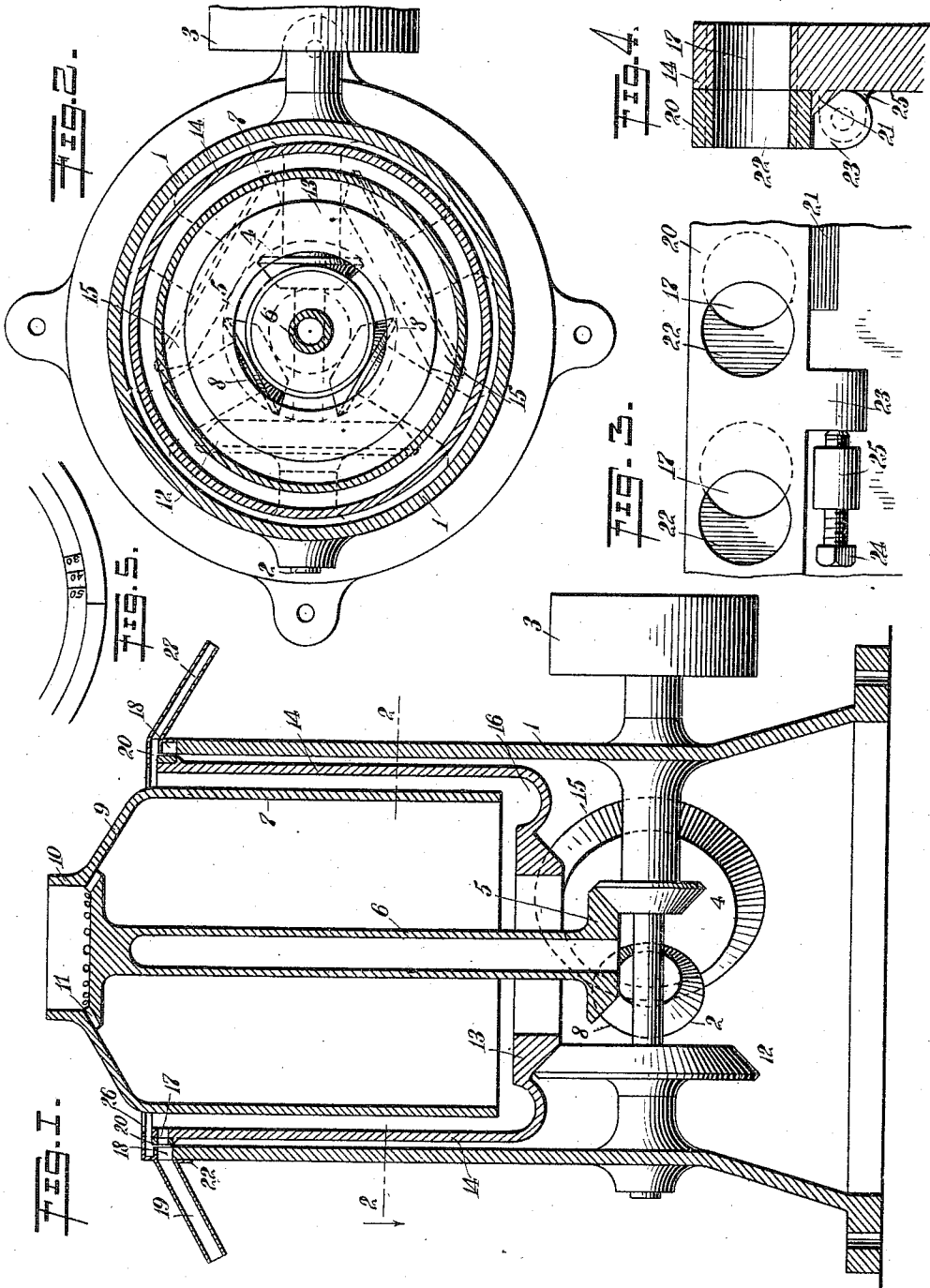


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CENTRIFUGAL SEPARATOR.
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CENTRIFUGAL SEPARATOR.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, FALES J. BABCOCK, a citizen of the United States, and a resident of Syracuse, in the county of Onondaga and State of New York, have invented a new and Improved Centrifugal Separator, of which the following is a full, clear, and exact description.

This invention relates to a separator of the centrifugal type, which is adapted to separate fluids of different specific gravity, from each other, such as cream and skim milk, and which may be used also to separate sugar from sap.

An object of this invention is to provide a device of the character described, which will be simple in construction, readily accessible for cleaning, noiseless and efficient in its operation, and inexpensive to manufacture.

Another object of this invention is to provide a centrifugal separator with a plurality of bowls adapted to rotate in different directions, with means for changing the direction of the fluid being separated in said bowls.

A further object of this invention is to provide a centrifugal separator with means for adjusting the outflow openings through which the heavier fluid passes.

These and further objects, together with the construction and combination of parts, will be more fully described hereinafter and particularly set forth in the claims.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views, and in which—

Figure 1 is a vertical section through the center of my device; Fig. 2 is a horizontal section on the line 2—2 of Fig. 1; Fig. 3 is an enlarged detail view in elevation, showing the means for adjusting the size of the openings through which the heavier fluid leaves the outer bowl; Fig. 4 is an enlarged vertical section through the outer bowl and the rings for adjusting the size of the passage from said bowl; and Fig. 5 is a fragmentary top plan view illustrating the relative adjustment of the ring with the outer bowl.

Referring more particularly to the separate parts of the device, 1 indicates a casing or support, in which is journaled in suitable anti-friction bearings, a rotatable shaft

2, which is driven from any suitable source of power by a pulley 3 secured thereon. The shaft 2 is provided with a small bevel gear 4, which meshes with a bevel gear 5 on a central hollow shaft 6, which supports and is secured to at its upper end, an inverted bowl 7. In order to evenly support the shaft 6 and thus the bowl 7, there are provided a plurality of bevel gears 8, which are rotatably supported on stub shafts secured to the casing 1 in any well known manner and which engage the bevel gear 5 in spaced relation from each other. The bowl 7 is of a peculiar form; that is, it is formed with a cylindrical body portion which slopes upwardly and inwardly from the top, to form a conical portion 9, which has connected to it a hollow cylindrical flange 10, which forms with the top of the shaft 6, a suitable receptacle for the fluid to be separated. The point at which the shaft 6 joins the bowl 7 is provided with a plurality of perforations or channels 11, which extend substantially parallel to and alongside of the conical portion 9. The receptacle 10 is thus formed with a series of channels extending from its bottom circular corner to the interior of the bowl 7, and at such an angle that the fluid in the receptacle 10 will be delivered along the under surface of the conical portion 9. The shaft 2 is also provided with a somewhat larger bevel gear 12, which meshes with and supports a bevel gear 13 on a bowl 14, which telescopes with and is arranged concentric with the bowl 7. In order to further balance and support the gear 13 and thus the bowl 14, there are provided a plurality of bevel gears 15, rotatably supported in spaced relation on stub shafts, which are secured in any well known manner to the frame 1. The bowl 14 is preferably formed with a cylindrical body portion, which extends alongside of the cylindrical portion of the bowl 7, and then forms a circular groove or channel 16 which underlies and overlaps the lower edge of the bowl 7, so as to receive the fluid passing down the sides of the bowl 7. The bowl 14 is provided near its upper edge with a plurality of perforations or openings 17, which are arranged in alinement with a channel or passageway 18 provided on the top of the support 1 and arranged concentrically with respect to the bowl 14. The channel 18 is provided with an outlet pipe 19, from whence the skim milk or other heavy fluid separated by the

machine, may be drawn. The supporting and driving bevel gears are preferably friction gears, so as to form even, steady supports.

5 In order to regulate the amount of skim milk or other heavy fluid which flows through the openings 17, there is provided a concentric ring 20, which is supported on a flange 21 secured in any well known manner to the bowl 14. This ring 20 is provided with a plurality of openings 22, which are adapted to be brought into more or less direct alinement with the openings 17, so as to regulate the flow of fluid through the openings 17. In order to do this, the ring 20 is provided with a lug 23, which is engaged by an adjusting screw 24, that has a screw-threaded engagement with a lug 25 on the bowl 14. The fluid which does not pass through the openings 17, passes over the top of the bowl 14 and into a concentrically arranged channel 26, which is provided above the channel 18, and which has an outlet pipe 27, by means of which the lighter fluid, such as cream, may be drawn out of the separator. The adjustment of the ring 20 relative to the bowl 14, and thus the percentage of cream being obtained, may be determined by the position of an indicating line on the ring 20 relative to a plurality of indicating lines on the bowl 14, as is clearly illustrated in Fig. 5.

The operation of the device will be readily understood when taken in connection with the above description. The bowls 7 and 14 are set in rapid rotation by means of the shaft 2, which is driven from any suitable source of power. The material to be separated, such as fresh milk, is then poured into the receptacle 10 formed in the upper portion of the bowl 7. This material will then be delivered, by reason of the inclination of the channels 11, and also by reason of the centrifugal force due to the rotation of the bowl 7, along the under surface of the conical portion 9. The mixture of the light and heavy fluid contained in the material will pass along down the sides of the bowl 7, and the heavier particles such as skim milk, will gradually displace the lighter particles, such as the cream, and force their way into the outermost points, or in close contact with the inner surface of the bowl 7. When the material reaches the lower edge of the bowl 7, it will come in contact with the bowl 14, which is rotating in the opposite direction to the bowl 7. The material will thus be changed, both from its downward direction to an upward direction and from a rotation in one direction to a rotation in the opposite direction. This change will further aid the separation of the particles of the different fluids, as the heavier particles will not change their direction of movement as rapidly as the lighter par-

ticles. The material being separated will then pass up between the outer surface of the bowl 7 and the inner surface of the bowl 14, clinging to the surface of the bowl 14 by reason of the centrifugal force, due to the rotation of this bowl. The particles will now become thoroughly separated, the cream creeping toward the inside of the film, and the skim milk displacing the cream and clinging to the surface of the bowl 14. When the material reaches the openings 17, they will be so adjusted as to permit the proper amount of the heavy fluid, such as skim milk, to pass through into the channel 18, from whence it will flow out through the outlet pipe 19. The lighter fluid, such as cream, will pass over the top edge of the bowl 14 and into the channel 26, from whence it will be drawn off through the outlet pipe 27. The relative densities of the fluids separated; that is to say, the thickness of the cream and the poverty of the skim milk, may be regulated by adjusting the passageways through the openings 17 and 22.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:—

1. In a separator, the combination with a plurality of concentric imperforated bowls, of means for rotating said bowls in different directions.

2. In a separator the combination with a plurality of telescopically arranged imperforated bowls of means for rotating said bowls relative to each other.

3. In a separator, the combination with an inner cylindrical bowl, of means for rotating said bowl, an outer imperforated bowl, and means for rotating said outer bowl relative to said inner bowl.

4. In a separator, the combination with a plurality of concentrically-arranged imperforated bowls, each having openings at the top and bottom thereof, of means for driving said bowls in opposite directions.

5. In a separator, the combination with a plurality of juxtaposed rotatable separating bowls, of means for feeding the material to be separated at the top of one of said bowls, means for drawing off the separated fluids from said bowls, and means for rotating said bowls in different directions.

6. In a separator the combination with a plurality of juxtaposed imperforated bowls of means for rotating one of said bowls relative to another of said bowls, means for feeding the material to be separated to one of said bowls, means for drawing off the heavier fluid from another of said bowls, and means for drawing off the lighter fluid from said last-mentioned bowl adjacent the top thereof.

7. In a separator, the combination with a plurality of concentric bowls adapted to suc-

cessively treat a fluid by passing the same along the surface of the innermost bowl and transferring to the next adjacent bowl over the edge of the preceding bowl, said fluid traveling in opposite vertical directions in the adjacent bowls, of means for rotating said bowls in different directions.

8. In a separator, the combination with a support, of a shaft journaled in said support, means for driving said shaft, a plurality of bevel gears secured to said shaft, a plurality of bowls, each having bevel gears thereon engaging with said bevel gears on said shaft, means for supplying the material to be separated to one of said bowls, and means for withdrawing the separated fluids from another of said bowls.

9. In a separator, the combination with a support, of a shaft journaled in said support, means for driving said shaft, a plurality of bevel gears secured to said shaft, a plurality of bowls, each having bevel gears thereon engaging said bevel gears on said shaft, additional idle gears for supporting said bowls, means for supplying the fluid to be separated to one of said bowls, and means for drawing off the separated fluids from another of said bowls.

10. In a separator, the combination with a support, of a shaft journaled in said support, a plurality of bevel gears secured to said shaft, a plurality of bowls, having bevel gears thereon engaging with said bevel gears on said shaft, additional means for supporting said bowls, means for supplying the fluid to be separated to one of said bowls, a plurality of channels for receiving the separated fluid from another of said bowls, means for drawing the separated fluids from said channels, and means for regulating the specific gravities of the fluids to said channels.

11. In a separator, the combination with a plurality of bowls, of means for rotating said bowls, means for supplying the material to be separated to one of said bowls, another of said bowls having a plurality of openings near its upper edge, a ring, having a plurality of openings adapted to be placed in alinement with said first-mentioned openings, and means for adjusting said ring.

12. In a separator, the combination with an inner bowl, of means for supplying fluid to be separated to said bowl, an outer bowl, having a plurality of openings near its upper end, a conduit juxtaposed to said openings in said outer bowl, a ring interposed between said conduit and said openings and having a plurality of openings therein, and means for adjusting said ring so as to adjust the openings therein into and out of

alinement with the openings in said outer bowl.

13. In a separator, the combination with a support, of a shaft rotatably journaled in said support, a pair of oppositely facing bevel gears secured to said shaft, a pair of concentrically arranged bowls, having bevel gears thereon adapted to engage with each of said bevel gears on said shaft, one of said bowls having a receptacle formed therein with passages leading to the interior of said bowl, the other of said bowls having a plurality of openings near its upper edge, a conduit channel juxtaposed to said openings, a ring, having openings therein interposed between said conduit channel and said openings, means for adjusting said rings so as to place the openings therein into and out of alinement with the openings in said last-mentioned bowl, a conduit channel juxtaposed to the upper edge of said last-mentioned bowl, and means for withdrawing the fluid from said last-mentioned conduit channel.

14. In a separator, the combination with a support, of a shaft journaled in said support, a pair of facing bevel gears secured on said shaft, a pair of concentrically arranged bowls having bevel gears thereon engaging said bevel gears on said shaft, a plurality of idle bevel gears for engaging each of said bevel gears on said bowls, so as to support said bowls, one of said bowls having a receptacle formed therein with passages leading to the interior of said receptacle, the other of said bowls having a plurality of openings formed therein near its upper edge, a conduit channel connected to said support and juxtaposed to said openings, means for regulating the flow of fluid from said openings to said conduit channel, means for drawing the fluid from said conduit channel a conduit channel located above the upper edge of said last mentioned bowl, and means for withdrawing the fluid from said last mentioned channel.

15. In a separator the combination with a plurality of rotatable bowls of means for feeding fluid to be separated to one of said bowls, another of said bowls having a plurality of superposed circular channels disposed along the top thereof, and means for controlling the flow of fluid through said circular channels.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FALES JOHNSON BABCOCK.

Witnesses:

E. ROSS PERKINS,

CHARLES O. TRUESDELL.