(No Model.) 2 Sheets—Sheet 1.

P. M. & D. T. SHARPLES.

CENTRIFUGAL SEPARATOR.

No. 442,461. Patented Dec. 9, 1890.

FIG. 1.

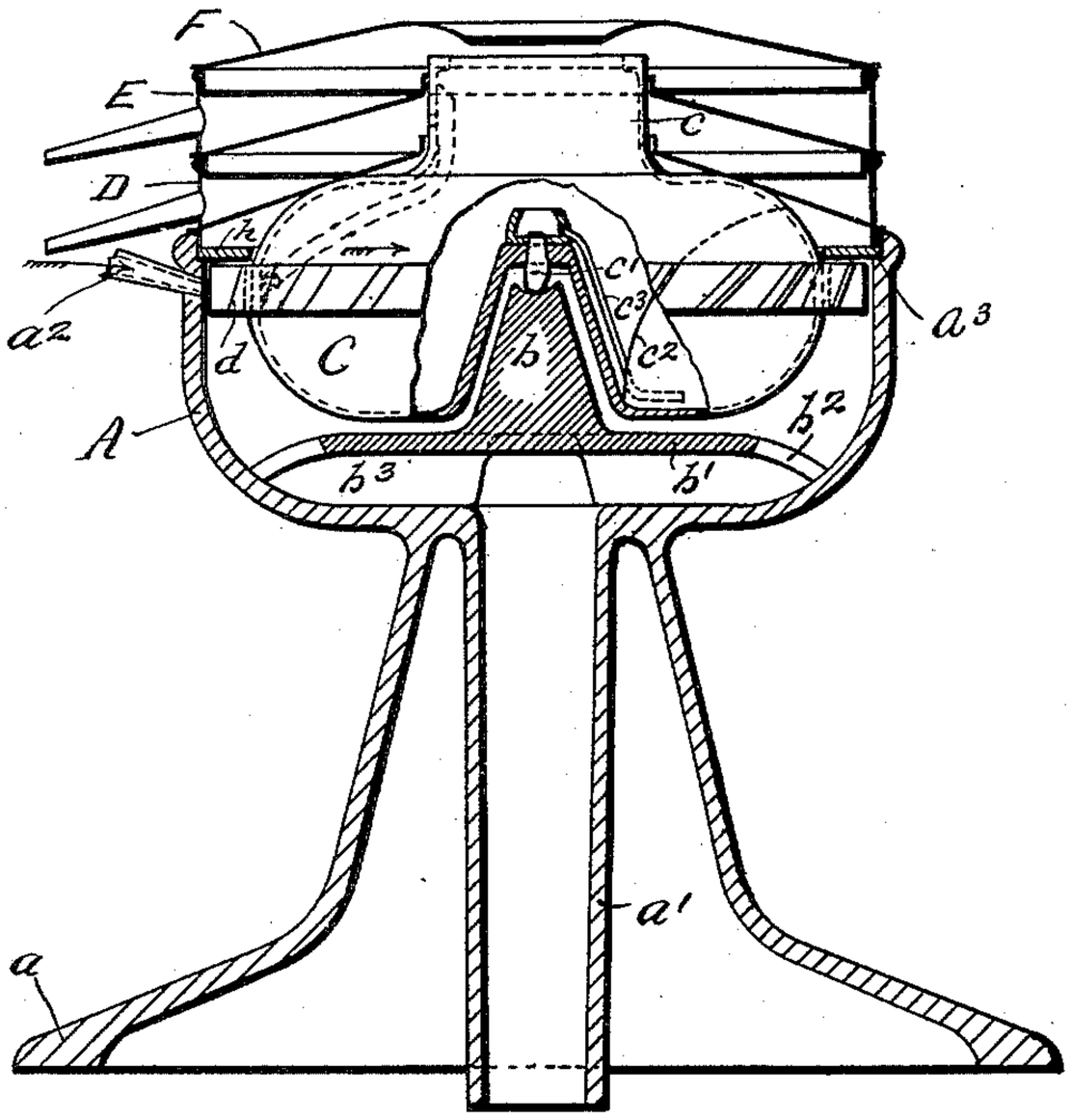
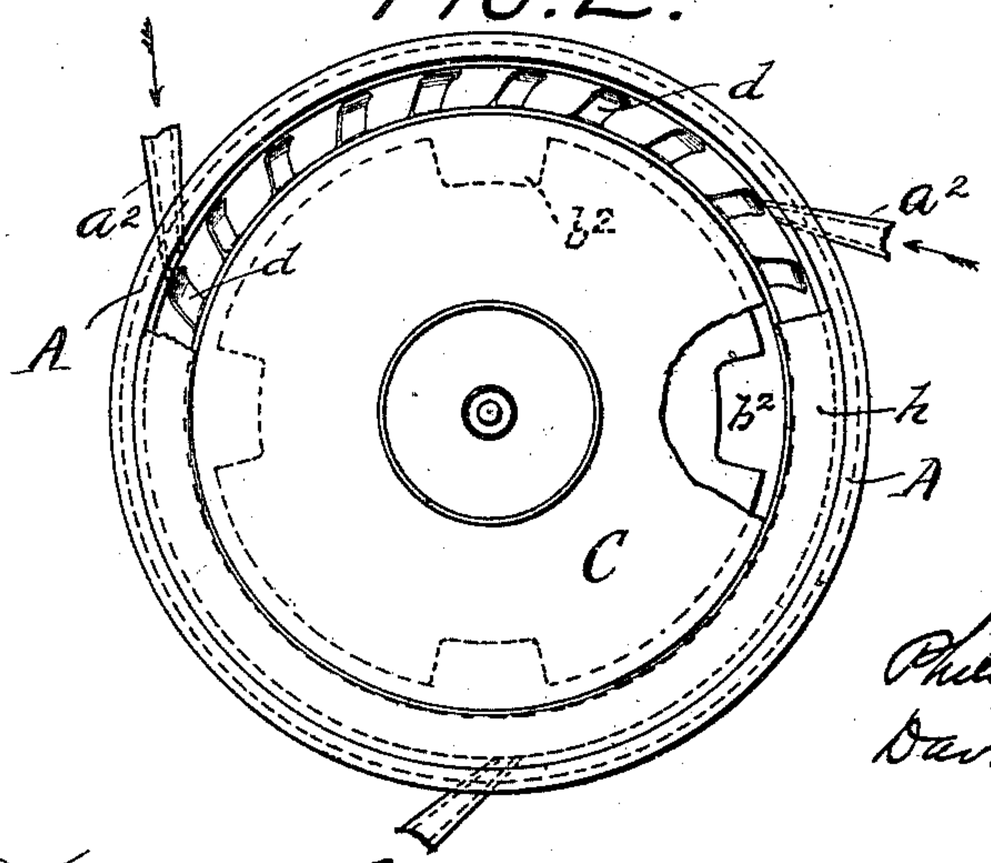


FIG. 2.



Witnesses
P. A. Kelly.
W. A. Serrell

Philip M. Sharples
Davis T. Sharples
Inventor

By their Attorney M. Stewart

(No Model.) 2 Sheets—Sheet 2.

P. M. & D. T. SHARPLES.

CENTRIFUGAL SEPARATOR.

No. 442,461. Patented Dec. 9, 1890.

FIG. 3.

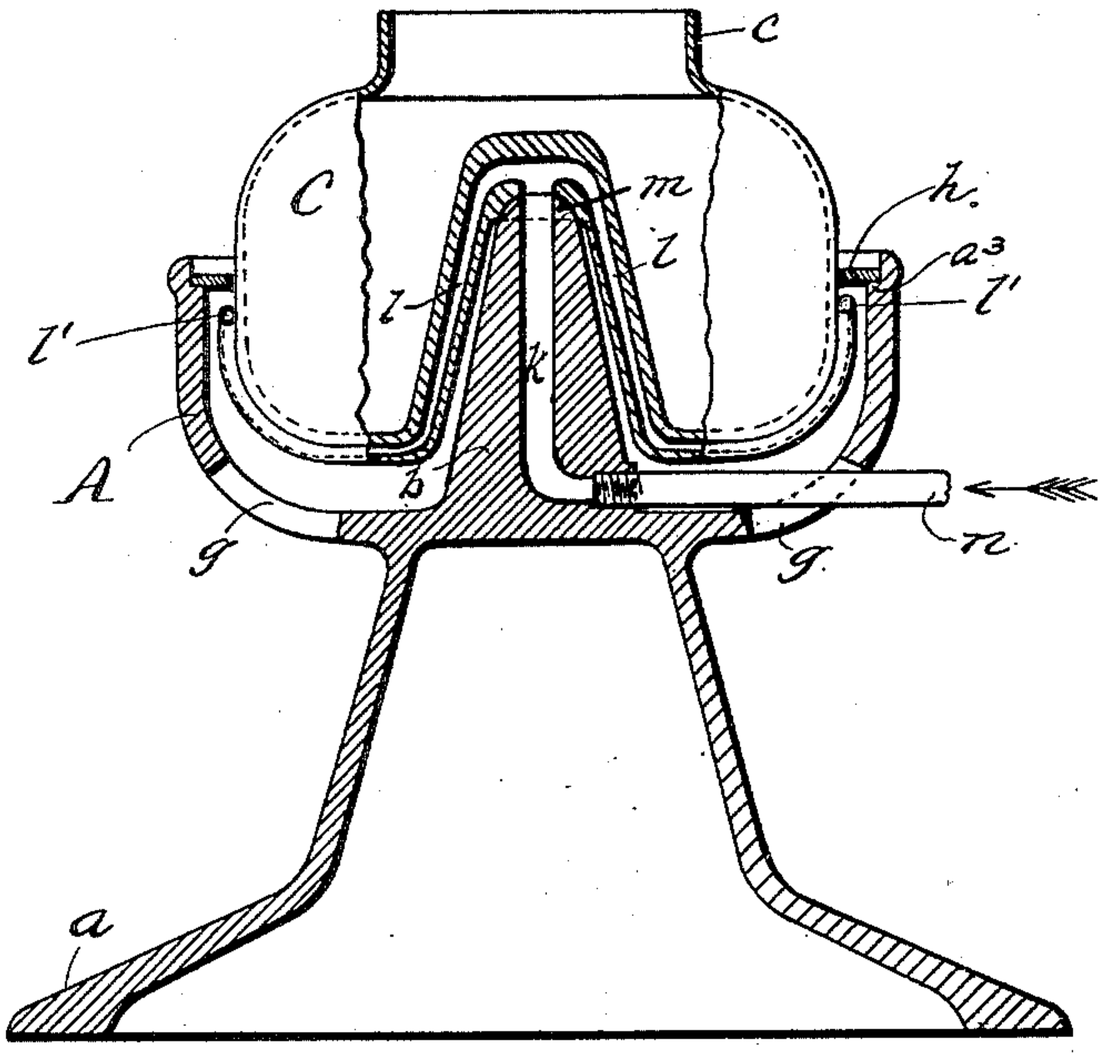
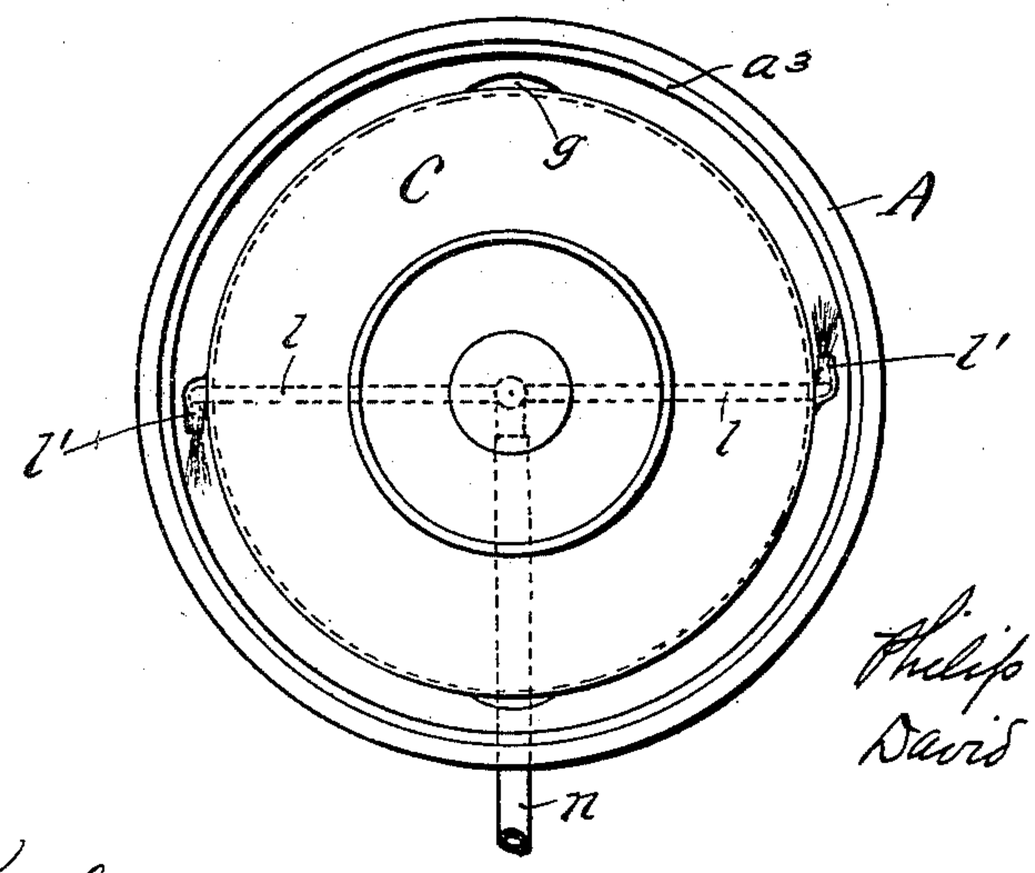


FIG. 4.



Witnesses
B. A. Kelly Jr.
W. A. Shuman

Philip M. Sharples
David T. Sharples
Inventors

By their Attorney J. L. Stewart

UNITED STATES PATENT OFFICE.

PHILIP M. SHARPLES, OF WEST CHESTER, PENNSYLVANIA, AND DAVID T. SHARPLES, OF ELGIN, ILLINOIS.

CENTRIFUGAL SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 442,461, dated December 9, 1890.

Application filed March 6, 1890. Serial No. 342,896. (No model.)

To all whom it may concern:

Be it known that we, PHILIP M. SHARPLES, of West Chester, county of Chester, State of Pennsylvania, and DAVID T. SHARPLES, of Elgin, in the county of Kane, State of Illinois, citizens of the United States, have invented certain Improvements in Centrifugal Separators, of which the following is a specification.

This invention relates more especially to that class of centrifugal machines which are adapted to separate the lighter from the heavier constituent of a compound fluid, as cream from the blue milk.

The improvements relate, mainly, to the method of operating the centrifugal vessel and of increasing its capacity. The centrifugal vessel is suspended in a casing and is operated directly by the motive power, a driving-spindle being entirely dispensed with and the balancing of the vessel only being required. The motive power is applied at the outer wall of the vessel, and is preferably a heated jet or jets, (as of steam,) which, while driving the vessel, at the same time by contact with said outer wall imparts to the heavier constituent of the compound liquid (as milk) undergoing separation an increased heat, which materially assists in hastening the complete separation of the lighter constituent (cream) without materially heating the latter.

Other features are set forth, in connection with the accompanying drawings, in the following detailed description of the practical application of the invention.

Figure 1 is a partly-sectional elevation of a machine of preferred construction embodying our invention. Fig. 2 is a plan view of the same with the skim-milk and cream receptacles removed and showing the arrangement of three jets. Figs. 3 and 4 are respectively a sectional elevation and a plan of a machine, showing some modifications of our invention.

The centrifugal separator-vessel C, which is represented as mainly of a well-known form in vertical machines, is dished at the bottom and provided with a central pivot c', which is socketed in a step b, forming part of the casing or frame A. This step is projected upward in the dished base of the vessel, so as to bring the suspension-point c' to about the center of gravity of the vessel and its load when the machine is in operation. The casing A rests upon a suitable base a, and is formed with a central passage a', communicating at its lower end with any suitable conduit. The step b extends upward from a partition-plate b', which is located between the base of the separator-vessel and the mouth of the passage a', forming a chamber b^3, communicating by openings b^2 with the upper portion of the casing. Upon the upper edge of the casing is supported in an ordinary manner receptacles D and E and cover F, which extend inward to the open throat c, and receive, respectively, the skim-milk and cream which are continuously delivered during the operation of the machine. The new milk is admitted in any suitable manner, as through a tube c^3, in front of a blade c^2, which compels it to rotate with the vessel.

The motive power which we employ to rotate the vessel C consists, preferably, of one or more jets, as of steam, directed by suitably-located nozzles a^2, against wings or buckets d, projecting from the periphery of the vessel. These projections, which are represented as forming part of a band secured to the periphery of the vessel, are preferably arranged in the same horizontal plane with the point of suspension c', and a single jet may be thus employed without necessarily affecting the balancing of the vessel. The projections d may be arranged and shaped in any desired manner, but are here shown as forming an acute angle, with the periphery of the vessel on the side against which the jet impinges, and also out of line axially, the lower edge being behind the upper. The nozzles a^2, of which three are represented in Fig. 2, are shown as directed downward in Fig. 1, and are arranged symmetrically, so that their combined action when properly adjusted does not affect the balancing of the vessel. Immediately above the projections d an annular partition h, of glass or other non-heat-conducting material, is supported on a circular ledge a^3 of the casing A, its inner edge being arranged to clear the periphery of the rotating vessel.

Our machine may be operated directly by the action of any escaping jet; but we prefer to use, generally, either steam or some heavier fluid projected thereby, first, because the great speed at which vessels of this character are rotated necessitates the use of a jet of high velocity, and, secondly, because of the effect which the heat thus applied has in accelerating and completing the separation of the cream from the milk, which effect we will now describe. As the new milk is admitted to the vessel in a continuous stream, it is gradually brought under the centrifugal action, and almost immediately there is an incomplete separation of the cream from the blue milk, the latter with a proportion of the cream still mixed with it being thrown toward the outer wall of the vessel. On account of the greater facility with which these particles of cream can tear loose from their mechanical mixture with the blue milk it has been customary and advantageous to feed the new milk into the vessel at a higher temperature than would otherwise be done. In our machine, however, though the new milk be at a lower temperature, the separation will be more rapid and thorough than with warmer milk ordinarily, which is due to the fact that after the main portion of the cream has been separated by the first effect of the centrifugal force the milk, which still contains a considerable proportion of cream, is thrown against the outer wall of the vessel and heated thereby, owing to the contact of the hot jet or jets with the outer surface. The temperature being thus raised, every particle of cream is quickly released from the skim-milk and finds its way to the inner wall of cream, the temperature of which may be slightly raised thereby, though it will still be considerably cooler than usual, and yet a larger proportion of it will be obtained in less time.

The purpose of the annular partition *h* is to prevent any noticeable effect of heat upon the parts above the same. The downward direction of the jet tends to deflect it below the projecting buckets *d*, and the fan-like action of the latter assists in exhausting the steam exclusively through the openings b^2 and central passage or exhaust-outlet a', the deflector-plate b', which extends nearly to the periphery of the vessel, tending to prevent contact of the steam with the bottom of the vessel.

In Figs. 3 and 4 we have illustrated a modified construction, embodying, however, the main features of our invention. The separator-vessel is suspended in substantially the same way, except that the point of suspension *m* is shown considerably above the center of gravity. It is rotated by the reaction instead of impact, steam being admitted through a pipe *n* and central steam-passage *k* through the step *b*, said passage communicating by a ball-joint at *m* with branches *l l*, terminating in nozzles l'' at the periphery of the vessel. These nozzles are shown decidedly below both the center of gravity and point of suspension of the vessel, which arrangement, though inferior to that already described, is yet quite satisfactory if the jets be symmetrically arranged so as to balance each other. The exhaust in this case is through openings *g* in the wall of the casing.

The advantages of our improved construction and method of operation over those heretofore in use are very decided. The method of suspending and operating the separator-vessel directly, as described, has the very great advantage of necessitating but one balancing, whereas when a spindle is used, whether operated by a steam-jet or otherwise, not only must both the spindle and the vessel be placed and kept in balance, but bearings must be used, which are a great source of trouble. The extremely high speed at which these vessels revolve makes the perfect balancing of them a necessity, and the accomplishment of this is greatly simplified by employing but one revolving body and but one step, as in our construction. When a spindle is used, the center of balance of the vessel and spindle combined (which is the center of rotation) must be exactly in the center of the spindle, or else the bearings will necessarily become heated. The minutest variation of the center of the spindle from this true center of rotation will thus cause trouble in the bearings, whereas in our construction the variation of the center of suspension from the true center of rotation may be comparatively large without noticeable effect. When the point of suspension is at the center of gravity of the loaded vessel and the jets of steam, compressed air, or other suitable medium act upon the periphery on the same horizontal plane as the center of suspension, the highest degree of efficiency will be secured, though slight variations do not materially affect the results.

The important advantage gained by heating the partially-skimmed milk during the operation of the machine, thus securing cooler cream and yet a perfect and rapid separation of it from the blue milk, has been already referred to.

Having thus fully set forth our invention and the means for practically and advantageously using it, we do not limit it to the forms of machine illustrated; but

What we claim is—

1. The improvement in the process of creaming milk by centrifugal force, which consists in increasing the temperature of the portion of the liquid in rotating separator-vessel which is farthest from the center of rotation, substantially as and for the purpose set forth.

2. The improvement in the process of creaming milk by centrifugal force, which consists in heating the wall of the separator-vessel during its operation, whereby the heavier outer portion of the liquid is made warmer than the lighter inner portion, substantially as and for the purpose set forth.

3. In a centrifugal machine, a separator-vessel suspended upon a fixed bearing located substantially in the perpendicular passing through the center of gravity of the loaded vessel, in combination with means for applying rotating power directly to said vessel, substantially as set forth.

4. In a centrifugal machine, a rotary separator-vessel pivotally suspended, substantially as described, in combination with a nozzle or nozzles located at the periphery of the vessel and adapted to apply a jet, as of steam, thereto, whereby said vessel is directly rotated and the heat of the jet utilized, substantially as and for the purpose set forth.

5. In a centrifugal machine, a separator-vessel suspended at the center of gravity of the loaded vessel upon a fixed bearing, in combination with means for applying rotating power at the periphery of said vessel, substantially as set forth.

6. In a centrifugal machine, the combination, with the casing provided with an exhaust outlet or outlets and with the receptacles supported thereon, of a separator-vessel suspended within said casing and provided with a series of peripheral projections located above said exhaust-outlet and arranged at an angle to the axial plane, substantially as described, and a nozzle arranged to direct a jet (as of steam) against said projections, substantially as set forth.

7. In a centrifugal machine, a separator-vessel suspended upon a fixed bearing, in combination with means for applying rotating power to the periphery of said vessel upon the same horizontal plane as the center of suspension, substantially as set forth.

8. In a centrifugal separator, the combination, with a suspended rotary vessel operated directly by steam, substantially as described, of a casing provided with a central exhaust-outlet, as a', an intermediate perforate plate forming an exhaust-chamber b^3, and a central support, as b, for said vessel, substantially as set forth.

9. In a centrifugal machine, the combination, with a suspended separator-vessel and a steam-nozzle located at the periphery thereof, substantially as described, of a casing provided with an exhaust-outlet below said vessel, liquid-receptacles supported on said casing above said nozzle, and a non-conducting annular partition, as h, between said nozzle and receptacles, substantially as set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

PHILIP M. SHARPLES.
DAVID T. SHARPLES.

Witnesses as to the signature of Philip M. Sharples:

M. SHARPLES,
M. L. WALSH.

Witnesses as to the signature of David T. Sharples.

J. N. THOMPSON,
F. E. ALLEN.