No. 830,425. PATENTED SEPT. 4, 1906.

W. E. FORD.

ORE CONCENTRATOR.

APPLICATION FILED MAY 10, 1905.

4 SHEETS—SHEET 1.

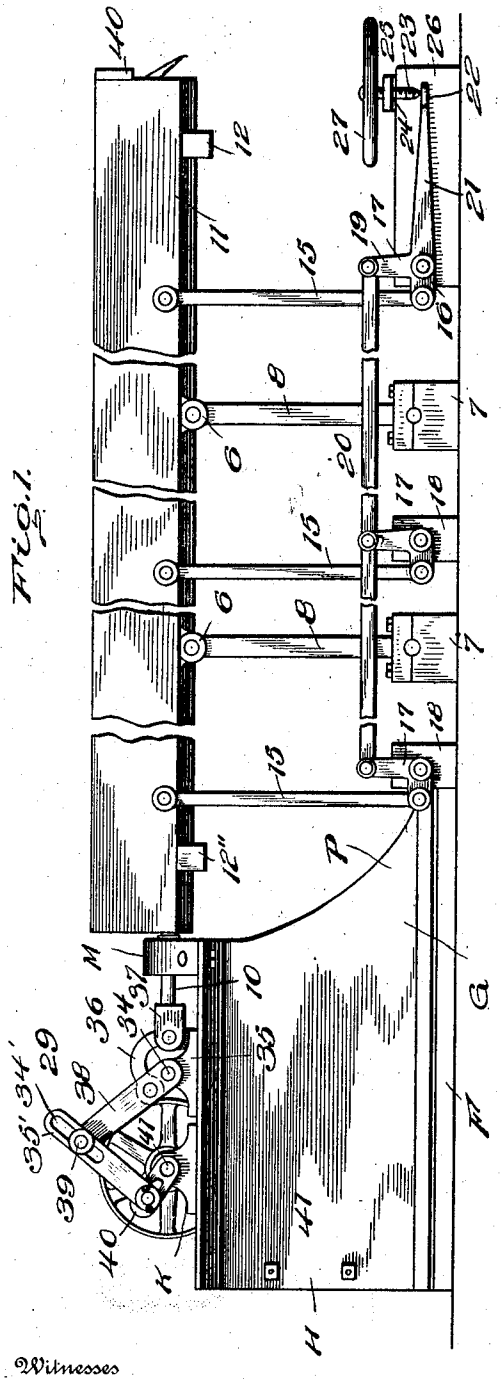


Fig. 1.

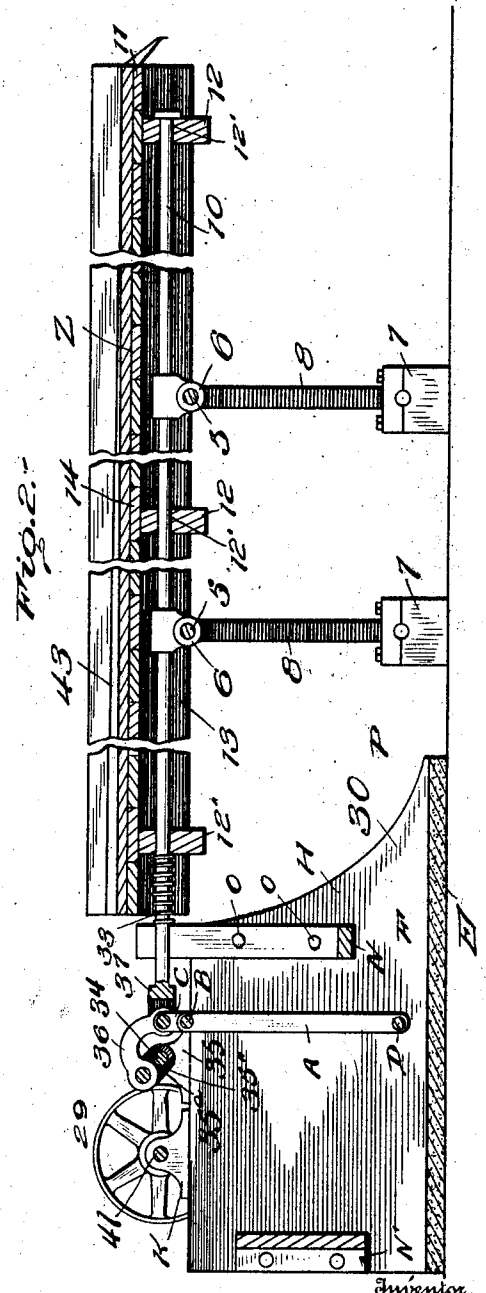


Fig. 2.

Witnesses

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4 SHEETS—SHEET 2.

Fig. 3.

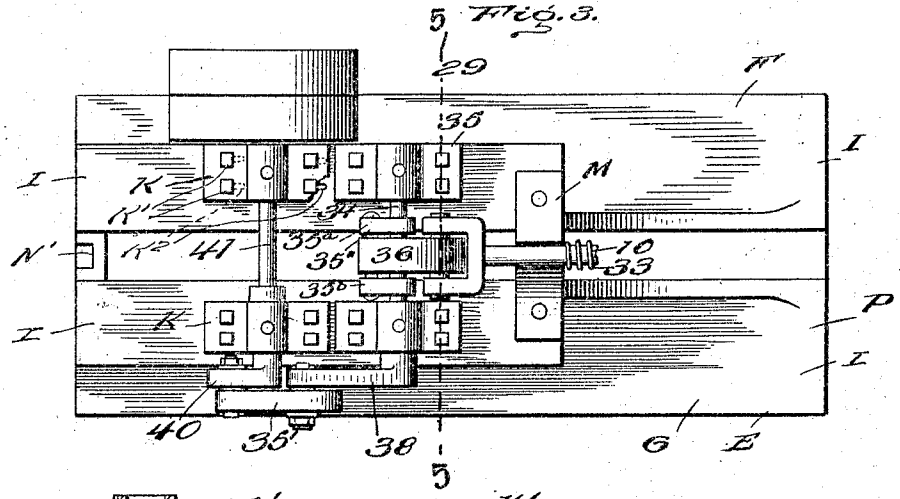


Fig. 4.

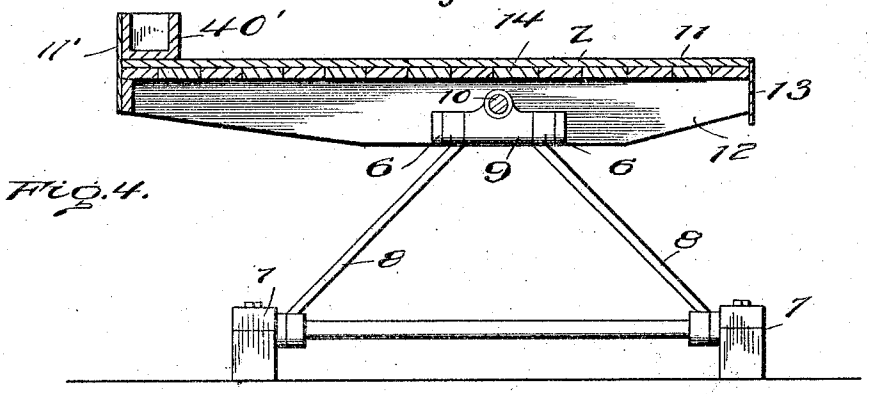
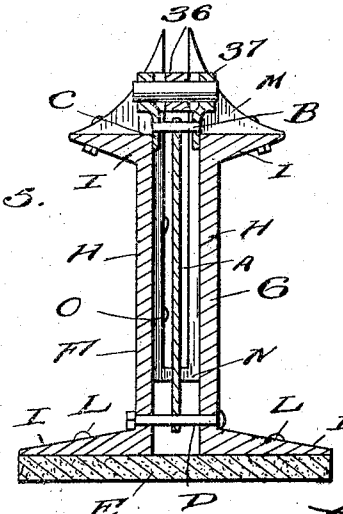


Fig. 5.



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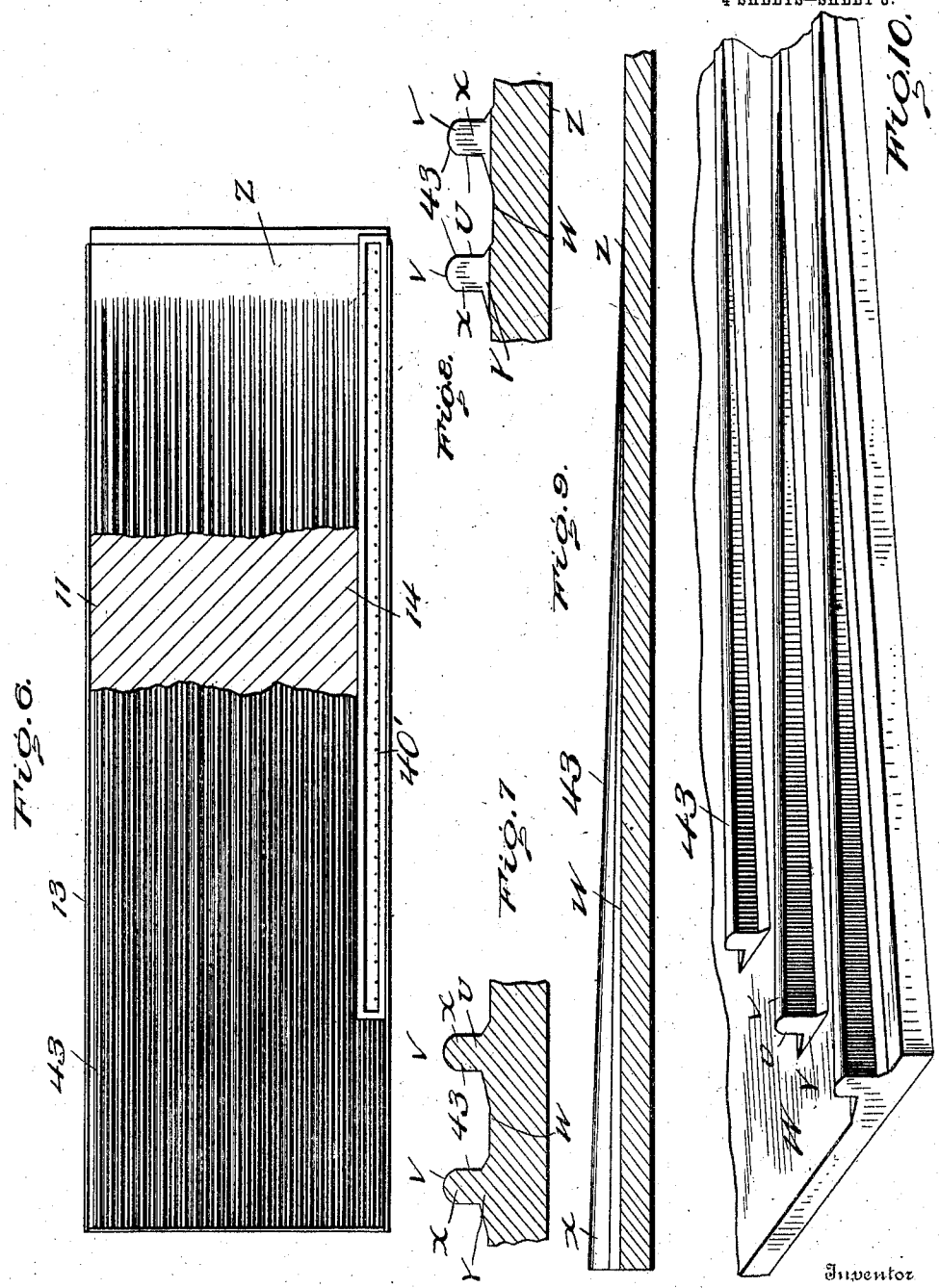
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4 SHEETS—SHEET 3.



Witnesses

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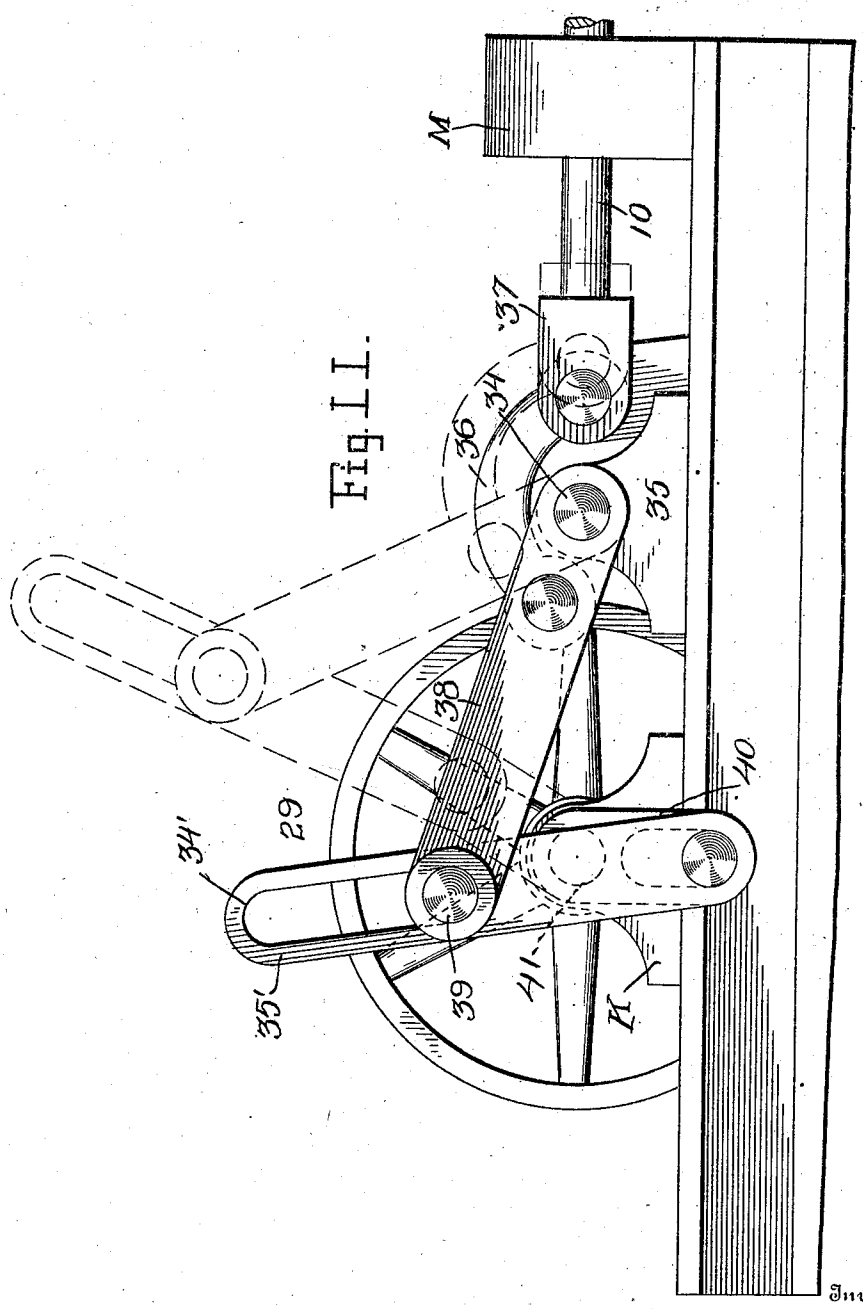
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4 SHEETS—SHEET 4.

Fig. II.



Witnesses
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UNITED STATES PATENT OFFICE.

WILLIAM E. FORD, OF CARTHAGE, MISSOURI.

ORE-CONCENTRATOR.

No. 830,425. Specification of Letters Patent. Patented Sept. 4, 1906.

Application filed May 10, 1905. Serial No. 259,746.

To all whom it may concern:

Be it known that I, WILLIAM E. FORD, a citizen of the United States, residing at Carthage, in the county of Jasper, State of Missouri, have invented certain new and useful Improvements in Ore-Concentrators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to ore-treating machines, and more particularly to those known as "concentrators," and has for its object to provide a machine of this nature which will be arranged to separate matter of various specific gravities.

Another object is to provide a machine of this kind which will be susceptible of adjustment and which will include a movable bed and means for moving the latter.

Another object is to provide a bed equipped with the ribs known as "riffles," these riffles being arranged in a novel manner.

Other objects and advantages will be apparent from the following description, and it will be understood that changes in the specific construction shown and described may be made within the scope of the claims and that any suitable materials may be used without departing from the spirit of the invention.

In the drawings forming a portion of this specification, and in which like characters of reference indicate similar parts in the several views, Figure 1 is a side elevation. Fig. 2 is longitudial section. Fig. 3 is a top plan view of the reciprocating mechanism. Fig. 4 is a transverse section of the bed. Fig. 5 is a transverse section on line 5 5 of Fig. 3. Fig. 6 is a top plan view of the bed. Fig. 7 is a detail sectional view showing two of the riffles at the feed end of the bed. Fig. 8 is a sectional view showing two of the riffles adjacent to the discharge end of the bed. Fig. 9 is a longitudinal section of the bed, showing one of the riffles in side elevation. Fig. 10 is a perspective view showing a portion of a bed embodying a modified form of the invention. Fig. 11 is a side elevation of the invention, showing the table-actuating mechanism in full lines at one limit of its movement and in dotted lines at the other limit of its movement,

Referring now to the drawings, the present invention comprises a plurality of transversely-extending shafts 5, journaled at their ends in brackets 6. Mounted upon these shafts there are supporting members 7, which include upwardly and inwardly directed side pieces 8, having horizontally-extending members 9, journaled therebetween at their upper ends. A longitudinally-extending shift-rod 10 is mounted in these members 9, and pivoted upon this shift-rod there is a bed 11, including spaced transversely-extending beams 12, having openings 12′, in which the shift-rod is revolubly engaged and to which at the ends are secured longitudinally-extending sills 13, having a floor 14 secured thereupon, this floor being formed of diagonally-disposed planks.

The shift-rod 10 is located at one side of the central longitudinal axis of the bed, and pivoted to the sill 11′, which lies farthest from the shift-rod, there are a plurality of depending links 15, which are pivoted at their lower ends to the horizontally-extending arms 16 of bell-crank levers 17, which are pivoted upon brackets 18. The remaining arms 19 of the bell-crank levers extend upwardly and are connected by a rod 20. A horizontal arm 21 extends oppositely from the arm 16 of one of the levers and has an outer end 22, against which rests one end of a threaded bar 23, which is engaged in the threaded perforation 24 of a block 25, the latter being secured upon a suitable support 26, which may be a horizontally-extended portion of the bracket 18, to which the last-mentioned bell-crank lever is attached. The bar 23 is provided with a horizontal hand-wheel 27, and it will thus be seen that the just-described portion of the machine may be operated to vary the transverse pitch of the bed.

The beam 12, which lies adjacent to the rearward or feed end 28 of the bed, is indicated at 12″, and located at this end of the bed there is an actuating mechanism 29, mounted upon a foundation 30, consisting of a concrete base E, upon which are secured a pair of longitudinally-extending spaced channel-irons F and G, their webs H being disposed vertically and their flanges I being directed outwardly, the upper flanges being somewhat narrower than the lower flanges. Cast integral with the upper flanges of a channel-iron adjacent to the forward ends thereof are boxings 35, in which a rock-shaft 34 is journaled, and mounted upon the upper

flanges I adjacent to the rearward ends thereof are boxings K, in which is journaled a power-shaft 41, and these boxings are adjustable longitudinally of the channel-irons to permit of variation of the positions of the arm 38 and link 35′ with respect to each other.

The channel-irons F and G are secured to the concrete base E by means of anchor-bolts L. Extending upwardly from the channel-irons forwardly of the boxings 35 there are projections M, which are connected by a yoke N, extending downwardly between the channel-irons, and these projections are held in position by bolts O engaged therein and in the upper flanges I of the channel-irons. The projections M receive thereagainst the rearward end of a helical spring 33, which surrounds the shift-rod 10 and which rests at its forward end against the beam 12″, this spring forming a buffer to prevent lost motion between the working parts.

The channel-irons F and G have a yoke N′ secured therebetween adjacent to their rearward ends, and this yoke has its spaced portions fastened to the webs H of the channel-irons by means of suitable bolts, the yokes M and N′ thus acting to connect the channel-irons and strengthen the structure. The forward ends of the channel-irons are slanted downwardly and forwardly, as shown at P.

The rock-shaft 34 extends transversely and has an upwardly-extending crank 35″ therein, which is connected by means of a curved link 36 with the adjacent end of the rod 10, this rod having spaced arms 37 connected therewith, between which the link 36 is pivoted. At one end the shaft 34 has an upwardly-extending arm 38, having a laterally-projecting pin 39 at its upper end, which is adjustably engaged in a slot 34′, formed longitudinally in the upper portion of a link 35′, which extends downwardly and which is pivoted to a crank 40, carried by the horizontally-extending power-shaft 41.

The arm 38, as mentioned above, is pivoted to the link 35′ above the planes of the shafts 34 and 41, and it will be seen from the drawings that as the shaft 41 revolves the crank 40, revolving therewith, will rock the arm 38 through the medium of the link 35′, and the arc through which this arm moves is one of approximately eighty degrees. By reason of the fact that the crank 35″ and the arm 38 occupy a common plane longitudinally of the shaft 34, as shown, the crank 35″ also moves through an arc of approximately eighty degrees, and the arrangement is such that when the crank is at the forward limit of its movement in the direction of the bed it occupies a nearly-vertical position, the crank occupying an approximately horizontal position when at the rearward limit of its movement. It will thus be seen that this crank moves through a portion of a circle described concentrically with the shaft 34, and this portion of the circle is the upper portion of that half of the circle which lies farthest from the bed.

It will of course be seen that when the crank 35″ moves through its arc the shift-rod 10 will be moved through the medium of the link 36, and it will also be apparent that when the crank is moved rearwardly its horizontal movement is constantly decreased and the rate of horizontal movement of the shift-rod is proportionately decreased, the rate of movement of the shift-rod being increased when the crank is moved upwardly and forwardly until the crank has reached the forward limit of its movement, when the maximum of speed of the shift-rod and therewith the bed will have been reached. When the crank has reached the forward limit of its movement, its motion and that of the shift-rod and bed are reversed, and this reversal takes place when the bed is moving at its greatest rate of speed. By reason of the fact that the speed of the shift-rod 10 is constantly decreasing during the rearward movement thereof, the power of this shift-rod is constantly increased, and it will be seen that the buffer-spring 33 is compressed during this increase of power. By reason of the proportionate lengths of the link 35′ and the arm 38 the crank 40 moves through a greater portion of its circle when the arm 38 is being moved rearwardly than when the arm is being moved forwardly, so that the bed 11 is moved forwardly at a greater rate of speed than when it is moved rearwardly. By reason of the fact that the rearward movement of the bed is at a rate of speed less than that of the forward movement thereof, the power exerted by the shaft is further increased during its rearward movement, and this increase of power also occurs during the compression of the spring 33.

The shaft 34 is unbroken, the crank 35″ being formed by spaced arms 35ª and 35ᵇ, which extend at right angles to the shaft, and the link 36 is concave at that surface which lies in the direction of the shaft 34 to receive into its concavity the portion of the shaft extending between the arms 35ª and 35ᵇ. It will thus be seen that a structure is provided the strength of which is materially increased by the fact that the shaft is unbroken.

A supporting-link A is pivoted at its upper end upon a pin B, extending laterally from an arm C, which depends from the rearward end of the shift-rod 10, this pivot-point being in a horizontal plane with the pivot-points of the supporting members 7 and the members 9, and at its lower end the link A is pivoted on a bolt D, engaged in the webs of the channel-irons, this bolt occupying a common plane with the shafts 5. The link A thus supports the rearward end of the shift-rod 10.

Located above the floor 14 of the bed there are a plurality of longitudinally-extending planks Z, which form the working surface of the bed, and formed integral with these planks there are a plurality of upwardly-projecting longitudinally-extending riffles 43 of equal width, which extend parallel to each other and in spaced relation. Each of these riffles consists of a base portion Y and an upper central portion X, the former being somewhat wider than the latter and having its upper surface at opposite sides of the central portion slanted downwardly and outwardly to the working surface W of the bed. The upper portions X of the riffles are reduced in height gradually from their rearward to their forward ends and the upper surfaces of these central portions are curved transversely throughout their entire lengths, as shown at V. Throughout their rearward portions the central portions X of the riffles have vertical side surfaces U; but by reason of the fact that the central portions of the riffles are slanted downwardly toward their forward ends these vertical surfaces are constantly reduced in height until they disappear, and the arcs V terminate at the slanted surfaces of the base portions Y. It will be readily seen that between this point and the forward ends of the riffles the arcs are of constantly lessening convexity, due to the further reduction of the height of the central portions of the riffles until the arcs disappear entirely, these arcs being merged into the slanted surfaces of the base portions, and it will also be seen that the height of these base portions is reduced until they terminate at their forward ends at the working surface W, the forward ends of the riffles being spaced from the forward end of the bed.

At the side edge of the bed 11, which lies farthest from the rod 12, there is a water-supply box 40′, arranged to discharge water upon the bed.

In operation the shaft 41 is rotated upwardly and away from the bed, which causes the bed to move quickly forwardly and then slowly rearwardly, the speed being constantly increased during its forward movement and constantly decreased during its rearward movement, as described above, and it will be seen that when the bed is at the forward limit of its movement the crank 35″ will extend at a lesser angle to the plane of movement of the bed than when the bed is at the rearward limit of its movement, this being due to the fact that the crank moves through the portion mentioned above of a circle described concentrically with the shaft 34. Ore to be separated is placed upon the bed at the rearward or feed end thereof and the movement of the bed causes the ore to be thrown toward the discharge end thereof. At the same time water from the discharge-box 40′ passes over the surface of the bed transversely and the particles of matter of lesser specific gravity are carried off thereby, the particles of greater specific gravity falling between the riffles. It will thus be seen that the heaviest matter will be deposited between the riffles which lie nearest to the water-box and that the particles of lessening weight will extend toward the opposite side of the bed, the light waste matter being carried off entirely.

As will be readily understood, the transverse pitch of the bed may be varied as described above to suit different conditions, and by means of the slot 34′ of the link 35′ the mechanism is susceptible of adjustment to vary the length of the arc through which the arm 38 moves. By reason of the fact that the power-shaft 41 is adjustable toward and away from the shaft 34 the relative length of time consumed by the bed in its forward and rearward movements may be varied.

In Fig. 10 there is shown a modified form of the invention, in which the riffles 43 from the water-supply side of the bed to the discharge side thereof lie with the points at which the vertical side faces of their central portions Y disappear forwardly of these points of the preceding riffles, so that these points lie in a diagonal line extending transversely of the bed and the riffles terminate at their rearward ends on a diagonal line parallel to the line at which the vertical faces of the riffles disappear.

What is claimed is—

1. In a mechanism of the class described, the combination with a reciprocating bed, means for reciprocating the bed, said means comprising an unbroken rock-shaft, a crank carried by the rock-shaft, a curved link pivoted to said crank and disposed with its concaved side toward the said rock-shaft and being arranged to receive the said shaft in its concavity, and connections between the said link and the bed to reciprocate the latter when the crank is rocked, said crank being arranged to extend when at the limit of its movement toward the bed, at a lesser angle to the plane of movement of the bed than when the crank is at the limit of its movement away from the bed.

2. In a mechanism of the class described, the combination with a reciprocating bed, of means for reciprocating the bed comprising an unbroken rock-shaft, a crank carried by the rock-shaft and movable toward and away from the bed, a curved link pivoted to said crank and disposed with its concaved side toward the said rock-shaft and being arranged to receive said rock-shaft in its concavity, connections between the link and the bed to reciprocate the latter when the crank is rocked, said crank being movable to increase the angle between it and the plane of movement of the bed when the crank is

moved away from the bed and to decrease said angle when the crank is moved toward the bed.

3. In a mechanism of the class described, the combination with a reciprocating bed, of means for reciprocating the bed, said means comprising an unbroken rock-shaft, a crank carried by the rock-shaft, a curved link pivoted to the crank and disposed with its concaved side toward the rock-shaft and being arranged to receive said shaft in its concavity, and connections between the link and the bed for reciprocation of the latter when the shaft is rocked, said crank and link being movable with respect to each other to increase the angle between the crank and the link when the crank is moved toward the bed, and to decrease said angle when the crank is moved away from the bed.

4. In a mechanism of the class described the combination with a reciprocating bed, of means for reciprocating the bed comprising an unbroken rock-shaft, means for rocking the shaft, a crank carried by the rock-shaft, a curved link pivoted to the crank and operative connections between the curved link and the bed, said link being disposed with its concave side directed toward the rock-shaft and being arranged to receive the shaft in its concavity, said shaft extending at opposite sides of the link.

5. In a mechanism of the class described, the combination with a reciprocatory bed, of a shift-rod carried by the bed, and means for reciprocating the bed, said means comprising an unbroken rock-shaft, a crank carried by the rock-shaft and movable toward and away from the bed, means for rocking the shaft—and a curved link connected with the crank and with the shift-rod to reciprocate the latter when the shaft is rocked, said link having its concaved side directed toward the said rock-shaft and arranged to receive the said shaft in its concavity, said crank being arranged to lie at the least angle to the path of movement of the shift-rod when at the limit of its movement in the direction of the shift-rod.

6. The combination with a reciprocating body having a forward and a rearward end, of means for reciprocating the body comprising an unbroken rock-shaft, means for rocking the shaft, a crank carried by the rock-shaft and movable therewith forwardly and rearwardly in an arc, a curved link pivoted to said crank and disposed with its concaved side toward said rock-shaft and being arranged to receive the said shaft in its concavity, and connections between the crank and the reciprocating body for movement of the latter when the crank is rocked, said crank being arranged to lie at the least angle to the plane of movement of the body when the crank is at its forward limit of its movement.

7. In a mechanism of the class described, the combination with a reciprocatory bed, of means for reciprocating the bed comprising a power-shaft, an unbroken rock-shaft, a crank carried by the rock-shaft, a crank carried by the power-shaft, a curved link connected with the first-named crank, said link being adapted to receive the said rock-shaft in its concavity, an arm carried by the rock-shaft and pivoted to the link, the distance between the pivot-point of the link and arm and the pivot-point of the link and the crank being less than the distance between the first-named pivot-point and the rock-shaft, a crank carried by the rock-shaft, and operative connections between the crank and bed.

8. An ore-concentrator comprising a bed means for giving the bed a longitudinal differential shake and spaced upwardly-extending riffles carried by the bed, each of said riffles having a base portion and an upper central portion, the former being slanted upwardly from the surface of the bed to the central portion, said central portion having vertical side walls throughout a portion of its length and having an upper transversely-curved surface, said riffles being reduced in height from one end to the other, the points of termination of the side surfaces of the several riffles being disposed in a diagonal line transversely of the bed.

9. An ore-concentrator comprising a bed, means for giving the bed a longitudinal differential shake, spaced riffles carried by the bed and extending upwardly therefrom, each of said riffles having a base portion and an upper central portion, the base portion extending laterally beyond the central portion and being slanted upwardly from the surface of the bed to the central portion, said central portion having vertical side surfaces throughout a portion of its length and having a transversely-curved upper surface, said riffles being reduced in height throughout their entire lengths.

10. An ore-concentrator comprising a bed, means for giving the bed a longitudinal differential shake, spaced upwardly-extending riffles carried by the bed, each of said riffles having a base portion and an upper central portion, the base portion being slanted upwardly from the surface of the bed to the central portion, said riffles being gradually reduced in height from one end to the other, the entire portions of the riffles having vertical side surfaces terminating short of one end of the riffles and having transversely-curved upper surfaces.

11. An ore-concentrator comprising a bed arranged for longitudinal movement, means for reciprocating the bed, said means comprising an unbroken rock-shaft, means for rocking the shaft, a crank carried by the rock-shaft, a curved link pivoted to the crank and operative connections between the curved link and the bed, said link being

disposed with its concaved side toward the rock-shaft and being arranged to receive the said shaft in its concavity, said bed-reciprocating means being arranged to move the bed faster forwardly than rearwardly.

12. In a mechanism of the class described, the combination with a reciprocating bed, and a shift-rod connected thereto, of means for reciprocating the bed, said means including a suitable frame, a power-shaft mounted on said frame and adjustable longitudinally thereof, a rock-shaft, a crank carried by said power-shaft, a link adjustably connected to said crank, an arm carried by said rock-shaft and adjustably connected to said link, a crank carried by said rock-shaft, a curved link pivoted to said crank at one of its ends and connected at the other of its ends to said shift-rod, and a supporting-link pivoted in said frame at its lower end and pivoted at its upper end to the said shift-rod.

13. In an ore-concentrator, the combination with supports, of a rod mounted in the supports, said supports being arranged for longitudinal rocking movement to permit of longitudinal movement of the rod, a bed pivotally mounted upon the rod for transverse rocking movement with respect thereto, said rod lying at one side of the central longitudinal axis of the bed, a bed-moving mechanism connected therewith at the opposite side of said axis from the rod, said mechanism being arranged for operation to move the bed and vary the transverse pitch thereof, and means for adjusting said bed longitudinally of the said rod.

14. In an ore-concentrator, the combination with supports, of a rod mounted in the supports, said supports being arranged for pivotal movement to permit of longitudinal movement of the rod, a bed-reciprocating mechanism connected with the rod, a bed pivotally mounted upon the rod for transverse movement with respect thereto, said rod lying at one side of the central longitudinal axis of the bed, bell-crank levers, links connected at one of their ends to said bed at the side opposite the said axis from the rod and at the other of their ends to one of the arms of said bell-crank levers, a rod connecting the other of the arms of said bell-crank lever, a third arm carried by one of said bell-crank levers, and means for adjusting said arm to adjust the pitch of said bed.

15. In an ore-concentrator, in combination, rock-shafts, standards mounted upon said rock-shafts, a rod mounted upon said standards, said standards being arranged for longitudinal rocking movement to permit of longitudinal movement of the rod, a bed pivotally mounted upon the rod for transverse movement with respect thereto, said rod lying at one side of the central longitudinal axis of the bed, and a bed-moving mechanism connected therewith at the opposite side of said axis from the rod, said mechanism being arranged for operation to move the bed and vary the transverse pitch thereof.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM E. FORD.

Witnesses:
FRANK C. HALL,
E. M. COLFORD.