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System for Gas Cleaning

The invention relates to a system for gas cleaning which has at least one housing with a first chamber into which the gas to be cleaned can flow, and with a second chamber from which the cleaned gas emerges, between the aforementioned chambers there being a filter device through which a gas can flow, and which has filter media both for separation of the solid particles and also for dehydration of the gas by precipitation of coalesced liquid.

Systems of this type are known which are designed to eliminate not only dirt due to solid loading, but also to remove the pertinent gaseous media, and if the liquid particles coalesce on the filter device which is located within the housing, are also called coalescers. These systems are often used in conjunction with exhaust gas-generating processes, exhaust gas flows with comparatively high temperatures and optionally with very high pressures being handled.

The object of the invention is to make available a system of this type which has not only especially good cleaning action, but moreover also ensures very extensive dehydration.

This object is achieved according to the invention by a system which has the features of claim 1 in its entirety.

In that, as specified in the characterizing part of claim 1, there is an arrangement for preliminary dehydration, through which the gas flows before it flows into the actual coalescer housing, the gas is in the preconditioned state which promotes residual dehydration by coalescence on the respective filter medium. This yields extensive dehydration such that the cleaned gas can optionally be returned to the process.

Preferably the arrangement for preliminary dehydration is located on or in the housing of the filter device.

In advantageous embodiments the arrangement for preliminary dehydration has at least one cyclone. The use of a cyclone leads to a durable and reliable construction since no moving parts are necessary.

Embodiments in which the pertinent cyclone is integrated into the housing which also contains the coalescer, is characterized by an especially compact construction.

The housing in the normal installation position preferably defines a longitudinal axis which runs at least partially vertically, the first chamber being located in the lower section of the housing and being bordered laterally by a circular ring surface which is preferably concentric to the longitudinal axis. On the housing there can be an inflow opening for the gas which is to be cleaned, such that the gas is tangentially incident on the circular ring surface, so that the circular ring surface forms a cyclone for preliminary dehydration.

In these embodiments the housing on the lower end can be closed off by a collecting tank which holds the liquid which has been precipitated during preliminary dehydration.

The arrangement there can be made such that between the collecting tank and the circular ring surface of the cyclone there is a floor part which forms a drain funnel for the liquid which has precipitated on the cyclone as the lower boundary of the cyclone.

Preferably the housing can hold a filter device which extends along its longitudinal axis and which is made such that for the gas to be cleaned it provides an inner cavity which is surrounded by the filter media, between their exterior and the inside wall of the housing the second chamber being located which the cleaned gas enters after it has flowed out of the inner cavity of the filter device through the filter elements to the outside.

On the top end of the circular ring surface which forms the cyclone the housing can have a floor which separates the first chamber from the second chamber and on which a seat is made which forms a passage and into which a connection sleeve of the filter device can be inserted, which sleeve leads into the interior cavity of the filter device and via which the gas which has been dehydrated beforehand flows from the cyclone into the cavity of the filter device.

Above this floor, that is, in the region which belongs to the second chamber, the housing can have a widening which forms a chamber for collection of the fluid which has coalesced on the filter device and which can be removed from the chamber via an evacuation opening which is provided in the wall of the housing.

The invention will be detailed below using one embodiment which is shown in the drawings.

- FIG. 1 shows a front view of one embodiment of the system according to the invention with two coalescer housings which can be operated in alternation;
- FIG. 2 shows a longitudinal section of the coalescer housing of the embodiment, drawn schematically simplified;
- FIG. 3 shows a longitudinal section similar to FIG. 2, but the coalescer housing being turned by 180° relative to FIG. 2 and being shown without the filter device located in it;
- FIG. 4 shows a cross section corresponding to the intersection line IV-IV from FIG. 3, and
- FIG. 5 shows a pulled-apart perspective in which of the filter device which can be used for the system according to the invention only the filter media and stabilizing support elements are shown.

The invention will be explained below using one embodiment in which two coalescer housings 1 are used which are made identical except for the arrangement of the housing openings which is in mirror image. A transfer fitting 3 which in the manner conventional in the technology enables transfer of the gas flow supplied to the housings 1 and of the gas flow emerging from them is assigned to the housings 1 such that one housing 1 or the other is activated in alternation. As is to be seen in FIG. 1, the transfer fitting 3 as a control element has a transfer lever 5, depending on its operating position the gas flow being fed from an entry fitting 7 into one housing or the other, from which the gas flow is discharged via an exit fitting 9. The gas enters at the housings 1 each via one inflow opening 11. The cleaned gas flow emerges from the respective housing 1 via an outflow opening 13. A pressure equalization line which extends between the housings 1 is designated as 15 in FIG. 1.

FIGS. 2 to 4 show details of one embodiment of the coalescer housing 1 which can be used in the system according to the invention. As is apparent, the housing 1 is made as an elongated body which is square in outline, with a longitudinal axis designated as 17. In the normal installation position of the respective housing 1 the longitudinal axis 17 is aligned vertically. On the top end the housing 1 is closed by a cover part 19 which is screwed to it, sealing elements 21 forming a pressure-tight seal. A central vent opening in the cover part 19 is designated as 23.

The housing 1, on the opposite, lower end, is closed off by a collecting tank 25 which is screwed to it, likewise sealing elements 27 forming a pressure-tight seal between the collecting tank 25 and the housing 1. On the bottom the collecting tank 25 has an evacuation opening 29.

The different longitudinal sections of the interior of the housing 1 are each made circularly cylindrical, the interior of the housing 1 being divided fundamentally into two chambers, specifically a first chamber 31 which is connected to the inflow opening 11, and into which the gas to be cleaned flows, and a second chamber 33, see FIG. 2, in which the cleaned gas which emerges from this second chamber 33 via the outflow opening 13 is located.

The first chamber 31 and the second chamber 33 are separated from one another by a filter device 35 through which the gas can flow and which is schematically shown in FIG. 2 only in outline.

The part of the first chamber 31 which directly adjoins the inflow opening 11 forms a cyclone for preliminary dehydration of the gas. For this purpose the inflow opening 11 is aligned to an inner circular ring surface 37 of the housing 1 such that the gas flow which is entering via the inflow opening 11 is incident on the circular ring surface 37 such that a cyclone effect is created which causes preliminary dehydration as a result of the centrifugal forces which are acting on the flow which is running along the circular ring surface 37.

As shown by FIGS. 2 and 3, between the top end of the collecting tank 25 and the lower end of the circular ring surface 37 of the cyclone there is a floor part 39 which for the cyclone forms a floor which is recessed in the manner of a funnel with a central drain opening 41 via which liquid which has precipitated in the cyclone drains into the collecting tank 25.

Above the circular ring surface 37 the housing 1 has a floor 43 which separates the first chamber 31 from the second chamber 33, and on which a seat 47 is made which forms a passage 45 and a receiver for the connection sleeve 48 (see FIG. 2) of the filter device 35. This connection sleeve 48 leads into the inner cavity of the filter device 35 so that the gas which has been dehydrated beforehand in the cyclone travels from the cyclone into the interior of the filter device 35.

As has been shown, especially good dehydration action of the cyclone occurs when there is a relief-like profile in the form of a spiral on the wall which is bordered to the top by the cyclone chamber or flow chamber. As is apparent from FIGS. 2 to 4, for this purpose the bottom side of the floor 43 which borders the flow chamber to the top is not made with a smooth surface, but has a profile which is formed by a projecting rib 71 which runs in a spiral, with grooves between its turns. As FIG. 4 shows, the spiral 73 which has been formed in this way extends helically, from its outer start 75 which is located on the inflow opening 11, to the inside and against the direction of cyclone flow on the circular ring surface 37. A configuration such as this promotes settling of droplets which are falling onto the floor part 39. Depending on the flow conditions, a different number of spiral turns is possible.

As is shown in FIG. 5, the inner cavity of the filter device 35 is surrounded by the filter media and support elements through which the gas which has been dehydrated beforehand flows from the inside to the outside, the filter media being such that both precipitation of the solid particles and also dehydration take place by precipitation of coalesced liquid. For this purpose the filter device as inner layers which are used for particle precipitation has wire cloth and filter paper which

has been folded into a star shape. These layers are designated as 51 in FIG. 5. To the outside a perforated sheet 53 adjoins for stabilization. Above it there is a glass fiber fabric 55 for coalescence. A wire cloth 57 for drainage follows, over which a perforated sheet 59 for stabilization is located. Above the latter is a needle felt 61 for draining the liquid. A metal basket 63 finally forms the outer enclosure of the unit.

As FIGS. 2 and 3 show, above the floor 43 in the housing 1 there is a widening which belongs to the second chamber 33 and which forms a chamber 65 for collection of the liquid which has coalesced on the filter device 35 and which can be drained via a drain opening 67. An opening which is designed for connection of the pressure equalization line 15 (FIG. 1) in the upper region of the housing 1 is designated as 69. It goes without saying that the openings 23, 29, 67 and 69 which are additionally provided on the housing besides the inflow opening 11 and the outflow opening 13 are each provided with pressure-tight fittings which are not shown.

While the invention is described using one example in which two coalescer housings 1 can be operated in alternation by actuating a transfer fitting 3, it goes without saying that a different system structure with only one coalescer housing or a different number of housings can be provided. Instead of a cyclone which has been integrated into the housing 1, preliminary dehydration could take place differently, for example with one or more cyclones connected upstream from the housing. The use of cyclones connected next to one another can likewise be provided, especially in cases in which gas flows of different volumetric flows or different flow velocity must be handled.

C l a i m s

1. A system for gas cleaning which has at least one housing (1) with a first chamber (31) into which the gas to be cleaned can flow, and with a second chamber (33) from which the cleaned gas emerges, between the aforementioned chambers (31, 33) there being a filter device (35) through which a gas can flow, and which has filter media both for precipitation of the solid particles and also for dehydration of the gas by precipitation of coalesced liquid, **characterized in that** the system has an arrangement (11, 37) for preliminary dehydration of the gas upstream of the filter device (35).
2. The system according to claim 1, **wherein** there is an arrangement (11, 37) for preliminary dehydration on or in the housing (1) of the filter device (35).
3. The system according to claim 1 or 2, **wherein** the arrangement for preliminary dehydration has at least one cyclone (11, 37).
4. The system according to claim 3, **wherein** at least one cyclone (11, 37) is integrated into the housing (1).
5. The system according to claim 4, **wherein** the housing (1) in the normal installation position defines a longitudinal axis (17) which runs at least partially vertically and wherein the first chamber (31) is located in the lower section of the housing (1) and is bordered laterally by a circular ring surface (37) which is preferably concentric to the longitudinal axis (17).
6. The system according to claim 5, **wherein** on the housing (1) there is an inflow opening (11) for the gas which is to be cleaned, arranged such that the gas is tangentially incident on the circular ring surface (37), so that the latter forms a cyclone for preliminary dehydration.

7. The system according to claim 6, **wherein** the housing (1) on the lower end is closed off by a collecting tank (25) which holds the liquid which has been precipitated during preliminary dehydration.
8. The system according to claim 7, **wherein** between the collecting tank (25) and the circular ring surface (37) of the cyclone there is a floor part (39) which forms a drain funnel for the liquid which has precipitated on the cyclone as the lower boundary of the cyclone.
9. The system according to one of claims 1 to 8, **wherein** the housing (1) can hold a filter device (35) which extends along its longitudinal axis (17) and which for the gas to be cleaned has an inner cavity which is surrounded by the filter media (51, 55, 57, 61), between its exterior and the inside wall of the housing (1) there being the second chamber (33).
10. The system according to claim 9, **wherein** on the top end of the circular ring surface (37) which forms the cyclone, the housing (1) has a floor (43) which separates the first chamber (31) from the second chamber (33) and on which a seat (47) is made which forms a passage (45) and into which the connection sleeve (48) of the filter device (35) can be inserted, which sleeve leads into the interior cavity of the filter device, and via which the gas which has been dehydrated beforehand flows from the cyclone into the cavity of the filter device (35).
11. The system according to claim 10, **wherein** the housing (1) above the floor (43) which is located on the top end of the cyclone has a widening which forms a chamber (65) for collection of the fluid which has coalesced on the filter device (35) and which can be removed from the chamber (65) via an evacuation opening (67) which is provided in the wall of the housing (1).

12. The system according to claim 10 or 11, **wherein** on the bottom of the floor (43) which forms the upper boundary of the cyclone there is a spiral (73) which is formed from a rib (71) which projects from the surface, with grooves located in between.
13. The system according to claim 12, **wherein** the spiral (73) runs to the inside from its outer end (75) which is located on the inflow opening (11) opposite the direction of the flow on the ring surface (37).