

N. MOSSBERG.
CONCENTRATOR.
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1,057,079.

Patented Mar. 25, 1913.

2 SHEETS—SHEET 1.

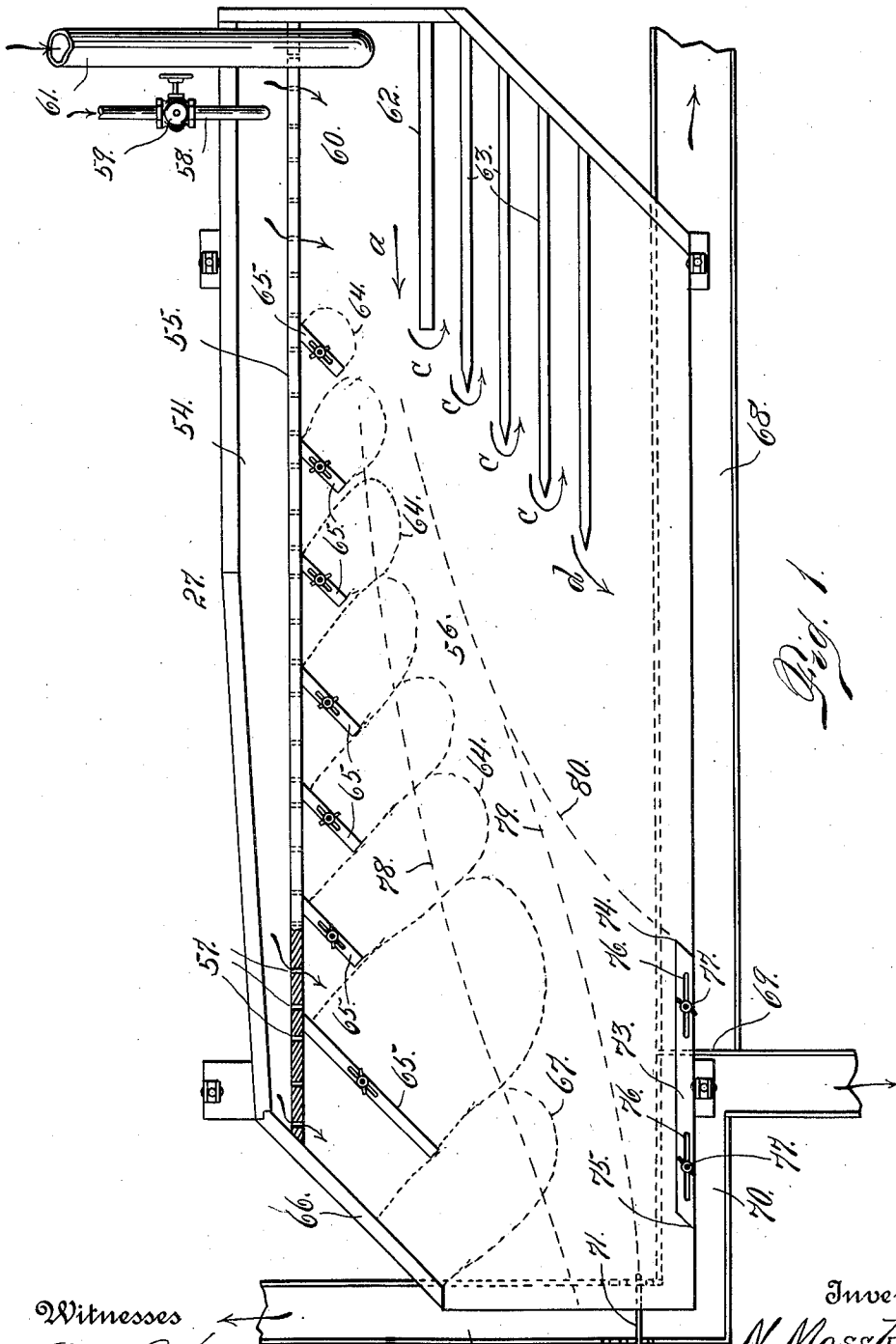


Fig. 1

Witnesses
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2 SHEETS—SHEET 2.

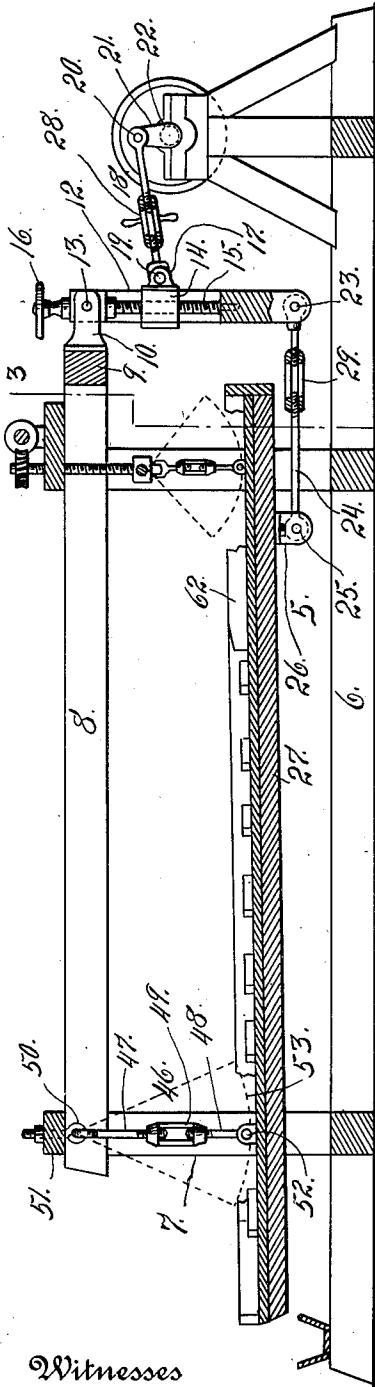


Fig. 2

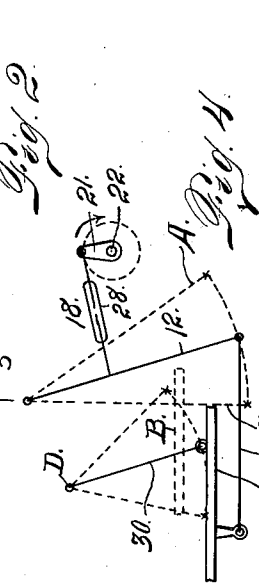


Fig. 4

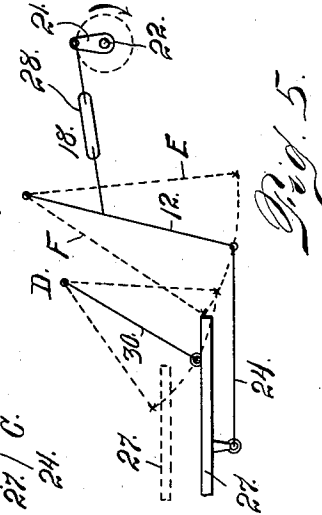


Fig. 5

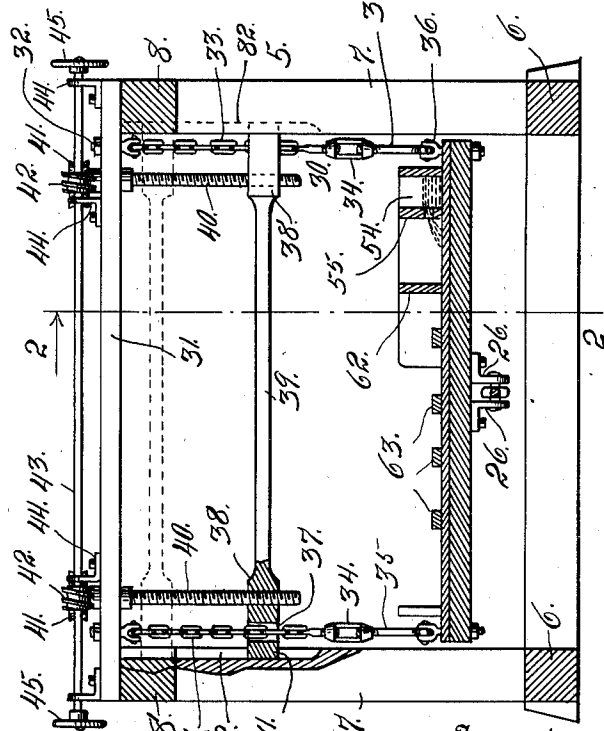


Fig. 3

Witnesses

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UNITED STATES PATENT OFFICE.

NELS MOSSBERG, OF DENVER, COLORADO.

CONCENTRATOR.

1,057,079.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, NELS MOSSBERG, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Concentrators; and I do 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, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in concentrators, my object being to provide an apparatus of this character which shall efficiently perform the function of separating metallic values from the gangue and which may at the same time be of simple and economical construction.

My improved concentrator, generally speaking, consists of a table suspended to oscillate longitudinally in such a manner as to cause the concentrates to travel toward the tail of the table, or the extremity opposite the head where the material to be treated is fed thereto; while the gangue travels in a transverse direction, being discharged at the lower longitudinal edge of the table, which is inclined both longitudinally and transversely.

The material to be treated, in the form of pulp, is discharged at the upper or highest corner of the head of the table, while the wash water, utilized in treating the material, is delivered to a trough arranged along the upper longitudinal edge of the table, one wall of the trough being perforated to permit the escape of the water to the concentrating surface of the table top.

An important feature of my present invention, consists in the arrangement of water deflectors which extend forwardly and downwardly from the perforated wall of the wash water trough, the said deflectors consisting of strips of suitable material directed diagonally across the table, but relatively short, whereby they shall not interfere with the travel of the concentrates longitudinally of the table and their discharge at the tail end thereof. These deflectors are so arranged that during the forward travel of the table, the wash water which escapes from the trough in the rear of the deflectors, is splashed thereagainst and carried rear-

wardly toward the head of the table, forming a sort of eddy acting upon the material to perform the separating function. These rearwardly directed eddies, or wash water currents, act upon the gangue to carry the latter rearwardly and downwardly toward the lower longitudinal edge of the table, while the concentrates, which are heaviest, occupy the lowermost position on the table top and are of sufficient weight to resist the action of the eddies, or currents. In this way, the deflectors by producing the eddies, or currents, perform an important function in the treatment of the material.

Another novel feature consists in the construction for regulating the oscillating movement of the table, whereby its head extremity may be caused to occupy its highest position, either at the limit of its forward or rearward stroke. Furthermore, I employ flexible suspension means at the head of the table, and provide a vertically adjustable bar equipped with openings through which the suspension chains, for instance, pass. By the vertical adjustment of this bar the radius of the arc of travel of the head of the table may be regulated. For instance, if the bar is so adjusted as to allow a relatively long length of chain between it and the table, the radius of the arc in which the head swings will be greater, and consequently, the arc of travel will more nearly approach the horizontal, while if the rigid bar is lowered so that a relatively short length of chain is below the same, the arc of travel will be relatively steep.

Having briefly outlined my improved construction, I will proceed to describe the same in detail, reference being made to the accompanying drawing in which is illustrated an embodiment thereof.

In this drawing: Figure 1 is a top plan view of my improved concentrating table. In this view only the table top, together with the means for supplying wash water and pulp is illustrated, together with the troughs for receiving the concentrate and gangue discharge from the table. Fig. 2 is a vertical longitudinal section of the table. This section is taken on the line 2—2, Fig. 3, the parts being shown on a smaller scale than Fig. 1. Fig. 3 is a section taken on line 3—3 Fig. 2. Figs. 4 and 5 are diagrammatic views, illustrating the manner of regulating the swing of the head of the table by changing the length of the pitman lead-

ing from the crank shaft to the vertically disposed lever arm employed in imparting the oscillating movement to the table.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate the frame work of the machine, consisting of bottom beams 6, upright beams 7, and longitudinally disposed top beams 8, the latter being connected by a transverse top beam 9, which is centrally provided with a rearward projection 10 upon which a lever arm 12 is fulcrumed, as shown at 13. This lever arm has a nut engaged by a screw 15, journaled in the lever arm and terminating at its upper extremity in a hand wheel 16. By turning this hand wheel the nut may be caused to travel vertically, either up or down, upon the lever arm. This nut is provided with a rearwardly projecting lug 17, with which the forward extremity of a pitman 18, is pivotally connected, as shown at 19, the rear extremity of the pitman being pivotally connected, as shown at 20, with a crank 21 of a shaft 22.

The lower extremity of the lever arm, being the extremity remote from the fulcrum 13, is pivotally connected, as shown at 23, with a rod 24, whose forward extremity is pivoted, as shown at 25, to a pair of angle brackets 26, between which the forward extremity of the rod is located, the said brackets being connected with the lower surface of the table 27. The pitman 18 is provided with a turn-buckle device 28 for regulating its length. The rod 24 is also divided, its two members being connected by a turn-buckle 29.

As the crank shaft 22 is rotated, it will be understood that a longitudinal oscillatory movement will be imparted to the table, since the latter is suspended to swing in a longitudinal direction.

As illustrated in the drawing, the head of the table is suspended by flexible devices 30, whose upper extremities are connected with a top bar 31 by means of fastening devices 32. These devices 30 have chain members 33, the lower extremities of the chains being connected with a turn buckle 34, from which short rods 35 move downwardly, and are pivotally connected with the table on opposite sides by fastening devices 36. The chain members of the suspension devices 30 constitute the greater length of these devices. These chain members pass through openings 37 formed in the opposite enlarged extremities 38 of a transverse horizontally disposed bar 39, the latter being vertically adjustable by means of vertically disposed screws 40 journaled in the top bar 31, and threaded into the extremities of the bar 39. The upper extremity of each screw 40 is equipped with a worm wheel 41, which is engaged by a worm 42 mounted on a shaft 43 journaled

in angle brackets 44 mounted on the top bar 31. The outer extremities of the shaft 44 are provided with hand wheels 45 for convenience of operation. From this description it will be understood that by raising and lowering the bar 39 the arc of travel at the head of the table during the oscillating movement of the latter, may be regulated at will, whereby this arc may be relatively abrupt, or more nearly approaching the horizontal as may be desired. The table is further suspended near the tail thereof, by means of devices 46, consisting of upper and lower members 47 and 48, connected by a turn-buckle 49. The upper members 47 of these suspension devices are connected with eye bolts 50, secured to a cross bar 51, while the lower members 48 are pivotally connected, as shown at 52, with the table. These suspension devices permit a relatively long swing of the tail of the table, whereby the arc 53 described thereby, forms a part of a relatively large circle. No provision is made for regulating this arc, except by raising and lowering the table by the manipulation of the turn-buckle 49. On the contrary, in the case of the suspension devices at the head of the table, the arc of swing may be changed without interfering with the position of the table, that is to say, without raising or lowering the table's head, this being accomplished by the vertical adjustment of the bar 39, through which the flexible members of the suspension devices 30 pass, as heretofore explained.

Coming now to the construction of the table proper, the same may be composed of any suitable material, said table being made large enough to give the desired capacity. This table, which in its entirety has been designated by the numeral 27, is suspended in such a manner that it is both longitudinally and transversely inclined. Along its upper longitudinal edge is formed a wash water trough 54, whose wall 55 adjacent the concentrating surface 56 of the table is perforated, as shown at 57, to allow the water to escape to the table top for concentrating purposes. This trough is supplied with wash water from a pipe, or conduit, 58, leading from a suitable source of supply, the passage of water through the pipe being regulated by a valve 59. The pulp to be treated by the table is delivered to the uppermost corner 60 of its concentrating surface by a conduit 61, leading from a source of pulp supply. Below the space 60 where the pulp is originally discharged, a number of relatively short baffles, 62 and 63, are arranged, these baffles being of sufficient height to prevent pulp from passing over them whereby the pulp is caused to travel forwardly, or in the direction of the arrow "a," (see Fig. 1), until it is brought within range of the water eddies indicated by the dotted

lines 64, these eddies being formed by the dashing of the wash water against deflectors 65, whose upper extremities engage the partition 55 and extend therefrom in a direction diagonally of the table top. The deflectors, however, are relatively short, and preferably increase somewhat in length from the head toward the tail of the table, whereby the eddies 64 correspondingly increase in magnitude from the head toward the tail of the table.

The uppermost corner at the tail of the table is shaped to form a diagonal line preferably parallel with the deflectors 65. This corner of the table is provided with an upturned flange 66, which extends downwardly and forwardly beyond the longest deflector 65, and to the extent that it extends beyond the lower extremity of the adjacent deflector 65, this flange 66 itself constitutes a deflector, and causes an eddy 67 at the tail of the table.

Extending longitudinally below the lower edge of the table is a trough 68 for receiving the gangue discharge from the lower longitudinal edge of the table.

Separated from the trough 68 by a partition 69, is a receptacle 70 for what may be termed "middlings" or material which contains some values. This "middlings" receptacle is separated by an adjustable partition 71 from the trough, or receptacle 72, located at the tail of the table. In order that the discharge of gangue and middlings from the lower edge of the table may be regulated to harmonize with changed conditions, I employ a bar 73, which is located at the lower longitudinal edge of the table, and as illustrated in the drawing, a portion of it is located above the forward extremity of the gangue trough, while its forward portion extends above the "middlings" receptacle, and if when the table is in use the bar 73 is located as illustrated in Fig. 1, the gangue will be discharged into the trough 68 from that portion of the lower longitudinal edge of the table rearward of the rearward extremity 74 of the bar 73, while the "middlings" will enter the middlings receptacle between the forward extremity 75 of the bar, and the partition 71, separating the "middlings" receptacles from that of the concentrates. This bar, however, is provided with longitudinally arranged slots 76, through which are passed set screws 77, which are threaded into the body of the table top. By loosening these set screws, the bar may be moved forwardly, according to the requirement in treating any material.

In describing the construction diagrammatically illustrated in Figs. 4 and 5, it may be stated that the rearwardly located full line in each of these views represents the lever arm 12, and it is therefore, designated by the same reference character.

With this explanation, it will be understood that the part connected with this lever arm, and extending rearwardly therefrom is the pitman 18, having the turn buckle 28, the said pitman leading to the crank 21 of the shaft 22. Now if when the crank is in its uppermost position, as illustrated in Fig. 2, the turn-buckle 28 be adjusted to cause the lever arm 12 to occupy the full line position in Fig. 4, it will follow, assuming that the crank shaft is turning toward the left, or in the direction indicated by the adjacent arrow in Fig. 4, that by the time the table and lever arm have reached their rearward limit of oscillation, the lever arm will be in the position of the dotted line "A", while the table will be in the position indicated by the dotted lines "B", while when the table and lever arm have reached the limit of their forward stroke, the lever arm will be in the position indicated by the dotted line "C", while the table will be in the position below that of the full lines, the table in this case, being designated by 27, its reference character in the other views. From this, it will be understood that when the table has reached its forward limit of movement, its head extremity will be in its lowermost position, which will have a tendency to retard, rather than facilitate the forward travel of the material from the head toward the tail of the table. In these views, the shorter and forwardly located full lines, indicate the suspension means 30, located at the head of the table, the upper extremities "D" of each of these lines representing the point where the extremity 38 of the bar 39 engages the chains 33 of the suspension means 30. Again, if the turn buckles 18 be so adjusted when the crank arm 21 is at its uppermost position that the lever arm 12 shall occupy the position illustrated in Fig. 5, the lever arm will be in the position indicated by the dotted line "E" when at its rearward limit of travel, and in the position indicated by the dotted line "F" when at its forward limit of travel. In this event, the table will be in its lowermost position when at its rearward limit of travel, and in its highest position when at its forward limit of travel, the forward position being indicated by the dotted lines in Fig. 5 and the position mid-way of its forward and rearward stroke being indicated by the full lines in the same figure. Hence, when the table is at its forward limit of movement, if the pitman is adjusted, as shown in Fig. 5, the head of the table will be at its most elevated position, which will facilitate the travel of the material longitudinally of the table from the head toward the tail thereof. From this explanation, the significance of regulating the length of the pitman, in its effect upon the operation of the table will be understood. It is assumed that this

adjustment of the pitman will be made when the table is mid-way of its forward and rearward strokes, or when the crank 21 is in the position shown in Figs. 4 and 5; this makes it easy to determine the proper adjustment, as will be readily understood.

From the foregoing description, the use and operation of my improved concentrator will be readily understood. It must be assumed that the screws 40 are so adjusted as to properly regulate the elevation of the bar 39, in order to give the head of the table the proper arc of oscillation, without changing its elevation, while the suspension devices 46 at the tail of the table are adjusted to give the latter its proper inclination. The forwardly located suspension devices 30 are also vertically adjustable by means of turn-buckles 34 to regulate the inclination of the table, both longitudinally and transversely, but after this is accomplished, the arc of travel of the head of the table, whether it shall be relatively steep, or more nearly approaching the horizontal, may be regulated by adjusting the bar 29, as will be readily understood. It must also be assumed, that the length of the pitman 18 is so adjusted as to determine the proper height for the head of the table during its oscillating movement. If it is desired to have the head of the table highest when at the limit of its rearward stroke, the pitman may be adjusted, as shown in Fig. 4, while should it be considered that it would be advantageous to have the head of the table highest when at the forward limit of its stroke, the pitman should be adjusted, as shown in Fig. 5; while for other positions of the table when at the forward and rearward limit of stroke, the length of the pitman may be correspondingly regulated. For instance, if it is desired to have the head of the table at the same elevation when at both the forward and rearward limit of its stroke, and lowest when in the intermediate positions, the pitman should be regulated, as illustrated in Fig. 2, or so that the lever arm 12 is in the vertical position when the table is in the position mid-way of its forward and rearward strokes.

Assuming that the table is properly adjusted, wash water is fed into the trough 54 through the pipe or conduit 58, while the material, in the form of pulp, to be treated is discharged on the upper portion 60 of the head of the table through the conduit 61. This material, then under the influence of the longitudinal oscillation of the table and the action of the deflectors 65 upon the wash water will be separated into gangue and concentrates, the gangue being lightest and therefore acted on by the eddies, or currents 67 produced by the deflectors 65, will be carried transversely downwardly over the table and discharged from its rearward edge into

the trough 68, forward of the separating bar 73, while the concentrates will travel longitudinally toward the tail of the table and be discharged into the trough 72; while if there is an intermediate grade, or "middlings" produced, it will be discharged into the receptacle 70, intermediate the gangue receptacle 68 and the concentrate receptacle 72.

The arrows "c" in Fig. 1, indicate the travel of the material transversely, downwardly on the table at its head extremity where the short baffles 62 and 63 are located. By the time the portion of the material acted on by these baffles leaves the lowermost baffle, the values will be entirely separated therefrom, and the gangue will pass over the lower longitudinal edge of the table, as indicated by the arrow "d," it being assumed that the concentrates, or values, will have been completely separated from the gangue before the lowermost baffle is reached, and be traveling toward the tail of the table under the influence of the action of the latter, as heretofore described.

Referring to Fig. 1 of the drawing, the dotted line 78 extending lengthwise of the table, indicates approximately the transverse center of the concentrates area as they travel forwardly toward the trough, or concentrates receptacle, 72. These concentrates occupy a fairly well defined longitudinal area, extending on opposite sides of the dotted line 78. The area below this line extends approximately to the dotted line 79. The space between the dotted line 79 and a line 80, may be designated as the area of the table occupied by the "middlings," while the space at the right of the line 80, may be termed the area occupied by the gangue which is discharged from the lower longitudinal edge of the table between the point where this line intersects the said edge, and a point opposite the arrow "d." The lines 78, 79 and 80, are not intended to be absolutely accurate, since it is well known that under different circumstances the relative areas occupied by the different grades of material will vary considerably. These lines are, however, intended to give an approximate idea of the areas occupied by the respective grades of material, and it is believed they will, to some extent, facilitate a proper understanding of the principle of operation of my improved construction. The extreme ends 81 of the bar 39 enter grooves 82, formed in the up-right beams 7 of the frame work, whereby the bar 39 is held against displacement in a longitudinal direction. This construction prevents any strain upon the adjusting screws 40, which otherwise would result if the adjustable fulcrum bar 39 were not anchored, as just explained. In further explanation of the operation of the table, it may be stated that by

virtue of the vertical adjustment of the nut 14 on the lever arm 12, the length of the table's stroke is regulated.

The baffle plate, or wall 62, makes a sort of receptacle at the upper right hand corner of the table (see Fig. 1), for the pulp to be treated, and into which the material is fed from the conduit 61. The elements 63 which have been termed "baffles," while they are relatively shallow, as illustrated in Fig. 3, are in reality baffle plates, or walls, rather than "riffles," since when the machine is in operation, no material passes over these elements; they simply form stops to prevent the pulp as it leaves the receptacle 60 from passing transversely downwardly to the lower longitudinal edge of the table too abruptly. By the employment of these baffles the heavy material containing the values is caused to travel forwardly and enter the concentrates area of the table, where it is acted on by the eddies, or currents, 64. Any material which leaves the lowermost baffle, taking the direction of the arrow "d," will be devoid of values, as heretofore explained.

Having thus described my invention, what I claim is:

1. In a concentrator, a longitudinally reciprocating table inclined longitudinally toward the concentrates discharge end and also transversely, means for introducing pulp at the upper end and wash water along the upper side edge of the table, and deflectors upon the upper surface of the table adjacent the upper side edge and so arranged as to direction as to cause eddy currents to flow diagonally across and toward the upper end of the table, and spaced baffle plates 35 mounted upon the surface of the table, said plates being of sufficient height to prevent pulp from passing over them, and extending downwardly from the head of and parallel to the length of the table, said plates 40 increasing in length toward the lower side of the table.

2. In a concentrator, a longitudinally reciprocating table, inclined downwardly toward the concentrates discharge end and also transversely, means for introducing pulp at the upper end and wash water along the upper side of the table, and deflectors projecting from and extending along the table surface and inclined downwardly toward the lower side and toward the concentrates discharge end, said deflectors being adapted to create eddy currents diagonally against the longitudinal flow of concentrates.

3. In a concentrator, a longitudinally re-

ciprocating table inclined downwardly toward one side and toward the concentrates discharge end, means for introducing pulp at the upper end and wash water along the upper side edge of the table, and deflectors 65 projecting from and extending along the table surface adjacent the upper side edge of the table and inclined diagonally toward the lower side and toward the concentrates discharge end, said deflectors being adapted 70 to create eddy currents diagonally against the longitudinal flow of concentrates.

4. In a concentrator, a longitudinally reciprocating table inclined downwardly toward one side and toward the concentrates 75 discharge end, means for introducing pulp at the upper end and wash water along the upper side edge of the table, and deflectors projecting from and extending along the table surface near the upper side edge, said 80 deflectors being parallel and suitably spaced, and inclined downwardly toward the lower side and toward the concentrates discharge end, and being adapted to create eddy currents diagonally against the longitudinal 85 flow of concentrates.

5. In a concentrator, a longitudinally reciprocating table inclined downwardly toward one side and toward the concentrates discharge end, means for introducing pulp 90 at the upper end and wash water along the upper side edge of the table, and deflectors projecting from and extending along the table surface near the upper side edge and being inclined downwardly toward the lower 95 side and toward the concentrates discharge end, and increasing in length from the head toward the tail of the table, the said deflectors being adapted to create eddy currents diagonally against the longitudinal flow of 100 concentrates.

6. In a concentrator, a longitudinally reciprocating table inclined longitudinally toward the concentrates discharge end and also transversely, means for introducing 105 pulp at the upper end and wash-water along the upper side edge of the table, and deflectors upon the upper surface of the table adjacent the upper side edge and so arranged as to direction as to cause eddy currents to 110 flow diagonally across and toward the upper end of the table, said deflectors being adjustable as to direction.

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

NELS MOSSBERG.

Witnesses:

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