(No Model.)

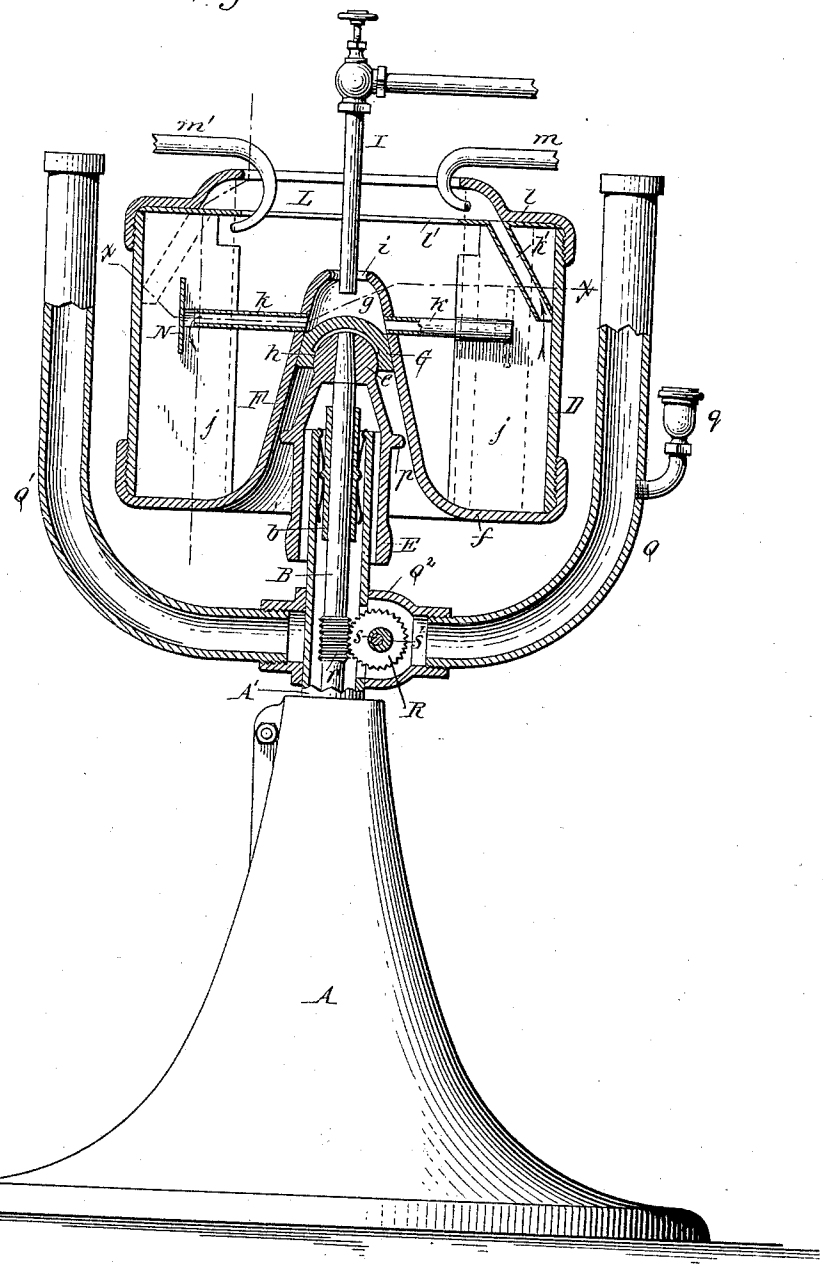
3 Sheets—Sheet 1.

F. HART.

CENTRIFUGAL SEPARATOR.

No. 436,419. Patented Sept. 16, 1890.

Fig. 1.



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Fig. 2.

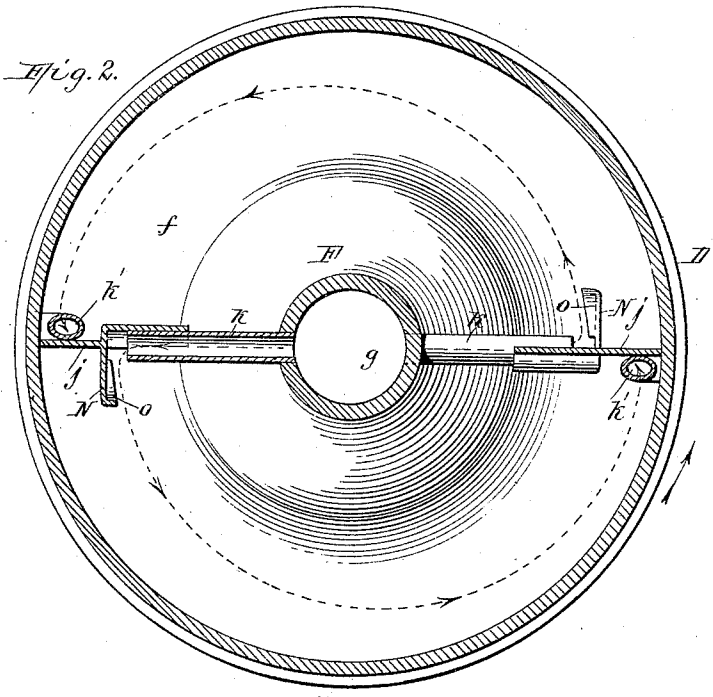


Fig. 3.

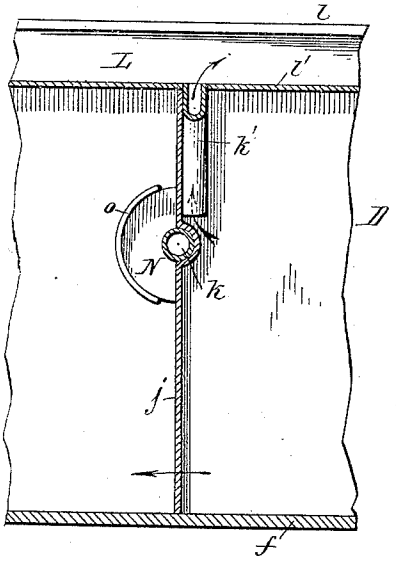


Fig. 4.

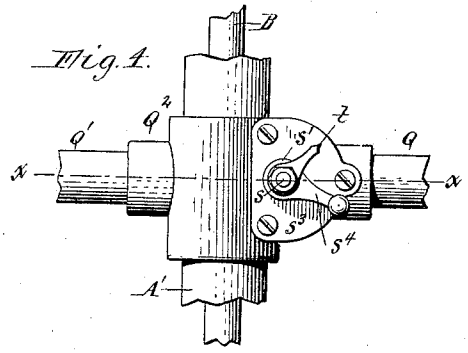
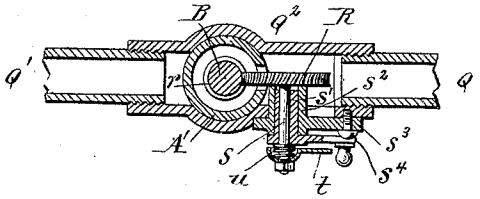


Fig. 5.



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(No Model.)

3 Sheets—Sheet 3.

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CENTRIFUGAL SEPARATOR.

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Fig. 6.

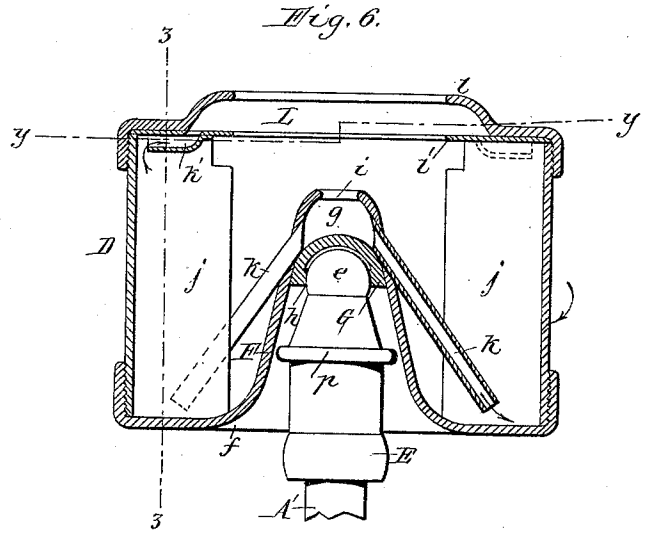


Fig. 7.

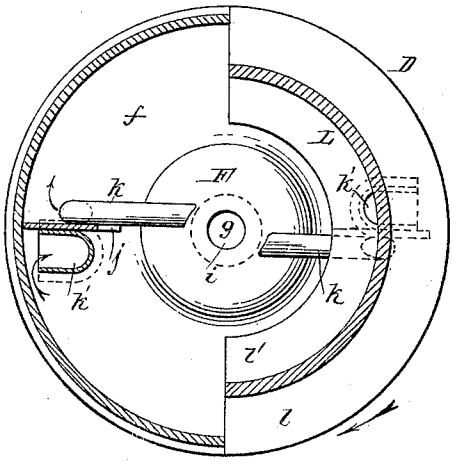
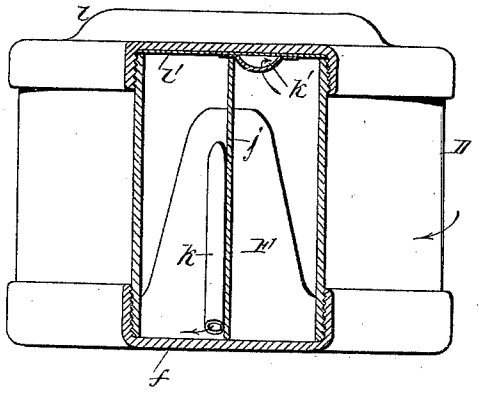


Fig. 8.



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UNITED STATES PATENT OFFICE.

FREDERICK HART, OF POUGHKEEPSIE, ASSIGNOR TO D. H. BURRELL & CO., OF LITTLE FALLS, NEW YORK.

CENTRIFUGAL SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 436,419, dated September 16, 1890.

Application filed July 5, 1889. Serial No. 316,545. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK HART, a subject of the Queen of England, residing at Poughkeepsie, in the county of Dutchess and State of New York, have invented a new and useful Improvement in Centrifugal Separators, of which the following is a specification.

This invention relates more particularly to that class of centrifugal separators which are employed for separating full-milk into cream and skim-milk.

My invention has for its objects to increase the separating capacity of the separating-drum, to improve the construction of the feed cup or receptacle and its discharge-pipes, and to provide the machine with a simple indicator for determining the speed of the separating-drum.

In the accompanying drawings, consisting of three sheets, Figure 1 is a sectional elevation of a centrifugal separator provided with my improvements. Fig. 2 is a horizontal section of the separating-drum in line *x x*, Fig. 1, on an enlarged scale. Fig. 3 is a fragmentary vertical section of the separating-drum, showing an interior view of the deflector at the mouth of each discharge-pipe of the feed-cup. Fig. 4 is an elevation of the portion of the machine in which the speed-indicator is arranged. Fig. 5 is a horizontal section, partly in elevation, in line *x x*, Fig. 4. Fig. 6 is a sectional elevation showing a modified construction of the feed and discharge pipes. Fig. 7 is a horizontal section in line *y y*, Fig. 6. Fig. 8 is a vertical section in line *z z*, Fig. 6, looking toward the axis of the drum.

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

A represents the base or pedestal of the machine, and A′ the hollow or tubular standard secured in the pedestal and projecting above the same.

B is the spindle arranged within the hollow standard and resting at its lower end in a step-bearing in the standard, its upper portion being sustained in a yielding bearing *b*, arranged in the upper portion of the standard, so as to give the spindle a limited lateral play to enable the separating-drum D to find its center of gravity.

E is a sleeve-pulley secured to the upper portion of the drum-spindle and surrounding the upper end of the tubular standard. The sleeve-pulley is provided at its upper end with a spherical knuckle *e*, in which the tapering shank of the drum-spindle is secured.

F represents the hollow central hub of the separating-drum extending from the bottom *f* upwardly into the drum, and G is a plug secured in the hub at a short distance below the apex thereof, so as to form a milk cup or receptacle *g* in the upper portion of the hollow hub or cone. The plug G is provided in its under side with a socket *h*, which fits loosely over the spherical knuckle of the spindle and forms a bearing which permits the drum to rock upon the spindle and balance itself thereon.

The construction of the milk-cup shown in the drawings is very simple and reduces the cost of manufacture, as the bottom of the separator and its central cone are formed by stamping or pressing it out of one piece of sheet metal by a pair of dies, and the bottom of the milk cup is formed by a separate plug, which is inserted into the cone from below.

I represents the feed-pipe, which enters the upper end of the feed-cup *g*, at the center thereof, through an opening *i* formed in the apex of the hollow hub F.

The separating-drum is divided into two or more independent separating-compartments by imperforate radial blades or partitions *j*, which extend from the top to the bottom of the drum and are tightly fitted against the top and bottom and the peripheral wall of the drum, so as to practically isolate the several compartments and prevent the milk from flowing from one compartment into another, except that one or both blades may be provided with a minute opening near the periphery of the drum to prevent unbalancing of the same. Each separating-compartment is provided with a separate inlet-pipe *k*, which is connected with the feed-cup *g* and delivers the full-milk at or near one end of the compartment, and with a separate discharge-pipe *k′*, arranged at or near the opposite end of the compartment, whereby the skim-milk is removed from the drum. The radial inlet-

pipes are preferably arranged horizontally, as shown in Fig. 1. L is the annular trough at the upper end of the drum, with which the discharge-pipes k' of the several separating-compartments are connected, and which is formed between the cover l of the drum and a horizontal diaphragm l', in the usual manner. m represents the skimming-pipe which removes the skim-milk from the annular trough L, and m' is the skimming-pipe by means of which cream is discharged from the drum. By dividing the separating-drum into a number of compartments in this manner and providing each with a separate inlet and discharge the path of the milk through the drum is shortened without reducing the separating action or effect, and the separating capacity of the drum is correspondingly increased.

In the drawings the drum is represented as being divided into two compartments; but, if desired, a greater number of compartments may be employed.

By thus arranging the several inlets for the full-milk equidistant circumferentially, the solid deposits which are formed against the peripheral wall of the drum near the mouths of the inlet-pipes are likewise arranged equidistant and the drum is kept in proper balance at all times.

If desired, the inlet-pipes may be inclined downwardly toward the lower end of the peripheral wall of the drum, as represented in Figs. 6, 7, and 8. This arrangement lengthens the path of the milk, as it causes the milk to pass vertically through the drum, as well as partly around the same; but such arrangement is less desirable than the horizontal arrangement illustrated in Fig. 1, because the centrifugal force tends to move the pipes from their inclined to a horizontal position, and the inclined pipes are therefore more liable to be broken and require a more secure fastening than the horizontal pipes.

Each blade or partition j is provided in its inner portion with a horizontal semi-cylindrical depression or indentation, in which the adjacent inlet-pipe k is secured, as represented in Figs. 2 and 3. By this construction the inlet-pipe is rigidly held in place, and the formation of crevices or narrow recesses between the pipe and the blade, in which dirt or other solid material is liable to lodge, is avoided.

Each blade is provided opposite the outer or discharge end of its inlet-pipe with a shield or deflector N, which causes the inflowing liquid to be spread or sprayed into a thin sheet as it enters the drum, thereby reducing the velocity of the inflowing milk and preventing it from disturbing the adjacent separated layers of cream and skim-milk. This deflector is preferably arranged on the front or advancing side of each blade and at a short distance outwardly from the end of the pipe, so as to allow the liquid to escape freely from the pipe. The deflectors or shields N are preferably arranged at right angles to the pipes, and are provided at their front edge with a dam or inwardly-projecting flange o, which is highest at the middle and decreases in height upwardly and downwardly, as represented in Fig. 2, so as to deflect the greater portion of the liquid upwardly and downwardly. The upper and lower ends of the dam terminate at a short distance from the upper and lower ends of the deflecting-plate N, so as to leave unobstructed open spaces at these points through which the liquid freely issues in a vertical direction. The portion of the liquid flowing horizontally over the widest central part of the dam is deflected by the latter concentrically with the adjacent zone of full-milk and prevented from moving across and mingling with the outer zone of separated skim-milk. The inlet-pipes extend so far outwardly in the drum that their discharge ends are arranged in the zone occupied by the material having about the same specific gravity as the inflowing milk, so as to avoid as much as possible the commingling of the entering full-milk with the separated layers of cream and skim-milk.

p represents an annular flange formed on the upper portion of the sleeve-pulley E, and said flange limits the rocking motion of the separating-drum by coming in contact with the inner surface of the hollow hub F, and thereby prevents the hub from striking the feed-pipe I and the drum from striking the skimming-pipes m m', and thus bending or otherwise injuring these pipes.

Q Q′ represent hollow arms connected at their lower ends to opposite sides of a casing Q^2, surrounding a portion of the hollow standard. These arms rise on opposite sides of the separating-drum, and one of them is provided with an oil-cup q.

r is a worm formed on the drum-spindle, and R is a worm-wheel arranged within the casing Q^2 and meshing with the worm r, the hollow standard A′ being provided with an opening, through which the worm-wheel projects inwardly. As represented in Figs. 1 and 5, this worm-wheel is secured to the inner end of a short horizontal shaft s, journaled eccentrically in a stud s', which is capable of turning in a bearing s^2, formed in the removable front plate s^3 of the casing Q^2. The outer end of the eccentric-stud projects beyond the bearing s^2, and is provided with a crank or arm s^4 for turning the stud.

t is a pointer or index-finger secured to the outer end of the shaft of the worm-wheel and traversing the outer face of the front plate s^3.

u represents a spiral spring surrounding the outer portion of the worm-wheel shaft and interposed between the inner side of the index-finger and the outer side of the crank-arm s^4. This spring holds the worm-wheel against the inner end of the bearing s^2 and the crank-arm against the outer end of said bearing, thereby maintaining a tight joint at these points, and thus preventing leakage.

In the position of the parts represented in the drawings the indicator is in gear with the drum-spindle, and the index-finger is caused to move slowly over the face of the front plate s^3 and indicate by its speed the speed of the drum, the actual speed of the drum being easily calculated when the number of revolutions is known which the spindle makes for each revolution of the index-finger. Upon swinging the rock-arm downwardly into a vertical position the eccentric-stud is caused to move the worm-wheel away from the spindle and throw it out of gear, while by swinging the arm into the position shown in the drawings the worm-wheel is moved into gear with worm.

In the arrangement of the parts represented in the drawings the parts are held in gear so long as the crank-arm is held in an elevated position, and upon releasing the crank-arm it falls by gravity and automatically throws the parts out of gear.

The hollow arms Q Q′ and connecting hollow parts are filled with oil to the top of the upper spindle-bearings. All of the interior parts of the indicator are by this construction inclosed and immersed in the bath of oil, whereby the parts are kept well lubricated and protected against dust and dirt. All parts of the indicator are carried by the removable front plate s^3, and it is therefore readily applied and removed.

I do not desire to claim in this application the construction of the yielding spindle-bearing herein shown, as the same is claimed in another application for Letters Patent, filed by me February 28, 1888, Serial No. 265,592.

I claim as my invention—

1. The combination, with the separating-drum having a raised hollow hub provided at its upper end with a central opening, of a detached plug inserted into the hollow hub below its upper end to form a feed-cup of which said plug constitutes the bottom, substantially as set forth.

2. The combination, with the separating-drum, of imperforate blades or partitions fitted tightly against the top, bottom, and peripheral wall of the drum, whereby the drum is divided into independent compartments, separate inlet-pipes, each opening into one of said compartments, and separate outlet-pipes for the skim-milk, each starting from one of said compartments, substantially as set forth.

3. The combination, with the separating-drum, of imperforate blades or partitions fitted tightly against the top, bottom, and peripheral wall of the drum, whereby the drum is divided into independent compartments, a central feed-cup, inlet-pipes connected with the feed-cup equidistant circumferentially and each opening into one of said compartments, and separate skim-milk discharge-pipes, each starting from one of said compartments, the inlet-pipe of each compartment being arranged adjacent to one blade and the discharge-pipe adjacent to the other blade of the same compartment, substantially as set forth.

4. The combination, with the separating-drum, of an inlet-pipe whereby the liquid is delivered toward the peripheral wall of the drum, and a deflecting-plate arranged across the discharge end of said pipe between the latter and the inner side of the drum, whereby the milk is prevented from passing directly against the inner side of the drum, substantially as set forth.

5. The combination, with the separating-drum, of an inlet-pipe whereby the liquid is delivered toward the peripheral wall of the drum, and a deflecting-plate arranged across the mouth of said pipe and provided with a marginal dam or deflecting-rib, substantially as set forth.

6. The combination, with the separating-drum, of an inlet-pipe whereby the liquid is delivered toward the peripheral wall of the drum, and a deflecting-plate arranged across the mouth of said pipe and provided with a marginal dam which is highest at the middle and diminishes in height upwardly and downwardly, substantially as set forth.

7. The combination, with a separating-drum, of a blade or partition arranged therein and provided with a groove or indentation, and an inlet-pipe seated in said groove or indentation, substantially as set forth.

8. The combination, with the separating-drum having a radial blade or partition, of an inlet-pipe resting against the side of the partition, and a deflecting-plate secured to said blade across the mouth of the inlet-pipe, substantially as set forth.

9. The combination, with the spindle and the separating-drum having a hollow hub and resting upon the spindle, of a sleeve-pulley mounted on the spindle and provided with a flange or rim which limits the rocking movement of the drum, substantially as set forth.

10. The combination, with the hollow frame of the machine provided with an oil-inlet, the separating-drum, and its spindle, of a speed-indicator connected with the spindle and having its internal parts arranged within the hollow frame of the machine and immersed in the oil-bath, substantially as set forth.

Witness my hand this 1st day of July, 1889.

FREDERICK HART.

Witnesses:

F. W. DAVIS,

GEO. H. SHERMAN.