

May 28, 1968

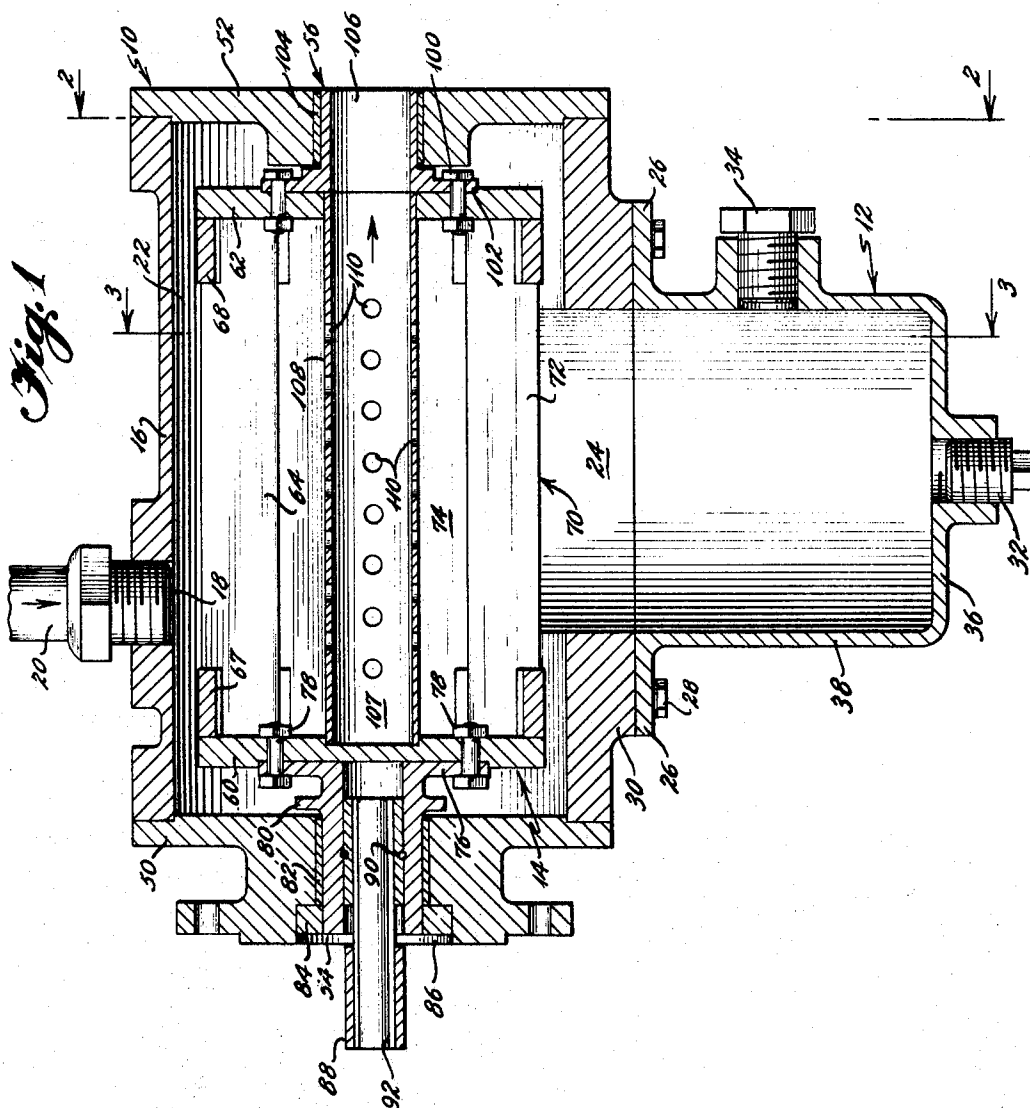
W. C. BERGSTROM

3,385,447

CENTRIFUGAL SEPARATOR

Filed Sept. 26, 1961

2 Sheets-Sheet 1



INVENTOR

William C. Bergstrom

BY

Robert B. Buckley

ATTORNEY

May 28, 1968

W. C. BERGSTROM

3,385,447

CENTRIFUGAL SEPARATOR

Filed Sept. 26, 1961

2 Sheets-Sheet 2

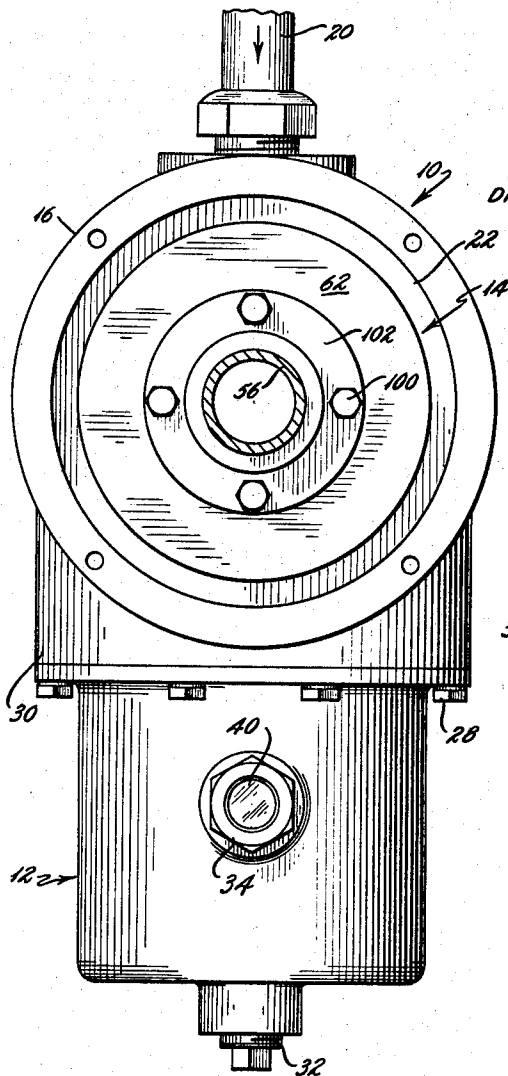


Fig. 2

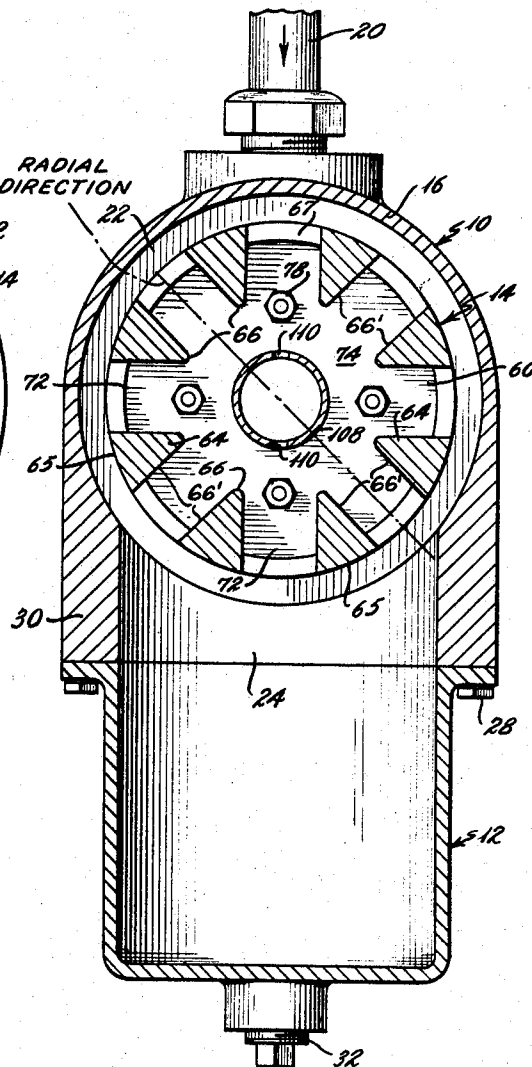


Fig. 3

INVENTOR

William C. Bergstrom

BY

Robert B. Buckley

ATTORNEY

1

3,385,447

CENTRIFUGAL SEPARATOR

William C. Bergstrom, Miami, Fla.; Robert W. Bergstrom, executor of estate of said William C. Bergstrom, deceased

Filed Sept. 26, 1961, Ser. No. 140,718

1 Claim. (Cl. 210—360)

This invention relates to the separation of mixtures of materials of different densities. More particularly, this invention provides efficient apparatus for cleaning impure or dirty lubricating oil in engine systems, separating water from jet engine fuel, separating water from gasoline, and the like.

The present invention resides in the concept of a centrifugal separator for producing a separation of materials of different densities from a mixture thereof.

The separator of the invention is of sturdy construction for withstanding stresses developed at high speeds of rotation.

The separator of the invention provides for continuously feeding a mixture to the separator and removing purified lighter material. The heavier material is collected in the separator. The heavier material can be cleaned from the sump upon periodic maintenance of the separator.

The separator also includes a device for indicating or observing from the outside of the separator the level of heavier material collected inside the separator.

For a better understanding of the invention and its other objects, advantages and details, reference is now made to the presently preferred embodiment of the invention which is shown, for purposes of illustration only, in the accompanying drawings.

In the drawings:

FIGURE 1 is a vertical sectional view through a centrifugal separator according to the invention taken along the axis thereof;

FIGURE 2 is a transverse sectional view along the line 2—2 in FIGURE 1; and

FIGURE 3 is a vertical sectional view taken along the line 3—3 in FIGURE 1.

Briefly stated, the separator illustrated in the drawings includes a housing with a rotor or drum rotatably positioned inside the housing. The mixture of materials to be separated is injected through an inlet opening in the housing and enters the drum through slots formed by spaced vanes extending along the length of the rotor. The vanes impel the mixture to move rotationally and thus produce the centrifugal separation whereby the heavier materials migrate toward the outer portions of the rotor and into the space between the rotor and the housing and the lighter materials migrate toward the axis of the rotor.

A sump is connected to the lower portion of the housing for receiving separated heavier materials, such as sludge and metal particles separated from impure lubricating oil. Inspection plugs are formed in the walls of the sump for indicating the level of sludge in the sump.

The rotor includes a hollow tube extending along the axis and having a plurality of holes formed therein for the flow of the materials to and from the inside of the tube. The lighter material, such as purified lubricating oil, passes through the holes into the interior of the tube and outwardly from the separator via an outlet opening extending through the rotor and housing at the axis. The degree of separation can be regulated by controlling the number and size of these holes.

As seen in the drawings, the illustrated centrifugal separator includes a housing 10, a sump 12 secured to the lower portion of the housing 10, and a rotor or drum 14 rotatably mounted inside the housing. The housing 10 includes a generally cylindrical wall 16 having an inlet

2

opening 18 formed at its upper portion threadedly receiving an inlet pipe 20 for delivering a mixture of materials of different densities, such as contaminated or dirty lubricating oil, to the space 22 between the housing 10 and rotor 14 and to the hollow interior of rotor 14.

The lower portion of the housing wall 16 has an aperture 24 formed therein registering with the interior of generally cup-shaped sump 12 having a flange 26 extending around its upper end and joined by bolts 28 to an annular rim 30 extending downwardly from the housing wall 16. The sump 12 receives heavier material, such as sludge from lubricating oil, and has a pair of screw-threaded plugs 32 and 34 extending into the bottom 36 and cylindrical side wall 38, respectively thereof. These plugs can include a magnetic plug or sight indicator for inspecting the interior of the sump to determine the amount and nature of the sludge collected therein. The plug, 34 as seen in FIGURE 2, includes a transparent sight glass 40 for inspecting the interior of the sump 12.

The housing wall 16 has a generally-right-circular-cylindrical shape, and has its opposite ends closed by end panel 50 at one end and end panel 52 at the opposite end. These panels have bores formed therein receiving, respectively, stub shafts 54 and 56 of the rotor 14.

The rotor 14 is generally cylindrical in shape and includes a pair of disc-shaped end plates 60 and 62 connected by circumferentially-spaced vanes 64 extending between the end plates.

Each vane 64 has the approximate cross-sectional shape, as seen in FIGURE 3, of a sector of a circle with its arc 65 along the circumference of rotor 14, its narrow edge 66 closest to the axis of rotor 14, and its sides 66' converging toward the axis of the rotor. Cylindrical bands 67 and 68 are joined, respectively, to end plates 60 and 62 and together with vanes 64, form the cylindrical wall 70 of the rotor 14.

The vanes 64 have slots or apertures 72 formed therebetween for the flow of materials to and from the hollow interior 74 of rotor 14. The shape of the vanes 64 determines that each slot 72 has a uniform or constant width in a radial direction, that is, in the direction of the depth of the slot, as seen in FIGURE 3.

Stub shaft 54 has a flange 76 joined by bolt assemblies 78 to the rotor end plate 60. The stub shaft 54 has an annular flange 80 extending outwardly adjacent housing panel 50 for locating the rotor 14 at a predetermined position within the hollow housing 10. A bushing 82 is received in the bore formed in housing panel 50 and surrounds the stub shaft 54 for reducing friction. An annular seal 84 is received in a countersink 86 formed in housing panel 50 and sealingly engages the outer surface of stub shaft 54. Drive shaft 88 is received in a bore formed in stub shaft 54 and is connected for rotation as one with shaft 54 by a snap ring 90. Splines 92 are formed on the drive shaft for engagement by a suitable source of power (not shown) to cause rotation of the rotor 14 within the housing 10.

The other end plate 62 of the rotor 14 is secured by bolt assemblies 100 to the flange 102 of stub shaft 56 received in a bore in housing end panel 52. A bushing 104 surrounds the stub shaft 56 for reducing friction and providing a seal. The stub shaft 56 has a cylindrical outlet opening 106 formed at its axis in registry with the interior 107 of a tube 108 extending axially along the length of rotor 14 and having a plurality of rows of spaced holes 110 formed therein for the flow of materials. The tube 108 has its opposite ends joined, respectively, to end plates 60 and 62 and thereby increases the rigidity, sturdiness and endurance of rotor 14. The degree of separation of the materials can be regulated by controlling the number and size of holes 110.

In operating the centrifugal separator previously described for the purification of contaminated or dirty lubricating oil, the dirty oil is pumped through pipe 20 into inlet opening 18 where it flows into the space 22 between the housing 10 and rotor 14. The source of power (not shown) is engaged with drive shaft 88 to rotate the rotor 14 within the housing 10. The dirty oil passes through slots 72 formed between vanes 64 into the hollow interior 74 of the rotor. The vanes 64 impel the oil and cause rotation thereof. Thereafter, by the difference in densities, the denser, contaminating materials, such as sludge and metal particles, are impelled to migrate or flow through opening 24 into sump 12. The purified oil, being of less mass per unit volume, migrates or flows through holes 110 into the hollow interior 107, constituting an unobstructed axial zone, of tube 108 and outwardly through outlet opening 106 for a return to the lubricating system of the engine to which the separator is attached.

During periodic maintenance, the entire separator can be flushed out with steam in order to remove the sludge and metal particles from the sump 12. The plug 32 can also be removed for draining the sump.

Thus it will be seen that the invention provides a centrifugal separator of relatively simple, yet sturdy construction for efficiently separating materials of different densities.

While a presently preferred embodiment of the invention has been illustrated and described, it will be recognized that the invention can be variously embodied and practiced within the scope of the following claim.

I claim:

1. In a centrifugal separator for separating a mixture of different densities, said separator including a hollow housing, a hollow rotor rotatably supported in said housing for rotation about an axis and defining a space between said housing and said rotor, said housing having an inlet opening formed therein for the passage of a mixture of materials into said space, said rotor and housing having an

outlet opening extending therethrough at said axis, said rotor having a tube extending along the axis of the rotor and spaced substantially inwardly from the periphery of said rotor, said tube communicating with said outlet opening, said tube having a plurality of holes formed therein for the flow of separated less dense material into said tube, said housing including a wall with an outlet aperture formed therein, a sump secured to said housing and communicating with said outlet aperture for collecting separated more dense material; the improvement which comprises said rotor including a plurality of vanes extending inwardly at circumferentially-spaced positions around the rotor, said rotor having slots formed therein between said vanes for the flow of materials, each said vane having its sides converging toward the axis of the rotor so that the vane tapers inwardly and each slot is of substantially-uniform width in a radial direction, the narrow inner edge of each vane being spaced from said tube by a distance sufficient to provide an annular unobstructed space surrounding said tube; whereby, upon rotation of said rotor, said vanes accelerate to rotation a mixture of materials, materials migrate through said slots, and the less dense material collects in said tube and passes out said outlet opening.

References Cited

UNITED STATES PATENTS

978,450	12/1910	Homans	210—360
1,262,146	4/1918	Ward et al.	210—360
1,461,687	7/1923	Strobel	210—95
1,869,797	8/1932	Cleaver	210—360
2,442,234	5/1948	Dunmire	210—360
3,105,042	9/1963	Roosa	210—94

REUBEN FRIEDMAN, *Primary Examiner*.

HERBERT L. MARTIN, *Examiner*.

C. R. REAP, J. DE CESARE, *Assistant Examiners*.