Aug. 18, 1959 R. L. DEGA 2,900,129

CENTRIFUGE FOR CLEANING FLUIDS

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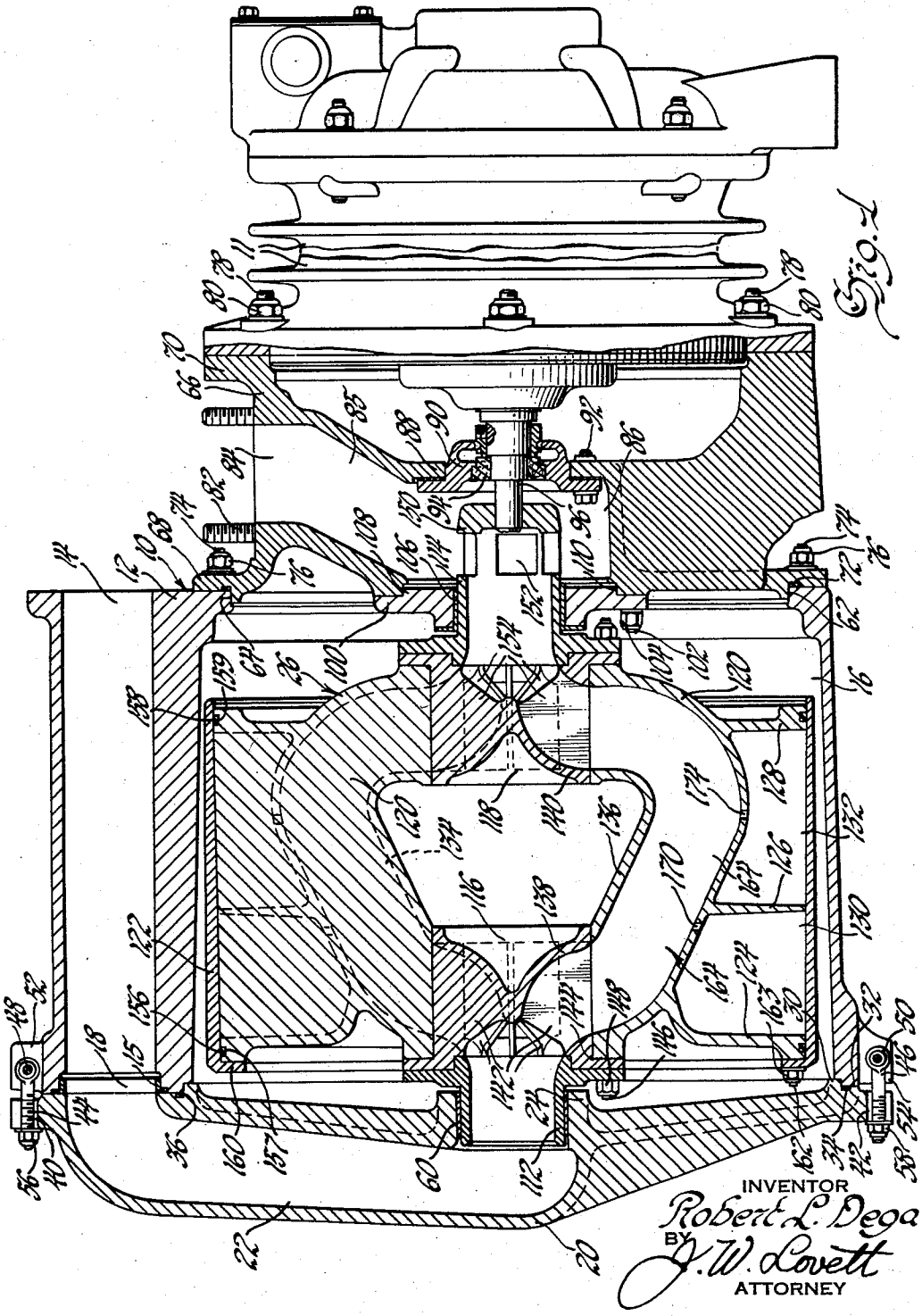


Fig. 1

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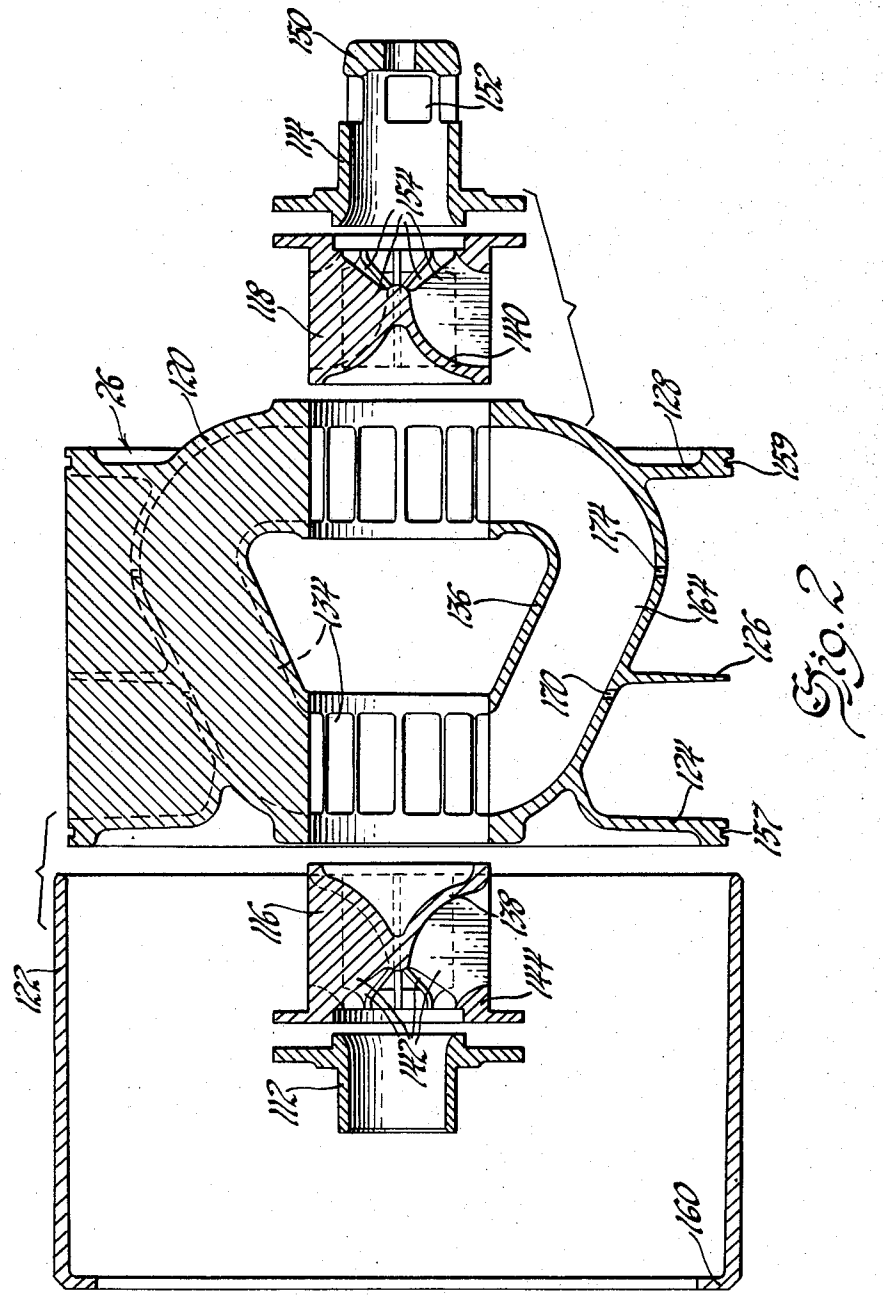


Fig. 2

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CENTRIFUGE FOR CLEANING FLUIDS

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Application May 25, 1955, Serial No. 510,965

7 Claims. (Cl. 233—28)

This invention relates to centrifuges for cleaning fluids and more particularly to centrifuges especially suitable for removing impurities such as fine suspended particles from oil or other liquids.

The present invention comprises an improvement in centrifuges of the type disclosed in an application for United States Letters Patent S.N. 376,014, filed August 24, 1953, in the name of Robert L. Dega and entitled "Centrifuge for Liquids."

In the use of centrifuges for clarifying or cleaning liquids it has often been found that considerable power or torque is required to gain effective and satisfactory separation of impurities. Obviously, it would be desirable, in any given instance, to reduce the power required without minimizing the effectiveness of the centrifuge operation. In prior centrifuges dismantling of such devices for cleaning has been resorted to and a further difficulty has been experienced in so doing due to the necessity for disconnecting pipe connections and handling the unwieldy elements which are utilized in the assembled construction. In addition, the parts constituting prior centrifuges have often been of such formation that cleaning has been difficult despite complete disassembly. Another difficulty has arisen in the use of prior devices in this field in that after they have been subjected to disassembly and cleaning of the parts, reassembly is often difficult and therefore a time-consuming operation delaying reuse of the equipment.

One object of the present invention is to provide an improved centrifuge for efficiently removing impurities suspended in fluids.

Another object of the invention is to provide a centrifuge with a minimum of power requirements for efficient operation.

Still another object is to provide a centrifuge capable of being readily dismantled and so constructed as to be easily cleaned when the parts are in disassembly.

Another object is to provide a centrifuge, the parts of which may readily be manufactured and assembled with a minimum in cost for the completed unit.

To these ends, a feature of the invention comprises a bulbous fluid flow separator within a centrifuge and having at least one concavo conical portion for diverting the flow of fluid being treated. One other feature is a casing which may be opened to gain access to the centrifuge rotor to facilitate the removal of the latter without dismantling any conduit connections to exterior fluid handling apparatus such as a pipe system.

Another feature is a centrifuge rotor having parts which present outwardly facing surfaces for expediting cleaning when the centrifuge and rotor are disassembled. Another feature is a centrifuge comprising a casing and rotor which may readily be assembled for operation and with a minimum expenditure of time and effort.

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

In the drawings:

Fig. 1 is a view of a centrifuge in which the present invention is embodied and a motor connected thereto, a part of the view being in section and taken along the axis of the centrifuge; and

Fig. 2 is an exploded view of rotor elements shown in assembled relation in Fig. 1, the various elements being shown in sections taken along the axis of the rotor.

The drawings illustrate one embodiment of the invention and disclose a centrifuge generally indicated at 10 and adapted to be driven by a motor 11. It will be understood that any form of motive power may be suitable to drive the centrifuge in a given installation.

The centrifuge comprises a casing 12 in which are formed two chambers 14 and 16 with parallel axes. The chamber 14 is the smaller of the two and is located near one side of the casing 12 in such a way as to form an inlet passage for fluid as will further appear. One end of the passage 14 is adapted to be placed in communication with a fluid circulatory system such as a pipe line (not shown) and the other end of the passage 14 is enlarged to form an annular recess 15 for the reception of a resilient sealing member 18.

The chamber 16 is slightly tapered with its largest cross section substantially in the same plane as the sealing member 18.

A cover member 20 is formed with a passage 22 adapted to register with the end of the passage 14 when the member is placed in its proper operative position with respect to the casing 12. The passage 22 is formed in such a way as to extend radially within the cover 20 and to communicate through a hub 24 formed on the cover with the interior of a rotor generally indicated at 26, as will further appear. The cover bears an annular flange 30 and a cooperating shoulder portion 32 for retaining an annular sealing ring 34 of resilient material. The casing 12 is recessed as at 36 for the reception of the flange 30. The cover bears bifurcated portions such as 40 and 42 through which bolts such as those shown at 44 and 46 may extend. These bolts are pivoted as at 48 and 50 to projections such as 52 and 54 extending from and integral with the casing 12. Nuts 56 and 58, together with appropriate washers, are utilized on the bolts 44 and 46 to hold the cover 20 firmly in position on the casing 12. It will be understood that two or more bolts may be employed for the purpose of holding the cover in position. The hub 24 is lined with a bearing material 60.

The smaller diameter end of the chamber 16 is further reduced in its internal diameter to form a shoulder 62 for engaging the exterior cylindrical surface 64 formed on an intermediate casting 66. This casting is made with flanges 68 and 70 for proper mounting with respect to and between the casing 12 of the centrifuge and the motor 11. A sealing gasket 72 is retained in an annular recess formed on one side of the flange 68 and this gasket is arranged to form a seal with one end of the casing 12. The casing 12 and the casting 66 are joined by means of appropriate studs 74 and cooperating nuts 76. As many of these studs may be employed as is necessary in a given installation although only two are depicted. The flange 70 is joined to the motor 11 by means of suitable bolts or studs 78 and nuts 80. Studs 82 are affixed to the casting 66 to serve as a convenient means for attaching the flange of a pipe not shown. These studs 82 are arranged around a discharge opening 84 formed in the casting and constituting one end of a passage 85 radially leading into a central chamber 86 which is in communication with the interior of the rotor 26 as will further appear.

A web portion 88 of the casting 66 is so made as to carry a sealing bracket 90 and the latter is held in position by means of suitable bolts such as bolt 92. The

bracket 90 may take any of many forms but the instant disclosure illustrates an annular sealing washer 94 compacted to prevent leakage of fluid from the passage 85 along the motor shaft 96.

A bearing plate 100 is fixed to the casting 66 by means of studs such as stud 102 and customary fasteners such as nut 104. The bearing plate is bored and lined with anti-friction bearing material 106. The bearing plate is accurately located with respect to the casting 66 by providing the plate with a cylindrical portion 108 snugly fitted within a recess 110 formed in the casting 66.

The rotor 26 is mounted in the chamber 16 on trunnions supported upon the bearing material 60 and 106. The rotor comprises hollow stub shafts 112 and 114, end portions 116 and 118, a bowl 120, and a cylindrical sleeve 122. Spaced annular webs 124, 126 and 128 extend outwardly from the bowl 120 and define two annular series of pockets 130 and 132. Twelve radial vanes 134 (Fig. 2) are made integral with the bowl 120 and are equally spaced around the axis thereof. A bulbous fluid flow separator is located within the bowl 120 and is formed with an imperforate frusto conical wall portion 136 integral with the vanes 134 and two concavo conical portion 138 and 140 each of which is integral with an end portion 116 or 118. The conical portion 138 is joined by means of twelve webs 142 to a flanged portion 144 to constitute the integral and detachable end portion 116. Studs and nuts such as the stud 146 with its nut 148 are used to hold the stub shaft 112, portion 116 and bowl 120 in assembled relation so that the webs 142 are in alignment with the vanes 134. The end portion 118 is similarly attached to the stub shaft 114 and the other end of the bowl 120. The stub shafts 112 and 114 are hollow, as heretofore stated, and constitute inlet and outlet fittings, respectively, but the stub shaft 114 is formed with an end portion 150 which is non-rotatably affixed with relation to the motor shaft 96 by means of a key and keyway not shown in the drawings. Also, the stub shaft 114 is provided with four radially directed openings 152 for the discharge of fluid. Webs 154 of the end portion 118 are caused to be placed into alignment with the vanes 134 as in the case of the webs 142.

Annular sealing gaskets 156 and 158 are retained in recesses 157 and 159, respectively, which are formed in the peripheries of the webs 124 and 128. These gaskets are so placed as sealingly to engage the interior surface of the sleeve 122. One end of the latter is formed with an annular and inwardly or radially directed flange 160 which is detachably affixed to the end facing of the web 124 by nuts and studs such as stud 162 and its nut 163.

From the above, it will be seen that the bowl 120 is provided with twelve radially extending passages 164 and that adjacent passages are separated by vanes 134. It is also to be seen that these passages are in communication with the hollow trunnions or stub shafts 112 and 114 by way of the end portions 116 and 118 so that fluid may pass from one end to the other of the rotor. Two arcuate slots or openings 170 and 174 are formed through the exterior wall of the bowl 120 for each passage 164. These slots are so located most efficiently to remove suspended matter, by the action of centrifugal force, from the fluid passing through the passages 164. Each slot 170 is located near the annular web 126 and communicates with one pocket 130. Each slot 174 communicates with a pocket 132.

It will be noted that the end portions 116 and 118 bear no special sealing means for preventing leakage of fluid from the passages 164. It has been found that the mechanical fit may be easily made in the instant construction so that the clearance between the parts is small and the amount of leakage from the rotor is therefore negligible.

Assuming that the motor 11 is operated to rotate the rotor 26 and fluid such as contaminated lubricating oil is introduced through the passage 14 by pumping means not disclosed, such fluid will enter through the stub shaft 112, pass through the passages 164, the stub shaft 114, and out through the discharge opening 34. Impurities suspended in the fluid are caused to pass through the slots 170 and 174 and be deposited in the pockets 130 and 132. The concavo conical portion 138 tends to divert the incoming fluid stream into the passages 164 with as little shock loss as possible. The design of the vanes 142 also contributes in reducing the shock loss as they serve to act on the fluid as closely as possible to the center of rotation of the rotor. On the outlet side of the rotor the concavo conical portion 140 brings the fluid stream back to the center of rotation of the rotor again without undue shock loss. The concavo conical portions 138 and 140 are primarily responsible for the low pressure drop experienced in using the centrifuge and this minimizes the power requirements for the motor 11.

The centrifuge and motor may be mounted with their axes vertical or horizontal or at any angle and regardless of the angle disassembly of the unit for removal of the dirt deposited in the pockets 130 and 132 may readily be accomplished. There is no need to disconnect pipe connections to gain access to or to remove the rotor 26. Upon removal of the cover member 20, the rotor 26 is fully exposed to view and may easily be withdrawn from the casing 12 and subsequently disassembled into its six separate parts as illustrated in Fig. 2 if repair or replacement of any part is necessary. It will be seen that with removal of the sleeve 122 from the annular webs of the bowl 120 that the series of pockets 130 and 132 are open to be cleaned from the outside. Usually when the cover 20 is removed, it is not necessary to completely disassemble the rotor as only the sleeve 122 need be removed to gain easy access to the pockets 130 and 132 in which the impurities from the fluid are deposited.

I claim:

1. A centrifuge comprising a bowl mounted on hollow trunnions and having spaced annular webs surrounding it and integral therewith, two of said webs forming circular end plates, a cylindrical sleeve coaxially mounted on said bowl between said trunnions and detachably affixed to the peripheries of said webs and defining with said webs at least one pocket for the retention of impurities after removal of said sleeve, at least one opening extending outwardly through the wall of said bowl and communicating with said pocket, a bulbous fluid flow separator in said bowl and cooperating therewith to define passages communicating with said hollow trunnions, and said sleeve, bowl and separator being adapted to rotate together as a unit.

2. A centrifuge comprising a bowl mounted on hollow trunnions, spaced webs surrounding said bowl, a cylindrical sleeve concentric with said bowl and detachably supported on said webs between said trunnions to cooperate with the bowl and webs in defining pockets, openings extending through the wall of said bowl in a plane normal to the axis of said trunnions and communicating with said pockets, sealing means between the peripheries of said webs and said cylindrical sleeve, and said bowl and sleeve being adapted to rotate together as a unit.

3. A centrifuge comprising a casing supported at one end only, a substantially cylindrical rotor mounted in said casing, a cover detachably joined to the other end of said casing and serving as a support for one end of said rotor, said casing and cover defining a passage leading to the interior of said rotor, and means at the said one end of said casing for discharging fluid from said rotor.

4. A centrifuge comprising a casing, a rotor mounted on hollow trunnions for rotation with respect to said casing and including a bowl and closed pockets arranged around said bowl, a cover detachably joined to one end of said casing and serving as a support and bearing for one of said trunnions, said casing and cover defining a passage leading to said one trunnion and to the interior of said rotor, means at the other end of said casing for discharg-

ing fluid from said rotor, and a bulbous fluid flow separator in said bowl and cooperating with the latter to define passages communicating with said trunnions and said closed pockets.

5. A centrifuge comprising a casing supported at one end, a cover detachably mounted on the other end of said casing, a rotor mounted on hollow trunnions for rotation with respect to said casing, one of said trunnions being journaled in said cover, said casing and cover defining an inlet passage leading from said one end to said one hollow trunnion, said rotor including a cylinder, a bowl and a bulbous flow separator, said cylinder and bowl being coaxially arranged to define pockets placed around and within said rotor, said separator and bowl defining passages communicating with said hollow trunnions, openings leading outwardly from said passages to said pockets, said separator and bowl including end portions detachably joined to said trunnions, and each of said end portions having a concavo conical surface for guiding fluid with respect to said passages to minimize fluid pressure drop.

6. A centrifuge comprising a bowl mounted on hollow trunnions and having spaced annular webs surrounding it and fixed thereto, the inner surface of said bowl being generated by an unbroken line extending from one of said trunnions to the other, a cylindrical sleeve between said trunnions detachably mounted on said webs and with the latter defining at least one pocket, at least one opening extending outwardly through the wall of said bowl and

communicating with said pocket, and said sleeve being arranged to rotate with said bowl.

7. A centrifuge comprising a bowl mounted on two hollow trunnions, the inner surface of said bowl being generated by a substantially unbroken line extending from one of said trunnions toward the other, openings extending outwardly through the wall of said bowl and having a total cross sectional area small in extent as compared with the area of said surface, a bulbous fluid flow separator having radial vanes and cooperating with said surface to define passages communicating with the said openings and the interiors of said trunnions, said separator having concavo conical portions, each of the latter having a small end facing one of said trunnions and coaxial therewith, a part of said bowl and one of said conical portions being joined as a unitary element of partially cylindrical configuration enclosed by another part of said bowl thereby facilitating construction.

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