

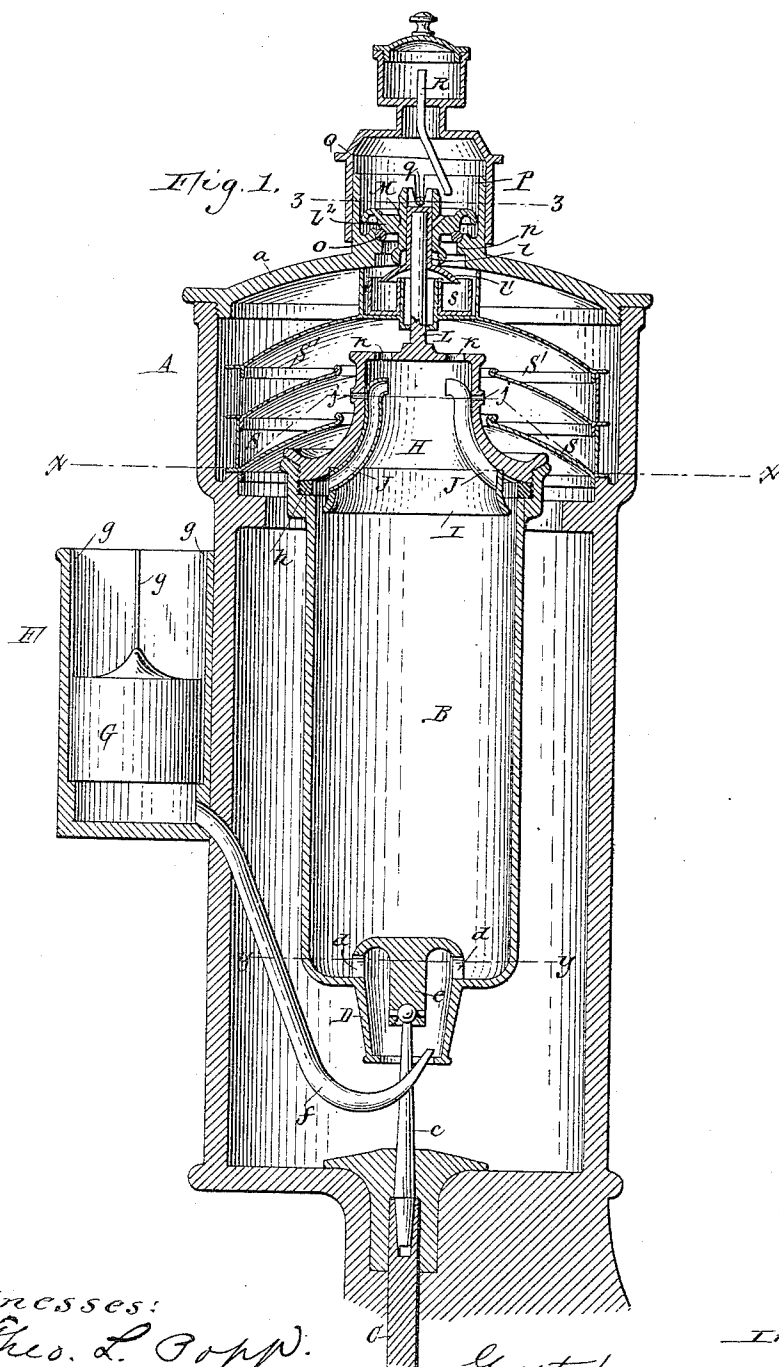
(No Model.)

2 Sheets—Sheet 1.

G. DE LAVAL.
CENTRIFUGAL SEPARATOR.

No. 445,066.

Patented Jan. 20, 1891.



Witnesses:
Thos. L. Gopp.
Chester D. How.

Inventor:
Gustaf DeLaval,
By Edward Wilhelm,
Attorney.

(No Model.)

2 Sheets—Sheet 2.

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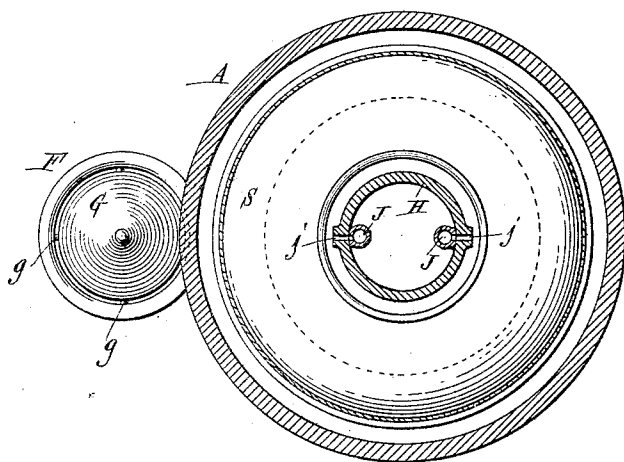


Fig. 2.

Fig. 3.

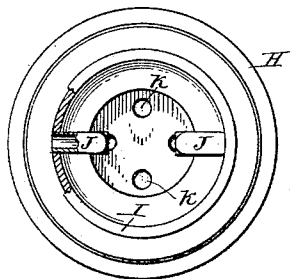


Fig. 4.

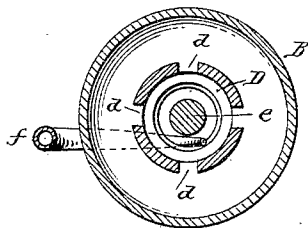
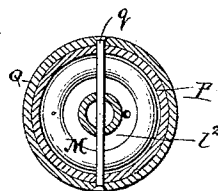


Fig. 5.



Witnesses:
Theo. L. Popp.
Chester D. Howe.

Inventor:
Gustaf de Laval,
By Edward Wilhelm
Attorney.

UNITED STATES PATENT OFFICE.

GUSTAF DE LAVAL, OF STOCKHOLM, SWEDEN, ASSIGNOR TO THE AKTIE-
BOLAGET SEPARATOR, OF SAME PLACE.

CENTRIFUGAL SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 445,066, dated January 20, 1891.

Application filed July 24, 1889. Serial No. 318,598. (No model.)

To all whom it may concern:

Be it known that I, GUSTAF DE LAVAL, a citizen of Sweden, and a resident of Stockholm, Sweden, have invented a new and useful Improvement in Centrifugal Separators, of which the following is a specification.

My invention relates to centrifugal machines for separating compound liquids of different gravities, and the objects of my invention are to improve the separation, to increase the separating capacity, to reduce the power required for running the machine, and to render the latter safe and reliable at high speed. As these centrifugal machines are used principally for creaming milk, I have illustrated and described my improvements as embodied in a centrifugal creamer.

In the accompanying drawings, consisting of two sheets, Figure 1 is a sectional elevation of a centrifugal creamer provided with my improvements. Fig. 2 is a horizontal section in line *xx*, Fig. 1. Fig. 3 is a bottom plan of the bowl-cover with portions of its depending flange and of one of the skim-milk pipes in section. Figs. 4 and 5 are horizontal sections in lines *yy* and *zz*, Fig. 1, respectively.

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

A represents the upper portion of the stationary frame of the machine, which is constructed in the form of an inclosing housing having a cover *a*, but which may be of any other suitable form.

B represents the vertical separator-bowl, having the inlet for the full milk in its bottom and the discharge devices for the cream and skim-milk at its top.

C represents the driving-spindle, which is journaled in the lower part of the main frame and receives power in any suitable manner.

c is a flexible spindle-extension, which is seated with its lower large end in a socket formed in the upper end of the driving-spindle and upon which the bowl rests. This extension tapers upwardly and is provided at its upper end with a spherical knuckle.

D represents an inverted receiving-cup arranged underneath the bottom of the bowl and having an inlet-opening around the spindle-extension *c*. This cup flares upwardly

and communicates with the interior of the bowl through openings *d*, located immediately above the bottom of the bowl. The bottom of the inverted cup projects into the bowl and is provided with a downwardly-projecting hub *e*, having a spherical socket in which the knuckle of the spindle-extension engages. The latter is preferably attached to the hub by a cross-pin.

F represents the feed-cup secured to one side of the main frame above the bottom of the bowl, and *f* the feed-pipe, which extends from the bottom of the feed-cup downwardly below the inverted receiving-cup and then upwardly on one side of the spindle-extension and into the mouth of the receiving-cup. The milk issues in an ascending jet from the upturned nozzle of the feed-pipe and enters the feed-cup, which latter causes the milk to flow upwardly by centrifugal action and its upwardly-flaring form, through the openings *d* into the lower portion of the bowl.

G represents the float in the feed-cup in which it is guided by internal vertical ribs *g*.

H represents the cover of the bowl, to which it is attached at its periphery by a screw-thread entering an internally-threaded flange which is formed at the upper end of the bowl.

h is a packing-ring of rubber or other suitable material interposed between the cover and the bowl.

I represents an annular flange or curtain, which depends from the cover, and is arranged near the inner side of the peripheral wall of the bowl, so as to form a narrow annular chamber between the bowl and the flange into which the separated skim-milk enters.

J represents the skim-milk-discharge pipes, which are arranged on the under and inner sides of the cover and extend from the flange I to and beyond the skim-milk-discharge openings *j*. The pipes J open with their lower ends outwardly through the flange I into the annular skim-milk space, so as to receive the skim-milk therefrom. This flange or curtain separates the surrounding annular space, which receives the skim-milk from the central top portion of the bowl, and forms a dam which prevents the undulatory or oscillatory disturbances or waves which run upwardly

along the peripheral wall of the bowl from passing into the central top portion of the bowl where the separated cream accumulates. These waves would break up the accretions of cream and drive more or less of the separated skim-milk into the same, which is prevented by the depending flange.

The cover is provided with an upwardly-projecting contracted neck and a flat top. The discharge-openings *j* for the skim-milk are formed in the sides of this neck and extend through the outer portions of the tubes *J*, which latter extend upwardly and inwardly beyond these openings.

k represents the cream-discharge openings formed in the flat top portion of the cover.

L represents a journal secured to or formed on the cover and projecting upwardly from the flat top thereof. *M* represents a movable bearing in which this journal is supported, and *l* is a sleeve interposed between the journal and the bearing and provided at its lower end with a flange *l'*, which deflects the surplus of lubricating material outwardly. The bearing *L* is provided with a surrounding circular flange *l''*, which rests upon a yielding ring *O* of rubber or similar material. The latter in turn rests upon an annular shoulder *p*, formed in an oil-cup *P*, which incloses the bearing and is formed on the cover *a* of the frame. The bearing is prevented from turning in the cup by a transverse pin *q*, secured to the cover *Q* of the oil-cup and resting in notches in the cup and in the bearing. The cover of the oil-cup is provided with a feeder *R*.

S represents the annular trough for the reception of the skim-milk, and *S'* the trough for the cream surmounting the same. The trough *S'* is provided on its top with a raised collar which contains a removable annular trough *s*. The latter surrounds the journal below the flange of the sleeve *l* and receives the surplus oil thrown off from the sleeve and prevents it from running into the bowl or the cream and skim-milk troughs. The flexible spindle-extension at the bottom permits the bowl to move laterally by bending or springing the extension and adjust itself until it is in equilibrium, thereby preventing undue friction in the bearings and trembling of the bowl, which latter would interfere with the separation and endanger the apparatus at the high speed with which these machines are operated. The movable bearing at the top of the bowl facilitates this adjustment of the latter.

I claim as my invention—

1. The combination, with a vertical separating-bowl provided at its bottom with a receiving-cup having its lower imperforate portion arranged below said bottom and opening downwardly and its upper portion arranged above said bottom and provided with lateral openings, of an elevated feed-cup and a feed-pipe extending downwardly from the feed-cup and provided at its lower end with an upturned nozzle, substantially as set forth.

2. The combination, with a vertical separating-bowl provided at its bottom with a receiving-cup opening downwardly and having a hub within said receiving-cup, of a spindle arranged below the bowl and having its upper end seated in said hub, an elevated feed-cup, and a feed-pipe extending downwardly from said receiving-cup and provided at its lower end with an upturned nozzle, substantially as set forth.

3. The combination, with the bowl, of a driving-spindle, a flexible extension connecting the spindle with one end of the bowl, a journal attached to the opposite end of the bowl, and a movable bearing in which said journal is supported, substantially as set forth.

4. The combination, with the bowl provided at its upper end with a journal and the frame provided with an oil-cup having an internal collar surrounding the journal, of a bearing having a surrounding flange, an elastic ring interposed between the flange and said collar, and a cover provided with a transverse pin entering notches in the oil-cup and bearing, substantially as set forth.

5. The combination, with the bowl having its cover provided with a contracted neck and a discharge for the heavy liquid in said neck, of a flange or curtain depending from said cover near the inner surface of the bowl, and a conduit for the heavy liquid penetrating said flange or curtain with its receiving end and leading to said discharge, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 22d day of February, 1889.

GUSTAF DE LAVAL.

Witnesses:

NERE A. ELFWING,
EMIL H. CAASE.