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ARRANGEMENT IN CONNECTION WITH CENTRIFUGAL BOWLS

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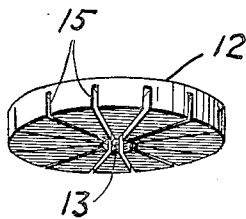


FIG. 2.

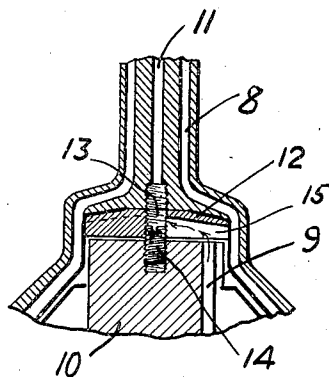


FIG. 3.

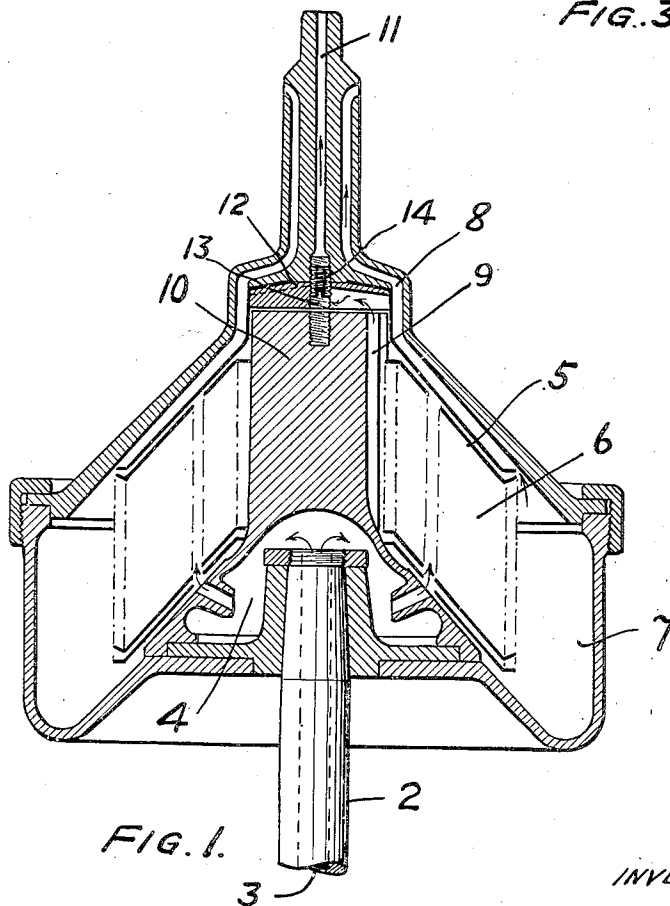


FIG. 1.

WITNESS:

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UNITED STATES PATENT OFFICE

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ARRANGEMENT IN CONNECTION WITH CENTRIFUGAL BOWLS

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In separating certain kinds of liquids or mixtures of liquids it is necessary to prevent the air from coming into contact with the liquid when it is fed into the bowl or discharged therefrom. One means of accomplishing this purpose is the use of so-called "closed" centrifuges. In these the liquid is fed into the bowl under pressure (usually through the rotation shaft of the bowl) and is led into a separating chamber which is (preferably) provided with discs. When two liquids of different specific gravity are separated, the lighter liquid moves inward within the separating chamber toward the rotation axis of the bowl and is thence led through channels extending upward to a central outlet; while the heavier liquid moves outward within the separating chamber and is discharged from the bowl through channels and openings situated at a certain distance from the rotation axis. If only one liquid is treated, that is, if it is purified from heavier impurities, it moves inward within the separating chamber and flows out through a central outlet.

When the lighter liquid or the liquid which is being liberated from heavier impurities moves inward through the separating chamber, it tends to follow the hydrodynamic law according to which its state of energy remains unchanged. This means, in other words, that if the liquid has been brought into rotation by the bowl, so that each particle travels a path around the rotation axis at a certain peripheral speed, the angular velocity of said particle tends to increase or reduce when its distance from the rotation axis is reduced or increased respectively. The result of this would be, if no measures were taken to prevent it, that the particle, when it is moving inward, would travel a path around the rotation axis with increasing angular velocity the shorter the distance from the rotation axis. One of the known expedients which has been adopted to prevent this operation is to provide the central element on which the discs are positioned with channels through which the liquid streams upwards after it has left the discs.

In these channels "sliding" (the action above explained) is prevented.

In so-called "open" centrifugal bowls, in which the outlet for the lighter liquid is situated at a certain distance from the rotation axis, this conveyor-device is sufficient, as it can be positioned the same radial distance from the bowl's axis as the liquid outlet. In closed centrifugal bowls, wherein a liquid outlet is situated at or very close to the rotation axis, such conveyor-devices alone do not operate satisfactorily, as the liquid is not prevented from sliding when passing from the channels in the central element inwardly into the central outlet. The result is that the liquid attains a very great angular velocity; and since the magnitude of the centrifugal force acting upon the liquid is proportional to the square of the angular velocity but only to the first power of the radius, it is evident that the resistance to the flow of the liquid inward is strongly increased.

The present invention has for its object to provide means whereby the above objectionable conditions may be overcome, and comprises conveyor-devices positioned in a central portion of the bowl. The invention is applicable to a centrifugal bowl which has one or more closed outlets for separated liquid and which is provided with a central element carrying discs and having, inside the discs, longitudinal channels for leading and conveying separated liquid. The invention is characterized by devices which prevent the liquid from sliding when it passes from these channels in the central element into a central outlet for separated liquid.

In the drawing, which shows one embodiment of the invention:

Fig. 1 is a vertical sectional view of a centrifugal bowl embodying my invention. Fig. 2 is a perspective view of the disc which is provided with channels connecting the longitudinal channels in the central element with the axial discharge channel. Fig. 3 is a detail sectional view of a modification.

The centrifugal is carried by a bowl spindle 2. The bowl spindle is provided with an axial channel 3 through which liquid is fed into the bowl under pressure. The channel 3

opens into a central chamber 4, whence the liquid to be separated flows out into a separating chamber 6 provided with discs 5. The bowl shown in the drawing is constructed for separating a mixture of liquids into two constituents of different specific gravity. The heavier constituent passes outward towards the so-called sludge space 7 of the bowl and is led out through channels 8. The lighter liquid streams inward toward the rotation axis of the bowl and is caught by channels 9 formed by longitudinal grooves in the outside of a central element 10. These grooves are situated inside the inner rims of the discs 5. The grooves communicate with a central channel 11 through which the lighter constituent of the liquid is discharged from the bowl.

According to the embodiment of the invention shown in Figs. 1 and 2, an element 12 in the form of a disc (separately shown in Fig. 2) is arranged above the central element 10. This said element is provided with a central hole 13, which is threaded to receive a hollow screw 14. This screw may also extend for some distance within the channel 11. Element 12 is, on its lower side, provided with a number of radial channels 15 which communicate with the threaded hole 13. Through these channels the channels 9 and 11 are connected one with another. By making the width of the channels 15 rather small it becomes possible, for two reasons, to completely, or at least nearly completely, avoid undesirable movements of the liquid while it is passing inward toward the hole 13. First: It is possible to make the diameter of the hole 13 small, as the channels 15 are narrow, so that a conveying action is obtained very close to the rotation axis. Second: Local rotative movements of the particles of the liquid are avoided during the passage inward through the channels 15, which local rotative movements, as hereinbefore explained, are caused by the tendency of the liquid to maintain its state of energy. By preventing these rotative or sliding movements, the centrifugal force acting on the liquid is reduced, which force would otherwise tend to counteract the flow of the liquid inward, or, in other words, increase the pressure which is necessary for passing the liquid through the centrifugal bowl.

By means of the screw 14 it is possible to regulate the size of the connecting openings of the radial channels 15 at the hole 13; that is, it is possible to fix the amount of liquid discharging through the outlet 11. This regulation may be accomplished by threading the screw 14 either into that part of the channel 11 which is threaded, as shown in Fig. 1, or into the threaded hole in the upper part of the central element 10, as shown in Fig. 3. In order that the through-flow area for the liquid through the channels

15 shall be sufficiently great notwithstanding the small width of the channels, the height (depth) of the channels should be relatively great.

The disc 12 and the neck of the bowl containing the outlet passage 11 are, preferably, separate parts, as shown, but they all, or any two of them, may be made integral, as they all rotate as a unit on spindle 2.

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

1. The combination with a "closed" centrifugal bowl provided with a central outlet for separated liquid extending along substantially the axis of the bowl and of such restricted diameter as to discharge the separated liquid substantially coincident with such axis and a central element provided with a number of receiving and conveying channels for separated liquid extending substantially parallel to, but spaced a substantial distance from, the axis of the bowl, of means providing a number of passages connecting said liquid-receiving and conveying channels with said central liquid-outlet channel.

2. The combination with a "closed" centrifugal bowl provided with a central outlet for separated liquid extending along substantially the axis of the bowl and of such restricted diameter as to discharge the separated liquid substantially coincident with such axis, a central element and a liner of discs carried thereby, the central element being provided in its periphery with a number of longitudinally extending channels adapted to receive and convey liquid that has been separated between the discs, of means providing a number of substantially radially extending passages connecting said liquid-receiving and conveying channels with said central liquid-outlet channel.

3. The combination with a "closed" centrifugal bowl provided with a central outlet channel for separated liquid and a central element provided with a number of longitudinal channels for receiving and conveying separated liquid extending substantially parallel to, but spaced a substantial distance radially from, said central outlet channel, of means providing a number of passages connecting the discharged ends of said liquid-receiving and conveying channels with the inlet end of said central liquid-outlet channel, said passages being of a depth (measured longitudinally of the bowl's axis) substantially greater than their width (measured concentrically with the bowl's axis).

4. The combination with a "closed" centrifugal bowl provided with a central outlet channel for separated liquid and a central element provided with a number of longitudinal channels for receiving and conveying separated liquid extending substantially parallel to, but spaced a substantial distance radially

from, said central outlet channel, of a disc positioned above the central element and provided with a number of passages communicating at their outer inlet ends with the discharge ends of said longitudinal liquid-receiving and conveying channels and at their inner outlet ends with the inlet end of said central liquid-outlet channel.

5. The combination with a "closed" centrifugal bowl having a neck element provided with a central outlet channel for separated liquid and a central element inside the separating chamber of the bowl and provided with a number of longitudinal channels adapted to receive and convey separated liquid and spaced a substantial distance radially from the axis of the bowl, of a disc positioned between said neck element and said central element and having a central hole substantially aligning with said central outlet channel and having also a number of passages communicating at their outer inlet ends with the discharge ends of said longitudinal channels and at their inner outlet ends with said hole, and an adjustable hollow screw threaded in said hole and into one of said elements.

6. The combination with a "closed" centrifugal bowl having a neck element provided with a central outlet channel for separated liquid and a central element inside the separating chamber of the bowl and provided with a number of longitudinal channels adapted to receive and convey separated liquid and spaced a substantial distance radially from the axis of the bowl, of a disc posi-

tioned between said neck element and said central element and having a central hole substantially aligning with said central outlet channel and having also a number of passages communicating at their outer inlet ends with the discharge ends of said longitudinal channels and at their inner outlet ends with said hole, and an adjustable hollow screw threaded in said hole and into one of said elements, the passages in the disc extending radially of the disc and of a width substantially less than their depth and opening in the peripheral edge of the disc and along one face thereof.

7. The combination with a "closed" centrifugal bowl having a neck element provided with a central outlet channel for separated liquid and a central element inside the separating chamber of the bowl and provided with a number of longitudinal channels adapted to receive and convey separated liquid and spaced a substantial distance radially from the axis of the bowl, of a disc positioned between said neck element and said central element and having a central hole substantially aligning with said central outlet channel and having also a number of passages communicating at their outer inlet ends with the discharge ends of said longitudinal channels and at their inner outlet ends with said hole.

In testimony of which invention, I have hereunto set my hand, at Stockholm, Sweden, on this 7th day of January, 1932.

NORE EINAR BERGNER.