Aug. 4, 1959 R. L. DEGA 2,898,037

CENTRIFUGE FOR CLARIFYING FLUID

Filed March 9, 1955 2 Sheets-Sheet 1

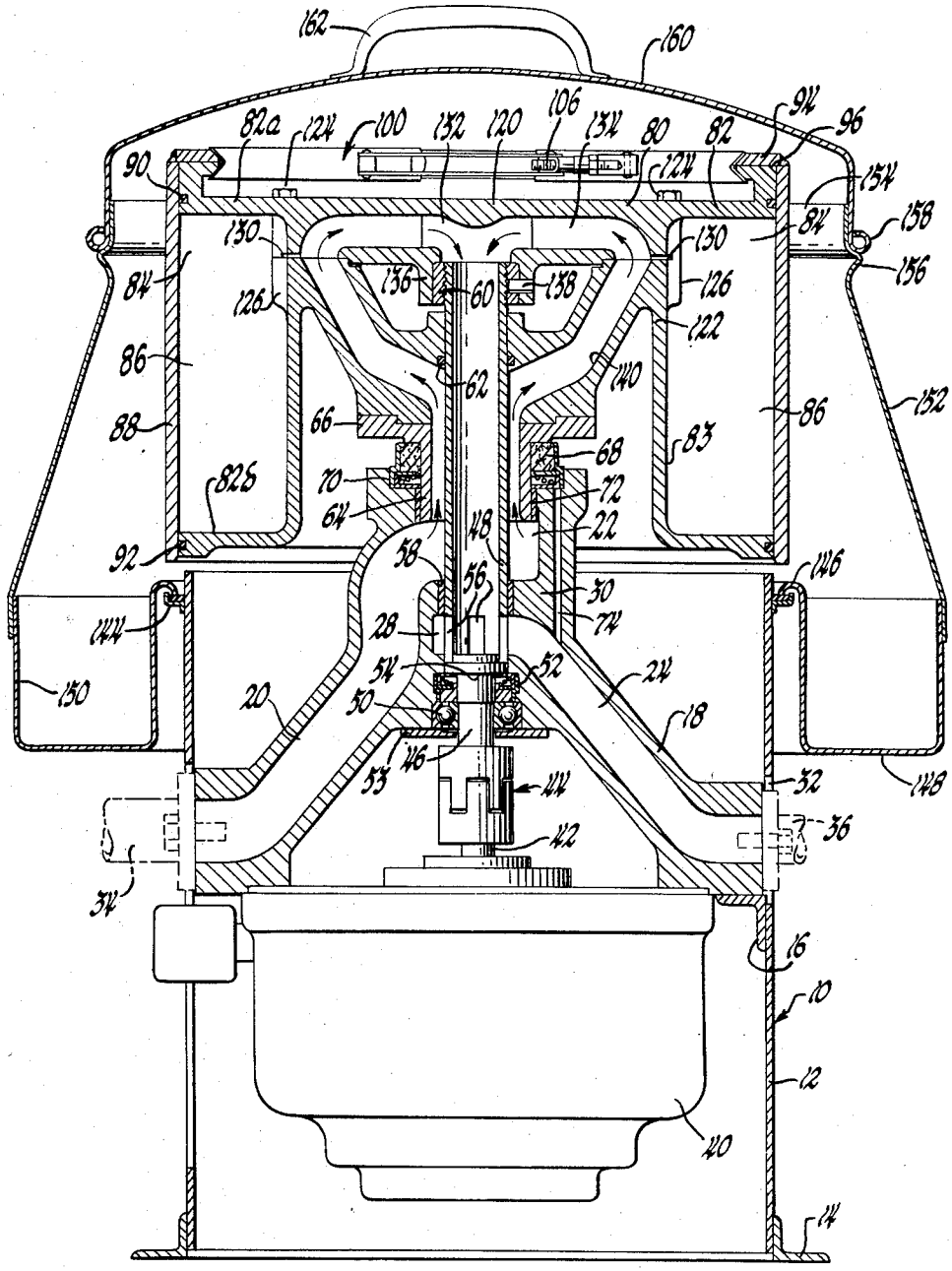


FIG. 1

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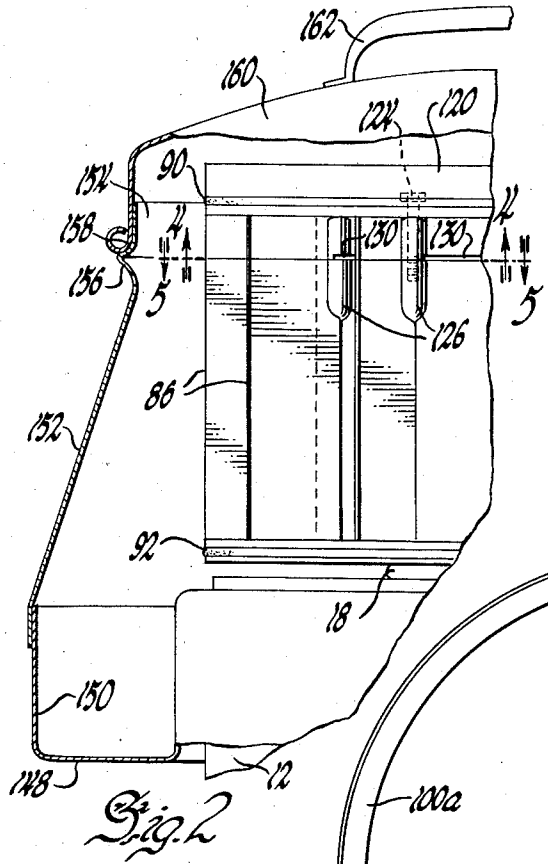


Fig. 2

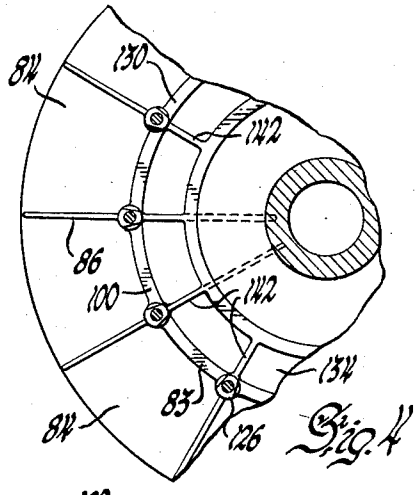


Fig. 4

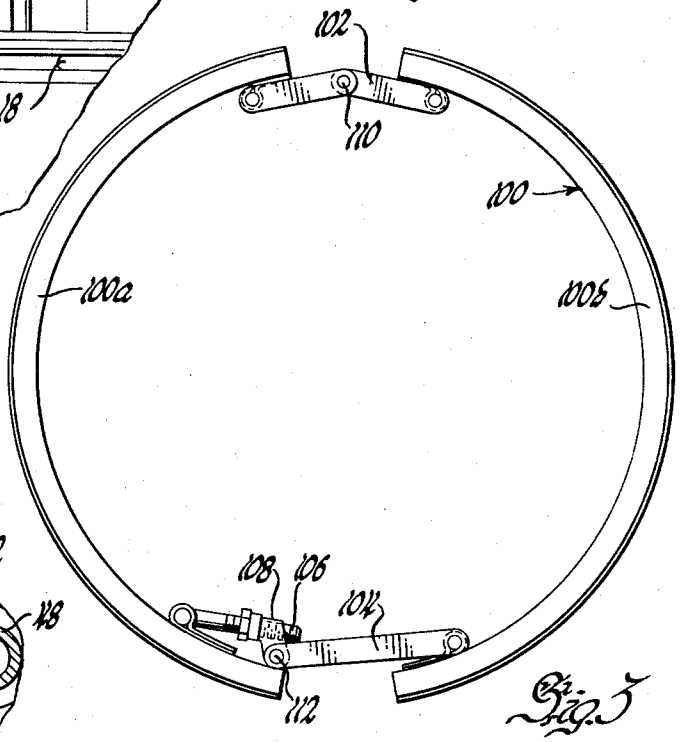


Fig. 3

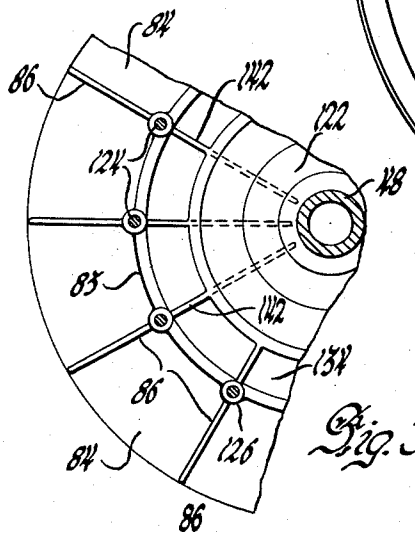


Fig. 5

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CENTRIFUGE FOR CLARIFYING FLUID

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Application March 9, 1955, Serial No. 493,090

3 Claims. (Cl. 233—21)

This invention relates to centrifuges for treating fluids and more particularly to centrifugal separators for removing solid particles or impurities from oil or other liquids.

In the separation of finely divided solids or impurities from fluids of less specific gravity such as oil, centrifugal separators have been utilized but difficulties have been experienced heretofore in cleaning the apparatus employed and in facilitating the removal of the impurities from the apparatus for ultimate disposal. It will be appreciated that the sludge formed by the impurities is of such a nature that it is not conducive to ease of handling.

The present invention constitutes an improvement of the centrifugal apparatus disclosed in the application for United States Letters Patent, Serial Number 376,014, filed August 24, 1953, in the name of Robert L. Dega.

An object of the present invention is to provide an improved centrifuge in the use of which suspended impurities may be separated from a fluid such as oil and so deposited that they may easily be removed from the apparatus.

Another object is to provide a centrifuge which, during normal operation, retains foreign matter or impurities separated from a fluid of less specific gravity and which is so constructed that the separated impurities may be collected in a convenient receptacle by subsequent operation of the centrifuge.

To these ends, a feature of the invention pertains to a centrifuge with its main operative parts accessible at one end thereof for disassembly and cleaning. Another feature is a removable sleeve defining the outer wall of at least one pocket into which the impurities are deposited during normal fluid clarifying operation of the centrifuge. Still another feature pertains to a stationary receptacle or trough arranged in combination with a removable sleeve surrounding a rotatable centrifuge body, the removable character of the sleeve permitting transfer of impurities restrained by the sleeve to a receptacle or trough during periods between normal operational intervals of the apparatus.

These and other important features of the invention will now be described in detail and pointed out more particularly in the appended claims.

In the drawings:

Fig. 1 is a sectional and elevational view taken in a plane passing through the axis of a centrifuge in which the present invention is embodied, a power source therefor being shown in elevation;

Fig. 2 is a fragmentary view of the centrifuge shown in Fig. 1 with portions removed to illustrate the operation;

Fig. 3 is a plan view of a detail shown in Fig. 1;

Fig. 4 is a sectional view looking in the direction of the arrows 4—4 in Fig. 2; and

Fig. 5 is a sectional view looking in the direction of arrows 5—5 in Fig. 2.

In the drawings, the centrifuge disclosed is shown to comprise a support generally indicated at 10. This support comprises a vertical and cylindrical shell 12 having an annular angle bar 14 surrounding and attached to its

base to serve as an adequate footing. An intermediate portion of the shell 12 is provided with a flanged member 16 in its interior and upon which a conical casting 18 is mounted. This casting is so made as to provide a fluid inlet passage 20 which extends from outside of the shell 12 upwardly and inwardly to an annular chamber 22 formed in the upper portion of the casting. The latter also is so formed as to provide an outlet passage 24 which communicates with an annular chamber 28 concentric with the chamber 22 and separated from the latter by a portion 30 of the casting. The passage 24 extends downwardly and outwardly into alignment with an opening 32 in the shell 12. An inlet pipe 34 and an outlet pipe 36 are shown in dot-and-dash lines in Fig. 1 and the arrangement is such that these pipes may be connected to the casting 18 in a conventional manner so that they communicate with the passages 20 and 24, respectively. It should be noted that the inlet passage 20 is larger in cross section than the outlet passage 24. The pipe 34 is arranged to communicate with a source of supply of contaminated fluid such as oil having gritty particles suspended in it. The pipe 36 is adapted to convey clarified fluid such as clear oil to a container for receiving the same for reuse.

An electric motor 40 is mounted within the support 10 in such a way that its shaft 42 is directed upwardly to communicate by means of a universal joint 44 with a reduced and solid end 46 of a hollow shaft 48. The end 46 of the shaft is journaled in the casting 18. Free rotation of the shaft is permitted by means of a ball bearing arrangement 50 and a fluid tight sealing arrangement 52. A bearing retainer plate 53 is attached to the underside of the casting 18 by four cap screws and serves to retain the bearing and sealing arrangements 50 and 52 in place as well as to support the shaft 48. The shaft 48 bears a shoulder 54 which rests upon the sealing arrangement 52. However, the major portion of the weight of the rotation portion is supported by a second shoulder resting on the inner race of ball bearing 50. The shaft is also provided with four radial slots 56 by means of which the interior of the shaft communicates with the chamber 28 and the outlet passage 24. The shaft 48 is also journaled within a bushing 58 retained within the casting portion 30. The upper end of the shaft 48 is open and also threaded to receive a collar 60. Spaced from the open end of the shaft and fixed to the latter is an outer annular ridge member or shoulder portion 62.

Also journaled on the casting 18 is a hollow stub shaft 64 which is arranged concentrically with the shaft 48 and is provided with a stepped flange 66 at its upper end. This flange rests upon a packing arrangement 68 surrounding the shaft 64 and which is placed in a recess 70 formed in the top of the casting. The lower end of the shaft 64 is journaled within a bushing 72 fixed to the casting. A vertical drain passage 74 extends downwardly from the sealed recess 70 and communicates with the outlet passage 24.

A two-piece centrifuge body 80 is attached to the two shafts 48 and 64. This body is surrounded by an outer portion or structure 82 which includes a wall 83 and outwardly extending parallel flanges 82A and 82B to define an annular chamber adapted to receive impurities. This structure also includes radial vanes 86 extending outwardly from the wall 83 and a removable sleeve 88. In the instant disclosure 12 vanes 86 are provided to divide the annular chamber surrounded by the sleeve 88 into 12 pockets 84.

The flanges 82A and 82B are recessed to receive O-rings 90 and 92 constituting seals against the inner surface of the sleeve member 88. Welded to the top end of the sleeve 88 is an annular or ring-like member 94 which is adapted to rest upon the top marginal surface

96 of the structure 82. The ring-like member 94 cooperates with the structure 82 to present a beveled and inwardly directed edge for engagement with a clamp or snap ring 100. The latter is formed in two arcuate portions 100A and 100B as seen in Fig. 3. Adjacent ends of these two portions are joined together by means of a toggle arrangement 102 having no adjustment provided therein. The other ends of these portions are joined by means of a toggle arrangement 104 incorporating a threaded rod 106 and a pivot connection 108 adjustably held on the rod. It will be understood that the clamp or snap ring 100 may be expanded by moving the pivots 110 and 112 of the toggle arrangement 102 and 104 outwardly. The ring 100 may be reduced in diameter by moving the pivot points inwardly.

The centrifuge body 80 includes an end portion 120 to which the flange 82A is joined. This end portion is attached to the main portion 122 of the centrifuge body by means of bolts 124 which pass downwardly and into portions 126 extending into the dirt pockets 84. These bolts are accessible from the upper end of the apparatus as will further appear.

The end portion 120 is formed with recesses 130 which extend between adjacent vanes 86. With the end portion 120 and the main portion 122 joined together in the assembly, the recesses 130 define arcuate slots which communicate outwardly with the dirt pockets 84.

The upper central and interior part of the end portion 120 provides a chamber 132 which communicates with the interior of the shaft 48 and also with radial passages 134. These passages extend outwardly and then curve downwardly into the main portion 122 and inwardly to the duct formed within the shaft 64. A hub 136 on the portion 120 is fixed to the collar 60 by means of a pin 138.

Support of the body 80 is borne at two areas on the shaft 48. In assembling the centrifuge, the portion 120 is first joined to the collar 60 by means of the pin 138 to form a top unit. This unit is then joined to the main body portion 122 by means of bolts 124. The complete centrifuge body 80 is then screwed down on the shaft 48 until the portion 122 engages the shoulder portion 62 locking the rotative parts together. Support of the centrifuge body 80 in a vertical direction is, therefore, given at the top portion and the shoulder portion 62 of the shaft 48. Lateral stability is given by the shaft 64.

It will be noted that the passages 134 within the main centrifuge body portion 122 present imperforate outer walls 140 which are inclined outwardly and upwardly to the openings or slots 130. As seen in Figs. 4 and 5, the passages 134 are separated by vanes 142. Each vane 142 is in radial alignment with a vane 86.

Around the shell 12 and near the upper end thereof is placed a gutter 144 and resting within that gutter in such a way that detachment may easily be undertaken is a downturned flange 146 which is a portion of a trough 148. The trough likewise surrounds the shell 12 and the outer wall 150 thereof is joined to a conical portion 152 to constitute a receptacle for receiving impurities previously separated from the oil as will subsequently appear. A reduced upper end 154 of the receptacle is formed to present an outwardly extending ridge 156 upon which may rest the rolled edge 158 of a cover 160 provided with a handle 162. The cover is so made as to enclose or conceal the rotatable parts of the centrifuge within the receptacle.

In operation of the centrifuge the motor 40 is caused to rotate the centrifuge body 80 by means of the shaft 48 and oil to be clarified is supplied under pressure through the pipe 34, the intake passage 20, and the annular duct formed by the shaft 64 to the passages 134. Impurities are caused to be discharged through the slots 130 by virtue of their higher specific gravity as compared with the oil and the clarified oil subsequently passing down through the shaft 48 is discharged through the openings 56 and the passage 24 to the pipe 36. The impurities discharged outwardly by way of the slots 130 are deposited in the pockets 84 and the latter are of sufficient capacity to serve for a considerable length of time before cleaning of the apparatus is needed. The separation of the impurities from the oil at the slots is sharp and distinct and no opportunity is afforded in the centrifuge for the oil and impurities again to intermix.

In an initial operation of the centrifuge there is a flow of liquid through the slots 130 into the pockets 84 to fill the latter. During subsequent operation and as impurities are thrown into the pockets, a volume of liquid equal to the volume of separated impurities must be displaced back through the slots into the main liquid stream. The resulting counter current flow of impurities and liquid in the slots has no appreciable effect on efficient operation as the quantity of liquid displaced in a given time interval is very small whereas the centrifugal force imparted to the impurities is considerable.

After an extended period of operation when the pockets 84 may become so filled with impurities or sludge as to impair the efficient operation of the apparatus, the motor 40 is stopped and the cover 160 is removed from the conical portion 152. The snap ring or clamp 100 is then reduced in diameter by suitable operation of the toggles 102 and 104 so that the sleeve 88 is free for manual removal in an upward direction from the centrifuge body. Removal of the sleeve 88 causes the pockets 84 to be open to the receptacle constituting the conical portion 152 and the trough 148. The cover 160 is then replaced in its position concealing the centrifuge body and the motor 40 is again operated centrifugally to throw or impell the impurities from the pockets 84 and against the inner wall of the portion 152. The sludge then falls into the trough 148 and the receptacle may be removed from the support 10 for convenience in cleaning out the deposited impurities or means not shown may be employed for cleaning the trough and portion 152 in situ.

After cleaning of the apparatus, the sleeve 88 and snap ring 100 as well as the cover 160 are again placed in their operative positions and the centrifuge is again ready to perform its operative cycle.

I claim:

1. A centrifuge for clarifying fluid comprising a support having a fluid inlet passage and a fluid outlet passage therein, concentric hollow shafts journaled on said support for rotation about a vertical axis and forming ducts communicating separately with said inlet and outlet passages, a centrifuge body connected to said shafts for rotation therewith, passages within said body connecting said ducts, structure around said body forming at least one pocket for the reception of impurities, said structure including a sleeve detachably joined to said body partially to define said one pocket, an opening leading from one of said body passages to said pocket, a receptacle surrounding said body and structure and arranged to form a stationary trough for reception of impurities from said pocket upon removal of said sleeve, a removable cover on said receptacle for concealing said centrifuge body, structure and detachable sleeve, means attached to said body for rotating the same and associated with said support at one end of the body, and said sleeve and cover being removable from said body at the other end thereof.

2. A centrifuge comprising a support having a fluid inlet passage and a fluid outlet passage therein, vertical and coaxial hollow shafts journaled on said support, one of said shafts being relatively short and communicating with said inlet passage, the other of said shafts being longer and within said one shaft and communicating with said outlet passage, a centrifuge rotor body with its interior connected to said shafts and arranged to be driven by one of said shafts, said support being located at one end only

of the rotor body, a sleeve detachably fixed to and encircling said body and cooperating with the latter in forming at least one pocket for the reception and retention of impurities during normal centrifuge operation, an opening leading outwardly from the interior of said body to said pocket, the upper end of said rotor body being closed and accessible to facilitate removal of the sleeve in the direction of the rotor body axis, and a receptacle supported free of and surrounding said sleeve and arranged to receive said impurities from said pocket upon detachment of the said sleeve from said rotor body.

3. A centrifuge such as set forth in claim 2, the receptacle including an annular trough located beneath and extending outside the periphery of the rotor body and thereby being adapted to receive impurities from the latter by gravitational and centrifugal forces when the sleeve is removed from said body.

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