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Carter

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[54] **CENTRIFUGING APPARATUS**

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[51] **Int. Cl.** **B04b 1/20**

[58] **Field of Search** ..... 233/16, 19 R, 19 A, 233/20 R, 20 A, 21, 22, 46, 47 R, 17, 7, 29, 27, 35, 41, 38; 210/368

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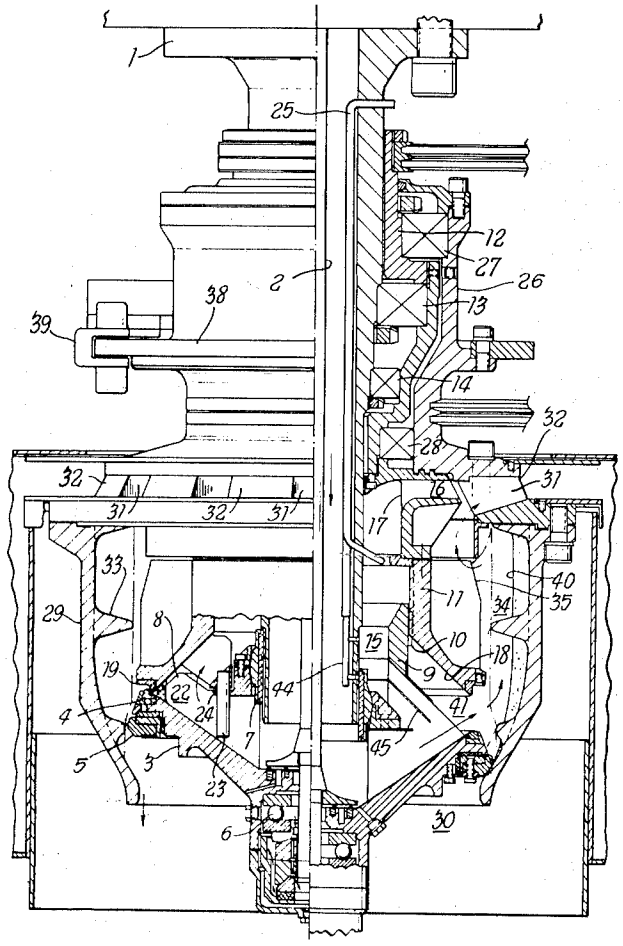
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[57] **ABSTRACT**

Centrifuging apparatus comprises a main centrifuging chamber having a bypass containing sensing means to sense when a certain flow is produced in the bypass as a result of sediment increase in the main centrifuging chamber, the main chamber having a movable wall movable to open a discharge aperture of the main chamber and to define a secondary centrifuging chamber with the bypass to maintain a centrifuging action when the main chamber is being discharged of sediment.

11 Claims, 2 Drawing Figures



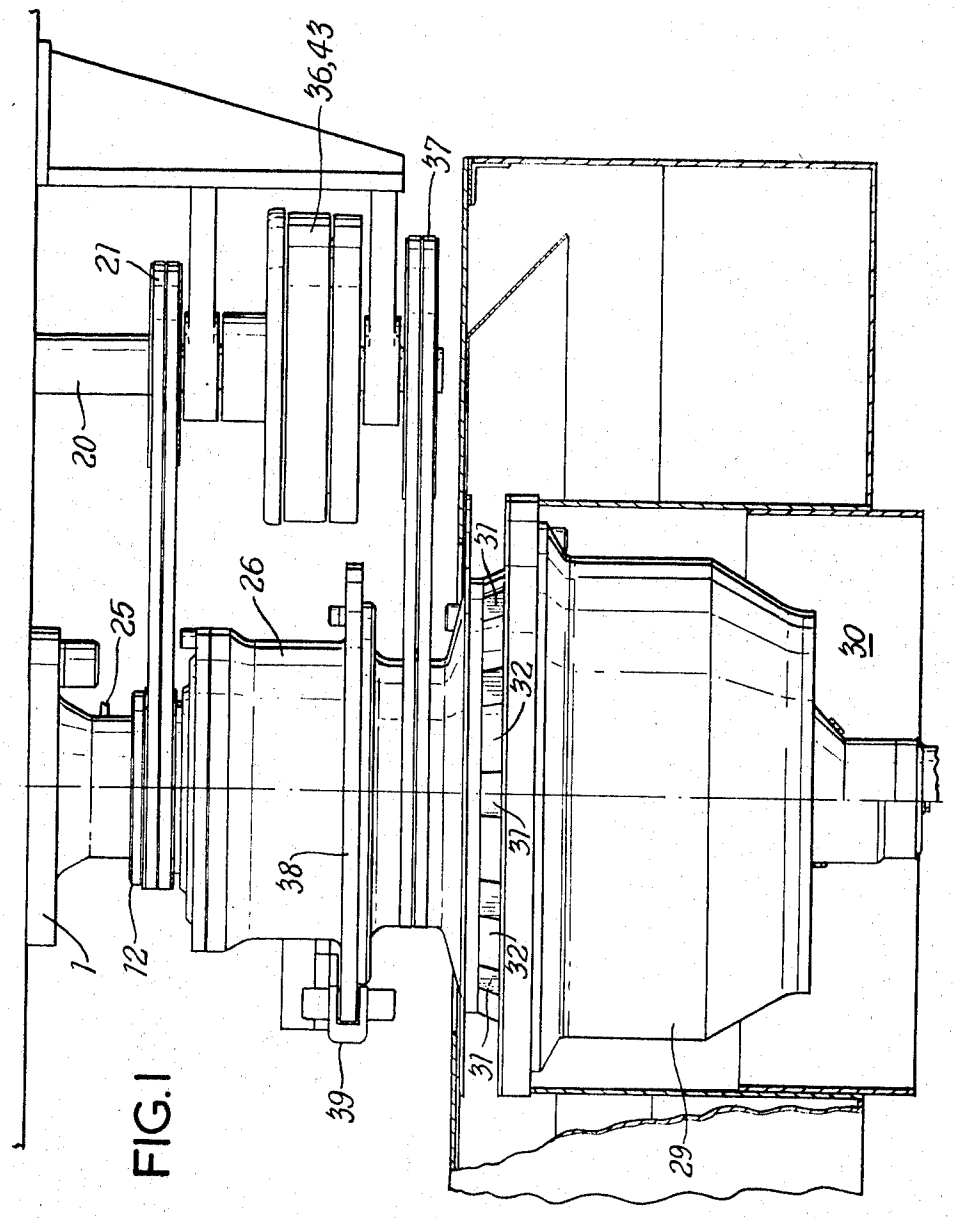
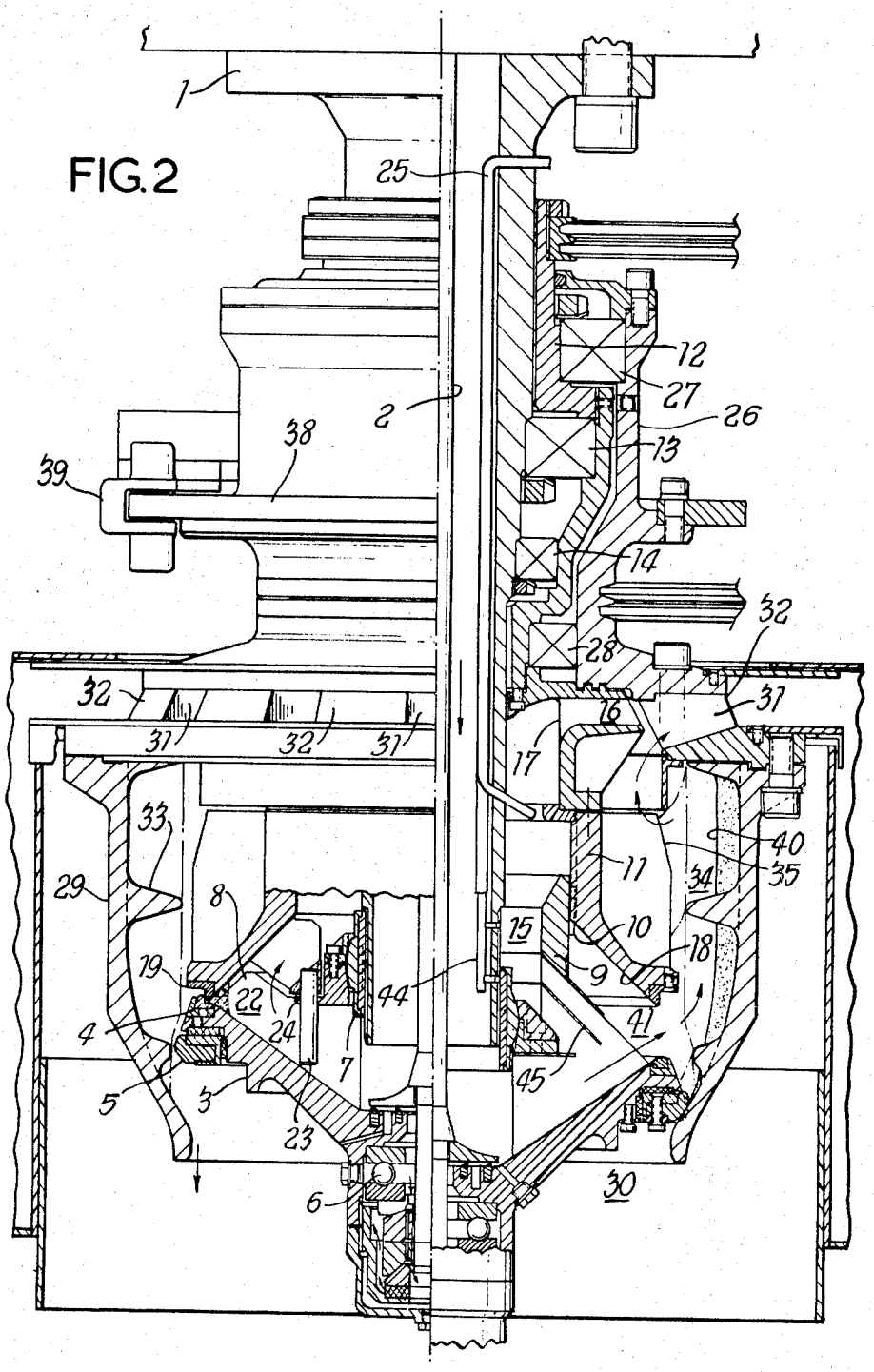


FIG. 1

FIG. 2


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CENTRIFUGING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to centrifuging apparatus and is particularly applicable to clarifiers for clarifying fluid from machine tools.

In the machine tool field, considerable quantities of machine tool coolant and lubricant fluid are used each day in any factory of significant size and this creates a problem in the handling of the used fluid and in particular in its cleansing for reuse, where one is dealing with fluid continuously flowing from machine tools.

It is an object of the invention to provide apparatus which can be designed to deal with this cleaning problem substantially without the need to regulate the flow of the fluid from a machine tool and which can dispose readily of the sludge accumulated by the cleaning action.

It will also be appreciated that, in the cleaning of fluid from sources such as machine tools, centrifuged material builds up in the centrifuging chamber until such an amount of the sediment is reached that the proper functioning of the clarifier is impaired and the centrifuge must be stopped for cleaning. However, it is not always possible to ascertain the correct moment for stopping the clarifier, and even if it were, the problem would remain of what to do with still supplied fluid.

The invention according to one embodiment can also provide a centrifuging

SUMMARY OF THE INVENTION

An apparatus from which, preferably, an indication can be derived of when an excessive build-up of centrifugal material occurs, and, in particular, with which the flow of fluid supplied to the apparatus can be maintained when an excessive amount of sediment forms in the apparatus.

According to the invention there is provided a centrifuging apparatus comprising:

means defining an inlet for a mixture having components of different specific gravities;

means defining an outlet for the component of lesser specific gravity of said mixture;

a first rotatable wall structure defining an internal space communicating with said inlet and said outlet;

a second rotatable wall structure coaxial with and encircling said first structure, said second structure defining an outer wall portion of a first centrifuging chamber communicating with said outlet and also defining for said chamber a discharge aperture for discharging the component of greater specific gravity accumulated at said outer wall portion; and

a third wall structure displaceable relative to the first and second structures and having a first operative position in which said third wall structure closes said discharge aperture and permits communication between said inlet and said first chamber and a second operative position in whcih said aperture is open and said third wall structure engages said first wall structure to define therewith a second centrifuging chamber into which said inlet opens. Preferably, said first rotatable structure defines for said first chamber a bypass from said inlet tp said outlet and adapted to receive an increasing amount of mixture from said inlet as the centrifuged component of greater specific gravity increasingly constricts communication between said inlet and said first chamber. There may be sensing means within said bypass to sense fluid within said bypass to give an indication of excessive sediment in the first chamber.

Preferably, said sensing means will be provided to initiate the discharge mode, but this is not necessary; for example a timer might be provided to initiate the discharge mode at preselected times.

A preferred embodiment comprises a static portion and first and second independently rotatable portions. The static portion defines at least a portion of said inlet, the first-mentioned chamber is defined between the first rotatable portion and the, surrounding second rotatable portion, and the bypass is defined within the first rotatable portion. The movable wall portion is movable axially of the rotatable portions between a first position closing an aperture at the base of the second rotatable portion and a second position closing an aperture at the base of the first rotatable portion and severing communication between the inlet and the first-mentioned chamber. The first portion diverges towards the movable wall portion and/or the movable wall portion diverges towards the first portion so that a subsidiary centrifuging chamber is defined in the second position. Sensing means is disposed by the bypass. Any suitable flow sensing means may be employed; by way of example these means may be a resonant ultrasonic system the oscillation of which is interrupted by a predetermined flow in the bypass.

DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

FIG. **1** is a partially cut-away view of a clarifier; and

FIG. **2** is an axial partial cross-section of the clarifier of FIG. **1**, the right-hand section of FIG. **2** illustrating the clarifier in its centrifuging mode of operation and the left-hand section of FIG. **2** illustrating the clarifier in its discharging mode.

The illustrated clarifier comprises, basically, a static structure, first and second rotatable structures and an axially movable and rotatable bottom wall member associable with both rotatable structures.

The static structure comprises an inlet tube **1** through which extends a draw bar **2** axially displaceable by means, for example, of a hydraulic actuator. The lower end of the draw bar rotatably supports the bottom wall member **3** carrying at its periphery upper and lower annular seals **4** and **5** respectively. The wall member **3** is of generally conical shape and its bearings **6** are cooled and lubricated by lubricant flowing along the path indicated by arrows. The wall member **3** is also supported by the tube **1** via rubber bearing **7** which is lubricated by clean fluid under pressure through pipe **44.** The inner conical surface of the wall member **3** carries vanes **8** the upper ends of which support a tubular member **9** having an outer surface splined or keyed at **10** to engage with the inner surface of a tubular portion **11** of the first rotatable structure **12** of the clarifier. Instead of the splined or keyed coupling the structure **12** may carry pins **23** engaging in apertures **24** carried by the wall member **3.**

The first rotatable structure **12** is mounted by bearings **13** and **14** upon the inlet tube **1** and is adapted to be continuously driven by a motor from shaft **20** via belt drive **21.** The lower portion of the structure **12** defines an annular passage **15** surrounding the tube **1,**

open at its lower end and opening at its upper end at an annular outlet **16** containing impeller vanes **17**. the lower end of the structure **12** is formed with a frusto-conical portion **18** having an annular peripheral ring **19** to engage seal **4**, as illustrated at the left-hand section of the figure. When so engaged, the portion **18** defines with the wall member **3** a centrifuging chamber **22** communicating with the inlet tube **1**. Separation is assisted in chamber **22** by conical disc or discs **45**.

A resonant sensor is provided to sense flow in passage **15**. This sensor is an ultrasonic resonator including two tubes which pass through the inlet tube **1** into the passage **15** where the open ends of the two tubes face each other. One of these tubes is visible in the figure and is denoted **25**. When an appreciable flow exists in passage **15**, the ultrasonic oscillations normally passing between said open ends are interrupted, the oscillations cease and the sensor emits a signal.

The second rotatable structure **26** is mounted on the first structure **12** by bearings **27** and **28**. The lower portion of the structure **26** constitutes a centrifuge bowl **29**. The bowl **29** has an aperture **30** at its lower end, an annular outlet **31** to a fluid collector at its upper end, the outlet **31** containing diffusion vanes **32**, and a helically extending rib or ribs **33** on its inner wall. The bowl **29** defines a main centrifuging chamber **34** with the first rotatable structure **12**, this chamber containing vanes **35** attached to the first rotatable structure **12**.

The structure **26** is adapted to be driven from the motor shaft **20** via a controllable, e.g., electromagnetic, clutch **36** and a belt drive **37**. The structure **26** also carries a brake disc having braking means **39**. Braking may also be effected in the drive, for example by an electromagnetic brake/clutch **43**.

The braking means **39** and the clutch **36** or the brake/clutch **43** are operable in response to the ultrasonic sensor.

In normal operation, the clarifier is in the condition illustrated at the right-hand side of the figure with the structures **12** and **26** rotating together at the same speed and with the wall member **3** closing the aperture **30** of the bowl **29**. Contaminated fluid, from a machine tool for example, enters the inlet tube **1** and passes therefrom via a vortex in wall member **3** into the chamber **34** where contaminating particles are centrifuged onto the inner wall of the bowl **29** and build up as sludge **40**, whilst clarified fluid passes through outlet **31**. Eventually the build-up of sludge will constrict an inlet **41** to the chamber **34**, causing some of the fluid to flow through passage **15** and thus bypass the chamber **34**. This bypassing flow will cause the ultrasonic sensor to emit a signal.

This signal will operate a relay to initiate a rapid discharging operation. The first step of this operation is the lifting of the draw bar **2** to lift the wall member **3** until its seal **4** contacts ring **19** and seals-off chamber **34**. Centrifuging will continue in the chamber **22**, the clarified fluid passing from outlet **16** to outlet **31** and drawing excess fluid from the chamber **34**. Balance is assisted by diffusion vanes **32**. Secondly, the clutch **36** is operated to remove drive from the structure **26** and finally the braking means are operated to brake the bowl **29**, thus ejecting sludge **40** downwardly and through the now-open aperture **30**. This ejection is assisted by the helical rib or ribs **33**.

I claim:

1. A centrifuging apparatus comprising:

means defining an inlet for a mixture having components of different specific gravities;

means defining an outlet for the component of lesser specific gravity of said mixture;

a first rotatable wall structure defining an internal space communicating with said inlet and said outlet;

a second rotatable wall structure coaxial with and encircling said first structure, said second structure defining an outer wall portion of a first centrifuging chamber communicating with said outlet and also defining for said chamber a discharge aperture for discharging the component of greater specific gravity accumulated at said outer wall portion; and

a third wall structure displaceable relative to the first and second structures and having a first operative position in which said third wall structure closes said discharge aperture and permits communication between said inlet and said first chamber and a second operative position in which said aperture is open and said third wall structure engages said first wall structure to define therewith a second centrifuging chamber into which said inlet opens.

2. An apparatus as claimed in claim **1**, wherein said first rotatable structure defines for said first chamber a bypass from said inlet to said outlet and adapted to receive an increasing amount of mixture from said inlet as the centrifuged component of greater specific gravity increasingly constricts communication between said inlet and said first chamber.

3. An apparatus as claimed in claim **2**, and comprising sensing means for sensing fluid flow in said bypass.

4. An apparatus as claimed in claim **3**, wherein said sensing means are a resonant ultrasonic system which has a resonant state until a certain flow exists in said bypass.

5. An apparatus as claimed in claim **2**, wherein said third structure is movable axially of said first and second structures and in said second operative position is within the space encircled by said second structure and defines therewith a continuously annular discharge zone of said discharge aperture.

6. An apparatus as claimed in claim **2**, wherin said second structure defines said outlet in the form of an annular outlet and said first structure defines a further, outwardly opening, outlet opening into said annular outlet.

7. An apparatus as claimed in claim **1**, wherein at least one of said first wall structures and said third wall structure diverges towards the other to define said second chamber.

8. An apparatus according to claim **1**, and comprising a stationary structure defining said inlet and a movable member axially displaceable within said stationary structure and carrying said third wall structure.

9. An apparatus as claimed in claim **1** and comprising means for changing the speed of said first chamber.

10. An apparatus as claimed in claim **1**, wherein the first and second wall structures are independently rotatable and the second wall structure has braking means.

11. An apparatus as claimed in claim **1**, wherein said first chamber has a peripheral wall having a helical rib to assist the discharge of material from that wall.

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