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2,243,697

LIQUID SUPPLY MEANS FOR CENTRIFUGAL SEPARATORS

Filed Oct. 4, 1939

2 Sheets-Sheet 1

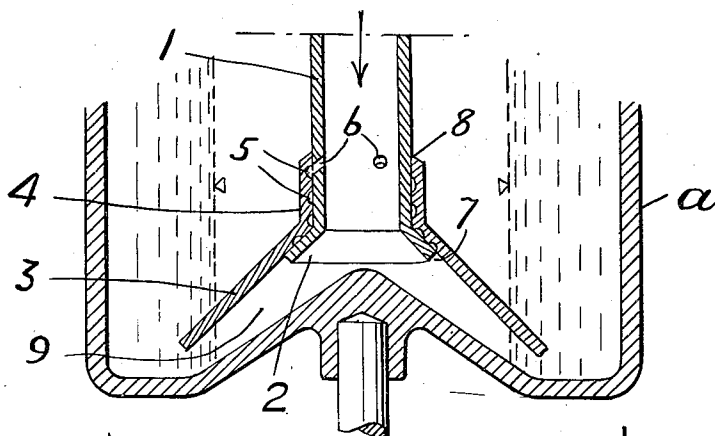
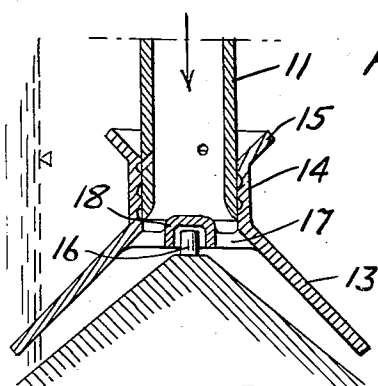


FIG. 2.

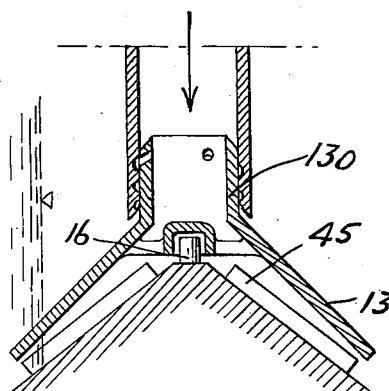


FIG. 3.

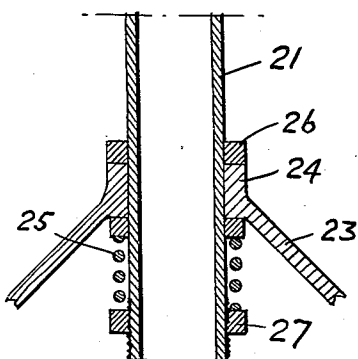


FIG. 4.

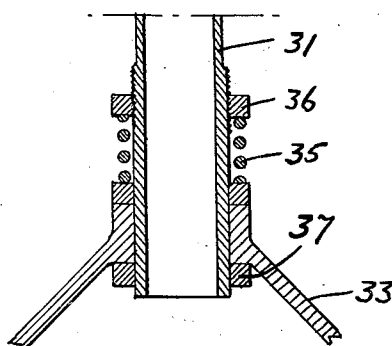


FIG. 5.

WITNESS:

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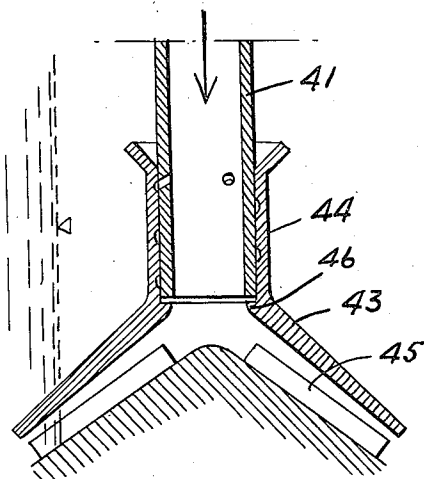


FIG. 6.

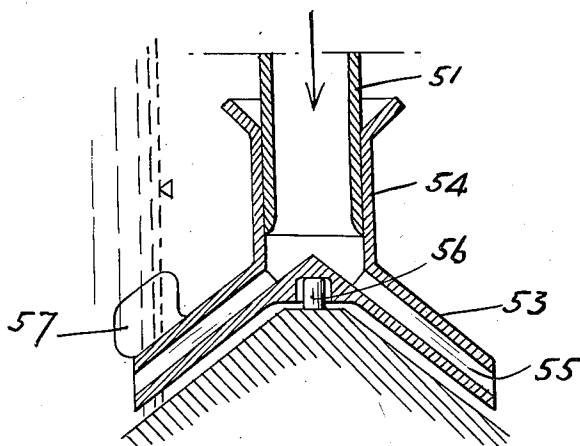


FIG. 7.

WITNESS:

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LIQUID SUPPLY MEANS FOR CENTRIFUGAL SEPARATORS

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Application October 4, 1939, Serial No. 297,859
In Sweden November 28, 1938

11 Claims. (Cl. 233—45)

In feeding liquid into "open" centrifuges (as distinguished from centrifuges of the "closed" type), admixture of air in the supply chamber has been to a considerable extent avoided by expanding the lower end of the supply tube to form a wider, usually cone-shaped, portion which, during operation, penetrates the body of liquid in the bowl, or, in other words, extends outside the free liquid level in the bowl. In this way it has been sought to obtain an unbroken flow of liquid from the feed tube into the rotating mass of liquid. In addition to such arrangement being unfavorable to admixture of air with the liquid, it has the advantage that comparatively few impacts occur when the liquid is being conducted through the inlet chamber.

However, the arrangement is open to certain objections and does not entirely effect its intended object. For instance, that part of the wider portion which projects into the liquid has a braking effect on the liquid and on the bowl, resulting in increased power consumption. Besides, the effect of preventing air from becoming mixed with the liquid is not altogether attained because this wider portion, relative to which the liquid rotates at a high speed, tears up the liquid, the result of which is some admixture of air. In this respect conditions are analogous to the effect of a paring disc for controlling the outflow of a separated constituent of the original mixture. Experience has shown that air really gets past the rim of a paring disc into the admission orifices of the outlet channels—at least when there is no considerable overlapping. Owing to the high speed of rotation, a supply of frothless liquid is therefore jeopardized.

According to the present invention, the described defects are avoided by so constructing and arranging the wider or expanded liquid-transmission end of the supply chamber that it is capable of rotating relative to the feed tube while not necessarily having a rotative movement corresponding to that of the bowl. When the transmitting part transfers the liquid being supplied from the supply tube to the rotating mass of liquid, it has a conveying effect on the liquid under supply. The transmitting part is thereby braked, so that its number of revolutions becomes less than that of the bowl. It adjusts its rate of rotation to the frictional forces acting thereon in opposite directions, that is, the force of the liquid being transmitted and the force of the revolving mass of liquid.

The accompanying drawings illustrate different embodiments of the invention, each of the seven

figures being a sectional elevation of one of such embodiments.

In the construction shown in Fig. 1, the stationary feed tube 1 connects at its lower end with a liquid transfer or transmitting device comprising essentially a conical member 3 above the bowl bottom, which is adapted to project outside the free level of the liquid undergoing separation in the bowl *a*. The transmitting member 3 is so supported as to have a permissive movement of rotation, during the rotation of the bowl, relative both to the feed tube and to the bowl, as hereinbefore described.

In the construction of Fig. 1, this is accomplished by providing the lower end of the feed tube with a short conical flange 2 and by providing the conical transmitting member 3 with a neck 4, the inner end of the conical member 3 resting on the flange 2 and the neck 4 surrounding the lower end of the feed tube above the flange 2. Thereby the transmitting device is supported and guided by the feed tube, but is capable of rotation thereon.

It is advantageous to lubricate the contacting surfaces of the feed tube and transmitting device. This may be effected by providing the contacting surface of one of these elements, preferably the transmitting device, with a groove or grooves 5, which may be advantageously in the form of a spiral groove. The groove or grooves should be so arranged that in the operation of the centrifuge liquid is pumped therethrough to thereby lubricate the sliding surfaces, thus eliminating the danger of damaging the contacting surfaces of the feed tube and transmitting device by friction between them. Liquid may be fed to the groove or grooves 5 through one or more holes 6 in the wall of the feed tube, which preferably are directed obliquely downward from the inner face of the feed tube through the wall thereof.

During the rotation of the bowl, there is a tendency to create a vacuum below the lower rim 7 of the flange 2. If, with such a vacuum, the groove or grooves 5 began at this rim, liquid would not enter the groove, but instead air would be sucked from the upper edge 8 of the neck 4 into the channel 9. Air, however, is prevented from being so drawn in by supplying liquid, instead, through the holes 6. Such holes should form an acute angle with the direction of the liquid in the feed tube, so that a dynamic pressure is generated in the holes.

In the embodiment of the invention shown in Fig. 2, the transmitting device 13 is supportable by a central pin 16 fixed to the bowl bottom and

rotating with the bowl. The transmitting device 13 is provided with a bridge 17 to which is fixed a box 18 which rests on the pin 16. Between the pin 16 and the surrounding wall of the box 18 a clearance is provided to provide for radial movements of the bowl spindle. As in Fig. 1, the transmitting device 13 is guided by the feed tube 11 by means of a neck 14 embracing the lower end of the feed tube. The neck may be provided at its upper end with a conical flange 15, with the aid of which the feed tube 11 may be more easily applied when the centrifuge is being assembled.

Fig. 3 shows a slight modification of Fig. 2. Instead of the neck 130 of the transmitting device 13 surrounding the feed tube, as in Fig. 2, it extends inside the tube and may be so tapered as to be readily inserted into the tube when the centrifuge is being assembled; or the feed tube 11 may be provided with a conical flange as indicated in Fig. 1.

In the embodiment of the invention shown in Fig. 4, the neck 24 of the transmitting device 23 is maintained in contact with a shoulder 26 on the feed tube 21 by means of a spring 25 arranged between the neck and another shoulder 27 on the lower end of the feed tube. The latter shoulder may be advantageously a nut which is threaded on the tube and by means of which the tension on the spring 25 can be regulated.

Alternatively, the spring may be so positioned above the neck as to maintain the neck in contact with the lower shoulder. This arrangement is shown in Fig. 5, in which 31 is the feed tube, 33 the transmitting device, 36 and 37 the shoulders and 35 the spring. The shoulder 37 may be in the form of a ring which is tightly and rigidly fixed to the feed tube 31, while the shoulder 36 may be a nut threaded on the tube.

The purpose of the constructions shown in Figs. 4 and 5 is to obtain the desired degree of tightness of connection between the feed tube and the transmitting device. The frictional forces between the neck of the transmitting device, the shoulders and the spring should, of course, be maintained within narrow limits, so that the transmitting device is not to any considerable degree prevented from participating in the rotation of the liquid.

In the modification shown in Fig. 6, 41 is the feed tube, 43 the transmitting member and 44 a neck, on the latter member, surrounding the feed tube. Secured to the bowl bottom and extending radially through the transmitting channel below member 44 are wings 45 which cause the liquid delivered from the feed tube 41 to partake of the rotation of the bowl. Such wings may also be applied to other embodiments, as, for example, that shown in Fig. 3. The member 43 which, as hereinbefore described, projects into the body of liquid in the bowl, is, by means of these wings, 45, subjected to a pressure from the now rotating liquid being supplied. As there is no corresponding liquid pressure on the upper side of member 43, it is lifted upward during operation. No means for supporting the transmitting device is therefore needed. The pressure by which the part 43 is lifted upward depends on the degree to which the liquid being supplied is brought into rotation, which in turn is dependent on the clearance existing between the wings 45 and the part 43, and other factors. An increase of the clearance results in a reduction of the conveying action and thus also of the upwardly directed pressure. The part 43

may automatically assume a vertical position in which the upward pressure is equal to the weight of the part 43. If the upward pressure corresponds to a degree of conveying which is not sufficient for conducting the liquid being supplied to the separating chamber, the degree of conveying action and thus also the pressure may be increased at will by providing means limiting the upward movement of the part 43. The limiting means may consist of a shoulder 46 on the part 43 which contacts with the lower end of the feed tube 41. During operation liquid is pressed between the sliding surfaces of the shoulder 46 and tube 43, so that these surfaces are prevented from becoming damaged. Lubricating means between the contacting surfaces, such, for example, as specified in the description of Fig. 1, may be provided.

In the modification shown in Fig. 7, 51 is the feed tube, 53 the transmitting member and 54 a neck, on the latter member, surrounding the feed tube. In this construction, instead of the liquid transmitting channel being between the transmitting member and the bowl bottom, it is wholly in the transmitting member, the latter being provided with upper and lower walls forming such channel. Within this channel are placed wings 55. In this arrangement the transmitting device must be supported during operation in some manner, since the upward and downward pressures of the liquid in the channel of the transmitting device balance each other. Such supporting means may be a central pin 56, such as described in explaining the modification shown in Fig. 2. In order that the wings 55 shall be able to bring the inflowing liquid into rotation, the part 53 must also be brought into rotation. It is true that that portion of the part 53 which projects into the rotating mass of liquid is to some degree brought into rotation by the friction between the liquid and the said part; but in order to give a rotation speed of some importance to the part 53, a considerably greater conveying force is required. This may be attained, for instance, by providing the part 53 with wings 57 which extend some way into the rotating bulk of liquid. By suitably determining the size and the shape as well as the number of the wings 57 it is possible to so fix the rotation speed of the part 53 that the conveyance and transmission of the liquid from the tube 51 to the rotating mass of liquid are effected as far as possible without impacts.

In the several embodiments herein described, it should be noted that the transmitting device will not rotate if there is no liquid being processed. Thus, when starting the centrifuge and until liquid is admitted, the transmitting device remains stationary on the feed tube, and only after the bowl has become filled with liquid is the transmitting device forced to participate in the rotation. While no liquid can be fed to the sliding surfaces between the feed tube and the transmitting device during rotation of the bowl to effect lubrication of such surfaces, if no liquid is being fed to the bowl, that is not objectionable, because then the transmitting device remains stationary. As soon, however, as liquid flows into the bowl and puts the transmitting device into rotation, liquid is also conducted to said sliding surfaces.

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

1. A centrifuge comprising a rotatable bowl, a central non-rotatable feed tube and a transmit-

ting device adapted to deliver liquid from the feed tube to the bowl and of such substantially greater diameter than the feed tube as to penetrate the body of liquid being processed in the bowl, said transmitting device being freely rotatable independently of the bowl around the feed tube and adapted, solely under the force of the revolving mass of liquid opposed by the braking action of the liquid being conveyed from the feed tube to the bowl and any friction between the transmitting device and the feed tube, to rotate, during the operation of the bowl when liquid is being supplied thereto, at a rate slower than that of the bowl.

2. A centrifuge in accordance with claim 1 in which the transmission device comprises a member of substantially greater diameter than the feed tube providing, between the feed tube and the bowl bottom, a passage for conveying the liquid from the feed tube to the bowl chamber.

3. A centrifuge in accordance with claim 1 in which the liquid transmitting device is guided on the central feed tube so as not to partake of any radial movement of the bowl.

4. A centrifuge in accordance with claim 1 in which the liquid transmission device comprises a neck which is guided on the central feed tube and in which one of said members is provided with a groove adapted, during the operation of the centrifuge while liquid is being supplied thereto, to receive said liquid and lubricate the contacting surfaces of the feed tube and the neck of the transmission device.

5. A centrifuge in accordance with claim 1 in which the transmission device is guided by the feed tube and which is free, during the rotation of the bowl while liquid is being supplied thereto, to rise under the unbalanced pressure on the upper and lower sides of the transmission device.

6. A centrifuge in accordance with claim 1 in which the transmission device is guided by the feed tube but is supported, when the bowl is not

rotating, upon the bowl bottom, said transmission device being free, during the rotation of the bowl while liquid is being supplied thereto, to rise under the unbalanced pressure on the upper and lower sides of the transmission device.

7. A centrifuge in accordance with claim 1 in which the transmission device comprises a conical shaped member providing, between the feed tube and the bowl bottom, a passage for conveying the liquid from the feed tube to the bowl chamber, and wings carried by the bowl bottom and extending from the inner to the outer part of said passage.

8. A centrifuge in accordance with claim 1 in which the liquid transmitting device comprises a neck which is guided and supported on the central feed tube.

9. A centrifuge in accordance with claim 1 in which the liquid transmitting device is guided and supported on the central feed tube, said supporting means comprising a ring adjustable on the feed tube and a spring confined between said ring and the transmitting device.

10. A centrifuge in accordance with claim 1 in which the liquid transmitting device comprises upper and lower walls providing between them a channel for conveying the liquid from the feed tube to the separating space of the bowl, and a wing carried by the transmitting device and located in the bowl chamber in a position to penetrate the body of liquid being processed therein.

11. A centrifuge in accordance with claim 1 in which the liquid transmitting device comprises upper and lower walls providing between them a channel for conveying the liquid from the feed tube to the separating space of the bowl, wings extending from the inner to the outer part of said channel, and wings carried by the transmitting device and located in the bowl chamber in a position to penetrate the body of liquid being processed therein.

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