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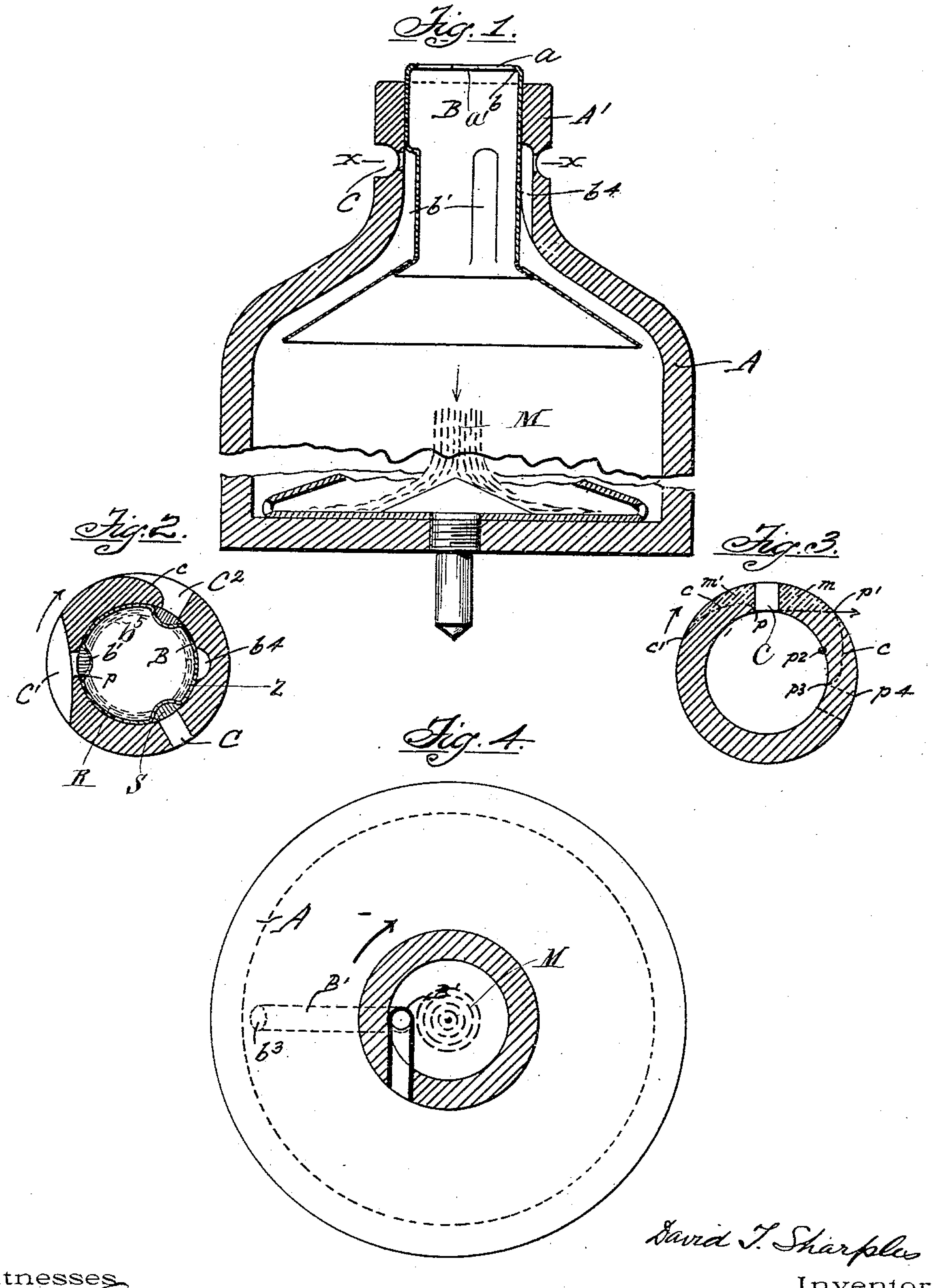
D. T. SHARPLES.

CENTRIFUGAL CREAM SEPARATOR.

(Application filed July 7, 1897.)

(No Model.)



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CENTRIFUGAL CREAM-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 620,722, dated March 7, 1899.

Application filed July 7, 1897. Serial No. 643,685. (No model.)

To all whom it may concern:

Be it known that I, DAVID T. SHARPLES, a citizen of the United States, residing at Elgin, county of Kane, State of Illinois, have invented certain Improvements in Centrifugal Separators, of which the following is a specification.

My invention relates particularly to centrifugal liquid-separators such as are largely used for separating cream from milk. In these machines it is very desirable that the separated liquids shall be discharged from the rapidly-rotating vessel with as little velocity as possible, for not only is a considerable amount of power wasted by discharging the liquid with unnecessary velocity, but other disadvantages result from it, among them the liability of injuring the quality of the discharged liquid, such as cream.

The main object of my present improvements is to secure a minimum velocity of discharge for a given speed of rotation, and in order to secure this result I have so arranged the outlets from the vessel as to make the discharge approximately tangential to the inner-wall surface, notwithstanding that the discharging liquid is passed through said wall, and I have also provided an improved construction of conduits within the bowl whereby I am enabled to reduce the diameter of this inner wall and utilize for the purpose of separating all except the least possible space at the center of the vessel.

Figure 1 is a sectional elevation of a centrifugal machine embodying my improvements. Fig. 2 is a cross-sectional view taken on the line x x of Fig. 1. Fig. 3 is a similar cross-sectional view used to illustrate the principle involved in my improved form of outlet. Fig. 4 is a cross-sectional view similar to Fig. 2, but showing an ordinary milk-tube arranged to discharge in the improved manner described.

A represents the body of an ordinary centrifugal vessel, having a neck A′ with a central inlet or feed-opening a of smaller diameter than the interior of the neck, thus forming a circular shoulder b. This vessel is mounted and rotated in any suitable manner. A stream of milk M is continuously admitted through the feed-opening a and under the influence of centrifugal action fills the bowl except near the center of rotation, where it forms a cylindrical wall of a diameter somewhat larger than that of the feed-opening a, the circular shoulder b serving to confine the liquid which rises in the neck of the vessel.

In the construction shown the skim-milk during the operation of the machine is discharged through the openings C in the wall of the vessel, which openings communicate with the enlarged interior of the vessel, while the cream being crowded nearer the center is allowed either to discharge over the top, as in Fig. 1, where a notch a' is provided in the circular shoulder b to localize the overflow, or below the top through an opening in the wall similar to the skim-milk outlet, both of which methods are in common use. These outlets through the wall ordinarily extend in a radial direction through its thickness, as shown at C, Figs. 2 and 3, and in Fig. 3 I have indicated the effect of such openings or passages through the wall upon the liquid which is discharged through them. Assuming the vessel to rotate in the direction indicated by the arrow, any liquid which reaches the outlet C will tend to fly off at a tangent to the point p in the direction pp'. At first sight it would appear that the metal m in front of the outlet C would obstruct this tangential discharge, but owing to the rotary movement of the vessel this is not the case, for if the discharged liquid were free to flow in the direction p p' then if it is assumed that it lose none of its initial velocity by the time that a particle of the liquid starting at p reached the point p' the point p of the vessel would have traveled an equal distance, or to p^2; but in fact the particle will have lost some of its initial velocity if allowed to move freely to p', and consequently the point p will really have traveled to a point p^3 beyond p^2 and the outlet C would have reached the position indicated by dotted lines. It is obvious, therefore, that the particle of liquid assumed to reach the point p' would really have been carried onward while passing through the radial outlet C and would actually leave the vessel at p^4 with a velocity considerably greater than that at which it entered the outlet at p. In order to avoid this increase of velocity in passing through the wall of the vessel, I have, therefore, concluded that the metal m' lying to the rear of the point p, at which the discharging liquid enters the outlet, should be cut away, so as to avoid any interference with the free flow of this liquid in the tangential line pp', or, in other words, that the rear face of the outlet relative to the motion of the vessel should be shaped approximately as indicated by the line c, so that the particle of liquid starting at p, at or near the inner wall, may have reached the point p' in the tangential line before the point c' of the outlet would get to the same place in its rotary motion. If this is done, it is evident that the velocity of the discharging liquid is merely that due to the distance of the point p from the center of rotation and that it is not affected by the greater velocity of the exterior wall of the vessel, as I have shown to be the case with the forms of outlets heretofore used, and as these vessels are rotated in some cases at a speed of twenty-five thousand revolutions per minute the decrease in velocity of discharge effected by my improved form of outlet is very considerable and the resulting benefits are important.

I have found it most convenient and satisfactory in practice to form my improved outlet by means of a cutting-tool arranged to cut away the rear metal m' approximately at a tangent to the inner edge p of the outlet, and in doing this the metal m is also naturally cut away, as shown at C', Fig. 3, though this is not necessary to allow the free escape of the liquid, the latter, as already explained, crossing the thickness of the wall in a rearward direction, as indicated by the line c of outlet C^2, Fig. 2. In Fig. 4 an ordinary skim-milk tube B' is represented as extending from b^3 near the outer wall of the vessel up into the neck and through the wall of the latter. Instead of passing through this wall radially, however, in my improved construction it passes through in a rearward direction, as shown, thus providing an equivalent outlet to those shown at C' and C^2 of Fig. 2.

By means of my improved form of outlet above described I am enabled to discharge the escaping liquid at about the velocity of the interior wall of the neck instead of that of the exterior wall. In order that the diameter of this inner wall may be reduced, thereby still further reducing the velocity of discharge, I have provided an improved arrangement of passage-ways or conduits within the vessel by which to conduct the separated liquids to the discharge-outlets. Instead of employing a single small pipe extending from each of the skim-milk outlets to the largest diameter of the vessel, as indicated in Fig. 4, I preferably use a piece of thin tubing B of an exterior diameter adapted to fit in the bore of the neck of the vessel. Longitudinal depressions or grooves b' are provided in the tube, one for each outlet, by pressing the metal inward, so as to form a corrugated cross-section, as indicated. The lower end of this tube is provided with a flaring extension toward the outer wall of the vessel, forming a partition, above which the skim-milk from the outer wall of the vessel passes through the grooves b' to the outlets C. The cream rises within the tube through the longitudinal passage-ways b^5, formed between the inwardly-pressed metal at b' b', a sufficient thickness of cream-wall being maintained, as shown, by inwardly flanging the tubing at the top, as already mentioned, to form the usual overhanging shoulder b. It may be discharged over the top, as indicated, or through the wall of the neck, as preferred. This construction enables me to provide conduits of ample size for the passage of the skim-milk with a minimum projection of the conduit-wall toward the center of the vessel, the skim-milk conduit-wall being formed partly by the neck of the vessel and partly by the inwardly-pressed metal of the tube at b', thus leaving as large a clear central space as is possible with a given diameter of neck for the free admission of the stream of inflowing milk. The cream passage-ways b^5, located between the skim-milk conduits b' and within the tube instead of outside it, extend to practically the same distance from the center of rotation as do the skim-milk conduits b' outside the tube, so that both cream and milk rise in the same zone or belt 2, Fig. 2, the section of cream being indicated by the dotted circles at R and the skim-milk by the radially-lined sections S.

What I claim is—

1. A centrifugal liquid-separator vessel having a discharge-outlet extending in a rearward direction through the thickness of the wall thereof, to facilitate the discharge of liquid from the rotating vessel.

2. A centrifugal-separator vessel having a discharge-outlet through the wall thereof, the thickness of the wall being reduced exteriorly at said outlet substantially as and for the purpose set forth.

3. A centrifugal-separator vessel having a neck and a tubing fitted therein, said tubing being corrugated or grooved to form separate passage-ways for the cream and skim-milk respectively, the former being within the tubing and the latter outside the same and all extending into the same zone or belt of liquid substantially as described.

4. A centrifugal-separator vessel having a neck and tubing fitted therein, said tubing being corrugated or grooved to form separate passage-ways extending into the same zone or belt of liquid, for the cream and milk respectively, and having an inwardly-flanged top to retain the cream and a flaring bottom substantially as described.

5. A centrifugal-separator vessel having a neck provided with separate passage-ways communicating respectively with the cream and skim-milk zones of the enlarged body of the vessel said skim-milk passage-way in the neck extending into the cream zone or belt, and a discharge-outlet from said passage-way extending in a rearward direction through the thickness of the neck-wall substantially as set forth.

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

DAVID T. SHARPLES.

Witnesses:
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