(No Model.)

M. L. HOYT.

CENTRIFUGAL LIQUID SEPARATOR.

No. 562,782. Patented June 23, 1896.

Fig. 1.

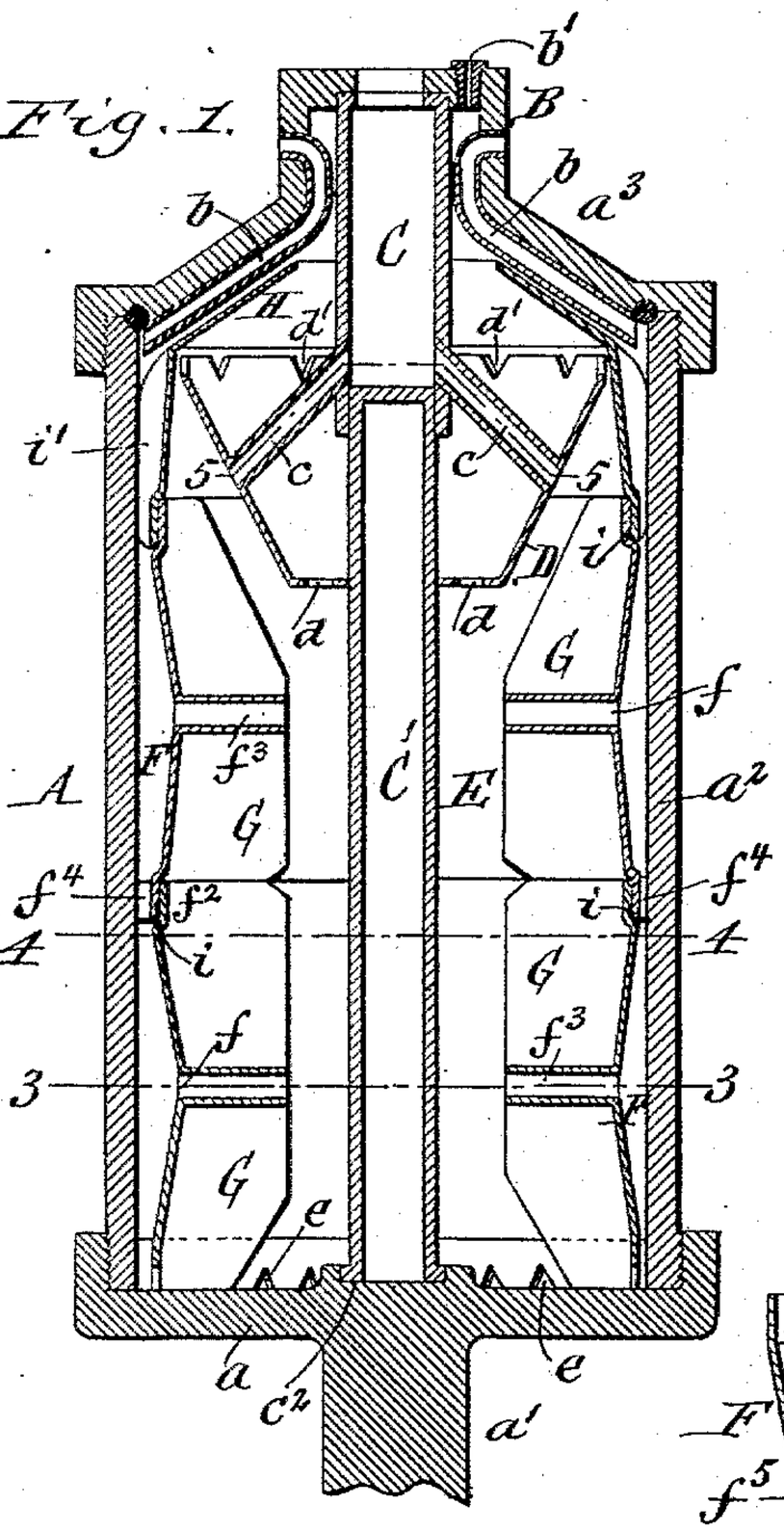

Fig. 2.

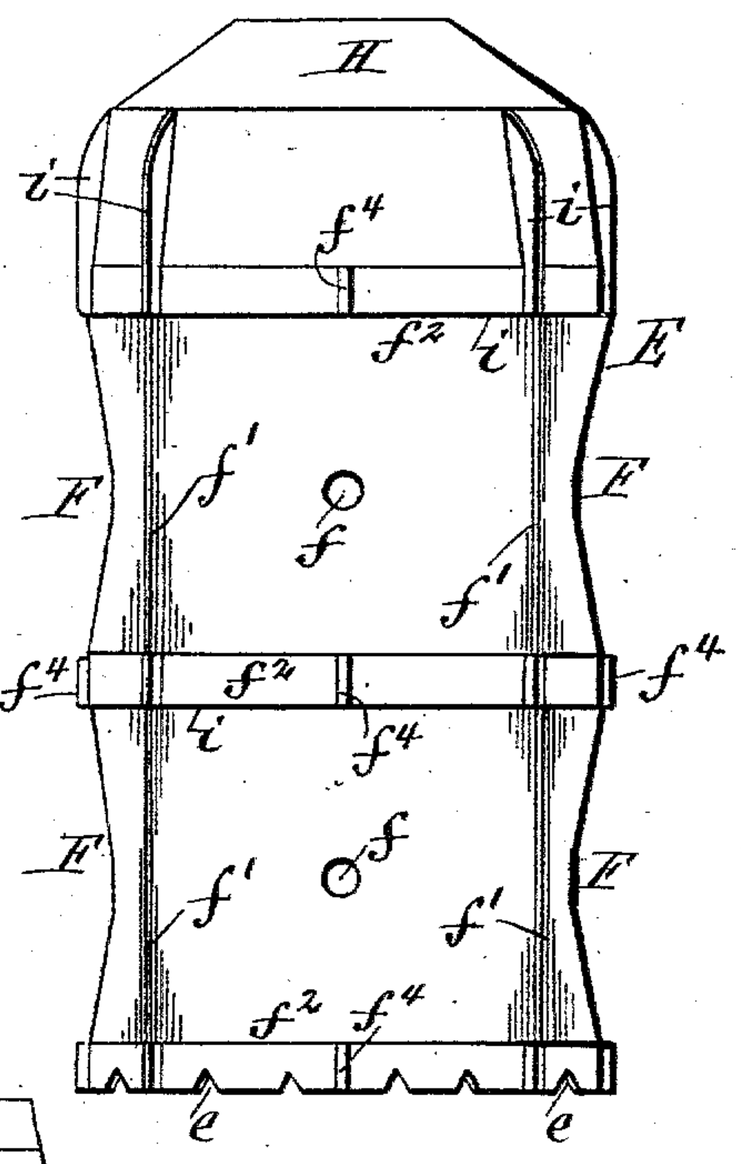

Fig. 6.

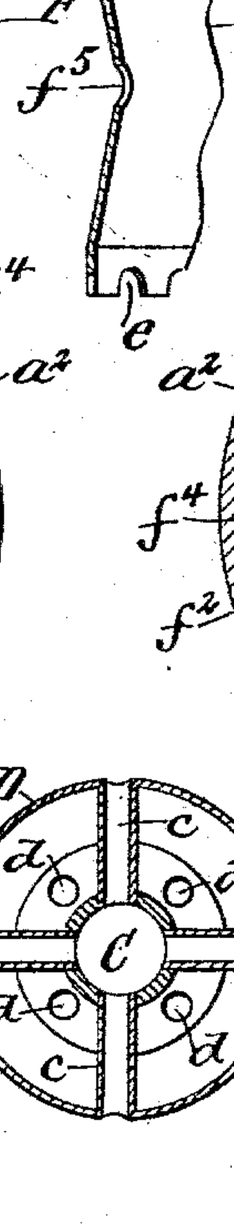

Fig. 3.

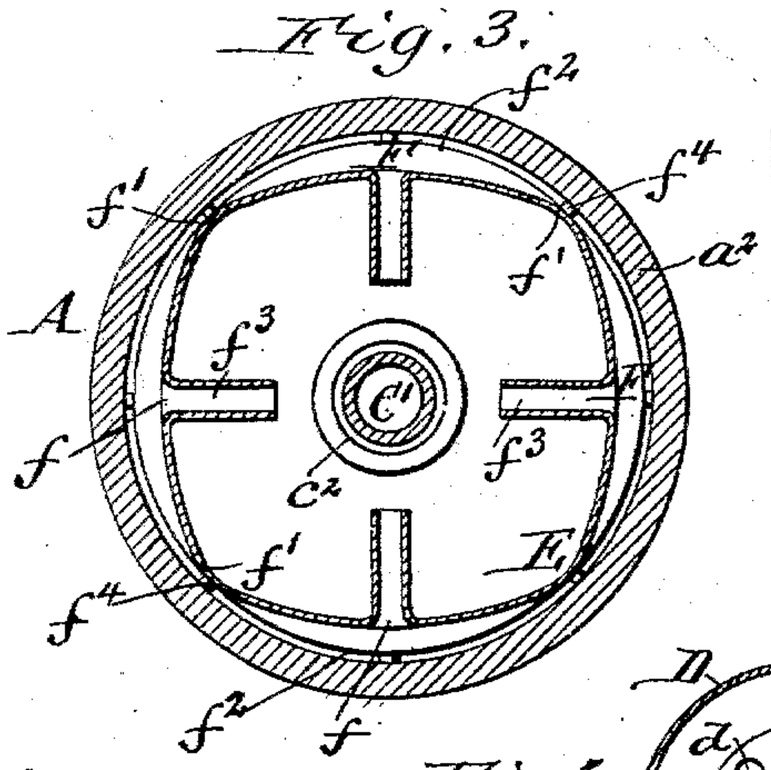

Fig. 4.

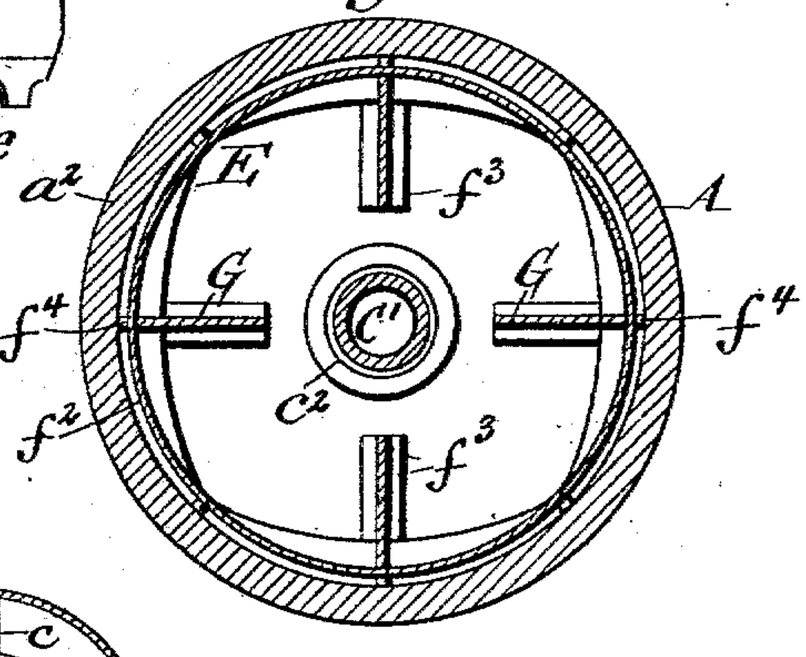

Fig. 5.

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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL LIQUID-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 562,782, dated June 23, 1896.

Application filed April 1, 1896. Serial No. 585,690. (No model.)

To all whom it may concern:

Be it known that I, MATTHEW L. HOYT, a citizen of the United States, residing at Birchton, in the county of Saratoga and State of New York, have invented a new and useful Improvement in Centrifugal Liquid-Separators, of which the following is a specification.

This invention relates to that class of centrifugal separators which are employed for separating a compound liquid into its constituent liquids of different densities, more particularly for separating milk into cream and skim-milk. These separators are provided with imperforate bowls having a supply device for the full milk and separate discharges for the separated cream and skim-milk. Various devices have been arranged in the liquid-space of such bowls for the purpose of increasing the skimming capacity of the same.

The object of my invention is to produce a simple and efficient device which, when placed in the liquid-space of such a bowl, will largely increase its skimming capacity.

In the accompanying drawings, Figure 1 is a sectional elevation of a separator-bowl provided with my improvements. Fig. 2 is an elevation of the skimming-shell shown in Fig. 1. Figs. 3, 4, and 5 are horizontal sections, respectively, in lines 3 3, 4 4, and 5 5, Fig. 1. Fig. 6 is a fragmentary vertical section of my improved skimming-shell without cream-pipes.

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

A represents the bowl of a centrifugal cream-separator, which may be of any ordinary or suitable construction. As shown in the drawings, this bowl has a bottom *a*, formed on the upper end of the spindles *a'*, a cylindrical peripheral wall a^2, secured at its lower end to said bottom, and a removable cover a^3, which is connected by a screw-threaded connection and packing with the upper end of the peripheral wall in a well-known manner.

b represents the skim-milk discharge-pipes, which are secured to the under side of the cover, and *b'* the cream-discharge orifice, both delivering the separated liquids from the contracted neck B of the cover in a well-known manner.

C represents the feed-pipe, which is arranged centrally in the neck of the cover and extends downwardly from the latter a short distance into the bowl, where it is provided with branch or delivery pipes *c*, which extend downwardly and outwardly from the bottom of the feed-pipe and terminate with their outer ends in the full-milk zone of the bowl, that is to say, outwardly of the cream zone and inwardly of the skim-milk zone. The feed-pipe C rests upon a tubular standard or supporting extension C', to which it is preferably secured by soldering, so that both can be inserted and removed together. The lower end of the standard C' rests, preferably, in a shallow central socket c^2 in the bottom of the bowl. The cover bears upon the upper end of the feed-pipe when screwed down upon the peripheral wall of the bowl, whereby the feed-pipe and its standard are held in place. The ends of the branch pipes *c* of the feed-pipe open, preferably, in an inverted conical shield D, which extends inwardly and outwardly from the mouths of the branch pipes and prevents the milk issuing therefrom from agitating or disturbing the upper portion of the annular body of cream, usually designated as the "cream-wall." Such agitation would cause separated cream particles to become commingled again with the entering full milk and is therefore to be avoided. The inner and lower end of this shield extends, preferably, to and is secured to the standard C' and is in that case provided with openings *d*, which are located in the cream zone and through which the cream, which is separated below the shield, passes upwardly toward the cream-outlet of the bowl. The upper edge of the shield may be notched, as shown at *d'*, to facilitate the escape of skim-milk around the upper edge of the shield.

E represents an upright skimming-shell or partition which is arranged in the liquid-space of the bowl near the inner surface of the peripheral wall thereof and which rests upon the bottom of the bowl and terminates near the cover. This shell is approximately cylindrical, but has in its outer surface shallow depressions F of greater or less area, each of which slopes from all sides to an opening *f*, which is located in that portion of the depres-

sion which is nearest the axis of the bowl. As shown in the drawings, two such shallow depressions are arranged, one above the other, in the height of the shell, and four circumferentially around the shell, so that the outer surface of the shell is composed of eight of these shallow depressed areas or fields which are separated by correspondingly low upright ridges or bulges f' and circumferential ridges or bulges f^2. The number of these sections or areas may, however, be increased or reduced and depends somewhat upon the size of the bowl. Each of the openings f is provided on the inner side of the shell with a pipe f^3, which extends inwardly to or near the cream zone. This shell is held at the desired short distance from the inner surface of the peripheral wall of the bowl by spacing ribs or projections f^4 of any suitable form or construction.

G represents radial wings secured to the inner surface of the shell for the purpose of compelling the body of liquid within the shell to rotate therewith. These wings are preferably arranged in the same vertical plane as the cream-tubes of the respective superposed areas of the shell, as shown, so that the wings will serve at the same time to support the tubes.

The upper end of the shell is provided with a conical cover H, which extends from the shell upwardly and inwardly above the shield of the feed-tube to or nearly to the cream zone, or so far toward the axis of the bowl that the partially-skimmed milk which is massed against the inner side of the shell is prevented by this cover from escaping upwardly to the outlets in the neck of the bowl and is compelled to move downwardly and pass around the lower end of the shell into the narrow annular space between the latter and the inner surface of the bowl. The lower edge of the shell is preferably provided with notches e for facilitating the passage of the milk around the lower edge of the shell.

The full milk which enters the bowl through the feed-pipe is subjected to a separating action within the shell E, whereby the large and more readily separated cream globules are separated from the partially-skimmed milk. The latter is forced outwardly against the inner side of the shell and the cream particles are crowded inwardly and form a cream wall which moves upwardly to the neck of the bowl and finally escapes from the cream-discharge therein. The partially-skimmed milk moves downwardly along the inner surface of the shell and passes around the lower edge of the shell into the narrow annular space between the shell and the peripheral wall of the bowl, through which space it flows upwardly. In this annular space the partially-skimmed milk is further separated and the separating action in this space is particularly effective for several reasons. The layer of liquid is thin and located in the outermost portion of the bowl, where the centrifugal action is greatest, The smaller cream globules which have escaped the separating action on the inner side of the shell are here separated from the skim-milk and crowded against the outer surface of the shell. The shallow sloping surfaces of the depressed areas in the outer surface of the shell collect these cream particles and conduct them to the escape-openings at the innermost points of the depressions, whence they pass through the inwardly-extending pipes to the cream wall. These pipes enable the cream to reach the cream wall without interference by the thick body of milk which rests against the inner surface of the skimming-shell, and are preferably employed, but they may be omitted, as shown in Fig. 6, where the shell is shown with apertures f^5 without cream-pipes, in which case the cream particles have to penetrate the layer of milk on the inner side of the skimming-shell.

Each outer sectional area or depression F of the skimming-shell slopes in a circumferential direction as well as in an upright direction to the cream-tube at the innermost point of the depression and individually gathers the cream particles from its portion of the outer layer of liquid and conducts the same by the shortest and most direct route to the cream wall. The cream particles are prevented from lodging and thickening anywhere on the surface of the shell, as the surface of each area is pitched from all sides toward its escape opening or pipe. As the outer surface of the skimming-shell is composed of a number of these shallow converging depressions, the entire outer surface of the shell can be arranged very near the peripheral wall of the bowl, where the smaller cream particles can be most completely separated and the shell can nevertheless completely gather and drain off the separated cream particles. This insures a shell of larger diameter and area, whereby the separating action is increased both inside and outside of the shell. The cream separated on the inner side of the shell moves upwardly through the openings in the shield of the feed-pipe and passes out through the central opening of the conical top of the skimming-shell, and so reaches the neck of the bowl and escapes through the cream-discharge orifice. The cream which is separated above the shield of the feed-pipe joins the upwardly-moving cream wall, and the same is true of the cream which is separated above the conical top of the skimming-shell. The skim-milk enters the outer ends of the skim-milk pipes from the space outside of the skimming-shell.

The skimming-shell is preferably made in two horizontal sections, as shown, connected by a snug lap-joint i, which is sufficiently tight to prevent the escape of the partially-skimmed milk outwardly, but which permits the sections to be readily separated for cleaning. The removable cover of the skimming-shell is connected with the upper section by

a similar joint *i*, and this cover is also preferably provided with spacing and supporting projections *i'*.

I claim as my invention—

1. The combination with a separator-bowl having suitable feed and discharge devices, of an internal shell arranged in the liquid-space of the bowl near the peripheral wall thereof and having its outer surface composed of depressed portions and intervening ridges or elevations, which depressed portions approach the axis of the bowl from all directions and have at their innermost points outlets through which the cream flows inwardly, substantially as described.

2. The combination with a separator-bowl having suitable feed and discharge devices, of an internal shell arranged in the liquid-space of the bowl near the peripheral wall thereof, and having its outer surface composed of depressed portions and intervening ridges or elevations, which depressed portions approach the axis of the bowl from all directions and have at their innermost points outlets through which the cream flows inwardly, and a cover applied to the upper end of said shell and extending inwardly to a point near the cream zone, substantially as set forth.

3. The combination with a separator-bowl having suitable discharge devices, of an internal shell arranged in the liquid-space of the bowl near the peripheral wall thereof, and having its outer surface composed of depressed portions and intervening ridges or elevations, which depressed portions approach the axis of the bowl from all directions and have at their innermost points outlets through which the cream flows inwardly, a cover applied to the upper end of said shell and extending inwardly to a point near the cream zone, and a feed device delivering the milk into the upper portion of said shell, substantially as set forth.

4. The combination with a separator-bowl having discharge devices for the separated cream and skim-milk in its top, of a feed-pipe provided with an outwardly-extending delivery-pipe in the upper portion of the bowl, and an annular shield arranged in the upper portion of the bowl concentric with the latter and extending from the mouth of said delivery-pipe outwardly and upwardly toward the skim-milk zone and downwardly and inwardly toward the cream zone, substantially as set forth.

5. The combination with a separator-bowl having discharge devices for the separated cream and skim-milk in its top, of an internal shell arranged in the liquid-space of the bowl near the peripheral wall thereof, a feed-pipe provided with an outwardly-extending delivery-pipe within the upper portion of said shell, and an annular shield arranged within the upper portion of said shell and extending from the mouth of said delivery-pipe upwardly and outwardly toward the skim-milk zone, and downwardly and inwardly toward the cream zone and having at its upper end a passage through which partially-skimmed milk can flow upwardly and at its lower end a passage through which the cream flows upwardly, substantially as set forth.

Witness my hand this 26th day of March, 1896.

MATTHEW L. HOYT.

Witnesses:
EDWIN QUACKENBUSH,
E. J. BRIGGS.