No. 775,415. PATENTED NOV. 22, 1904.

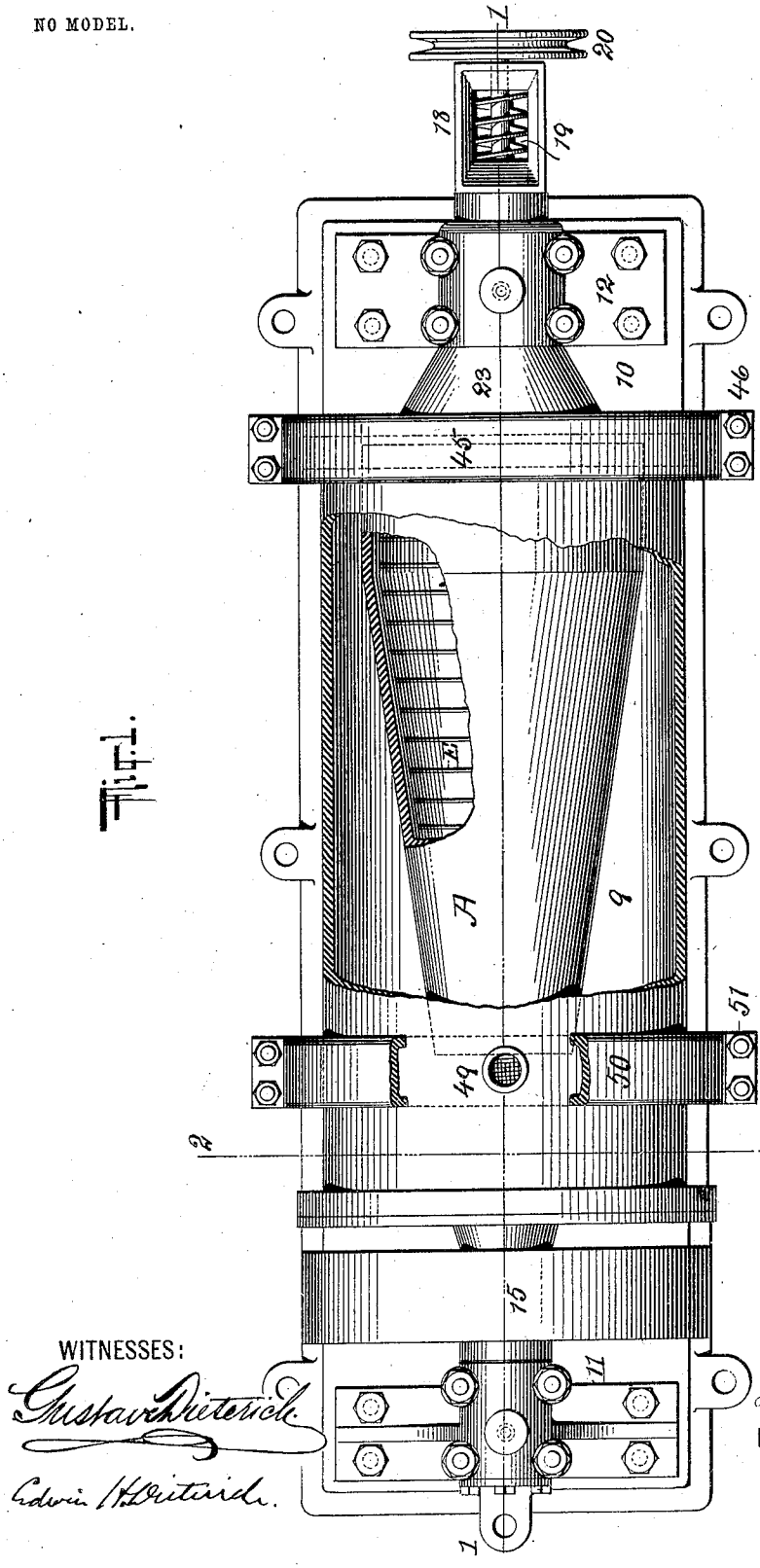
J. J. BERRIGAN.

CENTRIFUGAL SEPARATOR.

APPLICATION FILED FEB. 11, 1904.

NO MODEL. 6 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

Gustav Dieterich.

Edwin H. Dieterich.

INVENTOR

John J. Berrigan

BY Clark Benjamin

his ATTORNEY

No. 775,415. PATENTED NOV. 22, 1904.

J. J. BERRIGAN.

CENTRIFUGAL SEPARATOR.

APPLICATION FILED FEB. 11, 1904.

NO MODEL. 6 SHEETS—SHEET 2.

Fig. 1.

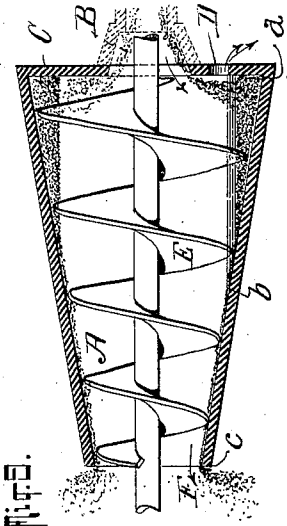
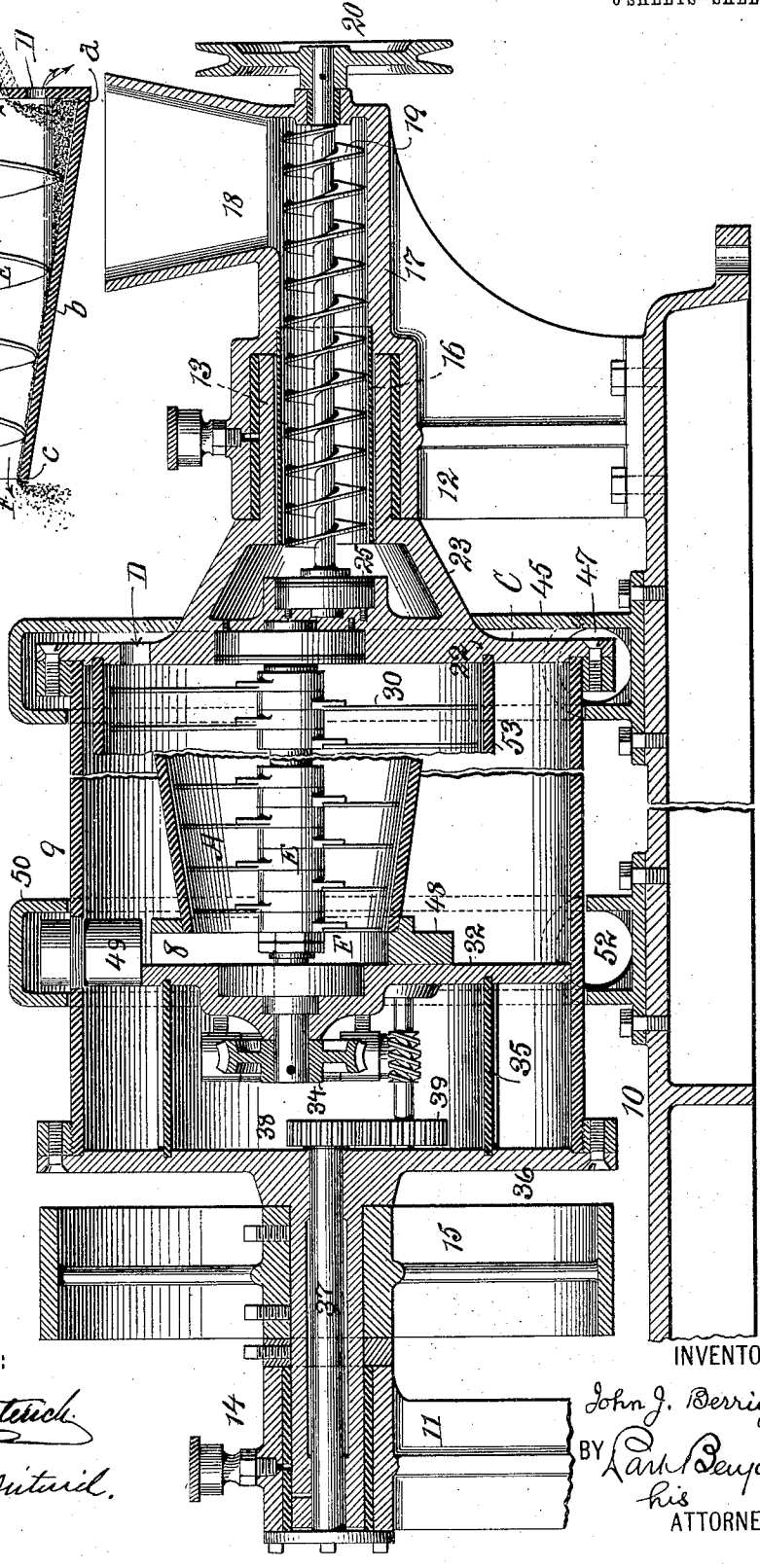


Fig. 2.



WITNESSES:

Gustave Dietsch

Edwin H. Whitwell.

INVENTOR

John J. Berrigan

BY Lark Benjamin

his ATTORNEY

No. 775,415. PATENTED NOV. 22, 1904.

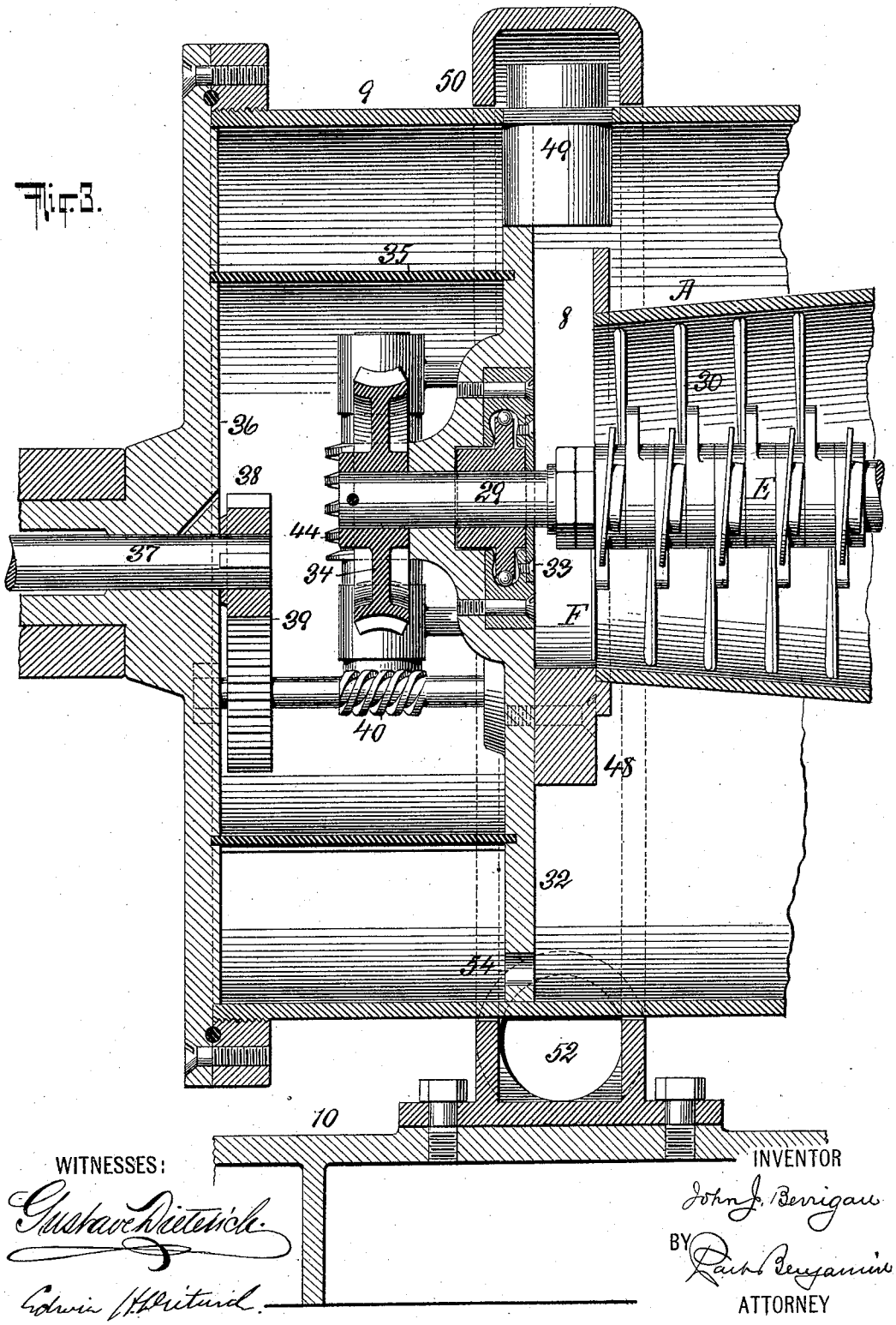
J. J. BERRIGAN.

CENTRIFUGAL SEPARATOR.

APPLICATION FILED FEB. 11, 1904.

NO MODEL. 6 SHEETS—SHEET 3.

Fig. 3.



WITNESSES:

Gustave Dietrich

Edwin H. Whitwell

INVENTOR

John J. Berrigan

BY Park Benjamin

ATTORNEY

No. 775,415. PATENTED NOV. 22, 1904.

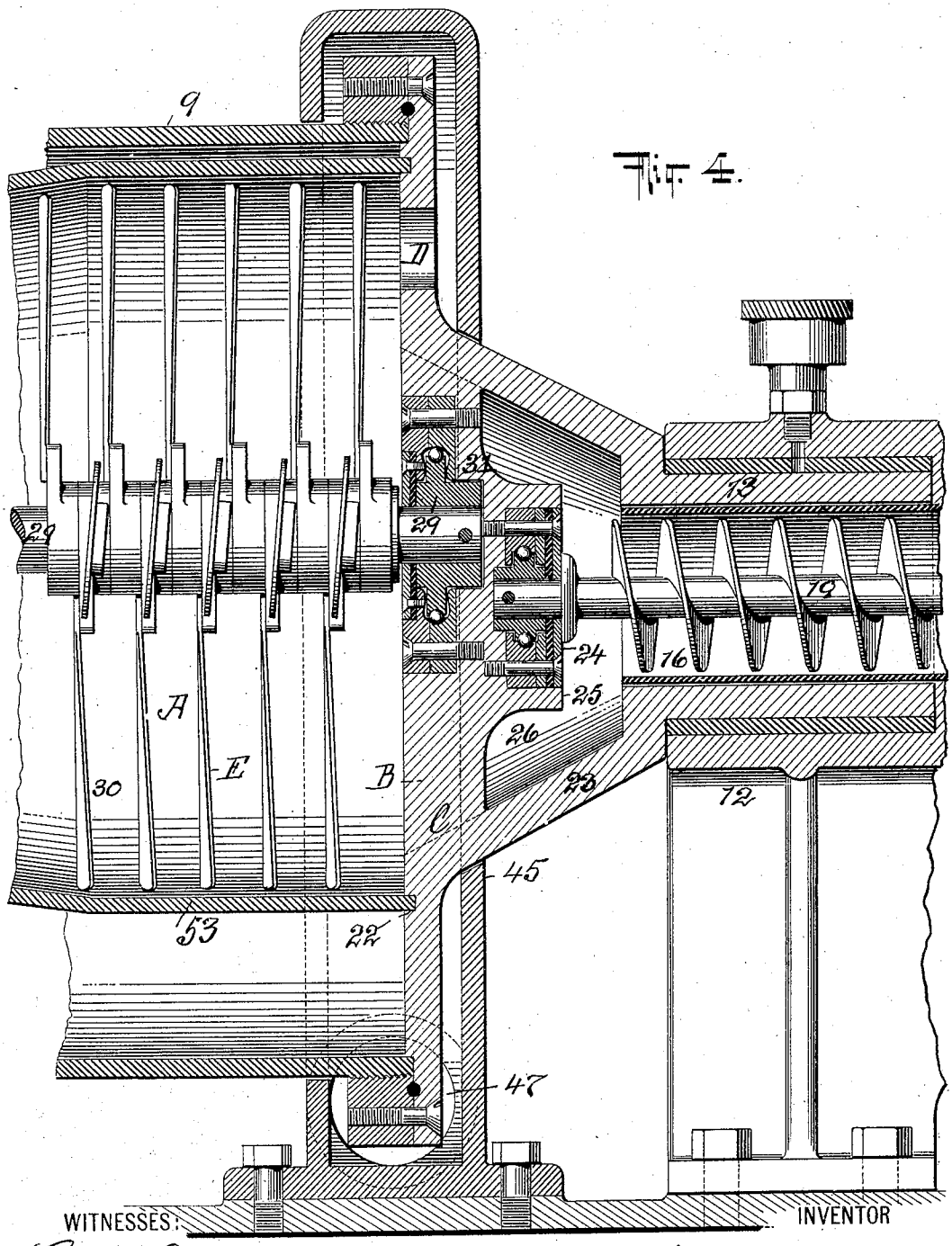
J. J. BERRIGAN.

CENTRIFUGAL SEPARATOR.

APPLICATION FILED FEB. 11, 1904.

NO MODEL. 6 SHEETS—SHEET 4.

Fig. 4.



WITNESSES:

Gustave Dieterich.

Edwin H. Dieterich.

INVENTOR

John J. Berrigan

BY

Parker Benjamin

Its ATTORNEY

No. 775,415. PATENTED NOV. 22, 1904.

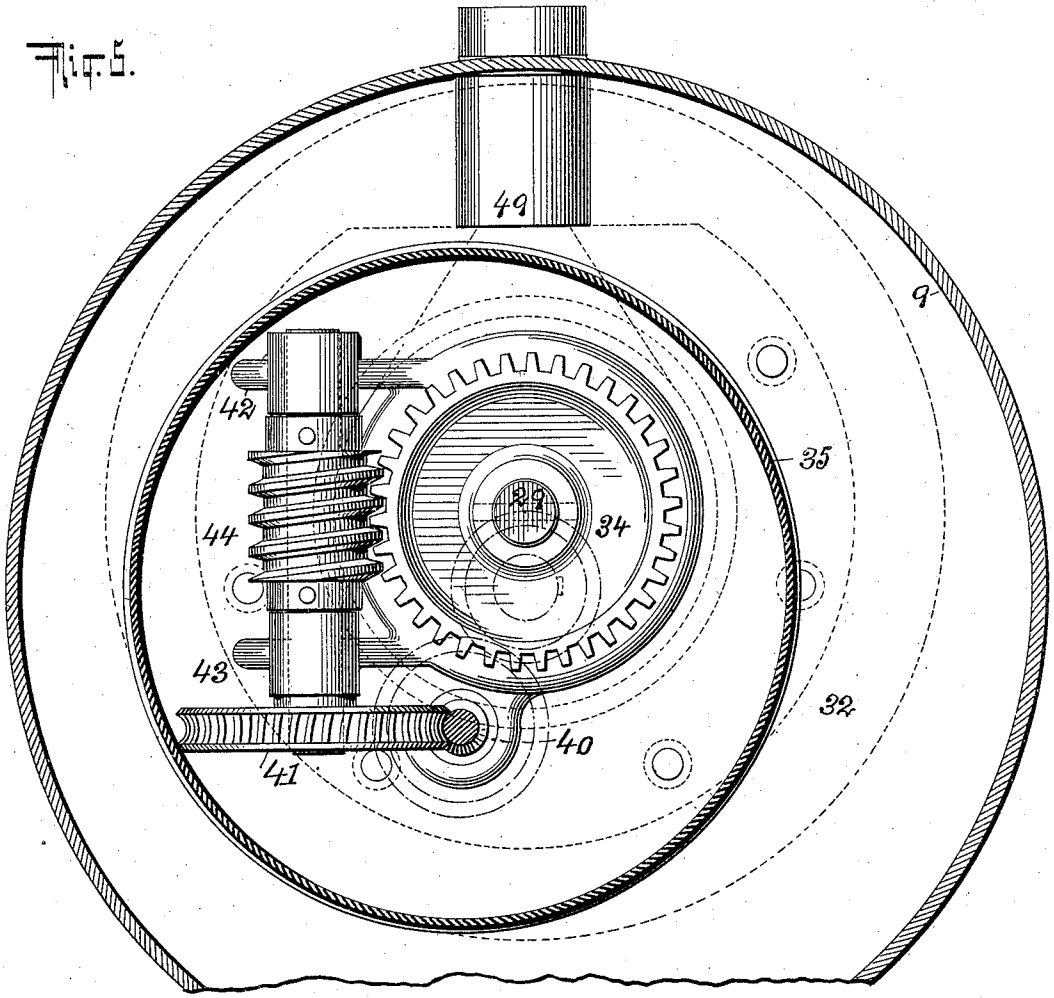
J. J. BERRIGAN.

CENTRIFUGAL SEPARATOR.

APPLICATION FILED FEB. 11, 1904.

NO MODEL. 6 SHEETS—SHEET 5.

Fig. 5.



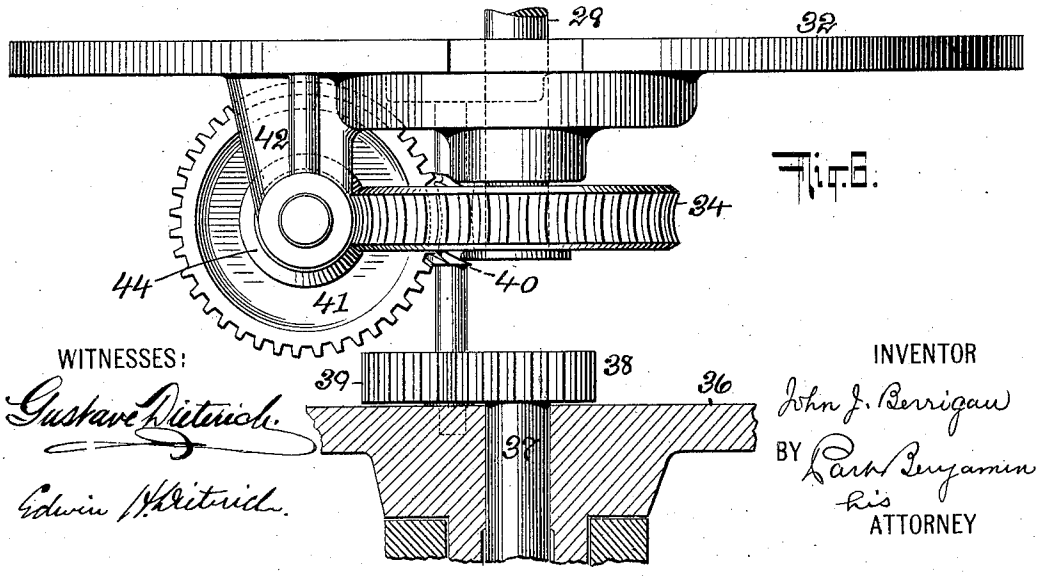


Fig. 6.

WITNESSES:

Gustave Dietrich.

Edwin W. Dietrich.

INVENTOR

John J. Berrigan

BY Carl Benjamin

his

ATTORNEY

No. 775,415. PATENTED NOV. 22, 1904.

J. J. BERRIGAN.

CENTRIFUGAL SEPARATOR.

APPLICATION FILED FEB. 11, 1904.

NO MODEL. 6 SHEETS—SHEET 6.

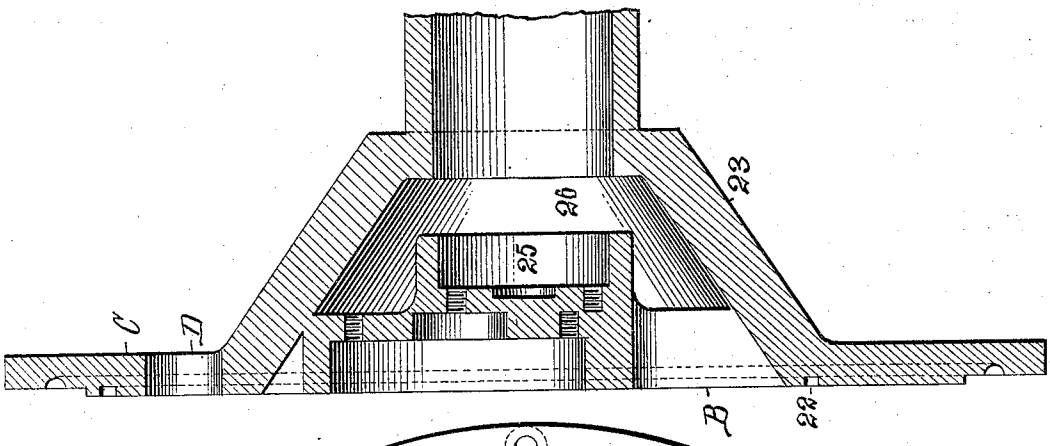


Fig. 6.

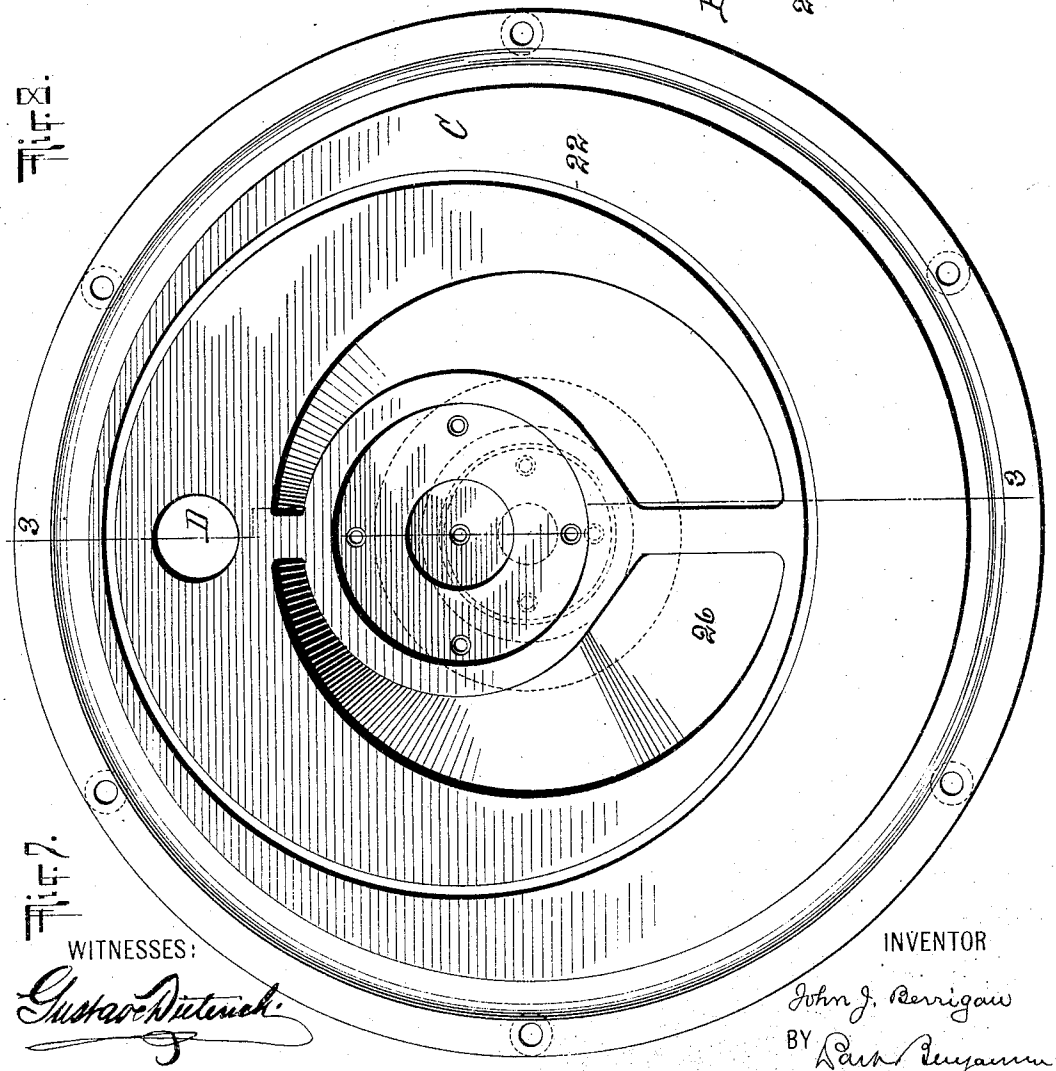


Fig. 7.

WITNESSES:

Gustave Dieterich.

Edwin H. Dieterich.

INVENTOR

John J. Berrigan

BY Paul Benjamin

Its ATTORNEY

No. 775,415. Patented November 22, 1904.

UNITED STATES PATENT OFFICE.

JOHN JOSEPH BERRIGAN, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO FRANCIS J. AREND, OF NEW YORK, N. Y., AND JOHN BERNSTROM, OF STOCKHOLM, SWEDEN.

CENTRIFUGAL SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 775,415, dated November 22, 1904.

Application filed February 11, 1904. Serial No. 193,147. (No model.)

To all whom it may concern:

Be it known that I, JOHN JOSEPH BERRIGAN, of East Orange, Essex county, New Jersey, have invented a new and useful Improvement in Centrifugal Separators, of which the following is a specification.

The invention is a machine for separating solids and liquids. The materials to be separated being placed in a rotary vessel, the liquid is drawn off by decantation from the inner surface of the deposit formed by centrifugal force on the circumferential wall of said vessel, while the solids are conveyed from said deposit longitudinally said vessel and over a dry space therein and finally ejected at a distance from their place of entry.

The invention consists, broadly, in a practical and operative embodiment of the aforesaid principle, substantially as herein disclosed, and in the construction more particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a plan view of the machine. Fig. 2 is a longitudinal section on the line 1 1 of Fig. 1, the middle portion of the machine being broken away and the ends brought into proximity. Fig. 3 is a vertical section of the end of the machine from which the solids are delivered. Fig. 4 is a similar section of the end from which the liquid is delivered. Fig. 5 is a cross-section, enlarged, on the line 2 2 of Fig. 1, showing the driving-gearing for the conveyer in the separating-bowl. Fig. 6 is a plan view of said gearing. Fig. 7 is a view of the inner side of the large head of the separating-cylinder. Fig. 8 is a section on the line 3 3 of Fig. 7; and Fig. 9 is a longitudinal section of the rotary separating vessel, illustrating the mode of separating the materials.

Similar numbers and letters of reference indicate like parts.

The principle of this machine is carried into effect by means of the conical rotary separating vessel A, Fig. 9, into which the combined materials to be separated are fed through an opening B in its large head C. They then by the action of centrifugal force form a ring or layer around the inner periphery of that vessel, in which layer the material of greater specific gravity will naturally be outermost. The liquid then escapes by what is substantially decantation through a suitably-placed opening D in the large head C. Meanwhile by the action of the conveyer E the solids are carried longitudinally the vessel to an outlet F at the small end thereof, whence they escape.

In the apparatus which I am about to describe in detail the rotary conical separating vessel is shown with its longitudinal axis of figure not coincident with its axis of rotation. This disposition, while desirable in the structure illustrated, is not essential to the separation of the liquid from the solids by decantation, since this result may be achieved when the longitudinal axis of figure and the longitudinal axis of rotation coincide.

The external cylinder 9 here shown, in which the vessel A is journaled, is a convenient balancing contrivance for said vessel when said vessel is placed within it in the eccentric position illustrated.

On the bed 10 of the apparatus are standards 11 and 12. In a box in standard 12 is received one trunnion, 13, of the cylinder 9, and in a similar box in the standard 11 the other trunnion, 14, is journaled. The driving-pulley 15 is fast on the trunnion 14 between its bearing and the cylinder. The trunnion 13 is hollow and receives a fixed lining-sleeve 16, which enters the feed-tube 17 in the standard 12. The feed-hopper 18 communicates with this tube. Also in said tube is a conveyer 19, which is rotated by the belt-pulley 20. The hollow trunnion 13 is formed upon the head C, which head serves to close the end of both the cylinder 9 and the separating vessel A. It is secured to the cylinder 9 by bolts and flanges in the usual way and is provided with a circular recess 22, Fig. 7, in which is seated the circular edge of the large end of the separating vessel A. The construction of the head C is clearly shown in Figs. 4, 7, and 8. It has a central boss 25, in which there is a ball-bearing 24 for the end of the shaft of conveyer 19. This boss, as shown, is in a conical projection 23, in which

projection is formed a chamber 26, Fig. 8, which communicates with the interior of the conical vessel A, as represented at B.

The combined materials to be separated being placed in the hopper 18 are by the action of the conveyer 19 forced through the chamber 26 in the head C, and so into the conical vessel A at its large end. Within the said vessel is a shaft 29, carrying a multiplicity of conveyer-blades 30, (forming the conveyer E,) so inclined as that by the rotation of the shaft these blades operate to move the solid material from the large to the small end of said vessel. One end of the shaft 29 is received in a ball-bearing 31 in the head C. The other end, Fig. 3, passes through a partition 32 in the cylinder 9, at which point it is provided with a ball-bearing 33 and carries at its end a worm-pinion 34.

The gearing about to be described, Figs. 5 and 6, which communicates with the worm-pinion 34, and so sets the conveyer-shaft 29 in rotation, is inclosed in an inner cylinder 35, which is seated at its ends in the partition 32 and the head 36 of cylinder 9. The object of this gearing is to impart to the shaft 29, and hence to the conveyer within vessel A, a rate of speed different from that of rotation of said vessel. This is effected in the following manner: Secured in the standard 11 is a fixed shaft 37, on the inner end of which and within the cylinder 9 is a pinion 38. Engaging with the pinion 38 is a planet-pinion 39, the shaft of which is journaled in the cylinder-head 36 and the partition 32. On said shaft is a worm-gear 40, which engages with the worm-pinion 41. The shaft of this pinion is vertical and is carried in two brackets 42, supported on the central portion of partition 32, Fig. 5. Midway between the brackets the pinion-shaft carries a worm-gear 44, and this worm-gear in turn engages with the worm-pinion 34 on the conveyer-shaft 29. Hence by the rotation of cylinder 9, caused by the belt-pulley 15, the planet-pinion 39 is carried in an orbit around the fixed pinion 38, and so rotated, and the rotation of the pinion 39 through the gearing described effects the rotation of the conveyer-shaft 29.

In the head C is formed, as already stated, the liquid-outlet D. The distance of the outer edge of that outlet measured from the inner surface of the circumferential wall of the separating vessel A is to be such as that on the rotation of said vessel the liquid will escape from said outlet D by decantation from the inner portion of the ring of material centrifugally produced within said vessel. In order to conduct away the liquid thus escaping, I provide a conduit-box 45, formed of two parts divided horizontally and having flanges 46, Fig. 1, by which they are bolted together. The lower half is secured to the bed of the machine and contains an outlet 47. The upper half has no escape-opening. By simply removing the connecting-bolts the upper half can be taken off to allow of convenient access to the outlet D in the head C. The small end of the separating vessel A is received in a box 48 on one side of the partition 32, and in this box is the opening 8, which communicates with a pipe 49 in the wall of cylinder 9, through which pipe the solid separated material escapes. A box 50 surrounds the cylinder at this point and is made, like the conduit-box 45, in two pieces bolted together, as shown at 51, the lower half being bolted to the bed and provided with an escape-outlet 52.

In the illustrative section, Fig. 9, the separating vessel is shown conical in form. In the other figures it is shown with a cylindrical portion 53 at its large end. This construction is preferable, since it allows the solid material to settle against the inner periphery over a greater area thereof.

The operation of the machine is as follows: The combined materials to be separated being introduced in the hopper 18 are carried by the conveyer 19 into the separating vessel A. By the action of centrifugal force of rotation they are at once thrown against the circumferential wall, which becomes lined entirely around with the solid ring. When the vessel is eccentrically disposed with reference to the axis of rotation of its support, then the liquid accumulates at the more eccentric portion of the circumference, so that around the remainder of said circumference it is practically drained from the solids there deposited. The liquid extends longitudinally the vessel (*a* to *b*, Fig. 9) for a certain distance. Beyond there is a dry space, (*b* to *c*, Fig. 9.) Over this dry space the solid material is carried by the conveyer before escaping from the outlet. As soon as the liquid accumulated on the more eccentric portion of the vessel becomes of such depth that it reaches the escape-outlet the liquid begins to be decanted away, while at the same time the conveyer continuously moves the solid out of the liquid in the pocket formed at the large end of the conical vessel, and so over the dry space *b c*, where it is further freed from moisture. Finally the solid reaches the outlet-duct 8, whence it is ejected through the pipe 49, and so to the receiving-box 50 and final outlet 52. The opening 54, Fig. 3, establishes communication through partition 32 for liquid which may escape into the cylinder 9.

I claim—

1. In a machine for separating solids and liquids, a rotary separating vessel and means within said vessel for conveying the solid material in a direction longitudinally said vessel from inlet to outlet; the said vessel having a liquid-escape opening disposed between its circumferential wall and its axis of rotation.

2. In a machine for separating solids and liquids, a conical rotary separating vessel, and means within said vessel for conveying the

solid material in a direction longitudinally said vessel from inlet to outlet; the said vessel having a liquid-escape opening disposed at its large end and between its circumferential wall and its axis of rotation.

3. In a machine for separating solids and liquids, a separating vessel rotary on a horizontal axis, and means within said vessel for conveying the solid material in a direction longitudinally said vessel from inlet to outlet; the said vessel having a liquid-escape opening disposed between its circumferential wall and its axis of rotation.

4. In a machine for separating solids and liquids, a rotary separating vessel, having a portion of its peripheral wall cylindrical and the remainder frusto-conical, and means within said vessel for conveying the solid material in a direction longitudinally said vessel from inlet to outlet; the said vessel having a liquid-escape opening disposed between its said cylindrical wall and its axis of rotation.

5. In a machine for separating solids and liquids, a frusto-conical rotary separating vessel, and means within said vessel for conveying the solid material longitudinally said vessel from inlet to outlet; the said vessel having an inlet at its large end and an outlet at its small end and a liquid-escape opening disposed between its circumferential wall and its axis of rotation.

6. In a machine for separating solids and liquids, a rotary separating vessel eccentrically disposed with reference to its axis of rotation, and means within said vessel for conveying the solid material in a direction longitudinally said vessel from inlet to outlet; the said vessel having a liquid-escape opening disposed between its circumferential wall and its axis of rotation.

7. In a machine for the separation of solids and liquids, a rotary frusto-conical separating vessel having a non-foraminous circumferential wall and provided with an inlet and two outlet openings; one of said outlet-openings being in the large head of said vessel with its outer edge at a distance from the circumference thereof, and the other of said outlet-openings being at the small end of said vessel, and means within said vessel for conveying the solid material from the inlet to the last-named outlet-opening.

8. In a machine for separating solids and liquids, a rotary frusto-conical separating vessel, eccentrically disposed with reference to its axis of rotation, having a non-foraminous circumferential wall and provided with an inlet and two outlet-openings; one of said outlet-openings being in the large head of said vessel with its outer edge at a distance from the circumference thereof and the other of said outlet-openings being at the small end of said vessel, and means within said vessel for conveying the solid material from the inlet to the last-named outlet-opening.

9. In a machine for the separation of solids and liquids, a cylinder rotary on its longitudinal axis, a separating vessel within said cylinder and having its axis parallel to said cylinder-axis, the said vessel having an inlet for the combined materials to be separated at one end, and a liquid-outlet extending through one head of said cylinder, and means within said vessel for conveying said solid material from said inlet to said outlet-opening.

10. In a machine for separating solids and liquids, a rotary separating vessel, means within said vessel for conveying the solid material in a direction longitudinally said vessel from inlet to outlet, the said vessel having a liquid-escape opening disposed between its circumferential wall and its axis of rotation and means for continuously feeding material into one end of said vessel.

11. In a machine for separating solids and liquids a rotary cylinder, axial trunnions supporting the same, a separating vessel supported within said cylinder and on a parallel axis to said cylinder-axis, means for feeding material through one of said trunnions and into said separating vessel and means within said separating vessel for conveying solid material from said inlet to an outlet; the said vessel having a liquid-escape opening disposed between its circumferential wall and longitudinal axis.

12. In a machine for separating solids and liquids, a rotary separating vessel, a spiral conveyer within said vessel for moving the solid material in a direction longitudinally said vessel from inlet to outlet, and means for rotating said conveyer at a speed different from that of rotation of said vessel; the said vessel having a liquid-escape opening disposed between its circumferential wall and its axis of rotation.

13. In a machine for separating solids and liquids, a rotary support, a separating vessel fixed thereon, having an inlet for the materials to be separated and an outlet for liquid extending through said support and an outlet for solids at the opposite end of said vessel, the said liquid-outlet being disposed between said inlet for the combined materials and the circumferential wall of said vessel, and means within said vessel for conveying solids from said inlet to said outlet at said opposite end.

14. In a machine for separating solids and liquids, a rotary cylinder, a separating vessel eccentrically supported within said cylinder and means within said vessel for conveying the solid material in a direction longitudinally said vessel from inlet to outlet; the said cylinder and vessel having a common head provided with a liquid-escape opening.

15. In a machine for separating solids and liquids, a rotary support, a separating vessel thereon having a liquid-escape opening, a conveyer within said vessel for moving the solid material in a direction longitudinally said ves-

sel from inlet to outlet, and means for actuating said conveyer by the rotation of said support.

16. In a machine for separating solids and liquids, a rotary support, a separating vessel thereon having a liquid-escape opening, a conveyer within said vessel for moving the solid material in a direction longitudinally said vessel from inlet to outlet, and means for actuating said conveyer by the rotation of said support at a speed of rotation different from that of said support.

17. In a machine for separating solids and liquids, a rotary support, a separating vessel eccentrically fixed thereon and having a liquid-escape opening, a rotary conveyer within said vessel for moving the solid material in a direction longitudinally said vessel from inlet to outlet and means for actuating said conveyer by the rotation of said support.

18. In a machine for separating solids and liquids, a rotary support, a frusto-conical separating vessel eccentrically fixed thereon, a rotary conveyer constructed to move the solid material from an inlet at the large end to an outlet at the small end of said vessel, and means for actuating said conveyer by the rotation of said support; the said vessel having in its large end a liquid-outlet extending through said support.

19. In a machine for separating solids and liquids, a rotary cylinder, a separating vessel fixed therein having a liquid-escape outlet through a wall of said cylinder, a conveyer within said vessel for moving the solid material longitudinally said vessel from inlet to outlet, and within said cylinder-gearing constructed to actuate said conveyer by the rotation of said cylinder, at a speed different from that of the rotation of said cylinder.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN JOSEPH BERRIGAN.

Witnesses:
WM. H. SIEGMAN,
I. A. VAN WART.