(No Model.)

C. A. BACKSTROM.

CENTRIFUGAL LIQUID SEPARATOR.

No. 355,050. Patented Dec. 28, 1886.

Fig. 1.

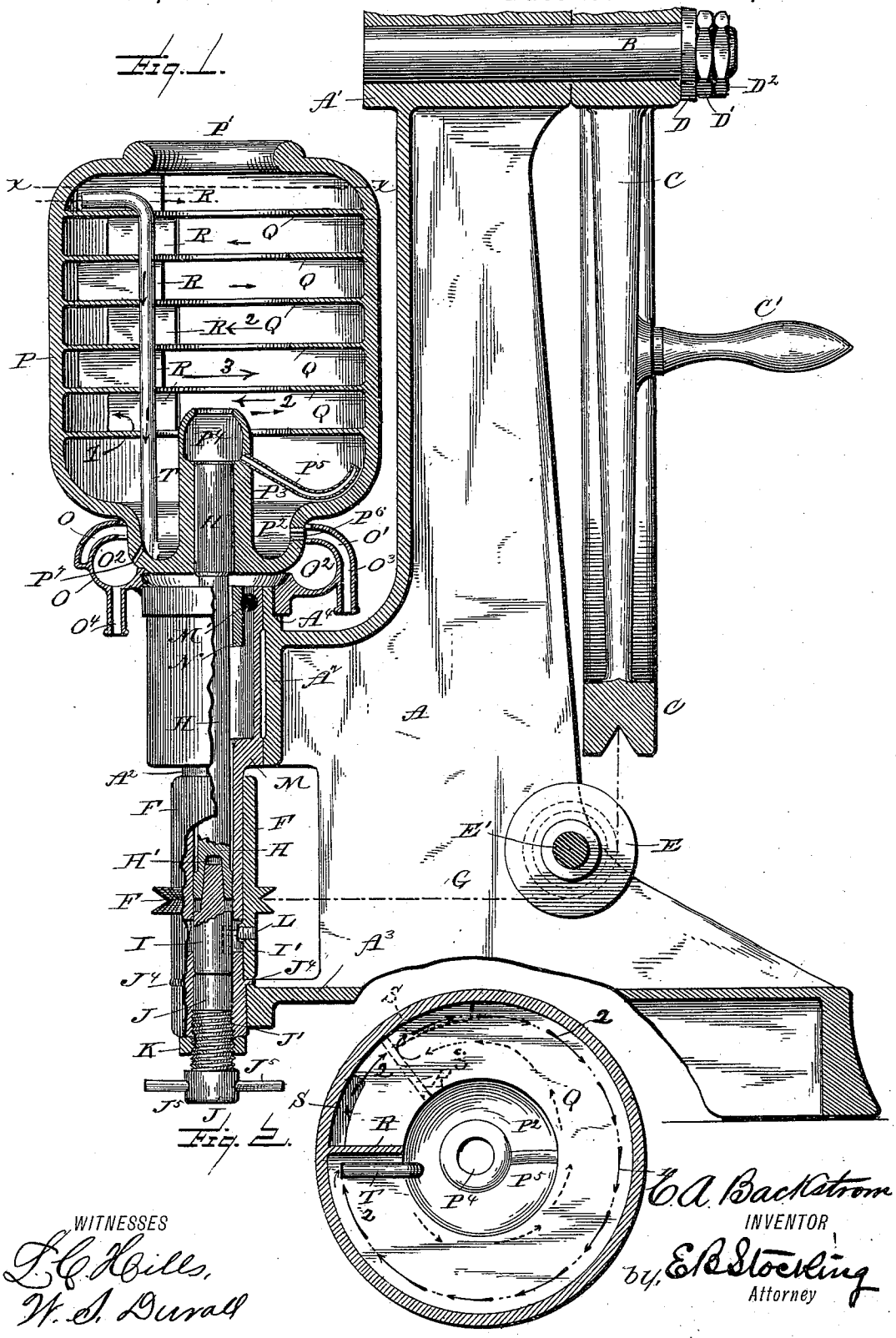

Fig. 2.

WITNESSES

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CENTRIFUGAL LIQUID-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 355,050, dated December 28, 1886.

Application filed September 18, 1886. Serial No. 213,866. (No model.)

To all whom it may concern:

Be it known that I, C. AXEL BACKSTROM, a citizen of the United States, residing at Trenton, in the county of Mercer, State of New Jersey, 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 has relation to centrifugal machines for separating a liquid into its constituent elements in accordance with the different specific gravity of each; and the object of the invention is to accomplish this result with a minimum speed of rotation of the separating-chamber of the machine.

Although hereinafter described in connection with the operation of creaming milk, it is apparent that the invention is useful in separating other liquids and similar substances.

Heretofore it has been the aim to construct centrifugal machines of such weight and proportions and with such a disposition of the material thereof as to withstand exceedingly high speeds of rotation—such as, for example, eight thousand revolutions per minute, or even higher—the machines themselves weighing from a thousand pounds upward, and in many instances being provided with a strong cylindrical jacket inclosing the separating chamber as a guard against injury from the flying fragments of the chamber when broken by the action of an enormous centrifugal force.

I have, by an invention disclosed in a pending application, No. 193,725, produced a machine wherein the speed of rotation required is reduced about one-half, and yet, even with such a reduced speed, the product of the machine is doubled, while the separating-chamber thereof is subjected to a diametrical distention when in operation which is clearly perceptible. In this invention I have attained a further reduction in the speed of rotation required, which enables me to place upon the market for the use of the public a machine which can be operated by hand, in contradistinction to machines requiring steam, water, or other power for running the same. The advantages accompanying this result include a reduction in first cost by the reduced amount of material in the machine and its portability, and in the fact that each dairyman may own and operate his own machine, and thus avoid the necessity of carting and transporting his milk to a more or less distant creamery.

Other objects and advantages of the invention will appear in the following description, and the novel features thereof will be particularly pointed out in the claims.

Referring to the drawings, Figure 1 is a substantially central vertical section, with portions in elevation, of a machine constructed in accordance with my invention. Fig. 2 is a horizontal section on the line X of Fig. 1.

Like letters refer to like parts in all the figures of the drawings.

A is a suitable frame-work, having three principal bearings, A' A^2 A^3, for the driving-shaft, spindle, and spindle-step, respectively, of the machine. Upon the stud B, rigidly mounted in the bearing A', is a driving-wheel, C, which is maintained in position by a washer, D, nut D', and set-nut D^2, whereby the wheel may be revolved on the stud by means of the handle C', secured in a spoke of the wheel. A belt or band passes from the driving-wheel around pulleys E, (one only is shown,) mounted upon a cross-shaft, E', arranged in the base, and around a pulley, F, connected with the spindle of the machine, the arrangement of the belt being shown by the dotted line G.

H represents the spindle of the machine, which, by means of a conical socket, H', is seated upon a spindle-section, I, adapted to fit the socket and to drive the spindle by friction. The section I rests upon a step, J, screw-threaded into a bushing, J', which rests in the bearing A^3 and upon the upper surface thereof by means of a flange, J^4. A jam-nut, K, serves to maintain the step in an adjusted position within the bushing, the lower end of the step being provided with a rod, J^5, which serves for the purpose of turning the same within the bushing to elevate or depress it. The section I is slotted longitudinally, as shown by dotted lines I', to receive a screw, L, projecting from the elongated hub F'' of the pulley F, whereby the rotation of the pulley causes the section I and spindle H to revolve. In the bearing A^2 there is mounted a shell, M, at the upper end of which is arranged a rubber ring or packing, M', and within the ring

is secured a box, N, which is bored larger than the spindle H. The upper end of the bearing A^2 is provided with a shoulder, A^4, upon which is mounted the receiving and discharging bowl O of the machine. This bowl is provided with an upper compartment, O′, and a lower compartment, O^2, the former having the discharge-pipe O^3 and the latter the discharge-pipe O^4.

P represents the separating chamber or drum of the machine, and although it may be made in separate pieces, it is herein shown as a single casting, having an opening, P′, in its upper end, a depressed neck or basin, P^2, at its lower end, in the center of which is the hub P^3, by which the chamber is mounted on the spindle H, and upon the upper end of the hub a milk-receiving bowl, P^4, and a series of shelves, Q, which are annular—that is, projecting from the inner wall toward the center of the chamber. Between the shelves, and between the upper shelf and the upper wall of the chamber, are arranged partitions R. The relative arrangement of the partitions is such that, counting from the upper one, the first, third, fifth, &c., of the partitions R are arranged over each other, while the second, fourth, sixth, &c., are arranged over each other, but in a different vertical plane. The first, third, fifth, &c., shelves have an opening, S, extending from the partition and located at the inner wall of the chamber, while the second, fourth, sixth, &c., shelves have similar openings, S. In Fig. 2 the first shelf, partition, and opening are shown in full lines, while the second partition and opening are shown in dotted lines. A pipe, P^5, extends from the supply-bowl P^4 into and toward the periphery or inner wall of the chamber below the bottom shelf Q, toward which the delivery end of the pipe is bent. A pipe, T, extends from the bottom of the bowl P^2 or neck of the chamber vertically to, over, and nearly across the top shelf Q.

This being the construction, the operation is as follows: A pipe from any suitable source of supply is arranged to deliver milk continuously and in a suitable quantity into the bowl P^4, from which it is delivered from the pipe P^5 into the lower part of the chamber. Centrifugal action now throws the milk toward the wall of the chamber, while the cream forms in an annular body inside of the milk and falls by gravity alone, and is delivered through the opening P^6 into the cream-discharge pipe O^3, which delivers it into any suitable receptacle. In this lower part of the chamber a partial separation of the cream is accomplished, and the cream separated is immediately discharged. As the milk increases in quantity it makes its way through the opening S of the lower shelf to and upon the upper surface thereof. When coming in contact with the partition R thereon, its course is changed, as shown by arrow 1, and it takes the direction upon that shelf indicated in Fig. 1 by the arrow 2, when it is again subjected to the action of centrifugal force, which brings the cream toward the center in an annular body, when the cream falls by gravity alone, and, joining the annular body of cream in the compartment below the shelf, is with it directly discharged, as described. As the milk increases it again passes upwardly through the opening S of the next shelf above in the direction of arrow 3, Fig. 1, and separation of cream again takes place, as described, and so on continuously until the upper shelf of the series is reached, when the milk, being near the periphery or inner wall of the chamber, traverses the upper shelf, as shown by the solid arrows 2 of Fig. 2, and enters the pipe T, down which it passes to and through an opening, P^7, in the neck of the chamber and into the chamber O^2 of the receiving-bowl, from which it is discharged through the pipe O^4 into any suitable receptacle. By this operation there are substantially repeated subjections of specified quantities of milk to the action of centrifugal force, whereby such cream therein which is not separated in the lower compartment of the chamber is separated or partially separated in the next upper compartment, and such cream as still may remain in the milk is separated or partially separated in the next upper compartment, and so on throughout the entire series of compartments in the chamber. In other words, by the construction and operation of my invention as disclosed herein, I subject a number of small quantities of milk separately to the action of centrifugal force, and, by reason of a change of direction in the course of the milk when separated into said small quantities, each separate quantity is retained for a comparatively longer time under the action of centrifugal force. Therefore it will be seen that I accomplish a practically perfect separation of the milk by the centrifugal force produced by a minimum speed of rotation, and thus reduce the operation within and subject to the capacity of a machine capable of being run by hand.

I do not herein broadly claim a separating-chamber having shelves provided with passages at their outer edges and partitions between the shelves, as that is disclosed in a pending application filed by me No. 209,035.

It is apparent that the number of shelves in the separating-vessel may be changed at will. The essential features of construction and operation of my invention in this instance consist not only in the provisions of shelves and partitions, but in providing means which operate to subject separate quantities of the milk to centrifugal force, and to immediately deliver the cream separated, so that it shall not again be liable to admixture with the milk. Furthermore, the milk after each separation is again subjected to the operation of the machine, and is finally separately discharged therefrom principally by the action of gravity.

Having described my invention and its operation, what I claim is—

1. In a centrifugal machine, a separating chamber or drum provided with shelves, each

having a single slot, and each joining the inner wall of the chamber, and with partitions, and a supply-bowl for delivering the milk beneath the lower shelf, and a discharge-pipe communicating only with the upper shelf of the chamber and with the bottom of the chamber or drum, substantially as specified.

2. A separating chamber or drum provided with annular shelves, each joining the inner wall of the chamber and having a single slot, partitions arranged between successive shelves, a supply-pipe terminating beneath the lowest shelf, and a discharge-pipe extending from and communicating with only the upper shelf and with the bottom of the chamber or drum, substantially as specified.

3. A separating-vessel having a depending neek or cream-bowl provided with a discharge-opening in a side wall of the neck, a supply-bowl and delivery-pipe therefor, a series of shelves arranged above the supply-pipe and slotted and partitioned, as described, and a discharge-pipe extending from near the inner wall of the chamber and above the upper shelf thereof to and communicating with an opening in the neck of the chamber, substantially as specified.

4. In a separating chamber or drum, the combination, with the annular shelves Q, having a single slot, as at S, and joining the inner wall of the chamber or drum, of the partitions R, arranged between the slots of adjacent shelves, as described, substantially as specified.

5. In a separating-vessel, the combination of a series of shelves, Q, each provided with a slot, S, a series of partitions, R, arranged between the slots, and a discharge-pipe, T, arranged over the upper shelf of the series and extending downwardly along the inner edges of the shelves and communicating with a discharge-opening of the vessel, substantially as specified.

6. The separating-chamber P, having the opening P′, the contracted depending neck P^2, the hub P^3, and the supply-bowl P^4, formed thereon, substantially as specified.

7. The chamber P, having the depending neck P^2, hub P^3, supply-bowl P^4, shelves Q, and partitions R, in combination with the receiving-bowl O, having the chambers O′ O^2, and discharge-pipes O^3 O^4, substantially as specified.

8. The frame A, having the bearings A′, A^2, and A^3, and the hand driving-wheel C, in combination with the spindle H and pulley F, the removable milk and cream receiving bowl O, mounted on the bearing A^2, and the separating-chamber P, having the shelves Q, the supply-bowl P^4, and the discharge-pipe P^5, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

C. AXEL BACKSTROM.

Witnesses:
JOHN C. DISBROW,
E. D. SHEPARD.