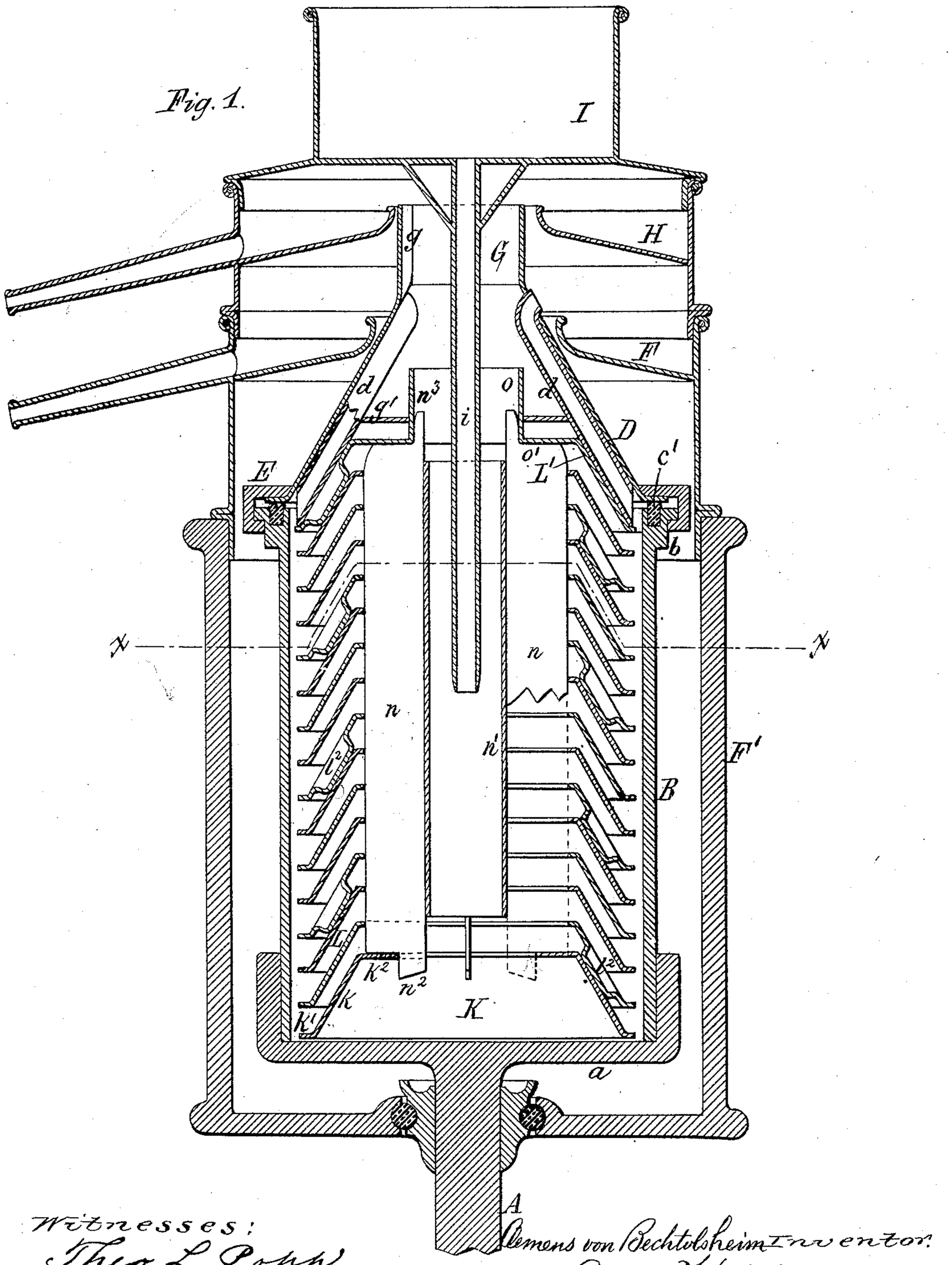
(No Model.) 3 Sheets—Sheet 1.

C. VON BECHTOLSHEIM.

CENTRIFUGAL SEPARATOR.

No. 432,719. Patented July 22, 1890.

Fig. 1.



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CENTRIFUGAL SEPARATOR.

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Fig. 2.

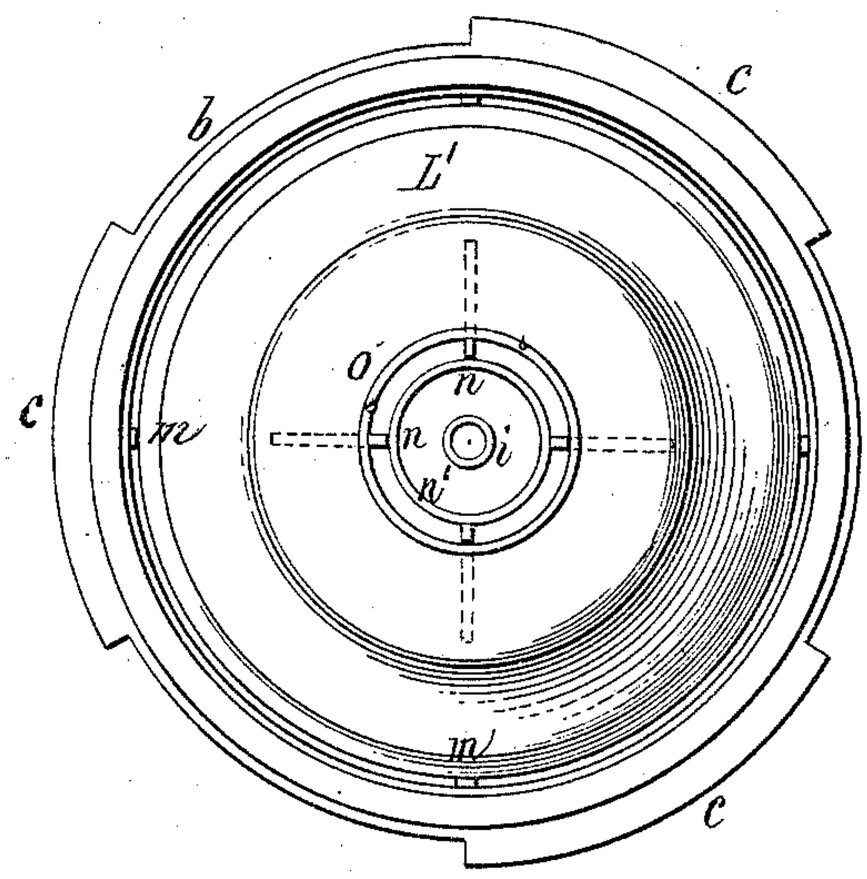


Fig. 3.

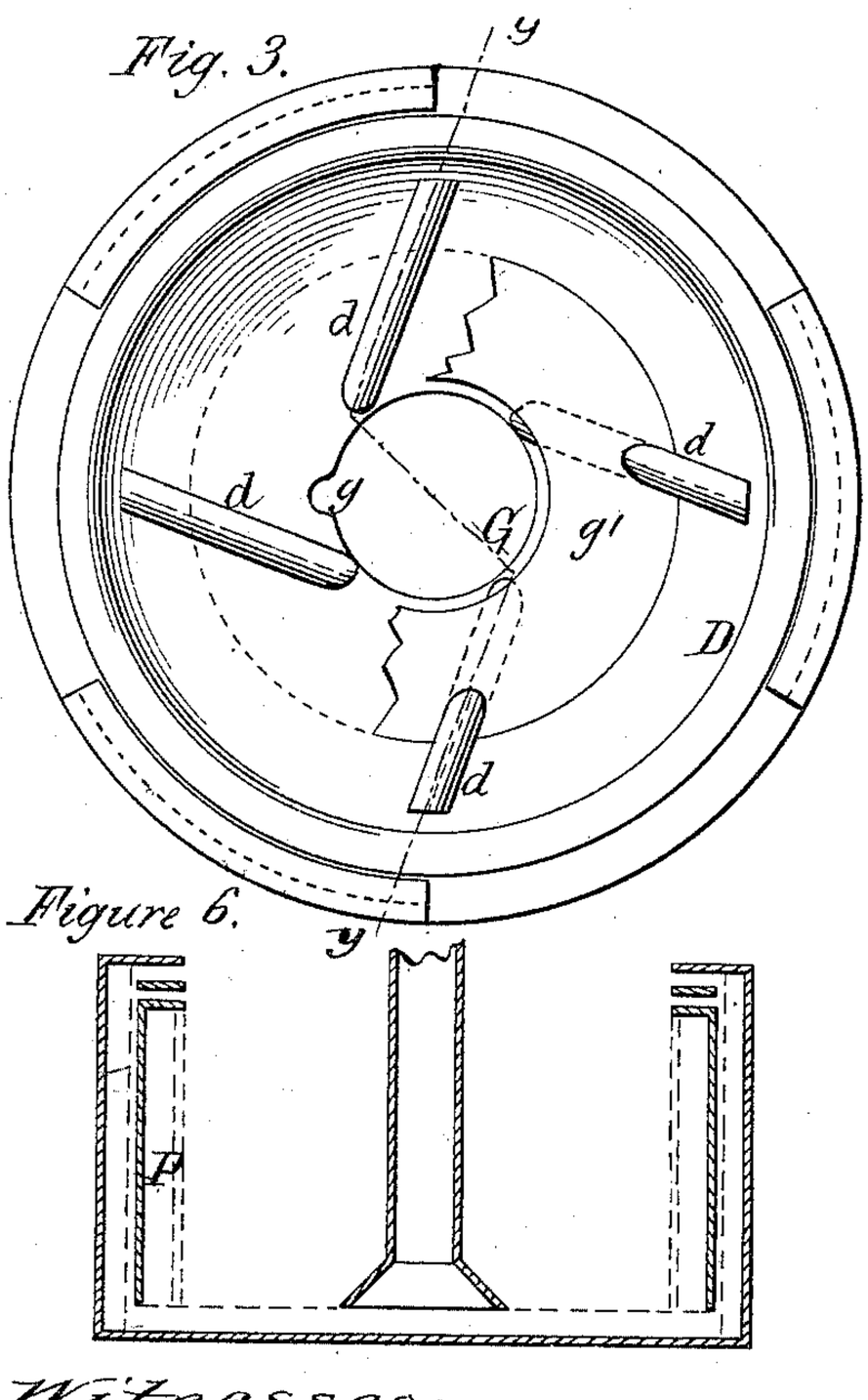


Figure 6.

Fig. 4.

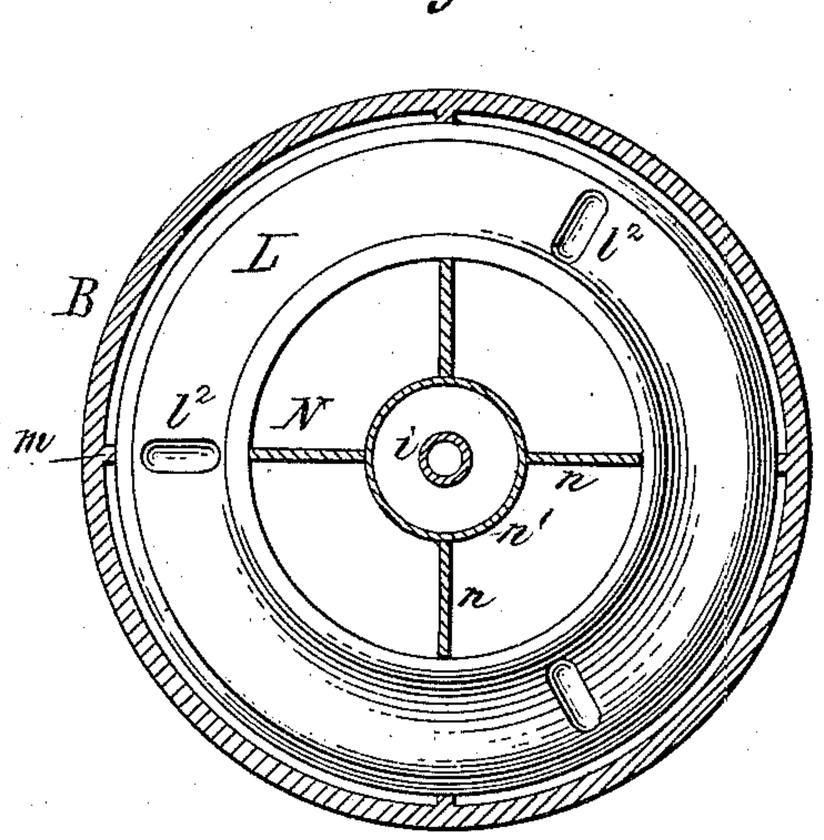
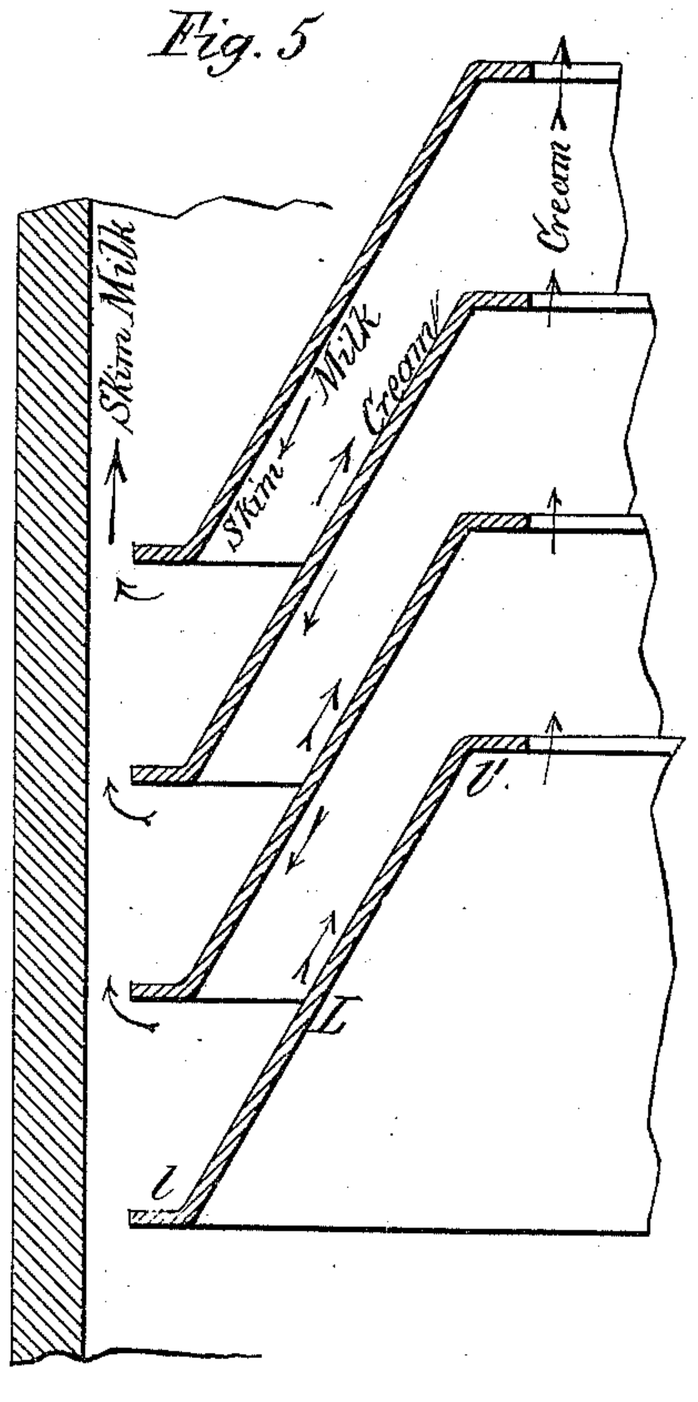


Fig. 5



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(No Model.) 3 Sheets—Sheet 3.

C. VON BECHTOLSHEIM.

CENTRIFUGAL SEPARATOR.

No. 432,719. Patented July 22, 1890.

Fig. 7.

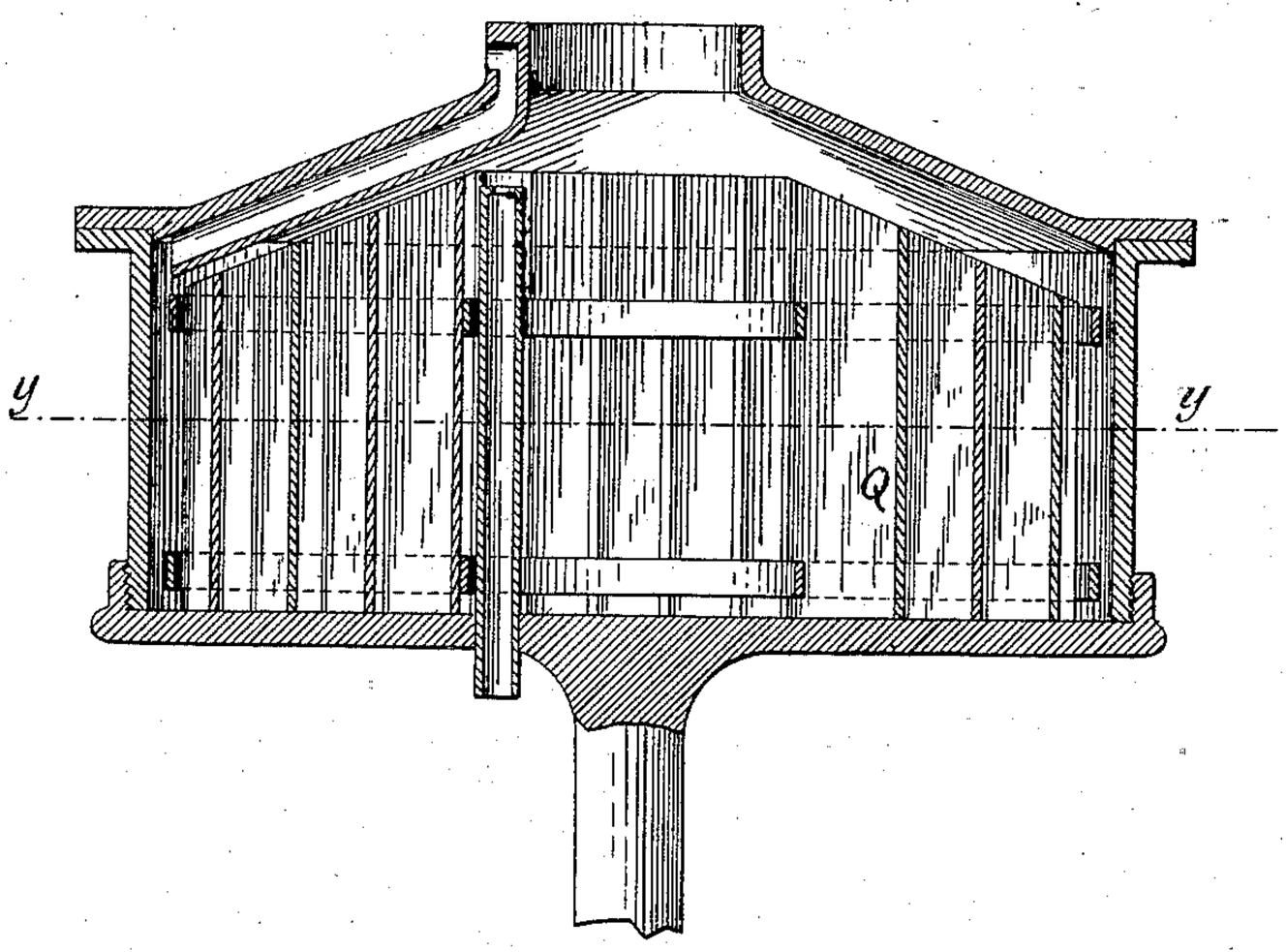
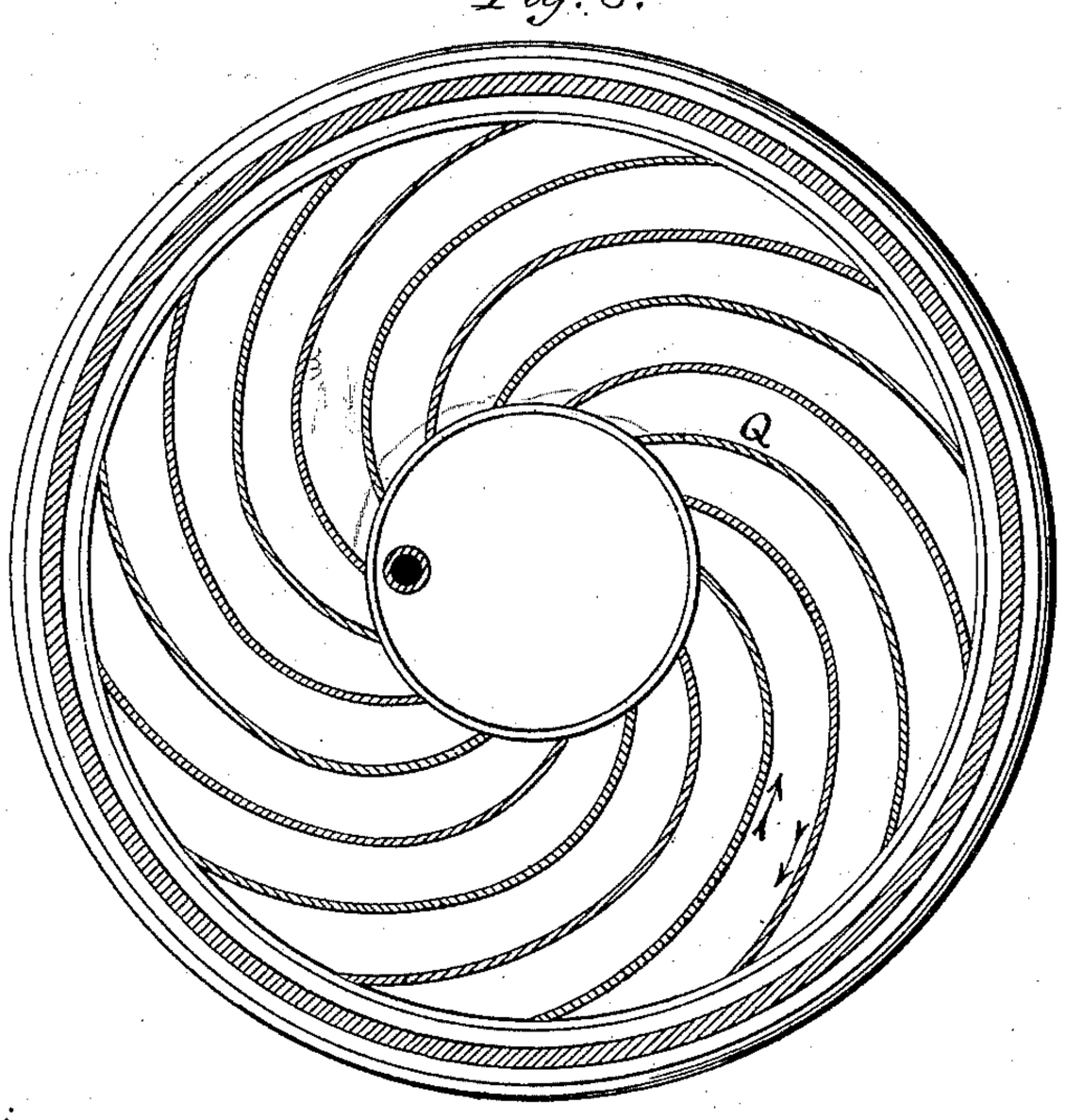


Fig. 8.



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UNITED STATES PATENT OFFICE.

CLEMENS VON BECHTOLSHEIM, OF STOCKHOLM, SWEDEN, ASSIGNOR TO THE AKTIEBOLAGET SEPARATOR, OF SAME PLACE.

CENTRIFUGAL SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 432,719, dated July 22, 1890.

Application filed May 12, 1890. Serial No. 351,377. (No model.) Patented in France January 30, 1888, No. 188,426; in Germany July 14, 1888, No. 48,615; in Belgium February 11, 1889, No. 84,973; in England February 18, 1889, No. 2,837; in Switzerland May 6, 1889, No. 839, and in Austria-Hungary September 17, 1889, No. 6,969 and No. 47,415.

To all whom it may concern:

Be it known that I, CLEMENS VON BECHTOLSHEIM, a subject of the Emperor of Germany, residing at Stockholm, in the Kingdom of Sweden, have invented a new and useful Improvement in Centrifugal Separators, (for which I have obtained the following Letters Patent: France, January 30, 1888, No. 188,426; Germany, July 14, 1888, No. 48,615; Belgium, February 11, 1889, No. 84,973; England, February 18, 1889, No. 2,837; Switzerland, May 6, 1889, No. 839, and Austria-Hungary September 17, 1889, Nos. 6,969 and 47,415,) of which the following is a specification.

This invention relates to that class of centrifugal separating-machines which are provided with imperforate bowls or drums in which a compound liquid is separated into its constituent liquids of different densities, which arrange themselves in concentric layers within the drum and can be separately discharged. These machines are used extensively for separating full or whole milk into cream and skim-milk, and I will therefore describe my invention as applied to a centrifugal creamer, although it is applicable to the separation of other compound liquids.

The object of my invention is to increase the separating capacity of the bowl or drum. In the cylindrical wall or annular body of milk which is formed in the bowl when the latter is in rapid rotation the heavy particles of blue or skim milk are driven outwardly or away from the axis of rotation with great force and accumulate nearest the peripheral wall of the drum, thereby crowding the cream particles, which are specifically lighter, toward the axis of rotation. In the unseparated full milk the blue milk and cream are contained in the same proportion from the periphery to the inner surface of the annular body. As the separation begins, the particles seek to separate and arrange themselves in concentric layers under the influence of the centrifugal force. The particles of heavy blue milk in the inner portion of the annular body move outwardly and displace the light particles of cream contained in the outer portion of the annular body. These cream particles move inwardly against the outwardly-moving particles of blue milk and are not only retarded in their inward movement, but frequently driven back by the impact of the outwardly-moving particles of blue milk, whereby the separation is retarded. My invention has the object to overcome this difficulty, and this object is attained by dividing the milk in the bowl into numerous thin layers, in each of which the heavy particles move outwardly into the skim-milk place and the light particles move inwardly into the cream-space without interfering one with the other, thereby effecting the separation in much less time and more completely than heretofore, and consequently increasing the separating capacity of a bowl of a given size.

In the accompanying drawings, consisting of three sheets, Figure 1 is a sectional elevation of the bowl and connecting parts of a centrifugal creamer provided with my improvements in line *y y*, Fig. 3. Fig. 2 is a top plan view of the bowl with the cover removed. Fig. 3 is a bottom plan view of the cover of the bowl with the diaphragm partly broken away. Fig. 4 is a horizontal section in line *x x*, Fig. 1. Fig. 5 is a fragmentary vertical section of the bowl on an enlarged scale. Fig. 6 is a diagram illustrating the principle of my invention. Fig. 7 is a vertical section showing a modified construction of my improvement. Fig. 8 is a horizontal section in line *y y*, Fig. 6.

Like letters of reference refer to like parts in the several figures.

A represents the spindle, and *a* the bottom of the bowl, formed in one piece with the spindle.

B represents the cylindrical peripheral wall of the bowl, secured with its lower end in the upturned flange of the bottom and provided at its top with a flange *b*, which carries on its side segmental ears *c* and has a packing-ring *c'* seated in its upper surface.

D represents the upwardly-tapering cover of the bowl, which rests with its bottom flange upon the packing-ring *c'*, and is secured to the cylindrical body by a clamping-ring E.

The latter engages with its upper flange over the bottom flange of the cover and with its lower flange under the segmental ears of the body. The cover is provided on its inner side with skim-milk tubes or passages *d*, which open with their lower ends near the peripheral wall of the bowl and have their upper ends turned outwardly through the wall of the cover, so as to discharge the skim-milk into the surrounding annular receptacle F, which rests upon the casing F′, inclosing the bowl. These discharge-tubes are inclined or pitched in the direction in which the bowl revolves; or, in other words, the lower or inlet ends of the tubes are arranged in advance of their upper or discharge ends, as clearly indicated in Figs. 1 and 3, whereby the discharge of the skim-milk is facilitated. The cover D is provided at its upper end with a contracted neck G, which is provided with a cream-discharge groove or channel *g*, through which the cream is delivered at the top of the neck into the surrounding receptacle H.

g′ is an annular diaphragm secured within the cover D between the inlets of the skim-milk tubes and the cream-notch.

I represents the full-milk receptacle, secured to the cover of the cream-receptacle H and provided with a feed-pipe *i*, by which the full milk is conducted into the bowl.

K represents a feed-cup, which rests upon the bottom of the bowl and receives the full milk from the pipe *i*. This cup has an inclined or upwardly-tapering side wall *k*, and reaches with its bottom flange *k′* nearly to the peripheral wall of the bowl, while its top flange k^2 extends inwardly from the upper end of the inclined side wall and is provided with a central opening through which the milk enters the cup.

L represents inclined division or partition rings, resting one upon the other and filling the outer portion of the bowl from the feed-cup to the cover. These rings are arranged in that portion of the bowl which is occupied by the annular body of milk and divide this body into numerous thin inclined layers, strata, or laminæ. Each of these inclined rings is preferably provided with a marginal horizontal flange *l* and an inner horizontal flange *l′* to stiffen the edges. The rings are kept at the proper distance from each other by spacing-ribs l^2, formed, preferably, integral with the rings by stamping or indenting the same. The rings are held with their peripheral edges away from the inner surface of the bowl by vertical ribs *m* on the cylindrical body of the latter. The division-rings are held in position laterally with reference to each other by a core N, consisting of radial plates or rings *n* and a hollow cylinder *n′*, to which the plates are secured. The lower ends of the wings are provided with projections n^2, which enter the opening in the top flange of the feed-cup and center the core on the same. The outer edges of the wings fit within the openings in the rings, whereby the latter are held against lateral displacement. The top ring L′ is provided with a contracted neck *o*, which is connected by a horizontal portion *o′* with the beveled wall of the ring. The latter rests with this horizontal portion upon the upper ends of the wings *n*, which are provided with projections n^3, entering the neck and centering the top ring on the core. The hollow cylinder of the core is open at both ends, and the feed-pipe enters this cylinder, so that the milk drops through the same in passing from the feed-pipe to the feed-cup.

The full milk escapes from the feed-cup over the inner edge of the central opening thereof. The annular body of milk fills the inclined annular spaces between the division-rings and extends outwardly beyond the rings to the inner periphery of the bowl and inwardly beyond the rings to the cream-line corresponding with the cream-discharge. In each inclined layer the heavy particles of blue milk are driven by centrifugal force against the under side of the ring, confining the top of the layer and follow the under side of the ring downwardly to the wall of the bowl, while the cream globules are displaced and lifted against the upper side of the ring which confines the lower side of the layer. A cream globule has therefore to move but the short distance which exists horizontally between two rings in order to get out of the current of heavy particles which is being driven toward the peripheral wall of the bowl. This outward current of heavy liquid seeks the top of the inclined layer, while the inward current of light liquid seeks the bottom of the layer, when the latter is inclined downwardly, as shown in Figs. 1 and 5, and as these currents do not interfere with each other the desired separation is effected rapidly and completely. The downward movement of the heavy particles of skim-milk is assisted by gravity when the plates are inclined downwardly and outwardly, as shown in Figs. 1 and 5. Direct upward passages are formed between the outer edges of the rings and the inner surface of the bowl, through which the separated skim-milk flows upwardly toward the skim-milk discharge, thereby preventing the separated skim-milk from being again commingled with the unseparated milk or cream. The separated cream particles move upwardly through the cream-space on the inner sides of the rings to the cream-discharge.

The angle or bevel of the rings may be varied from that shown in the drawings; but it has been found that an angle of about sixty degrees will give the best results. The number of rings may be increased or reduced; but it is found that rings whose beveled portions are arranged at a distance of about one-eighth of an inch from each other will give excellent results.

The principle of my invention is readily understood by referring to the diagram Fig. 6, which represents a separator-bowl in which the annular milk-space is divided into two

concentric parts of equal thickness by a sheet-metal cylinder P, arranged midway in the milk-space and concentric with the peripheral wall of the bowl. Assuming that the whole or full milk enters at the lower edge of the cylinder into the two annular spaces on the outer and inner sides of the dividing-cylinder P, the cream globules in the outer layer accumulate against the outer side of the cylinder P, while in the inner layer they accumulate in the inner portion of the annular body of liquid. In each layer the cream globules have to penetrate a layer of liquid only half as deep as the layer would be in the absence of the dividing-cylinder, and the separating capacity of the drum is thereby greatly increased. By arranging the dividing-plates obliquely, as represented in Fig. 1, the body of milk is divided and proper inlets for the full milk into each division and outlets for the separated skim-milk and cream are provided for each layer or division in a very simple manner.

I do not wish to limit myself to the division of the milk into inclined layers or laminæ, because divisions of different form will effect the desired result so long as the divisional stratum, layer, or lamina extends obliquely or otherwise across the radial line of the bowl, or, in other words, does not coincide with the radial line of the bowl, because under the action of centrifugal force the heavy particles will be driven to one side of the layer and force or lift the light particles to the other side, thus reducing the thickness of the layer and establishing two separate or distinct currents in each layer. For instance, the divisions may be made by spirally-curved plates Q, arranged vertically in the drum, as represented in Figs. 7 and 8. In this construction the heavy particles will be driven into the outer portion of each layer and the light particles will seek the inner portion thereof, whereby two currents are created in each layer, a current of skim-milk moving to the periphery of the bowl and a current of cream particles moving toward the axis of the bowl.

I claim as my invention—

1. The method herein described of separating cream from milk, which consists in subjecting the milk to the action of centrifugal force in thin layers, strata, or laminæ arranged across the radial lines of the bowl, whereby the heavy and light particles are massed on opposite sides of each layer, substantially as set forth.

2. The combination, with the separating bowl or drum, of partition or division plates arranged in the liquid-space across the radial lines of the drum and flow-passages for the heavy separated liquid formed along the inner side of the drum and connecting the spaces between the plates directly with the outlet for the heavy liquid, substantially as set forth.

3. The combination, with the separating bowl or drum, of beveled or inclined division-rings arranged in the liquid-space of the drum and flow-passages for the heavy separated liquid formed at the outer edges of the rings, substantially as set forth.

4. The combination, with the separating bowl or drum, of detachable superposed inclined rings arranged in the liquid-space of the drum and provided with spacing projections, whereby the rings are supported upon each other, substantially as set forth.

5. The combination, with the separating bowl or drum provided with an inlet for the compound liquid at one end and discharges for the light and heavy separated liquids at its opposite end, of superposed inclined rings arranged loosely in the liquid-space of the drum and provided at their outer edges with flow-passages for the heavy liquid, substantially as set forth.

6. The combination, with the separating bowl or drum, of removable beveled or inclined division-rings and a centering-core arranged within said rings, substantially as set forth.

7. The combination, with the separating bowl or drum, of removable beveled or inclined division-rings and a centering-core composed of a hollow cylinder and radial wings or plates, substantially as set forth.

8. The combination, with the separating bowl or drum, of a beveled feed-cup resting on the bottom of the bowl and beveled division-rings resting on the feed-cup, substantially as set forth.

9. The combination, with a separating bowl or drum, of a beveled feed-cup resting on the bottom of the bowl, beveled division-rings resting on the feed-cup, and a top ring provided with a contracted discharge-neck, substantially as set forth.

10. The combination, with a separating bowl or drum, of a beveled feed-cup resting on the bottom of the drum, a centering-core provided with projections entering the feed-cup, beveled division-rings resting upon the feed-cup and surrounding the core, and a top ring provided with a contracted neck which receives projections on the core, substantially as set forth.

11. The combination, with a separating bowl or drum provided on its inner side with longitudinal ribs or projections, of superposed inclined rings resting with their peripheral edges against said ribs, whereby flow-passages are formed between the edges of the rings and the drum, substantially as set forth.

Witness my hand this 22d day of April, 1890.

CLEMENS VON BECHTOLSHEIM.

Witnesses:
E. HAASE,
GEORG SUNDBERG.