(No Model.) 2 Sheets—Sheet 1.

R. LAFFERTY.

Centrifugal Machine.

No. 235,638. Patented Dec. 21, 1880.

FIG. 1.

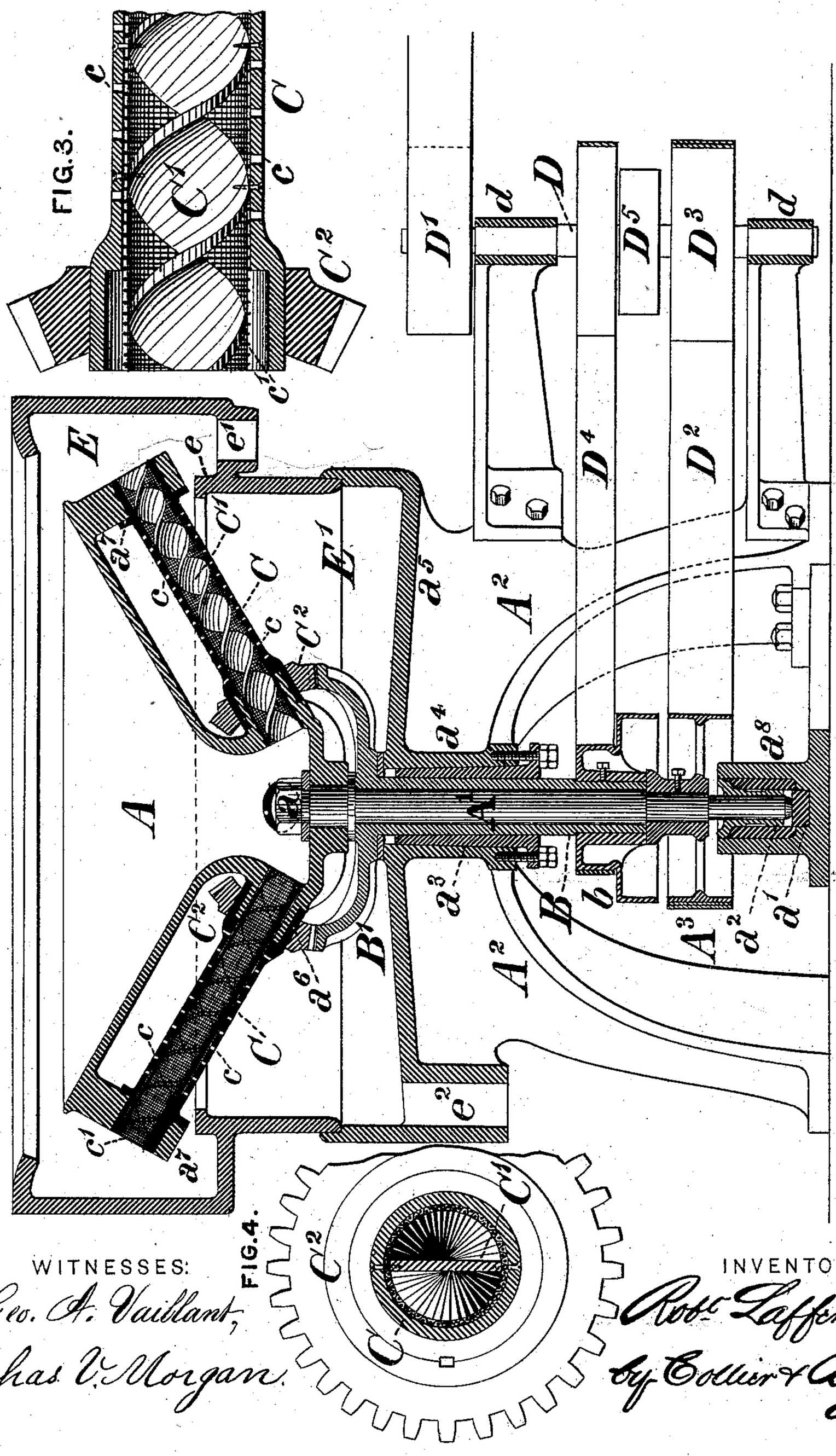

FIG. 3.

FIG. 4.

WITNESSES:

Geo. A. Vaillant,

Chas. V. Morgan.

INVENTOR:

Robt. Lafferty.

by Collier & Bell,

attys.

(No Model.)

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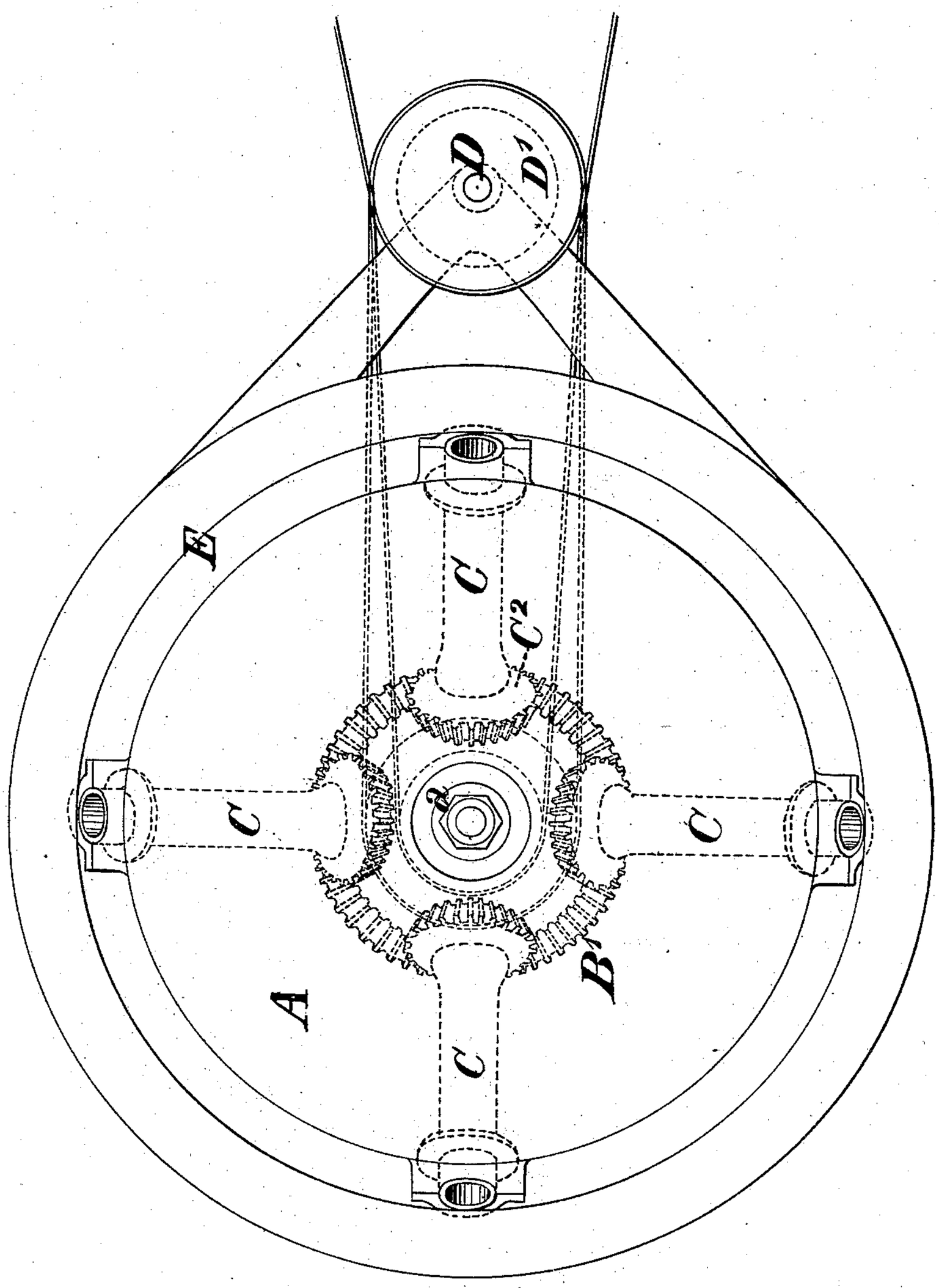

FIG. 2.

WITNESSES:

Geo. A. Vaillant,

Chas. C. Morgan.

INVENTOR:

Robt. Lafferty.

By Collier & Bell,

attys.

UNITED STATES PATENT OFFICE.

ROBERT LAFFERTY, OF GLOUCESTER CITY, NEW JERSEY.

CENTRIFUGAL MACHINE.

SPECIFICATION forming part of Letters Patent No. 235,638, dated December 21, 1880.

Application filed March 18, 1880. (No model.)

To all whom it may concern:

Be it known that I, ROBERT LAFFERTY, of Gloucester City, in the county of Camden and State of New Jersey, have invented certain new and useful Improvements in Centrifugal Machines, of which improvements the following is a specification.

My invention relates to machines of the class in which the separation of commingled liquids and solids, or the drying or draining of wet material of various descriptions, is effected by the action of centrifugal force generated by the rapid rotation of a vessel in which the matters to be treated are contained. In the use of machines for this purpose as heretofore constructed, so far as my knowledge and information extend, frequent stoppages are necessary to admit of the removal of the dried material and the insertion of fresh charges. The loss of time thereby involved materially reduces the efficiency of the apparatus in correspondingly diminishing the amount of its daily product, and the attention and labor of an operator is, moreover, required for charging and discharging.

The object of my invention is to provide a centrifugal machine in which the separation of liquid from solid matters may be effected continuously, and the necessity of stoppages during its operation avoided by the provision of simple and effective means for maintaining a continuous feed of the material to be treated and a continuous discharge of the separated liquid and solid constituents thereof.

To this end my improvements consist in the combination of a rotating receiving-vessel, a series of separating-vessels connected to and communicating therewith, and a fixed case having separate receptacles and discharge-passages for the separate constituents of the charge.

My improvements further consist in the combination of a rotating receiving-vessel, a series of separating-vessels, and mechanism by which mixed solid and liquid ingredients, fed continuously to the receiving-vessel, are conducted continuously therefrom, exposed to the separating action of centrifugal force, and continuously and separately delivered to separate receptacles in a fixed case.

The improvements claimed are hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a vertical central section through a centrifugal machine embodying my improvements; Fig. 2, a plan or top view of the same; Fig. 3, a longitudinal central section, on an enlarged scale, through a portion of one of the separating-vessels and its driving-gear; and Fig. 4, a transverse section, on a similar scale, through the same.

To carry out my invention, I provide a receiver, A, which has an open wide-mouthed top, and is, except as presently to be described, entirely closed on its sides and bottom. The form shown in the drawings is a convenient, though not an essential, one, as the receiver might, if desired, be made cylindrical or of any other form in which all horizontal sections through its walls would present circles concentric with its axis. The receiver A is firmly fixed upon the upper end of a vertical shaft, A′, which passes centrally through the bottom of the receiver, and is secured thereto by a screw-thread and a nut, *a*. The lower end of the shaft A′ bears on a step, *a′*, and the shaft rotates within a lower bearing, a^2, fitted within a box, a^8, secured to the legs or frame A^2 of the machine, being maintained and guided in vertical position by a hollow shaft, B, through which it passes, said hollow shaft rotating within a tapered gland or bushing, a^3, fitted in a bearing, a^4, depending centrally from a horizontal plate, a^5, connecting the legs A^2 at their upper ends.

A series of separating-vessels, C, each of which communicates at its inner end with the receiver A, and near the bottom thereof, is attached to said receiver, the several vessels being arranged radially to the axis thereof, and, in this instance, in inclined position, parallel to the conical periphery of its upper portion. The separating-vessels C are cylindrical metallic tubes, which at their inner ends are mounted so as to rotate freely on tubular journals a^6, projecting from the lower portion of the receiver A, and at their outer ends are similarly fitted in bearings a^7, depending from the periphery of the upper portion of the receiver. The tubes C are perforated with a number of small openings, *c*, throughout that portion of their length which is between their end bearings, and each is, preferably, lined with a cylinder of wire gauze or netting, *c′*.

A screw or spiral blade, C′, of metal, is inserted and secured in each of the tubes C, forming a continuous spiral channel, open at both ends, along the same.

A driving-pulley, A^3, is secured upon the shaft A′ of the receiver A, the upper face of its hub forming a step or bearing for the hollow shaft B, upon the lower end of which are secured the cone-pulleys *b*. A bevel-gear, B′, is formed upon or secured to the upper end of the shaft B, and meshes with a series of corresponding pinions, C^2, each of which is secured upon the inner end of one of the separating-vessels C. A vertical counter-shaft, D, is mounted in bearings *d*, secured to the frame A^2 of the machine, and has secured upon it a driving-pulley, D′, around which passes a belt, transmitting power from a prime mover. Rotation is imparted from the counter-shaft D to the receiver-shaft A′ by a belt, D^2, passing around a pulley, D^3, on the counter-shaft and around the pulley A^3 on the shaft A′, and the tubular shaft B is independently rotated by a belt, D^4, connecting the cone-pulleys *b* of the shaft B with cone-pulleys D^5 on the counter-shaft D.

By the above-described driving mechanism it will be observed that two separate movements of rotation are imparted to each of the separating-vessels C, one coincidently with the receiver A, about the axis of the latter, and another through the bevel-gears B′ and C^2, about its own axis, the ratio of the latter movement to the former being susceptible of variation by changes of the position of the belt D^4 on the cone-pulleys *b* and D^5.

The receiver A and its separating-vessels C are inclosed in a fixed outer case composed of an upper cylindrical receptacle, E, into which the outer ends of the separating-vessels C project, and a similar lower receptacle, E′, surrounding the perforated portions of the vessels C. The lower receptacle, E′, is closed at bottom by the plate a^5, which connects the legs A^2 of the machine, and is separated at top from the receptacle E by a flange, *e*. A discharge opening or nozzle, *e*′, is formed in the lower portion of the receptacle E, and a discharge-nozzle, e^2, is provided upon the lower receptacle, E′. A scraper may be employed for the purpose of removing the separated solid material from the upper receptacle, E, by traversing the annular space in the receptacle E around the flange *e*, and sweeping any material lying within said space into the discharge-nozzle *e*′.

In the operation of the machine, rotation having been imparted to the counter-shaft D, and thence to the receiver and separating-vessels C, the raw or undrained material is fed into the mouth of the receiver A, preferably by a pipe or conduit having its opening above the center thereof, and, under the influence of the centrifugal force developed by the rotation of the receiver, is projected into the open inner ends of the separating-vessels C, and gradually propelled outward through the same. The spiral blades C′ interpose barriers to the direct passage of the undrained material to the open outer ends of the vessels C, and compel its traverse to be made through the spiral spaces formed in the tubes by the convolutions of the blades C′, and substantially over the entire perforated surfaces of the tubes, the only portions thereof which are intercepted being those covered by the narrow edges of the blades C′, the length of such traverse being proportionate to the pitch of the blades, and its duration to the relative speeds of rotation of the receiver and of the separating-vessels about their respective axes.

It will be obvious that by increasing or decreasing the rotative speed of the hollow shaft B and its attached bevel-gear B′ relatively to that of the shaft A′ and receiver A the number of revolutions about their own axes made by the separating-vessels C during each revolution of the receiver will be increased; that the more nearly the rotative speeds of the shafts A′ and B approximate the less will be the number of axial revolutions of the separating-vessels C during each revolution of the receiver A, and that the direction of axial rotation of the vessels C will be changed according as the speed of the shaft B is greater or less than that of the shaft A′. In the outward traverse of the material fed to the receiver through the vessels C its liquid and solid constituents are separated by centrifugal action, the former passing through the wire netting and perforations *c* into the receptacle E′, and the latter passing out of the open ends of the vessels C into the receptacle E′. Moreover, the tendency of the solid portions of the charge to bank up and cake against the walls of the separating-vessels is effectually overcome by the constant changes in their positions, due to the axial rotation of the vessels, and the continual breaking up of the solid masses greatly facilitates the complete extraction of liquid therefrom.

It will be further obvious that a continuous feed proportioned to the capacity of the vessels C may be maintained and a corresponding continuous discharge of the separated ingredients effected, and therefore that no stoppage of the machine for the purpose of supply or discharge is requisite.

The machine being adapted to the treatment of various materials, as, for example, concentrated cane-juice, beet-root pulp, wet grain, &c., the axial speed of the separating-vessels and the fineness of their perforations will vary with the character of the material acted on, and are matters within and to be decided by the ordinary skill of those familiar with the construction of centrifugal machines.

I am aware that the employment, in a centrifugal machine, of a series of vessels projecting circumferentially from a central drum or cylinder, and having movements of rotation about their own axes as well as around the axis of the central cylinder, is not new, such structure being exemplified in the machine

for molding sugar into loaves which is described in English Letters Patent No. 13,490, granted to Alexander Alliott, February 3, 1851, and shown in Fig. 8 of the drawings thereof. I do not, therefore, broadly claim separating-vessels having two movements of rotation, either separately or in combination with a central receiving-vessel.

I claim as my invention and desire to secure by Letters Patent—

1. The combination, in a centrifugal machine, of an imperforate walled receiving-vessel, a series of perforated separating-vessels connected to and communicating therewith, and a fixed inclosing-case having separate receptacles into which the solid and liquid ingredients supplied to the receiving-vessel are separately and continuously discharged by the separating-vessels, substantially as set forth.

2. The combination, in a centrifugal machine, of an imperforate walled receiving-vessel, a series of perforated separating-vessels connected to and communicating therewith, each capable of rotation around its own axis as well as around the axis of the receiving-vessel, and a series of deflecting and conducting blades or plates, each located within one of the separating-vessels, whereby materials supplied to the receiving-vessel are caused to pass entirely over the perforated surfaces of the separating-vessels, these members being combined for joint operation, substantially as and for the purposes set forth.

3. The combination, in a centrifugal machine, of an open-mouthed receiving-vessel having closed sides and bottom, a central driving-shaft upon which said receiving-vessel is secured and with which it rotates, a series of perforated separating-vessels, each mounted in bearings on said receiving-vessel radially to the axis thereof and having an internal spiral blade, a tubular shaft inclosing the driving-shaft of the receiving-vessel, and gearing through which the separating-vessels are rotated about their own axes by the tubular shaft during their rotation about the axis of the receiving-vessel, substantially as set forth.

4. The combination, in a centrifugal machine, of a rotating imperforate walled receiving-vessel, a perforated separating-vessel connected to and communicating therewith, and a screw or spiral blade secured within said separating-vessel, substantially as set forth.

ROBERT LAFFERTY.

Witnesses:
WM. H. MYERS,
GEO. A. VAILLANT.