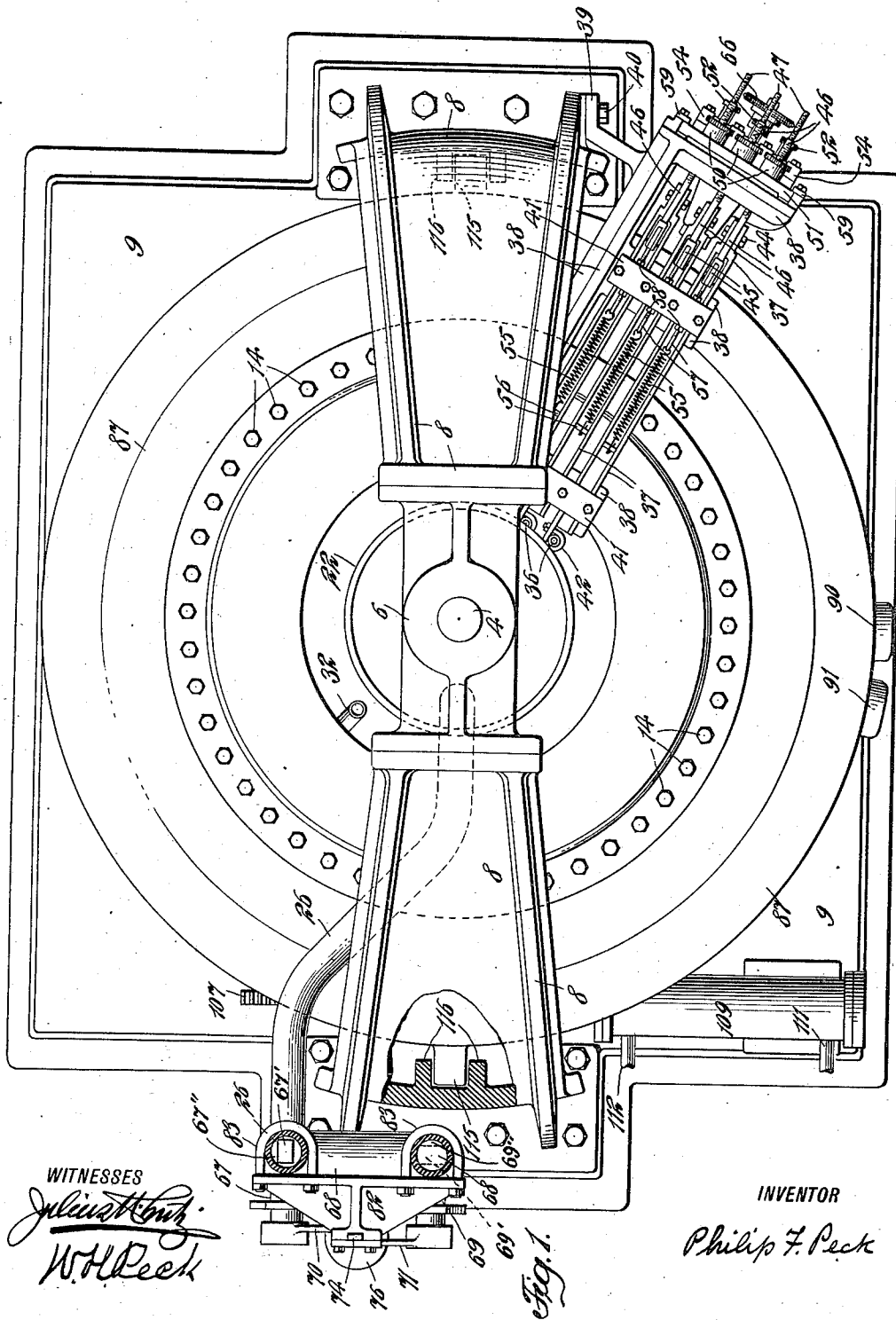


P. F. PECK.
CENTRIFUGAL ORE SEPARATOR.
APPLICATION FILED JAN. 3, 1911.

1,011,077.

Patented Dec. 5, 1911.

4 SHEETS—SHEET 1.



WITNESSES

Julius H. Peck
W. H. Peck

INVENTOR

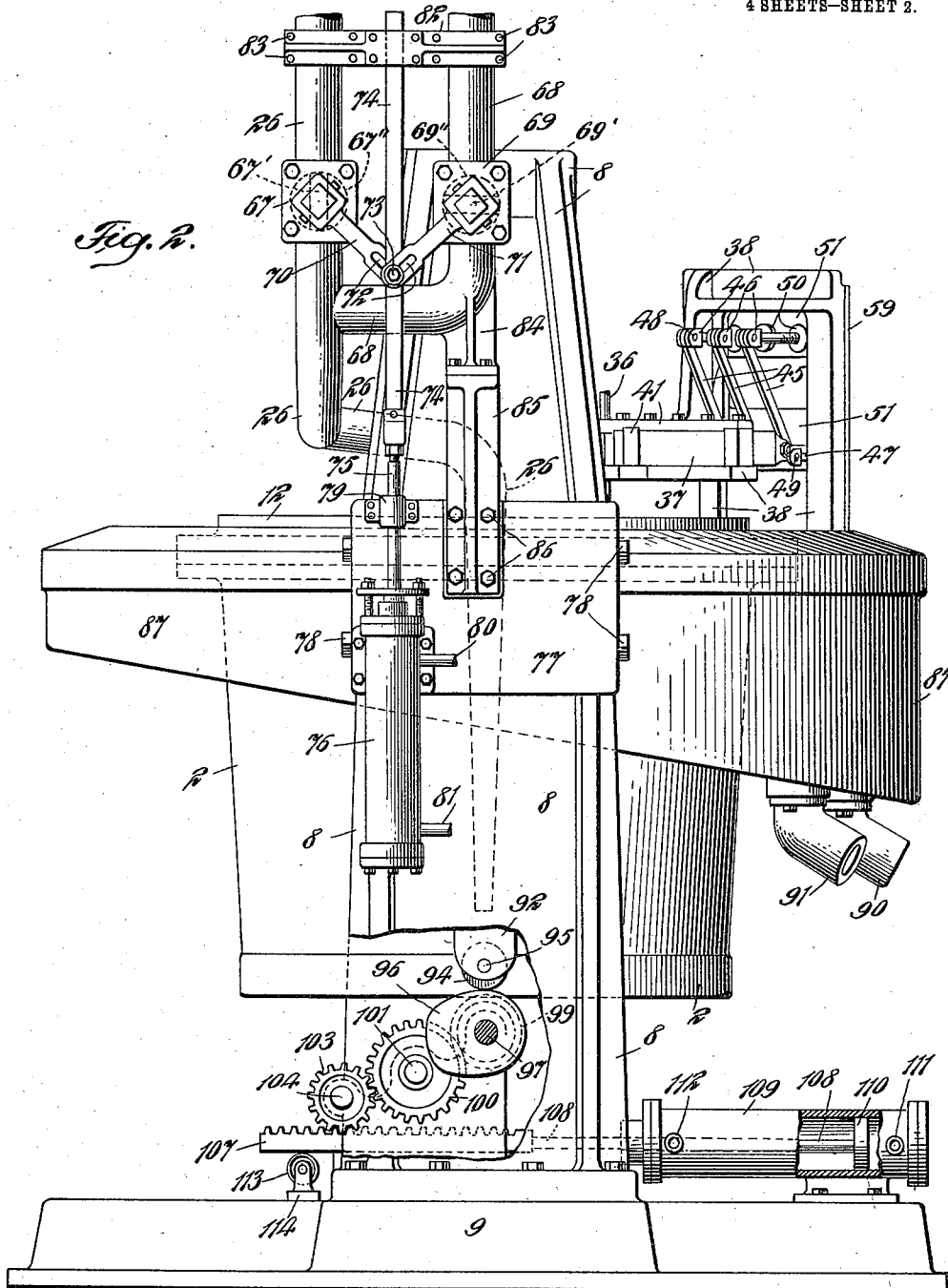
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4 SHEETS—SHEET 2.



WITNESSES
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4 SHEETS—SHEET 3.

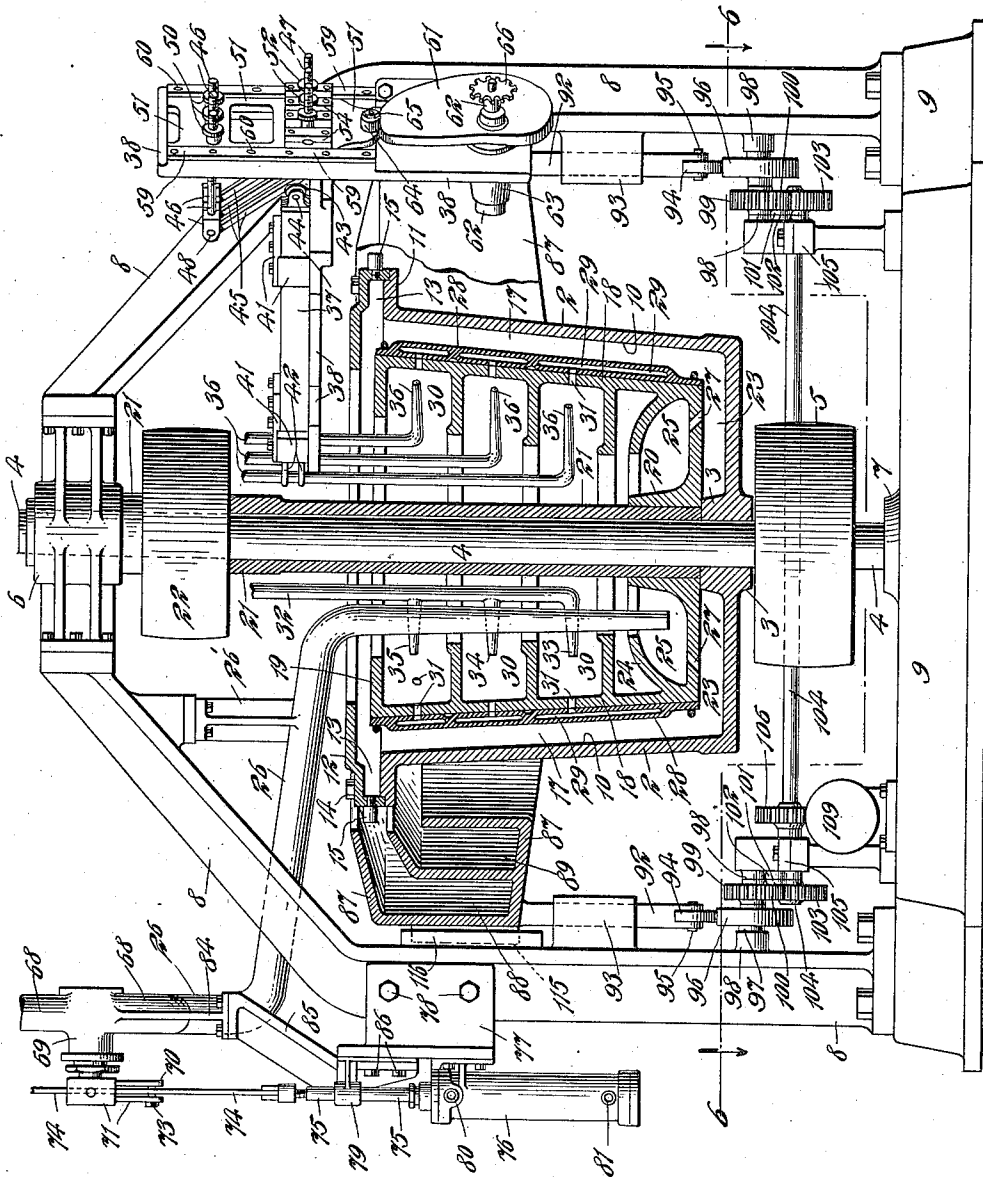


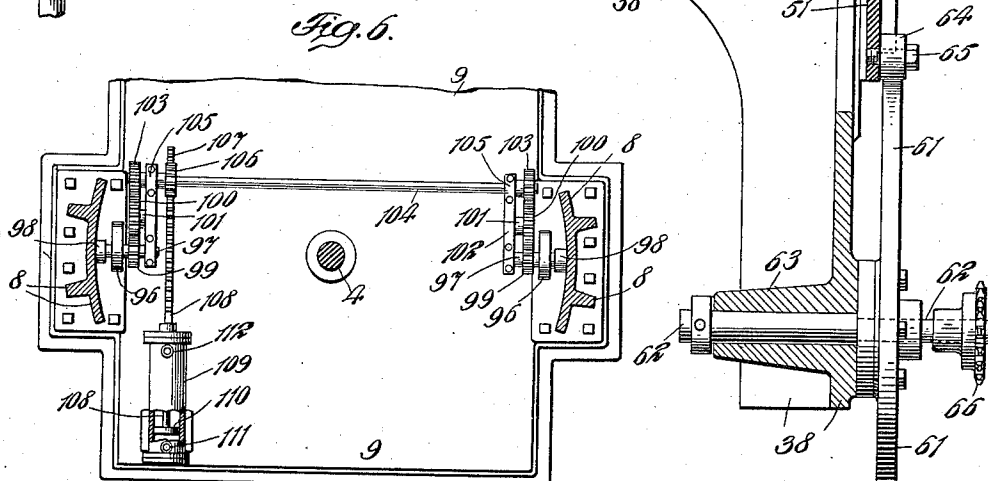
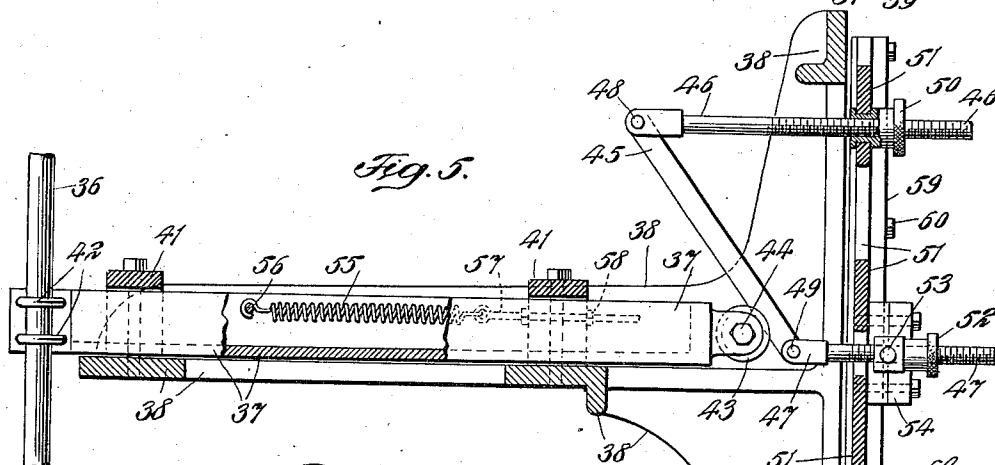
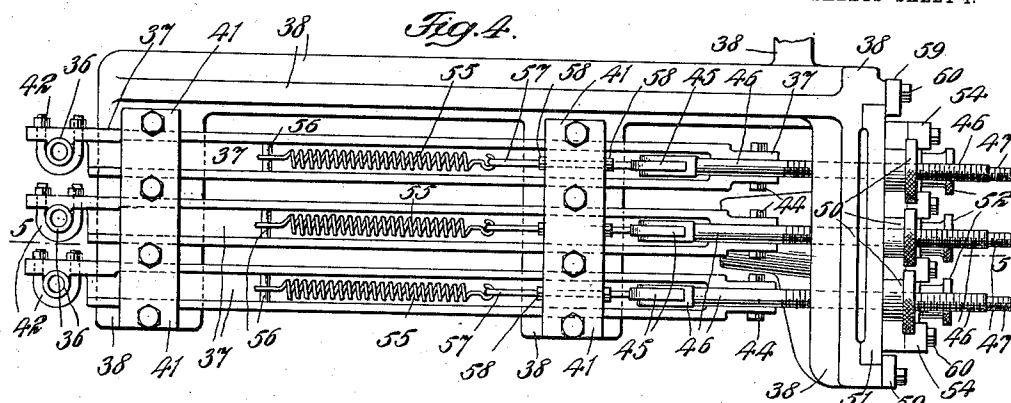
Fig. 3.

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1,011,077.

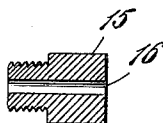
4 SHEETS—SHEET 4.



WITNESSES

WITNESSES
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Fig. 7.



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UNITED STATES PATENT OFFICE.

PHILIP F. PECK, OF CHICAGO, ILLINOIS.

CENTRIFUGAL ORE-SEPARATOR.

1,011,077.

Specification of Letters Patent.

Patented Dec. 5, 1911.

Application filed January 3, 1911. Serial No. 600,448.

To all whom it may concern:

Be it known that I, PHILIP F. PECK, a citizen of the United States, residing at Chicago, State of Illinois, have invented certain new and useful Improvements in Centrifugal Ore-Separators, of which the following is a specification.

The object of my invention is to provide an improved apparatus for separation of heavier and lighter parts of ores or similar solids, while in a finely divided state, and mixed with water, which is adapted to operate in successive cycles, alternately accumulating a bed of the heavier solids while separating and discharging the lighter and then separately discharging such bedded heavier solids.

To this end my invention consists mainly in means for governing the intensity of the liquid friction whereby separation is principally accomplished, and means for appropriately effecting cooperating movements of the launder of the apparatus.

In the drawings, Figure 1, is a top plan of my separating apparatus except that a small portion is shown broken away. Fig. 2, is a side elevation, of my separator having some parts broken away and some shown in section. Fig. 3, is a front elevation of the frame, and some other parts of my apparatus, and a vertical central section of the rotating part, excepting the pulleys and shaft. One side of the launder is shown in section and some other parts are shown in perspective, and elevation. Fig. 4, is a top plan of the mechanism for effecting removal of water from the internal parts of the deflector vessel. Fig. 5, is a section of Fig. 4, taken on line 5—5 of Fig. 4. Fig. 6, is a plan section of Fig. 3 on line 6—6, looking in the direction of the arrows, except that the shaft across the bed plate is shown entire, and part of the bed plate is broken away. Fig. 7, is an enlarged central longitudinal section of one of the discharge plugs detached.

In making my improved centrifugal ore separator, I provide a rotatable member 2, which I prefer to be in the form of a vessel, as illustrated in the drawings, and which I will hereinafter term as a separating vessel. This separating vessel has a closed bottom and substantially open top. The bottom is provided with a central hub 3, that rigidly

engages a shaft 4, by which the separating vessel is supported and is rotated when and as desired by a suitable pulley 5, secured on the shaft as shown. The shaft is mounted in journal boxes 6 and 7, respectively to maintain it in position.

The journal box 6, is attached to the upper part of a suitable frame 8, which is mounted on a bed plate 9, and the journal box 7, extends down through the bed plate, which supports it. The lower end of the shaft is stepped in the box 7, to carry its weight.

The separating vessel is turned and bored smoothly, and concentrically to its shaft or axis and on its inner peripheral wall is a separating surface 10, (Fig. 3), over which the substances to be separated pass, as hereinafter explained.

The top edge or rim of the open end of the separating vessel is formed into an outwardly extended flange 11, which has an annular recess in its outer top edge, into which the depending part of a ring or plate 12, is seated; this depending part being some greater in width than the depth of the annular recess in the flange 11, there is left between the ring and the flange, when the two are seated together, an annular space 13. The main part of the ring or plate 12, is made wide enough to extend in some distance toward the axis of the separating vessel as illustrated, thereby partly closing the opening in the top of the vessel.

The separating vessel is preferably made with its wall and the separating surface inclined outward from its bottom end to its top or open end, making it of greater diameter at the top, which is the discharge end of the vessel, and the diameter of the bore of ring 12, is less than that of the bottom end of the separating surface, enabling when desired, a sufficient body of water to be retained in the vessel to fill the separating passage and submerge the separating surface, as hereinafter explained.

The ring 12, is held in place on the flange of the vessel by screw bolts 14, which pass through it and are threaded into the flange. This ring, around through the peripheral wall of its depending part is provided with a row of screwthreaded holes communicating with the space 13, into which are screwed removable discharge plugs or members 15,

which are provided with holes 16, best shown in enlarged sectional detail Fig. 7, of suitable size to permit of desired discharge of liquid and material, yet to retain a sufficient quantity of liquid in the separating vessel to fill the separating passage and submerge the separating surface, and for purposes of satisfactory operation.

Located inside of the separating vessel, and with said vessel forming a separating passage 17, I provide a member to serve as a deflector, which preferably embodies a suitable non-elastic supporting element or portion 18, which I have illustrated in the form of a vessel, although this part may be any other suitable form of supporting structure. I will, for convenience, in the specification and claims in most instances term this element as a deflector vessel.

The deflector vessel has a closed bottom and an open top, except that at its top is an inwardly turned flange 19, which extends a desired distance toward the axis of rotation. This deflector vessel, is somewhat smaller in diameter than the inside of the separating vessel, thereby leaving the separating passage 17, adjacent to the separating surface; the deflector vessel is also somewhat shorter than the inside length of the separating vessel, and its central hub 20, securely and rigidly engages the lower portion of a sleeve 21, which is mounted in a rotatable manner around the central shaft 4, and rotation is imparted to it through a pulley 22, mounted on the upper end of the sleeve. The lower end of the sleeve 21, is stepped on the upper end of the hub 3; and is proportioned to hold the bottoms of the separating vessel and the deflector vessel apart sufficiently to leave a comparatively small space 23, between them, as illustrated in Fig. 3.

Within the deflector vessel, around its hub 20, I have provided a ring 24, which rises above the bottom of the vessel, and forms a feed chamber 25. This ring, which I will term a feed ring, has a central opening at its top, sufficiently larger than the outer diameter of the hub 20, to leave a desired annular space around the hub, through which the material for separation, mixed with water, ordinarily known as pulp, as well as concentrates removing water may be introduced by means of a suitable feed pipe 26, as hereinafter more fully explained. This pipe is supported in part by an attached bracket 26' (Fig. 3) secured to the frame of the separator as illustrated. In this instance the feed ring is formed integral with the deflector vessel, and within the feed chamber of this ring, communicating with the space 23, are a series of holes or passages 27, through the bottom of the deflector vessel, as illustrated, which serve as passages for the flow of pulp from the feed chamber

into the space 23, whence such pulp, actuated by centrifugal force, is driven into the separating passage 17, where separation takes place, and the heavier substances accumulate and form in a bed or layer on the separating surface.

The deflector member, in addition to the deflector vessel, which serves as a supporting element, embodies an expansible and contractible element 28, which I will term an expansible friction element. This friction element is in the nature of flexible covering or jacket located around, secured to and supported by the deflector vessel. It is preferably provided with multiple expansion chambers 29, extending circumferentially to the course of rotation of the deflector vessel, and adapted to be expanded by the pressure of water that may be forced into them during operation of the separator.

Within the deflector vessel I have provided circumferential multiple troughs or channels 30, which serve to receive water when desired, and through the wall of the deflector vessel, are provided with a sufficient number of holes 31, that communicate from the several troughs to their respective expansion chambers in the friction element, so that water introduced in the troughs will in part be driven, actuated by centrifugal force, into the expansion chambers, serving to expand the friction element.

The friction element serves the office of regulating the size of the separating passage by becoming enlarged through expansion, and it also serves the important office of generating a washing friction on the separating surface, or the surface of the bedding heavier substances. The intensity of this washing friction will depend partly on the velocity of different travel in rotation between the friction element and the separating vessel, and partly upon the degree of expansion of the friction element, caused by the amount of water within the respective troughs 30, which supply both volume and pressure of water to the expansion chambers.

The pressure of the water for effecting expansion of the friction element at a predetermined speed of rotation of the deflector vessel, and the resultant degree of such expansion will depend very largely on the amount of water maintained in the troughs 30, in the deflector vessel 18, from the fact that the water in such troughs form columns which, acted upon by centrifugal force, develop hydrostatic pressure substantially proportioned to the height or depth of such columns, resulting in a corresponding greater or less degree of expansion of the friction element.

In order to secure a condition to most satisfactorily accomplish separation, it is necessary to have and maintain the frictional

surface of the friction element, and the separating surface, or the surface of the bedding concentrates, in comparatively close differentially traveling proximity, and to effectuate this, it is necessary that expansion and contraction of the friction element be gradually and suitably regulated throughout the separating period.

To best enable gradual contraction of the friction element, I have provided means hereinafter described, for gradually removing the water from the annular troughs 30, in the deflector vessel, and thereby gradually decreasing the hydrostatic pressure within the expansion chambers of this element.

During operation of the separator, as above explained, the pulp to be separated into lighter parts known as tailings and heavier parts known as concentrates, passes from the feed chamber and the space 23, into the lower end of the separating passage, and actuated by centrifugal force and the resultant pressure of such force on the pulp in the space 23, the pulp is driven up through the separating passage toward its discharge end, and that portion which is not bedded on the separating surface as concentrates is driven out from the upper part of the separating passage and is discharged from the separating vessel as will be hereinafter more fully described.

The energy required for forcing the pulp or its separated products to flow through the separating passage from its lower end to its upper end, is mainly the result of the pressure of pulp that accumulates in the space 23, in sufficient quantity to produce that effect, and the consequent pressure of the pulp in the separating passage on the exterior surface of the friction element is greater at its lower end, gradually decreasing in the direction of its upper end, which decrease is occasioned by the lessening frictional resistance to such flow as the distance to the upper or discharge end becomes less. In order to balance this varying degree of external pressure and uniformly expand the friction element, I subject this element to a greater degree of expanding pressure at the lower end or portion of the separating passage than at the upper.

As means for introducing water into the several troughs 30, for purposes of expanding the friction element, I have provided a suitable pipe 32, with branches 33, 34 and 35, one of which extends into each of the troughs, as illustrated. The pipe 32, may connect with any appropriate source of supply of water for this purpose.

As means for removing the desired amount of water from the several troughs 30, and of regulating the amount maintained in them, and therefore the resultant amount of pressure applied for expanding the different

expansion chambers in the friction element, I have provided a water removing pipe or conduit 36 for each of said troughs, which I will term scoop pipe or pipes. These scoop pipes are appropriately located, each with its lower open end terminating in a direction against the course of rotation of the deflector vessel, and in appropriate position to remove the water from its respective trough to the extent that such end of the scoop pipe is moved in a direction toward or from the axis of rotation of the deflector vessel, and therefore proportionately increase or decrease the expanding pressure within the chambers of the friction element. The upper ends of the scoop pipes may communicate with any desired suitable means for disposal of water delivered by them.

As means for supporting the scoop pipes and fixing their positions, and also for moving them in and out, I have provided each with a preferably channel shaped supporting part 37, which is mounted in a manner adapted to be moved in or out transversely to the axis of rotation, supported by a bracket 38, which is secured to the frame of the separator at 39 (Fig. 1) by screw bolts 40, as illustrated.

The channel parts 37, are held in place by guide pieces 41, in a manner to allow lengthwise movement and at their ends nearest to the axis of the vessel, they securely hold their respective scoop pipes by means of clamp bolts 42. The opposite ends of these channel parts are provided with suitable rollers 43, held by bolts 44, especially shown in Fig. 5, and are in position to contact with and roll against the surface of bars 45. These bars or parts 45, are located in positions oblique to the channel parts 37, and to the axis of rotation of the vessel, and are held in such desired positions by adjustable rods 46, at their upper ends and by adjustable rods 47, at their lower ends, all of which rods are provided with bifurcated ends, adapted to receive the respective ends of the bars, pivotally engaging them through pins 48 and 49. These rods, at their ends opposite the bifurcated ends are screwthreaded for a considerable length and the upper rods pass through internally screwthreaded adjusting hand nuts 50, which are suitably carried by a reciprocated part 51, hereinafter more fully described. The lower rods 47, also engage screwthreaded adjusting nuts 52, similar to those of the upper rods and are carried by swivel parts 53, which are held in place on the reciprocable part 51, by clamp pieces 54, in a manner to enable them to swing and maintain alinement with their rods as the hand nuts are turned to adjust the oblique bars 45, both relatively and with relation to the axis of the vessel in degree of inclination and in distance, which results in regu-

lating the extent or distance and speed of travel of the channel parts 37, and their scoop pipes 36. As the reciprocable part 51, moves downward carrying with it the oblique bars, the channel parts, with their scoop pipes are forced inward toward the axis of the vessel, permitting water to accumulate in the troughs 30, to that extent.

As means for maintaining the rollers 43, of the channel parts in contact with the surface of the oblique bars 45, I have provided coiled springs 55, secured at one end to the channel parts by pins 56, and have anchored the other ends to eye bolts 57, extending through fixed parts of the bracket 38, as illustrated. The eyebolts are adjustable by nuts 58, so as to permit of regulation of tension of the coil springs.

As means for holding the reciprocable part 51, in place, I have provided guide strips 59, secured to the bracket 38, by bolts 60, and as means of effecting reciprocation of this part, I have provided a cam 61, secured to the lower part of the bracket 38, by means of a shaft 62, extending through the hub 63. The cam is in position under the reciprocable part, to contact with a suitable roller 64, that is held in place on the part 51, by a stud 65, so that as the cam is rotated the roller will travel over the peripheral surface of the cam, permitting the part 51, to travel downward as relatively the surface of the cam recedes, and forcing it upward as such surface of the cam moves in an upward direction, resulting in traveling the oblique bars 45, up or down with the reciprocation of the part 51, and in movement of the channel parts and scoop pipes toward or from the axis of rotation of the deflector vessel as may be desired, and so regulating the quantity of water within the several troughs 30.

To obtain appropriate different relative positions of the several scoop pipes, so as to secure the respective pressures desired in the various expansion chambers of the friction element, the rods 46 and 47, may be moved in or out by rotation of their hand nuts, resulting in changing the position of the oblique bars 45, to effect the desired extent of travel of the channel parts. These channel parts are therefore adjustable relatively and in both their extent and velocities of movement, from the fact that the oblique bars may be adjusted in position both in distance toward and from the axis of rotation of the separating vessel, and in degree of angle or inclination with respect to such axis. The cam 61, may be revolved by means of sprocket wheel 66, mounted on the end of the shaft 62, driven by any suitable desired source of power.

As means of supplying material, which I have termed, pulp, to the separating vessel, I have provided the feed pipe 26, as herein-

above stated, which pipe is provided, in its portion above the separating vessel, with a suitable ordinary stop cock 67, to regulate the supply of pulp and to stop this supply when desired. The port or opening 67' of this stop cock is indicated in an open position in Fig. 1. The pipe 26, may communicate with any suitable source of supply of pulp.

Connected with the pulp feed pipe, between the separating vessel and the stop cock, I have provided a water supply pipe 68, which is also provided with a stop cock 69, similar to the one in the pulp feed pipe. The passage 69', in this stop cock 69 is indicated by dotted lines as in a closed position in Fig. 2. The plugs of both of these stop cocks are illustrated in dotted lines in Fig. 2, being 67'' and 69'' respectively. To these stop cocks I have provided suitable handles 70 and 71, respectively, each of which is provided with a slotted opening 72, through which passes a bolt 73, engaging a reciprocable bar 74, which is secured to the upper end of a piston rod 75, of a suitable hydraulic cylinder 76. The hydraulic cylinder is fastened to a supporting casting 77, that is secured to the frame of the separator by screwbolts 78. The piston rod 75, at its upper portion, passes through an appropriate guide box 79, which is mounted on the casting 77. The hydraulic cylinder 76, is of any ordinary suitable type and is provided with hydraulic pipes 80 and 81, to supply water under pressure for operating it when desired.

The reciprocable bar 74, is held in place at its upper end by a guide casting 82, that is secured by bolts 83, to the pulp feed pipe and the water supply pipe. The pulp feed pipe is held by its junction with the water supply pipe, and the water supply pipe, is, in turn securely supported by an extended bracket part 84, which engages a support 85, that is rigidly anchored at its lower end to the casting 77, through means of screw bolts 86. The ports or passages in the stop cocks 67 and 69, are relatively located to obtain feed of pulp and water as desired, one being open while the other is closed as hereinabove stated.

As means for catching the tailings or waste; and the concentrates separately while being discharged from the separating vessel, and to deliver them separately for further disposition, I provide a suitably shaped adjustable, preferably metal, launder 87, having separate annular compartments 88 and 89, respectively, which are intended to receive these different products. Each compartment is provided with an annular opening at its upper extremity, in the direction toward the axis of the vessel, which opening is of size and suitably located with respect to the discharge plugs 15, of the vessel, so

that when the launder during operation is moved to its different positions, material being discharged from the vessel, will be delivered into the particular compartment designed to receive it. The annular compartment 88, in the launder is provided with a discharge opening 90, and the compartment 89, with a discharge opening 91.

As means for moving the launder in appropriate relative position, so each compartment will receive the particular material intended, I have provided the launder with downwardly extended arms 92, best illustrated in Fig. 3, which pass down through guide parts 93, that are secured to the frame columns of the separator. These arms at their lower ends are provided with suitable rollers 94, that are held in place by pins 95, and are in position to rest upon the peripheral surface of appropriately formed cams 96, that are mounted on shafts 97, which are held by journal boxes 98. On the shafts 97, are also securely mounted gear wheels 99, that mesh with gear wheels 100, that are in turn carried by shafts 101, mounted in journal boxes 102. The gear wheels 100, in turn, mesh with gear wheels 103, that are carried by a single shaft 104, extending across the bed plate of the separator as is shown. This shaft 104, is held in position by journal boxes 105. On the shaft 104, there is also securely mounted a gear wheel 106, in position to mesh with a rack 107, secured to the extended end of a piston rod 108, of a hydraulic cylinder 109, which is adapted through hydraulic pressure to move the rack endwise as may be desired. The piston rod 108, is provided within the cylinder with a suitable piston head 110. For supplying water to the hydraulic cylinder, I have provided suitable pipes 111 and 112. Under the rack 107, as best shown in Fig. 2, I have provided a roller 113, carried by a bracket 114, that serves to hold the rack in engagement with the gear wheel 106.

Water under pressure may be supplied from any suitable source, to the hydraulic cylinder 109, to operate the rack, and through the several gear wheels and the cam, to travel the arms 92, up or down, carrying the launder into positions desired, for the purposes above explained. The water for operating the hydraulic cylinder, should be supplied in a manner and at the times to appropriately fix the position of the several compartments of the launder to receive the particular materials desired, and in coöperating harmony with the movements of the scoop pipe mechanism hereinabove described.

As means for assisting to maintain the launder in appropriate vertical alinement while it is being moved up or down, I provide it with extended flanges 115, best illustrated in Figs. 1 and 3, which are in posi-

tion to travel between guide flanges 116, on the inside of the frame columns of the separator.

What I regard as new and desire to secure by Letters Patent is:

1. In a centrifugal ore separator, the combination of a rotatable separating vessel adapted to contain a body of water while in operation, a differentially rotatable deflector embodying an expansible and contractible friction element, means within the deflector adapted to supply water to the friction element, means adapted to remove said water having multiple members longitudinally reciprocable in a direction transverse to the axis of rotation of the vessel, carrying independent conduits, said reciprocable members relatively variable in extent and speed of movement and means for effecting such reciprocations and variations travelable in a direction transverse to the plane of movement of the reciprocable members, substantially as described.

2. In a centrifugal ore separator, the combination of a rotatable separating vessel adapted to contain a body of water while in operation, a deflector within the vessel differentially rotatable thereto, embodying an expansible and contractible friction element, means adapted to supply expanding water to the friction element, means embodying multiple members adapted to remove such water travelable in a direction transverse to the axis of the vessel and variable in extent and speed of travel with respect to each other and to said axis, and means adapted to effect such variation embodying reciprocal adjustable members in position oblique to the course of travel of said water removing means, substantially as described.

3. In a centrifugal ore separator, the combination of a rotatable separating vessel adapted to contain a body of water while in operation, a deflector within said vessel, differentially rotatable thereto, embodying an expansible and contractible friction element, means within the deflector adapted to supply water for expansion of the friction element, members movable in a direction transversely to the axis of the vessel carrying conduits adapted to remove water from the deflector, and means in position oblique to the axis of the vessel adapted to vary the extent and speed of travel of said water removing members relatively variable to each other and with relation to the friction element, substantially as described.

4. In a centrifugal ore separator, the combination of a rotatable separating vessel adapted to contain a body of water while in operation, a deflector within said vessel differentially rotatable thereto, embodying an expansible and contractible friction ele-

ment, means within the deflector adapted to supply water for expanding the friction element, means adapted to remove such water from the deflector carried by multiple
5 members movable in a direction transverse to the axis of rotation, means for effecting movement of said multiple members embodying multiple adjustable actuating parts, in position oblique to the axis of the vessel,
10 reciprocal supports for such actuating parts and cam mechanism adapted to effect reciprocation of such supports, substantially as described.

5. In a centrifugal ore separator, the combination of a rotatable separating vessel
15 adapted to contain a body of water while in operation, a differentially rotatable deflector within said vessel embodying an expansible and contractible friction element,

means within the deflector adapted to supply water for expanding the friction element, means adapted to remove said water from the deflector, embodying conduits supported and carried by movable members, and means for effecting movement of said
20 members embodying reciprocal portions located in portions oblique to the axis of the vessel, adapted to be adjusted with relation to each other and to the axis of the vessel in distance and degree of inclination, means
25 for effecting such adjustments, and means for effecting such reciprocation substantially as described. 30

PHILIP F. PECK.

Witnesses:

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."