July 1, 1930. H. E. T. HAULTAIN 1,768,761

CENTRIFUGE

Filed Aug. 9, 1929

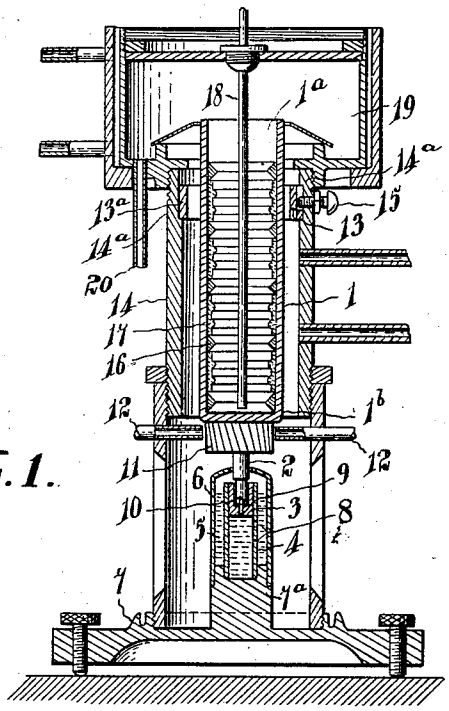


Fig. 1.

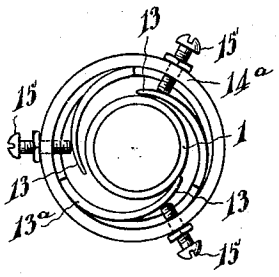


Fig. 2.

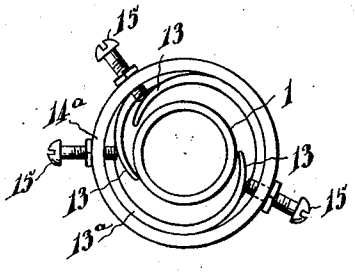


Fig. 3.

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Patented July 1, 1930 1,768,761

UNITED STATES PATENT OFFICE

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CENTRIFUGE

Application filed August 9, 1929. Serial No. 384,629.

This invention relates to certrifuges, and more particularly to the type in which the upper end of the rotatable tube or bowl is loosely journalled, and my object is to so construct the centrifuge that the tendency of the upper end of the tube to move continuously in an orbit bounded by its loose bearing is overcome. A further object is to provide means to prevent the escape of any separated matter from the interior of the tube. Other objects I have in mind will hereinafter appear.

I attain my objects by providing a plurality of contacts or spring fingers having their tube engaging parts or surfaces set to a circle slightly larger in diameter than the diameter of the tube and by arranging these contacts so that at least two adjacent contacts will be spaced less than 180° and preferably considerably over 60° apart. The lower end of the tube is provided with a spindle which rests on the end of a cup-shaped bearing and is also loosely journalled therein. Means is provided for continuously supplying this bearing with lubricant. The tube is driven by directing one or more currents of air against the teeth or vanes of an impeller wheel carried by the spindle.

The constructions are hereinafter more fully described, and are illustrated in the accompanying drawings, in which

Fig. 1 is a vertical section of my centrifuge;

Fig. 2 a cross-section thereof showing one form of spring contact fingers; and

Fig. 3 a view similar to Fig. 2, showing a modified arrangement of the fingers.

In the drawing like numerals of reference indicate corresponding parts in the different figures.

1 is a tube having its upper end 1^a open and its lower end 1^b closed. Preferably the closed end is integral with the walls of the tube, and is provided with a spindle 2. This spindle rests on and is loosely journalled in a cup-shaped bearing 3 which is carried by the inner wall 4 of an oil reservoir 5. An outer wall 6 of the oil reservoir is frictionally retained on a boss 7^a formed on a base 7 and the inner wall is threaded into the boss. Apertures 8 in the wall 4 form communications between the interior thereof and the reservoir 5. An aperture 9 in the bottom of the bearing 3 forms a communication between it and the interior of the wall 4. A slot 10 in the end of the spindle 2 is adapted, when the spindle is rotating, to circulate the oil through the bearing 3, the upper end of which communicates with the reservoir 5. On the spindle 2 is secured a wheel 11 having teeth or vanes against which currents of air are directed by air pipes 12, which are connected with a suitable source of supply.

A plurality of spring fingers 13 arranged concentric to the tube 1, but slightly spaced therefrom, are adapted to be engaged thereby to form a bearing or support for the upper end of the tube. These fingers are carried by a split ring 13^a which is frictionally retained in the upper part 14^a of a casing 14 which is suitably secured to the base 7. Screws 15 for adjusting the spring fingers 13 relative to the tube are threaded through the casing part 14^a, and these screws also tend to prevent the ring 13^a from creeping. It has been found in practice that the upper end of the tube 1 must be free to shift laterally, and that the tube has a tendency to rotate in an orbit against the fingers 13. In other words the tube tends to roll over the forward finger of the two fingers engaged by the tube, and thus shift itself into engagement with the next finger and the first mentioned finger, which is now towards the rear of the tube. To overcome this tendency the fingers are so arranged that at least two of them will be spaced not less than 120° apart. In Fig. 2 the three fingers are equally spaced apart while in Fig. 3 two of the fingers are 60° apart, thus leaving extra long gaps of 150° between each of these fingers and the third finger. By increasing the gap between the fingers, the force required to roll the tube over a finger is correspondingly increased. While the tube is being speeded up from rest it shifts quite frequently to engage successive pairs of contact fingers 13, and as the speed is increased the shifting is decreased. In prac-

tice the tube lies in a position close to or against one pair of fingers and sometimes shifts to a position close to the next pair of fingers.

This centrifuge is particularly adapted for the separation of bacteria from liquids used by pathologists. The bacteria are caught in pockets formed by rings 16 and 17 removably carried within the tube 1. The rings 16 are made of metal and are V-shaped in cross section, to prevent them from being flattened out by centrifugal force. It is essential that the rings make a leak-proof contact with the tube to close off the passage between the outer peripheries of the rings and the inner side of the tube. This is accomplished by inserting rings 17 of rubber between adjacent metal rings 16, whereby the rubber rings, which are flattened out by the centrifugal force, seal the passages behind the metal rings.

The liquid to be separated is deposited by a small tube 18 into the lower part of the tube 1 whereby the incoming liquid does not interfere with the outgoing clarified liquid which spills itself over the upper edge of the tube 1 into a container 19. This container may be supported on the casing part 14^a and is provided with an outlet 20.

What I claim as my invention is:

1. In a high speed centrifuge the combination of a tube; a bearing for the lower end of the tube adapted to permit a gyratory movement of the upper end thereof; and at least three contacts substantially concentric with the tube and adapted to be engaged by the upper end thereof; two adjacent contacts being widely spaced apart an angular distance of less than 180° and more than 60°.

2. In a high speed centrifuge the combination of a tube; a bearing for the lower end of the tube adapted to permit a gyratory movement of the upper end thereof; and at least three contacts substantially concentric with the tube and adapted to be engaged by the upper end thereof, two adjacent contacts being widely spaced apart for simultaneous engagement with the tube at points having an angular distance of more than 60°.

3. In a high speed centrifuge the combination of a tube; a bearing for the lower end of the tube adapted to permit a gyratory movement of the upper end thereof; and three spring fingers having contacts substantially concentric with the tube and adapted to be engaged by the upper end thereof, the spring contacts being widely spaced apart so that only two adjacent contacts will be engaged by the tube at one time and the angles containing the points of engagement will be more than 60°.

4. In a high speed centrifuge, the combination of a tube having its lower end provided with a spindle; a cup-shaped support in which the spindle is loosely journalled; a plurality of spring fingers having contacts substantially concentric with the tube and adapted to be engaged by the upper end thereof; two adjacent contacts being widely spaced apart an angular distance of less than 180° and more than 60°; and means for adjusting the fingers relative to the tube.

5. In a high speed centrifuge, the combination of a rotatable tube having a closed lower end; a spindle carried by the lower end; a cup-shaped support in which the spindle is loosely journalled; an oil reservoir having an inner wall for carrying the support and an outer wall forming a chamber communicating with the upper end of the cup-shaped support; a communication between the lower end of the cup support and the chamber; and a slot formed in the lower end of the spindle for causing the circulation of oil through the cup support.

6. In a high speed centrifuge the combination of a rotatable tube having removable rings therein forming pockets for matter separated by the centrifugal action of the centrifuge, the rings being formed of metal and resilient material alternately arranged whereby the resilient rings will seal the passages between the outer walls of the metal rings and the inner wall of the tube.

7. In a high speed centrifuge the combination of a tube; a bearing for the lower end of the tube adapted to permit a gyratory movement of the upper end thereof; and three spring fingers curved in the direction of their length and horizontally disposed adjacent the top of the tube, the said fingers having contacts adjacent their ends disposed substantially concentric with the tube on a slightly larger circle and adapted to be engaged by the tube, the contacts also being spaced apart an angular distance of less than 180° and more than 60°.

Signed at Toronto, this 27th day of July, 1929.

HERBERT E. T. HAULTAIN.