No. 808,092. PATENTED DEC. 26, 1905.

C. M. KETCHAM.

CENTRIFUGAL LIQUID SEPARATOR.

APPLICATION FILED JAN. 24, 1905.

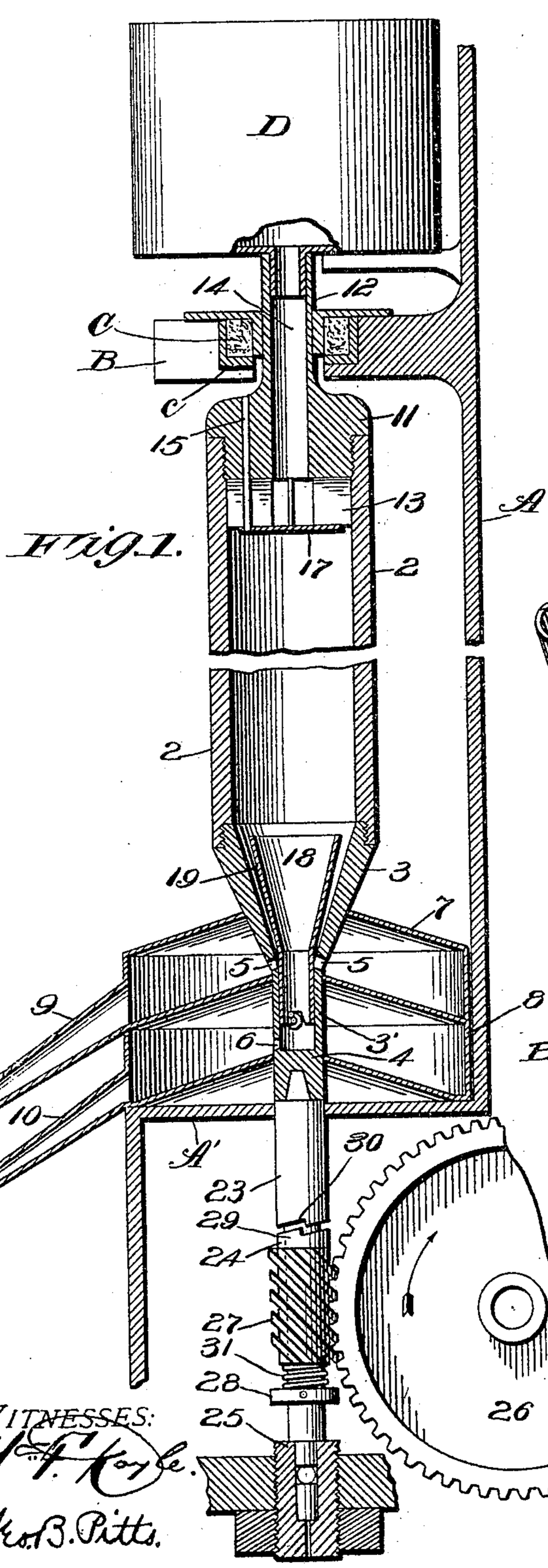

Fig. 1.

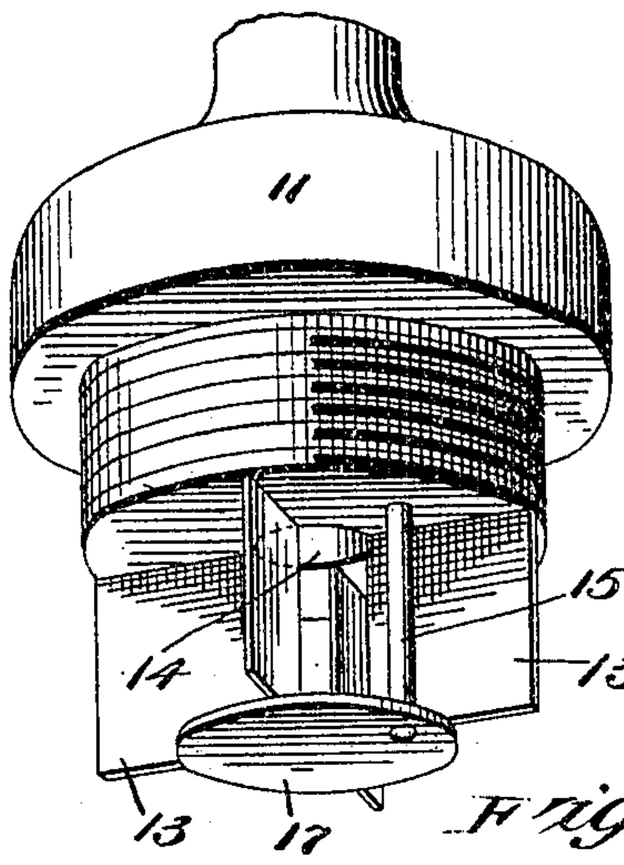

Fig. 2.

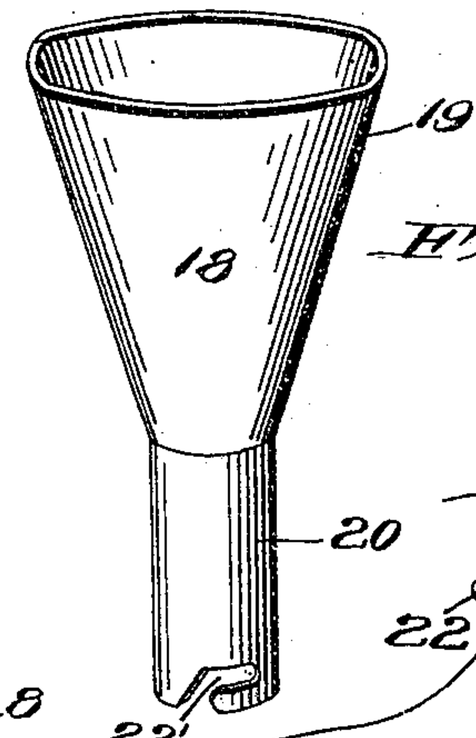

Fig. 3.

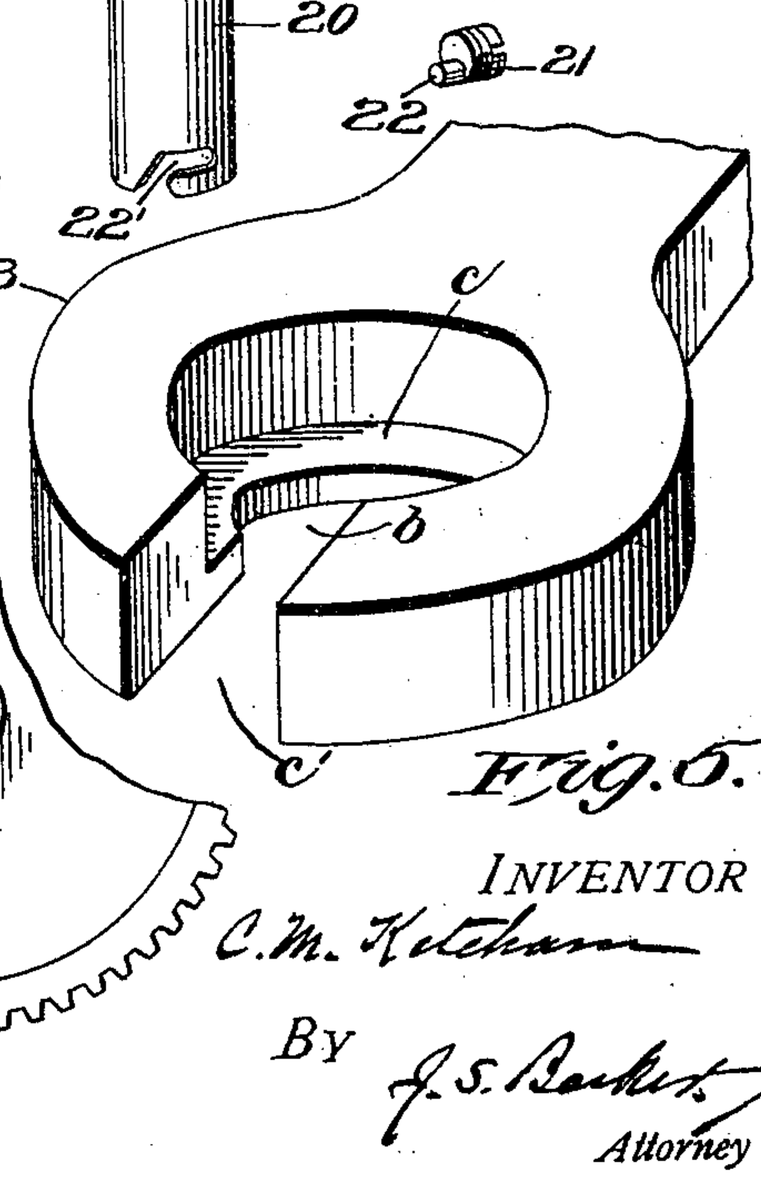

Fig. 4.

Fig. 5.

WITNESSES:

W. F. Coyle.

Geo. B. Pitts.

INVENTOR

C. M. Ketcham

BY J. S. Beckett

Attorney

UNITED STATES PATENT OFFICE.

CASSIUS M. KETCHAM, OF CARTHAGE, MISSOURI.

CENTRIFUGAL LIQUID-SEPARATOR.

No. 808,092. Specification of Letters Patent. Patented Dec. 26, 1905.

Application filed January 24, 1905. Serial No. 242,577.

To all whom it may concern:

Be it known that I, CASSIUS M. KETCHAM, a citizen of the United States, residing at Carthage, in the county of Jasper and State of Missouri, have invented certain new and useful Improvements in and Relating to Centrifugal Liquid-Separators, of which the following is a specification.

My invention relates to centrifugal machines, and has for its object to produce a machine of this type arranged and adapted for use as a cream-separator and that is simple in construction and the parts of which are separable and detachable, whereby they may be easily cleaned.

In the accompanying drawings, Figure 1 is an elevation, partly in section, of a machine embodying my invention. Fig. 2 is a perspective view of the separable head or closure at the feed end of the bowl or centrifugal separating-chamber. Fig. 3 is a perspective view of the skimming device. Fig. 4 is a detail perspective view of the adjusting device for the skimmer. Fig. 5 is an enlarged perspective view of the bracket or arm in which the machine is supported.

In the drawings, A represents an upright frame or support provided with a lateral extension A′, within which are mounted the lower bearings and the driving mechanism for the centrifugal machine.

At B is indicated an arm or bracket secured to the support A and in which is provided a bearing for the upper portion of the centrifugal machine, as indicated at C. The bracket is formed with a rabbeted opening *c* for the bearing C and is cut away or slotted, as indicated at *c*′, to permit the hollow shaft or axial portion 12 of the centrifugal apparatus to be passed into and out of the opening *b* laterally. It will of course be understood that the bearing C will have to be moved longitudinally along the shaft and out of line with the bracket before these lateral motions can take place.

The bowl or centrifugal separating-receptacle of my machine consists of a relatively long internally-unobstructed cylinder of small diameter provided at its lower end with a separable bottom or base 3 of an inverted-truncated-cone shape united to the bowl by screw-threads. To the truncated lower end of the base is secured a tubular part 3′, extending downward in the line of axial rotation of the bowl. This part is preferably integral with the base and is formed with the closed end 4, which is preferably shaped for connection with the driving-shaft. 5 5 indicate apertures extending through the cone-shaped base, preferably near the lower end thereof, and 6 is an aperture through the wall of the tubular part 3′ of the base, preferably opposite the floor of the closed end 4 thereof. Through these apertures is discharged the material being operated upon, the lighter grade—cream, when milk is the substance being treated—passing through the aperture 6, and the heavier grades, the skimmed milk, through the apertures 5.

Mounted on the support A′ are two collecting pans or receptacles 7 8, one above the other, and preferably surrounding the base 3 and tube 3′ and arranged to receive and collect the liquid which flows through the apertures 5 and 6, respectively, and deliver it to the discharge-pipes 9 10, through which it is carried off.

The upper end of the bowl is provided with a separable head or closure 11, united to the tubular portion of the bowl 2 by screw-threads and arranged to close the upper end thereof. I preferably form this head or closure with a tubular extension 12, that is arranged to form an inlet through which the milk is fed to the apparatus and also to serve as the shaft or axle of rotation at the feed end of the apparatus, this tubular extension being mounted in the bearing C.

A plate 17, transversely arranged relative to the axis of rotation of the bowl, is disposed opposite the opening 14 through the head 11 and a short distance therefrom. This plate serves as a spreader for the liquid entering the separating-chamber and prevents the newly-added quantity of liquid from commingling with that already in the separating-chamber before it has itself been subjected to the centrifugal force incident to the rapid rotation. A series of blades 13 is arranged between the plate 17 and the head or closure 11, four of them being shown, though a greater or less number might be employed. They serve both as the means for supporting the plate and as rotating blades to impart a rotation to the liquid immediately upon its entering the separating-chamber. The blades extend radially from the outer edge or wall of the feed-opening 14 close to the inner wall of the bowl 2. The plate is sufficiently smaller in diameter than the cross-area of the bowl 2 to leave space between it and the wall of the tube or bowl for the desired flow of liquid between them.

15 indicates a vent-tube for carrying off any

air that may enter the separating-chamber. It extends downward through the head 11 and through the plate 17.

Above the tubular bearing portion 12 of the head or closure I arrange a liquid-reservoir D, from which the liquid may be delivered in suitable quantities to the bowl 2 through the inlet 14.

In order to provide means whereby the skimmed milk and the cream may be directed into their delivery-apertures 5 and 6, I arrange within the base 3 an adjustable skimming device 18, which is preferably of funnel shape and consists of the cone-shaped portion 19, preferably of a shape to fit the inner surface of the base 3, and a tubular portion 20, extending downwardly from the cone-shaped portion 19 and of a size to closely fit within the tube portion 3′ of the base. The axis of the funnel or cone-shaped part of the skimming device is shorter than the axis of the cone-shaped portion of the base 3 of the bowl, so that the diameter of the base of the cone portion of the funnel is less than the diameter of the base of the cone of base 3. From this it is obvious that if the skimmer be raised from its lowermost position in which the funnel portion fits close against the inner walls of the base 3 there will be formed an annular space between the upper edge of the skimmer and the adjacent wall of the bowl and that the size of this annular space will increase as the skimmer is raised, until its upper edge comes opposite to the base or upper edge of the cone-shaped lower portion of the bowl. The passage that leads from the bowl to the openings through which the watery constituents of the milk are delivered may thus be varied in size by adjusting the skimmer in the direction of the axis of rotation of the bowl, and as the size of the passage that leads to the opening or openings through which the cream is delivered is constant it follows that the relations of these two passages can be varied, and accordingly the proportions delivered, respectively, through the openings 5 and 6 may be varied.

I have provided means for effecting the adjustment of the skimming device. It consists, preferably, of a screw-threaded member 21, provided with an eccentrically-disposed projection 22, with which the skimmer is connected by a bayonet-joint 22′. It will be evident that by adjusting the screw the skimmer is accordingly raised or lowered and is by these means brought to its desired position.

The driving-shaft 23 for the bowl is mounted in the extension A′ of the frame and is connected by some sort of separable joint, as indicated at 24, with the lower end of the bowl. The opposite end of the shaft is mounted in a step or thrust bearing at 25, which may be of any usual or preferred construction. A train of gearing, of which only the last wheel 26 is illustrated, is of a type commonly employed in apparatus of the kind to which my invention belongs. The wheel 26 engages with a spiral gear 27, which is in the form of a sleeve loosely mounted upon the shaft 23 and free to move thereon to a limited extent, being prevented from dropping down too low by a collar 28, secured to the shaft. Its upper end is formed into a clutch member 29, that is adapted to engage with a clutch member 30, carried by the shaft 23. The driving-wheel 26 turns in the direction indicated by the arrow thereupon, and its tendency is both to rotate the spiral-gear sleeve 27 and to lift it so that it comes into clutching engagement with the shaft 23, thereby connecting the gearing with the bowl. If from any cause during the operation of the apparatus the driving-gearing should slow down, so that the tendency of the bowl is to run faster than the spiral gear 27, this is permitted by reason of the gear being loosely mounted on the shaft and held in engagement with the clutch-face of the latter by the action of the driving-wheel 26, for the gear-sleeve 27 will be forced backward and downward upon the shaft sufficiently far to allow the bowl to run ahead and the cam-surfaces of the clutch 30 to pass those of the clutch 29 until either the speed of the motor increases to or beyond that of the bowl or the latter is reduced to that of the motor.

The operation of my device may be described as follows: The liquid to be separated passes from the reservoir D through the inlet-passage 14 in the axial extension 12 and entering the bowl first strikes against the plate 17, where it is caught by the blades 13 and thrown outward against the inner circumference of the bowl 2 by the centrifugal motion imparted to the liquid through the movements of the blades. As the milk escapes into the unobstructed portion of the bowl, which is the part between the plate 17 and the skimmer, it has had imparted to it the motion of the bowl, which motion is maintained owing to the small size of the tubular part of the bowl and its high speed of rotation. As the milk gradually passes down the tube 2 toward the delivery end thereof there is ample opportunity for the separation of the oily portions from the watery constituents thereof, such separation being sufficiently accomplished by the time the liquid reaches the tapering base portion 3. The heavier watery portions of the milk being thrown outward by the centrifugal operation of the apparatus pass into the space between the funnel of the skimmer and the wall of the base and escape through the apertures 5, while the cream passes down through the funnel and the tube 20 and out at the aperture 6. As the relative size of the opening from the tube 2 into the space leading to the openings 5 by the adjustment of the skimmer may be varied, so the relative amounts drawn from the openings 5 and 6 may be changed.

When it is desired to clean the apparatus, the reservoir D is removed, the bearing C is raised out of its seat, and the bowl removed, this being permitted by the construction of the bracket B and the separable joint at 24. The ends of the bowl, the tapering base 3, and the head or closure 11 are then removed, which leaves the tube 2 open-ended and entirely unobstructed. The skimmer is removable and the other parts of so simple construction and so easily accessible that they may be cleaned without difficulty and thoroughly.

It will be observed that the apertures through which the different grades into which the milk or other liquid is separated are delivered are not contracted by the adjustment of the skimmer for the purpose of regulating the relative flow through the apertures.

The lifting tendency of the wheel 26 upon the spiral gear 27 will usually be sufficient to operate the clutch; but I may, if found desirable, interpose a weak spring 31 between the collar 28 and the end of the spiral sleeve 27.

What I claim is—

1. In a centrifugal liquid-separator, a bowl cone-shaped at the discharge end, a tube extending beyond the cone-shaped end in line with the axis of rotation of the bowl, there being discharge-apertures leading from the cone-shaped end portion for the heavier grades of the liquid and an aperture leading from the axial tubular part for the discharge of the lighter grades of the liquid, a tubular separating device concentric with the cone-shaped end of the bowl and connected at one end with the discharge-tube and having its outer end open and extending toward the interior of the bowl, and means for rotating the bowl at high speed, substantially as set forth.

2. In a centrifugal liquid-separator, a bowl provided with an inverted-cone-shaped base through which is formed a discharge-aperture, and a tube extending therefrom in line with the axis of rotation of the bowl and provided with a discharge-aperture leading therefrom, and means for rotating the bowl at a high speed, substantially as set forth.

3. In a centrifugal liquid-separator, a bowl comprising an open-ended tube, a separable closure or head at the feed end thereof, a separable end of cone shape at the discharge end, a tube extending beyond the cone-shaped end in line with the axis of rotation of the bowl, there being discharge-apertures leading from the cone-shaped end portion for the heavier grades of the liquid and an aperture leading from the axial tubular part for the discharge of the lighter grades of the liquid, a tubular separating device concentric with the cone-shaped end of the bowl and connected at one end with the discharge-tube and having its other end open and extending toward the interior of the bowl, and means for rotating the bowl at high speed, substantially as set forth.

4. In a centrifugal separator, the combination of a rotating bowl having a feed-opening at one end, a spreader-plate disposed transversely across and at a short distance from the feed-opening, and radially-disposed blades arranged between the spreader-plate and the feed-opening, substantially as set forth.

5. In a centrifugal liquid-separator, the combination of a bowl comprising a relatively long tube, the discharge devices at one end of the tube, the feed-opening being at the other end of the tube, a spreader-plate arranged at a short distance from and in a plane transversely across the feed-opening, and radially-disposed blades for causing the liquid to partake of the rotary movement of the bowl arranged between the spreader-plate and the feed end of the bowl, the tubular part of the bowl between the spreader-plate and the discharge-orifices being interiorly free and unobstructed, substantially as set forth.

6. In a centrifugal liquid-separator, the combination of a rotating bowl having a feed-opening at one end, a spreader-plate disposed transversely across and at a short distance from the feed-opening and arranged to prevent the freshly-added liquid from commingling with the partially-separated liquid at the axial center of the bowl, and a vent-tube leading from below the spreader-plate, substantially as set forth.

7. In a centrifugal liquid-separator, the combination of a rotating bowl having separate discharge-orifices through which the material of different grades is discharged, means for separating the lower part of the bowl into two concentric portions, the outer portion being arranged to receive the heavier grades of the liquid and the inner portion the lighter grades, these separate portions communicating respectively with the separate discharge-orifices, and means for varying the relative sizes of these separated portions of the bowl in order to regulate the relative flow through the discharge-orifices, substantially as set forth.

8. In a centrifugal liquid-separator, the combination of a rotating bowl having its discharge end of tapering form and being provided with separate discharge-openings for the different grades into which the liquid is separated, an open-ended tubular wall concentric with the tapering discharge end of the bowl, and means for adjusting the said tubular wall in the direction of the axis of rotation of the bowl, substantially as set forth.

9. In a centrifugal separator, the combination of a rotating bowl having a tapering discharge end and separate discharge-orifices, a tapering open-ended tubular wall concentric with the inner wall of the tapering base of the bowl and interiorly connected with one of the discharge-openings while the other discharge-opening is connected with the bowl on the outside of the said separating-wall, and adjusting means for moving the funnel-shaped

wall in the direction of the axis of rotation of the bowl, substantially as set forth.

10. In a centrifugal cream-separator, the combination of a rotating bowl having a separable tapering base 3 terminating in a hollow tubular portion 3′ of reduced size, the part 3 being provided with a discharge-opening 5 and the part 3′ with a discharge-opening 6, a skimming device consisting of a partition-wall 19 of funnel shape, open at its upper end, and at its lower end formed into a tubular portion and arranged to fit closely within the tubular part 3′ of the end of the bowl, and a screw-adjusting device 21 for the skimming device, substantially as set forth.

CASSIUS M. KETCHAM.

Witnesses:
B. H. ESTERLY,
INA JOURNEY.