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(54) CENTRIFUGAL SEPARATOR HAVING A VENTILATION SYSTEM

ZENTRIFUGALABSCHEIDER MIT EINEM BELÜFTUNGSSYSTEM

SÉPARATEUR CENTRIFUGE DOTÉ D'UN SYSTÈME DE VENTILATION

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Description

Field of the Invention

[0001] The present invention relates to the field of centrifugal separators, and more specifically to centrifugal separators having a system for ventilating the space around the centrifuge rotor.

Background of the Invention

[0002] Centrifugal separators are generally used for separation of liquids and/or solids from a liquid mixture or a gas mixture. During operation, fluid mixture that is about to be separated is introduced into a rotating bowl and due to the centrifugal forces, heavy particles or denser liquid, such as water, accumulates at the periphery of the rotating bowl whereas less dense liquid accumulates closer to the central axis of rotation. This allows for collection of the separated fractions, e.g. by means of different outlets arranged at the periphery and close to the rotational axis, respectively.

[0003] When processing a flammable fluid over the flash point in a centrifugal separator there is a risk of creating an explosive atmosphere. This may occur if there are flammable gas and oxygen in certain concentrations in presence at a source of ignition. Different legislations demand that actions are taken in order to decrease or minimize the risk of an explosion occurring. For example, in the European Union there is the ATEX directive that regulates what equipment and work environment are allowed in an environment with an explosive atmosphere.

GB 751078 and CH 107681 describe centrifuges with means relating to the rotor to provide air circulation for cooling of the rotor and the electric motor driving the same.

[0004] JP 2015104701 describes a centrifuge system where the operation of the system is terminated if flammable gas is detected by a flammable gas detector.

[0005] A common method today for preventing explosions when processing a flammable fluid is purging the separation system with inert gas, such as nitrogen or carbon dioxide, which reduces or eliminates the oxygen content. Such a system is described in e.g. GB 2011808, in which a centrifuge is located in a container that can be sealed by means of a lid. Means is provided for supplying an inert gas for purging the container and centrifuge of all oxygen and other combustible gases/vapors etc. before start of the centrifuge process to reduce the risk of explosion.

[0006] However, such purging systems based on inert gas increase both the investment and operating costs and also the complexity of the centrifugal separator system, e.g. since inert gas systems usually require means for maintaining an overpressure of the inert gas around the centrifuge rotor. Thus, there is a need in the art for a less complex system for reducing the risk of explosion when processing flammable fluids in a centrifugal separator.

Summary of the Invention

[0007] A main object of the present invention is to provide a centrifugal separator having a convenient ventilation system.

[0008] A further object is to provide a centrifugal separator having a reduced risk for explosion during processing of a flammable fluid.

[0009] As a first aspect of the invention, there is provided a centrifugal separator for separation of at least two components of a fluid mixture which are of different densities which fluid mixture comprises a flammable fluid, which centrifugal separator comprises

a stationary frame,

a drive member configured to rotate a rotating part in relation to the stationary frame, wherein the rotating part comprises a spindle and a centrifuge rotor enclosing a separation space, the centrifuge rotor being mounted to the spindle to rotate together with the spindle around an axis (X) of rotation, wherein the rotating part is supported by the stationary frame by at least one bearing device,

wherein the stationary frame surrounds the centrifuge rotor, thereby forming a rotor space between the stationary frame and the centrifuge rotor, and wherein the stationary frame comprises at least one first air inlet arranged to provide fluid communication into the rotor space and at least one first air outlet arranged to provide fluid communication out from the rotor space,

wherein the at least one first air inlet and the at least one first air outlet are arranged in the stationary frame so as to provide a flow of air from the at least one first air inlet to and out through the at least one first air outlet upon rotation of the rotating part, and

wherein the at least one first air inlet is arranged to be connected to a source of air and wherein the at least one first air outlet is arranged to allow outflow of air from the rotor space. the centrifugal separator further comprises at least one sensor configured to detect a parameter related to the concentration of flammable gas in the air of said rotor space.

[0010] The centrifugal separator is for separation of a fluid mixture, such as a gas mixture or a liquid mixture. The stationary frame of the centrifugal separator is a non-rotating part, and the rotating part, such as the spindle is supported by the frame by at least one bearing device, such as by at least one ball-bearing.

[0011] The drive member is arranged for rotating the spindle and the centrifuge rotor mounted on the spindle. Such a drive member for rotating the rotating part may comprise an electrical motor having a rotor and a stator. The rotor may be provided on or fixed to the spindle so that it transmits driving torque to the spindle and hence to the centrifuge rotor during operation.

[0012] Alternatively, the drive member may be provided beside the spindle and rotates the rotating part by a

suitable transmission, such as a belt or a gear transmission.

[0013] The centrifuge rotor is adjoined to a first end of the spindle and is thus mounted to rotate with the spindle. During operation, the spindle thus forms a rotating shaft. The first end of the spindle may be an upper end of the spindle. The spindle is thus rotatable around the axis of rotation (X).

[0014] The rotating part may be arranged to rotate at a speed of above 3000 rpm, such as above 3600 rpm.

[0015] The centrifuge rotor further encloses a separation space in which the separation of the fluid mixture takes place. Thus, the centrifuge rotor forms a rotor casing for the separation space. The separation space may comprise a stack of separation discs arranged centrally around the axis of rotation. Such separation discs form surface enlarging inserts in the separation space. The separation discs may have the form of a truncated cone, i.e. the stack may be a stack of frustoconical separation discs. The discs may also be axial discs arranged around the axis of rotation.

[0016] The centrifugal separator may further comprise at least one inlet for fluid mixture, i.e. feed, that is to be separated. Such inlet may be a stationary pipe arranged for supplying the feed to the separation space. The inlet may also be provided inside a rotating shaft, such as the spindle. Thus, the spindle may be hollow and may further have a diameter of at least 10 mm, such as at least 20 mm. For example, the outer diameter of the spindle may be between 10-300 mm, such as between 20-200 mm.

[0017] The centrifugal separator may further comprise at least one liquid outlet for fluid that has been separated. The at least one liquid outlet for fluid that has been separated may comprise a first outlet and a second outlet arranged at a larger radius from the rotational axis as compared to the first liquid outlet. Thus, liquids of different densities may be separated and be discharged via the first and second liquid outlets, respectively. During operation, a sludge phase, i.e. mixed solid and liquid particles forming a heavy phase, may be collected in an outer peripheral part of the separation space. Therefore, the centrifugal separator may further comprise outlets for discharging such a sludge phase from the periphery of the separation space. The outlets may be in the form of a plurality of peripheral ports extending from the separation space through the centrifuge rotor to the rotor space between the centrifuge rotor and the stationary frame. The peripheral ports may be arranged to be opened intermittently, during a short period of time in the order of milliseconds, to enable discharge of a sludge phase from the separation space to the rotor space. The peripheral ports may also be in the form of nozzles that are constantly open during operation to allow a constant discharge of sludge.

[0018] The stationary frame may be single walled or e.g. double or triple walled and surrounds the centrifuge rotor at a distance from the rotor, thereby forming a rotor space between the rotor and the frame wall. The stationary frame comprises at least one first air inlet and at least one first air outlet. Thus, the frame may comprise a single air inlet and/or a single air outlet, or as an alternative, two or more air inlets and/or two or more air outlets. The at least one air inlet and the at least one first air outlet are arranged so as to provide fluid communication between the outside of the frame to the rotor space. Thus, the at least one air inlet and the at least one air outlet may be through holes in the stationary frame.

[0019] Air may be atmospheric air and the pressure of the air may be atmospheric pressure or a pressure that is higher than atmospheric pressure.

[0020] The at least one first air inlet and the at least one first air outlet are arranged in the frame so as to provide a flow of air from the at least one first air inlet to the at least one first air outlet upon rotation of the rotating part. Thus, the rotation of the centrifuge rotor may drive air from the outside of the stationary frame through the at least one first air inlet to the rotor space surrounding the rotor and then out from the rotor space through the at least one first air outlet. Thus, merely the rotation of the bowl may drive a flow of ventilating air through the stationary frame, thereby ventilating the centrifuge bowl.

[0021] The at least one first air inlet is further arranged to be connected to a source of air. The source of air may be the ambient air surrounding the centrifugal separator, and the at least one first air inlet may thus simply be a through hole or a pipe through the stationary frame. However, the source of air may also be pressurized air, such as the pressurized air from a common air source that is found in almost all industrial environments. Thus, the at least one air inlet may be arranged to provide a connection with such a pressurized air source, e.g. by means of threads or the like.

[0022] Furthermore, the at least one first air outlet is arranged to allow outflow of air from the rotor space. "Outflow of air" refers to the air outlet or outlets being arranged to allow a flow of air out from the rotor space upon rotation of the centrifuge rotor.

[0023] Thus, the at least one first air outlet may be free of any device that exerts a counter pressure to the air in the rotor space. Consequently, the at least one first air outlet may be arranged to allow free outflow of air from the rotor space. Thus, the at least one first air outlet may be free of e.g. any liquid seals.

[0024] The at least one first inlet and/or the at least one first air outlet may have a cross-sectional area of more than 0.5 cm^2, such as more than 1.0 cm^2, such as more than 1.5 cm^2, such as more than 2.0 cm^2, such as more than 2.5 cm^2.

[0025] The at least one first air inlet and/or the at least one first air outlet may comprise a substantially circular through hole in the frame having a diameter of more than 5 mm, such as more than 10 mm, such as more than 15 mm.

[0026] Furthermore, the at least one first air inlet and the at least one first air outlet may be arranged so as to provide a flow of air of above 4 Nm^3/hour, such as above

6 Nm^3/hour, such as above 8 Nm^3/hour from inlet to and out through outlet upon rotation of the centrifuge rotor at its operational speed.

[0027] The first aspect of the invention is based on the insight that the centrifuge rotor may be ventilated using a flow of air that is generated upon rotation of the centrifuge rotor. Thus, it is believed that the rotation of the centrifuge rotor may draw air into the rotor space via the air inlet, which then may leave the rotor space via the air outlet. This is thus advantageous in that the centrifugal separator does not need any complex inert gas system for decreasing the risk of explosion. The ventilation may thus be performed constantly by the air outside the separator. Moreover, since the air inlet may be connected to a source of pressurized air, the centrifuge rotor may also be ventilated during standstill of the separator and the ventilation using pressurised air may be performed constantly or with a frequency according to a time schedule.

[0028] In embodiments of the first aspect of the invention, the at least one first air inlet is arranged in the frame so that it communicates with a left portion of the rotor space and the at least one first air outlet is arranged in the frame so that it communicates with a right portion of the rotor space, or vice versa.

[0029] The "left" and "right" portions may be as seen in an axial plane through the centre of the centrifugal separator. The "left" portion may then be left of the rotational axis X whereas the "right" portion may be right of the rotational axis X. Thus, the left and right portions may be different portions of the rotor space.

[0030] An air inlet, an air outlet and the rotational axis may all be arranged in the same axial plane.

[0031] Thus, an air inlet may be provided in the frame to communicate with a first half of the rotor space and a first outlet may be provided in the frame to communicate with a second half, other than the first half, of the rotor space. This may facilitate that a large amount of the rotor space is ventilated when air flows from the air inlet to the air outlet.

[0032] In embodiments of the first aspect of the invention, the at least one first air inlet is arranged in the frame so that it communicates with an upper portion of the rotor space and the at least one first air outlet is arranged in the frame so that it communicates with a lower portion of the rotor space, or vice versa.

[0033] This is also advantageous in that it facilitates that a large amount of the rotor space is ventilated when air flows from the air inlet to the air outlet.

[0034] The "upper" and "lower" portions may be as seen in an axial plane through the centre of the centrifugal separator. The "upper" portion may then be axially above the centre of the centrifuge rotor, whereas the "lower" portion may be axially below the centre of the centrifuge rotor. Thus, the upper and lower portions may be different portions of the rotor space.

[0035] As an example the at least one first air inlet may be arranged in the frame so that it communicates with an upper left portion of the rotor space and the at least one first air outlet may be arranged in the frame so that it communicates with a lower right portion of the rotor space, or vice versa. This may facilitate that a large amount of the rotor space is ventilated when air flows from an air inlet to an air outlet.

[0036] The flammable gas may be a combustible gas, such as a hydrocarbon that originates from a flammable liquid, such as from an oil or fuel. The sensor may thus be a sensor comprising e.g. infrared or catalytic bead sensing technologies for detecting flammable gases. The at least one sensor may be arranged within the rotor space, such as on the inner surface of the stationary frame.

[0037] Using a sensor for detecting a parameter related to the concentration of flammable gas may be advantageous in that it allows for adjusting the flow of air, i.e. the ventilation, based on output from the sensor, and it may further give information that the concentration of flammable gas is below a specific, non-harmful level.

[0038] As an example the parameter may be the ratio of hydrocarbons to oxygen in the air of the rotor space. The parameter may also be the actual concentration of hydrocarbons. The centrifugal separator may thus also include a sensor configured to detect the concentration of oxygen in the rotor space, or it may comprise at least one sensor with the capacity of detecting both the concentration of oxygen and the concentration of hydrocarbon, or directly the ratio of hydrocarbons to oxygen.

[0039] As an example, at least one of the at least one sensor may be arranged in an additional space that is in fluid communication with the rotor space.

[0040] In embodiments, such an additional space does not surround the centrifuge rotor.

[0041] The additional space may thus be a passage or chamber, such as a tube-shaped passage or chamber, arranged outside the actual stationary frame but communicates with the rotor space via at least one opening in the frame. This may be advantageous allows for easy access to the at least one sensor.

[0042] Furthermore, the at least one first air inlet may be arranged to be connected to a source of pressurized air.

[0043] As an example, the at least one first air inlet may be arranged to be connected to a source of pressurized air and the centrifugal separator may further comprise a control unit configured to receive an input signal related to the parameter and generate a signal to regulate the flow of pressurized air based on the input signal.

[0044] This allows the flow of pressurized air, i.e. the ventilation of the centrifuge rotor, to be controlled by the detected parameter. Thus, the flow of ventilating air may be regulated by the detected parameters.

[0045] The control unit may comprise a processor and an input/output interface for communicating with the source of pressurized air and for receiving information about the parameter related to the concentration of flammable gas in the rotor space from at least one sensor.

[0046] Regulating may comprise increasing the flow of pressurized air if the detected parameter is above a threshold value. The threshold value may for example be a lower explosion limit for the ratio of hydrocarbons to oxygen in the rotor space or a specific concentration of hydrocarbons in the rotor space.

[0047] Regulating may further comprise decreasing the flow of pressurized air if the detected parameter is below a threshold value.

[0048] Regulating may also comprise using a regulation loop to keep the flow of pressurized air at a constant level or turning on or off the flow of pressurized air. Thus, the control unit may be configured to decrease the flow of pressurized air at standstill of the separator, i.e. it may further be configured to receive information about the rotational speed of the centrifugal separator and control the flow of pressurized air based on that information.

[0049] The centrifugal separator may thus comprise pressure regulating means arranged for supplying the air at a pressure that is higher than atmospheric pressure to the at least one first air inlet. The pressure regulating means may comprise a valve. The control unit may thus be arranged to generate a signal that is sent to the pressure regulating means.

[0050] In embodiments of the first aspect of the invention, the frame further surrounds the drive member thereby also forming a drive space enclosing the drive member, and further comprises at least one second air inlet arranged to provide fluid communication into the drive space and at least one second air outlet arranged to provide fluid communication out from the drive space, wherein the centrifugal separator further comprises means for generating a flow of air from a second air inlet to and out through a second air outlet.

[0051] The means for generating a flow of air from a second air inlet to and out through a second air outlet may for example comprise a fan. The means for generating a flow of air from a second air inlet to and out through a second air outlet may further be a source of pressurized air. Thus, at least one second air inlet may be arranged to be connected to a source of pressurized air. The at least one second air outlet may be arranged to allow outflow of air from the drive space, such as a free outflow without any counter pressure means. Further, the at least one second air inlet and the at least one second air outlet may be as or have a size as discussed in relation to the at least one first air inlet and the at least one first air outlet above.

[0052] Thus, the centrifugal separator may further be arranged for ventilating the drive space around the drive member in analogy with what is described about ventilation of the rotor space above. The drive space may be in fluid communication with the rotor space or it may be sealed from the rotor space. As an example, the centrifuge rotor may be arranged axially above or below the drive member, and the rotor space and the drive space may be sealed using e.g. a liquid seal axially between the rotor space and the drive space. The bearing device may be arranged in the drive space.

[0053] Furthermore, the centrifugal separator may comprise at least one sensor configured to detect a parameter related to the concentration of flammable gas in the air of the drive space.

[0054] Thus, a sensor arranged in the drive space may be a sensor as described in relation to the rotor space above.

[0055] Further, at least one second gas inlet may be arranged to be connected to a source of pressurized air, and wherein the centrifugal separator further comprises a control unit configured to receive an input signal related to the parameter and generate a signal to regulate the flow of pressurized air based on the input signal.

[0056] The control unit may be and may function, e.g. in terms of regulating the flow of pressurized air, as described in relation to the control unit for receiving a signal from at least one sensor configured to detect a parameter related to the concentration of flammable gas in the rotor space.

[0057] The same control unit may be used for receiving and controlling the flow of air in the rotor space and the drive space.

[0058] In embodiments of the first aspect of the invention, the centrifuge rotor is at its outer periphery provided with a set of sludge outlets for discharge of a higher density component such as sludge or other solids in a fluid mixture, and wherein the frame further encloses a solids collector for collecting the discharged component, and wherein the centrifugal separator further comprises at least one sensor configured to detect a parameter related to the concentration of flammable gas in the air of the solids collector.

[0059] The sludge outlets may be arranged to be opened intermittently or they may be arranged to be permanently opened, i.e. forming nozzles. The solids collector may comprise a cyclone.

[0060] Having at least one sensor arranged in the solids collector may further increase the safety of the process, i.e. it may give information also about any concentration of flammable gas in the solids collector. If the centrifugal separator comprises a control unit as described above, also the sensor in the solids collector may be connected to the control unit so that the flow of ventilation air may be regulated based on information from the sensor in the solids collector. The sensor in the solids collector may function as described in relation to the sensor in the rotor space and drive space, respectively.

[0061] As a second aspect of the invention, there is provided a method for ventilating a centrifugal separator, comprising

- providing a centrifugal separator according to the first aspect of the invention,
- supplying a fluid mixture comprising at least two components which are of different densities to be separated to the separation space of the centrifuge rotor; and

- rotating the rotating part so as to provide a flow of air from at least one first gas inlet to and out through at least one first gas outlet, thereby ventilating the centrifugal separator, wherein the fluid mixture to be separated comprises a flammable fluid and the method further comprises
- detecting a parameter related to the concentration of flammable gas in said rotor space, and
- regulating the flow of air from said at least one first gas inlet to and out through said at least one first gas outlet based on the detected parameter.

[0062] The terms and definitions used in relation to the second aspect are the same as discussed in relation to the first aspect above.

[0063] The fluid mixture to be separated may be a liquid mixture.

[0064] Depending on the application, the liquid mixture to be separated may have different temperature and if the liquid mixture to be separated comprises petrol or ethanol or other volatile chemical substances, it may start to have a substantial evaporation rate at room temperature or above. Thus, as an example, the liquid mixture supplied to the separator may be supplied at room temperature. As a further example, the liquid mixture may have a temperature of at least 40 °C, such as at least 50 °C, such as at least 90 °C, such as at least 95 °C, such as at least 98 °C.

[0065] The liquid mixture may be supplied to the separation space via a stationary inlet pipe from above or below, or it may be supplied via the spindle, such as through a duct in the spindle that co-rotates with the spindle.

[0066] Rotating the rotating part thus includes using the drive member for transmitting torque to the spindle so that the spindle and centrifuge rotor rotates. Rotating the rotating part may comprise rotating the centrifuge rotor at a speed that is above 3000 rpm, such as above 3600 rpm.

[0067] The method may of course also comprise separating the fluid mixture into two or several phases, such as one or two liquid phases and a solid or sludge phase.

[0068] The flammable fluid may comprise an oil. The oil may be selected from heavy fuel oil (HFO), lubrication oil or crude oil. HFO may be defined as in ISO 8217, Petroleum products - Fuels (class F) - Specification of marine fuels. Editions 2005 and 2012. Further, the fluid mixture to be separated may be heated to a temperature of above 70° C, such as to a temperature between 70° C and 98 ° C, such as to a temperature above 98 ° C, before being supplied to the separation space. This may increase the handling and separation of e.g. an oil mixture to be separated.

[0069] As discussed in relation to the first aspect above, the parameter may be the ratio of hydrocarbons to oxygen in the rotor space. The parameter may also be the actual concentration of hydrocarbons.

[0070] Regulating may comprise increasing the flow of pressurized air if the detected parameter is above a threshold value. The threshold value may for example be a lower explosion limit for the ratio of hydrocarbons to oxygen in the rotor space or a specific concentration of hydrocarbons in the rotor space.

[0071] Regulating may further comprise decreasing the flow of pressurized air if the detected parameter is below a threshold value.

[0072] Regulating may also comprise using a regulation loop to keep the flow of pressurized air at a constant level or turning on or off the flow of pressurized air

[0073] Thus, in embodiments of the second aspect of the invention, the method is further comprising

- detecting a parameter related to the concentration of flammable gas in a drive space surrounding the drive member, and
    - increasing the flow of air from the at least one first gas inlet to and through the at least one first gas outlet if the detected parameter is above a threshold value.

[0074] Further, in embodiments of the second aspect of the invention, the method is further comprising

- detecting a parameter related to the concentration of flammable gas in a solids collector, and
- increasing the flow of air from the at least one first gas inlet to and through the at least one first gas outlet if the detected parameter is above a threshold value

[0075] The method may of course comprise detecting a parameter related to the concentration of flammable gas in both the rotor space and the drive space, in the rotor space and in the solids collector, or in all three of the rotor space, the drive space and the solids collector.

Brief description of the Drawings

[0076]

Figure 1 shows a schematic drawing of an embodiment of a centrifugal separator that is ventilated using ambient air.

Figure 2 shows a schematic drawing of an embodiment of a centrifugal separator that is ventilated using ambient air and in which a sensor is used in an additional space.

Figure 3 shows a schematic drawing of an embodiment of a centrifugal separator that is ventilated using a flow of pressurized air.

Figure 4 shows a schematic drawing of an embodiment of a centrifugal separator that is ventilated using a flow of pressurized air that is regulated by means of a control unit.

Detailed Description

[0077] The centrifugal separator according to the present disclosure will be further illustrated by the following description of some embodiments with reference to the accompanying drawings.

[0078] Fig. 1 shows an embodiment of a centrifugal separator 1 having a stationary frame 2 and a rotating part 4. The rotating part 4 comprises a vertical spindle 5 and a centrifuge rotor 6, in which the actual separation takes place during operation of the centrifugal separator 1. A liquid mixture that is to be separated may during operation be introduced into a separation space (not shown) inside centrifuge rotor 6 from the top via a channel in pipe 33. Also, separated liquid phases, e.g. one or two depending on the application, are discharged in channels in this pipe 33. The separation space further comprise a stack of frusto-conical separation discs (not shown) in order to achieve effective separation of the liquid. The stack of truncated conical separation discs are thus examples of surface-enlarging inserts and are fitted centrally and coaxially with the centrifuge rotor. 6. Moreover, the centrifuge rotor 6 comprises at its periphery a set of sludge outlets 19, which may be opened intermittently to discharge a separated sludge phase radially out from centrifuge rotor 6. The sludge phase is collected in solids collector 20 after discharge. The solids collector 20 is in this case arranged radially outside the stationary frame 2.

[0079] The spindle 5 is journalled in an upper bearing 7a and a lower bearing 7b and carries at its upper end above the upper bearing 7a the centrifuge rotor 6. The rotating part 4 is rotatable about an axis X of rotation and driven by drive member 3, which in these examples comprise a screw gear. However, the drive device may of course as an alternative comprise an electrical motor or a belt drive. Furthermore, the drive member 3 may also be arranged axially above the centrifuge rotor 6.

[0080] The stationary frame 2 surrounds centrifuge rotor 6 at a distance from the centrifuge rotor 6 so that a rotor space 8 is formed around the centrifuge rotor 6. As illustrated in the figures, which all show an axial plane through the frame 2, the rotor space 8 may be divided in a left portion 11 and a right portion 12 of the rotational axis X. The rotor space 8 may also be divided in an upper portion 13 and a lower portion 14. The division between the upper portion 13 and the lower portion 14 may for example be a radial line through the sludge outlets 19, as illustrated by dotted line "Y" in the figures. Thus, in an axial plane, the rotor space 8 may be divided in an upper right portion, an upper left portion, a lower right portion and a lower left portion.

[0081] A first air inlet 9 is arranged in the stationary frame 2 in the upper left portion, whereas a first air outlet 10 is arranged in the stationary frame in the lower right portion. The first air inlet 9 and first air outlet 10 are arranged as through holes in the frame, with a diameter between 5 - 10 mm, so that the air inlet 9, the air outlet 10 and the rotational axis are all substantially in the same axial plane. The first air inlet 9 and the first air outlet 10 communicate with the ambient air. The first air outlet 10 has no liquid seal or the like that exerts a counter pressure, i.e. it is arranged so that it allows for a substantially free flow of air out from the rotor space 8.

[0082] The air inlet 9 thus communicates with the upper left portion of the rotor space 8 whereas the air outlet 10 communicates with the lower right portion. However, it is to be understood that the air inlet 9 for example also could be arranged in the frame 2 so that it communicates with an upper right portion of rotor space 8, whereas the air outlet 10 also could be arranged in the frame 2 so that it communicates with the lower left portion of the rotor space 8.

[0083] Due to the first air inlet 9 and the first air outlet 10, ambient air from outside of the frame 2 may be drawn into the rotor space 8 via the inlet 9 and then out from rotor space 8 via outlet 10 upon rotation of centrifuge rotor 6. Thus, a flow of ventilating air is formed through the rotor space, as illustrated by arrows "A" in the figures.

[0084] The stationary frame further comprises a lower part 16 that also surrounds drive member 3, thereby forming a drive space 27 around the drive member 3. The drive space 27 and the rotor space 8 is in this embodiment not in fluid contact, and may be separated by means of e.g. a water seal arranged e.g. above the upper bearing 7a. Also the lower part 16 of the frame comprises an air inlet and an air outlet, and are in Fig. 1 seen as a second air inlet 17 that communicates with a portion of the drive space 27 that is left of the rotational axis X, and a second air outlet 18 that communicates with a portion of the drive space 27 that is right of the rotational axis X, as seen in an axial plane. Also, the separator 1 comprises means for generating a flow of air (not shown) through the drive space 27, such as a fan. Thus, also a flow of ventilating air may be generated that ventilates the drive space 27 during operation of the centrifugal separator 1. This flow of air flows in the drive space 27 from the second air inlet 17 to and out through the second air outlet 18, as is illustrated by arrows "B" in the figures.

[0085] Further, the centrifugal separator 1 comprises a sensor 15a arranged in the rotor space 8, a sensor 15b arranged in the solids collector 20 and a sensor 15c arranged in the drive space 27. All these sensors may be sensors that detect a parameter related to the concentration of flammable gas, such as the ratio of hydrocarbons to oxygen in the vicinity of the sensors. Thus, these sensors 15 a-c may give information related to the concentration of harmful or flammable gases, and may be used e.g. to confirm that the ventilation around the rotor and/or the solids collector and/or the drive member is ok, or if the concentration of flammable gas is above e.g. a lower explosion limit in the rotor space 8, the solids collector 20 and or the drive space 27. Detecting a concentration of flammable gas above a certain limit could then trigger e.g. shutting down the separator, i.e. turning off the feed of mixture to be separated and/or decreasing the rotational speed of the drive member 3.

[0086] Fig. 2 shows a further embodiment of a centrifugal separator 1. This centrifugal separator 1 functions as discussed in relation to the separator of Fig. 1 above, with the only difference that the sensor 15a, which is arranged to detect a parameter related to the concentration flammable gas in the rotor space 8, is arranged in an additional space 21 that is in fluid contact with the rotor space 8. In this example, the additional space 21 is formed by a tube shaped extension 34 of the frame 2. This tube shaped extension 34 communicates with rotor space via through holes 22a and 22b of the stationary frame 2, but does not itself surround the centrifugal rotor 1. Due to the flow of air through the rotor space 8 and the through holes 22a and 2b, the concentration of flammable gas in additional space 21 detected using sensor 15a is representative for the concentration of flammable gas in the rotor space 8. Having the sensor 15a arranged in such an additional space is advantageous in that it allows for easy access to the sensor.

[0087] Fig. 3 shows a further embodiment of a centrifugal separator 1. This centrifugal separator 1 functions as discussed in relation to the separator of Fig. 1 above, with the exception that the separator 1 is free of any sensors for detecting the concentration of flammable gas and uses a flow of pressurized air for ventilating the rotor space 8 and the drive space 27. This is achieved by connecting the first air inlet 9 and the second air inlet 17 to a source of pressurized air, illustrated by "P" in the figures, using connections 29a and 29b, respectively, which may be in the form of pipes or tubings. The air is withdrawn from rotor space 8 and drive space 27 via first air outlet 10 and second air outlet 18, respectively, as discussed in relation to Fig. 1 above.

[0088] The source of pressurized air "P" is a common air source that is found in almost all industrial environments. The flow of air in connection 29a to the first air inlet 9 is regulated using valve 30a, whereas the flow of air in connection 29b to the second air inlet 10 is regulated using valve 30b. Having a flow of pressurized air, such as a constant flow of pressurized air, may thus make the sensors for detecting flammable gas redundant. In other words, the flow of pressurized air may be set at such level so that it keeps the concentration of flammable gas in the rotor space 8 and in the drive space 27 below a threshold, such as below a lower explosion limit.

[0089] Fig. 4 shows a further embodiment of a centrifugal separator 1. This centrifugal separator 1 functions as discussed in relation to the separator of Fig. 3 above, i.e. the air inlets 9 and 17 are connected to a source of pressurized air "P", but in this embodiment the regulation of the flow of air in connections 29a and 29b are performed using information from sensors for detecting flammable gas. The centrifugal separator as shown in the embodiment of Fig. 4 comprises sensors as discussed in relation to Fig. 1 above, i.e. a sensor 15a arranged in the rotor space 8, a sensor 15b arranged in the solids collector 20 and a sensor 15c arranged in the drive space 27.

[0090] The sensors are connected to a control unit 23, which may be arranged within the centrifugal separator 1 or as a separate unit. By means of control unit 23, the valves 30a and 30b, and thereby the flow of ventilating air may be controlled in a suitable way so that a required flow of air is obtained. This is achieved by means of connection 32a to valve 30a and connection 32b to valve 30b.

[0091] The control unit 23 may further comprise a communication interface 26, such as a transmitter/receiver, via which it may receive data from the sensors 15a, 15b and 15c and further transmit data to the valves 30a and 30b.

[0092] The received data may for instance include data of the measured parameter related to the concentration of flammable gas, such as data of the ratio of hydrocarbons to oxygen. This is indicated by connection 31a to sensor 15a in the rotor space 8, connection 31b to the sensor 15b in the solids collector 20 and connection 31c to the sensor 15c in the drive space 27. The transmitted data may for instance include a control signal for controlling the valves 30a and 30b.

[0093] The control unit 23 is further configured to carry out a method for controlling the flow of pressurized air to air inlets 9 and 17 according to embodiments disclosed herein. For this purpose the control unit 23 may comprise a processing unit 24, such as a central processing unit, which is configured to execute computer code instructions which for instance may be stored on a memory 25. The memory 25 may thus form a (non-transitory) computer-readable medium for storing such computer code instructions. The processing unit 24 may alternatively be in the form of a hardware component, such as an application specific integrated circuit, a field-programmable gate array or the like.

[0094] Thus during operation of the centrifugal separator as shown in Fig. 4, the control unit 23 may receive information from the various sensors 15a-c, and regulate the flow of ventilating air to the air inlets 9 and 17 based on the received information. For example, the control unit 23 may regulate valve 30a so that the flow of air is increased if the signal from sensor 15a arranged in the rotor space 8 indicates that the concentration of flammable gas in the rotor space 8 is above a certain threshold, such as above lower explosion limit. The control unit 23 may then regulate valve 30a so that the flow of air is decreased if the signal from sensor 15a indicates that the concentration of flammable gas in the rotor space 8 has decreased.

[0095] Regulating the valve 30a to decrease the flow of air may involve shutting valve 30a so that no air reaches the first air inlet 9.

[0096] In analogy, the control unit 23 may regulate valve 30a to increase or decrease the flow of pressurized air based on the information from sensor 15b arranged in the solids collector 20, or it may regulate valve 30a to increase or decrease the flow of pressurized air based on the information from both sensor 15a and 15b.

[0097] Further, the control unit 23 may regulate valve

30b to increase or decrease the flow of pressurized air that reaches the second air inlet 17 based on the information from sensor 15c, and may thus regulate the ventilation of the drive space 27 in analogy with what is discussed in relation to ventilating the rotor space 8 above.

[0098] Thus, the control unit 23 comprise a regulation loop, i.e. it may be configured to regulate the flow of air to the first inlet 9 and/or to the second air inlet 17 so that the concentration of flammable gas in rotor space 8 and/or drive space 27 is kept at a constant level or below a constant level.

[0099] The control unit may also be configured to receive information from other parts of the separator, e.g. from the drive means 3, which may be an electrical motor, and/or from a feed pump that regulates the feed of fluid mixture to be separated in the centrifugal separator 1. In this way, it may regulate the flow of pressurized air to first air inlet 9 and/or second air inlet 17 based on that information. As an example, the control unit 23 may receive information that the centrifugal separator is at standstill or that the feed to the separator is shut off, and may then regulate the valves 30a and 30b to decrease to shut off the flow of pressurized air to the first air inlet 9a and/or the second air inlet 9b.

[0100] The invention is not limited to the embodiment disclosed but may be varied and modified within the scope of the claims set out below. The invention is not limited to the orientation of the axis of rotation (X) disclosed in the figures. The term "centrifugal separator" also comprises centrifugal separators with a substantially horizontally oriented axis of rotation.

Claims

1. A centrifugal separator (1) for separation of at least two components of a fluid mixture which are of different densities which fluid mixture comprises a flammable fluid, which centrifugal separator comprises a stationary frame (2), a drive member configured to rotate a rotating part (4) in relation to the stationary frame, wherein the rotating part comprises a spindle (5) and a centrifuge rotor (6) enclosing a separation space, the centrifuge rotor being mounted to the spindle to rotate together with the spindle around an axis (X) of rotation, wherein the rotating part is supported by the stationary frame by at least one bearing device (7a, 7b)
   wherein the stationary frame surrounds said centrifuge rotor, thereby forming a rotor space between the stationary frame and the centrifuge rotor, and wherein the stationary frame (2) comprises at least one first air inlet (9) arranged to provide fluid communication into said rotor space and at least one first air outlet (10) arranged to provide fluid communication out from said rotor space,
   wherein the at least one first air inlet and the at least one first air outlet are arranged in the stationary frame so as to provide a flow of air from the at least one first air inlet to and out through the at least one first air outlet upon rotation of said rotating part, and wherein the at least one first air inlet (9) is arranged to be connected to a source of air and wherein the at least one first air outlet (10) is arranged to allow outflow of air from said rotor space, **characterized in that**
   the centrifugal separator further comprises at least one sensor (15a, 15b, 15c) configured to detect a parameter related to the concentration of flammable gas in the air of said rotor space.

2. A centrifugal separator according to claim 1, wherein the at least one first air inlet is arranged in the frame so that it communicates with a left portion of said rotor space and the at least one first air outlet is arranged in the frame so that it communicates with a right portion of said rotor space, or vice versa.

3. A centrifugal separator according to claim 1 or 2, wherein the at least one first air inlet is arranged in the frame so that it communicates with an upper portion of said rotor space and the at least one first air outlet is arranged in the frame so that it communicates with a lower portion of said rotor space, or vice versa.

4. A centrifugal separator according to any previous claim, wherein the parameter is the ratio of hydrocarbons to oxygen in the air of said rotor space.

5. A centrifugal separator according to any previous claim, wherein at least one of said at least one sensor is arranged in an additional space that is in fluid communication with said rotor space.

6. A centrifugal separator according to any previous claim, wherein the at least one first air inlet is arranged to be connected to a source of pressurized air, and wherein the centrifugal separator further comprises a control unit configured to receive an input signal related to said parameter and generate a signal to regulate the flow of pressurized air based on said input signal.

7. A centrifugal separator according to any previous claim, wherein said frame further surrounds said drive member thereby also forming a drive space enclosing said drive member, and further comprises at least one second air inlet arranged to provide fluid communication into said drive space and at least one second air outlet arranged to provide fluid communication out from said drive space, wherein the centrifugal separator further comprises means for generating a flow of air from a second air inlet to and out through a second air outlet.

8. A centrifugal separator according to claim 7, further comprising at least one sensor configured to detect a parameter related to the concentration of flammable gas in the air of said drive space.

9. A centrifugal separator according to claim 8, wherein the at least one second gas inlet is arranged to be connected to a source of pressurized air, and wherein the centrifugal separator further comprises a control unit configured to receive an input signal related to said parameter and generate a signal to regulate the flow of pressurized air based on said input signal.

10. A centrifugal separator according to any previous claim, wherein the centrifuge rotor is at its outer periphery provided with a set of sludge outlets for discharge of a higher density component such as sludge or other solids in a fluid mixture, and wherein the frame further encloses a solids collector for collecting the discharged component, and wherein the centrifugal separator further comprises at least one sensor configured to detect a parameter related to the concentration of flammable gas in the air of said solids collector.

11. A method for ventilating a centrifugal separator, comprising

- providing a centrifugal separator according to any one of claims 1-10;
- supplying a fluid mixture comprising at least two components which are of different densities to be separated to the separation space of the centrifuge rotor; and
- rotating the rotating part so as to provide a flow of air from at least one first gas inlet to and out through at least one first gas outlet, thereby ventilating said centrifugal separator, **characterized in that** the fluid mixture to be separated comprises a flammable fluid and the method further comprises
- detecting a parameter related to the concentration of flammable gas in said rotor space, and
- regulating the flow of air from said at least one first gas inlet to and out through said at least one first gas outlet based on the detected parameter.

12. A method according to claim 11, wherein the fluid mixture to be separated is heated to a temperature of above 70° C before being supplied to the separation space.

Patentansprüche

1. Zentrifugalabscheider (1) zum Abscheiden von mindestens zwei Komponenten eines Fluidgemisches, welche eine unterschiedliche Dichte aufweisen, wobei das Fluidgemisch ein zündbares Fluid umfasst, wobei der Zentrifugalabscheider Folgendes umfasst:

einen stationären Rahmen (2),
ein Antriebselement, konfiguriert zum Drehen eines Drehteils (4) relativ zu dem stationären Rahmen,
wobei der Drehteil eine Spindel (5) und einen Zentrifugalrotor (6) umfasst, welcher einen Abscheideraum umschließt, wobei der Zentrifugalrotor auf der Spindel montiert ist, um zusammen mit der Spindel um eine Drehachse (X) zu drehen, wobei der Drehteil durch den stationären Rahmen durch mindestens eine Lagervorrichtung (7a, 7b) gestützt ist,
wobei der stationäre Rahmen den Zentrifugalrotor umgibt, wodurch ein Rotorraum zwischen dem stationären Rahmen und dem Zentrifugalrotor gebildet wird, und wobei der stationäre Rahmen (2) mindestens einen ersten Lufteinlass (9) welcher ausgebildet ist, um eine Fluidkommunikation zu dem Rotorraum bereitzustellen, und mindestens einen ersten Luftauslass (10) umfasst, welcher ausgebildet ist, um eine Fluidkommunikation aus dem Rotorraum bereitzustellen,
wobei der mindestens eine erste Lufteinlass und der mindestens eine erste Luftauslass in dem stationären Rahmen angeordnet sind, um eine Strömung von Luft von dem mindestens einen ersten Lufteinlass in und nach außen durch den mindestens einen ersten Luftauslass bei der Drehung des Drehteils bereitzustellen, und
wobei der mindestens eine erste Lufteinlass (9) angeordnet ist, um mit einer Luftquelle verbunden zu werden und
wobei der mindestens eine erste Luftauslass (10) angeordnet ist, um das Ausströmen der Luft aus dem Rotorraum zu ermöglichen, **dadurch gekennzeichnet, dass**
der Zentrifugalabscheider ferner mindestens einen Sensor (15a, 15b, 15c) umfasst, welcher konfiguriert ist, um einen Parameter zu detektieren, welcher sich auf die Konzentration von zündbarem Gas in der Luft des Rotorraums bezieht.

2. Zentrifugalabscheider nach Anspruch 1, wobei der mindestens eine erste Lufteinlass in dem Rahmen derart angeordnet ist, dass dieser mit einem linken Abschnitt des Rotorraums kommuniziert und der mindestens eine erste Luftauslass in dem Rahmen derart angeordnet ist, dass er mit einem rechten Abschnitt des Rotorraums kommuniziert, oder umgekehrt.

3. Zentrifugalabscheider nach Anspruch 1 oder 2, wo-

bei der mindestens eine erste Lufteinlass in dem Rahmen derart angeordnet ist, dass er mit einem oberen Abschnitt des Rotorraums kommuniziert und der mindestens eine erste Luftauslass in dem Rahmen derart angeordnet ist, dass er mit einem unteren Abschnitt des Rotorraums kommuniziert, oder umgekehrt.

4. Zentrifugalabscheider nach einem der vorhergehenden Ansprüche, wobei der Parameter das Verhältnis zwischen Kohlenwasserstoffen und Sauerstoff in der Luft des Rotorraums ist.

5. Zentrifugalabscheider nach einem der vorhergehenden Ansprüche, wobei mindestens einer des mindestens einen Sensors in einem zusätzlichen Raum angeordnet ist, welcher mit dem Rotorraum fluidisch kommuniziert.

6. Zentrifugalabscheider nach einem der vorhergehenden Ansprüche, wobei der mindestens eine erste Lufteinlass angeordnet ist, um mit einer Druckluftquelle verbunden zu werden, und wobei der Zentrifugalabscheider ferner eine Steuereinheit umfasst, welche konfiguriert ist, um ein Eingangssignal zu empfangen, welches sich auf den Parameter bezieht und um ein Signal zu erzeugen, um die Strömung von Druckluft basierend auf dem Eingangssignal zu regeln.

7. Zentrifugalabscheider nach einem der vorhergehenden Ansprüche, wobei der Rahmen ferner das Antriebselement umgibt, wodurch auch ein Antriebsraum gebildet wird, welcher das Antriebselement umschließt, und ferner mindestens einen zweiten Lufteinlass, welcher angeordnet ist, um eine Fluidkommunikation zu dem Antriebsraum bereitzustellen, und mindestens einen zweiten Luftauslass umfasst, welcher angeordnet ist, um eine Fluidkommunikation aus dem Antriebsraum bereitzustellen, wobei der Zentrifugalabscheider ferner Mittel umfasst, um eine Strömung von Luft aus einem zweiten Lufteinlass zu und nach außen durch einen zweiten Luftauslass zu erzeugen.

8. Zentrifugalabscheider nach Anspruch 7, ferner umfassend mindestens einen Sensor, welcher konfiguriert ist, um einen Parameter zu detektieren, welcher sich auf die Konzentration von zündbaren Gas in der Luft des Antriebsraums bezieht.

9. Zentrifugalabscheider nach Anspruch 8, wobei der mindestens eine zweite Gaseinlass angeordnet ist, um mit einer Druckluftquelle verbunden zu werden, und wobei der Zentrifugalabscheider ferner eine Steuereinheit umfasst, welche konfiguriert ist, um ein Eingangssignal zu empfangen, welches sich auf den Parameter bezieht, und um ein Signal zu erzeugen, um die Strömung von Druckluft basierend auf dem Eingangssignal zu regeln.

10. Zentrifugalabscheider nach einem der vorhergehenden Ansprüche, wobei der Zentrifugalrotor an seinem Außenumfang mit einem Satz von Schlammauslässen versehen ist, um eine Komponente höherer Dichte, wie ein Schlamm oder andere Feststoffe in einem Fluidgemisch auszugeben, und wobei der Rahmen ferner einen Feststoffsammler zum Sammeln der ausgegebenen Komponente einschließt, und wobei der Zentrifugalabscheider ferner mindestens einen Sensor umfasst, welcher konfiguriert ist, um einen Parameter zu detektieren, welcher sich auf die Konzentration von zündbarem Gas in der Luft des Feststoffsammlers bezieht.

11. Verfahren zum Lüften eines Zentrifugalabscheiders, umfassend:

- Bereitstellen eines Zentrifugalabscheiders nach einem der Ansprüche 1-10,
- Zuführen eines Fluidgemisches, welches mindestens zwei Komponenten umfasst, welche eine unterschiedliche Dichte aufweisen und welche in den Abscheideraum des Zentrifugalrotors abzuscheiden sind; und
- Drehen des Drehteils, um eine Strömung von Luft von mindestens einem ersten Gaseinlass zu und nach außen durch mindestens einen ersten Gasauslass bereitzustellen, wodurch der Zentrifugalabscheider belüftet wird, **dadurch gekennzeichnet, dass** das abzuscheidende Fluidgemisch ein zündbares Fluid umfasst und das Verfahren ferner umfasst:
- Detektieren eines Parameters, welcher sich auf die Konzentration von zündbarem Gas in dem Rotorraum bezieht, und
- Regeln der Strömung von Luft von dem mindestens einen ersten Gaseinlass zu und nach außen durch den mindestens einen ersten Gasauslass basierend auf dem detektierten Parameter.

12. Verfahren nach Anspruch 11, wobei das abzuscheidende Fluidgemisch bis auf eine Temperatur über 70°C erwärmt wird, bevor es dem Abscheideraum zugeführt wird.

Revendications

1. Séparateur centrifuge (1) pour séparer au moins deux composants d'un mélange de fluide ayant différentes densités, lequel mélange de fluide comprend un fluide inflammable, lequel séparateur centrifuge comprend
une structure fixe (2),

un élément d'entraînement configuré pour faire tourner un organe rotatif (4) par rapport à la structure fixe, dans lequel l'organe rotatif comprend un arbre (5) et un rotor centrifugeur (6) enfermant une chambre de séparation, le rotor centrifugeur étant monté sur l'arbre de façon à tourner ensemble avec l'arbre autour d'un axe de rotation (X), et l'organe rotatif étant supporté par la structure fixe par au moins un dispositif de palier (7a, 7b),
dans lequel la structure fixe entoure ledit rotor centrifugeur, en formant ainsi un espace de rotor entre la structure fixe et le rotor centrifugeur, et la structure fixe (2) comprend au moins une première entrée d'air (9) agencée pour fournir une communication de fluide jusqu'à l'intérieur dudit espace de rotor et au moins une première sortie d'air (10) agencée pour fournir une communication de fluide hors dudit espace de rotor,
dans lequel la au moins une première entrée d'air et la au moins une première sortie d'air sont agencées dans la structure fixe de façon à engendrer un flux d'air à partir de la au moins une première entrée d'air vers l'intérieur et vers l'extérieur au travers de la au moins une première sortie d'air lorsque ledit organe rotatif tourne, et
dans lequel la au moins une première entrée d'air (9) est agencée pour être connectée à une source d'air et dans lequel la au moins une première sortie d'air (10) est agencée pour permettre l'écoulement de sortie de l'air depuis ledit espace de rotor, **caractérisé en ce que**
le séparateur centrifuge comprend en outre au moins un capteur (15a, 15b, 15c) configuré pour détecter un paramètre associé à la concentration de gaz inflammable dans l'air dudit espace de rotor.

2. Séparateur centrifuge selon la revendication 1, dans lequel la au moins une première entrée d'air est agencée dans la structure de telle sorte qu'elle communique avec une partie gauche dudit espace de rotor et la au moins une première sortie d'air est agencée dans la structure de telle manière qu'elle communique avec une partie droite dudit espace de rotor, ou vice-versa.

3. Séparateur centrifuge selon la revendication 1 ou 2, dans lequel la au moins une première entrée d'air est agencée dans la structure de telle manière qu'elle communique avec une partie supérieure dudit espace de rotor et la au moins une première sortie d'air est agencée dans la structure de telle manière qu'elle communique avec une partie inférieure dudit espace de rotor, ou vice-versa.

4. Séparateur centrifuge selon l'une quelconque des revendications précédentes, dans lequel le paramètre est le rapport des hydrocarbures à l'oxygène dans l'air dudit espace de rotor.

5. Séparateur centrifuge selon l'une quelconque des revendications précédentes, dans lequel au moins un du dit au moins un capteur est agencé dans une chambre supplémentaire qui est en communication de fluide avec ledit espace de rotor.

6. Séparateur centrifuge selon l'une quelconque des revendications précédentes, dans lequel la au moins une première entrée d'air est agencée pour être connectée à une source d'air comprimé, et dans lequel le séparateur centrifuge comprend en outre une unité de commande configurée pour recevoir un signal d'entrée associé au dit paramètre et pour générer un signal afin de réguler l'écoulement d'air comprimé sur la base du dit signal d'entrée.

7. Séparateur centrifuge selon l'une quelconque des revendications précédentes, dans lequel ladite structure entoure en outre ledit élément d'entraînement en formant ainsi une chambre d'entraînement enfermant ledit élément d'entraînement, et comprend en outre au moins une seconde entrée d'air agencée pour fournir une communication de fluide jusque dans ladite chambre d'entraînement et au moins une seconde sortie d'air agencée pour fournir une communication de fluide hors de ladite chambre d'entraînement, dans lequel le séparateur centrifuge comprend en outre des moyens pour produire un flux d'air à partir d'une seconde entrée d'air vers l'intérieur et vers l'extérieur au travers d'une seconde sortie d'air.

8. Séparateur centrifuge selon la revendication 7, comprenant en outre au moins un capteur configuré pour détecter un paramètre associé à la concentration de gaz inflammable dans l'air de ladite chambre d'entraînement.

9. Séparateur centrifuge selon la revendication 8, dans lequel la au moins une seconde entrée de gaz est agencée pour être connectée à une source d'air comprimé, et dans lequel le séparateur centrifuge comprend en outre une unité de commande configurée pour recevoir un signal d'entrée associé au dit paramètre et pour générer un signal afin de réguler l'écoulement d'air comprimé sur la base du dit signal d'entrée.

10. Séparateur centrifuge selon l'une quelconque des revendications précédentes, dans lequel le rotor centrifugeur est équipé, à sa périphérie extérieure, d'une série de sorties de boue pour évacuer un composant de densité supérieure tel qu'une boue ou d'autres matières solides dans un mélange de fluide, et dans lequel la structure inclut en outre un collecteur de matières solides pour collecter le composant évacué, et le séparateur centrifuge comprend en outre au moins un capteur configuré pour détecter

un paramètre associé à la concentration de gaz inflammable dans l'air du dit collecteur de matières solides.

11. Procédé de ventilation d'un séparateur centrifuge, comprenant :

- la fourniture d'un séparateur centrifuge selon l'une quelconque des revendications 1 à 10,
- l'alimentation d'un mélange de fluide comprenant au moins deux composants qui ont des densités différentes à séparer jusqu'à la chambre de séparation du rotor centrifugeur, et
- la rotation de l'organe rotatif de façon à fournir un flux d'air à partir de la au moins une première entrée de gaz vers l'intérieur et vers l'extérieur au travers d'au moins une première sortie de gaz, en ventilant ainsi ledit séparateur centrifuge, **caractérisé en ce que** le mélange de fluide à séparer comprend un fluide inflammable et le procédé comprend en outre :
- la détection d'un paramètre associé à la concentration de gaz inflammable dans ledit espace de rotor, et
- la régulation de l'écoulement d'air depuis ladite au moins une première entrée de gaz vers l'intérieur et vers l'extérieur au travers de ladite au moins une première sortie de gaz sur la base du paramètre détecté.

12. Procédé selon la revendication 11, dans lequel le mélange de fluide à séparer est chauffé à une température supérieure à 70°C avant d'être alimenté jusqu'à la chambre de séparation.

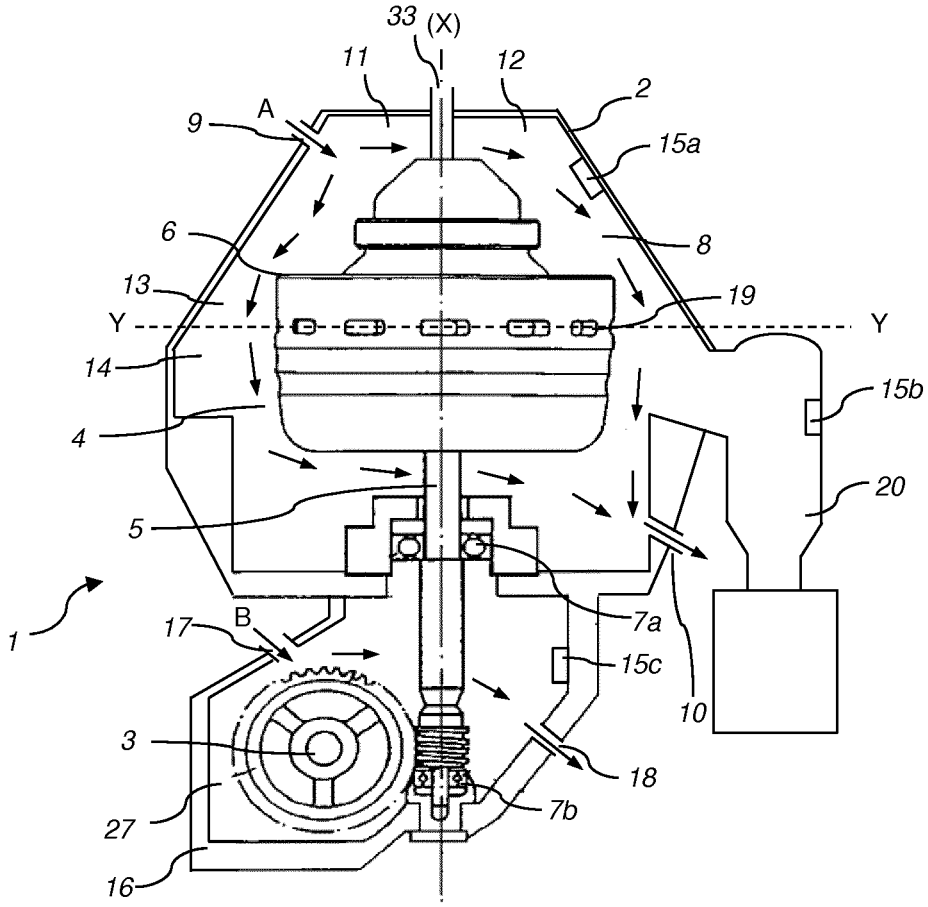
33
(X)
11
12
2
9
A
15a
6
8
13
19
Y
Y
14
15b
4
20
5
7a
1
17
B
15c
10
3
18
27
7b
16

Fig. 1

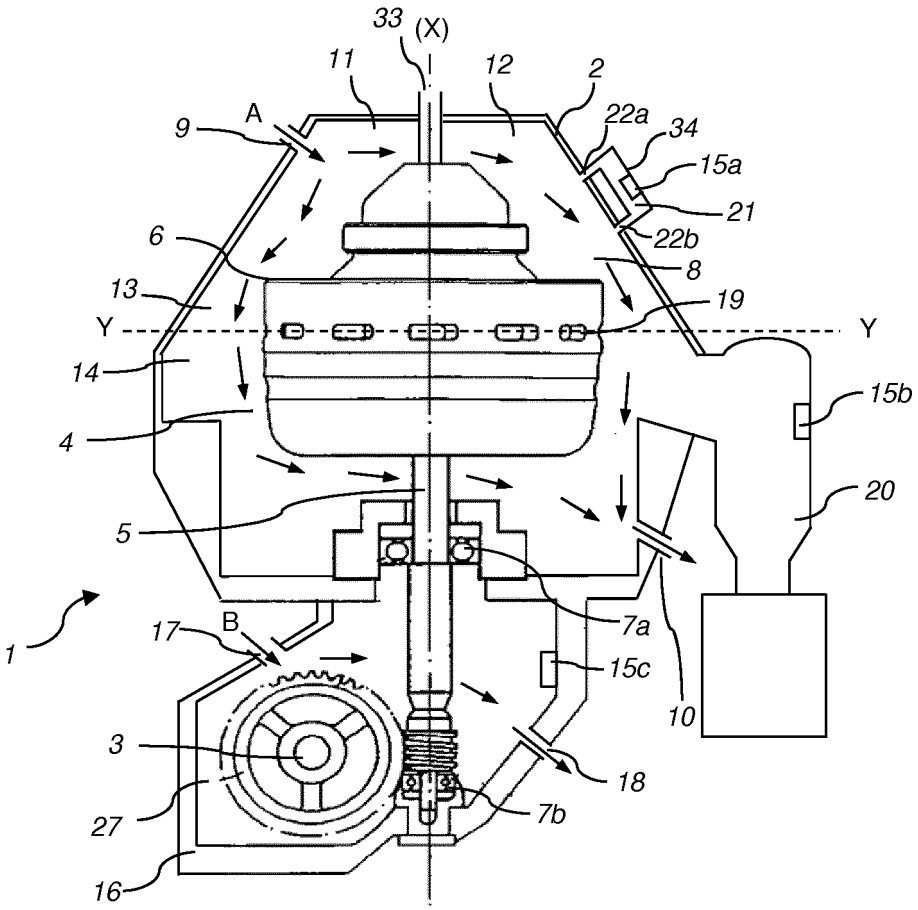
33
(X)
11
12
2
A
9
22a
34
15a
21
22b
6
8
13
19
Y
Y
14
15b
4
20
5
7a
1
B
17
15c
10
3
18
27
7b
16

Fig. 2

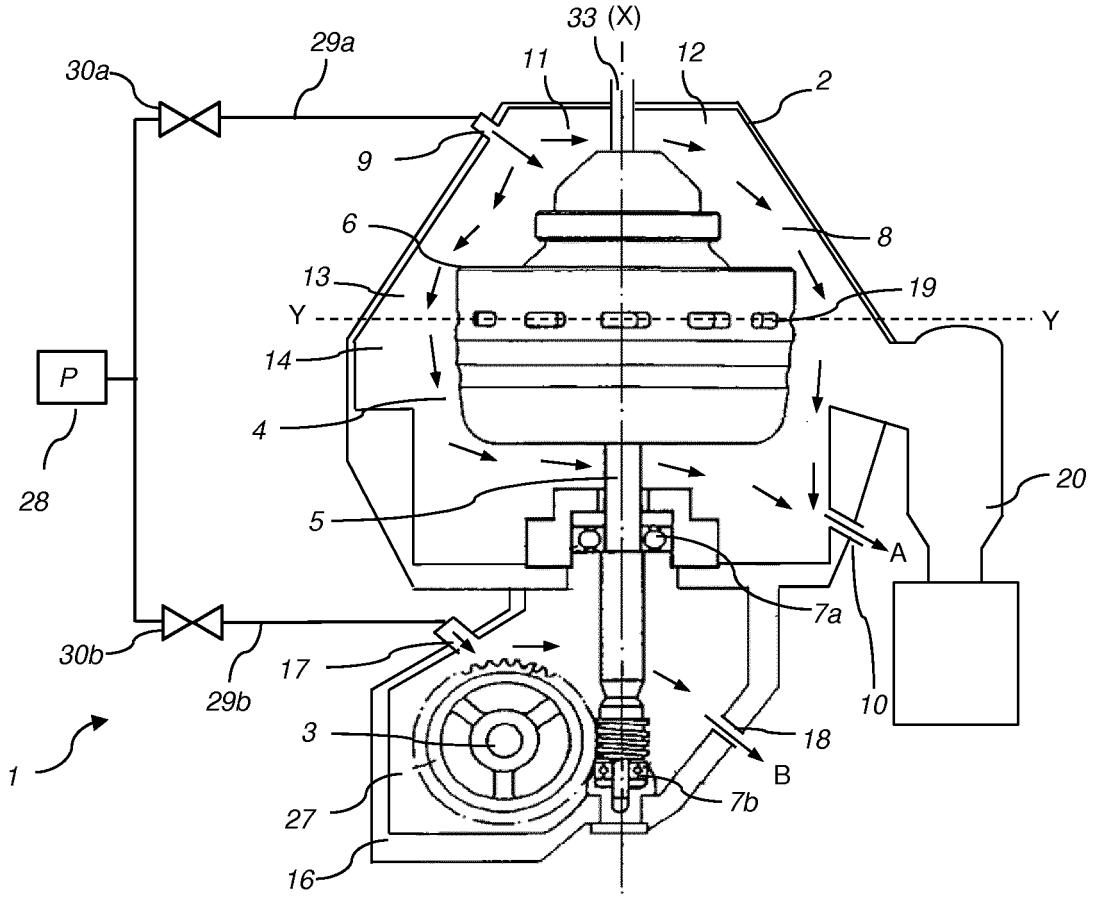
33 (X)
29a
30a
11
12
2
9
6
8
13
19
Y
Y
14
P
4
28
5
20
A
7a
30b
17
29b
10
3
18
1
B
27
7b
16

Fig. 3

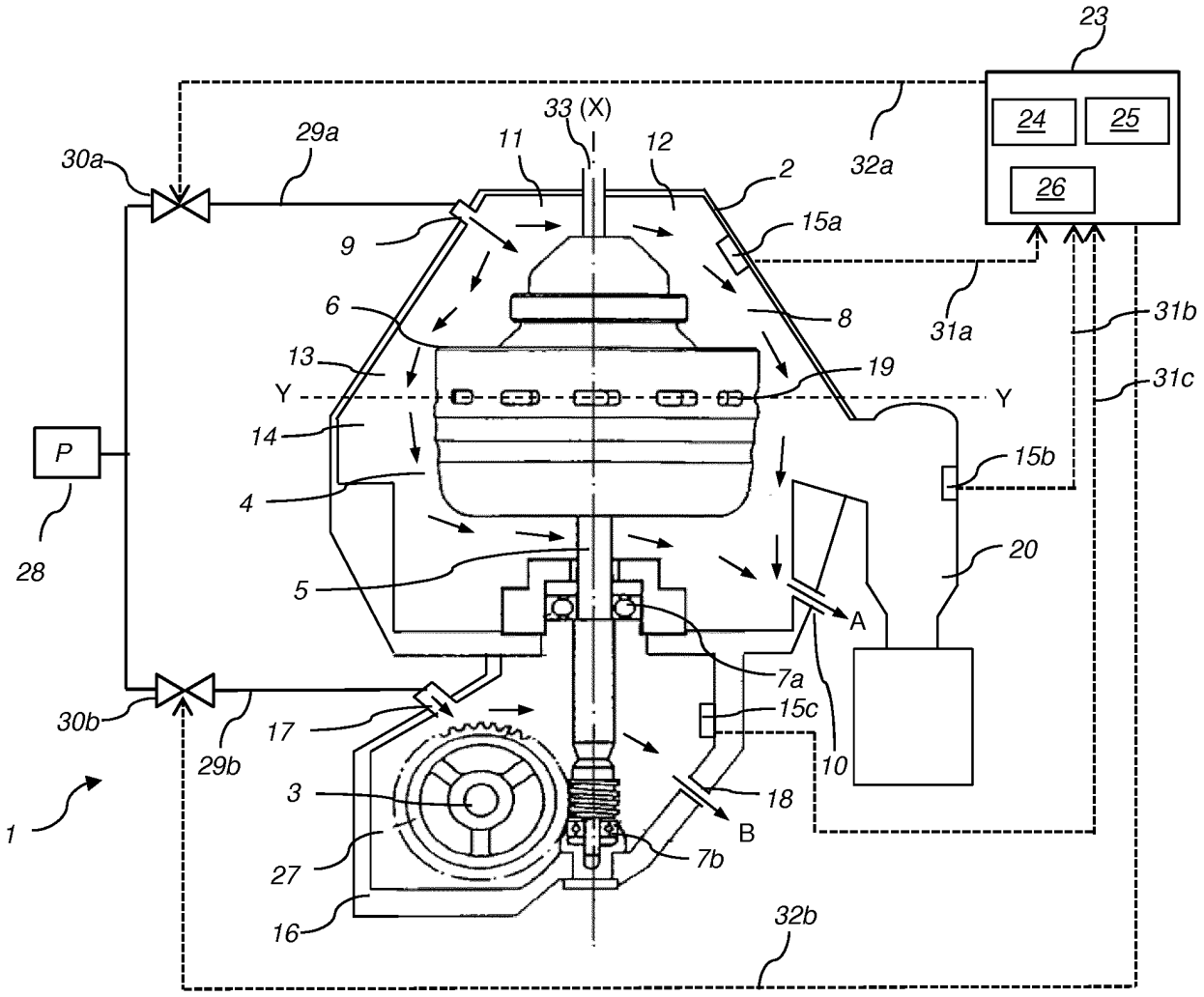
23
24
25
26
33 (X)
29a
11
12
2
32a
30a
9
15a
6
8
31a
31b
13
19
31c
Y
Y
14
P
15b
4
28
20
5
A
7a
30b
15c
17
29b
10
3
18
1
B
27
7b
16
32b

Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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