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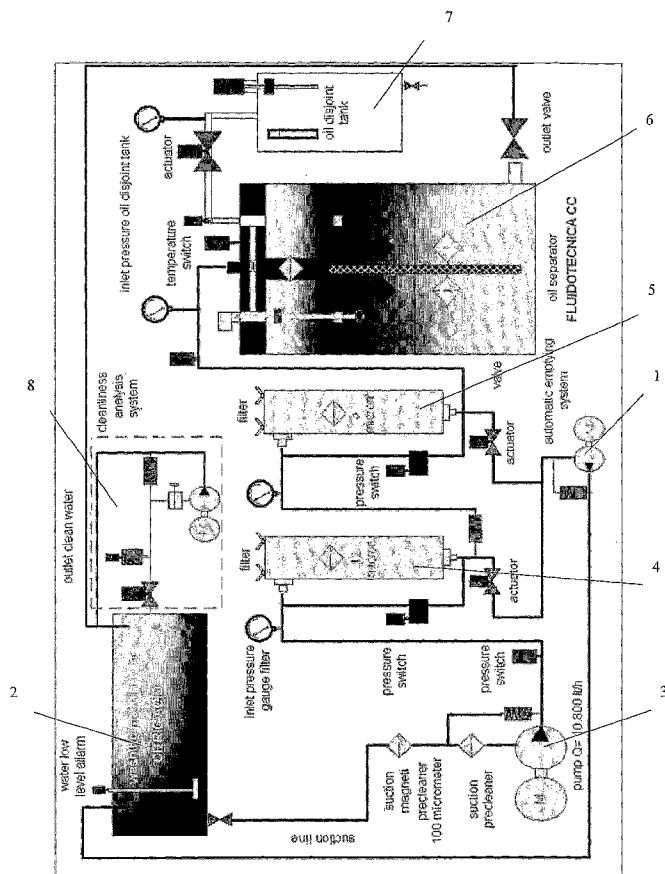
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(54) Title: SEPARATION PROCESS OF BI-PHASE FLUIDS AND RELATED ACCELERATOR SYSTEM



(57) Abstract: Process for the separation of two-phase fluids and relative accelerator unit, comprising means for pumping the two-phase fluid, at least one washing tank, filtering means for the coalescence of the particles, sensors and actuators for controlling flow rate, pressure and temperature, at least one tank for collecting the fluid at lower density (normally oil) and characterised by an oil separator inside of which a controlled field of hydrodynamic pressures is generated, correlated to the density of the fluids to be treated, which accelerates the stratification phenomenon, allowing the phase at lower density (for example oil) to be drawn off and the constant flow of the decontaminated phase (for example water) towards the outlet from the system.

Title: Separation process of bi-phase fluids and related
accelerator system

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DESCRIPTION

Forming the object of the present finding is a process for the
10 separation of two-phase fluids and the relative accelerator unit.

In the state of the art different systems for separating two-phase
fluids are known, which are based upon the following principles,
used totally or in part, according to the type of unit: the principle
of coalescence that indeed induces the phenomenon of
15 coalescence in the particles of dispersed fluid, through
coalescing filters or fluid channelling arrays; the principle of
separation that induces a laminar flow in the two-phase fluid in
order to cancel out the force vectors of a turbulent flow, as well
as a natural physical separation of the two fluids, with speed
20 proportional to their difference in density; finally, the principle
of removal of the dispersed fluid that separates the fluid at lower
density through use of skimmers or by overflow, still in laminar
flow.

The great disadvantage of known systems consists of the fact
25 that none of them is able to accelerate the separation process of

the two-phase fluid. Moreover, the above systems have all great limitations linked to the following negative aspects:

- 5 • limitation of the flow rate of fluid to be treated. The lack of the principle of acceleration of the phenomenon of separation means that the treated flow rates need to be limited in order to allow the fluid to have laminar flow, essential for the separation of the two fluids;
- 10 • very high degree of contamination of the residue. The levels of residual contamination of the treated fluid do not fall below a few percentage points;
- 15 • irreversibility of the system. Due to the limitations of the physical principles on which they are based, the systems described above are not able to separate two-phase fluids, with concentration of the fluid at lower density of over 50%;
- 20 • great bulk. In order to allow the rest state of the fluid, as the flow rates to be treated increases the volume requirements necessary to take the fluid into rest state increases proportionally; similarly the phenomenon of physical separation of the two fluids, without acceleration thereof, requires long decanting times of the fluids;
- low efficiency of the separation process. None of the systems described above are able to intercept particles of dispersed fluid in turbulent motion, since these are not present on the pick-up surface of the fluid to be treated;

- greatly limited conditions of use. In order to ensure that the physical principles on which they are based occur, the systems described above can be used exclusively in static applications.

5 The finding object of the present invention solves the technical
aforementioned problems since it concerns a process for the
separation of two-phase fluids and the relative accelerator unit.
The latter comprises pumping means (o forse il più letterale
thrusting means, non chiaro dal contesto, ndt) of the two-phase
10 fluid, at least one washing tank, filtering means for the
coalescence of the particles, sensors and actuators for controlling
flow rate, pressure and temperature, at least one tank for
collecting the fluid at a lower density (normally oil) and is
characterised by an oil separator capable of generating a
15 controlled field of hydrodynamic pressures, correlated to the
density of the fluids to be treated, in order to accelerate the
phenomenon of coalescence of the residual particles. Such a
field of pressures accelerates the stratification phenomenon,
allowing the phase at lower density (for example oil) to be drawn
20 off and the constant flow of the decontaminated phase (for
example water) towards the outlet from the system.

The purpose of the finding is therefore to achieve the task of
accelerating the separation of two fluids that cannot be mixed, at
different density, in turbulent flow.

According to a further purpose, the finding is reversible, since it allows the separation of the dispersed phase, without limitations in concentration in the continuous phase.

These and other advantages shall become clearer during the course of the detailed description of the invention that shall make specific reference to drawing 1/1 in which a preferred example embodiment of the unit and of the process flow chart is represented, absolutely not for limiting purposes.

The unit and the relative process are suitable for the separation of the phases of any two-phase fluid, characterised by phases at different density. With reference to fig. 1, the unit in object comprises a first pumping means (1) of the two-phase fluid, at least one washing tank (2), a second pumping means of the fluid (3), filtering means for the coalescence of the particles (4), (5) with different filtering power, a phase separator (6) that constitutes the heart of the system, at least one tank for collecting the fluid at lower density (7), a system for analysing the decontamination of the residual phase (8), sensors and actuators for controlling flow rate, pressure and temperature.

The two-phase fluid to be separated is therefore given the mechanical energy necessary to equalise the pressure drops of the system from the pumping means (1), (3). In the dispersed fluid, in turbulent motion, a first phenomenon of size variation of the particles is induced through forced coalescence in the filtering batteries (4), (5), in order to make the separation process

easier. The hydrostatic thrust acting on the particles, counteracted by the force vectors induced by the Brownian motion generated by the turbulence of the fluid, allows a first separation of the two phases to be obtained.

5 The fluid is then mechanically channelled, through calibrated diffusers, capable of generating a laminar flow and simultaneously the stratification of the two phases. In the phase separator (6), downstream of the diffusers, a controlled field of hydrodynamic pressures is generated, correlated to the density of
10 the fluids to be treated, in order to accelerate the phenomenon of coalescence of the residual particles. Such a field of pressures accelerates the stratification phenomenon, allowing the phase at lower density (for example oil) to be drawn off towards the collection tank (7) and the constant flow of the decontaminated
15 phase (for example water) towards the outlet from the system. The analysis of the decontamination is possible in the system (8) and normally the level of residual pollutant is of the order of a few ppm.

The two-phase fluid separation accelerator is therefore the ideal
20 system for the separation of two fluids at different density, in a vast field of application and without restrictions of any sort concerning the fluids, the flow rates, the temperatures, the flow and the characteristics of the location of use. It is recommended for applications in the following fields: mechanics, ironworking,

oil, food, shipping, aeronautics, environmental protection,
maritime ecology and chemistry.

CLAIMS

- 1) Process for the separation of two-phase fluids, consisting of phases at different density, characterised by the following operating principle: delivery of mechanical energy necessary to equalise the pressure drops due to the circuit to the two-phase fluid to be separated by means of suitable pumping means; induction, in the dispersed fluid, in turbulent motion, of a first phenomenon of variation in size of the particles through forced coalescence in suitable filtering arrays; mechanical channelling of the fluid through calibrated diffusers, capable of generating a laminar flow and simultaneously the stratification of the two phases; generation in the phase separator, downstream of the diffusers of a controlled field of hydrodynamic pressures, correlated to the density of the fluids to be treated, which accelerates the stratification phenomenon and allows the phase at lower density to be drawn off towards a collection tank and the constant flow of the decontaminated phase towards the outlet from the system.
- 2) Process according to claim 1, also comprising an analysis step of the decontamination of the residual fluid.
- 3) Process according to claim 2, wherein the level of contamination in the residual fluid is a few ppm.

- 4) Process according to claim 1, 2 or 3, able to be used for the separation of two fluids at different density, in a vast field of application and without restrictions of any sort concerning the fluids, the flow rates, the temperatures, the flow regime and the characteristics of the location of use.
- 5) Process according to one of claims 1 to 4 suitable for applications in the fields of mechanics, ironworking, oil, food, shipping, aeronautics, environmental protection, maritime ecology and chemistry.
- 6) Accelerator unit for separating two-phase fluids according to the process of claim 1, comprising means for pumping the two-phase fluid (1), (3), at least one washing tank (2), filtering means for the coalescence of the particles (4), (5), sensors and actuators for controlling flow rate, pressure and temperature, at least one tank (7) for collecting the fluid at a lower density and characterised by an oil separator (6) capable of generating a controlled field of hydrodynamic pressures, correlated to the density of the fluids to be treated, in order to accelerate the phenomenon of coalescence of the residual particles and their stratification, allowing the phase at lower density to be drawn off and the constant flow of the decontaminated phase towards the outlet from the system.
- 7) Unit according to claim 6, also comprising a system (8) for analysing the decontamination of the residual fluid.

- 8) Unit according to claim 7, capable of ensuring a level of contamination in the residual fluid equal to a few ppm.
- 9) Unit according to claim 6, 7 or 8, able to be used for the separation of two fluids at different density, in a vast field of application and without restrictions of any sort concerning the fluids, the flow rates, the temperatures, the flow regime and the characteristics of the location of use.
- 10) Unit according to one of claims 6 to 9 suitable for applications in the fields of mechanics, ironworking, oil, food, shipping, aeronautics, environmental protection, maritime ecology and chemistry.
- 11) Process for the separation of two-phase fluids and relative accelerator unit according to one of the previous claims, characterised by what has been described and illustrated in the attached drawing, the whole of which and the components of which can also be of different shapes and sizes and/or made from any type of material.

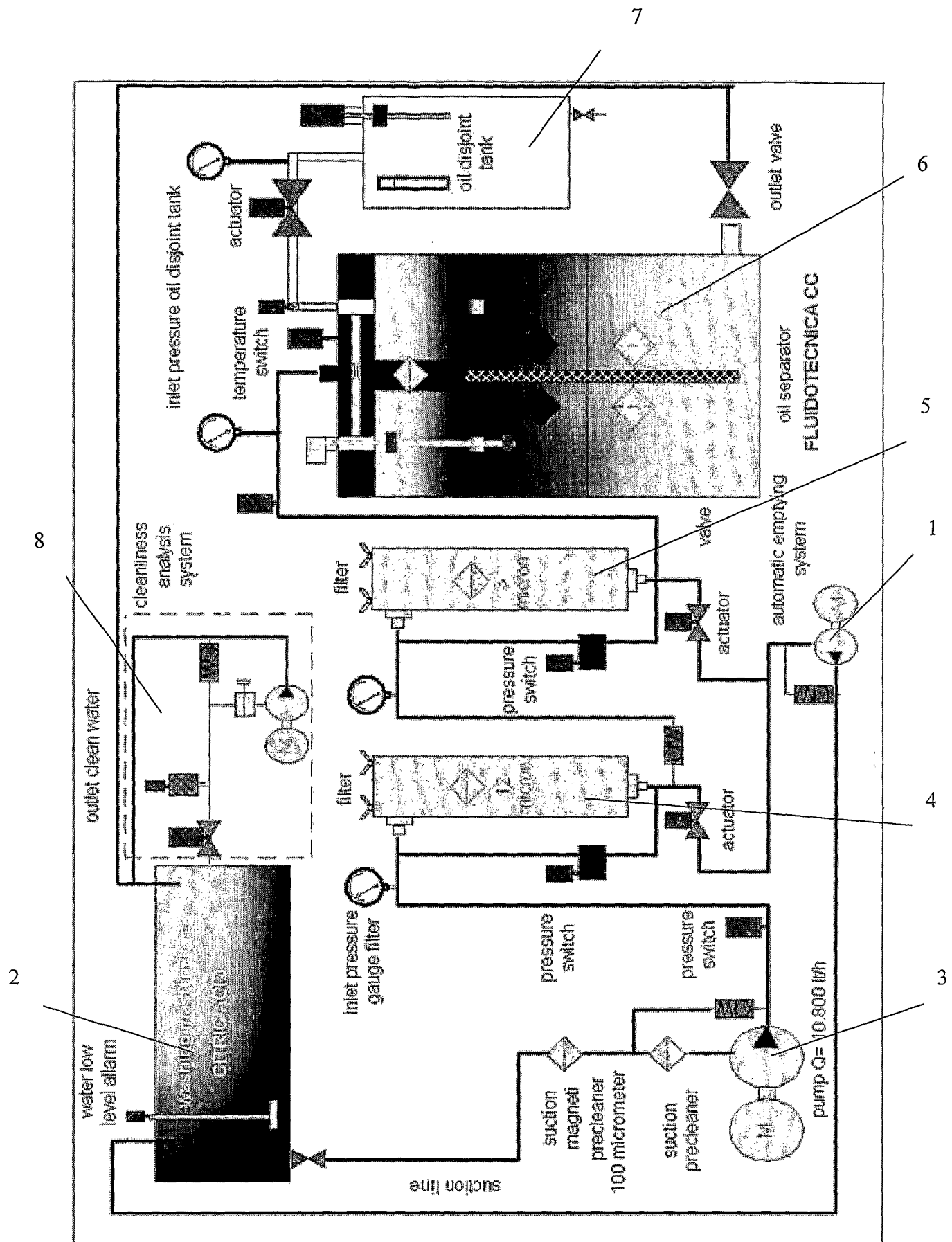


Fig. 1