(No Model.)

4 Sheets—Sheet 1.

S. C. ROCKMAN.

CENTRIFUGAL MACHINE.

No. 536,298. Patented Mar. 26, 1895.

Fig. 1.

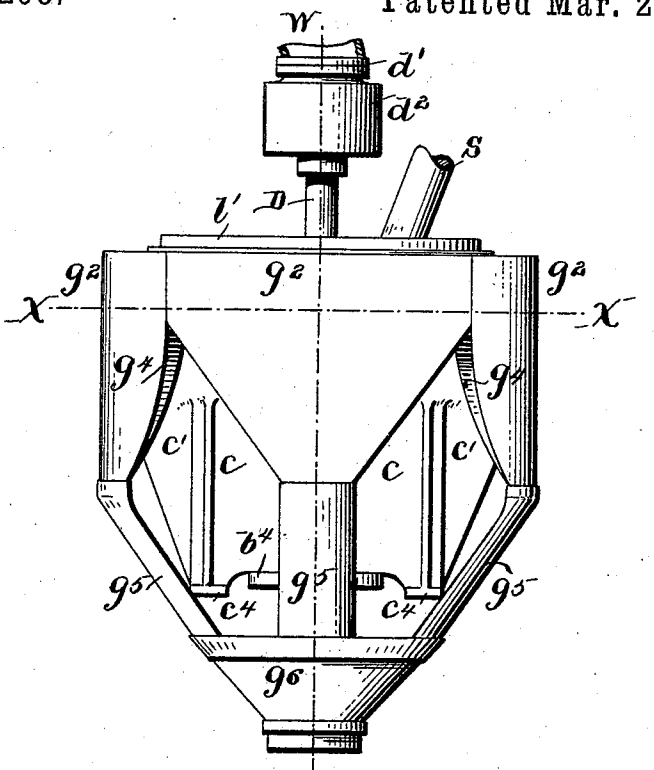
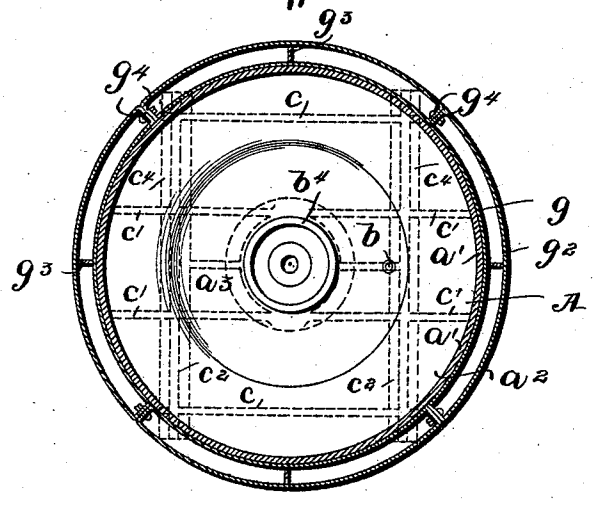


Fig. 3.



WITNESSES:

Jesse B. Keller

Frank L. Busser

INVENTOR.

Soren C. Rockman

by his atty

D. Hinding

(No Model.) 4 Sheets—Sheet 2.

S. C. ROCKMAN.

CENTRIFUGAL MACHINE.

No. 536,298. Patented Mar. 26, 1895.

Fig. 2.

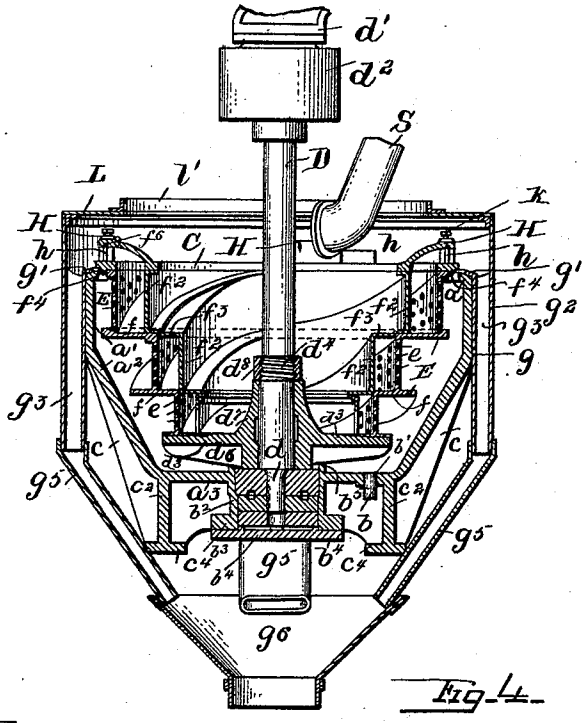
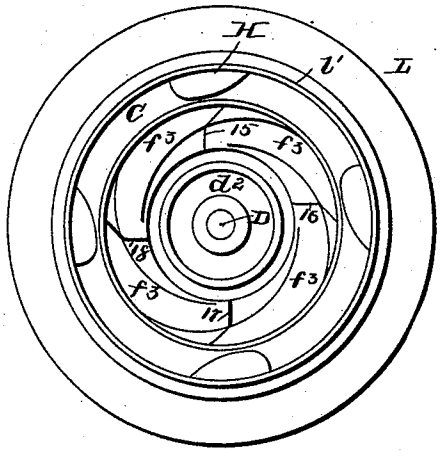
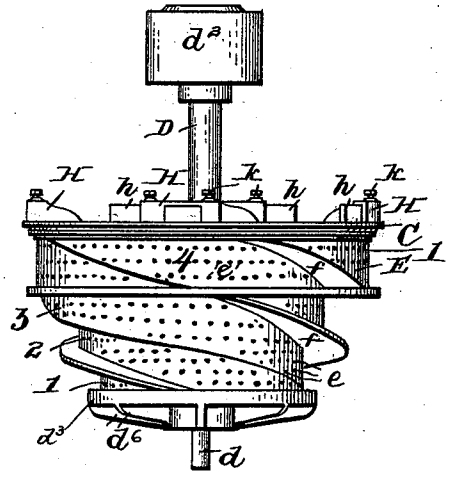


Fig. 4.

Fig. 5.





Witnesses.

Jesse B. Keller.

Frank L. Busser

Inventor.

Soren C. Rockman

by G. H. Harding

Attorney.

(No Model.) 4 Sheets—Sheet 3.

S. C. ROCKMAN.

CENTRIFUGAL MACHINE.

No. 536,298. Patented Mar. 26, 1895.

Fig. 6.

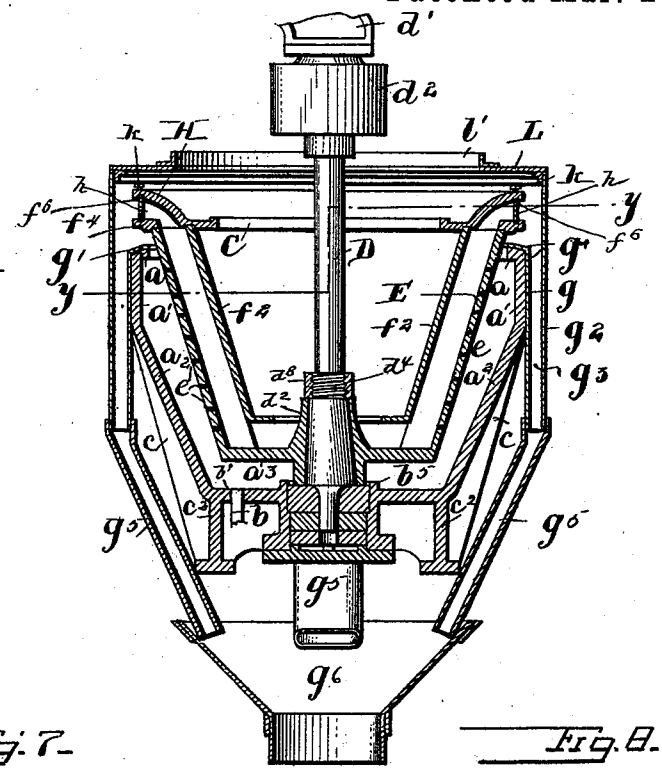


Fig. 7.

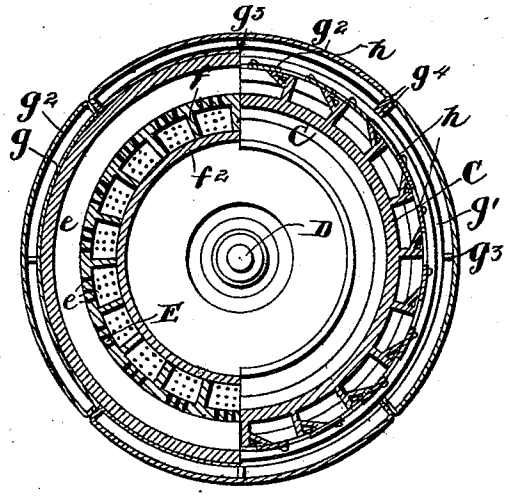
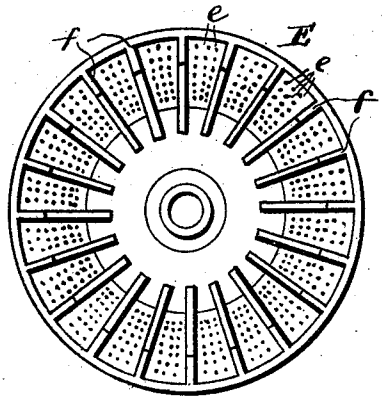


Fig. 8.



Witnesses.

Frank L. Busser

Frances Ellis

Inventor.

Soren C. Rockman

by J. J. Hardesty

Attorney.

(No Model.)

4 Sheets—Sheet 4.

S. C. ROCKMAN.

CENTRIFUGAL MACHINE.

No. 536,298. Patented Mar. 26, 1895.

Fig. 9.

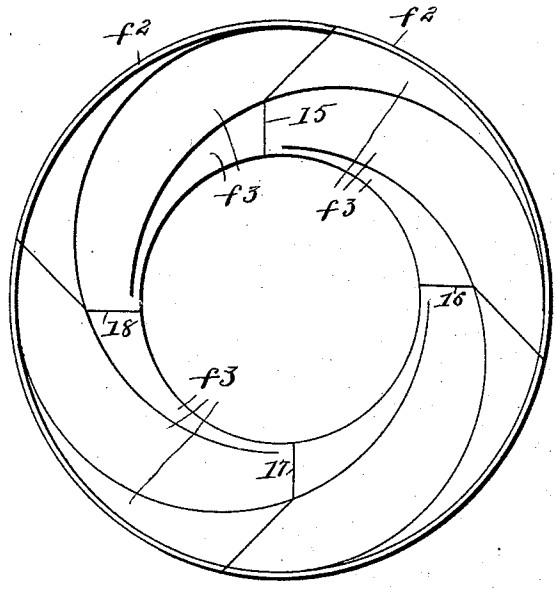
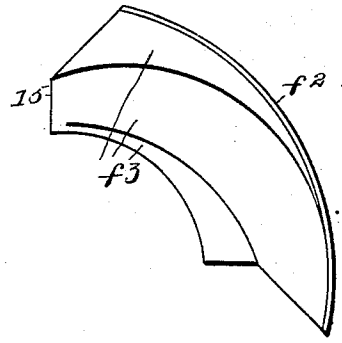


Fig. 10.



Witnesses.

Jesse B. Heller.

Frances Ellis.

Inventor.

Screen C. Rockman.

by G. D. Harding

Attorney.

UNITED STATES PATENT OFFICE.

SOREN C. ROCKMAN, OF PHILADELPHIA, PENNSYLVANIA.

CENTRIFUGAL MACHINE.

SPECIFICATION forming part of Letters Patent No. 536,298, dated March 26, 1895.

Application filed September 8, 1894. Serial No. 522,449. (No model.)

To all whom it may concern:

Be it known that I, SOREN C. ROCKMAN, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Centrifugal Separators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention has for its object the production of a centrifugal machine for the separation of liquids from solids, or the separation of liquids of different densities, and the construction of which will enable the machine to operate continuously, discharging the constituent parts separately from the machine and enabling a continuous feeding and discharge to take place.

My improved machine consists generally in using a rotating vessel formed of one or more ducts or conduits, and forming these conduits so that from the receiving end they shall preferably have a pitch vertically in a spiral form of gradually increasing radius from the center of rotation, and securing said conduits or ducts at the bottom to a receptacle which as shown is a plate into which said ducts or conduits open, said plate being adapted to receive the material to be separated, and the upper end of said conduits secured to a ring and opening into a trough or hopper provided with outlets. As shown, one of the walls of the conduit is perforated. Surrounding the conduits is a vessel which does not rotate, and which receives one of the constituents of the material to be separated after separation, said constituent passing through the perforated sides of the conduits, and in which there is an outlet to enable the constituent to be drawn off the machine.

The machine further comprises mechanism to regulate the quantity of discharge of the material from the discharge end of the conduits, thereby determining the extent of time the material is held under the centrifugal action.

The machine further shows combining with the ducts or conduits a simple and effective receiving hopper into which the conduits can discharge and from which the discharged material may be continuously conducted from the machine.

This is a general statement of the machine embodying my inventions, and the particular features and combinations I desire specifically to hold are set out in the claims.

I will first describe my improved separator as shown in the accompanying drawings, which illustrate a machine especially adapted for the separation of solids from liquids.

In the drawings,—Figure 1 is a side front elevation of my machine. Fig. 2 is a section on the line *w*—*w*, Fig. 1. Fig. 3 is a section on the line *x*—*x*, Fig. 1, with rotative vessel removed. Fig. 4 is a front elevation view of rotating vessel. Fig. 5 is a top plan view of the machine. Fig. 6 is a vertical longitudinal section of modified form. Fig. 7 is a section on line *y*—*y*, Fig. 6. Fig. 8 is a plan view of bottom of the basket of Fig. 6. Fig. 9 is a plan view of shield of Fig. 2. Fig. 10 is a plan view of one section of shield.

I will first describe the machine of Figs. 1 to 5.

A is a cylindrical formed vessel having a circumferential flange *a*, and vertical sides *a'*, and inverted cone-like sides a^2 extending to the bottom a^3.

b' is an orifice in the bottom, a^3, in which a pipe, *b*, is secured.

The bottom, a^3, has a central orifice, and projecting downward from said orifice is a cylindrical pipe-like portion, b^2, which has a flange portion, b^3, to which is connected or bolted a ring, b^4. This portion, b^2, projects slightly above the bottom, a^3, forming a cylindrical rim, b^5.

The vessel, A, is strongly ribbed on its outside by ribs, *c*, *c'*, c^2, &c., which extend downwardly to flanges, c^4, which can be bolted to the floor or beams, as may be desired, to keep the vessel in a fixed position.

The vessel, A, is preferably made of cast iron, and in the pipe-like portion, b^2, is placed a suitable step-bearing of the well known kind which supports a vertical shaft, D, at its bottom by means of a spindle *d*, resting on the step. At the upper end this shaft is guided in a vertical bearing depending from a bracket, *d'*, which bracket is rigidly secured.

d^2 is a pulley which is secured to the shaft,

D, and by means of which the shaft, D, is rotated. The lower end of the shaft, D, above this spindle, is made tapering and has secured to it a disk, d^3, which is made of cast steel strengthened with radial ribs, d^6, and has the rim, d^7, the rim being secured to the shaft by means of a nut, d^8, working on the threaded portion, d^4, of the shaft.

I secure to the bottom plate or disk, d^3, a series of inclosed conduits which are formed of vertical plates, E, which are provided with perforations, *e*, and solid bottom plates denoted by the letter, *f*, and an inner shield or cover forming the inner side and top, f^2 f^3, the parts just above described forming an inclosed conduit, one wall of which is perforated, that is, the outer wall or wall nearest the inclosing vessel A. The other wall or inner wall, and top and bottom are solid. The shield or cover is made in sections, parts or divisions, four being shown in the drawings (see points designated 15, 16 and 17 upon Figs. 5, 9 and 10) so that it can be readily removed from any part of the channel for inspection or cleaning the channel, or for the purpose of placing sieves of any desired mesh in the vertical perforated separating wall. As before described, the bottom of this conduit is secured to the plate, d^3, and the conduits are curved to form a spiral, making a three-quarters of a circumference in its turn.

The perforated plates and the bottom plates may be secured together or may be cast in one piece, and the perforations put in the plates, E, after the casting; and the side and bottom are secured to the opposite vertical side in any desired manner.

As shown in the drawings, Figs. 1 to 5, I use four of these conduits, noted 1, 2, 3, and 4, and as each one of the four makes three-quarters of a turn circumferentially and start from the bottom plates at points ninety degrees from each other and run substantially parallel in their convolution, the bottom plate of one duct, as shown in Fig. 2, will form a connection or be in alignment with the top plate of the next lower conduit, so that the whole combined forms, so far as the interior is concerned, a closed passage with the bottom plate, d^3, and what may be called the basket, B. I do not intend to limit myself to four conduits, as I may use one or a plurality. As is also clearly shown in the construction, the diameter of the vessel or the diameter of the spiral increases as the spiral progresses vertically. Thus, the position of the discharge of a conduit at the top is considerably farther from the center than it is at the bottom. I do not intend to limit myself to the exact pitch or curvature shown, or to whether the conduits make an entire convolution (three hundred and sixty degrees) or a plurality of convolutions, or less than a complete convolution, as the same may be varied as is considered necessary for the material for which it is to be used; and, if desired, the conduits need not be in the form of curves, but the walls may extend in straight lines from the receiving end to the discharge end, as shown in Figs. 6, 7, and 8 the purpose of the invention being to provide a conduit or plurality of conduits which shall have a pitch extending outwardly from the receiving end to the discharging end, and providing means to regulate the quantity of discharge from the discharge end of the conduit, the conical spiral conduit being however the preferable form.

C is a cover in the shape of an annular ring, having a strong curb, f^4, which overlaps the top rim of the conduits and is securely bolted to it. The cover is provided with four raised outlets, H, which cover the outlets of the conduits, and these outlets, H, are provided with gates, *h*, which slide between the wall of the outlets, H, and the flange, f^6, and regulate the outlet for the orifice of discharge from the conduit set screws, *k*, passing through the frame or outlet, H, and pressing upon the gate, *h*, enabling the gate to be opened the desired extent, so that the desired orifice of discharge from the conduits may be gaged.

As may be seen from this construction, as before set out, the portion of the cylindrical separator which acts upon the material to separate it into its constituent parts is formed of a series of inclosed conduits having perforated walls which have a pitch extending outwardly from the receiving end to the discharge end, and, as shown in Figs. 1 to 5, are bent so as to form conical spirals, from the bottom to the top, making in the machine shown, a turn of three-quarters of the circumference, and each one of these conduits is secured to corresponding conduits in the same plane, so as to form, as far as the interior of the vessel is concerned, a closed vessel, and each conduit at its lower portion opens into and is secured to the bottom plate, d^3, and at its top portion is secured to the annular ring cover, C.

L is an annular cover of sheet iron riveted to an angle-iron, *l*, on its inner edge, and to the angle-iron, *l'*, on its outer edge, and turned downward. To this ring is attached a circular hopper made in four parts bolted and secured fixedly together, which forms a continuous circular hopper into which, through the outlets, H, regulated by the gate, *h*, the material from the conduits passes, the hopper being made in four parts and of the same size as the separating vessel, A, at its top. The edge of the inside wall, *g*, of the hopper, is bent inwardly as at, *g'*, so as to overlap the flange, *a*, of the vessel, A, on which fixed vessel the hopper is thus carried. The outer wall, g^3, of the hopper is of similar shape, but of larger diameter. Plates, g^3, are riveted between the vertical sides, *g*, and g^2, at the four points, and hold the two walls at proper distance. The end walls, g^4, extend sloping downward and with the walls, *g* and g^2, are contracted at the bottom, and pipes, g^5, of rectangular shape, one for

each of the four divisions of the hopper connect with the divisions of the hopper and slope down to a central hopper, g^6, the central hopper g^6 being common to the four hopper spouts, g^5, and from this hopper, g^6, through the open bottom, the material may be passed to any desired point.

When the vessel formed of the conduits before described is rotated by means of the pulley, d^2, the material to be separated is passed in through the spout, S, to the interior of the vessel, B, falling upon the plate, d^3, and in the rotation of the vessel will be received and will follow the conduit from the bottom to the top, the centrifugal force being gradually increased as the spiral advances, being farther from the center. The liquid will pass through the perforations in the side plates and pass into the vessel, A, from which it passes out through the pipe. The solid matter which will not pass through the perforations in the plates, E, is discharged through the outlet at the top of the conduit, passing through the gate opening, and will be thrown over by the centrifugal force into the receiving hopper, and falling by gravity into the pipe, g^5, and through it to the hopper, g^6. By this operation, a progressive action is given to the material, gradually increasing the centrifugal force upon it, and at the same time bringing it from the bottom of the vessel to the top, and discharging the solid matter continuously. By adjusting the orifices of discharge formed by the gate, which is done by regulating the position of the gate, thus regulating the size of the orifice, I can cause the material to remain longer under the action of centrifugal force by causing it to be discharged more slowly and thus making the separation more complete, if the same be necessary.

Depending upon the fineness or completeness of the separation desired, I vary the size of the orifice in the perforated plate, E, which can be readily done by inserting a wire-cloth of any desired fineness and mesh, and securing it to the perforated sides, *e*.

I do not intend to limit my invention to a construction where the outer wall of the conduit is perforated. If the separation is solid from liquid, both walls may be perforated or only the outer wall. If it be the separation of liquids, if a perforated wall be used, I make one or the other of the walls perforated, dependent upon which liquid I desire to have pass out the mouth of the conduit. Thus, if it be separation of cream from milk, I make the outer wall perforated; but, in the case of liquids, neither wall need necessarily be perforated.

When in the claims I use the words "one of said walls being perforated," I intend to cover a construction in which at least one wall is perforated, whether the other be perforated or not, and the expression is used to point out that at least one wall must be perforated.

Having now fully described my invention, what I claim, and desire to protect by Letters Patent, is—

1. In a centrifugal separator, a rotatable conically spirally formed unobstructed conduit having an inner and outer wall connected and rotating together, one of said walls being perforated substantially as specified.

2. In a centrifugal separator, a rotatable conically spirally formed unobstructed conduit, having an inner and outer wall connected and rotating together, the material being received at one end of the conduit and discharged at the other, and means to regulate the quantity of discharge substantially as specified.

3. In a centrifugal separator, a rotatable conically spirally formed unobstructed conduit, the material being received at one end of the conduit and discharged at the other, and means to regulate the quantity of discharge substantially as specified.

4. In a centrifugal separator, a rotatable, conically, spirally formed conduit, having an inner and outer wall connected and rotating together, the outer wall of which is perforated.

5. In a centrifugal separator, a rotatable conically spirally formed conduit having an inner and outer wall, one of said walls being perforated, the material being received at one end of the conduit and discharged at the other, and means to regulate the quantity of discharge.

6. In a centrifugal separator, a rotatable conically spirally formed unobstructed conduit having an inner and outer wall, the material being received at one end of the conduit and discharged at the other, a fixed trough or hopper adjacent to the outlet of said conduit, and means to regulate the quantity of discharge substantially as specified.

7. In a centrifugal separator, a plurality of conically spirally formed conduits, one of the walls of each being perforated, each conduit starting at the same horizontal plane and terminating at the same horizontal plane as the other, said conduits being secured to each other so as to form a continuous outer, wall, the whole forming a vessel, a surrounding imperforate vessel, a plate at the receiving end of the said conduits, a ring at the other end of said conduits, a fixed trough or hopper adjacent to the outlet of said conduits, and adapted to receive the material from said conduits, means to regulate the discharge from said conduits, and means to rotate said vessel.

8. In a centrifugal separator, a plurality of conically spirally formed conduits, one of the walls of each being perforated, each conduit starting at the same horizontal plane and terminating at the same horizontal plane with the other, said conduits being secured to each other so as to form a continuous outer wall, the whole forming a vessel, a surrounding imperforate vessel, a plate at one end of said conduits, a ring at the other end of said con-

duits, said ring being provided with raised outlets equal in number to the conduits and in line with the discharge end of said conduits, and provided with adjustable gates, and means to rotate said vessel.

9. In a centrifugal separator, a plurality of conically spirally formed conduits, one of the walls of each being perforated, each conduit starting at the same horizontal plane and terminating at the same horizontal plane with the other, said conduits being secured to each other so as to form a continuous outer wall, the whole forming a vessel, a surrounding imperforate vessel, a plate at one end of said conduits a ring at the other end of said conduits, said ring being provided with raised outlets equal in number to the conduits and in line with the discharge end of said conduits, and provided with adjustable gates, a fixed trough or hopper adjacent to the outlet of said conduits, and adapted to receive the material from said conduits, and means to rotate said vessel.

10. In a centrifugal separator, a plurality of conically spirally formed conduits, one of the walls of each being perforated, each conduit starting at the same horizontal plane and terminating at the same horizontal plane with the other, said conduits being secured to each other so as to form a continuous outer wall, the whole forming a vessel, a surrounding imperforate vessel, a plate at one end of said conduits, a ring at the other end of said conduits, said ring being provided with raised outlets equal in number to the conduits and in line with the discharge end of said conduits and provided with adjustable gates, and means to rotate said vessel.

11. In a centrifugal separator, a plurality of conically spirally formed conduits, each conduit starting at the same horizontal plane and terminating at the same horizontal plane with the other, said conduits being secured to each other so as to form a continuous outer wall, the whole forming a vessel, a surrounding imperforate vessel, a plate at one end of said conduits, a ring at the other end of said conduits, said ring being provided with raised outlets equal in number to the conduits and in line with the discharge end of said conduits, and provided with adjustable gates, and means to rotate said vessel substantially as specified.

12. In a centrifugal separator, a conically spirally formed conduit, one of the walls of which is perforated, a plate at one end of said conduit, and a ring at the other end of said conduit, said ring being provided with a raised outlet in line with the discharge end of said conduit and provided with adjustable gates, means to rotate said conduit, a fixed trough or hopper adjacent to the outlet of said conduit and adapted to receive the product from said conduit.

13. In a centrifugal separator, a conically spirally formed conduit, one of the walls of which is perforated, a plate at one end of said conduit, and a ring at the other end of said conduit, said ring being provided with a raised outlet in line with the discharge end of said conduit and provided with adjustable gates, and means to rotate said conduit.

14. In a centrifugal separator, a conically spirally formed conduit, a plate at one end of said conduit, and a ring at the other end of said conduit, said ring being provided with a raised outlet in line with the discharge end of said conduit and provided with adjustable gates, means to rotate said conduit substantially as specified.

15. In a centrifugal separator, a rotatable vessel, provided with a conically spirally formed conduit, one of the walls of which is perforated, a part of the walls of said conduit being removable in sections from the remainder of the conduit for admission into the interior of the conduit at different parts.

16. In a centrifugal separator, a rotatable vessel provided with a conically spirally formed conduit, a part of the walls of said conduit being removable in sections from the remainder of the conduit for admission into the interior of the conduit at different parts substantially as specified.

17. In a centrifugal separator, a rotatable vessel having a series of perforated walls connected one to another by plates, said perforated walls and plates forming a series of conduits, said conduits extending outwardly toward the periphery and upwardly in the form of a spiral.

18. In a centrifugal separator, a rotatable vessel having a series of walls connected one to another by plates, said walls and plates forming a series of conduits, said conduits extending outwardly toward the periphery, and upwardly in the form of a spiral substantially as specified.

19. In a centrifugal separator, a rotatable vessel having a series of perforated walls connected one to another by plates, said perforated walls and plates forming a series of conduits, covers for said conduits, said conduits and covers extending outwardly toward the periphery and upwardly in the form of a spiral.

20. In a centrifugal separator, a rotatable vessel having a series of walls connected one to another by plates, said walls and plates forming a series of conduits, covers for said conduits, said conduits and covers extending outwardly toward the periphery and upwardly in the form of a spiral substantially as specified.

21. In a centrifugal separator, a rotatable vessel having a series of perforated walls connected one to another by plates, said perforated walls and plates forming a series of conduits, covers for said conduits formed in two or more sections, said conduits and covers extending upwardly and outwardly in a spiral form.

22. In a centrifugal separator, a rotatable vessel having a series of walls connected one

to another by plates, said walls and plates forming a series of conduits, covers for said conduits formed in two or more sections, said conduits and covers extending upwardly and outwardly in a spiral form substantially as specified.

23. In a centrifugal separator, a rotatable vessel having a series of perforated walls connected one to another by plates, said perforated walls and plates forming a series of spirally conically formed conduits, the material being received at one end and discharged at the other end of said conduits, and means to regulate the quantity of discharge from said conduits.

24. In a centrifugal separator, a rotatable vessel having a series of walls connected one to another by plates, said walls and plates forming a series of spirally conically formed conduits, the material being received at one end and discharged at the other end of said conduits, and means to regulate the quantity of discharge from said conduits substantially as specified.

25. In a centrifugal separator, a rotatable vessel having a series of perforated walls connected one to another by plates, said perforated walls and plates forming a series of conduits, covers for said conduits, said conduits and covers extending in the form of a conical spiral, the material being received at one end and discharged at the other end of said conduits, and means to regulate the quantity of discharge from said conduits.

26. In a centrifugal separator, a rotatable vessel having a series of walls connected one to another by plates, said walls and plates forming a series of conduits, covers for said conduits, said conduits and covers extending in the form of a conical spiral, the material being received at one end and discharged at the other end of said conduits, and means to regulate the quantity of discharge from said conduits substantially as specified.

27. In a centrifugal separator, a rotatable vessel having a series of perforated walls connected one to another by plates, said perforated walls and plates forming a series of conduits, covers for said conduits formed in two or more sections, said conduits and covers extending in the form of a conical spiral, the material being received at one end and discharged at the other end of said conduits, and means to regulate the quantity of discharge from said conduits.

28. In a centrifugal separator, a rotatable vessel having a series of walls connected one to another by plates, said walls and plates forming a series of conduits, covers for said conduits formed in two or more sections, said conduits and covers extending in the form of a conical spiral, the material being received at one end and discharged at the other end of said conduits, and means to regulate the quantity of discharge from said conduits substantially as specified.

29. In a centrifugal separator, a rotatable unobstructed conduit having a receiving end and a discharging end, and having a pitch extending outwardly from the receiving to the discharge end, and means to regulate the quantity of discharge, said conduit having an inner and outer wall, one of said walls being perforated.

30. In a centrifugal separator, a rotatable unobstructed conduit having a receiving end and a discharging end, and having a pitch extending outwardly from the receiving to the discharge end, said conduit having an inner and outer wall, and means to regulate the quantity of discharge substantially as specified.

31. In a centrifugal separator, a rotatable unobstructed conduit, having a receiving end and a discharging end, and having a pitch extending outwardly from the receiving to the discharge end, said conduit having an inner and outer wall, and means to regulate the quantity of discharge, a fixed trough or hopper adjacent to the outlet of said conduit substantially as specified.

32. In a centrifugal separator, a plurality of rotatable conduits each having a receiving end and a discharging end, and having a pitch extending outwardly from the receiving to the discharge end, and each having an inner and outer wall, one of said walls being perforated, and means to regulate the quantity of discharge of each conduit independent of the other.

33. In a centrifugal separator, a plurality of rotatable conduits each having a receiving end and a discharging end, and having a pitch extending outwardly from the receiving to the discharge end and each having an inner and outer wall, one of said walls being perforated, a plate at one end of said conduits, a ring at the other end, said ring being provided with raised outlets equal in number to the conduits and in line with the discharge end of said conduits, and provided with adjustable gates.

34. In a centrifugal separator, a rotatable conduit, having a receiving end and a discharging end, and having a pitch extending outwardly from the receiving to the discharge end, said conduit having an inner and outer wall, one of said walls being perforated, a plate at one end of said conduit, and a ring at the other end of said conduit, said ring being provided with a raised outlet in line with the discharge end of said conduit, and provided with adjustable gates, and means to rotate said conduit.

35. In a centrifugal separator, a rotatable unobstructed conduit having a receiving and a discharge end, and means to regulate the quantity of discharge substantially as specified.

36. In a centrifugal separator, a plurality of rotatable conduits, each having a receiving end and a discharging end, and having a pitch extending outwardly from the receiving to the discharge end, a plate at one end of said conduits, a ring at the other end, said ring being

provided with raised outlets equal in number to the conduits and in line with the discharge end of said conduits, and provided with adjustable gates.

37. In a centrifugal separator, a rotatable conduit having a receiving end and a discharging end, and having a pitch extending outwardly from the receiving to the discharge end, one of said walls being perforated, a plate at one end of said conduit, and a ring at the other end of said conduit, said ring being provided with a raised outlet in line with the discharge end of said conduit, and provided with adjustable gates, and means to rotate said conduit.

38. In a centrifugal separator, a plurality of rotatable conduits each having a receiving end and a discharging end, and having a pitch extending outwardly from the receiving to the discharge end, and each having an inner and outer wall, and means to regulate the quantity of discharge of each conduit independent of the other.

In testimony of which invention I have hereunto set my hand.

SOREN C. ROCKMAN.

Witnesses:
FRANK S. BUSSER,
PHILIP BOUTELJE.