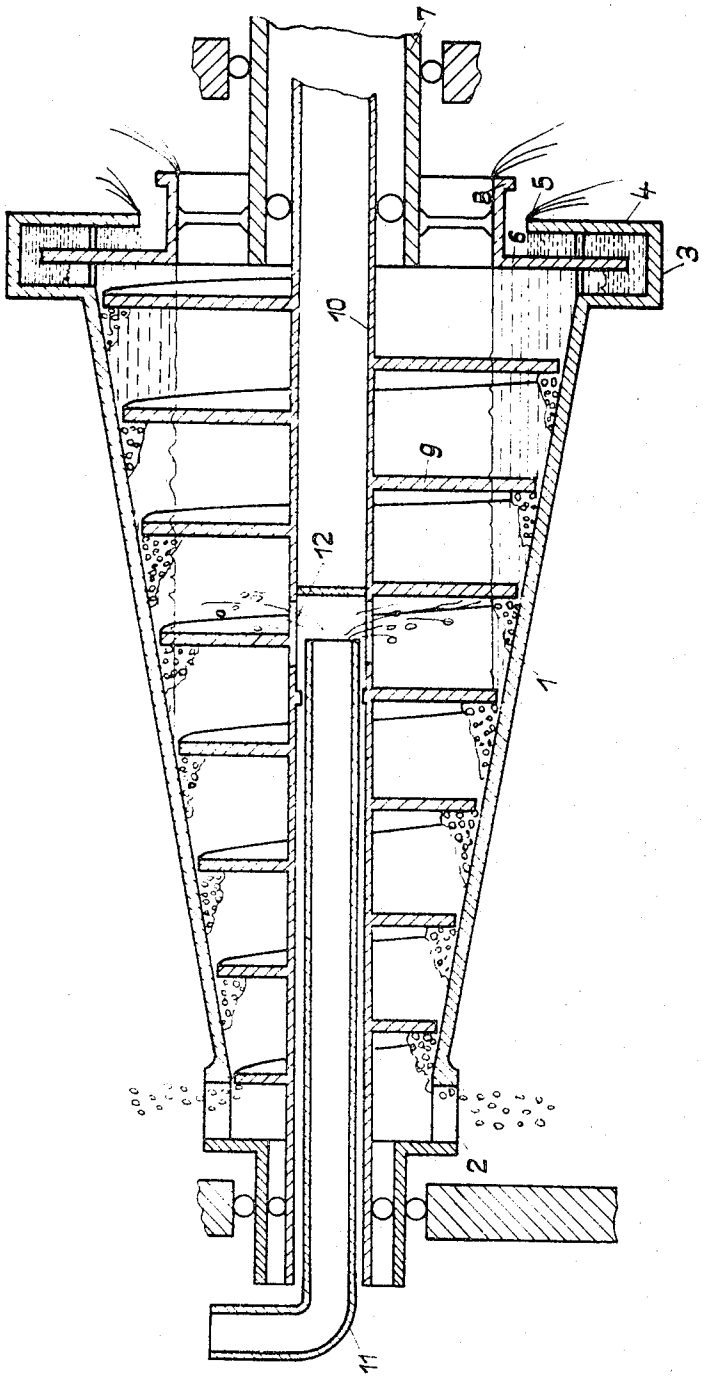
Dec. 31, 1968 F. W. SCHNEIDER ET AL 3,419,210

FULL-ENVELOPE CENTRIFUGE WITH DISCHARGE SCREW

Filed Aug. 9, 1965



Inventors
Fritz W. Schneider
Ingo G. Schneider
By Cornell Montague
Attorney

United States Patent Office 3,419,210
Patented Dec. 31, 1968

3,419,210

FULL-ENVELOPE CENTRIFUGE WITH DISCHARGE SCREW

Fritz W. Schneider, Schwerte (Ruhr), and Ingo G. Stohlmeier, Reinbek, near Hamburg, Germany, assignors to Beteiligungs- und Patentverwaltungsgesellschaft mit beschrankter Haftung, Essen, Germany, a corporation of Germany

Filed Aug. 9, 1965, Ser. No. 478,053
3 Claims. (Cl. 233—7)

ABSTRACT OF THE DISCLOSURE

A full-envelope centrifuge which comprises a substantially conically shaped centrifuge drum mounted for rotation about its longitudinal axis and constituting the setting chamber for the centrifuged goods. A discharge screw of substantially complementary conical shape is disposed in and mounted for rotation relative to the centrifuge drum. The latter has lateral exit openings at the narrow end thereof, which openings are adapted to remove the solid particles of the centrifuged goods. A first overflow weir is disposed at the wide end of the centrifuge drum and adapted to remove the lighter portion of the centrifuged goods. A second overflow weir is disposed at the wide end of the centrifuge drum. A circulation channel operates at a large diameter of the centrifuge and provides communication between the second overflow weir and the setting chamber, and the level of the heavier liquid portion is disposed outside of the setting chamber operated by the discharge screw.

The present invention relates to a full-envelope centrifuge with a feed screw.

Such device, also called "decanter," serves the purpose of separating the centrifuged goods consisting of suspensions into their solid and liquid components. It comprises substantially a mostly conically-shaped centrifuge drum, in the end wall of which disposed at its wider end is arranged an overflow weir for the lighter liquid portion of the centrifuged goods, and a discharge screw disposed inside of the centrifuge drum and having a certain number of revolutions relative to the centrifuge drum, by which the heavier solid particles of the centrifuged goods, depositing on the conical inner wall of the centrifuge drum, are feed in the direction of the narrower end of the centrifuge drum and are expelled there.

Under certain circumstances a satisfactory removal of the solid parts of the material is made difficult by the feeding screw or even impossible. This occurs, for instance, then when the deposited particles remain capable of flowing or if the friction between the latter and the centrifuge drum is smaller, than the friction between the deposited particles and the discharge screw. This case will occur in particular then when the centrifuged goods have two liquid phases in addition to the solid phase, whereby one of the liquid phases is specifically heavier than the solid phase. In this case, namely, the solid particles swim on the heavier liquid phase and can no more be transported by the feeding screw.

In order to remove in the later case the heavier liquid phase from the setting chamber, the envelope of the centrifuge drum is equipped partly with filters through which the heavier liquid can flow off. This solution was, however, not satisfactory, since the filters are clogged up comparatively fast and become thereby inoperative. Furthermore, it has been attempted to permit the heavier liquid phase to flow off by appropriately dimensioned nozzles provided at the lowest point of the setting chamber. Yet, even this solution is not satisfactory, since the nozzles are extremely sensitive to concentration deviations of the centrifuged goods and, thus, do not assure a satisfactory operation.

It is one object of the present invention to provide a full-envelope centrifuge with a discharge screw, which makes possible a satisfactory separation of the centrifuged goods into its components, which centrifuged goods consist of a solid phase and two liquid phases having the above-stated weight ratio without the use of non-stabile auxiliary means, as filters, nozzles or the like.

It is another object of the present invention to provide a full-envelope centrifuge with a discharge screw, wherein in addition to the overflow weir for the lighter liquid, a further overflow weir is provided for the heavier liquid portion, which is disposed behind the first-mentioned overflow weir, which further overflow weir is in communication with the setting chamber over a circulation channel disposed at a point of a comparatively large diameter, whereby the circulation channel is designed such, that the level of the heavier liquid portion is disposed outside of the setting chamber covered by the discharge screw.

It is still another object of the present invention to provide a full-envelope centrifuge with a discharge screw, wherein the overflow weir for the heavier liquid portion is disposed in the end wall of a cylindrical expansion provided in the otherwise conically centrifuged drum, a particular closing wall carrying the overflow weir for the lighter liquid portion projecting from the inside into the cylindrical expansion.

With these and other objects in view which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawing, in which the only figure is an axial section of the full-envelope centrifuge, designed in accordance with the present invention.

Referring now to the drawing, the actual centrifuge drum comprises a conical portion **1**, which terminates at its left end (seen on the drawing) in a portion having exit openings **2** for removal of the solid particles of the centrifuged goods and at the right end in a cylindrical expansion **3**. An annular end wall **4** of the cylindrical expansion **3** forms with its inner edge an overflow weir **5** for the heavier liquid portion of the centrifuged goods. A further closing wall **6** projects from the inside into the chamber surrounded by the cylindrical expansion, which closing wall **6** forms likewise a portion of the centrifuged drum and is connected with the latter, as well as with its rotating shaft by means of suitable stays. The closing wall **6** is likewise arranged of annular shape and forms with its inner edge an overflow weir **8** for the lighter liquid portion of the centrifuged goods.

Inside of the setting and drying chamber, formed by the conical portion **1** of the centrifuge drum, is disposed the discharge screw **9** with the corresponding shaft **10**. The number of revolutions of the shaft **10** is somewhat different from the number of revolutions of the centrifuge drum **1**, and in particular such, as can be ascertained from the drawing, that the solid particles of the centrifuged goods setting in the right portion of the centrifuge drum **1** are moved by the screw threads towards the left side, where they are thrown off through the exit openings **2**.

A filling tube **11** projects from the left side into the hollow shaft **10** of the discharge screw **9**. The centrifuged goods are fed through this tube **11**, as well as through lateral openings **12** disposed at the end of the tube **11** in the hollow shaft **10** into the setting chamber of the centrifuge drum **1**.

As can be ascertained from the drawing, the lighter

liquid portion of the centrifuged goods flows off over the overflow weir **8** in the closing wall **6**, while the heavier liquid portion is accumulated merely in the chamber surrounded by the cylindrical expansion **3** of the centrifuge drum and flows from the outside around the closing wall **6** and then flows off over the overflow weir **5**. The liquid level at both sides of the closing wall **6** is determined in known manner in accordance with the laws of communicating tubes. Since this law does not contain any values, which are combined with a possible timely change of concentration and quantity of the feed, the flow-off of the heavier liquid portion cannot be disturbed by such changes. The separation of the three phases takes place in addition also independently from the geometrical shape of the setting drum and of the discharge screw. It merely presumes, that the specific weights, as well as the concentration of the goods to be separated are at such ratio relative to each other, that the previously mentioned required friction between the solid portion and the setting drum is present. If this is not the case already anyway, as found in connection with many important material combinations, the inner phase of the centrifuge drum **1** may be equipped with longitudinal or spiral grooves (not shown), which contribute to an increase of the friction and simultaneously operate as flow-off channels for the heavier liquid portions.

While we have disclosed one embodiment of the present invention, it is to be understood that this embodiment is given by example only and not in a limiting sense, the scope of the present invention being determined by the objects and the claims.

We claim:

1. A full-envelope centrifuge, comprising

a conoidal centrifuge drum mounted for rotation about its longitudinal axis and constituting the separating chamber for the centrifuged goods,

a screw of substantially complementary shape disposed in and mounted on said axis for rotation relative to said centrifuge drum and closely adjacent thereto,

said centrifuge drum having at least one lateral exit opening at the narrow end thereof,

said screw being rotatable to move material towards said opening,

a first overflow weir disposed at the wide end of said centrifuge drum at a first distance from said axis to remove the lighter liquid portion of said centrifuged goods,

a second overflow weir disposed at the wide end of said centrifuge drum at a second distance greater than said first distance,

a channel at a large diameter of said centrifuge and having communication with said second overflow weir and said separating chamber,

said second weir being the end wall of said channel imperforate with said drum,

said first weir being a disc with its outer edge disposed in said channel, and

said weirs being axially spaced from each other.

2. The full-envelope centrifuge, as set forth in claim **1**, wherein

said centrifuge drum has a cylindrical extension including an end wall, the latter constituting said second overflow weir, and

a closing wall projecting into said cylindrical extension and carrying said first overflow weir.

3. A full-envelope centrifuge for separating the solid and liquid constituents of a suspension with two liquid constituents of lower and of higher specific weight, respectively, than that of the solid constituents, comprising

a rotatable centrifuge drum constituting a separating chamber for the solid constituent,

a rotatable discharge screw disposed in said centrifuge drum and adapted to remove the solid constituent out of said separating chamber,

a first annular end wall of said centrifuge drum forming a first overflow weir adapted to remove the lighter liquid constituent,

a second annular end wall forming a second overflow weir disposed outside of said first end wall and adapted to remove the heavier liquid constituent, the second overflow weir defining one side of a channel providing communication with the separating chamber and having its base spaced apart from the axis of rotation of said centrifuge drum,

said centrifuge drum having a conically shaped portion constituting said separating chamber for the solid constituent,

said conical portion being joined at one end to a wider cylindrical portion forming the base of said channel, and wherein said second overflow weir for the heavier liquid constituent being formed by the end wall of said channel, and

a boundary wall constituting said first overflow weir for the lighter constituent extending outwardly into said channel.

References Cited

UNITED STATES PATENTS

736,976	8/1903	Keiper	233—21 X
1,230,560	6/1917	Camp	233—7
1,435,545	11/1922	Morris	233—7
1,710,316	4/1929	Laughlin	233—7
1,712,184	5/1929	Wendel	233—21
1,780,655	11/1930	Nyrop	233—7
3,268,159	8/1966	Kern	233—7

HENRY T. KLINKSIEK, *Primary Examiner.*