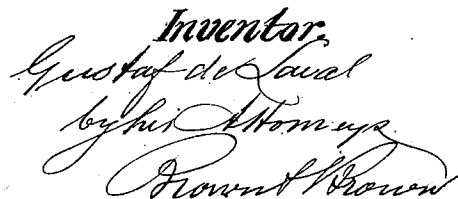


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UNITED STATES PATENT OFFICE.

GUSTAF DE LAVAL, OF STOCKHOLM, SWEDEN.

CENTRIFUGAL CREAMER.

SPECIFICATION forming part of Letters Patent No. 247,804, dated October 4, 1881.

Application filed July 31, 1879. Patented in England November 4, 1878, in France March 5 and June 30, 1879, in Belgium June 27, 1879, and in Italy June 30, 1879.

To all whom it may concern:

Be it known that I, GUSTAF DE LAVAL, of the city of Stockholm, Kingdom of Sweden, have invented certain new and useful Improvements in Apparatus for Separating Fluids by Centrifugal Force, of which the following is a specification.

My invention relates to apparatus for separating mixed fluids of different specific gravities by centrifugal force, in which the mixed fluid is introduced into a hollow centrifugal chamber and the separated fluids are conducted therefrom through separate pipes or nozzles. The apparatus is especially useful in creaming milk.

The invention consists, essentially, in the combination, with a hollow chamber rotating upon a vertical axis, of a pipe concentric with said axis for the admission of a compound fluid, and two or more nozzles, also concentric with said axis, for the delivery of the separated fluids.

It also consists in various details of construction and combinations of parts, hereinafter described.

In the accompanying drawings, Figure 1 represents a vertical section of the apparatus, and Fig. 2 a perspective view thereof on a smaller scale.

Similar letters of reference designate corresponding parts in both figures.

B designates a stand, preferably made of cast-iron, supporting a hollow chamber, A, preferably cast in one piece therewith.

D is a strong chamber formed of one piece of steel, iron, or other metal, and in form nearly elliptical in vertical section. It is arranged upon the upper end of a shaft, which projects into chamber A, and which rotates rapidly. This rotating chamber D has two tubular projections or nozzles, *l* and *n*, from its center upward, one within the other, which respectively serve as passages for the separated fluids, and both concentric with the axis of the chamber D. These tubular projections have suitable flanges to allow them to be bolted firmly upon the upper end of the chamber D, as shown.

G and H are vessels fitted around the tops of the nozzles *l* and *n*, leading from chamber D, the vessel G receiving the fluid flowing from

the nozzle *l* and the vessel H that flowing from the nozzle *n*. The two vessels G and H are concentric with the nozzles *l* and *n*, and are open at the center to permit said nozzles to project through them.

y y are two spouts arranged to convey from the vessels G and H the separated fluids to convenient receptacles.

q is a small tube leading downward through tube *n* into the radial channels *s s* at the bottom of the chamber D, and through which the fluid to be separated is first poured.

i is the shaft, through which motion is given to chamber D. It is provided with a flexible bearing, *r*, kept in position by means of the elastic ring *o*, made of rubber or other suitable material, and gland *p*, which allows a slight vibratory action of the upper end of said shaft.

e represents a short vertical shaft, mounted in the base of frame A, upon which the shaft *i* rests, and which is connected thereto by means of a friction-plate, *z*, of cork, wood, or other suitable material. This vertical shaft *e* is provided with a suitable driving-pulley, *a*, whereby power may be communicated to the apparatus by means of a belt, *d*.

E is a cover, which incloses tightly the chamber A.

X is a bent tube leading from the inner periphery of the chamber D to the tubular projection or nozzle *l*.

s s represent two or more radial pipes, fastened in the bottom part of chamber D, which lead the entering fluid toward the periphery of the chamber D to a point at which the separation begins, the fluids of greater specific gravity continuing toward the periphery, while the lighter fluid portions flow toward the center under the influence of centrifugal action, to be described farther on.

The operation of this apparatus is as follows: Rapid rotary motion being given to the chamber D, unskimmed milk or other compound fluid passes from a pipe, *f*, through pipe *g*, into the chamber D in a slow but continuous stream, the flow being regulated by a cock or valve in the supply-pipe *f*. By means of the rapid rotary motion, the compound fluid, continually flowing into the chamber D through the pipe *g*, is caused to separate into its constituents by

the centrifugal action imparted to the fluids of different gravities, thereby causing the heavier to tend toward the outer circumference of chamber D, while the lighter is forced to remain nearer the center. As the chamber becomes filled with the separated fluids the heavier fluid portions commence to overflow through the curved pipe X and nozzle *l* into vessel G, while the cream from the milk, or the lighter portion of other compound fluid, will overflow from the inner nozzle, *n*, into vessel H. At the end of the operation, when all of the milk or other compound fluid to be separated at one time has been poured into the apparatus, in order to complete the separation of the contents remaining in vessel D, the rotation of the same is stopped for a moment. The rotation is then renewed, and some of the heavier portion of the already-separated fluid is poured through pipe *g* again. This causes the remaining cream or other light fluid to rise through the inner tube, *n*, and to be thrown into vessel H until the last remaining portion has become separated and the operation completed. As the supply of milk or other compound fluid is continuous, it will be understood that incipient and progressive separations of the supply into accretions of cream and skimmed milk or any other simple fluids are at all times taking place within the chamber.

By means of this apparatus I am enabled to separate any fluids of different specific gravities continually. One stream of compound fluid enters by means of pipe *q*, while the separated fluids flow from the two spouts *y y*, respectively.

This apparatus is simple, cheap, and valua-

ble for many operations in the arts, and is especially adapted to the separation of cream from milk, either fresh or old. It may be operated by hand or otherwise.

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

1. The combination, with a hollow chamber rotating upon a vertical axis, of a pipe concentric with said axis for the admission of a compound fluid, and two or more nozzles, also concentric with said axis, for the delivery of the separated fluids, substantially as specified.

2. The combination, with a hollow chamber rotating upon its vertical axis, of a pipe concentric with said axis for the admission of a compound fluid, two or more nozzles, also concentric with said axis, for the delivery of the separated fluids, and a curved pipe extending from the outermost of said nozzles down and outwardly within said chamber, nearly to the periphery thereof, substantially as specified.

3. A closed centrifugal chamber provided with a double set of concentric and central vertical discharge tubes or nozzles, in combination with a stationary receiver consisting of the central annular compartments, G H, through the hollow center of which the double tubes or nozzles project, substantially as specified.

4. The combination of the rotary chamber D, inlet pipe or passage *q*, radial passages *s*, extending therefrom, nozzles *l n*, and curved pipe *x*, substantially as specified.

GUSTAF DE LAVAL.

Witnesses:

OSCAR LAMM, Jr.,
GUSTAF ULFF.