May 27, 1930. H. G. KOEPKE 1,760,071

CENTRIFUGAL SEPARATOR

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Fig. 1.

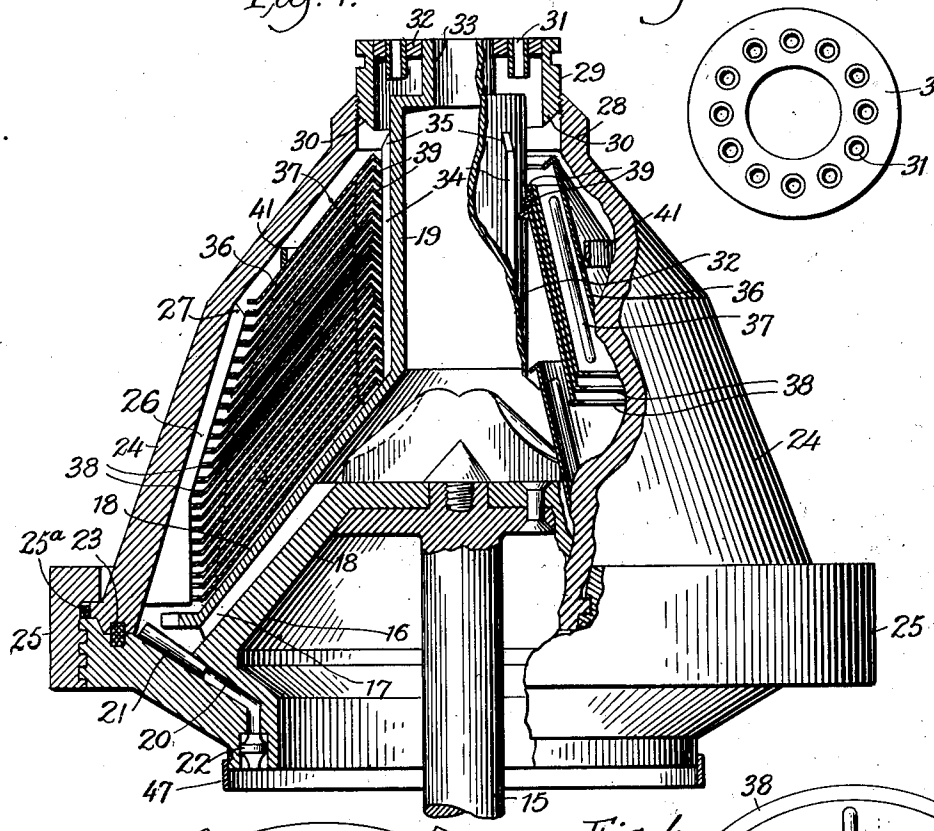

Fig. 2.

Fig. 3.

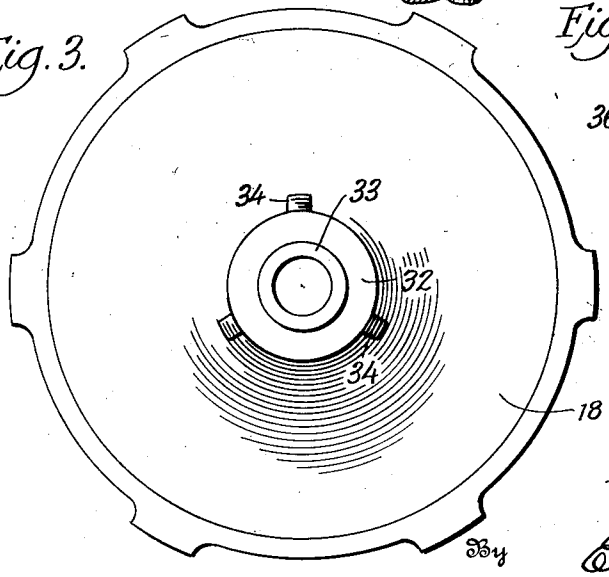

Fig. 4.

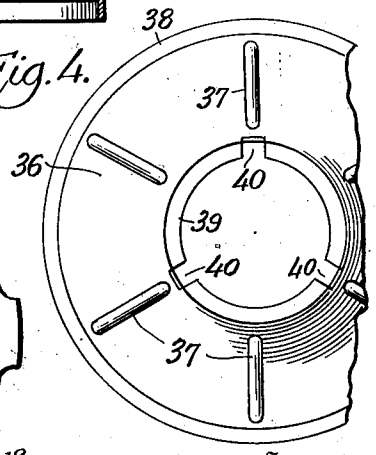

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Fig. 5.

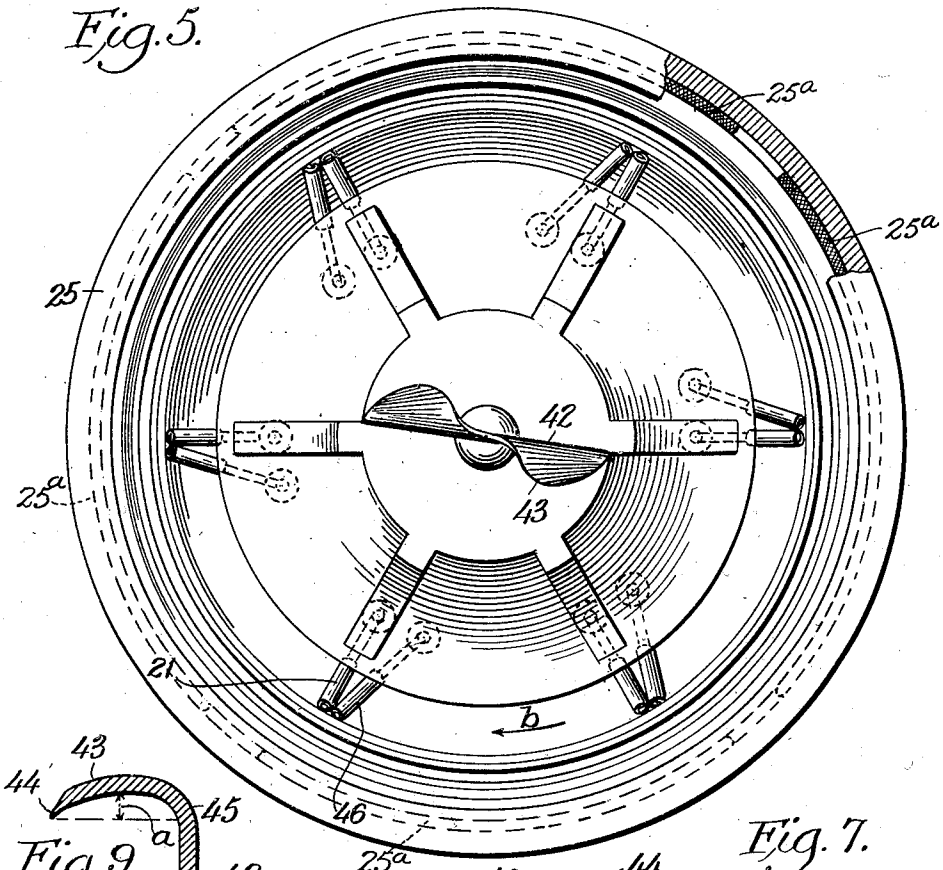


Fig. 9.

Fig. 7.

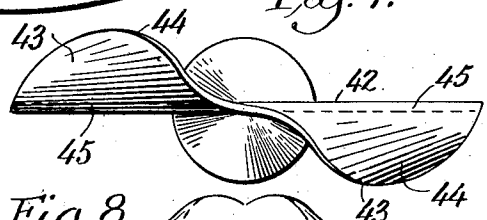


Fig. 6.

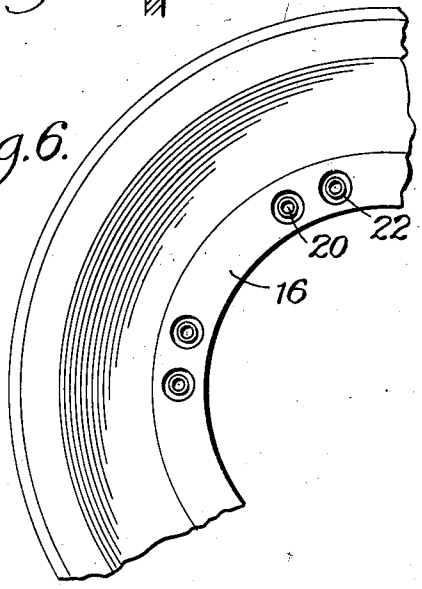
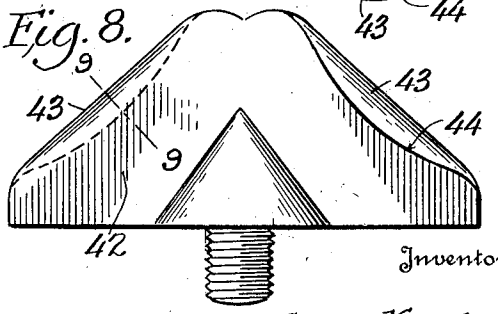


Fig. 8.



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Patented May 27, 1930 1,760,071

UNITED STATES PATENT OFFICE

HENRY GEORGE KOEPKE, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO STANDARD BRANDS INCORPORATED, OF DOVER, DELAWARE, A CORPORATION OF DELAWARE

CENTRIFUGAL SEPARATOR

Application filed September 17, 1926. Serial No. 136,128.

My invention relates to centrifugal separators of the discharge nozzle conical disc type, primarily constructed for the separation of yeast from most of the associated liquids in which it has been propagated.

The speed of such separators cannot well be increased beyond that now generally used, namely close to 5,000 R. P. M., nor is it, for practical reasons, advisable to increase the size of such separators which now require two men to handle some of the parts, but it is desirable to increase the efficiency of separation, the quantity of wort handled and the smoothness of operation, and to decrease the stoppage of the yeast discharge, and to so construct the machine that the sensitive spindle rotating at such a great speed shall not cause the bowl to vibrate.

I have recognized that if these defects in the present day machines could be obviated, the supervision of the machines could be decreased per machine, or, what amounts to the same thing, the same attendant could supervise a greater number of machines.

After experiments extending over considerable time I have succeeded in constructing a centrifugal separator of the type described which gives very unexpected results without increasing the size and weight of the parts, or increasing the speed of operation.

I have succeeded in doubling the quantity of yeast and associated liquid that can be treated and separated in a given time without destroying the efficiency of the separation, and in some instances this efficiency more than doubles the capacity of the present day machines of equal size.

I have decreased the vibration of the bowl, decreased the stoppage of the yeast discharge nozzles, and decreased irregularities of operation due to irregular feed or irregular discharge; I have simplified the construction and, as a whole, produced a much more practical machine which in operation has given unusually satisfactory results from the point of view of the users of such machines.

Referring now to the accompanying drawing, in which like parts are similarly designated:

Figure 1 is a view partly in elevation and partly in vertical section;

Fig. 2 is a plan view of the bowl top;

Fig. 3 is a plan view of the top of the tubular shaft and its conical lower end;

Fig. 4 is a plan view of one of the discs showing the notches in the upper flange and the spacer ribs;

Fig. 5 is a plan view of the bowl showing the yeast tubes and propellers;

Fig. 6 is a bottom view of part of the bowl showing the yeast outlets;

Figs. 7 and 8 are, respectively, plan and elevation of the propeller;

Fig. 9 is a section of the propeller blade on line 9—9 of Fig. 8.

The separator comprises a bowl spindle 15 with a bowl base 16 supported thereon. The bowl base has the usual ribs 17 for supporting the lower conical end 18 of the tubular shaft 19 in spaced relation to the bowl. Said bowl base has ducts 20 in the upper ends of which are secured yeast pipes 21 which may be retained in place by soldering or "sweating in", and in the lower ends of these ducts are secured the yeast discharge nozzle 22.

The bowl base and bowl shell each has a groove near its periphery for the usual rubber gasket 23 for packing the joint between the bowl base 16 and the bowl shell 24 which is held to the base by the usual coupling ring 25. This ring I have altered by providing four small strips 25ª, Figs. 1 and 5, in the upper part of the ring 25 to make the connection between the bowl shell and bowl more secure.

In a separator, the internal diameter of the coupling ring of which is about 14 inches, I have found it satisfactory to provide four equally spaced spacing strips 25ª each about 4 or 5 inches long with rounded ends, square or approximately square in cross-section, soldered or otherwise firmly secured in and conforming to the curvature of the internal angle of the coupling ring, above the threads in the ring, and serving when the coupling ring is in place to solidify the bowl construction and render the separator less susceptible to vibration than if these spacing members 25ª are omitted. Instead of the spacing strips 25ª, it is equally within the purview and scope

of my present invention to provide a single continuous spacing strip, preferably of rectangular cross-section, fitted closely in the internal angle of the clamping ring and extending entirely around its inner surface above the threads, tightly to close the space which in previous constructions has remained between the clamping ring above its threads and the outer edge of the bowl.

The bowl shell is provided with ribs 26 whose narrower upper end is bevelled at 27, and from the second slope of the shell to about the level of the edge of the second disc, so that the separated liquid or beer between the hood and second disc will be free for relative circular movement at this point, unhindered by the upper end of the ribs 27 beyond this point.

In previous construction of yeast separators, it has been the practice to provide an annular internal shoulder extending around the bowl shell at the angle formed by the junction of the upper and lower slopes of the bowl shell. In my improved construction, I make the upper sloping section of the bowl shell of such pitch as to eliminate this shoulder so that an obtuse angle is formed by the junction of the upper and lower slopes of the bowl shell at approximately the height of the upper ends of the ribs 27.

The neck 29 has in its top plate 32 an increased number of discharge outlets as compared with separators of previously usual construction (advantageously 12 outlets may be provided) and these outlets, in my improved construction, are provided with vertical tubes 31 set in and extending below the top plate 32, so that they properly regulate the discharge and tend to minimize or substantially obviate any jet effect adjacent the discharge outlets which jet effect, if present, would extend down into the liquid so as to entrain unseparated yeast which might be present adjacent the outlets. In the absence of an appreciable jet effect, with my new construction, such yeast is left free to move toward the periphery of the bowl shell and settle down to the yeast tubes, thus increasing the efficiency of separation of yeast from associated liquid. The neck 29 is screw-threaded in the tubular top 28 of the hood.

As shown in the drawing (Fig. 1) the neck 29 terminates at its lower end in an angle of approximately 50° and in connection with the upper portion of the hood 28 forms a pocket or trap which assists in properly retarding the outflow of wort and in retaining yeast that passes the discs.

The tubular shaft 19 is provided on its exterior with a plurality of longitudinal ribs 34, suitably three in number as shown, which are smooth and have their upper ends bevelled at 35, the slope being approximately a continuation of the slope of the upper separator disc, thereby avoiding the fan effect, and stirring the separated beer at the discharge neck, and avoiding the undue forcing of the discharge with the consequent pull lower down at the surface of the discs, due to the tendency to form a vacuum at the neck.

The so-called discs 36 are in reality cones, as usual, having on them six spacers 37 and outwardly turned horizontal outer bottom edges 38, and at their inwardly turned upper edges 39 are provided with a plurality of notches 40 corresponding in number and arrangement to the ribs 34. These edges 39 are bent downwardly, preferably at an angle of 45° to the horizontal. These downwardly bent inner edges cause the beer to make a sharp turn, decrease the speed of flow at this point and permit any entrained heavier yeast to more readily move under the centrifugal action against the inclined wall of the upper one of two adjacent discs and settle toward the bottom of the bowl to pass out through the yeast tubes.

The upper disc 36 is also provided with spacers 37 on its upper surface, and has secured thereon between it and the bowl shell 24 a vertical ring 41 whose lower and upper edges are preferably but not necessarily bevelled in accordance with the slopes of the upper disc and the bowl shell and assist in preventing yeast from passing out with the beer, should the separator be overcharged and help to keep the liquid at a given speed in accordance with the speed of the bowl. This ring 41 is held in place by rivets which secure it to the top disc and at its lower edge is preferably soldered or otherwise secured to the disc in a liquid tight joint.

On the bowl there is a propeller 42 having two blades and formed with a high pitch, and it will be noted that the overturn 43 of the blade 42 has a curvature such that the outer edge 44 at the termination of the arched portion *a* lies in a plane passing through the point 45 where the overturn is tangent to the surface of the blade proper and is not flat as is in previous constructions. In other words, the overturn of the blade is caused, by reason of its shape, to produce a greater pull with the greatest width of overturn at about the middle of each blade. The greater arching of the overturn serves to more efficiently pass the beer through the machine. This arching is greatest, i. e. of greater radius of curvature near the top and center of the propeller where the two oppositely directed blades meet in a notch.

The curvature of the cross section of each blade is such that the radii of curvature in the overturned portions of the blade decrease toward the bottom of the blade, so that the passage of the liquid downward along the blade is conical.

The blade also differs from the known type in that the lateral edges of the blades at the extreme periphery are vertical or nearly so

at 44, Fig. 9, and also before the blade begins to curl as at 45.

The general slope of the triangular contour or blade sides is greater, i. e. makes a steeper angle with the horizontal, than heretofore.

The bowl moves in the direction of the arrow *b* and in addition to the usual radially directed yeast tubes 21 I use an additional tube 46 inclined to the tube 21, there being preferably but not necessarily one such inclined tube 46 adjacent each radial tube 21, or I may dispense with the radial tubes and use only the inclined tubes 46 equally spaced. These tubes, whether they be auxiliary to radial tubes or not, may have any desired angle to a radius, the limit being tangential to the direction of movement, so that a positive pressure is maintained on the yeast to produce a higher pressure discharge, which eliminates clogging of the tubes and nozzles. They have a scooping action in receiving the yeast that has settled or separated at the edge of the bowl.

It will thus be seen that all the improvements in my new separator mutually assist in increasing the speed of separation and in increasing the volume of yeast and associated liquid that can be efficiently separated per unit of time and equipment, and what is of very material economic value is that with my machine I obtain heavier yeast, by which the trade understands yeast with less associated liquid that has to be subsequently removed in the filter press.

It will be noted that I do not screw the discs in place by means of a lock-nut or other securing device. Thus the discs rest in place by gravity and their balance is not disturbed by possible non-uniform pressure at their smaller ends by a fastening device as heretofore used. Also, with my construction the vibration of the apparatus is materially lessened.

In order to prevent splashing of yeast against surrrounding parts of the machine as the yeast is discharged from the nozzles at the lower end of the bowl base, I provide the latter with a depending flange or ring 47 which may be soldered or otherwise firmly secured to the outer periphery of the bowl base at its lower portion, as shown in Fig. 1, this flange being of sufficient width that its lower edge lies in a plane somewhat below that in which the tips of the yeast discharge nozzles are positioned.

I have found, in actual practice, that by reconstructing a yeast separator of the discharge nozzle type, as hereinbefore described and without materially altering the dimensions of the various component parts of the separator, except as necessary to make them conform to my hereinbefore described novel construction, I am enabled, without increasing the speed of operation of the separator, and while fully maintaining or increasing the efficiency of separation of yeast from associated liquid, to increase the capacity of the separator to substantially double or more the capacity at which it could be efficiently operated without such improvements.

This result is accomplished notwithstanding the fact that in the reconstruction of a separator of this type to embody the various features of my invention, the use of the ring 41, in accordance with my construction, may necessitate the omission of a number of the upper discs from the separator. In actual practice, I have found that the capacity of a separator, when reconstructed in accordance with my invention, may be doubled notwithstanding that approximately one-sixth of the original number of discs may, in the reconstruction, be discarded.

What I claim and desire to protect by Letters Patent is:

1. In a centrifugal separator of the discharge nozzle type, the combination with a central supply tube having a plurality of longitudinal ribs thereon; of a series of conical separator discs notched to fit on said ribs with but small clearance, said ribs being bevelled at their tops to form substantially a continuation of the surface of the upper disc and passing through all of the discs.

2. In a centrifugal separator of the discharge nozzle type, discharge tubes inclined to the radial plane of the separator.

3. In a centrifugal separator having a bowl and bowl shell, a neck having a flange screw-threaded in the top of the bowl shell and whose lower end is bevelled to form a re-entrant angle with such top.

4. In a centrifugal separator of the discharge nozzle type, discharge outlets at the top of the bowl neck, said outlets being provided with downwardly extending vertical conduits extending down into the space within the bowl neck.

5. In a centrifugal separator of the discharge nozzle type, a plurality of vertical conduits extending downwardly from an outlet in the top of the bowl neck and through which liquid may pass in the normal operation of the separator to the outlet from a zone a short distance below the same.

6. In a centrifugal separator of the discharge nozzle type having a bowl and bowl base and discharge nozzles positioned in the bowl base, a depending flange mounted on and extending downwardly from the lower outer edge of the bowl base and having its lower edge in a horizontal plane below that of the discharge nozzle tips.

7. In a centrifugal separator of the discharge nozzle type, a propeller comprising two blades each having an edge portion overturned at about midway of its length, the overturn being curved, and the edge of the blade at the maximum lying substantially in a

plane through the tangent point of the blade and its overturn.

8. In a centrifugal separator of the discharge nozzle type, a propeller having two propelling blades curled in opposite directions and forming channels tapering downwardly.

9. In a centrifugal separator of the discharge nozzle type, a propeller having two alined propelling blades with a vertical notch between them, each blade terminating at its extreme peripheral edge vertically, and each blade having a larger entrance than discharge formed by the conically curled middle portion of the blade.

In witness whereof, I have hereunto signed my name to this specification on the 14 day of September, 1926.

HENRY GEORGE KOEPKE.