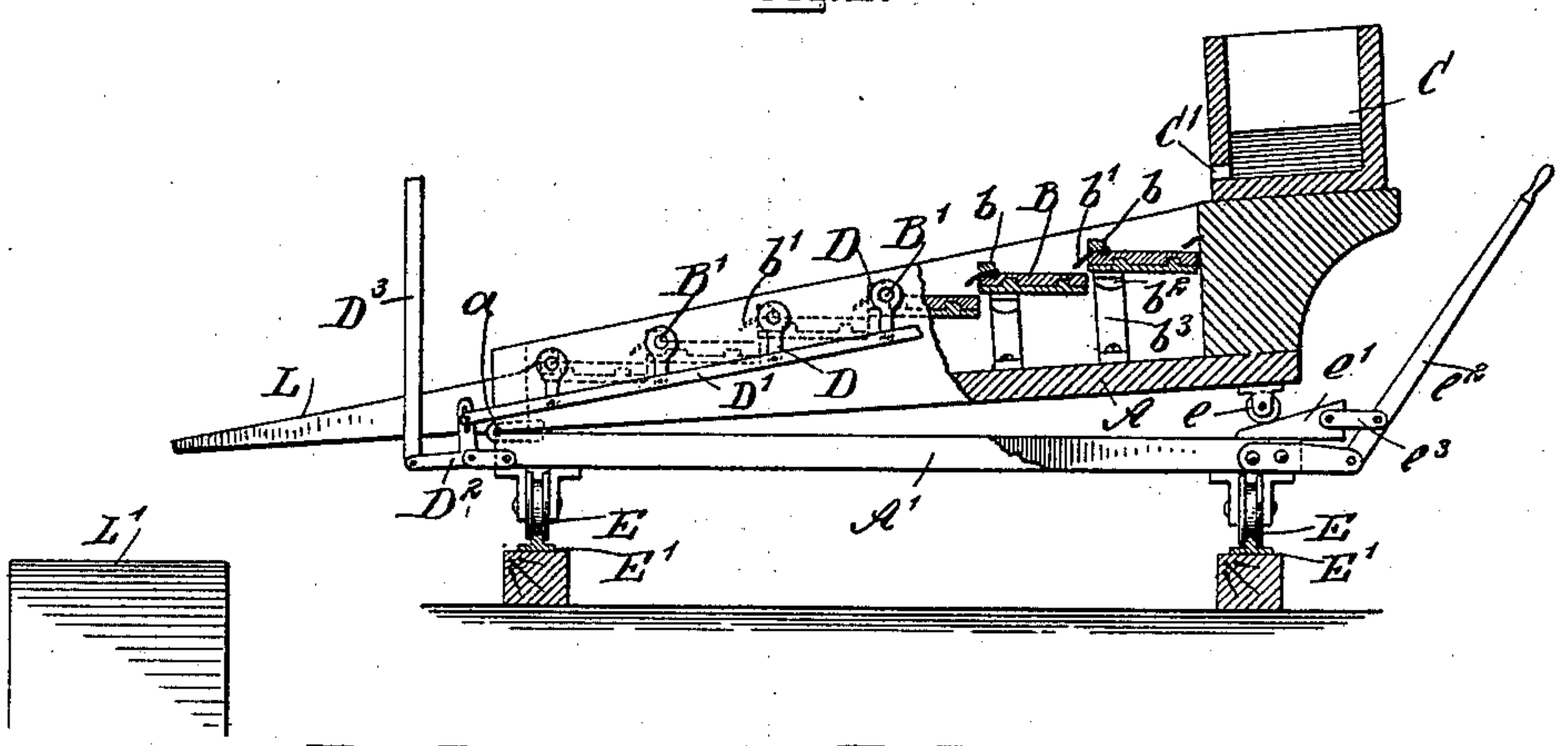
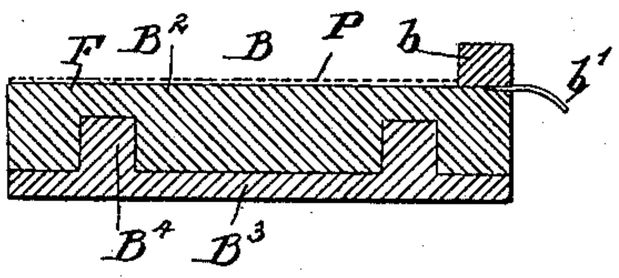


Fig. 6.

Fig. 7.



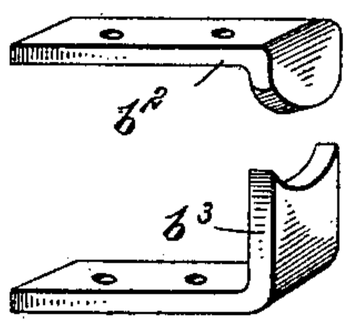


Fig. 4.

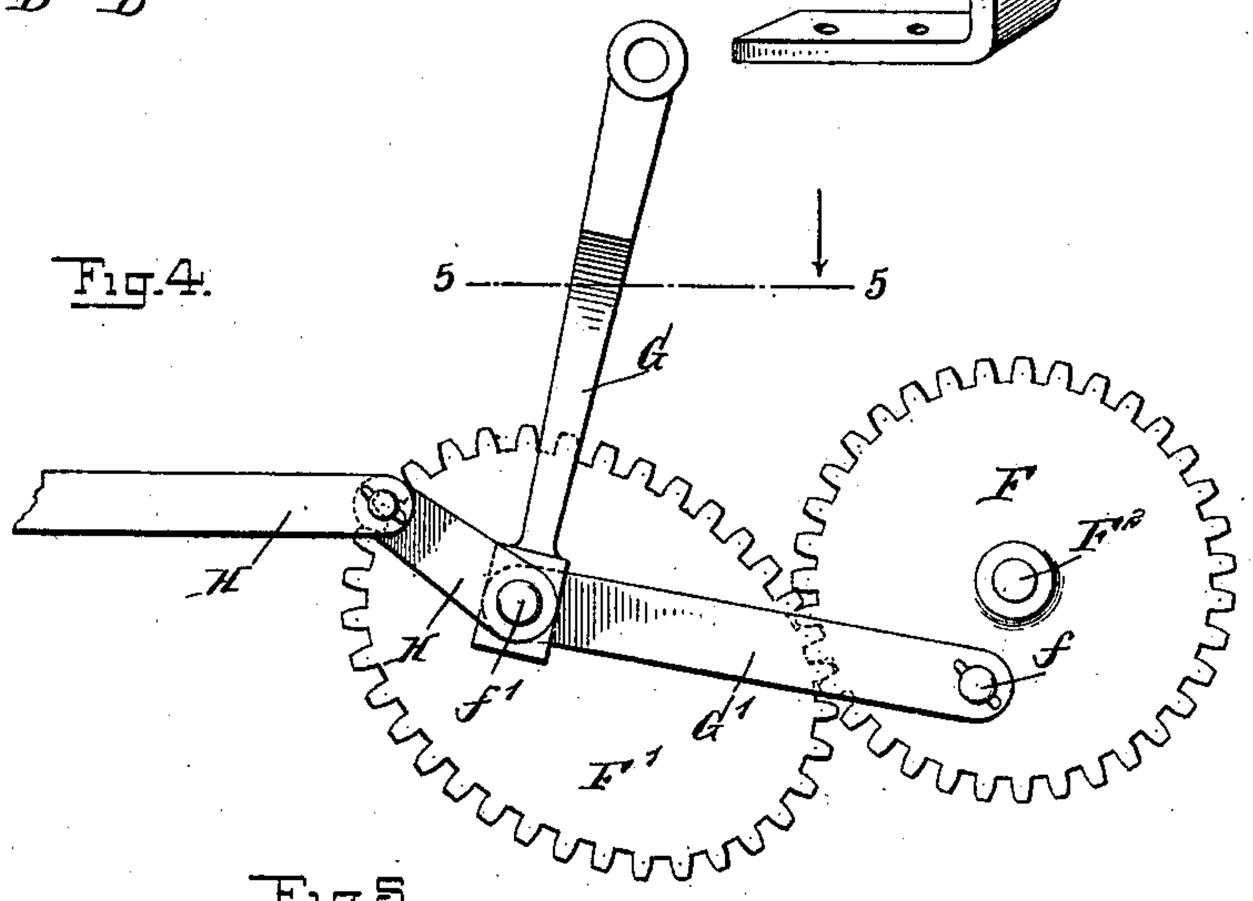
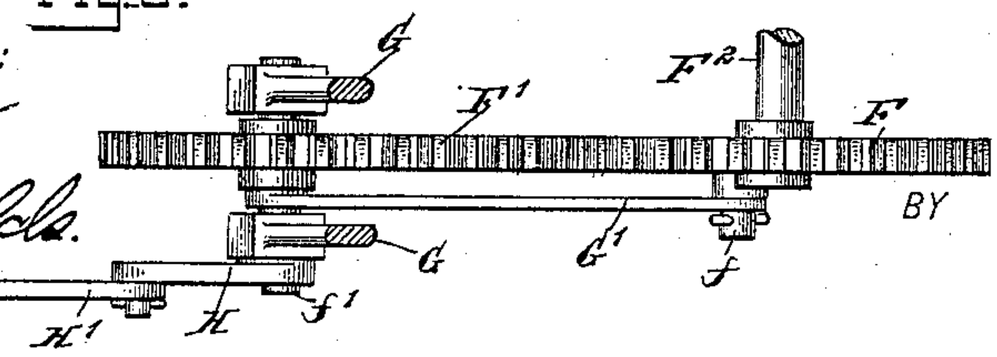


Fig. 5.



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UNITED STATES PATENT OFFICE.

HENRY C. GRANNATT, OF COLORADO SPRINGS, COLORADO.

ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 632,109, dated August 29, 1899.

Application filed May 6, 1898. Serial No. 679,941. (No model.)

To all whom it may concern:

Be it known that I, HENRY C. GRANNATT, of Colorado Springs, in the county of El Paso and State of Colorado, have invented a new and Improved Ore-Concentrator, of which the following is a full, clear, and exact description.

My invention relates to an ore concentrating or amalgamating device to be used in connection with water and which treats the material by flowing it over plates or tables which are inclined and which are given longitudinally-reciprocating and laterally-oscillating motions.

The invention comprises the features which will be hereinafter described, and particularly pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a top plan view of my device. Fig. 2 is a side elevation. Fig. 3 is an end elevation, partially in section. Fig. 4 is a side elevation of the elliptical gears by which the differential reciprocation is obtained. Fig. 5 is a top plan view of said gears. Fig. 6 is a cross-section through the slats upon which the ore is treated, and Fig. 7 is a perspective view of the pivot used for supporting the central portions of the pivoted slats.

The object of my invention is to provide a machine for the treatment of ores by the wet process which shall require less water than the mechanisms usually employed and at the same time to secure a greater efficiency.

The framework of my device comprises two frames A and A′, which are pivoted by hinges *a* upon one side edge, so that the angle of the upper frame A may be readily adjusted to comply with the requirements in treating different ores. The upper frame A is preferably of a rectangular shape and has mounted therein a series of slats B, extending longitudinally of the frame. These slats are provided with riffles *b*, extending along the lower side edge thereof and retaining the water and ore upon the slat. The length of the riffles *b* upon the successive slats varies, being shortest on the upper slat and increasing in length on the successive slats.

The pulp or ground ore mixed with water is introduced into the box C, which is placed at the upper edge of the concentrator, and escapes upon the slats through an opening C′ at one end of the concentrator. It is intended that the pulp should have a comparatively small amount of water mixed therewith, as the device is intended for use in places where the supply of water is scarce. It is not to be understood, however, that my device will work successfully only with a small supply of water, but that it is especially adapted for use in places where the water-supply is short.

The slats B are preferably constructed as indicated in the cross-section shown in Fig. 6. Each slat consists of two parts B^2 and B^3, which are connected to each other by grooves and tongues B^4. The object of this construction is to prevent warping of the slats. The slats are provided at each end with pivots B′, which are located at one side of the slats and preferably on the same line as the riffles *b*. While it is preferred that the upper edge of the riffles *b* should be directly over or in line with the center of pivots, the device will work with large measure of success when the riffles are placed at either side of this point, the best result, however, being obtained when the riffles correspond in line with the pivots. This last construction produces a line of comparatively unagitated or quiet material next to the riffles and gives the heavier particles a better chance to collect there. If the pivot were otherwise placed relative to the riffle, the material being concentrated would be kept in greater agitation, so that no quiet zone or line could form, and the heavier particles would be carried along more rapidly.

To give an oscillating motion to the slats, the pivot at one end of each slat is extended and is provided with a crank D, the cranks upon the different slats being connected by a common connecting-rod D′. To more thoroughly support the central portions of the slats, which otherwise might sag, a pivot, such as that shown in Fig. 7, is provided. This pivot consists of two bent plates b^2 and b^3, the plate b^2 being fastened to the under surface of the slat and the plate b^3 being attached to the frame A. The plate b^2 has one end bent downward and provided with a convexly-rounded extremity, while the plate b^3 has one end bent up and provided with a concavely-

rounded extremity adapted to engage the end of the plate b^2.

Each of the slats E is preferably provided on the edge having the riffle with a flap b' of leather, tin, or other suitable material and which projects a sufficient distance to insure the overflow from one slat being deposited within the edge of the slat below it.

The frame A is made adjustable in elevation upon the frame A′ and is provided with rollers e upon the edge opposite the hinges. Mounted upon the frame A′ is a lever e^2, connected by means of a link e^3 with an inclined block or wedge e', which supports the roller e. By moving this wedge in or drawing it out the elevation of this edge of the frame A is varied. The frame A′ is provided with rollers or wheels E beneath the same and running upon a track E′, extending longitudinally of the frame. The whole device is thus capable of longitudinal motion upon the track. This motion is secured by means of the circular and elliptical gears. (Shown in Figs. 4 and 5, also in Fig. 2.)

Upon a suitable supporting-frame I is journaled a circular gear F, which is fixed upon a shaft F^2, which carries a pulley F^3. This pulley is connected by a belt J′ with a pulley mounted upon any suitable shaft J, said shaft being rotated by connection with some source of power. The gear F is thus given a continuous and uniform rotation. The gear F is provided with a crank-pin f, upon which is pivoted one end of link G′. The opposite end of the link is loosely held upon a pin f', that is secured upon an elliptical gear F′. This gear is supported by means of an arm G, which at its upper end is pivoted upon the framework I and at its lower end engages the pin f'. This permits the gear F′ to swing in an arc of a circle of which the arm G is a radius. The outline of the gear F′ is so constructed with reference to the pivot-points f and f' and their distances from their respective centers that the gears F and F′ are constantly in mesh. The link G′ serves to hold the gear F′ against the gear F, while the arm G gives it a swinging support.

Upon the pin f' is fixed a crank-arm H, to the outer end of which is secured a link or connecting-rod H′, which at its opposite end is attached to the frame A. By this means the frame A is given a reciprocation which varies in speed, being more rapid in one direction than in the other. The more rapid motion of the frame is given to it while traveling away from the gear-wheels, while the slow motion is on the return. The result of this is to work the heavier particles of the ore, which carry the values, toward the left, as shown in Figs. 1 and 2—that is, along the slats toward the ends of the riffles b. One or more pipes K or other suitable means are provided by which clear water may be introduced upon the slats, so as to insure a more thorough washing and separation of the parts.

The operation of the device is as follows: The pulp or ground ore is introduced through the box C upon the upper slat and at one end thereof. These slats are given a constant slight oscillating motion upon their pivots and at the same time are given a reciprocating motion as a body. As a consequence of this the pulp is not given an opportunity to settle, but is kept thoroughly agitated in the water, and a smaller amount of water is also sufficient for this purpose. The oscillating movement of the slats will tend to work the concentrates down into the angle above the riffles. The lighter particles, which will come to the surface, will work over the edges of the riffles with a portion of the water and be deposited upon the slat next below. The concentrates and heavier particles will, by the longitudinal reciprocation of the frame and slats, be gradually worked lengthwise of the slats until they reach the ends of the riffles. They will then be discharged from the ends of the riffle upon the slat next below. As the riffle upon each succeeding slat is longer than the preceding one, the result by the time the concentrates reach the first slat is a very thorough separation of the worthless particles from the valuable ones.

To the lower end of the frame, as described, may be attached a finishing-table L. This table is flat and has an incline in about the same direction as that of the slats, being made to tip more or less to suit different kinds of ore. This table is given a longitudinal reciprocation with the main frame. Beneath the lower edge of the table may be placed two V-shaped plates, which serve to secure a final separation of the concentrates from the worthless particles of the ore.

This device may be used for concentrating ores in places where the water-supply is very limited. It will secure a thorough separation with great economy in the use of water. In ordinary use it is preferable that the slats B be covered with a layer of some material such as linoleum. Such a layer is indicated by the dotted lines at P in Fig. 6. In case the device is desired to be used as an amalgamator, as well as a concentrator, an amalgamated metal plate may be substituted for the sheet of linoleum. The riffles may also be extended the entire length of the slat and the longitudinal reciprocating motion disconnected.

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

1. An ore-concentrator, comprising a frame having a series of inclined slats therein, pivoted at their lower edges and each having a riffle extending along its pivot edge, and with its upper edge substantially in line with the pivots, said slats being placed in successively lower planes, so that the overflow from one is received by the next, and the riffles extending from the feeding end of the slats a part only of their length and being of successively greater length, and means for giving the

frame reciprocations longitudinally of the slats, and for simultaneously giving the slats a slight oscillation on their pivots, substantially as described.

2. An ore-concentrator, comprising a frame having a series of inclined slats therein, pivoted at their lower edges, each having a riffle extending along its pivoted edge, the upper edges of the riffles being substantially in line with the pivots, said slats being placed in successively lower planes so that the overflow from one is received by the next, and the riffles extending from the feeding end of the slats a part only of their length and being of successively greater length, wheels under the frame, a track extending longitudinally of the slats, mechanism attached to the frame to reciprocate it, and means for simultaneously giving the slats a slight oscillating motion on their pivots, substantially as described.

3. An ore-concentrator, comprising a frame having a series of inclined slats therein, pivoted at their lower edges, each having a riffle extending along its pivot edge with its upper edge substantially in line with the pivots said slats being placed in successively lower planes, so that the overflow from one is received by the next, and the riffles extending from the feeding end of the slats a part only of their length and being of successively greater length, wheels under the frame, a track for said wheels extending longitudinally of the slats, mechanism attached to the frame to reciprocate it, cranks upon the slat-pivots, a common connecting-rod for said cranks, and a power connection to said rod, for simultaneously giving the slats a slight oscillating motion, substantially as described.

4. An ore-concentrator, comprising a frame having a series of inclined slats therein, pivoted at their lower edges, each having a riffle extending along its pivot edge, and with its upper edge substantially in line with the pivots, said slats being placed in successively lower planes so that the overflow from one is received by the next, and the riffles extending from the feeding end of the slats a part only of their length and being of successively greater length, means for giving the frame reciprocations longitudinally of the slats and for simultaneously giving the slats a slight oscillation on their pivots, and an inclined finishing-table attached to the opposite side of the device and receiving the concentrates thereon, substantially as described.

5. An ore-concentrator, comprising a frame formed in two parts, hinged to each other at one edge and provided at their other edges with adjustable separating means, said frame having a series of inclined slats therein, pivoted at their lower edges and each having a riffle extending along its pivot edge with its upper edge substantially in line with the pivots, said slats being placed in successively lower planes so that the overflow from one is received by the next, and the riffles extending from the feeding end of the slats a part only of their length and being of successively greater length, and means for giving the frame reciprocations longitudinally of the slats and for simultaneously giving the slats a slight oscillation on their pivots, substantially as described.

6. An ore-concentrator, comprising a frame formed in two parts hinged to each other at one edge, a roller on one part at its opposite edge, a wedge-block engaging said roller, a lever controlling the wedge-block, said frame having a series of inclined slats therein, pivoted at their lower edges and each having a riffle extending along its pivot edge, and with its upper edge substantially in line with the pivots, said slats being placed in successively lower planes so that the overflow from one is received by the next, and the riffles extending from the feeding end of the slats a part only of their length and being of successively greater length, and means for giving the frame reciprocations longitudinally of the slats and for simultaneously giving the slats a slight oscillation on their pivots, substantially as described.

7. An ore-concentrator, comprising a frame having a series of inclined slats therein, pivoted at their lower edge, and having intermediate pivotal supports, comprising bars having respectively a convex and concave arc formed upon their ends and fixed to the slats and their supports, the slats also having riffles extending along their pivot edge, with their upper edges substantially in line with the pivots, said slats being placed in successively lower planes so that the overflow from one is received by the next, and the riffles extending from the feeding end of the slats a part only of their length and being of successively greater length, and means for giving the frame reciprocations longitudinally of the slats, and for simultaneously giving the slats a slight oscillation on their pivots, substantially as described.

8. An ore-concentrator, comprising a frame having a series of inclined slats therein, pivoted at their lower edges and each having a riffle extending along its pivot edge, the upper side of the riffle being substantially in line with the pivots, said slats being placed in successively lower planes so that the overflow from one is received by the next, and the riffles extending from the feeding end of the slats a part only of their length and being of successively greater length, the slats also having flaps extending from their lower edge over the upper edge of the next slat, and means for giving the frame reciprocations longitudinally of the slats and for simultaneously giving the slats a slight oscillation on their pivots, substantially as described.

9. An ore-concentrator, comprising a frame having a series of inclined slats therein, pivoted at their lower edge and each having a riffle extending along one edge and substantially in line with its pivot, said slats being

placed in successively lower planes, so that the overflow from one is received by the next, and the riffles extending from the feeding end of the slats a part only of their length and being of successively greater length, flaps attached to the lower sides of the slats and extending over the upper edge of the next slat, wheels under the frame, a track extending longitudinally of the slats, mechanism attached to the frame for reciprocating the frame, cranks upon the pivots of the slats, and means connected to said cranks, for simultaneously giving the slats a slight oscillating motion, substantially as described.

10. An ore-concentrator, comprising a frame having a series of inclined slats therein, pivoted at their lower edges and each having a riffle extending along its pivot edge, the upper edge of the riffle being substantially in line with the pivots, said slats being placed in successively lower planes, so that the overflow from one is received by the next, and the riffles extending from the feeding end of the slats a part only of their length and being of successively greater length, a differential reciprocating mechanism connected to the frame for giving it motion longitudinally of the slats, and means for simultaneously giving the slats a slight oscillating motion on their pivots, substantially as described.

11. An ore-concentrator, comprising a frame having a series of inclined slats therein, pivoted at their lower edges and each having a riffle extending along one edge substantially in line with its pivots, said slats being placed in successively lower planes, so that the overflow from one is received by the next, and the riffles extending from the feeding end of the slats a part only of their length and being of successively greater length, a circular spur-gear having a power connection, an elliptical spur-gear, means for moving the gear-centers to hold said gears in mesh, a crank-pin carried by the elliptical gear, a link connecting said crank-pin with the concentrating-frame, and means for simultaneously giving the slats a slight oscillating motion on their pivots, substantially as described.

12. An ore-concentrator, comprising a frame having a series of inclined slats therein, pivoted at their lower edges and each having a riffle extending along its pivot edge, the upper edge of the riffle being substantially in line with the pivots, said slats being placed in successively lower planes so that the overflow from one is received by the next, a circular gear having a power connection, an elliptical gear, a link connecting the gears and holding them in mesh, a link having a fixed pivot at one end and pivoted at the other end to the elliptical gear, a crank-pin upon said elliptical gear, a link connecting said crank-pin with the concentrating-frame, and means for simultaneously giving the slats a slight oscillating motion on their pivots, substantially as described.

HENRY C. GRANNATT.

Witnesses:
JOHN M. BUSTER,
A. R. THOMPSON.