March 11, 1969 R. T. BEAZLEY 3,432,091

CENTRIFUGAL FLUID CLEANERS

Filed Sept. 21, 1966 Sheet 1 of 3

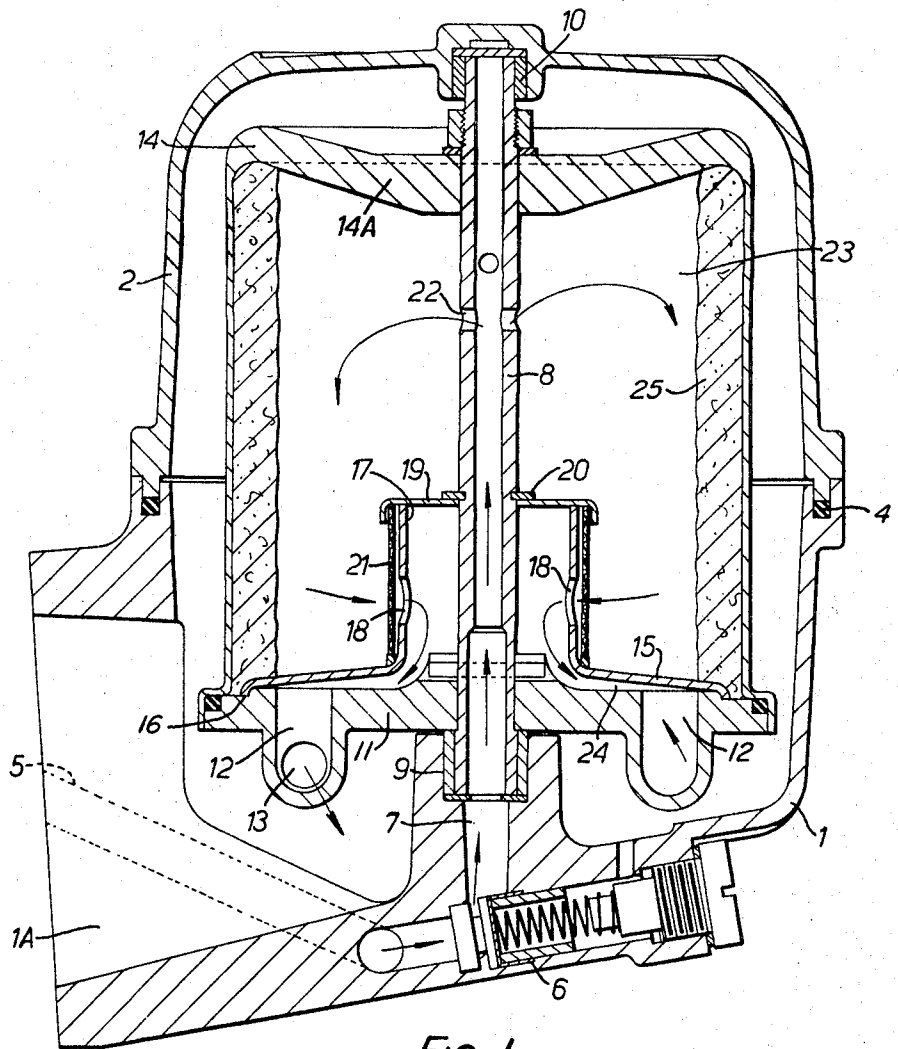

FIG. 1.

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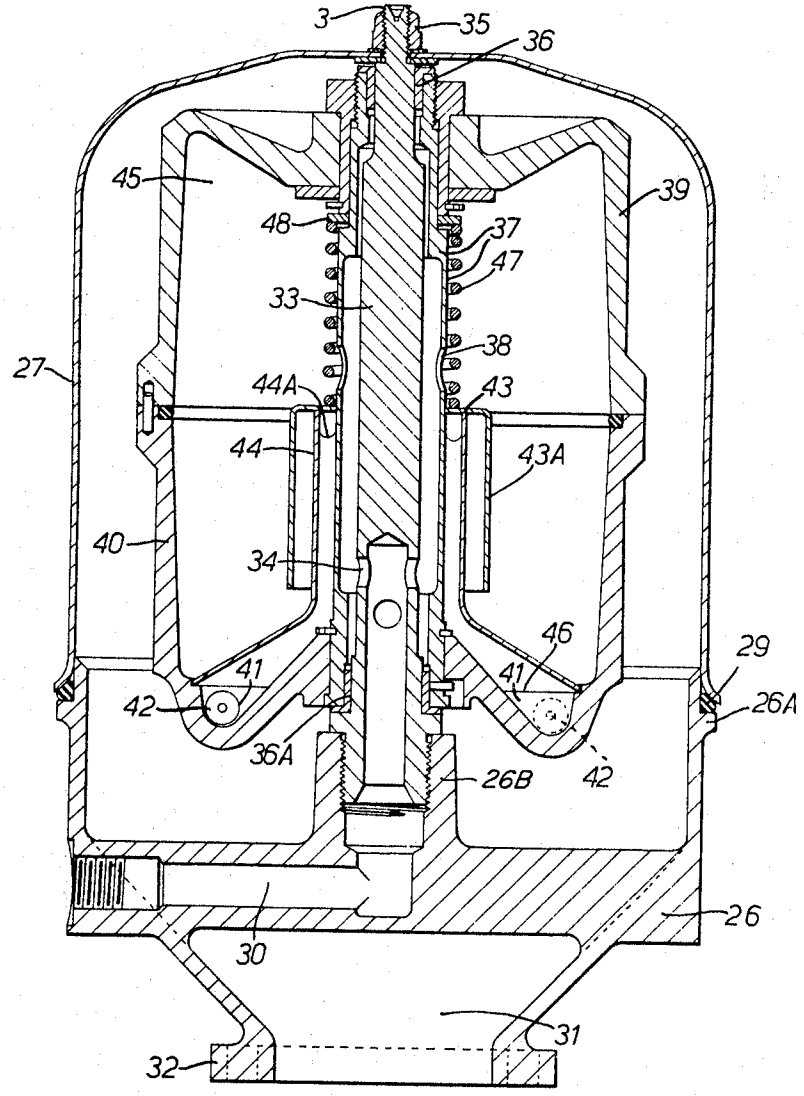

FIG. 2.

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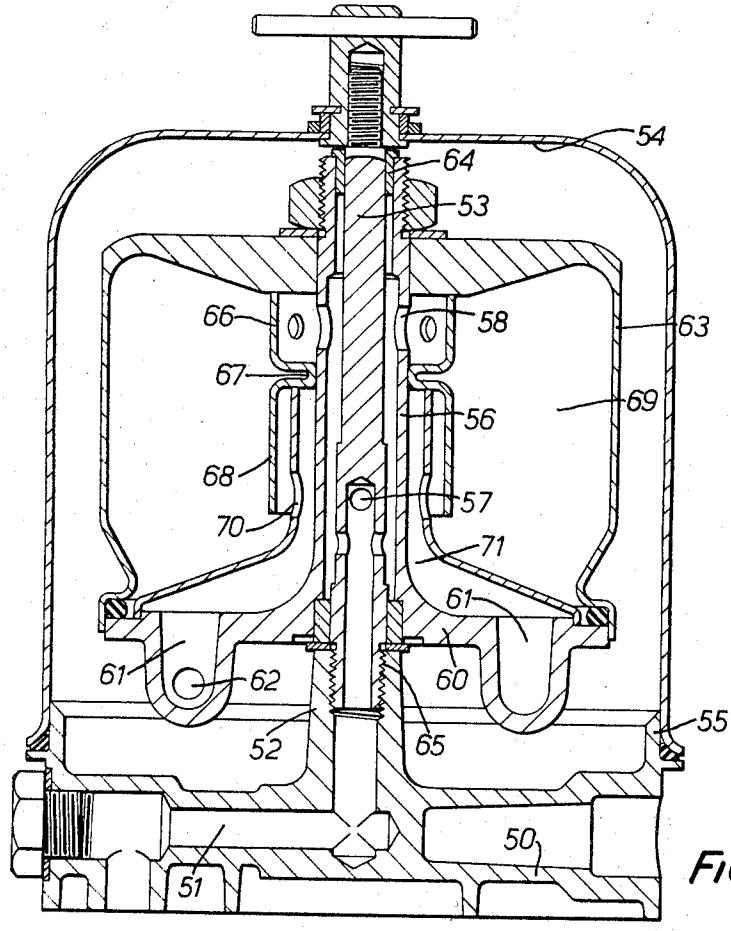

FIG. 3.

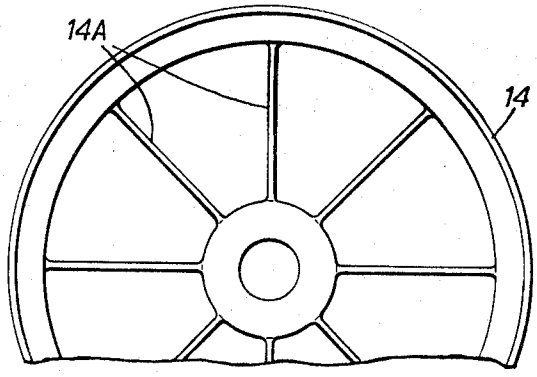

FIG. 4.

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CENTRIFUGAL FLUID CLEANERS

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U.S. Cl. 233—1 5 Claims
Int. Cl. B04b 3/00

ABSTRACT OF THE DISCLOSURE

A fluid cleaner of the centrifugal type comprises a rotor provided with a hollow hub through which fluid to be cleaned is delivered to inlet apertures communicating with the interior of the rotor chamber. Material centrifuged out is deposited on the wall of the rotor chamber, and the cleansed liquid flows out of the rotor chamber through one or more nozzles directed at a tangent to the axis of rotation of the rotor so as to render the rotor self-rotatable by the reaction of the liquid jets which are discharged from the nozzles.

This invention relates to centrifugal fluid cleaners and is concerned with the rotors of such fluid cleaners of the kind in which the rotor has a central hollow hub through which the fluid to be cleaned is delivered to inlet apertures communicating with the interior of the rotor chamber, and in which the fluid flows from the interior of the rotor chamber through one or more nozzles which are displaced substantially from the axis of rotation of the rotor and are formed so that the fluid ejected from them is ejected in a direction having a substantial tangential component relatively to a circle having the axis of rotation for centre so that the rotor is caused to rotate by the reaction of the jets thus issuing from the nozzles. Usually at least two nozzles are provided and for convenience herein this will be assumed to be the case.

The invention is more particularly concerned with rotors for centrifugal fluid cleaners of the kind referred to in which the rotor chamber is divided by a partition into an inlet compartment with which the inlet opening or openings for flow of fluid from the hollow hub communicate, and an outlet compartment with which the inlet compartment communicates through a passage or passages, (hereinafter for convenience called the transfer passage) while the nozzles communicate with the outlet compartment. Thus, during operation the fluid flows from the hollow hub into the inlet compartment and thence through the transfer passage into the outlet compartment and thence out of the outlet compartment through the nozzles.

It is an object of the present invention to provide an improved form of rotor for a centrifugal cleaner of the kind referred to in which the characteristics of the fluid flow through the rotor chamber will tend to be such as to provide for good separation of solid material from the fluid, in a manner permitting substantial build-up of such solid material on the wall of the inlet compartment, while preventing the carrying through of solids to the outlet compartment and hence to the nozzles.

To this end according to the present invention in a rotor for a centrifugal cleaner of the kind including a hollow hub through which fluid to be cleaned is delivered to inlet apertures communicating with the interior of the rotor chamber and in which the fluid flows from one end of the interior of the rotor chamber through one or more reaction nozzles arranged to cause rotation of the rotor, the interior of the rotor is divided by an annular partition into a relatively large inlet compartment with which the inlet openings communicate and a relatively small outlet compartment with which the nozzles communicate the inlet and outlet compartments communicate with one another through a transfer passage closely surrounding the hollow hub and the hub carries an annular baffle so disposed as to prevent liquid flowing in a direct path from the inlet openings to the inlet to the transfer passage and to cause such liquid to flow over the outer circumference of the baffle and then inwards before it enters the transfer passage.

In certain constructions according to the invention the transfer passage comprises a tubular member concentric with and spaced from the hub and opening at one end into the outlet compartment while its other end is closed, such tubular member having fluid entry openings in its circumferential wall for the entry into it of fluid from the inlet compartment while its end remote from the outlet compartment makes a substantially fluid tight seal with the baffle member.

Moreover in such a construction the tubular member may be surrounded by a gauze or like filter element somewhat spaced from the tubular member so that the fluid flowing into the entry openings of the transfer passage has to pass through this filter element, which will therefore prevent the passage into the outlet chamber of solid particles of a size which might otherwise block the reaction nozzle or nozzles, as might otherwise occur say during the starting up period when the rotor has not achieved a sufficient rotational speed to extract such particles by centrifugal action.

In other constructions according to the invention the entry to the transfer passage may be so disposed that the fluid flowing from the inlet compartment into it is caused to flow in a direction having a substantial component towards the inlet opening or openings. Thus not only is the fluid which enters the inlet compartment from the inlet opening or openings deflected radially outwards by the baffle into the outer circumferential area of the inlet compartment but, before it can pass through the transfer passage has its axial direction of flow reversed so that the fluid entering the transfer passage tends to be drawn from an area of the inlet compartment adjacent to the end thereof remote from the inlet openings.

Three constructions according to the invention are shown by way of example in the accompanying drawings in which:

FIGURE 1 is a cross-sectional elevation of one construction according to the invention in a plane containing the axis of rotation of the rotor,

FIGURE 2 is a similar view to FIGURE 1 of a second construction according to the invention,

FIGURE 3 is a similar view to FIGURE 1 of a third construction according to the invention, and

FIGURE 4 is an underneath plan view of the upper part of the rotor shown in FIGURE 1 illustrating a feature which may be applied to that rotor or to the rotor of the construction shown in FIGURE 2 or that shown in FIGURE 3.

In the construction illustrated in FIGURE 1 and FIGURE 4 the centrifugal fluid cleaner comprises a housing consisting of a base part **1** and an upper part **2** which have engaging edge portions, as indicated at **3**, having associated with them a fluid seal **4** so that the upper part **2** can be removed from the base part **1** when desired. The two parts **1** and **2** of the housing may be secured to one another in a readily detachable manner by any suitable means. Formed in the base part **1** of the housing is an inlet passage **5** for the entry of liquid to be cleaned, this passage communicating by way of a port controlled by a spring pressed valve **6** with the lower end of a vertical

passage 7 which in turn communicates with the lower end of the bore of a hollow hub or spindle 8. The lower end of the hub 8 is mounted in a bearing 9 in the base part 1 of the housing while its upper end is mounted in a bearing 10 in the upper part 2 of the housing so that the hub 8 can rotate freely within the housing 1, 2. Secured to the hub 8 is a rotor drum comprising a lower end or base 11 formed to provide two passages or wells 12 carrying at their lower ends reaction nozzles 13, and an upper part 14 constituting the circumferential wall and the upper end of the rotor drum.

Arranged within the rotor drum is an annular partition wall comprising a wide angle frusto-conical part 15 the lower edge 16 of which engages in a fluid tight manner a spigot on the base 11 as shown while its inner edge is formed integral with an upwardly projecting tubular part 17 spaced from the hub 8 and having formed in its circumferential wall a series of transfer openings 18. The upper end of the tubular projection 17 is closed by an annular cap 19 extending between and making a fluid-tight joint with the upper edge of the projection 17 and the circumferential surface of the hub 8, and held in position, for example by a circlip indicated at 20. Surrounding and slightly spaced from the tubular projection 17 is a filter gauze indicated at 21.

The partition wall 15 thus divides the rotor drum into upper and lower compartments 23 and 24 and the hub 8 is provided with inlet openings 22 communicating with the upper compartment 23 while an outlet passage 1A is provided in the base 1 of the body part.

The operation of the device is as follows:

Liquid is fed under pressure through the passage 5 and flows through the passage 7, the bore of the hub 8, and the inlet openings 22 into the upper compartment 23 of the rotor drum. The liquid then flows from the upper compartment 23 into the lower compartment 24 by way of the openings 18 and the tubular projection 17 and escapes from the lower compartment 24 by way of the nozzles 13, the reaction of the jets from which causes the rotor drum to rotate rapidly so that the liquid therein is subject to centrifugal force and solid matter in the liquid in the upper compartment is caused to collect on the interior of the wall 14 as shown at 25. The general pattern of flow of the liquid throughout its travel is indicated by arrows, the liquid discharged by the nozzles 13 escaping from the casing 1, 2 through the outlet passage 1A.

As shown in FIGURE 4 the under face of the upper end of the part 14 of the rotor may be provided with a series of radial ribs 14A which are also indicated in dotted line in FIGURE 1, for the purpose of promoting rotation with the rotor of the liquid in the inlet compartment of the rotor, and more especially ensuring adequate rotation of the upper portion of the liquid in the rotor which has only recently entered the inlet compartment of the rotor.

In the construction shown in FIGURE 2 the centrifugal fluid cleaner comprises a housing consisting of a base 26 and an upper part 27 in the form of an inverted cup, the base being provided with a cylindrical flange 26A the upper edge of which makes a fluid tight seal, with the assistance of a packing ring 29, with the lower edge portion of the upper part 27. The base 26 is formed to provide an inlet passage 30 for the liquid to be cleaned this passage being formed in a diametrically extending bar-like portion of the base which leaves free communication between an outlet passage 31 for cleaned liquid and the chamber enclosed by the base 26 and the upper part 27 of the housing the outlet passage 31 being provided at its lower end with a surrounding flange 32 by which the base 26 can be bolted to the casing of an engine or other apparatus having an aperture to receive the clean oil or other liquid. Formed at the centre of the base 26 is a hollow boss 26B the bore of which communicates with the inlet passage 30 while the boss serves as a support for the lower end of a vertical spindle 33 the upper end portion of which is solid while its lower end portion is formed hollow to provide a bore which is in effect a continuation of the inlet passage 30 and terminates in a series of radial ports 34. The upper end of the spindle 33 is supported in the upper end of the part 27 and provided with a nut 35 securing the part 27 to the base 26.

Rotatably mounted upon the spindle 33 on bearings 36, 36A is a tubular member 37 the centre part of which is spaced from the spindle 33 to provide a liquid passage and is provided with radial openings 38 constituting inlet openings to the interior of a rotor of which the member 37 constitutes the hub. This rotor comprises upper and lower cup like parts 39, 40 the rim portions of which engage and make a fluid tight seal with one another with the assistance of a sealing ring, the lower cup like part 40 being formed to provide in its lower wall two wells 41 each of which supports a reaction nozzle 42 for the escape of fluid from the rotor in a tangential direction. Mounted upon the hollow hub 37 so as to be co-axial therewith is a member comprising the radially extending baffle part 43 from the edge of which depends a tubular part 43A substantially spaced from the hub 37 and a second tubular part 44 spaced from the hub 37, and from the tubular part 43A and making a fluid tight seal at its upper end with the baffle part 43 and having a wide frusto-conical part at its lower end so that it serves to divide the interior of the rotor into an inlet compartment 45 and an outlet compartment 46 from the latter of which the nozzles 42 lead. The member comprising the parts 43, 43A and 44, is held in position by a compression spring 47 the lower end of which acts on the upper face of the baffle part 43 while its upper end acts on a thrust washer 48.

It will be seen that in this construction the liquid to be cleaned enters the hollow hub 37 adjacent to its lower end and flows therefrom into the inlet compartment 45 through the inlet openings 38 and, owing to the presence of the baffle part 43, 43A has then to flow outwards into the outer circumferential areas of the inlet compartment 45 before it can flow into the entry to the transfer passage constituted by the annular space between the parts 43A and 44 and thence from the upper end of this annular space through ports 44A into the annular space between the part 44 and the hub 37 and thus into the outlet compartment 46 and through the nozzles 42. It will moreover be seen that, before it can enter the transfer passage between the ports 43A and 44 the fluid which has hitherto had a component of axial flow in the downward direction has to have its axial component of direction reversed so that it flows towards the inlet openings 38, the arrangements being such that the fluid entering the transfer passage thus tends to be drawn from the lower outer circumferential areas of the inlet compartments 45.

In the construction shown in FIGURE 3 the general construction and arrangement of the housing, apart from differences in dimensions and detail is the same as that of the construction shown in FIGURE 2, the housing comprising a base 50 formed to provide an inlet passage 51, and a central hollow boss 52 with which the inlet passage 51 communicates and which also forms a support for the lower end of a spindle 53 the upper end of which is supported at the centre of a cuplike upper part 54 which constitutes the upper part of the housing, and has a rim making a fluid tight seal with a cylindrical flange 55 constituting part of the base 50. In this construction the rotor comprises a hollow hub 56 the centre part of which surrounds and is spaced from the centre part of the spindle 53 to provide a passage for the flow of fluid from the inlet passage through ports 57 in the spindle to ports 58 adjacent to the upper end of the hollow hub 56 similar to the hub 37 in FIGURE 2. In the construction shown in FIGURE 3 the hollow hub 56 is formed integral with the base part 60 of the rotor which is formed to provide wells 61 from which the reaction

nozzles **62** deliver liquid in tangential directions, the upper part of the rotor chamber being constituted by an inverted cup like member **63** and the rotor as a whole being supported rotatably on the spindle **53** by means of bearings **64** and **65**. As will be seen in this construction the baffle member comprises an upper tubular part **66** which projects into engagement with the lower surface of the upper part of the rotor chamber and has ports in its wall, an inwardly extending duplex flange **67** engages the hub **55** and a downwardly extending "skirt" **68**, while the dividing wall between the inlet compartment **69** of the rotor chamber is of similar form to that of FIGURE 2 but has the entry openings **70** to the transfer passage **71** near the lower end of the part **68**.

It will be seen that the parts **66**, **67**, **68** constitute in effect a baffle which causes the fluid leaving the inlet openings in the part **66** to flow outwards into the outer radial areas of the inlet compartment **69** before it can pass into the entry openings **70** of the transfer passage and hence through this passage into the outlet compartment, while moreover the tubular part **68** also causes the liquid flowing from the entry openings **70** and having a downward axial component as it flows through the inlet compartment **68** to reverse its direction of axial flow and flow upwards into the openings **70** before it can flow downwards again into the outlet compartment.

What I claim as my invention and desire to secure by Letters Patent is:

1. A rotor chamber assembly for a centrifugal cleaner including a hollow hub provided with inlet apertures in its upper portion through which fluid to be cleaned is delivered from the hub to the interior of the rotor chamber at a point adjacent the upper end of the rotor chamber, at least one reaction nozzle disposed adjacent to the lower end of the rotor chamber and arranged to cause rotation of the rotor, an annular partition dividing the interior of the rotor chamber into a relatively large inlet compartment with which the inlet apertures communicate and a relatively small outlet compartment with which the nozzle communicates, while providing a transfer passage near the lower end of the inlet compartment for fluid flow from the inlet compartment into the outlet compartment, said transfer passage closely surrounding the hollow hub, and an annular baffle carried by the hub and serving to prevent liquid flowing in a direct path from the inlet openings to the inlet to the transfer passage and to cause such liquid to flow over the outer circumference of the baffle and then inwards before it enters the transfer passage.

2. A rotor chamber assembly for a centrifugal cleaner as claimed in claim **1** including a tubular filter element extending below the baffle member and disposed to cause all fluid flowing from the inlet compartment to the outlet compartment to pass therethrough.

3. A rotor for the centrifugal cleaner as claimed in claim **1** in which the transfer passage comprises a tubular member concentric with and spaced from the hub and opening at one end into the outlet compartment while its end remote from the outlet compartment makes a substantially fluid tight seal with the baffle member.

4. A rotor for a centrifugal cleaner as claimed in claim **3** including a filter element surrounding the tubular member and somewhat spaced from the tubular member whereby all fluid flowing to the entry openings of the transfer passage has to pass through said filter element.

5. A rotor for a centrifugal cleaner as claimed in claim **1** in which said baffle comprises a filter for solid particles in the fluid.

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HENRY T. KLINKSIEK, *Primary Examiner.*

U.S. Cl. X.R.

233—23