(No Model.) 2 Sheets—Sheet 1.

J. EVANS.

CENTRIFUGAL LIQUID SEPARATOR.

No. 347,702. Patented Aug. 17, 1886.

Fig. 1.

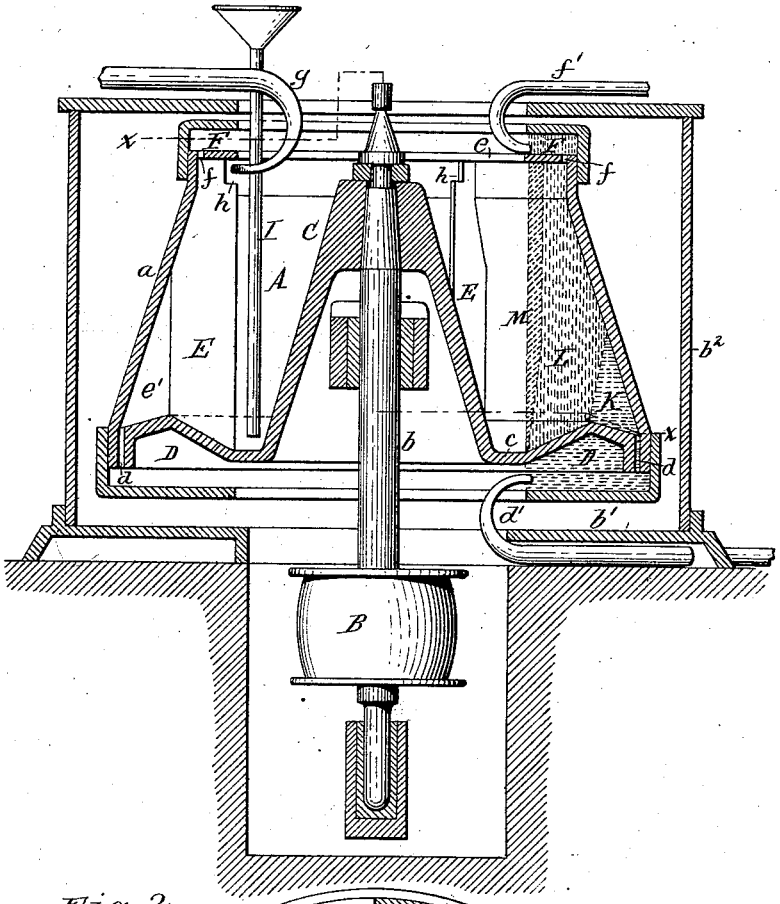
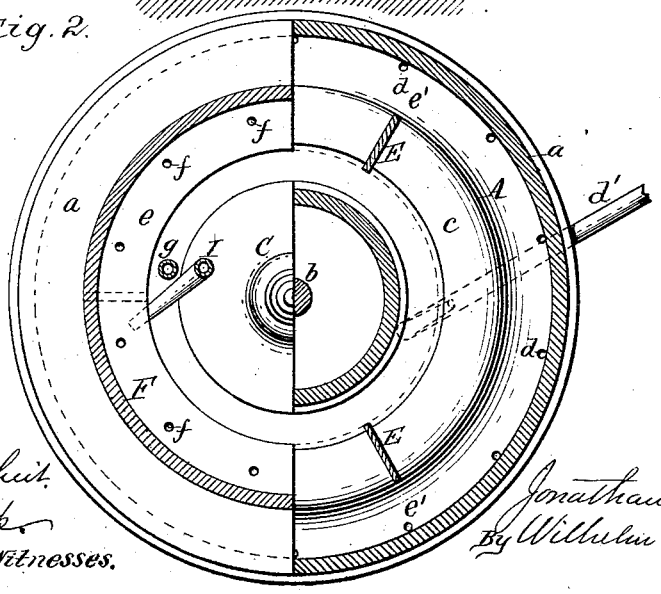


Fig. 2.



Witnesses.
Chas. J. Buchholt.
Thos. L. Popp.

Inventor:
Jonathan Evans
By Wilhelm Bonner
Attorneys.

(No Model.) 2 Sheets—Sheet 2.

J. EVANS.

CENTRIFUGAL LIQUID SEPARATOR.

No. 347,702. Patented Aug. 17, 1886.

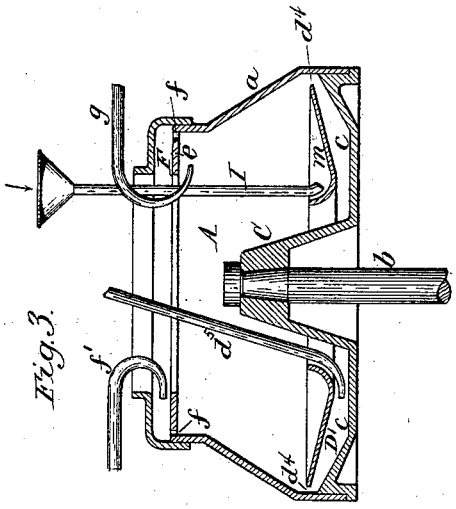


Fig. 3.

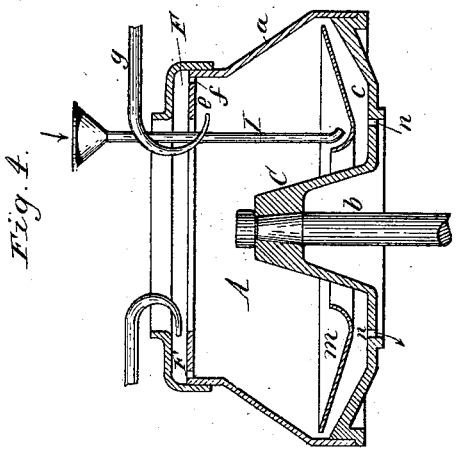


Fig. 4.

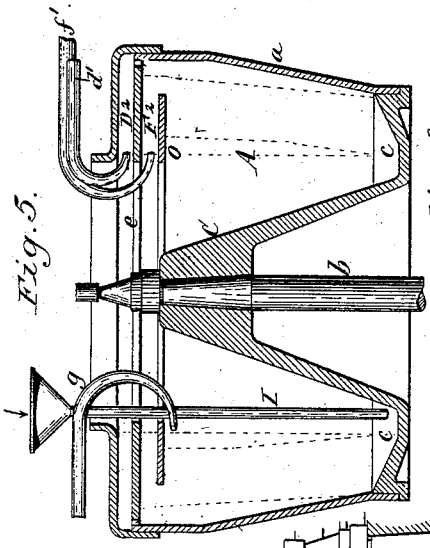


Fig. 5.

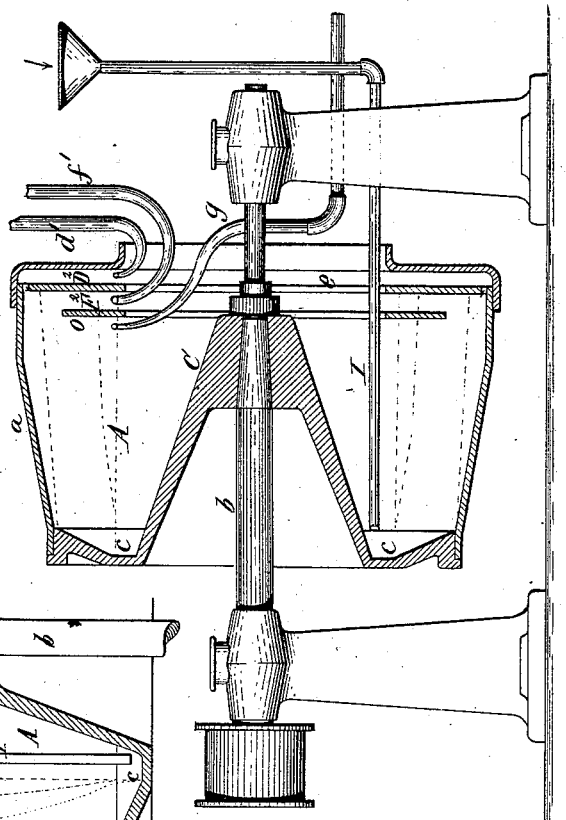


Fig. 6.

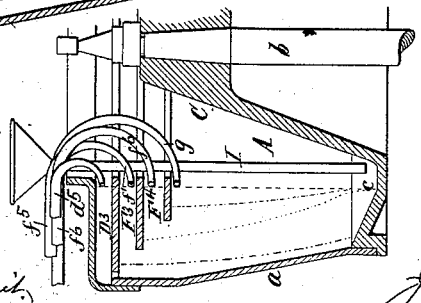


Fig. 7.

Chas. J. Buchholz.
Thos. L. Poppe
Witnesses.

Jonathan Evans. Inventor.
By Wilhelm & Bonner
Attorneys.

UNITED STATES PATENT OFFICE.

JONATHAN EVANS, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO DAVID H. BURRELL, OF LITTLE FALLS, NEW YORK.

CENTRIFUGAL LIQUID-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 347,702, dated August 17, 1886.

Application filed October 16, 1885. Serial No. 180,100. (No model.)

To all whom it may concern:

Be it known that I, JONATHAN EVANS, of the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented new and useful Improvements in Centrifugal Liquid-Separators, of which the following is a specification.

This invention relates to an improvement in that class of centrifugal separators which are employed for separating compound liquids into their constituent liquids of different densities or gravities.

The object of this invention is the construction of a machine by which a liquid composed of three or more component liquids of different gravities can be separated by a continuous operation into its component parts, each product of the separation being discharged separately and continuously from the separator.

My invention consists to this end of the improvements in the construction of the separator, which will be hereinafter fully set forth, and pointed out in the claims.

In the accompanying drawings, consisting of two sheets, Figure 1 represents a vertical section of my improved separator mounted upon a vertical spindle. Fig. 2 is a horizontal section on line *x x*, Fig. 1. Figs. 3, 4, and 5 are vertical sections showing modified constructions of my improved separator. Fig. 6 is a vertical section showing a separator of the construction represented in Fig. 5 mounted upon a horizontal shaft. Fig. 7 is a fragmentary vertical section of a separator adapted to separate a compound liquid into four component liquids.

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

A represents the separating-drum provided with an upwardly-tapering outer wall, *a*, mounted upon a vertical spindle, *b*, which is rapidly rotated by a belt running around a pulley, B, or other suitable means.

b' represents the stationary base of the separator, and *b²* the stationary case resting on the base *b'* and inclosing the drum A.

c represents the bottom of the drum, and C its central hub, which is secured to the spindle *b*.

D is an annular collecting-chamber for the heavy material, arranged below the bottom *c*, and secured to the lower portion of the drum. This chamber communicates with the large end of the tapering drum by openings *d*, formed in the bottom *c*, closely to the outer wall of the drum.

d' is a skimming-pipe, which is secured to the stationary frame or casing of the machine, and which projects with its bent receiving end into the annular chamber D, so as to remove the material therefrom.

e is an annular flange secured to the upper contracted end of the drum and projecting inwardly therefrom.

E represents upright wings or blades secured to the interior of the drum and extending from the bottom *c* to the top flange, *e*. These wings do not extend to the outer wall, A, at the enlarged end of the drum, but leave spaces *e'* between their outer edges and the wall of the drum at the enlarged end thereof, which spaces permit the heaviest material to distribute or equalize itself over the inner surface of the outer wall of the drum, in the enlarged portion thereof.

F is an annular collecting-chamber for the liquid of medium gravity, secured to the upper contracted end of the drum above the top flange, *e*, and communicating with the interior of the drum by openings *f*, formed in the top flange, *e*, closely to the outer wall of the drum.

f' is a skimming-pipe secured to the stationary frame or case of the machine, and projecting with its bent receiving end into the annular chamber F, to remove the liquid therefrom. *g* is a similar skimming-pipe projecting with its bent receiving end below the top flange, *e*, into the body of the drum in the proper position to remove the lightest liquid. The upper ends of the wings E are notched on their inner sides, as shown at *h*, to clear the pipe *g*.

I represents the feed-pipe, which depends into the body of the drum and terminates near the bottom thereof on one side of the central hub.

The improved machine, constructed as here-

inbefore explained, is adapted to separate a compound liquid into three liquids of different densities. It is adapted, for instance, for separating the wool-bath or wool-scourings into its three component liquids, consisting of the wool grease or oil, which is the lightest ingredient, the washing solution, which is the next heaviest ingredient, and the semi-liquid impurities, which constitute the heaviest ingredient. The wool bath or scourings is fed into the rapidly-rotating drum through the feed-pipe I, and is driven by the centrifugal force against the outer wall of the drum. Under the influence of the centrifugal force the constituent parts of the wool-bath are separated, and arrange themselves in three distinct concentric layers or strata against the outer wall of the drum, as indicated in Fig. 1. The outer layer, K, is semi-liquid, and is composed of the heavy semi-liquid impurities with an admixture of the solution. This material is forced by the inclined outer wall of the drum through the discharge-openings *d* into the lower receiving-chamber, D, from which it is removed by the skimming-pipe *d'*. The next inner layer, L, is composed of the washing solution, and escapes through the discharge-openings *f* into the upper collecting-chamber, F, from which it is removed by the skimming-pipe *f'*. The innermost layer, M, is composed of the wool oil or grease, and is removed from the drum by the skimming-pipe *g*. The skimming-pipe *g* and the openings *f* and *d* constitute the three passages through which the three products of the separation escape from the separating-drum proper, and these three passages are located at different distances from the axis of rotation, corresponding with the three concentric layers of the separated component liquids, while the mouths of the skimming-pipes constitute the final discharges, and are arranged at nearly the same distance from the axis of rotation. In this manner the compound liquid fed into the drum is separated by centrifugal force into three component liquids, and the three products of the separation are discharged continuously from the drum.

In the same manner the machine may be used for separating crude starch from the gluten and other impurities, and for various other purposes.

In the modified construction represented in Fig. 3 a deflecting-plate or false bottom, *m*, is arranged in the drum above the bottom *c*, and the discharge-openings for the heaviest material (marked d^4 in this figure) are arranged at the outer edge of this deflecting-plate. The feed-pipe I delivers the liquid to be separated upon this deflecting-plate, and the skimming-pipe for the discharge of the heaviest material (marked d^3 in this figure) enters the space D' between the deflecting-plate and the bottom, which space performs the function of the collecting-chamber D in the construction represented in Fig. 1.

In the construction represented in Fig. 4 the heavy liquid is discharged from the space between the deflecting-plate *m* and the bottom *c* by overflowing through openings *n* in the bottom.

In the construction represented in Fig. 5 the drum is enlarged upwardly, and the collecting-chambers for the heaviest material and the material of medium gravity are both arranged at the upper end of the drum, and marked, respectively, D^2 and F^2 in this figure. The chamber D^2 is arranged above the top flange, *e*, and the chamber F^2 is formed between the top flange and an annular plate, *o*, secured in the drum below the top flange.

In the construction represented in Fig. 6 the drum, having both collecting-chambers D^2 and F^2 at its enlarged end, is mounted upon a horizontal shaft.

In the construction represented in Fig. 7 the drum is provided with four separate discharges for discharging four separated component liquids continuously. For this purpose the drum is provided with three annular collecting-chambers, D^3, F^3, and F^4, which receive the separated liquids at different distances from the axis of rotation corresponding with the three outer concentric layers of the separated component liquids, and from which the liquids are continuously discharged by suitable skimming-pipes, d^5 f^5 f^6. The lightest liquid is discharged by the skimming-pipe *g*, which opens in the innermost layer in the body of the drum.

The receiving ends of the skimming-pipes may be made tapering or spoon-shaped, as may be preferred.

When the liquid fed into the separator is variable in its composition—for instance, when it contains more heavy material at one time than another—the discharge of the heavy material is intermittent and occurs when a sufficient layer of heavy material has been separated.

It is obvious that the chambers D' D^2 D^3, which receive the heaviest material, in the modified constructions represented in Figs. 3, 5, 6, and 7 are the equivalents of the chamber D, represented in Fig. 1, and that the chambers F^2 and F^3, which receive the liquid of medium gravity in the modified constructions represented in Figs. 4, 5, and 6, are the equivalents of the chamber F, which receives the liquid of medium gravity in the constructions represented in Figs. 1, 2, 3, and 4; also, that the skimming-pipes which remove the liquid from equivalent chambers in the several constructions perform the same functions in each construction and are equivalents of each other.

I claim as my invention—

1. The combination, with a separating-drum, of an annular plate secured to the drum and forming a chamber, D, which receives the heavy material therefrom, an annular plate secured to the drum and forming a chamber, F, which receives the material of medium gravity therefrom, and stationary discharges

through which the three separated liquids are automatically removed from the drum and its chambers D and F, substantially as set forth.

2. The combination, with a separating-drum, of an annular plate secured to the drum and forming a chamber, D, which receives the heavy material therefrom, and a skimming-pipe, *d*, entering the chamber D, an annular plate secured to the drum and forming a chamber, F, which receives the material of medium gravity therefrom, and a skimming-pipe, *f*, entering the chamber F, and a skimming-pipe, *g*, through which the light material is discharged from the drum, substantially as set forth.

3. The combination, with the separating-drum having a tapering outer wall, of an annular plate secured to the drum, near the large end thereof, and forming a chamber which receives the heaviest material from the large end of the drum, an annular plate secured to the drum, near the small end thereof, and forming a chamber which receives the material of medium gravity from the small end of the drum, and a skimming-pipe whereby the lightest material is removed from the drum, substantially as set forth.

Witness my hand this 16th day of September, 1885.

JONATHAN EVANS.

Witnesses:
DARRACH CLEAVER,
R. G. KEES.