G. M. ANDERSON.

CENTRIFUGAL CREAM SEPARATOR.

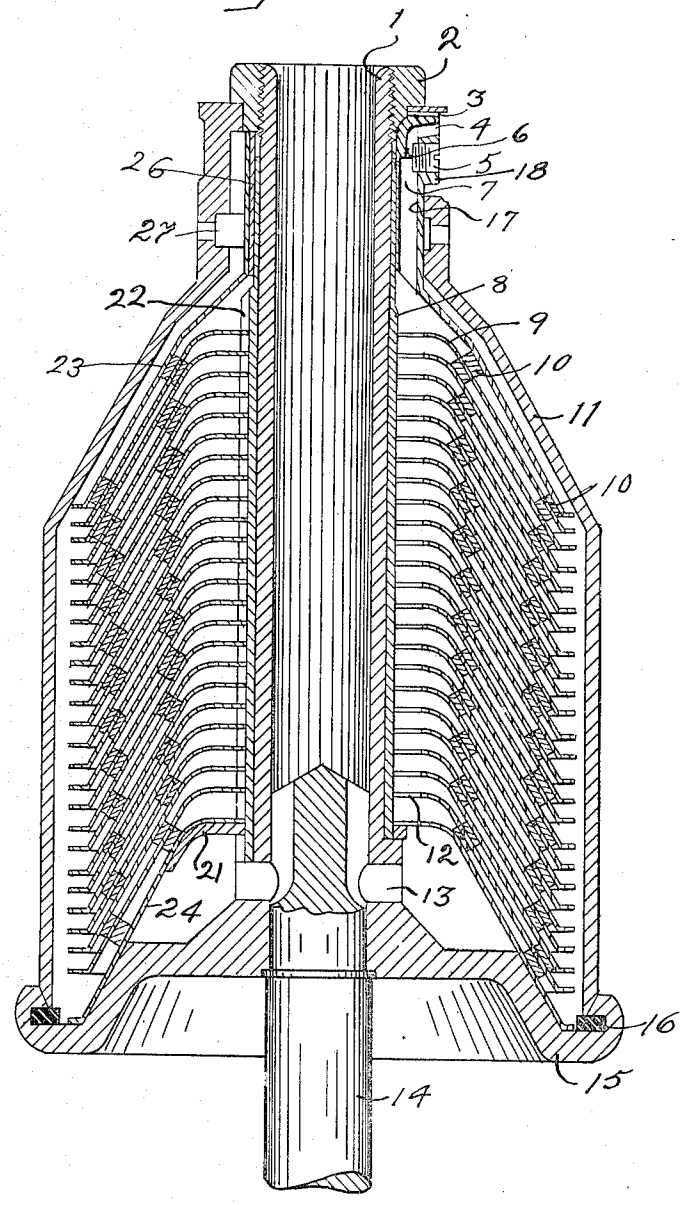
APPLICATION FILED JUNE 16, 1909.

960,768.

Patented June 7, 1910.

3 SHEETS—SHEET 1

Fig. 1.



WITNESSES

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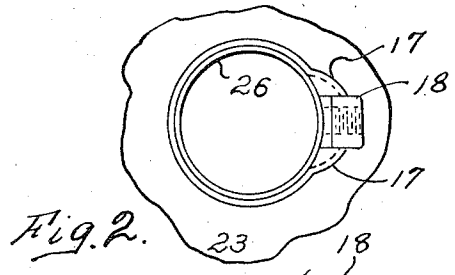

Fig. 2.

Fig. 9.

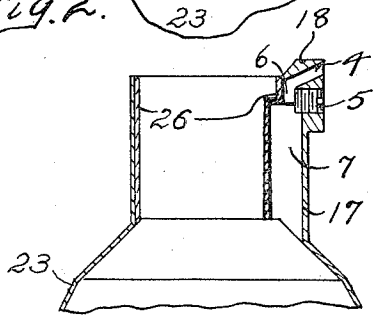

Fig. 3.

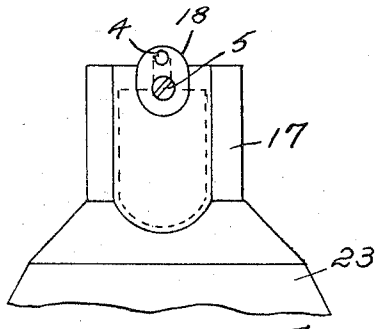

Fig. 4.

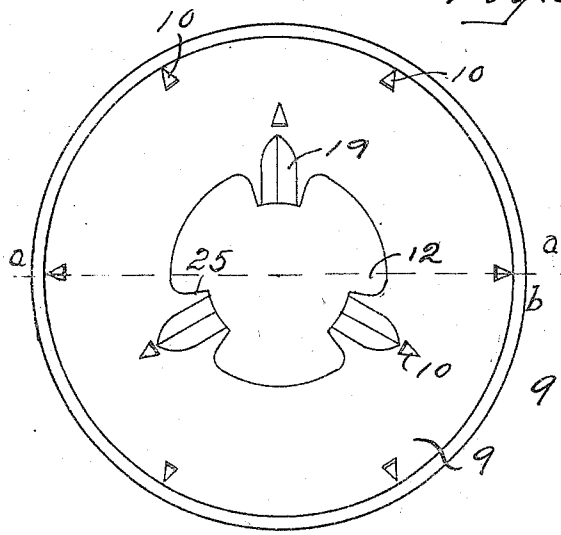

Fig. 5.

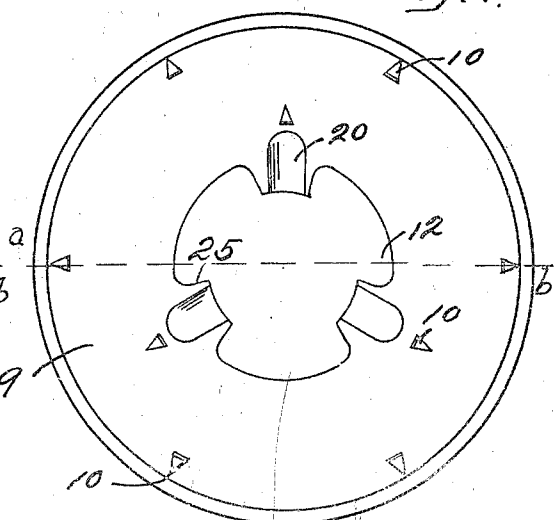

Fig. 7.

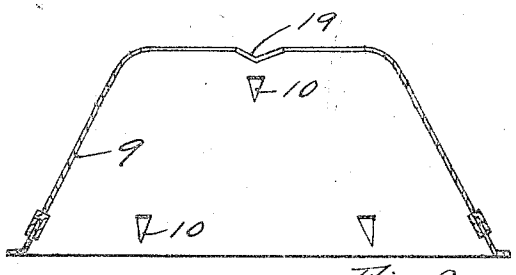

Fig. 6.

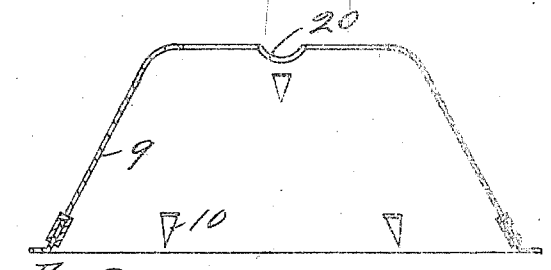

Fig. 8.

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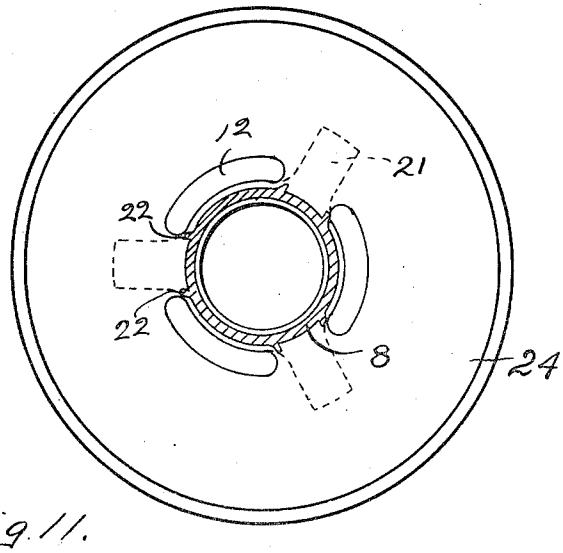


Fig. 11.

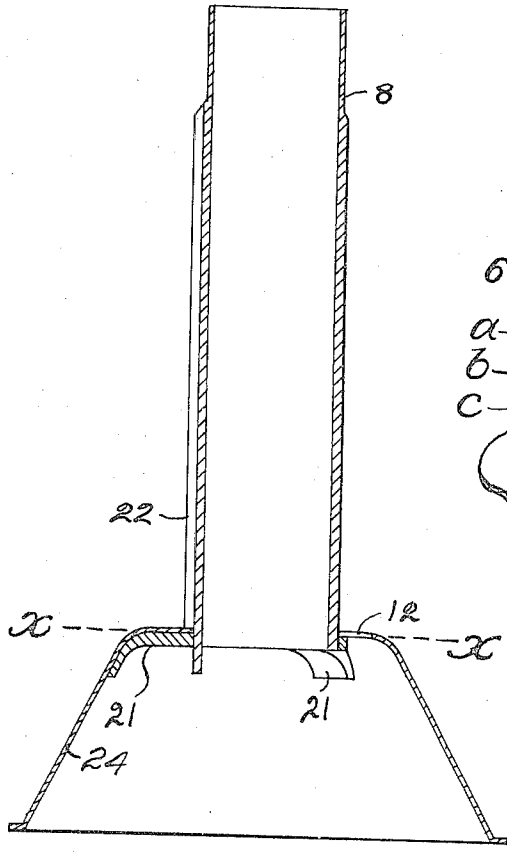
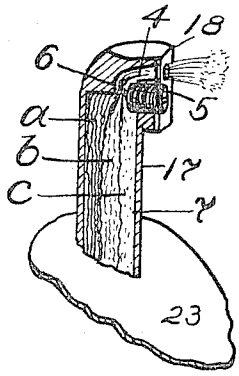


Fig. 10.

Fig. 12.



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CENTRIFUGAL CREAM-SEPARATOR.

960,768. Specification of Letters Patent. Patented June 7, 1910.

Application filed June 16, 1909. Serial No. 502,505.

To all whom it may concern:

Be it known that I, GUSTAF M. ANDERSON, a citizen of the United States of America, and a resident of Waterloo, Blackhawk county, Iowa, have invented certain new and useful Improvements in Centrifugal Cream-Separators, of which the following is a specification.

My invention relates to improvements in centrifugal cream separators, and the objects of my improvements are these: first, to provide a liner made up of a pile of separated frusta whose inner edges have projections which extend toward and engage a concentric support; second, such frusta whose said inwardly-directed projections lead into and through the inner cream zone; third, such frusta whose inwardly-directed projections are angular in cross-section with the apices of their angles arranged to stem the cream zone current toward the cream-exit; fourth, such frusta whose inwardly-directed projections are curved or semi-cylindrical in cross-section, with the outer curve or semi-cylindric surface of each likewise arranged to stem the current of escaping separated cream; fifth, frustum supporting-means adapted to concentrically support such frusta, and designed appropriately to best conduct the current of escaping cream in the cream zone toward its exit with a minimum of interference due to adhesion of coagulating cream on its outer surface. These objects I have accomplished by the means which are hereinafter fully described and claimed, and which are illustrated by the accompanying drawings, in which:

Figure 1 is a central vertical axial section of the bowl of a centrifugal cream separator, containing also in central vertical section my improved liner and regulable non-clogging cream-exit. Fig. 2 is an upper plan view of the cream-exit head and a broken portion of the diaphragm on which it is mounted. Fig. 3 is a vertical central section of the structures shown in Fig. 2, taken through the axis of the communicating channels leading to the cream-exit. Fig. 4 is a side elevation of the structures shown in Fig. 2. Fig. 5 is an upper plan view of one of my improved liner frusta, showing the angularly-channeled inwardly-directed projections thereof. Fig. 6 is a central vertical axial section of the frustum shown in Fig. 5, taken on the line *a*—*a*. Fig. 7 is an upper plan view of one of my improved liner frusta, showing the inwardly-directed projections thereof provided with semi-cylindric radial delivery channels. Fig. 8 is a central vertical axial section of the frustum shown in Fig. 7, taken on the line *b*—*b*. Fig. 9 is an enlarged perspective view of one of my improved frustum spacing-clips. Fig. 10 is a central vertical section of the frustum supporting-means. Fig. 11 is a horizontal section of the structure shown in Fig. 10, taken on the line *x*—*x*. Fig. 12 is an enlarged detail diagrammatic view of the communicating cream-exit channels and their intercepting adjustable dam, parts being broken away and the radially-varying density of cream indicated therein.

The central principle or inventive idea comprehended in my several improvements to a centrifugal cream separator is the designing of the liner and cream-exit so as to free all passages leading to the cream-exit from impediments and adapt them variously for complete delivery regardless of the exigencies of temperature or the varying cream content of the full milk. In other words, it is an embodiment in practice of the modern requirements of a cream separator, which are a small bowl of supreme efficiency in skimming milk of different temperatures or which has a great variation in percentage of cream. It is necessary to prevent clogging due to coagulation of the cream at comparatively low temperatures, which causes a filling up of the bowl, and a cessation of separation.

The bowl of my improved centrifugal cream separator, is formed in two portions, the body 11 and a removable base 15, the spindle 14 being axially united to the latter. The contacting parts of the body 11 and the base 15 are provided at their line of junction with a rubber gasket 16 set in an annular groove in the base to prevent leakage. The upper end of the spindle 14 projects above the base 15 in the form of a boss which is fitted within the hollow lower end of a milk inlet-tube 1, but is grooved to afford channels which communicate with the radially-directed milk-deliveryin orifices 13. The tube 1 is integral with said base and concentric with the axis of the bowl. When said base and tube have been fitted within said bowl, a lock-nut 2 serves to secure the upper end of the tube in its seat in the contracted top of the bowl. A frustum-supporter 8, in the form of a hollow cylinder,

is removably fitted over the inlet-tube 1, and is provided on its exterior surface with a plurality of spaced apart low vertical ridges 22 for a purpose presently to be described. The lower end of the cylinder 8 is secured to and communicates with a concentric hollow frustum 24, whose upper edges are bent inwardly to approach the cylinder horizontally, while the horizontal portion is provided with a plurality of slots 12. A reinforcing three-armed body 21 is employed to unite and strengthen the junction of the cylinder 8 and the frustum 24. The lower part of the frustum 24 is supported on the base of the bowl, and is fitted closely but removably about a raised portion thereof.

The liner of the bowl is composed of a pile of separating plates each in the form of a hollow frustum 9, with their inner portions bent to extend horizontally inwardly toward the axis of the bowl. The inner edges of the frusta are formed with projections separated by spaces 12, the latter coincident with and lying vertically above the slots 12 in the frustum 24 so as to register therewith and thus afford uninterrupted channels for the passage therethrough of milk and cream. These projections 25 are preferably shaped in the form of radially directed troughs, and the latter may be made either V-shaped or semi-cylindric in cross-section as shown in Figs. 5 and 7 at 19 and 20 respectively. This conformation of the projections 25 not only strengthens them, but also serves them as conduits for the cream seeking the cream zone, and the said projections pass through the cream zone and contact with the exterior surface of the supporting cylinder 8. The inner ends of the projections 25 are received between pairs of low vertical parallel ridges 22 on the cylinder 8, said ridges keeping the frusta 9 in the same registering vertical alinement. The apices or cylindric convexities of the troughs 19 or 20 as the case may be are directed downward or so as to stem the ascending current of separated cream in the cream zone next the cylinder 8, in order that their sloping sides may thus present least resistance to the passage of the fluid. If inverted, the troughs would form cups which would retain quantities of the cream as well as offering considerable resistance to the movement of the current past them.

The forming of the ridges 22 as shown, low and of small area, does away with any necessity for large radially-extended spacing wings which frictionally engage and become clotted with the heavier cream in the innermost part of the cream zone under certain conditions of lowered temperature. The frusta are thus properly supported and kept in vertical registration with a minimum of interference with the cream current in its passage toward the cream exit. The prolongations 25 as thus used also carry the separating cream inwardly to a limit coincident in distance from the bowl's axis with the extreme inner limit of the cream exit, which was not possible in that form of construction where the large radial wings were used, in which latter case the inner cream zone limit was farther from the axis of the bowl. In other words, in the old form of construction, the central tubular shaft carried its wings well into the cream wall or zone. The cream moving toward the center engaged the outer edge and the sides of these wings and in the case of cold or thick cream was inclined to coagulate or clot thereon. In my improved device, the cream zone or stratum is permitted to be continued well toward the axis thereof, and since the cream exit is variable in distance from the axis, the cream zone is continued to that location where the cream exit has its innermost limit, the regulation of the dilution of the cream skimmed may be fixed by the adjustable exit to the extreme limits. I am aware that projections or abutments were secured to the inner portions of separating disks or frusta heretofore so as to engage the supporting axial tube with their inner edges, but such projections were intended to convey the full milk outwardly as feeding devices to said disks or frusta. They also presented a serious interference with the inward and upward flow or progress of the cream current. The projections which I use are for an entirely different purpose and fulfil an entirely different function, which is to convey the separating cream to the innermost limit of the cream zone and in doing so effect the least interference with the movement thereof to its outlet.

Each frustum 9 is provided with a plurality of slots adapted to receive the spacing devices 10. The spacing device 10 is formed of a small diamond-shaped piece of metal transversely doubled upon itself to form two parallel spaced apart angular members, and so inserted in a slot of the frustum 9 as to leave the apices of the members directed toward the outer edge of the frustum. The members of the device are then pressed or clenched down as shown upon the frustum. This arrangement of the spacing means between the frusta 9 affords the least resistance to the inward flow of separating cream, and thus helps in preventing clogging of the liner with cream clots when the cream or bowl are cold or the cream is very thick.

The numeral 23 designates a hollow inner cone within and spaced away from the conical head of the bowl 11, and having a hollow upwardly directed cylindrical extension having a thimble 26 fitted therein. The skimmed milk passes between the cone 23 and the bowl-head into the milk-exit 27. The cream

passes upward inside of the cone 23 and into a tubular channel which is formed of two parts, the entrance part 7 in the tube 17 being of larger area with its inner wall extending nearer to the axis of the bowl than the inner wall of the communicating part 6 in the tube 18. The upper part of the channel 6 is bent or curved outwardly at 4 forming a cream-exit. A screw 5 is fitted within an interiorly threaded seat at the junction of the channels 6 and 7, so that when it is turned it moves inwardly to partially intercept both channels at their line of communication, the diameter of the screw being slightly larger than the width of the said communication between the two channels.

Referring particularly to Fig. 12, which is a diagrammatical representation of the probable action of my improved variable cream-exit or outlet, it will be seen that it depicts the cream-screw or adjustable dam 5 as partly moved inward toward the axis of the bowl within the outlet at the line of junction of the channels 6 and 7. In this position it so restricts the outer portion of the outlet as to prevent the issue of the most diluted or outer stratum of the cream. For purposes of convenience, I have represented the cream in the channel 7 as divided into three strata, *a*, *b* and *c*, of specific gravities increasing from *a* to *c*. It is, of course, obvious that there is no such dividing line between strata since the cream zone varies imperceptibly in density radially from the bowl's axis under the influence of centrifugal force, but as an illustration the defining of strata is convenient. The function, therefore, of the screw 5 is to more or less dam the issuing cream to correspondingly vary its amount of dilution, since if the screw is not intruded into the current of the stratum *c*, the skimmed cream will have a maximum of dilution with the milk yet unseparated therefrom in the outer zone of the cream wall corresponding with this stratum. If moved radially inward to intercept the stratum *c*, the skimmed cream will be of less specific gravity including the strata *b* and *c*, but if the dam be brought inwardly still more, only the cream of lightest specific gravity in the stratum *a* will be skimmed. Now, the object of my improvement in making the cream outlet communicating channels 6 and 7 of different areas with the inner wall of the channel 7 nearer the axis of the bowl, is this; to afford a greater clearance for the issuing cream to prevent clotting of the same therein when cold or especially thick and rich. Even in the event that when cold some of the richest cream might clot upon the inner walls of the passage 7, its area is sufficient to permit a free flow of the cream from the cream zone through the outlet to always be regulable by the screw or movable dam 5 to vary the dilution of said cream as desired. The location of the screw 5 at the junction or communication of the channels 6 and 7 affords a perfect control of the communication, the inner end of the screw being movable partly in the upper end of the channel 7 as well as partly in the lower end of the channel 6 of lesser area. The wider channel 7 also permits of the recession of the cream zone inward toward the bowl's axis farther than in some liners, thereby permitting a surer control of the issuing cream, by giving better clearance to the thickest cream. While the outer limit of the inner walls of both the channels 6 and 7 is the same, the widening of the channel 7 allows of a radially wider cream zone being skimmed, which gives the operator a wider choice of regulation of dilution of the cream in skimming.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is:

1. In a centrifugal cream separator bowl, a central hollow body therein, and a hollow frustum located concentrically therein, said frustum having projections from its inner edge adapted to engage said body, and each of said projections being formed into a trough with the cavity of the trough directed toward the cream-outlet of the bowl.

2. In a centrifugal cream separator bowl, a central hollow body therein, and a hollow frustum located concentrically therein, said frustum having projections from its inner edge adapted to engage said body, and each of said projections being formed into a V-shaped trough with the cavity of the trough directed toward the cream-outlet of the bowl and the apex of the trough adapted to stem the current of cream passing toward said cream-outlet.

3. In a centrifugal cream separator bowl, a central hollow body therein, and a hollow frustum located concentrically therein, said frustum having projections from its inner edge adapted to engage said body, and each of said projections being formed with a crimp extending into the cream zone whose closed side is adapted to stem the escaping cream in the cream zone adjacent to said central body.

4. In a centrifugal cream separator bowl, in combination, a central hollow body having vertical troughs in its outer surface, and a pile of separating plates disposed concentrically about said body and spaced apart, each of said separating plates having projections extending inwardly from its inner edge to engage said sleeve within the said troughs thereon, the inner edges of said plates between said projections receding outwardly to provide a series of alined channels through said liner next to the outer surface of said sleeve.

5. In a centrifugal cream separator bowl,

in combination, a central hollow body having vertical separated ridges on its outer periphery and an orificed flaring base resting on the bottom of the bowl concentrically therewith, a pile of hollow frusta supported by said body and its base, each frustum having projections from its inner edge removably engaging the said body between said vertical ridges, and each projection being constructed in the form of a trough directed toward the cream zone of the bowl and adapted to deliver cream toward the outer surface of said body, the vertices of said trough being directed to stem the current of cream in the cream zone of the bowl.

Signed at Waterloo, Iowa, this 29th day of May, 1909.

GUSTAF M. ANDERSON.

Witnesses:
G. O. MATTER,
O. D. YOUNG.