A. R. WILFLEY.

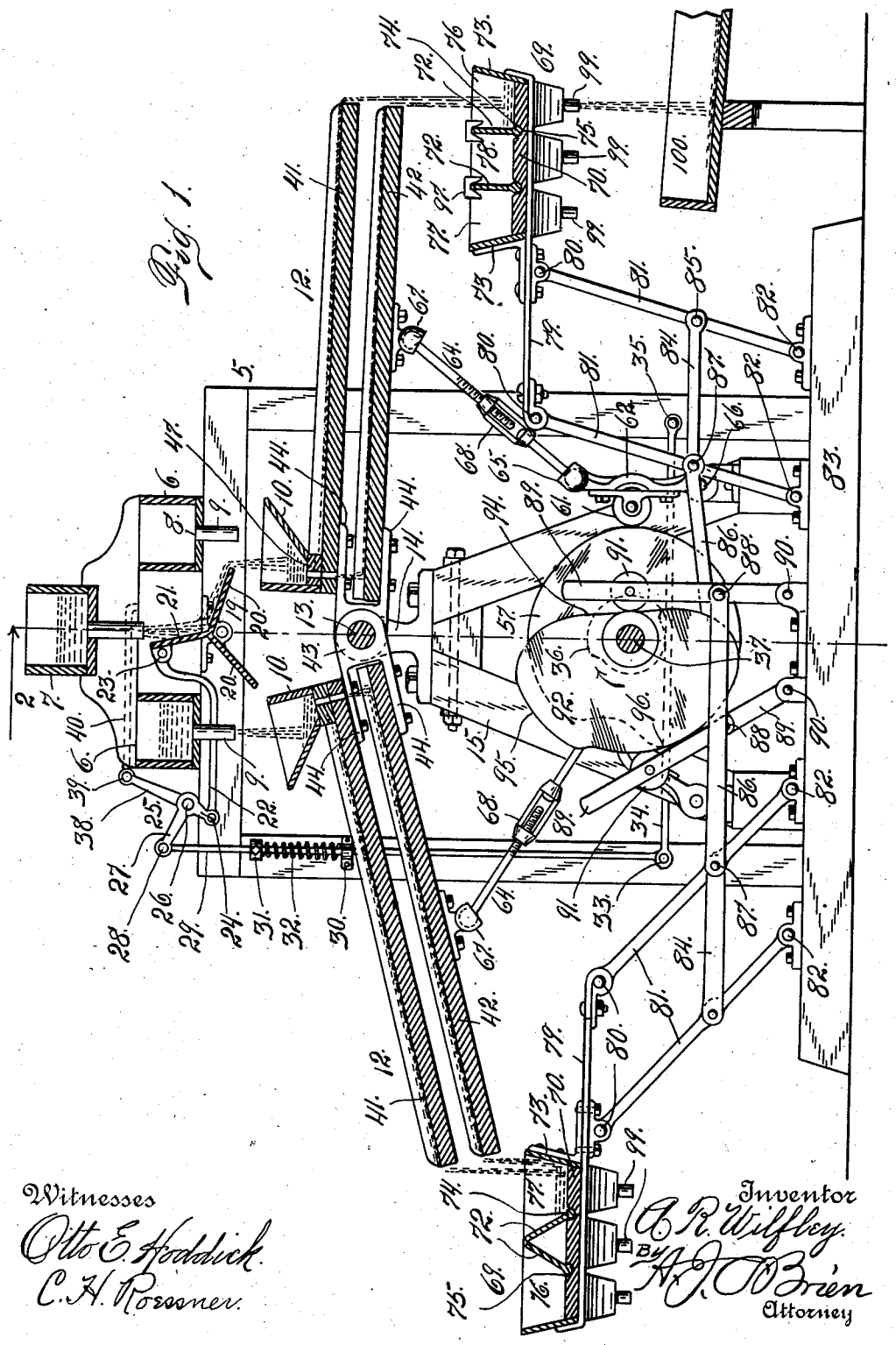
CONCENTRATOR.

APPLICATION FILED FEB. 2, 1911.

1,021,961.

Patented Apr. 2, 1912.

6 SHEETS—SHEET 1.



Witnesses

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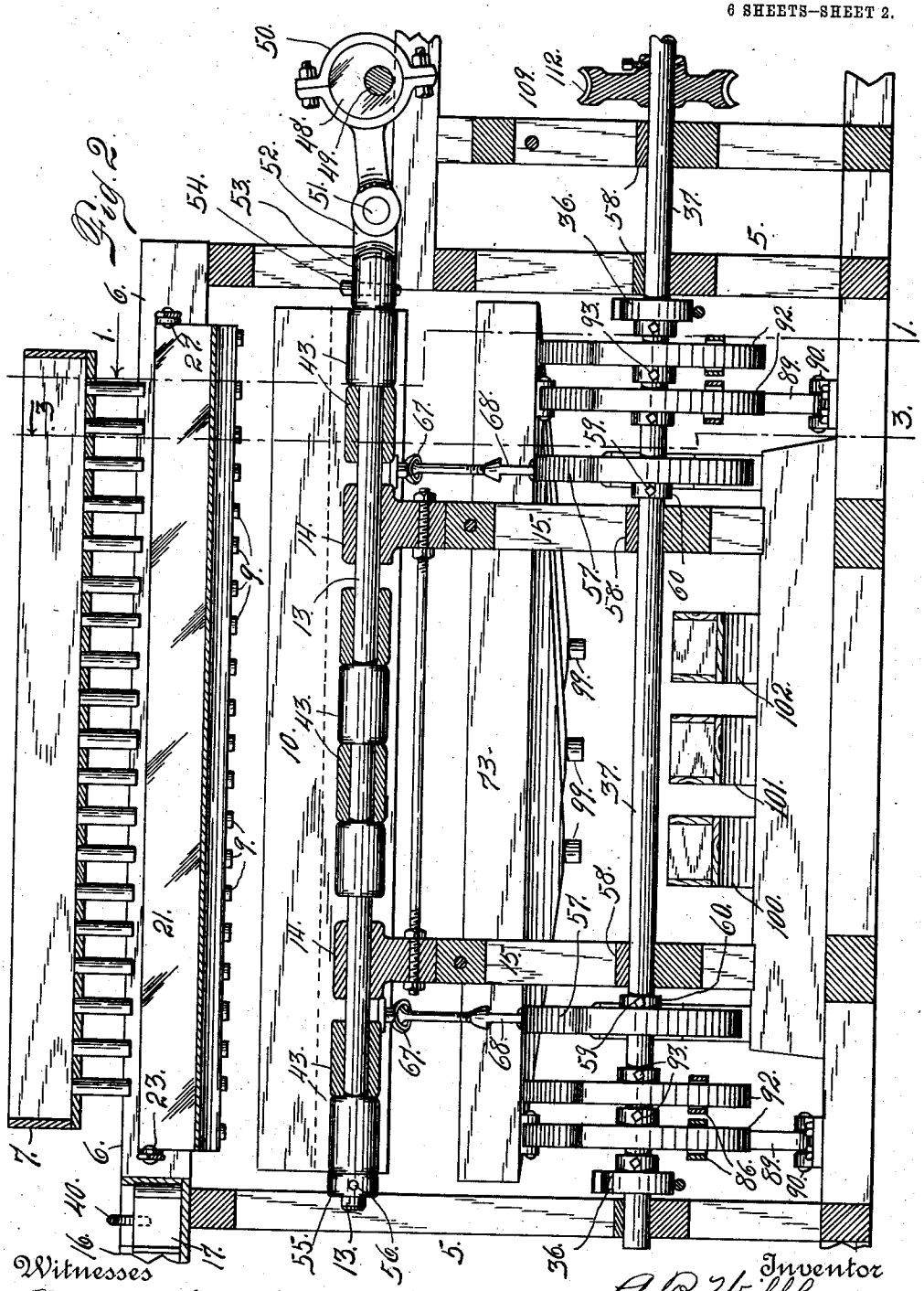
6 SHEETS—SHEET 2.

Fig. 2.



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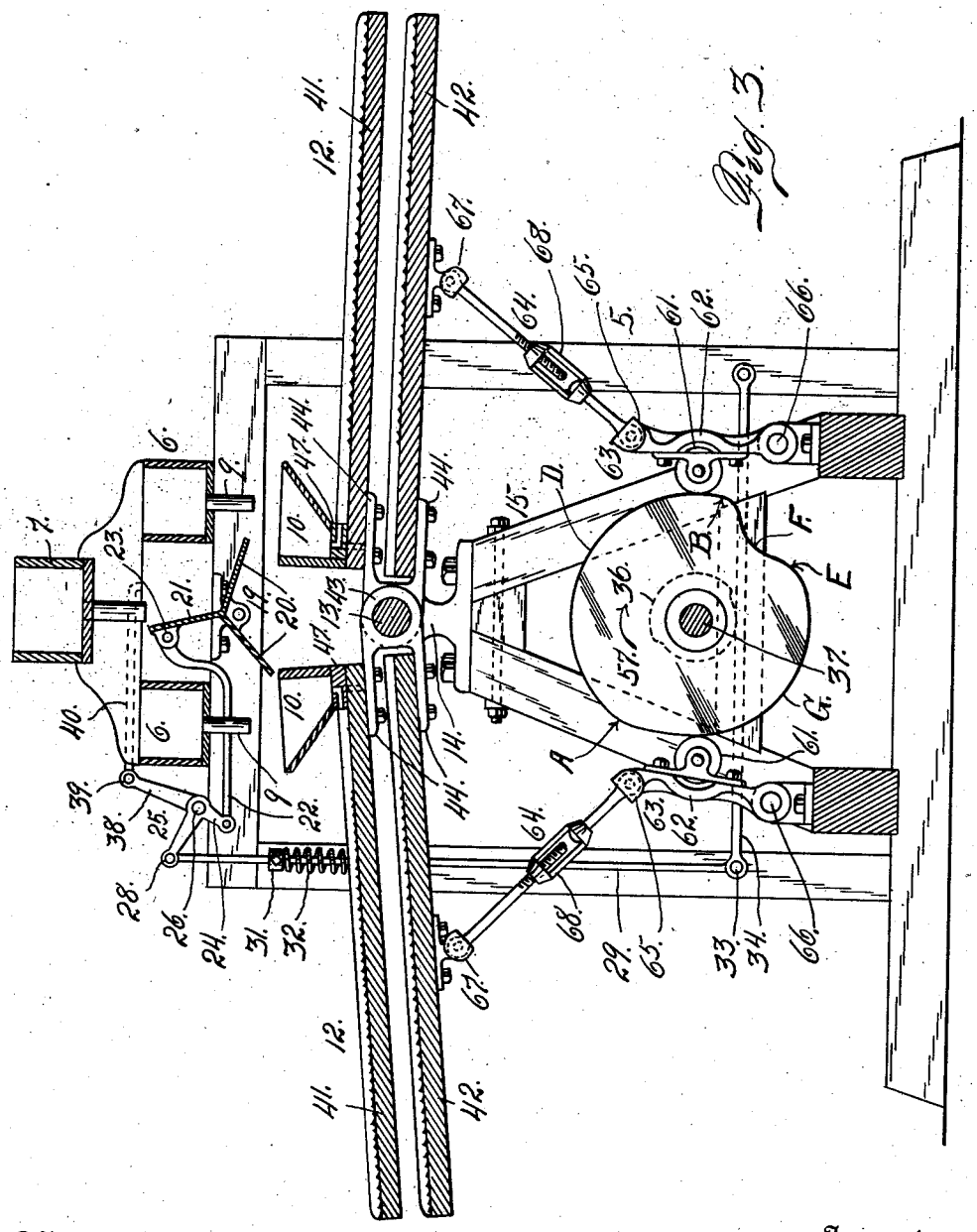

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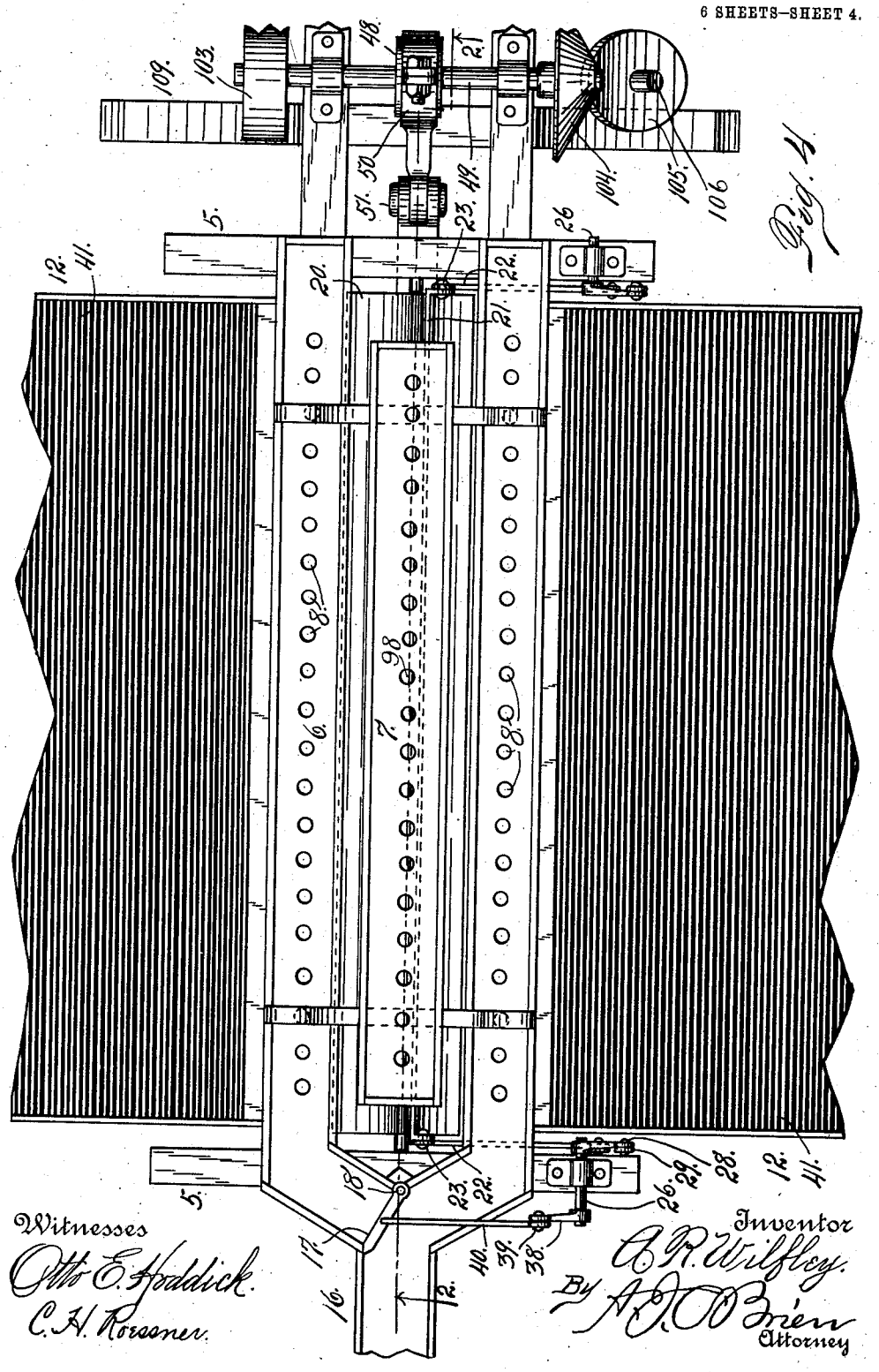

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6 SHEETS—SHEET 5.

Fig. 6.

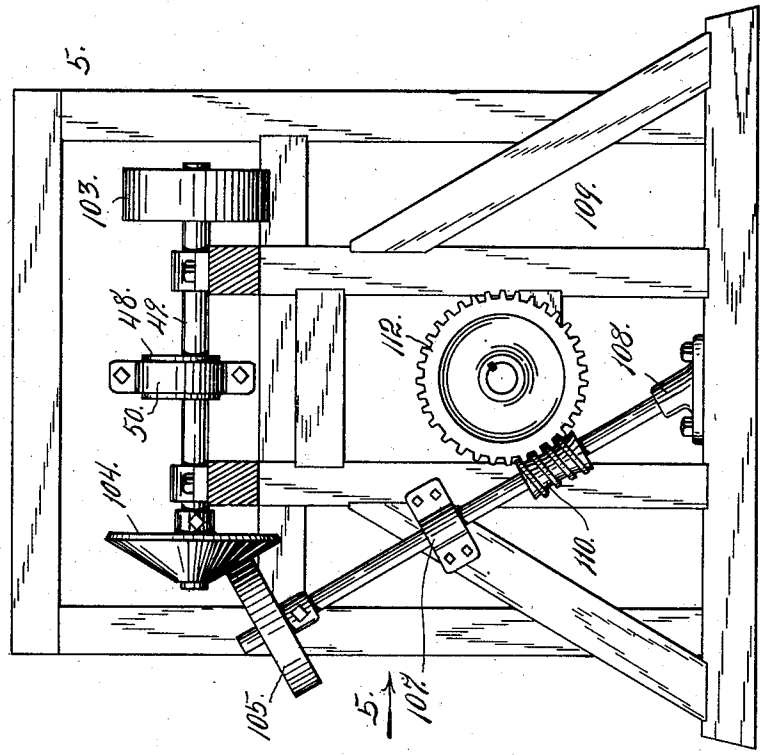
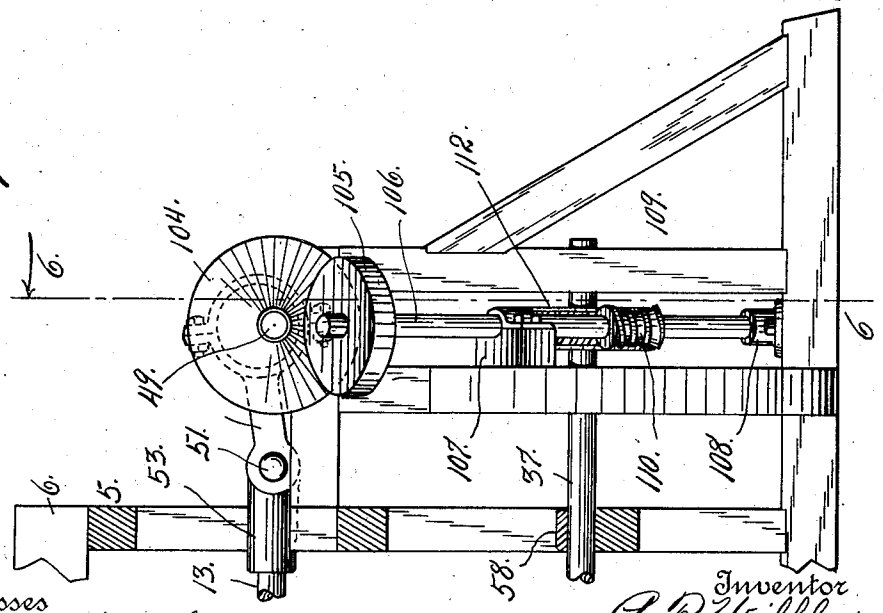


Fig. 5.



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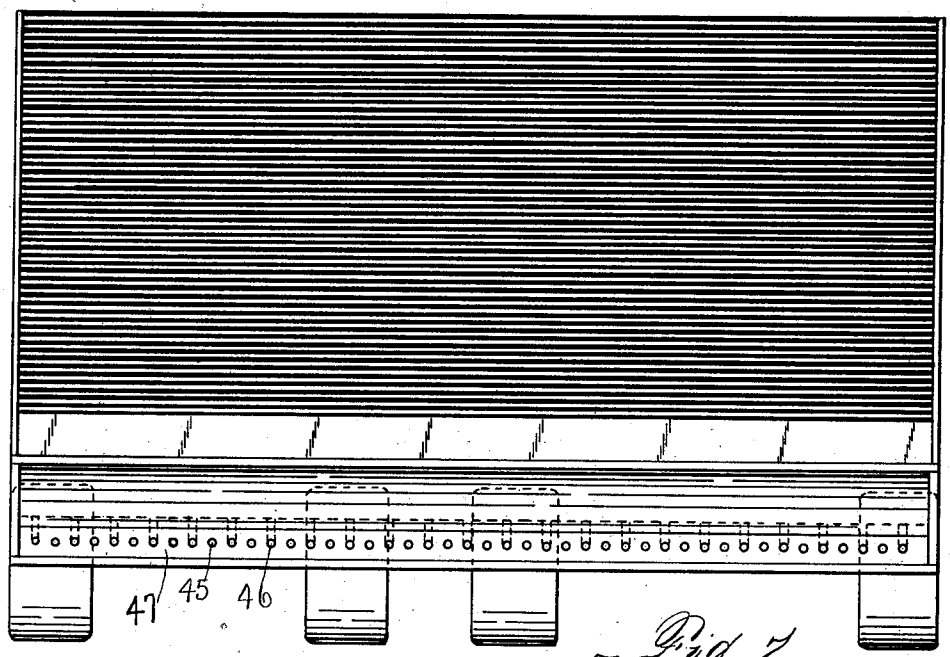

Fig. 7.

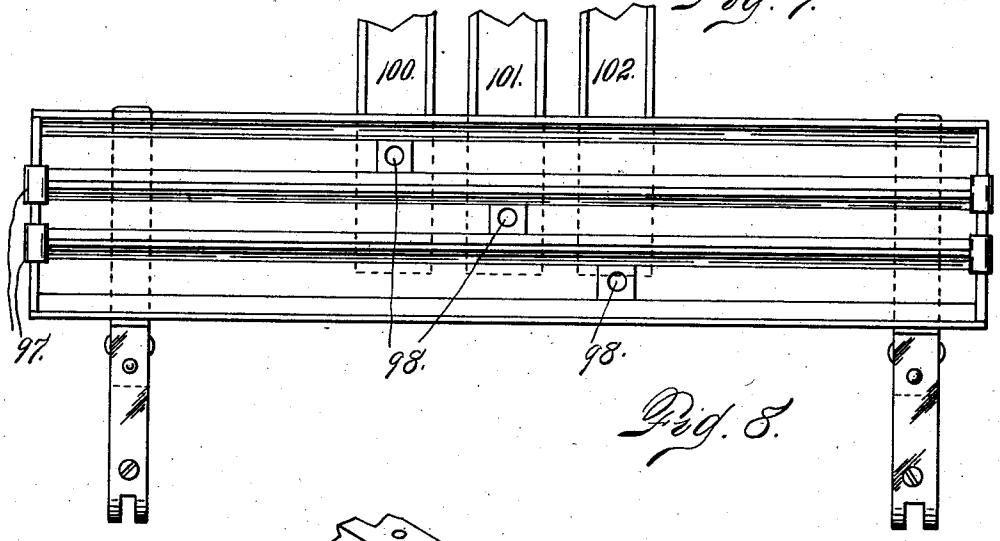

Fig. 8.

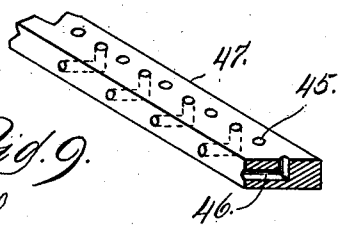

Fig. 9.

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UNITED STATES PATENT OFFICE.

ARTHUR R. WILFLEY, OF DENVER, COLORADO.

CONCENTRATOR.

1,021,961. Specification of Letters Patent. Patented Apr. 2, 1912.

Application filed February 2, 1911. Serial No. 606,196.

To all whom it may concern:

Be it known that I, ARTHUR R. WILFLEY, 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 adapted for the treatment of ore, whereby the concentrates or values are separated from the gangue.

In the simplest form of my improved construction I employ a table having one or more decks, which is adapted to be held at a certain inclination during the separation of the concentrates from the gangue during the treating of a given charge of ore, after which the said table is automatically and suddenly thrown to a position of increased inclination, whereby the concentrates thereon are quickly discharged from the table, the latter being suddenly raised to its original or what may be termed its initial position. In my improved construction as illustrated in the drawing I employ two double-deck tables arranged to be alternately thrown to a position of increased inclination. That is to say, the table on one side of the tilting axis being held in the position of least inclination or nearly level during the time that the table on the opposite side of the tilting axis is dropped to its position of greatest inclination. Provision is made to automatically cut off the feed from each table during a considerable interval before it drops to its position of greatest inclination, since the feed of pulp to the table is only continued during approximately one-half the rotary movement of cams employed for controlling the tables. In other words, the pulp is fed to the table until the latter is loaded, the table during this time being in a position almost level or only slightly inclined. The feed of the pulp thereto is then automatically cut off, and the table by virtue of its cam control drops to a slightly increased inclination. During this time the concentrating function is performed, resulting in the stratification of the material upon the table, whereby the gangue is separated from the values. During the performance of the concentrating function wash water is discharged to the table, this water being automatically turned onto the table simultaneously with the cutting off of the feed of the pulp thereto. The discharge of the wash water to the table is continued until the latter through the instrumentality of its cam control drops to its position of steepest inclination, since this water facilitates the discharge of the concentrates, which is accomplished during the last named position of the table.

Provision is also made for automatically raising and lowering troughs, one of which is adapted to receive the discharge of the gangue, during the treatment of the material for the purpose of separating the gangue from the values, while the other is employed to receive the discharge of the concentrates. In order that these troughs may be respectively brought into position to receive the discharge from the table when in differently inclined positions, it is necessary that they shall be raised and lowered simultaneously with the imparting of the corresponding movements to the table.

As illustrated in the drawing the tables are transversely inclined and a longitudinal reciprocating movement is imparted thereto for the purpose of separating the values from the gangue. This reciprocating movement is continuous regardless of the inclination of the tables.

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 an end view of my improved concentrating apparatus, a portion of the mechanism being shown in section taken on the line 1—1, Fig. 2, looking toward the left. Fig. 2 is a vertical section taken approximately on the line 2—2, Fig. 1. Fig. 3 is a transverse section taken on the line 3—3, Fig. 2, looking toward the left. Fig. 4 is a top plan view of the construction, the tables on both sides being partly broken away. Fig. 5 is a detail view illustrating the head motion and the means for operating the cam shaft employed to perform the automatic functions of the machine. This is a view looking in the direction of arrow 5, Fig. 6. Fig. 6 is a section

taken approximately on the line 6—6, Fig. 5, viewing the operating mechanism in a position at right angles to Fig. 5. Fig. 7 is a top plan view in detail of one of the tiltable tables. Fig. 8 is a top plan view in detail of a set of troughs arranged to receive the gangue and concentrate discharge from the tables. Fig. 9 is a fragmentary perspective detail view of the bottom of one of the feed hoppers mounted on the upper longitudinal edge of the concentrating table, the same being constructed and arranged to deliver pulp or wash water, as the case may be, simultaneously to both decks of the table.

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

Let the numeral 5 designate an upright rectangular frame upon the top of which are supported two water troughs 6, while above these troughs and centrally located between them is a pulp trough 7. The two water troughs 6 have openings 8 in their bottoms for the escape of the water through depending nozzles 9 with which each trough is provided, the said nozzles being arranged to deliver water to hoppers 10 carried by concentrating tables 12 hinged upon a centrally located shaft 13, the said shaft being mounted in bearings 14 secured to the top of an upright frame 15 located within the area surrounded by the frame 5, the top of the frame 15 being considerably below the top of the frame 5 in order to permit the necessary feed of water and pulp to the tables.

The two water troughs 6 are adapted to be alternately placed in communication with a main supply trough 16 (see Fig. 4), by means of a swinging gate 17 hinged at 18, and actuated in a manner hereinafter more fully explained.

The pulp from the trough 7 is fed continuously to a deflector 19 arranged above the hoppers 10 and extending longitudinally of the structure. This deflector consists of two downwardly inclined wings 20 and a centrally located, upwardly extending member 21 to whose opposite extremities are connected rods 22 as shown at 23, the opposite extremities of the rods being connected with arms 24 of bell crank levers 25 fast upon shafts 26 journaled on the framework 5, and whose opposite arms 27 are pivotally connected as shown at 28 with rods 29 which pass downwardly through guides 30 mounted on the upright frame 5. Between these guides and stop collars 31 on the rods are coil springs 32 which have a tendency to maintain the deflector in such a position that the pulp discharge from the trough 7 is on one side of the member 21, whereby the pulp passes to the hopper 10 of the right-hand table, referring to Fig. 1.

The lower extremity of each rod 29 is pivotally connected as shown at 33 with a rod 34 whose opposite extremity is pivoted on the frame 5 as shown at 35. A cam 36 fast on a cam shaft 37 acts upon each rod 34 at predetermined intervals, to force downwardly the extremity of this rod connected with the rod 29, whereby the bell crank levers 25 are actuated to shift the deflector so that its member 21 shall occupy a position at the right of the stream of pulp from the pulp trough, referring to Fig. 1, thus allowing the pulp to pass to the opposite or left-hand table of the structure, still referring to the same figure.

Simultaneously with the movement of the deflector 19 through the medium of the cams 36 and their connections as just described, the gate 17 will be actuated in a direction opposite from the member 21 of the deflector through the medium of a crank arm 38 fast on one shaft 26 and extending in a direction opposite from the arm 24 of the bell crank lever, the said crank arm 38 being connected at its upper extremity as shown at 39 with a rod 40, connected in operative relation with the gate 17 (see Fig. 4). By the movement of the gate 17 in the opposite direction from the member 21 of the deflector, the water from the main trough 16 is turned into the water trough 6 on the side of the structure from which the pulp feed has been cut off, thus allowing the water to discharge upon the table after the pulp has ceased to pass thereto. The object of this construction and arrangement is the employment of the wash water in the separation of the values from the gangue and to facilitate the discharge of the concentrates from the table 12 located on the side of the water discharge, since at the same time that the pulp feed is cut off from a table, the table is tilted, first slightly and later to a relatively steep inclination, for the purpose of discharging the concentrates accumulated thereon during and after the period when the pulp is fed thereto. From this it will be understood that the two tables are alternately tilted to a relatively steep inclination for the purpose of discharging the concentrates therefrom, the concentrate discharge of one table taking place while the pulp is fed to the other table or while the concentrates are accumulating upon the latter.

As illustrated in the drawing each table 12 is composed of two decks 41 and 42, both of which are rigidly connected at their edges adjacent the shaft 13 by means of hinge sleeves 43, each of which has two separated arms 44, one of which is secured to one deck and the other to the other deck of the table, the two being sufficiently separated for the purpose of permitting the water and pulp to pass freely to the lower deck from the hopper 10, which is provided with two distinct sets of openings 45 and

46, the openings 45 being formed straight through the bottom of the hopper and the upper deck, allowing the material to pass to the lower deck, while the openings 26 are angle-shaped and arranged to discharge material upon the upper deck, the angle-shaped openings being formed in the bottom member 47 of the hopper, this member engaging the upper longitudinal edge of the upper deck and projecting above the same. The construction and arrangement of these openings is best illustrated in Fig. 9.

Both tables 12 are given a longitudinal vibration through the medium of an eccentric 48 fast on an operating shaft 49, and whose strap 50 is connected by means of a pin 51 with the forward extremity of a link 52 whose opposite extremity is connected with the forward end of the shaft 13 which is mounted to reciprocate in the bearings 14. The hinge sleeves 43 which connect the tiltable tables with the shaft 13 are so arranged that the longitudinal vibration is simultaneously imparted to both tables, the hinge sleeves having no longitudinal movement on the shaft. In order to connect the link 52 with the forward extremity of the shaft 13, the link is provided with an enlargement 53 in which is formed a socket into which the forward extremity of the shaft protrudes, this hollow extremity of the link being connected with the shaft by a wedge-shaped key 54, while a collar 55 is secured to the rear extremity of the shaft by a fastening device 56. The collar 55 and the large extremity of the link 52 respectively and directly engage adjacent extremities of two hinge sleeves 43 of the same table, while these two sleeves 43 of one table are in direct engagement with corresponding sleeves 43 of the other table, the two sleeves 43 of the last named table being between the sleeves 43 of the first named table.

In order to raise and lower the tables, whereby they are caused to assume positions suitable respectively for loading the table with pulp, concentrating the same, and finally discharging the concentrates, cams 57 are employed, these cams being mounted on the shaft 37 which is journaled in the framework as shown at 58. These cams are secured to the shaft in such a manner that they may be rotatably adjustable thereon, by means of setbolts 59 passed through collars 60 with which the cams are provided. Arranged on opposite sides of each cam 57 is an antifrictional roller 61 which is carried by a member 62 of a toggle construction 63 having a member 64 pivotally connected with the member 62 as shown at 65, and with the lower deck of the corresponding table as shown at 67, the member 64 having a turn-buckle 68 for regulating its length. As illustrated in the drawing two of these cams 57 are employed, both cams acting automatically and in unison to regulate the transverse inclination of the tables 12, and as the cams are interposed between the two pairs of toggles, the various movements resulting from the action of the cams are given the tables alternately. Each of these cams has three faces, whose radii vary. For instance, from a point A on the outer surface of each cam to a point B traveling in the direction of the arrow, is a face D, every part of which is equally distant from the center of the cam shaft 37. This face of the cam has the maximum degree of eccentricity. From the point B traveling in the same direction, to a point E, is an inwardly curved recess F. The face formed by this recess is nearest the center of motion, and the central point of the recess is nearer the center of the cam shaft than any other point on the outer surface of the cam; while from the point E to the point A traveling in the same direction is a face G, of a less radius than the face D, the radius increasing as the point A is approached, to avoid an abrupt offset where the faces G and D merge.

Each toggle member 62 is pivoted at its lower extremity as shown at 66, and when this member is forced outwardly away from the center of the cam shaft, to the greatest degree, by the cam, the exterior angle formed by the toggle members 62 and 64, or the angle nearer the cam, is greater than a right angle; in other words, the toggle members are always bent inwardly toward the center of motion, whereby the tables will increase their inclination by gravity whenever they are permitted to do so by the variation in the eccentricity or radial distance of the various faces of the cams. For instance, referring to Fig. 3, the table 12 on the right-hand side is raised to its upward limit of movement, its inclination being only slight, varying but little from the horizontal. This is by virtue of the fact that the anti-frictional roller 61 is in engagement with the face D farthest from the center of motion of the cams 57. This condition of the right-hand table 12 (see Fig. 3) will be maintained during the entire time that the face D is in engagement with the anti-frictional roller 61 on the right-hand side of the machine. However, after the points A on the cams 57 when rotating in the direction of the arrow on the cam exposed in Fig. 3, have passed the rollers 61 on the right-hand side of the cam, the table 12 on the corresponding side will increase its inclination slightly by reason of the fact that the face G, which will next engage the same roller, is slightly nearer the center of motion than the face D. This condition of the table on the right-hand side, for instance, will be

maintained during the entire time that the faces G of the two cams are in engagement with the rollers 61 on the right-hand side of the machine, after which these rollers will drop into the recesses F, whose bottoms are the nearest points with reference to the center of motion, and the table in question will assume, by gravity, its greatest inclination.

During the time that the rollers 61 of either pair of toggles on the same side of the machine are in engagement with the faces D of the cams 57, the table is in a position nearly horizontal, or in a position of slight inclination, and it is during this period that the pulp is fed to the table from the box 7, by virtue of the peculiar position of the rocking deflector 19, which is automatically controlled to harmonize with the positions of the tables as heretofore intimated. Now as the faces D of the cams leave the rollers 61 of either pair of toggles on the same side when traveling in the aforesaid direction, the said rollers will engage the faces G and the inclination of the table will be slightly increased, as shown at the left in Fig. 3. During this time the feed of pulp to the table is interrupted by the automatic shifting of the deflector 19, and the treatment of the ore upon the table for the purpose of separating the values from the gangue is continued without interruption until the recessed face E of each cam engages the roller 61 of the toggle member in question, when the table falls by gravity to its greatest degree of inclination, whereby the concentrates are discharged therefrom, the flow of water to the table being continued during the entire time that the rollers 61 of either pair of toggle members on the same side of the machine are in engagement with the faces G and F of the cams 57. It will therefore be understood that in the first instance, or when either table is in nearly a flat or horizontal position, the pulp is fed to the table to the necessary depth to constitute a charge. The table then slightly changes its inclination and the separation of the gangue from the concentrates is continued, the discharge of pulp to the table being interrupted. The table then assumes its greatest inclination for the purpose of discharging the concentrates therefrom, the passage of the wash water to the table being continued for this purpose.

During the time that the tables are actuated as heretofore explained, troughs adapted to respectively receive the discharge of gangue and concentrates from the tables are correspondingly and automatically actuated. As illustrated in the drawing there are two sets of troughs 69 mounted on each side of the machine, each set having a continuous bottom 70 and separated into two or three compartments, as may be desired. When only two grades of material are required two movable partitions 72 interposed between the side walls 73 are brought together at the top, their lower extremities being rounded as shown at 74 and engaging recesses or groves of corresponding shape 75. In this event the gangue is discharged into the outermost compartment 76, while the concentrates are discharged into the innermost compartment 77. When, however, it is desired to separate the material discharged from the tables into three grades, namely, gangue, concentrates and middlings, the two movable partitions 72 are placed in the upright position (see the right-hand side of Fig. 1), whereby a middle compartment 78 is formed. In this event the gangue is discharged into the outermost compartment 76; the concentrates, or the best grade thereof, into the innermost compartment 77; while the compartment 78 receives what may be termed a middlings grade, containing some metallic values. These troughs are mounted upon horizontally disposed metal bars 79 which extend underneath the bottom 70 of each trough, each bar or strap being pivotally connected as shown at 80 with the upper extremities of two parallel bars 81 whose lower extremities are pivotally connected as shown at 82 with the base 83 of the frame. The parallel bars 81 of each pair are connected intermediate their extremities by a link 84, the extremities of the link being pivotally connected with the respective bars as shown at 85. Connected with one bar 81 of each pair of parallel bars as shown at 87, is a rod 86 whose opposite extremity is connected as shown at 88 with an oscillating bar 89, whose lower extremity is pivotally connected with the base of the structure as shown at 90. Each of these bars 89 carries an anti-frictional roller 91 adapted to be engaged by a cam 92 secured to the shaft 37 by setbolts 93, whereby the cams are rotatably adjustable upon the shaft, in case it is desired to vary their position to enable them to accurately perform their function in the regulation of the position of the troughs 69 to harmonize with the position of the tables.

As illustrated in the drawing there are two cams 92 located near each extremity of the machine, the individual cams of each pair respectively acting on the two adjacent bars 89, one cam acting to move its bar in one direction, and the other cam acting to move its bar in the opposite direction. By virtue of this construction two cams 92 simultaneously act to raise each set of troughs, the two sets of troughs on opposite sides of the machine being alternately raised and lowered. It will therefore be understood that each set of troughs is supported

by two pairs of parallel bars 81, which act in harmony under the influence of the cams 82 acting on the oscillating bars 89. Each of these cams 92 has a relatively flat face 94 whose central portion is quite close to the center of motion or the center of the cam shaft 37. When the cam is in this position the set of troughs 69 controlled thereby is allowed to drop to its lowest position (see Fig. 1 where the troughs on the left-hand side are at their lowest limit of movement), whereby the compartment 77 is adapted to receive the discharge of concentrates from the table which is at its lowest limit of inclination. At the same time that one pair of cams 92 is in position to allow the troughs on the left-hand side of the machine to fall to their lowest limit of movement, the corresponding set of troughs on the right-hand side of the machine is raised by the action of a corresponding cam on the oscillating bar 89 farther toward the left.

Each cam 92 has three faces, namely, what may be termed the flat face 94, the face of maximum eccentricity 95, which merges into a face 96 located nearer the center of motion than the face 95. From this it will be understood that when the face 94 of the cam 92 controlling a set of troughs has the central portion of its flat face in engagement with the roller 91 of its corresponding oscillating bar 89, the set of troughs controlled by this cam will be at its lowest limit of movement; while when the face 95 is in engagement with the said roller the set of troughs will be raised to its highest position; while when the face 96 of the cam engages the same roller the set of troughs is in an intermediate position harmonizing with the position of the corresponding table when the faces G of the cams 57 act upon the anti-frictional devices of the toggles controlling the said table.

In order to maintain the movable partitions 72 in the trough structure in the vertical position, whereby the intermediate compartment 78 is formed, to the upper edge of each partition is applied a cap having a longitudinal groove adapted to receive the upper edge of the partition. Each of these caps is provided at its extremities with hooks 97 adapted to engage the opposite ends of the trough structure, thus securing the caps in place and locking the partitions in the vertical position, as indicated at the right of Fig. 1.

Each of the trough compartments is provided with an opening 98 in communication with a depending outlet nozzle 99. These nozzles are arranged to discharge into launders 100, 101 and 102 respectively, the concentrates passing into the launder 100, the middlings (if a middlings grade is desired) into the launder 101, and the gangue into the launder 102. These launders are arranged sufficiently below the trough structure to permit the latter the necessary vertical movement, whereby its position is made to harmonize with the varying positions of its corresponding table as heretofore described.

The necessary power for imparting the reciprocating movement to the tables and for actuating the cam shaft, may be derived from any suitable engine or motor (not shown), adapted to be connected with the shaft 49 by means of a pulley 103. To the extremity of the shaft 49 opposite the pulley is secured a cone-shaped friction gear 104 which engages a friction wheel 105 fast on a shaft 106, which as illustrated in the drawing is inclined at an angle of about 45 degrees. This shaft is journaled intermediate its extremities in a box 107, its lower extremity engaging a step-box 108 secured to the bottom of the head motion framework 109. Upon the shaft 106 is a worm 110 which engages a worm wheel 112 fast on the cam shaft 37.

From the foregoing description the operation of my improved concentrator will be readily understood. As the shaft 49 is rotated, the reciprocating vibratory movement is imparted simultaneously to both tables through the medium of the eccentric strap 51 which is connected with the shaft 13 upon which the tables are hinged as heretofore explained. Simultaneously with the imparting of the reciprocating movement to the tables, the worm shaft 106 is operated and a relatively slow movement imparted to the cam shaft 37. The movement of the cam shaft results in the automatic operation of all the movable elements of the mechanism, through the instrumentality of the various cams mounted thereon, and the connections between the said cams and the elements to be actuated hereinbefore described in detail. The operation of these various parts will now be briefly and connectedly described.

The relatively small cams 36 act upon the rods 34 to simultaneously move the water gate 17 and the pulp deflector 19, these two elements being shifted in opposite directions, whereby the water is delivered to either table simultaneously with the cutting off of the pulp discharge to the same table by virtue of the connections heretofore described. The movement of the cams 57 acting through the toggles 63 serves to alternately raise and lower the tables on opposite sides of the machine, whereby the inclination of each table is changed successively from its initial position, in which it is only slightly inclined, to a slightly increased inclination, and finally to a relatively steep inclination. When the position of the table is nearly level, or when slightly inclined, a charge of pulp is fed thereto and distributed thereon. This operation takes place when the faces D of the

cams 57 are acting upon the toggles 63 which control the table in question. As soon, however, as the faces G of the cams are brought into engagement with the same toggles, the inclination of the table is slightly increased, the feed of pulp thereto simultaneously cut off, and the discharge of water thereto commences by virtue of the automatic mechanism heretofore described. While the faces G of the cams are in engagement with the toggles in question, the operation of separating the gangue from the concentrates or values is going on, this operation being completed by the time the faces F of the cams engage the said toggles, in which event the table drops to its position of greatest inclination, whereby the concentrates are discharged. It will be understood that both tables are simultaneously actuated by the same pair of cams 57, the various steps and the movements of the tables being, however, alternately completed; since the tables are arranged on opposite sides of the center of motion of the actuating cams.

Simultaneously with the movement of the tables into their various positions heretofore described, the trough structures 69 are operated in harmony with the operation of the tables, whereby the latter are allowed to discharge the various grades of material into as many different compartments of the troughs. These movements of the trough structures are brought about through the instrumentality of four cams 92, two of these cams acting upon one of the trough structures and the other two upon the other trough structure, by virtue of the connections heretofore described.

An important feature of my improvement consists in the fact that each table has a plurality of decks arranged one above another, provision being made for feeding the material simultaneously to the various decks. This is something more than mere duplication, since with a single-deck table it is difficult to properly regulate the feed of the material thereto. That is to say, it is difficult to feed it sufficiently slowly without danger of its being cut off altogether by the clogging of the relatively small passages through which it must pass from the source of supply. However, by employing tables with a number of decks, the discharge from the source of supply may be made through relatively large passages, thus completely overcoming the clogging difficulty, since the various decks of the table will handle a relatively large quantity of material, which may be delivered to a common launder mounted upon the upper deck of each table and movable with the latter. Furthermore, by the employment of plural-decked tables fed from a common launder mounted on the uppermost deck and having feed passages leading to all the decks, the latter may be relatively close together and the operator in charge only need watch the top deck, since the operation must be identical on all the decks. By virtue of this construction the capacity of the table may be indefinitely increased without requiring any additional care or attention on the part of the operator.

It will be understood that by feeding the pulp to a single-deck table the passages leading from the pulp trough must be relatively small and easily clogged. On the contrary, by employing a common launder mounted on the table and equipped with passages leading to the various decks, these passages may be as large as desired, and as long as they are of uniform size each deck will receive its proper proportion of the material delivered to the common launder, it being understood that the passages leading from the common launder are large enough to allow all of the material fed to the launder to pass to the table decks as fast as it enters the launder, since there need be no accumulation of pulp in the latter. However, with the common feed trough it is different as there must be an accumulation of material therein, and consequently the passages leading therefrom to supply pulp to the table must measure the quantity of pulp delivered thereto, and if the table is a single-deck structure the passages must only be half the size that could be employed where a double-deck table is to be supplied. It will therefore be seen that by increasing the number of decks a relatively large quantity of pulp may be supplied from the original source of pulp supply, thus making it practicable to make the openings sufficiently large to prevent the possibility of clogging.

It is found in actual practice where single-deck tables are employed, as has been the practice heretofore, that the operator usually feeds a greater quantity of pulp to the table than is required in order to produce the best results, but he considers it advisable to do this rather than take chances of having the supply passages clogged. In other words, the evil resulting from the clogging of the relatively small passages is greater than that resulting from feeding an oversupply of pulp to the table. However, with my improved construction it will be understood that this difficulty may be entirely overcome, since the number of decks may be increased indefinitely.

Attention is called to the fact that in my improved construction the pulp is subdivided and delivered to the various table decks after it has been distributed. Hence the construction involves a distributing launder and a subdividing launder. The distributing launder comprises the regular box or trough containing the source of pulp

supply. From this launder the pulp passes to the launder where it is subdivided and delivered to the respective decks of the table.

From the detailed description heretofore given of my improved duplex double construction and arrangement, whereby two tables are located on opposite sides of the center of the machine, each table being arranged to be given a relatively steep inclination every time the operating cams 57 make a complete rotation, each table is at its relatively steep inclination for a short time only or while the anti-frictional bearing rollers 63 are in engagement with the recessed faces F of the two cams which control the tables. From an inspection of these cams it will be observed that the two faces D and G are approximately equal in length with the short recessed face F interposed between them on one side of the cam. Hence it follows that the pulp is fed to each table about half of the time and cut off therefrom during the other half of the time, the period when it is cut off being employed in treating or concentrating the charge delivered to the table, while it is controlled by the faces D of the cams. It will be further understood that during the time that a charge of pulp is being fed to one table, it is cut off from the other table, the separation at that time taking place upon the latter.

Having thus described my invention, what I claim is:

1. In combination, a plurality of concentrating decks, a pulp distributer, comprising a receptacle substantially equal in length to the feed space of each deck, said receptacle having unobstructed discharge openings of relatively large capacity, said openings adapted to deliver the pulp in distributed volume, sub-dividing means intermediate said decks and the distributer adapted to deliver the pulp to the respective decks, said sub-dividing means being proportioned and adapted to deliver the pulp from the distributer to the respective decks without restraint.

2. In combination, a plurality of concentrating decks, arranged one above another, a pulp distributer comprising a receptacle substantially equal in length to the feed space of each deck, said receptacle having unobstructed discharge openings of relatively large capacity, said openings adapted to deliver the pulp in distributed volume, sub-dividing means mounted on the uppermost deck below the distributer and adapted to deliver the pulp to the respective decks, said sub-dividing means being proportioned and adapted to deliver the pulp from the distributer to the respective decks without restraint.

3. In combination, a plurality of similar concentrating decks connected for common actuation, a pulp distributer comprising a receptacle substantially equal in length to the feed space of each deck, said receptacle having unobstructed discharge openings of relatively large capacity, said openings adapted to deliver the pulp in distributed volume, sub-dividing means intermediate said decks and the distributer adapted to deliver the pulp to the respective decks, said sub-dividing means being proportioned and adapted to deliver the pulp from the distributer to the respective decks without restraint.

4. In combination a plurality of similar concentrating decks connected for common actuation and arranged one above another, a pulp distributer comprising a receptacle substantially equal in length to the feed space of each deck, said receptacle having unobstructed discharge openings of relatively large capacity, said openings adapted to deliver the pulp in distributed volume, sub-dividing means intermediate said decks and the distributer adapted to deliver the pulp to the respective decks, said sub-dividing means being proportioned and adapted to deliver the pulp from the distributer to the respective decks without restraint.

5. In combination a plurality of similar concentrating decks connected for common actuation and arranged one above another, a pulp distributer comprising a receptacle substantially equal in length to the feed space of each deck, said receptacle having unobstructed discharge openings of relatively large capacity, said openings adapted to deliver the pulp in distributed volume, sub-dividing means mounted on the uppermost deck below the distributer and adapted to deliver the pulp to the respective decks, said sub-dividing means being proportioned and adapted to deliver the pulp from the distributer to the respective decks without restraint.

6. In combination, a plurality of concentrating tables, a feeder adapted to feed pulp in distributed volume, delivery means interposed between said tables and said feeder, adapted to deliver the pulp from the feeder in its distributed form and without restraint of volume, and means for operating said delivery means for alternate delivery and cut off of pulp supply to each table in succession.

7. In combination a plurality of concentrating tables, a feeder adapted to feed pulp in distributed volume, delivery means interposed between said tables and said feeder adapted to deliver the pulp from the feeder in its distributed form without restraint of volume, said delivery means including a deflector pivoted between the tables which are arranged end to end, and means for operating said deflector for alternate delivery and

cut off of pulp supply to each table in succession.

8. In combination a plurality of concentrating tables arranged end to end, a feeder adapted to feed pulp in distributed volume, delivery means interposed between said tables and said feeder adapted to deliver the pulp from the feeder in its distributed form and without restraint of volume, said delivery means including a deflector pivoted between the tables, and means connected with the deflector for maintaining equality in the periods of delivery to the respective tables.

9. In combination a plurality of concentrating tables, a feeder adapted to feed pulp in distributed volume, delivery means interposed between said tables and said feeder adapted to deliver the pulp from the feeder in its distributed form and without restraint of volume, means for operating said delivery means for alternate delivery and cut off of pulp supply to each table in succession, and water supply means adapted to deliver water to the respective tables during the period when the pulp supply is cut off.

10. In combination a plurality of concentrating tables, a feeder adapted to feed pulp in distributed volume, delivery means interposed between said tables and said feeder adapted to deliver the pulp from the feeder in its distributed form and without restraint of volume, means for operating said delivery means for alternate delivery and cut off of pulp supply to each table in succession, water supply means adapted to deliver water to the respective tables during the period when the pulp supply is cut off, and a connection between the pulp deflector and the water supply means adapted to operate the latter on the movement of the deflector.

11. The combination of a tiltable concentrating table, means connected with the table to tilt the latter to three positions of successively greater inclination and maintain the inclinations for predetermined periods, means for supplying pulp during the period of least inclination and for cut off of pulp during the periods of increased inclination, and means for supplying water during the two periods of greater inclination, the water supply means being the same and common to the table when in both positions.

12. The combination of a tiltable concentrating table, a cam having three faces, means connected to the table and bearing upon said cam, the faces of the cam being proportioned to tilt the table to the three positions of successively greater inclination and maintain the inclinations for predetermined periods, means for supplying pulp during the period of least inclination and for cutting off the supply during the periods of increased inclination and means for supplying water during the two periods of greater inclination.

13. The combination of a tiltable concentrating table, a cam having three faces, means connected to the table and bearing upon said cam, the faces of the cam being proportioned to tilt the table to the three positions of successively greater inclination and maintain the inclinations for predetermined periods, means for supplying pulp during the period of least inclination and for cutting off the supply during the periods of increased inclination, and means for supplying water during the two periods of greater inclination, the relative length of the three faces being such that the time during which the tables are maintained in the first and second positions is relatively long and approximately equal, while the time during which they are maintained in the third position is relatively short.

14. The combination of a tiltable concentrating table, means connected with the table to tilt the latter to three positions of successively greater inclination and maintain the inclinations for predetermined periods, means for supplying the pulp during the period of least inclination and for cutting off the supply during the periods of increased inclination and means actuated by the inclination-changing means, for supplying water during the two periods of greater inclination.

15. The combination of a tiltable concentrating table, a cam having three faces, means connected with the table and bearing upon said cam, the faces of the cam being proportioned to tilt the table to three positions of successively greater inclination, the faces of the cam varying in length and their relative length being such that the table is maintained in the first and second positions during the greater part of the time while it occupies the third position for a relatively short space of time, means for supplying pulp during the period of least inclination, means for cutting off the supply during the periods of greater inclination and means for supplying water during the two periods of greater inclination.

16. The combination of a tiltable concentrating table, a cam having three faces, a connection between the cam and the table, the faces of the cam being proportioned to tilt the table to three positions of successively greater inclination and maintain the inclinations for predetermined periods, means having actuating means in common with the tilting means for supplying the pulp during the period of least inclination and for cutting off the supply during the periods of increased inclination and means for supplying water during the periods of greater inclination.

17. The combination of a concentrating

table tiltably mounted, means for automatically changing the inclination of the table at predetermined intervals, troughs adapted to receive the discharge of the gangue and concentrates from the table, a parallel bar construction for supporting the said troughs, a cam connected to the table-actuating-means, and acting on said construction for regulating the position of the troughs to harmonize with the variation in the inclination of the table, substantially as described.

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

ARTHUR R. WILFLEY.

Witnesses:

F. E. BOWEN,

JNO. G. POWELL.