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(54) **System for controlling the environmental emissions during the discharge step in centrifuges**

(57) A system for controlling the emissions into the environment during the discharge step of a preferably vertical-axis top-load centrifuge (1) comprising a removable bag (12) for containing the material to be centrifuged, and an extraction circuit (2, 3, 4) of the solid part of said

material during a discharge step of said bag (12), the extraction circuit (2, 3, 4, 6) is pneumatically connected both to said centrifuge (1) and to said main extraction pipe (4) and the bag (12) present covering means (13) for putting said bag (12) under vacuum with respect to ambient pressure.

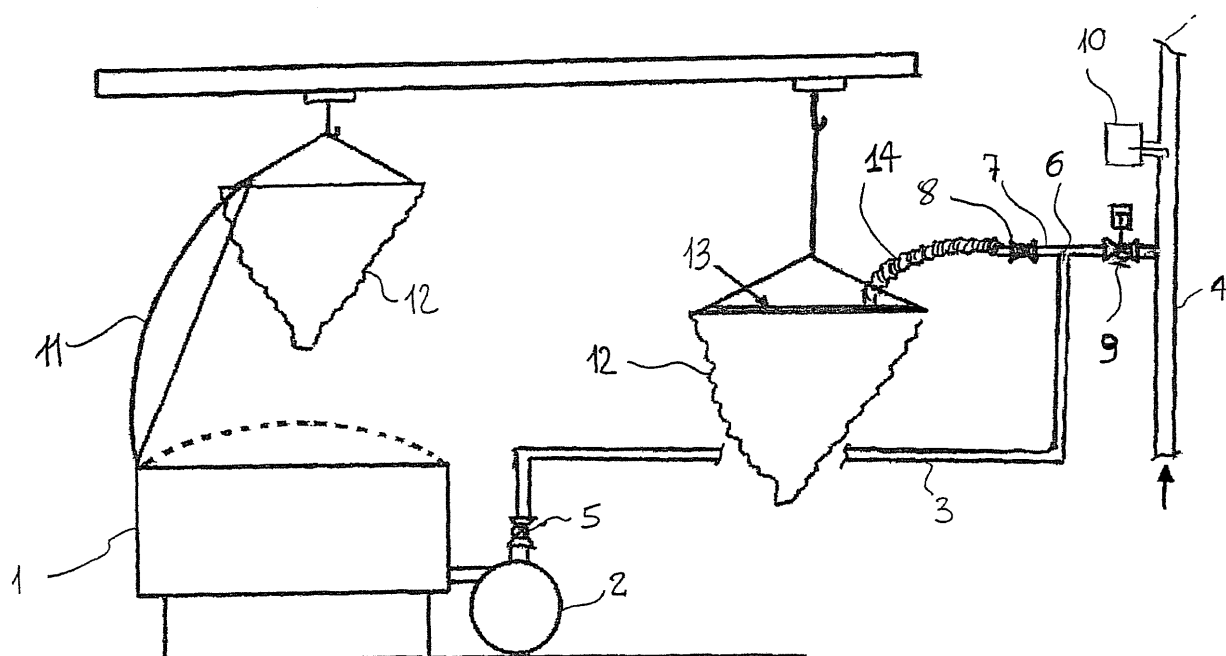


FIG. 1

Description

Field of the invention

[0001] The present invention relates to a system for controlling the emissions into the environment during the discharge step of centrifuges and, more precisely, to a system for the control of emissions into the environment during the discharge step of top-load vertical-axis centrifuges.

State of the art

[0002] It is known that top-load vertical-axis centrifuges are normally provided with a rotating basket wherein is placed a filtering element, usually consisting of a bag made of fabric or non-woven fabric. The basket is applied to a metal ring which during the discharge step of the centrifuge is extracted by means of a hoist and positioned above the drums or containers intended to receive the centrifuged product. In particular applications, the bag may also be made of metallic net or other filtering means.

[0003] The normal operation of a centrifuge consists in a loading step, during which a suspension containing a solid to be separated is loaded into the centrifuge, a subsequent separation or 'squeezing' step wherein the centrifugal force caused by the rotation of the basket causes the liquid to be released and discharged outside the centrifuge, and finally the discharge step of the moist solid.

[0004] At the end of the centrifuging step, the bag contains the moist solid product separated from black liquor wherein is was contained.

[0005] When the centrifuge is opened and later during the entire discharge step of the moist product from the bag to the collection containers, vapours are emitted into the environment due to the evaporation of the liquid wherein both the solid and the bag itself are imbued.

[0006] A drawback consequently arises related to the fact that, in all existing systems for the control of emissions in vertical-axis top-load centrifuges, during such discharge step a localised extraction of various type is envisaged with modest efficiency, due to the large size of the polluting source and the distance between the point of emission and the point of collection, with high flow rates of extracted air.

Summary

[0007] It is therefore the object of the present invention to solve the aforesaid drawback by providing a system for controlling emissions into the environment during the discharge step of centrifuges wherein the bag itself is kept under vacuum during discharge of the centrifuge. In this way, the value of pollutants dispersed into the working environment during discharge is considerably reduced (from 5 to 10 times less than traditional systems).

[0008] Another object of the present invention is to pro-

vide a system for controlling emissions into the environment during the discharge step of centrifuges wherein the use of flammable solvents is possible.

[0009] A further object of the present invention is to provide a system for controlling emissions into the environment during the discharge step of centrifuges wherein, thanks to its high efficiency, the extracted air flow is considerably reduced with respect to traditional systems and therefore the costs of downstream abatement systems needed to comply with the legal limits related to the discharge of pollutants into the atmosphere are reduced.

[0010] The expected reduction of pollutant concentration into the environment is in the order of 5 to 10 times that of the concentration measured without the described system; such values are indicative because the exact result depends on various parameters, such as the degree of moisture of the product, the type of solvent, the temperature, the vacuum and extracted flow rate, the environmental ventilation, etc.

[0011] Therefore, the present invention provides a system for controlling the emissions into the environment during the discharge step of centrifuges according to the annexed claims.

Detailed description of the invention

[0012] A detailed description of the a system for controlling emissions into the environment during the discharge step of centrifuges according to the present invention will now be given by the way of non-limiting example, with reference to the single annexed drawing which schematically shows the control system of the present invention.

[0013] With reference to the figure, the system comprises a centrifuge 1 for separating a solid phase from a liquid phase in the already known manner. The main body of centrifuge 1 is pneumatically connected to a collecting reservoir 2 for the black liquor resulting from the centrifugation of the material within centrifuge 1. Reservoir 2 is, in turn, pneumatically connected to an extraction circuit 3 wherein vacuum is formed by means of a connection to a main conduit 4.

[0014] A first shut-off valve 5 for communicating and vacuum in said reservoir 2 during the discharge step of centrifuge 1 is comprised in circuit 3.

[0015] Circuit 3 is connected to a main pipe 4 by means of a connection joint 6. Connection joint 6 in addition to the coupling for pipe 3 comprises a further coupling 7 for a second load, and is provided with a respective second shut-off valve 8 (illustrated in greater detail herebelow). The connection between joint 6 and pipe 4 is obtained by means of a servo-controlled safety valve 9.

[0016] A flammable gas analyser/detector 10 (illustrated in better detail below) is arranged downstream of safety valve 9 and on main pipe 4.

[0017] On the other hand, centrifuge 1 comprises a cover member 11 to the access region thereof and where a bag 12 for the containing of the material to be treated

is provided. Bag 12 is removably arranged within centrifuge 11 in an intrinsically known way. The function of bag 12 is that already known, i.e. to withhold the solid part of a material to be centrifuged and separate through the same the liquid part contained in the centrifuged material thanks to the permeability of the material itself.

[0018] According to the system of the present invention, when centrifuge 1 is opened and during all the entire discharge step of the moist product from bag 12 to the collection containers, in order to limit the emission of vapours into the environment caused by evaporation of the liquid wherein both the solid and the bag 12 itself are imbued, it is provided the application of a lid 13 on the opening of the bag 12 during the entire opening step of the centrifuge and the discharge of the product from bag 12. The lid 13 is connected with a flexible pipe 14 to coupling 7 and connected to main pipe 4. This solution allows to keep bag 12 containing the previously separated solid in the centrifuge under a slight vacuum condition during the entire discharge step of the same. Furthermore, according to the system of the invention and before the opening of the centrifuge to extract the bag after having stopped the machine at the end of the wringing step, it is allowed to manually open valve 5 forming a vacuum in the centrifuge itself by means of reservoir 2. This entails that when the lid 13 is opened for extracting the bag 12, the centrifuge is under a slight vacuum and not in a plenum, with evident reduction in the quantity of vapours emitted into the environment.

[0019] Lid 13 essentially consists of a plastic and/or metallic material in a discoidal member shaped to be positioned and connected onto the edge or ring to which bag 12 itself is fixed. The size and shape of the edge of lid 12 is such as to allow an easy connection and at the same time to minimise air leakage through said edge, the exact shape of the edge therefore depends on the model of centrifuge 1 used.

[0020] Lid 13 is positioned on the ring supporting the bag at the initial moment of opening of the centrifuge. Such positioning is performed manually by the operator and, according to the shape of the ring, may consist simply in placing the lid or may require inserting or fixing it by means of suitable retainers. Flexible pipe 14 is maintained permanently connected to the lid, therefore the bag is under vacuum as soon as the lid is positioned.

[0021] For safety reasons, in the case of centrifuges processing flammable liquids (e.g. organic solvents commonly used in the chemical and chemical-pharmacological industry), the system according to the present invention is designed so that the concentration of solvent in the extraction manifold will be generally under the LEL (Lower Explosive Limit). Such concentration is detected by a sensor 10 arranged downstream along pipe 4, which is circuitally connected to an indicating and control unit (not shown in the figure).

[0022] However, such limit could be exceeded due to operating faults or particular process conditions (e.g. solid excessively imbued in solvent). Therefore, according

to the system of the present invention, an alarm system is further provided wherein when a predetermined percentage of LEL is exceeded (generally 50%) and detected by detector 10, the alarm system activates an acoustic and visual indication on an indicating panel (not shown in the figures) and closes servo-assisted extraction valve 9, consequently causing the fast dilution of the flammable solvent in the aspirated current.

[0023] The intervention threshold which causes the extraction valve 9 to close must be established by the user who, for reasons of greater precaution in the event of incorrect measurement by the instrument, may require thresholds lower than 50%; such choice does not conceptually modify the operation of the system.

[0024] The sensor for measuring the concentration of flammable solvent in the aspirated current may be placed either directly on the pipe or connected to it by means of a tube with which a appropriate pump or ejector takes the gas to be examined and send it to the sensor, which is accommodated in a container and therefore works in a plenum instead of under vacuum. These operative procedures depend on the type of sensor installed and must be established according to the indications provided by the supplier of the sensor.

[0025] Therefore, in the event of an alarm due to high concentration of flammable substance, the operator shall 'reset' the system by pressing a specific reset button on the panel. This operation may determine the following actions:

- Silence the acoustic alarm;
- Leave the visual alarm active.

[0026] Later, a further pressure of the reset button will cause the re-opening of the automatic safety/extraction valve 9 on manifold 6.

[0027] If the cause of alarm has not ceased, the system will keep the extraction valve 9 closed until the concentration returns under the maximum set threshold.

[0028] At this point, it is apparent that various options are possible, for reopening valve 9 also with a single command simultaneous with the alarm silencing command, providing that the cause of alarm (e.g. high concentration) has ceased.

[0029] Similarly, valves 5 and 7 can also be automated by means of selectors or buttons; the automation of such valves does not modify the system logic and does not introduce any conceptual modification to the invention.

[0030] If there is no problem of formation of explosive mixture due to the presence of flammable vapours (typically in centrifugation from acid black liquor, e.g. concentrated hydrochloric acid, acetic acid or formic acid, etc.), according to the present invention it is not necessary to introduce dilution air into the main pipe 4, and even to use the safety system to shut down extraction in the event of a high concentration of flammable material. Indeed, in this operating condition, the aspirated flow is limited to the flow extracted from bag 12 by means of

pipe 14 through coupling 7 and without dilution air, with evident advantages for the treatment system downstream of pipe 4.

[0031] By the way of example, a 12000 m³/hour air extraction system is provided in a prior art industrial application for collection of hydrochloric acid from centrifugation of a 20-30% solution of hydrochloric acid in water wherein a centrifuge with diameter 1500 mm is used and the air must be treated in a wet scrubber (packed column working with basic solution) with diameter 1700 mm before being released into the atmosphere.

[0032] According to the new system of the present invention applied to the same industrial production, an extraction flow lower than 1000 m³/hour is provided with a hydrochloric acid concentration in environment equal to 10-20% that obtained with the traditional system. The aspirated air treatment also provides the installation of a wet scrubber with a diameter of approximately 500-600 mm.

[0033] The advantages that the system according to the present invention presents are apparent to people skilled in the art.

[0034] For example, notwithstanding the better efficiency of the new system, the reduced size of the air conveying pipes, the cost of the fan and of the column, the cost of electrical energy absorbed by the fan and by the column circulation pump, and the spaces occupied by the air treatment system such advantages can be easily estimated on the basis of the reduction in aspirated flow, from 12000 to 1000 m³/hour, i.e. approximately 10% of the total value of the prior art.

Claims

1. A system for the control of environmental emissions during the discharge step of a centrifuge (1) comprising a bag (12) for containing the material to be centrifuged, said bag (12) being removably arranged within said centrifuge (1), and an extraction circuit (2, 3, 4) for extracting the solid part of said centrifuged material during a discharge step of said bag (12),

characterised in that said extraction circuit (2, 3, 4, 6) is pneumatically connected both to said centrifuge (1) and to a main extraction pipe (4), and **in that** said bag (12) further comprises a cover means (13) to be connected to said extraction circuit (3, 4, 6) for putting said bag (12) in a vacuum condition with respect to the room pressure and during said discharge step.

2. The system for the control of environmental emissions during the discharge step of a centrifuge (1) according to the preceding claim, wherein said extraction circuit comprises:

- a reservoir (2) for collecting black liquor from

said centrifuge (1) and pneumatically connected to the latter;

- an extraction circuit (3) pneumatically connected to said reservoir (2) and to said main pipe (4); and

- a servo-controlled shut-off/safety valve (9) arranged between said circuit (3) and said main extraction pipe (4).

3. The system for the control of environmental emissions during the discharge step of a centrifuge (1) according to the preceding claim, wherein said extraction circuit (3) further comprises a connection joint (6) between said circuit (3) and said main pipe (4) having a coupling (7) for a second load, said connection joint (6) being fitted onto said servo-controlled safety valve (9).

4. The system for the control of environmental emissions during the discharge step of a centrifuge (1) according to any of the preceding claims, further comprising a flammable gas analyser/detector (10) fitted downstream of said safety valve (9) and onto said main pipe (4).

5. The system for the control of environmental emissions during the discharge step of a centrifuge (1) according to any of the preceding claims, further comprising extraction means (14) for being pneumatically connected to said coupling (7) of said connection joint (6) and for co-operating with said covering means (13) of said bag (12) and with said extraction circuit (3, 4, 6) during said discharge step, the arrangement being that following the connection of said extraction means (14) to said bag (12) the latter is under vacuum with respect to the room pressure.

6. The system for the control of environmental emissions during the discharge step of a centrifuge (1) according to the preceding claim, wherein said extraction means comprises a flexible pipe (14).

7. The system for the control of environmental emissions during the discharge step of a centrifuge (1) according to any of the preceding claims, wherein said covering means comprises a lid (13) removably and air-tightly fitted onto the upper part of said bag (12) during the entire bag discharge step and washing step, said lid (13) being functionally connected to said flexible pipe (14).

8. The system for the control of environmental emissions during the discharge step of a centrifuge (1) according to the preceding claim, wherein said lid (13) substantially comprises a disc member engaging said flexible pipe (14) and the upper end of said bag (12).

9. The system for the control of environmental emissions during the discharge step of a centrifuge (1) according to the preceding claim, wherein said lid (13) is substantially made of plastic and/or metallic material. 5
10. The system for the control of environmental emissions during the discharge step of a centrifuge (1) according to any of the preceding claims, further comprising a control panel indicating the exceeding of a predetermined concentration (LEL) of flammable/explosive substances, said concentration being detected by said sensor (10), and said panel being circuitally connected to a control unit. 10
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11. The system for the control of environmental emissions during the discharge step of a centrifuge (1) according to the preceding claim, wherein following the exceeding of a predetermined percentage of (LEL), an acoustic and/or visual indication on said indicating panel is activated, and said servo-controlled extraction valve (9) is closed. 20
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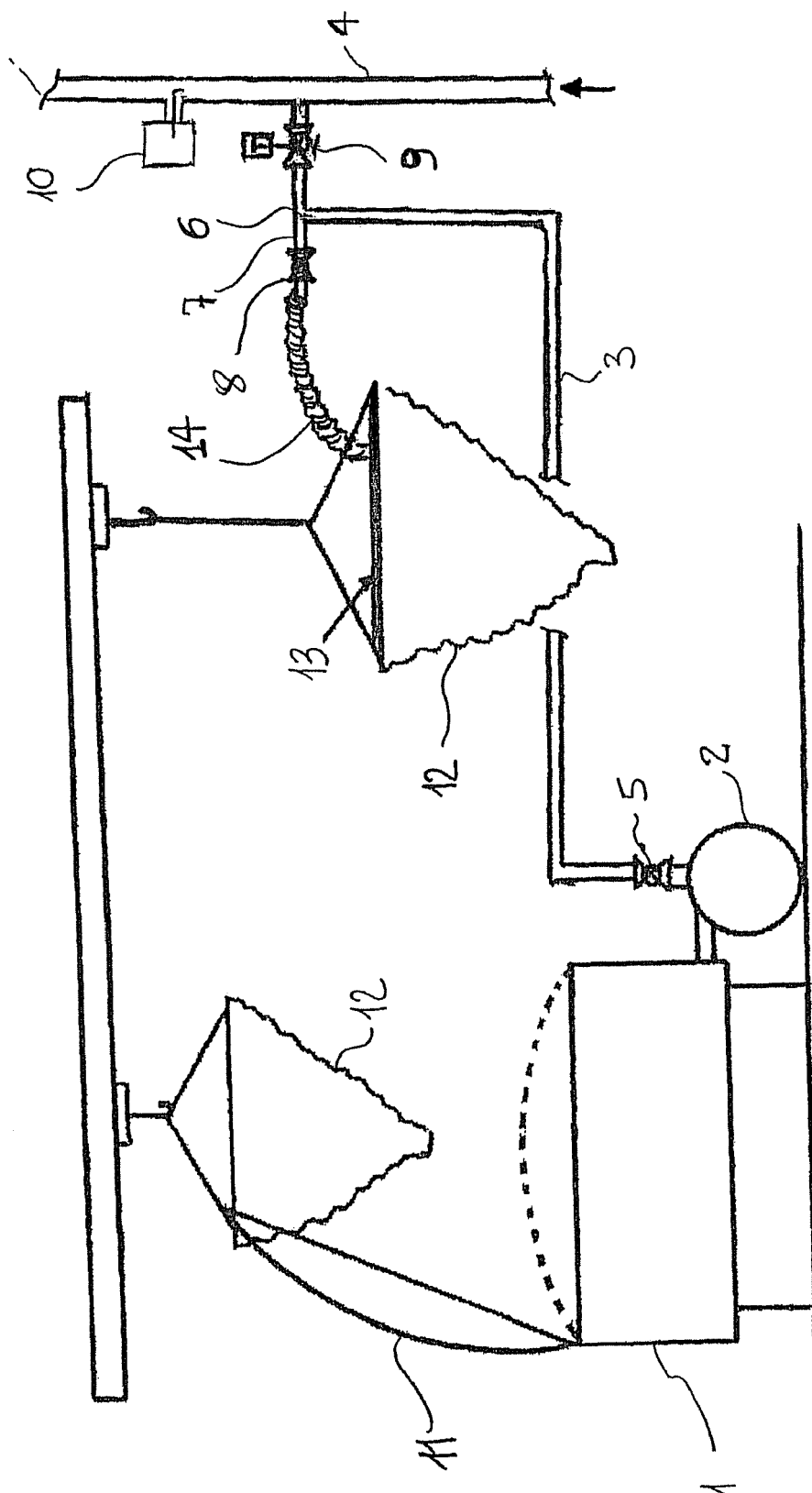


FIG. 1



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 06 12 0833

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 8 February 2007	Examiner Leitner, Josef
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 12 0833

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The members are as contained in the European Patent Office EDP file on
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