C. D. HELLSTRÖM.

CENTRIFUGAL LIQUID SEPARATOR.

APPLICATION FILED DEC. 22, 1906. RENEWED FEB. 19, 1910.

954,958. **Patented Apr. 12, 1910.**

3 SHEETS—SHEET 1.

Fig: 1.

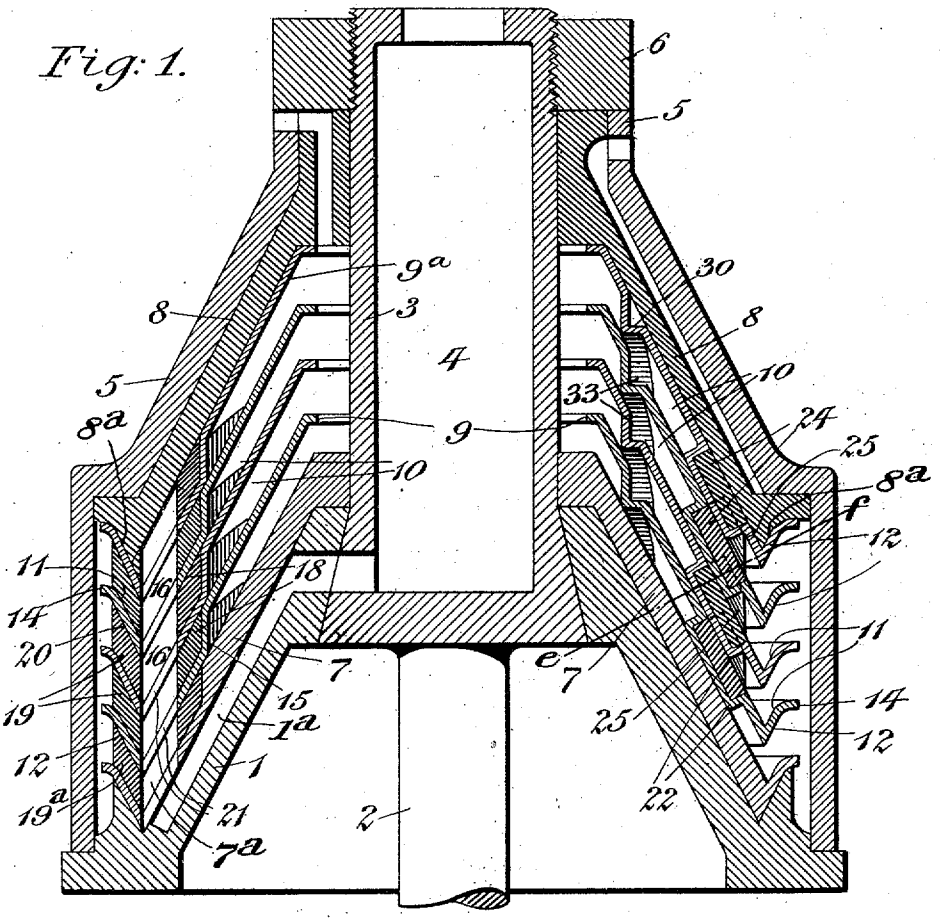


Fig: 5

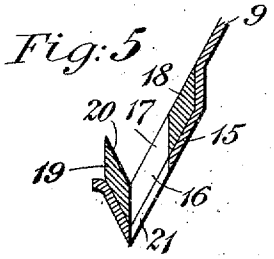


Fig: 3

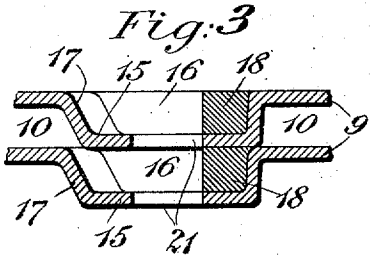
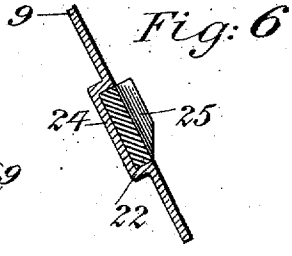


Fig: 6



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3 SHEETS—SHEET 2.

Fig: 2

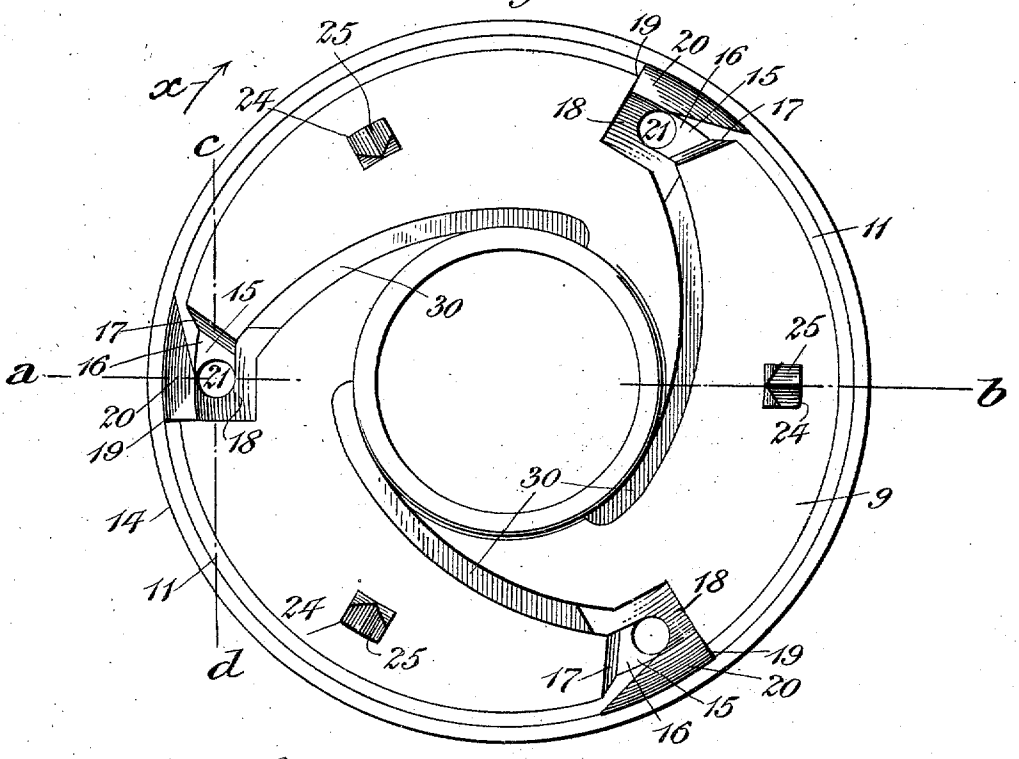


Fig: 4

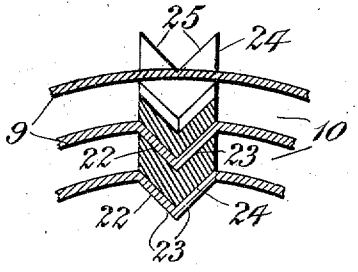


Fig: 7

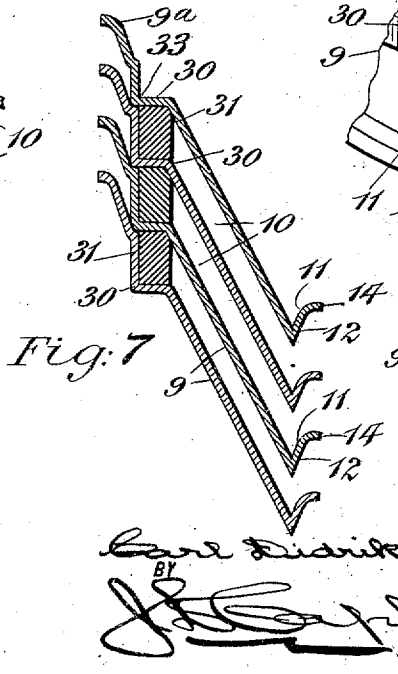


Fig: 8

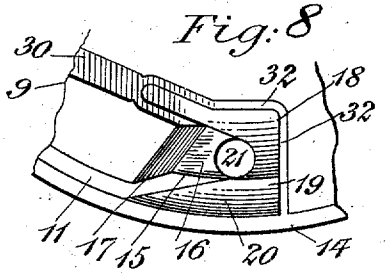
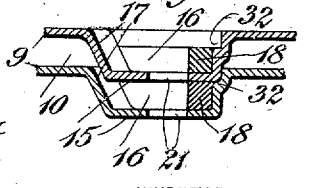


Fig: 9



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3 SHEETS—SHEET 3.

Fig. 10.

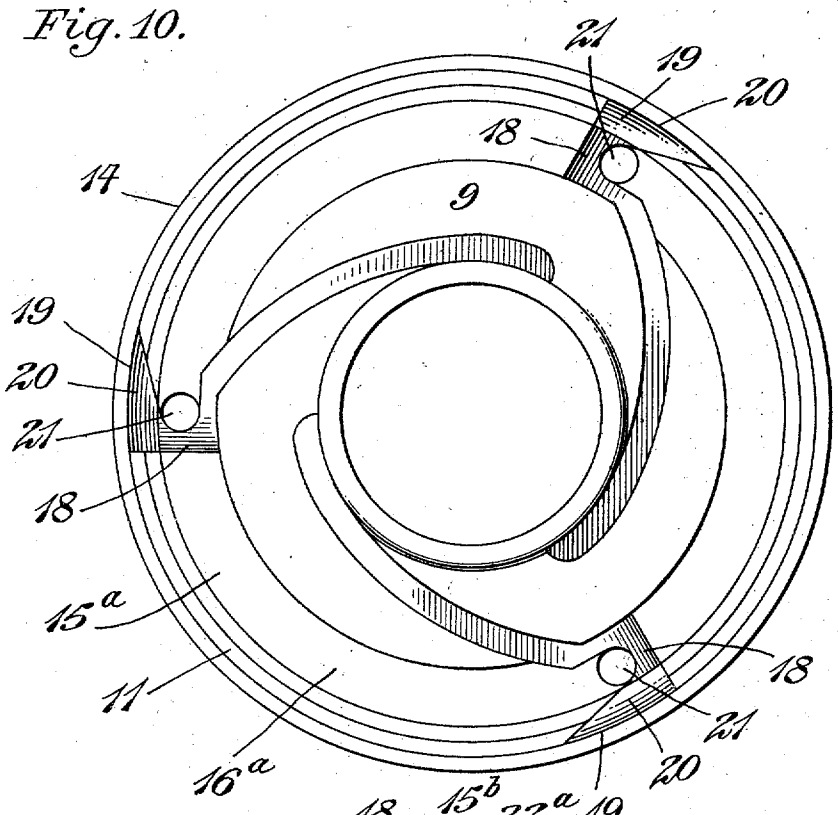
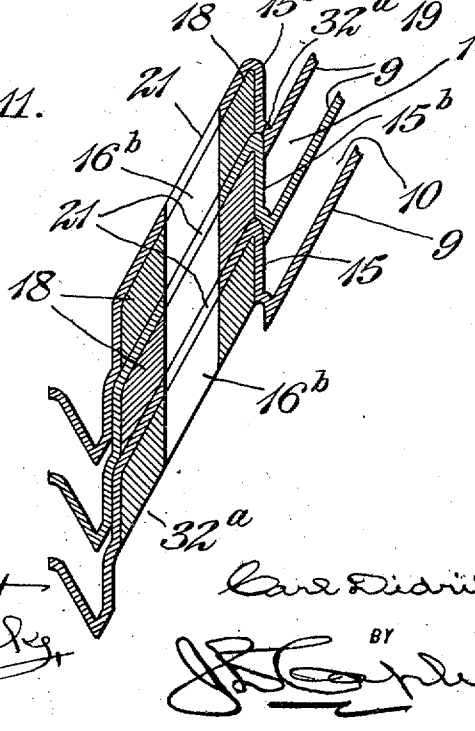


Fig. 11.



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CENTRIFUGAL LIQUID-SEPARATOR.

954,958. Specification of Letters Patent. Patented Apr. 12, 1910.

Application filed December 22, 1906, Serial No. 349,152. Renewed February 19, 1910. Serial No. 544,904.

To all whom it may concern:

Be it known that I, CARL DIDRIK HELLSTRÖM, a subject of the King of Sweden, and resident of Belgviken, Eskilstuna, in the Kingdom of Sweden, have invented certain new and useful Improvements in Centrifugal Liquid-Separators, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to certain improvements in liners for centrifugal separators, and more particularly in that class of such liners which comprise a plurality of superposed funnel-shaped plates spaced apart to produce between them narrow compartments for the passage of the liquid during the operation of the separator, and the object of the invention is to provide a liner of this general character of a simple and comparatively inexpensive nature, having a novel and improved arrangement of means for maintaining the liner plates in proper spaced relation and for preventing displacement or deformation thereof during use.

The invention consists in certain novel features of the construction, and combinations and arrangements of the several parts of the improved liner, whereby certain important advantages are attained, and the device is rendered simpler, less expensive, and otherwise better adapted and more convenient for use, all as will be hereinafter fully set forth.

The novel features of the invention will be carefully defined in the claims.

In order that my invention may be the better understood, I will now proceed to describe the same with relation to the accompanying drawings, wherein—

Figure 1 is a vertical section taken axially through a centrifugal separator drum, and showing a liner embodying my invention applied thereto for use, the plane of the section being indicated by the line *a*—*b* in Fig. 2; Fig. 2 is a plan view of one of the liner plates detached from the separator drum; Fig. 3 is an enlarged fragmentary sectional detail view taken through two of the liner plates in the plane indicated by the line *c*—*d* in Fig. 2, and illustrating certain features of construction which will be hereinafter referred to; Fig. 4 is another fragmentary sectional detail view, somewhat similar to Fig. 3, but taken in the plane indicated by the line *e*—*f* in Fig. 1, and illustrating other features of construction to be hereinafter referred to; Fig. 5 is a fragmentary sectional view taken through one edge of one of the liner plates, detached, and showing certain features of construction to be hereinafter referred to; Fig. 6 is a fragmentary sectional view taken through the sloping part of one of the liner plates, detached, and showing certain other features of construction; Fig. 7 is a fragmentary sectional detail view taken in the plane indicated by the line *a*—*b* in Fig. 2, and illustrating a modified formation of certain parts of the liner comprised in the present invention; Fig. 8 is a fragmentary plan view illustrating certain features of construction of the device shown in Fig. 9; Fig. 9 is a sectional detail view similar to Fig. 3, but illustrating a modified formation of the parts therein shown; Fig. 10 is a plan view similar to Fig. 2, but illustrating a modified formation of the liner plate, and—Fig. 11 is a fragmentary sectional view similar to Fig. 1, but illustrating another formation of the liner comprised in my present invention.

Referring first to Figs. 1 to 6, inclusive, 1 represents the base member of a centrifugal drum having an upright rotatory shaft 2, at the upper part of which is produced an enlargement or bearing portion 3, which is hollowed out as shown at 4 to produce a chamber at the axis of the drum to which the full milk is supplied. The drum is supplied with a removable cover 5, held in position by means of a nut 6 which has threaded engagement with the upper extremity of the bearing portion 3.

As herein shown the centrifugal drum is provided with bottom and top plates 7 and 8, between which the improved liner constructed according to my invention is securely clamped and held, said bottom and top plates being herein shown as formed from comparatively thick material, and having means for engagement with the liner plates to strengthen and retain the same in place, as will be hereinafter explained. It will be evident, however, that these plates may be omitted without departure from my invention and where desired, the bottom and top of the drum may be provided with means for engagement with the liner plates.

As shown in the drawings, the improved liner is formed from a plurality of super-

posed funnel-shaped plates 9, 9, formed from thin metal and arranged in the centrifugal drum and surrounding the axial bearing portion 3, said plates 9, 9, being spaced apart to produce between them narrow spaces or chambers 10, 10, adapted to be traversed by the milk during the use of the improved liner, and each of said plates 9, 9, is provided with an upturned and outwardly inclined annular flange or rim 11, extended around it and so shaped that its lower outwardly and upwardly inclined surface affords an annular shoulder or abutment 12, extended around such plate adjacent to its outer perimetral edge or margin. As herein shown, the flanges or rims 11, of the several funnel-shaped plates 9, 9, have their outer upper parts directed outwardly as seen at 14 to produce narrow beads which are adapted, when the liner is assembled within the drum, to contact upon the wall thereof, or upon ribs or projections produced thereon.

At certain points around its outer or perimetral part or at three equi-distant points, as herein shown, each of the funnel-shaped plates 9, 9 is provided with integral depressed portions, which afford chambers or recesses 16, 16 upon the top surfaces of said funnel shaped plates, and projecting members 15, 15 pendent beneath the under or lower surfaces of said plates 9, the said pendent supporting members 15, 15 thus produced being arranged to project as shown in Figs. 3 and 5, at such distances below the under or lower surfaces of said plates 9 as to be adapted, by contact upon the subjacent plates or parts, to support said plates in spaced relation, as clearly shown in Figs. 1 and 3. In each of the chambers or recesses 16, 16 thus produced at the top surfaces of the funnel shaped plates 9, 9 is secured, by soldering or otherwise, a filling piece or member 18 which, as clearly shown in Figs. 1, 2, and 5, has its top surface made flush with the top surface of the plate to which it is secured, and serves to fill the chamber or recess 16 wherein it is held from top to bottom so as to materially increase the strength and stiffness of the pendent projection or spacing member 15 produced at the lower or under surface of said plate by the bending of the metal downward to form such chamber or recess 16.

Each filling piece or member 18 has, adjacent to the upturned flange or bead 11 of the plate 9 to which it is secured, an integral upturned and outwardly directed projection or part 19, the under or outer surface of which is arranged to fit flush upon the inclined or tapered surface of said adjacent flange or bead 11 and the inner or upper beveled surface of which is arranged, when the plates are assembled, as shown in Fig. 1, to afford a shoulder or abutment 20 which is adapted for accurate contact upon the outer or lower beveled surface 12 of the flared or tapered marginal flange or bead 11 of the superjacent plate 9.

When the improved liner constructed according to my invention is arranged in the separator drum, as shown in Fig. 1, the lowermost funnel shaped plate 9 is rested upon the thickened bottom plate 7 at the lower part of the drum, being supported at a suitable elevation above said plate 7 by the engagement of its supporting or spacing members 15, 15 therewith, and having the lower or outer surfaces of its upturned flange or bead 11 engaged upon shoulders afforded by the tapered or beveled inner surfaces of upturned projections 19ª carried by the plate 7 and herein shown as made similar to the projections 19 of the filling members or pieces 18 of the respective plates 9. Where desired, as stated above, the plate 7 may be dispensed with, and the liner may be supported directly above the bottom of the separator drum.

Above the topmost plate of the liner, when within the separator drum, as shown in Fig. 1, is fitted the thickened top plate 8, which is provided with an inclined surface 8ª, which is adapted to conform and fit accurately against the inner or upper beveled surface of the marginal upturned and flared flange or rim 11 of said topmost plate, the filling members 18 of said topmost plate 9 being herein shown as unprovided with the upwardly and outwardly directed parts or projections 19 such as are provided upon the remainder of the plates 9 comprised in the liner.

In assembling the plates 9 within the separator drum, the spacing members 15, 15 are alined with each other parallel with the axis of the drum, and since each such member 15 has its lower surface engaged upon a filling member 18 of the subjacent plate, it will be seen that great strength is afforded, and the assembled structure is adapted to withstand, without liability of damage or derangement of its plates, such pressure as may be imposed thereon in securing the cover of the drum in position, and furthermore, since the outer edge portion of each plate has secure engagement upon the shoulders or abutment 20 afforded by the inner or upper beveled surfaces of the upturned projections 19 of the filling members, it will be seen that the several plates 9 are thereby prevented from slipping or springing laterally during the operation of the drum, so that bending or deformation of the thin metal plates is effectively avoided.

At the thickened portions of the plates afforded by the filling members 19, 19 secured within the chambers or recesses 16, 16, the several plates 9 of the improved liner are apertured, as seen at 21,

21 upon the drawings, and in assembling the plates within the separator drum, such apertures 21, 21 in the several superposed liner plates are alined with each other in directions parallel with the drum axis, to produce passages extended upwardly adjacent to the periphery of the liner as clearly shown at the left-hand side in Fig. 1, and which are adapted to receive the full milk supplied by way of a passage or passages 1^a produced in the lower part of the drum and having communication with said passages by way of apertures 7^a suitably formed in the thickened lower part 7.

At the forward side of each filling piece or member 19, with reference to the direction of rotation of the drum, as indicated by the arrow x, in Fig. 2, such filling piece 19 is cut away or notched out as clearly shown in Figs. 2 and 3, so that the full milk rising through the apertures 21, 21 at each vertical passage of the liner is permitted to flow freely from such passage into the forward end of each recess or chamber 16, and is permitted to escape from such chamber or recess into the space or compartment 10 between plates 9, 9 with which such chamber or recess 16 is in communication, and as shown in Figs. 2 and 3 the said forward ends of the chambers or recesses 16, 16 have upwardly inclined surfaces 17 which facilitate the flow of the full milk from said chambers or recesses to the spaces or compartments 10 between the several plates 9, 9 of the liner.

In addition to the engaging means above described which serve to maintain the liner plates in spaced relation and prevent the plates from being sprung or stretched out of shape during use of the separator, I have shown the liner plates provided with auxiliary engaging devices which serve to prevent turning of the plates relatively to each other during use, whereby the vertical passageways afforded at the openings 21, 21, might be occluded, and as shown in Figs. 1, 2, 4 and 6, said auxiliary engaging means comprises filling or spacing blocks or members 24, 24, of which three are provided at each plate 9, located at equi-distant points midway between the first mentioned engaging means, comprising blocks or members 18, 18.

The auxiliary filling or spacing blocks or members 24, 24, are securely held, by soldering or otherwise, in chambers or recesses afforded in the plates 9, 9 at points some distance above and within the marginal rims or flanges 11, 11 of said plates, the structure being such that the metal of each plate is depressed at each such chamber or recess, and thereby a projection is produced at the under-side of each plate 9 beneath such chamber or recess, as clearly shown at 22 on the drawings.

The depressions or chambers wherein the auxiliary filling or spacing blocks or members 24, 24 are held, are made V-shaped in cross section, so as to produce inclined or beveled surfaces or shoulders 23, 23 extended at angles to each other upon the opposite lower sides of the several projections 22, 22 produced upon the undersides of the liner plates by the formation of the above-named depressions or chambers therein, and the upper parts of said spacing blocks or members 24, 24 of the several liner plates excepting that which is uppermost, are extended upwardly above the upper conical surfaces of the corresponding liner plates, so as to form projections upon said upper conical surfaces of the liner plates, which projections are notched out to produce opposite inclined or beveled surfaces 25, 25 at angles to each other and adapted to conform to and fit flush upon the beveled or inclined surfaces 23, 23 of the respective projections 22, 22 upon the under surfaces of the liner plates. By this arrangement the projections 22 at the underside of each liner plate are adapted to contact upon and interlock with the corresponding projections at the upper side of the subjacent plate, so as to maintain the plates in spaced relation and to strengthen the structure to enable it the better to withstand crushing strains imposed in the direction of its axis, and since the interlocking inclined or beveled surfaces 23 and 25 of the several projections are extended in planes at angles to the direction of the rotatory movement applied to the liner during use, it will be seen that the several plates are prevented from shifting one upon the other, whereby the apertures 21, 21 are maintained in communication and are prevented from becoming closed or obstructed during the use of the device.

In connection with the spacing means above described I have shown the improved liner also provided with auxiliary spacing means, which as shown in Figs. 1 and 2 are in the form of spiral projections 30 extended along the undersides of the respective liner plates from the chambers or depressions 16, 16 adjacent to the peripheral parts of the plates upwardly and inwardly toward the central upper portions of the liner plates, each such spiral projection being produced, as herein shown, by an integral portion of the corresponding liner plate which is bent downwardly to produce such projection 30 at the under surface of the plate, a corresponding spiral channel 33 being produced in the upper surface of the plate, as clearly shown in Figs. 1 and 2. By this arrangement, the spiral projections 30 at the underside of each liner plate are adapted for contact upon the upper conical surface of the subjacent plate to hold the several plates of the liner in spaced relation and to afford

increased strength and stiffness such as is desirable for preventing deformation of the plates under the strains to which they are subjected during actual use. In some cases I have also found it desirable to provide spiral filling strips or members 31 extended in the spiral channels 33 produced upon the upper surfaces of the liner plates by the bending of the metal to form the spiral projections 30 at their undersides as above described. Such a construction is shown in the detail sectional view, Fig. 7, wherein said filling strips or members are arranged to project above the conical upper surfaces of the plates in position for accurate contact upon the spiral projections 30 of the superjacent liner plates.

In Fig. 9 I have shown a modified formation of the liner embodying my invention, wherein the pendent projection 15 upon the lower side of each liner plate is engaged within the upper enlarged portion 32 of the corresponding chamber or depression 16 in a subjacent liner plate in such a manner as to lock the plates against independent turning movement and thereby prevent them from shifting sufficiently to occlude or obstruct the apertures 16 during operation of the separator.

From the above description of my improvements, it will be obvious that the liner constructed according to my invention is of an extremely simple and comparatively inexpensive nature, and is particularly well adapted for use by reason of the strength and rigidity of its construction, and it will also be obvious from the above description that the device is susceptible of considerable change, within the scope of the appended claims without material departure from the principles and spirit of my invention, and for this reason I do not desire to be understood as limiting myself to the precise formation and arrangement of the several parts herein set forth in carrying out my invention in practice. For example, it is evident that the annular depressed portions of the liner plates may extend to a greater or less extent around the circumference of each plate and may even be made in annular formation as shown at 15^a in Fig. 10, so as to afford an annular channel 16^a extended around the peripheral portion of the plate, and the filling pieces or members 18 may be secured in said annular channel 16^a so as to extend across the same adjacent to each aperture 21. Or, if desired, the chambers or depressions may be produced in the lower surfaces of the plates, as shown at 16^b in Fig. 11, in which case integral parts of the plates which are upbent to produce said depressions or chambers will be caused to project above the upper conical surfaces of the plates as shown at 15^a, and may be engaged in enlargements 32^a of the depressions or chambers 16^a of adjacent plates so as to strengthen the structure and prevent the liner plates from turning relatively to each other during use.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A liner for centrifugal separators comprising a plurality of funnel-like plates adapted to be fitted one within the other in spaced relation, each such plate having one of its conical surfaces provided with a projection and its opposite conical surface provided with a shoulder adapted for engagement upon the projection of an adjacent plate at the side of such projection which is adjacent to the perimeter of the liner.

2. A liner for centrifugal separators comprising a plurality of funnel-like plates adapted to be fitted one within the other in spaced relation, each such plate having an integral depressed portion forming on one of its conical surfaces a projection and upon its opposite conical surface a chamber, and a filling member fixedly held within said chamber and adapted for engagement with the projection of an adjacent plate.

3. A liner for centrifugal separators comprising a plurality of funnel-like plates adapted to be fitted one within the other in spaced relation, each such plate having an integral depressed portion forming a projection at one conical surface of the plate and a chamber at the opposite surface thereof, and a filling block held within said chamber and provided with a shoulder adapted for engagement upon the projection of an adjacent plate at the side of such projection which is adjacent to the perimeter of the liner.

4. A liner for centrifugal separators comprising a plurality of funnel-like plates adapted to be fitted one within the other, each such plate having one of its conical surfaces provided with a projection adapted for engagement with an adjacent plate to hold the plates in spaced relation, the opposite conical surface of said plate having a depression produced in it opposite to said projection and an opening produced in the plate within said depression and adapted for the flow of fluid.

5. A liner for centrifugal separators comprising a plurality of funnel-like plates adapted to be fitted one within the other, each such plate having a projection extended outwardly beyond one of its conical surfaces and adapted for contact upon an adjacent plate to hold the plates in spaced relation, and provided with a depression produced in it opposite to said projection, said depression having one of its walls inclined from its lower to its upper part to facilitate the flow of the milk from said depression, and an opening extended through said projection

and adapted for the flow of fluid into said chamber.

6. A liner for centrifugal separators comprising a plurality of funnel-like plates adapted to be fitted one within the other, each such plate having an integral depressed portion forming a projection extended from one conical surface of the plate and adapted for contact upon an adjacent plate to hold the plates in spaced relation, the said depressed portion forming a chamber at the opposite conical surface of the plate, a filling block held within said chamber and a passage extended through the projection and said filling block and adapted for the flow of fluid from one surface of the plate to the other.

7. A liner for centrifugal separators comprising a plurality of funnel-like plates adapted to be fitted one within the other, each such plate being provided upon its upper convex surface with upwardly extended shoulders adapted for engagement with projections upon an adjacent plate at the sides of such projections which are nearest adjacent to the perimeter of the liner.

8. A liner for centrifugal separators comprising a plurality of funnel-like plates adapted to be fitted one within the other, the upper convex surface of each such plate being provided adjacent to its perimeter with upwardly directed shoulders, and the lower concave surface of each plate being provided with projections adapted for engagement against the inner surface of the shoulders of an adjacent plate to hold such plates in spaced relation.

9. A liner for centrifugal separators comprising a plurality of funnel-like plates adapted to be fitted one within the other, each such plate being provided with channels extended in spiral directions from its central portion toward its outer part, and filling members extended along the channels of the plate and forming spiral projections adapted for contact upon an adjacent plate to hold the plates in spaced relation.

10. A liner for centrifugal separators comprising a plurality of funnel like plates adapted to be fitted one within the other, each such plate having a plurality of channels extended spirally from its inner portion toward its outer part and having an integral depressed portion at the outer end of each such channel, said depressed portion forming upon one surface of the plate a projection adapted for contact with an adjacent plate to hold such plate in spaced relation and forming a chamber at the opposite surface of the plate, and communicating with the adjacent spiral channel, and filling members inserted in said chambers and provided with parts traversing the chambers adjacent thereto and projecting from the conical surface of the plate and adapted for contact with an adjacent plate.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

CARL DIDRIK HELLSTRÖM.

Witnesses:
CARL FRIBERG,
ROBERT APELGREN.