

Dec. 19, 1939.

H. ARGANT ET AL

2,184,033

CENTRIFUGE FOR CHEMICAL REACTIONS

Filed Dec. 6, 1937

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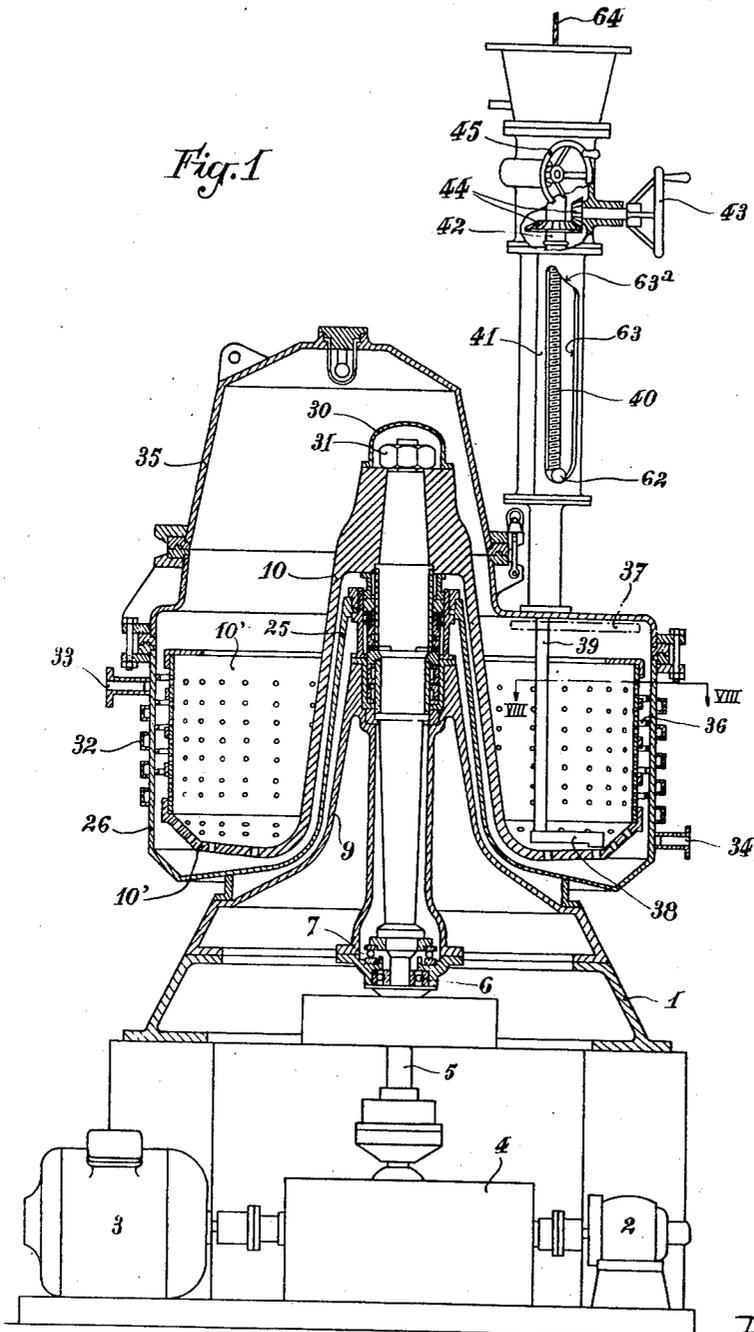


Fig. 1

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4 Sheets-Sheet 2

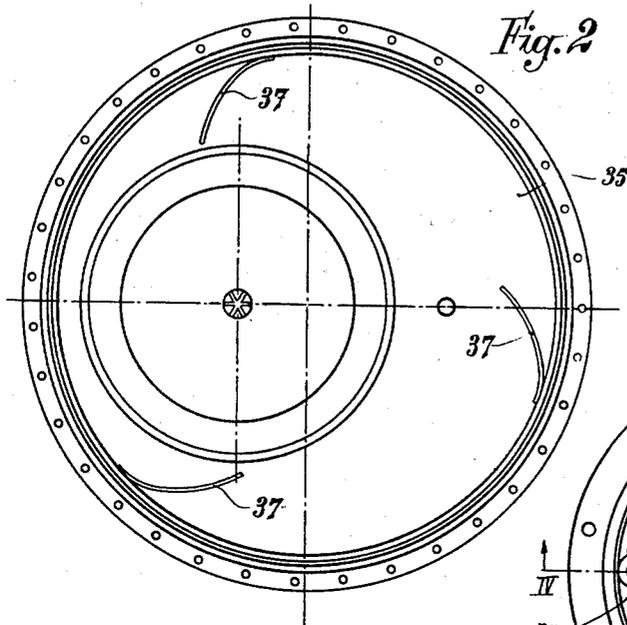


Fig. 2

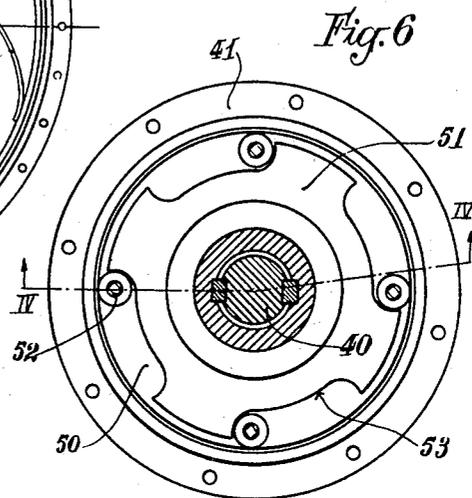


Fig. 6

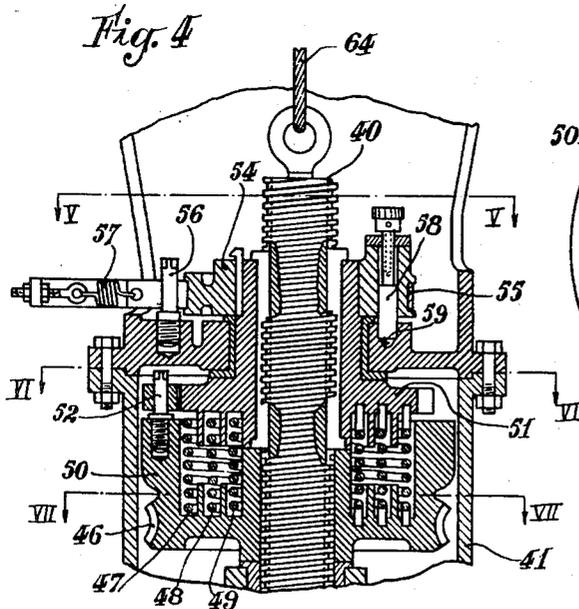


Fig. 4

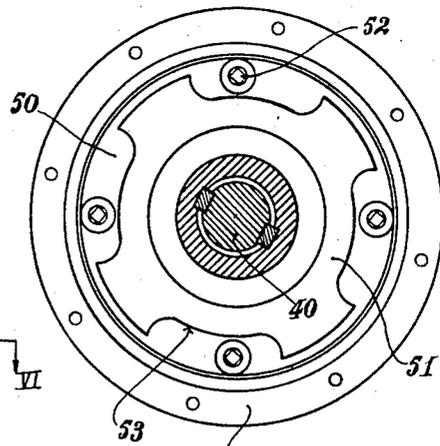


Fig. 11

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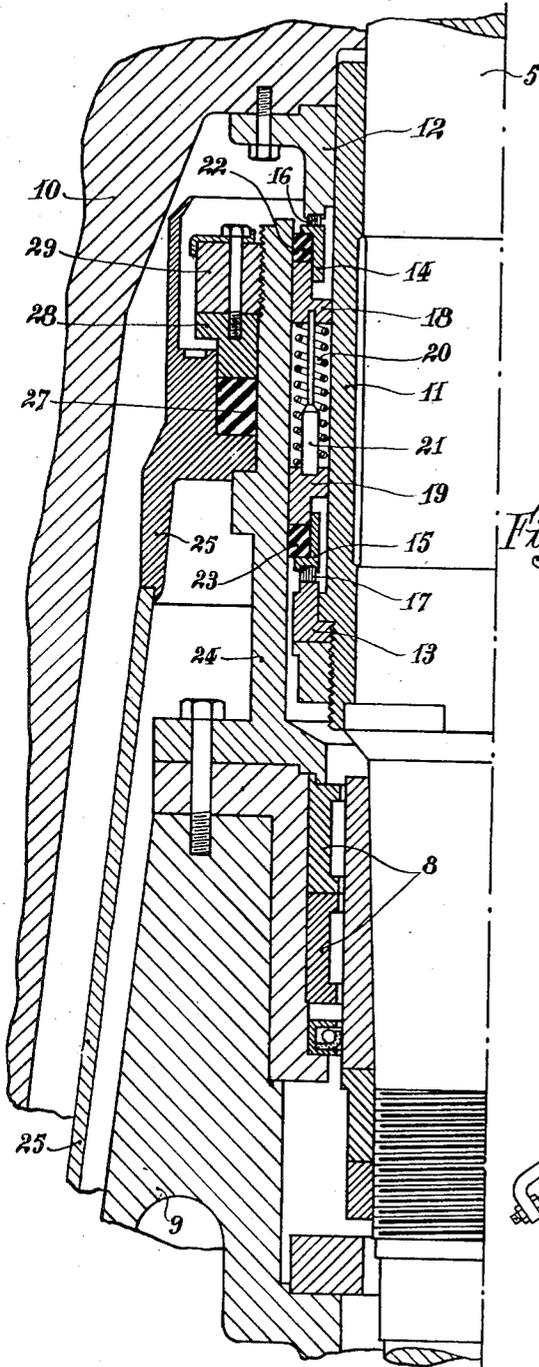


Fig. 3

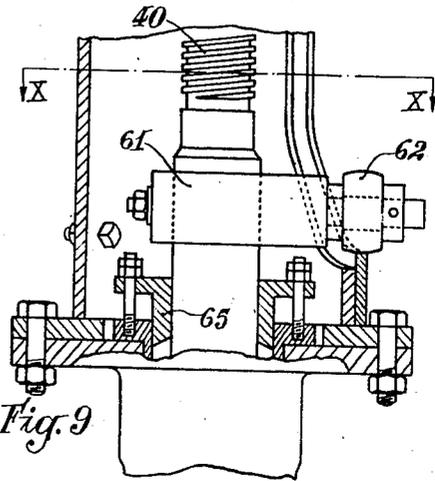


Fig. 9

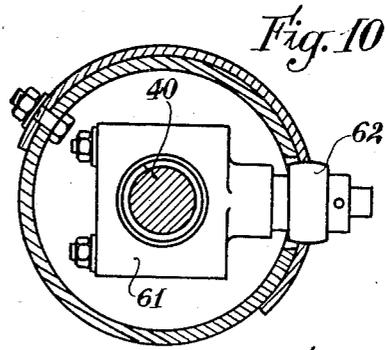


Fig. 10

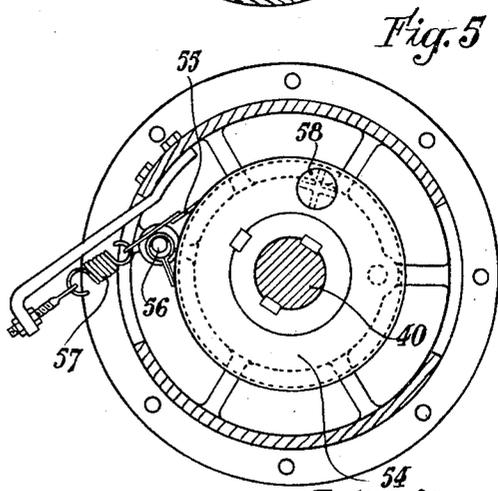


Fig. 5

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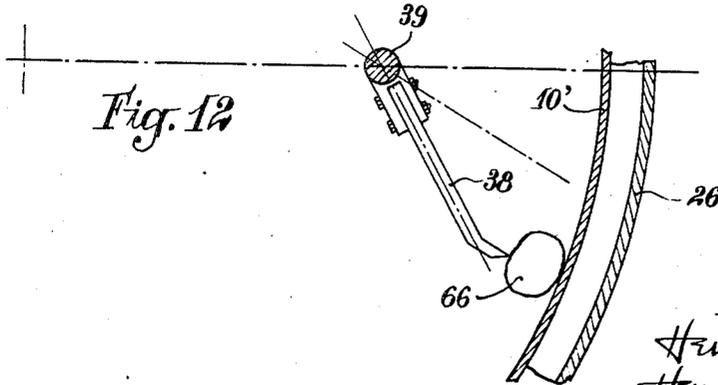
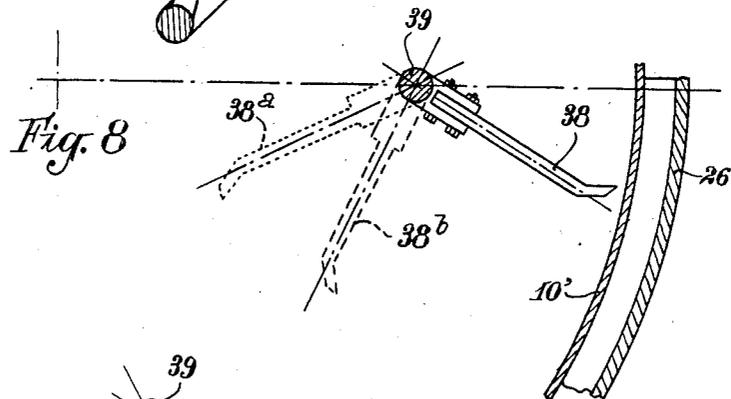
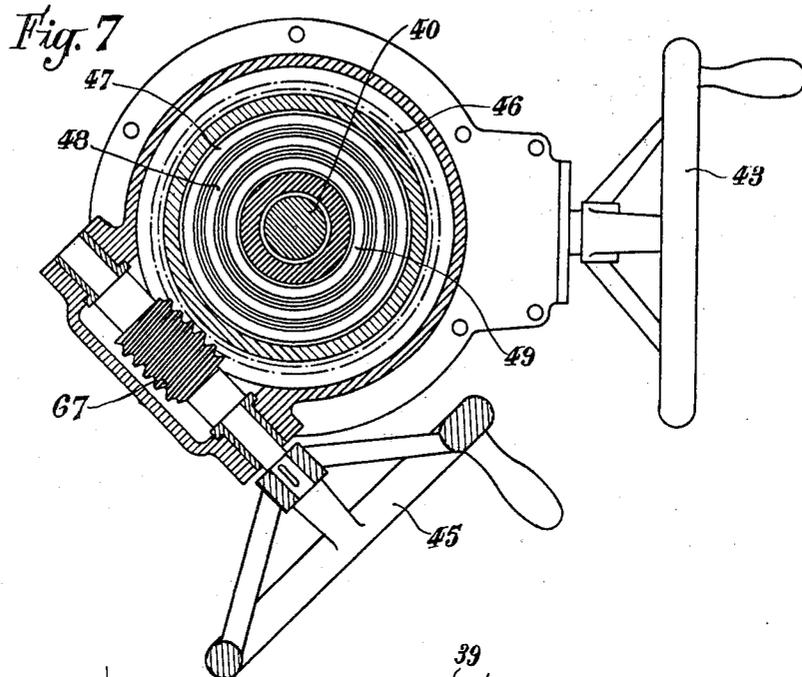
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CENTRIFUGE FOR CHEMICAL REACTIONS

Filed Dec. 6, 1937.

4 Sheets-Sheet 4



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CENTRIFUGE FOR CHEMICAL REACTIONS

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Application December 6, 1937, Serial No. 178,420
In France December 7, 1936

4 Claims. (Cl. 210—70)

This invention relates to a vertical centrifuge more particularly adapted for effecting chemical reactions.

It is a well known fact that in such machines the difficulty is the necessity of using materials which are not attacked by the chemical agents; it is of course possible to use appropriate kinds of stainless steels for the parts which come into contact with the reagents. But when dealing with volatile chemicals, or when projections of liquid may occur, this special steel is to be used not only for the rotating basket and the casing, but also for the central part of the machine; the construction becomes expensive and difficult, more particularly for the bearings of the spindle.

Another drawback of the known machines is the difficulty of ensuring a regular distribution of the solid matter against the walls of the rotating basket when the rotation at high speed is taking place. The machine is generally more or less tightly closed and the operators have therefore no easy access to its interior.

Still another drawback is that the discharge of the basket is often rendered difficult by the volatile or acid agents which impregnate the mass of the material to be discharged.

A first object of this invention is to provide a centrifuge wherein a perfectly tight packing device will prevent access of the corrosive liquids or vapours to the bearings of the spindle, whereby the mechanical parts of the machine may be made of ordinary metal, irrespective of the nature of the reagents.

A further object of this invention is to provide a centrifuge wherein vacuum or pressure may be established, for instance in order to reclaim vapours of expensive solvents.

Still another object of this invention is to provide a centrifuge of the character above referred to comprising an automatic disintegrating blade or scraper, controlled by means wholly exterior to the machine ensuring its travel in parallel relation with respect to the walls of the rotating basket and without contacting the same.

Still another object of this invention is to provide a centrifuge with automatic disintegrating blade or scraper wherein a peculiar controlling means is provided for the said blade or scraper, whereby the latter operates as a distributor equalizing the layer of solid substance against the walls of the rotating basket.

In the annexed drawings:

Fig. 1 is a general vertical section of a centrifuge according to this invention.

Fig. 2 is a bottom plan view of the casing cover.

Fig. 3 is a partial sectional view to an enlarged scale showing the packing device around the spindle.

Fig. 4 is an enlarged vertical section of the controlling gear for the scraper.

Figs. 5, 6 and 7 are cross-sections taken along lines V—V, VI—VI and VII—VII of Fig. 4.

Fig. 8 is a partial diagrammatical section of Fig. 1 taken along line VIII—VIII and drawn to an enlarged scale.

Fig. 9 is an enlarged partial vertical section of the scraper controlling column, showing the controlling roller.

Fig. 10 is a cross-section thereof.

Fig. 11 is a view substantially similar to Fig. 6, but showing the parts when the scraper is deviated by an obstacle.

Fig. 12 is a view substantially similar to Fig. 8, but at the position corresponding to Fig. 11.

The machine illustrated comprises a base enclosing two electromotors 2 and 3, the first one being adapted to rotate the centrifuge at low speed while the second one is used for the rotation at high speed. These two motors are connected with the vertical spindle 5 of the centrifuge through an appropriate gear box 4. Spindle 5 is supported and guided by bearings 6, 7 and 8, and it projects above an axial hollow column 9 fixed to base 1, where it carries the bell-shaped hub 10 of the rotating basket 10' of the centrifuge.

There is disposed a packing device around spindle 5 between the top of column 9 and hub 10, such device comprising (Fig. 3) a sleeve 11 clamped on spindle 5 and carrying two opposed thrust rings 12 and 13. Rings 12 and 13 cooperate with counter-rings 14 and 15 having their active faces provided with graphite rings 16 or 17 which are embedded in the material of the counter-rings. The latter are axially pressed against the thrust rings 12 and 13 by two rings 18 and 19 urged apart by springs 20 guided by rods 21. And between each ring 18 or 19 and the corresponding counter-ring 14 or 15 there is disposed an annular joint 22 or 23 made of rubber, which tightly contacts the outer sleeve 24 fixed at the top of column 9.

Rings 18 and 19, joints 22 and 23 and counter-rings 14 and 15 do not rotate, while rings 12 and 13, and sleeve 11 rotate with spindle 5.

There is disposed around sleeve 24 an annular member 25 forming the top of the central conical part of the casing 26, and there is provided a rubber ring 27 to form a tight joint between

member 25 and sleeve 24, such ring being pressed by a counter ring 28 urged by a nut 29.

Hub 10 is clamped at the upper end of spindle 5 by a nut 31 enclosed within a protective cap 30.

5 Basket 10' with its hub 10 and cap 30, casing 26 and its central member 25 together with the upper parts of the packing device are made of special steel or other material uncorrodible by the chemicals used, while column 9, spindle 5 and bearings 6, 7 and 8 are made of ordinary metal.

15 Casing 26 (Fig. 1) is surrounded by a heating or refrigerating coil 32 made of a U-iron welded against the outer wall of the casing. The inlet and outlet are shown at 33 and 34. There is also provided a cover 35 adapted to tightly close casing 26, the chemicals being introduced by means of valves not shown; the said valves also permit of establishing vacuum or pressure within the centrifuge. Casing 26 also carries helicoidal projections 36 which cause the liquid to circulate vertically when basket 10' is rotated. Spiral blades 37 are also provided under cover 35 (Fig. 2) for ensuring the circulation in cooperation with projections 36. As shown in Figs. 1 and 2, blades 37 and projections 36 are so disposed that if the direction of rotation of basket 10' is such that the liquid is circulated upwardly by projections 36, it is directed towards the center of the machine by blades 37, and vice-versa.

30 The centrifuge further comprises a scraper adapted to ensure a regular distribution of the material to be treated and to disintegrate the final product from the basket. The scraper or blade proper 38 (Figs. 1 and 8) is carried at the lower end of a vertical shaft 39. The latter passes through a stuffing-box 65 (Fig. 9) and is then formed as a screw 40 disposed axially within a column 41 fixed on casing 26. Screw 40 is axially driven by a nut 42 (Fig. 1) rotated by means of a hand wheel 43 through a pair of bevel gears 44. Screw 40 together with spindle 39 may also be rotated by means of a handwheel 45 (Figs. 1 and 7) in the manner hereafter described.

45 Handwheel 45 is keyed on a shaft oblique with respect to the plane of Fig. 1 and carrying a worm 67 in mesh with a worm wheel 46 loose on screw 40. To wheel 46 are fixed the lower ends of three co-axial torsion springs 47, 48 and 49 (Fig. 4) disposed within a sort of drum 50 supported by wheel 46. The upper ends of springs 47, 48 and 49 are fixed to a member 51 slidably keyed on screw 40. Drum 50 carries four vertical studs 52 which pass through four peripheral notches 53 of member 51 as more clearly shown in Fig. 6.

55 The initial tension of springs 47, 48 and 49 tends to rotate member 51 anticlockwise with respect to drum 50. Studs 52 thus abut against one end of notches 53. But when the clockwise torque applied to shaft 39 and screw 40 by the scraper 38 is too high, for instance when the scraper strikes against an obstacle 66 (Fig. 12), member 51 is able to rotate with respect to wheel 46 against springs 47, 48 and 49 for an angle corresponding to the angular extension of notches 53 (Fig. 11). Owing to this rotation scraper 38 may disengage itself from the obstruction. The arrangement described therefore operates as a safety device.

70 Member 51 extends upwardly in the form of a hub carrying a pulley 54 (Figs. 4 and 5) on which there is wound a belt 55 having an end attached to a fixed stud 56 while its other end is tensioned by a spring 57. This arrangement forms a brake which retards the anticlockwise return

of the scraper 38 when it has been deviated against the action of springs 47, 48 and 49 in the manner above described. This brake also dampens any torsional oscillation which may be caused by the operation of the scraper.

5 Pulley 54 also carries a vertical finger 58 which may be engaged into a blind hole 59 of the cover 60 of column 41. Pulley 54, member 51 and screw 40 are then locked at a position corresponding to an appropriate distance between the edge of scraper 38 and the inner wall of the basket 10' as it will be understood below.

15 A ring 61 (Figs. 9 and 10) is fixed on shaft 39 at the upper end thereof, such ring carrying a radial roller 62 projecting through an opening 63 of column 41. This opening, more clearly shown in Fig. 1 is profiled in such a manner as to limit the movement of scraper 38 either towards the axis of basket 10' or towards the periphery thereof. The scraper is therefore not liable to come into contact with any part of the basket even when operated by an unskilled operator. As shown in Fig. 1 the upper part of opening 63 forms a notch 63a in which roller 62 is brought when scraper 38 is to remain inactive.

20 A cable 64 with counterweight not shown balances the weight of screw 40 and associated parts.

The operation is as follows:

30 The machine is loaded with the substances to be treated (solids and liquids). The necessary conditions of temperature and pressure being fulfilled, the reaction takes place, while basket 10' is rotated at reduced speed, by motor 2. Scraper 38 is then at its highest position (position shown at 38a in Fig. 8) and therefore inactive. The bath is circulated by projections 36 and blades 37 as above explained.

40 When the reaction is ended, finger 58 is engaged into hole 59 and scraper 38 is lowered by handwheel 45. The scraping edge of scraper 38 then travels vertically and at a distance of the walls of basket 10', thus equalizing the layer of solid matter, while the bath is discharged and the machine progressively brought to its highest speed by motor 3. The position of scraper 38 during this operation is shown at 38b in Fig. 8.

50 When the centrifuging is ended and eventually, after vacuum drying, scraper 38 is progressively rotated anticlockwise and moved upwardly and downwardly so as to disintegrate the layer of solid matter from the walls of basket 10'. This generally produces a light dust which is easily discharged from the machine by suction.

55 The above-described machine may be used with advantage more particularly for any kind of reaction, taking place between substances in the liquid and in the solid phases, for instance for acetylating cellulose.

We claim:

60 1. A centrifuge for chemical reactions comprising in combination a base forming a hollow vertical column; a vertical spindle co-axial with said hollow vertical column and protruding above the top of the same; a packing device around said spindle at the top of said column; a tightly closable fixed casing separate from said base and resting thereon co-axially with said hollow vertical column, the bottom of said casing forming an upward substantially conical extension surrounding said hollow vertical column and tightly connected with said packing device; a hollow substantially conical hub keyed on the upper end of said spindles above said packing device, said hub extending downwardly to surround the extension of said tightly closable casing; and a

rotating basket carried within said casing by said hub co-axially with said spindle.

2. A centrifuge for chemical reactions comprising in combination a base forming a hollow vertical column; a vertical spindle co-axial with said hollow vertical column and protruding above the top of the same; bearings rotatably supporting said spindle within said hollow vertical column; a sleeve fast on said spindle above said bearings; a packing device around said sleeve at the top of said column; tightly closable fixed casing separate from said base and resting thereon co-axially with said hollow vertical column, the bottom of said casing forming an upward substantially conical extension surrounding said hollow vertical column and tightly connected with said packing device; a hollow substantially conical hub keyed on the upper end of said spindle above said sleeve, said hub extending downwardly to surround the extension of said tightly closable casing; and a rotating basket carried within said casing by said hub co-axially with said spindle.

3. A centrifuge for chemical reactions comprising a base forming a hollow vertical column; a vertical spindle rotatably supported within said hollow vertical column and protruding above the top of the same; a tightly closable fixed casing separate from said base and resting thereon co-axially with said hollow vertical column, said casing having a bottom forming an upward substantially frusto-conical extension surrounding said hollow vertical column; a sleeve fixed at the top of said hollow vertical column co-axially with said spindle; a packing device carried by said sleeve to form a tight joint between said sleeve and said spindle; a hollow substantially conical hub keyed on the upper end of said spindle above said sleeve and in tight contact there-

with, said hub extending downwardly to surround the extension of said tightly closable casing; a basket carried by said hub within said casing; and a tight connection between said sleeve and the upper part of the said substantially frusto-conical extension of said tightly closable fixed casing.

4. A centrifuge for chemical reactions comprising a base forming a hollow vertical column; a vertical spindle co-axial with said hollow vertical column and protruding above the top of the same; bearings rotatably supporting said spindle within said hollow vertical column; a sleeve fast on said spindle above said bearings; a tightly closable fixed casing separate from said base and resting thereon co-axially with said hollow vertical column, said casing having a bottom forming an upward substantially frusto-conical extension surrounding said hollow vertical column; a second sleeve fixed at the top of said hollow vertical column co-axially with said first-named sleeve; a packing device carried by said second-named sleeve to form a tight joint between said second-named and said first-named sleeves; a hollow substantially conical hub keyed on the upper end of said spindle above said first-named sleeve and in tight contact therewith, said hub extending downwardly to surround the extension of said tightly closable casing; a basket carried by said hub within said casing; and a tight connection between said second-named sleeve and the upper part of the said substantially frusto-conical extension of said tightly closable casing.

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