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(54) Updraft gasifier comprising a grate

(57) The invention relates to an updraft gasifier (4) updraft gasifier (4) for a biomass gasification system (2) to generate gasifier product gas to be burned in a combustion unit (6), which gasifier (4) comprises:
• a first inlet (9) for biomass in the upper area (12) of the gasifier (4), and
• a first outlet (11) for ash in the lower area (13) of the gasifier (4), and
• a second inlet (14) for a gasification agent in the lower area (13) of the gasifier (4), and
• a second outlet (15) for the gasifier product gas in the upper area (12) of the gasifier (4), and
• a grate (16; 23) between the first inlet (9) and the first outlet (11) to handle the ash;

wherein the
• grate (16; 23) is arranged in a cross-sectional area of the gasifier (4) and comprises at least one air channel (17; 25, 26, 31) connected to the second inlet (14) and at least one nozzle (20; 32) connected to the air channel (17; 25, 26, 31) to transport the gasification agent into the cross-sectional area of the gasifier (4).

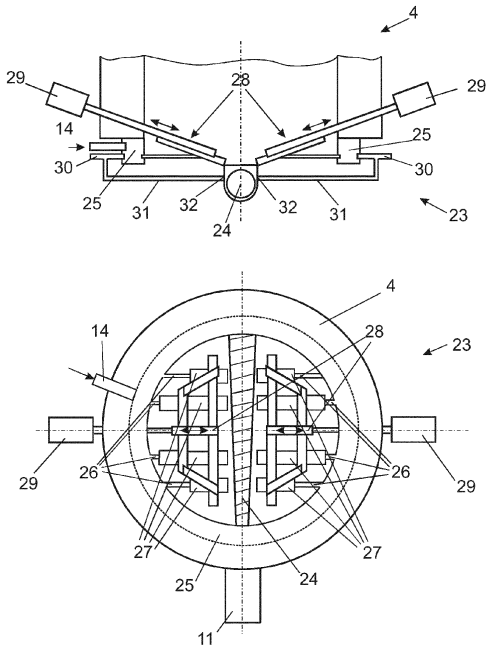

FIG.5

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Description

[0001] The invention relates to an updraft gasifier for a biomass gasification system to generate gasifier product gas to be burned in a combustion unit, which gasifier comprises:

- a first inlet for biomass in the upper area of the gasifier, and
- a first outlet for ash in the lower area of the gasifier, and
- a second inlet for a gasification agent in the lower area of the gasifier, and
- a second outlet for the gasifier product gas in the upper area of the gasifier, and
- a grate between the first inlet and the first outlet to handle the ash.

[0002] The document WO 2007/081296 A1 discloses a cross draft gasifier for biomass that uses a downdraft and an updraft mode to produce gasifier product gas, which can be burned in a combustion unit. The disclosed gasifier comprises a first inlet for municipal waste in the upper area of the gasifier and a first outlet of the gasifier for the ash at the bottom of the gasifier. The gasifier furthermore comprises a second inlet for preheated air or oxygen with nozzles in the wall of the lower area of the gasifier and a second outlet in the wall of the upper area of the gasifier for syngas as gasifier product gas generated in the gasifier. A fix mounted ash grate made of special material which is high temperature resistant is used to enable that the syngas in the accumulated ash content in this portion can be sucked easily in the updraft mode.

[0003] This known gasifier processed in the downdraft mode comprises the disadvantage that the gasification agent is not well distributed into the ash and biomass by the nozzles in the wall of the gasifier. Due to the unequal distribution of the gasification agent hot zones are created that cause ash melting and ash agglomeration what finally can lead to blocking of the gasifier.

[0004] Thus in view of the foregoing it is desirable to have an improved biomass gasifier that ensures an even distribution of the gasification agent into the ash and biomass. To solve this problem a gasifier according to the invention is characterized in, that the grate is arranged in a cross-sectional area of the gasifier and comprises at least one air channel connected to the second inlet and at least one nozzle connected to the air channel to transport the gasification agent into the cross-sectional area of the gasifier.

[0005] The updraft gasifier according to the invention comprises the advantage that the gasification agent is distributed by at least one, but preferable several nozzles, arranged at the grate in the cross-sectional area of the gasifier. In a preferred embodiment the grate comprises a moving scraper with an air channel and nozzles to distribute the gasification agent. Due to the movement of the scraper, the position of the nozzles changes over time what ensures a smooth and even distribution of the gasification agent within the ash and biomass. Furthermore, the flow of the gasification agent through the air channel and nozzles of the scraper advantageously cools the temperature of the scraper. These and other advantages of the invention will be explained based on to embodiments of the invention.

Figure 1 is a perspective view of a Stirling plant with the preferred biomass gasifier of this invention.

Figure 2 is a side view of the Stirling plant of Figure 1.

Figure 3 is a perspective view of the gasifier of the Stirling plant of Figure 1.

Figure 4 is a sectional view and top view of a grate within a gasifier of Figure 3.

Figure 5 is a sectional view and top view of a grate according to a second embodiment of the invention.

[0006] Figure 1 is a perspective view and Figure 2 is a side view of a Stirling plant 1 to generate heat and electricity from biomass. The Stirling plant 1 comprises a biomass gasification system 2 to generate heat, which heat to some extent is transformed into electricity by four Stirling engines 3. The biomass gasification system 2 comprises an updraft gasifier 4, from which gasifier product gas is transported through pipes 5 to four combustion units 6 where the gasifier product gas is burnt to heat up a transfer medium used to drive the Stirling engines 3.

[0007] Figure 3 is a perspective view of the gasifier 4 of the biomass gasification system 2. The gasifier 4 is built as updraft gasifier. In principle the updraft gasifier is a standing tubular reactor 7 which consists essentially out of cylindrical steel shell isolated and lined with bricks on the inner side. Additional the reactor 7 is isolated on the outer side as well, to avoid hot surfaces. The gasifier 4 comprises a wood chip conveyor 8 connected to a first inlet 9 of the gasifier 4 as fuel feed and an ash conveyer 10 connected to a first outlet 11 of the gasifier 4 as fuel discharge.

[0008] The wood chip conveyor 8 feeds the gasifier 4 through the lateral first inlet 9 which is arranged in the upper area 12 of the gasifier 4. The feeding is monitored by a filling level indicator. The filling level indicator consists out of a rotating blade in the filling space mounted on a geared motor. The filling level is periodically checked and if necessary the fuel feed activated.

[0009] The gasification in the updraft gasifier 4 takes place in a counterflow principle, thereby the fuel passes the gasifier 4 from its upper area 12 to its lower area 13, while the gasification agent enters the gasifier 4 at a second inlet 14 at the bottom of the gasifier 4 and leaves the gasifier 4 as gasification product gas (syngas) at a second outlet 15 in the upper area 12 of the gasifier 4. There-

by different zones are formed in the gasifier 4. Basically four zones are formed, the drying zone, the pyrolysis zone, the reduction zone and the oxidation zone. As a gasification agent, a defined mixture of flue gas and air is used. The gasification agent is preheated in a gas pre-heater of the biomass gasification system 2 and afterwards fed at the second inlet 14 at the bottom of the gasifier 4.

[0010] The updraft gasifier 4 furthermore comprises a grate 16 that is arranged in the cross-sectional area of the gasifier 4 at the bottom of the gasifier 4 just above the first outlet 11 to handle and thereby discard the ash. Figure 4 is a sectional view and top view of the grate 16 in the gasifier 4. The grate 16 comprises an air channel 17 connected to the second inlet 14 to transport the gasification agent through the grate 16. The grate 16 furthermore comprises a scraper 18 realized by eight hollow triangle shaped profile elements 19 fixed to the air channel 17. The profile elements 19 comprise openings 20 functioning as nozzles to enable a flow of the gasification agent from the second inlet 14 through the air channel 17 and the profile elements 19 into the lower area 13 of the gasifier 4.

[0011] As a result the advantage is achieved, that the gasification agent is distributed through the openings 20 more or less equally over the cross-sectional area of the gasifier 4 into the ash and biomass within the gasifier 4. The creation of hot zones which may cause ash melting and ash agglomeration what finally can lead to blocking of the gasifier 4 is avoided.

[0012] The updraft gasifier 4 furthermore comprises a grate drive 21 connected to a connection element 22 of the air channel 17. The grate drive 21 periodically moves the air channel 17 and the scraper 18 fixed to the air channel 17. This provides the advantage that the ash is moved by the scraper 18 into the ash conveyer not shown in Figure 4. In addition, this movement of the scraper 18 with the openings 20 provides the advantage that the position of the openings 20 changes over time what enables that the gasification agent gets even better distributed into the ash and biomass.

[0013] Figure 5 is a sectional and top view of a grate 23 in a gasifier according to a second embodiment of the invention. The grate 23 could be attached to the bottom of the updraft gasifier 4 and would push the ash within the gasifier 4 into a screw drive 24 connected to the first outlet 11 to discharge the ash into the ash conveyor 10. The grate 23 comprises an air channel with a ring channel area 25 that is connected to the second inlet 14. Eight smaller air channels 26 are connected to the ring channel area 25, which air channels 26 are spread over the cross-sectional area of the gasifier 4. Each of these air channels 26 comprises several nozzles to distribute the gasification agent.

[0014] To avoid plugging of these nozzles with ash, the nozzles are shielded by covers 27. This has the advantage that the maintenance work to keep the distribution of the gasification agent through the nozzles functional is reduced.

[0015] The grate 23 furthermore comprises two movable scrapers 28, each connected to a scraper drive 29. With the movement of the scrapers 28, ash is moved from the bottom of the gasifier 4 into the screw drive 24 to discharge the ash. In this embodiment the scrapers 28 do not comprises air channels to discharge the gasifier agent which gets distributed through the fixed nozzles only. This provides the advantage that the scrapers 28 are robust and easy manufactured.

[0016] The air channel 25 of the grate 23 furthermore comprises two cleanouts 30. These cleanouts 30 are closed during normal production of the gasifier product gas and may be opened by a service personal to enable cleaning of the air channels 25 and 26. These cleanouts 30 provide the advantage that the air channels of the grate 23 may be kept clean and fully functional.

[0017] The screw drive 24 in the gasifier 4 as part of the ash conveyer comprises an air channel 31 and nozzles 32 as well. These nozzles 32 advantageously add to the equal distribution of the gasifier agent into the ash and biomass. But it has to be stated that in a less preferred embodiment the invention works without these elements 31 and 32 as well. Furthermore there could be other ways to connect the air channel 31 with the nozzles 32 as shown in Figure 5.

[0018] In another embodiment of the invention, the grate could comprise all kind of different air channels and types of nozzles to distribute the gasifier agent. The scraper may be fixed, but preferable is movable to transport the ash into the ash conveyer.

[0019] In another embodiment the air channel could comprise the form of a square or rectangle or any other from that might have advantages for the particular realization. In principle the air channel functions as a manifold system to transport the gasification agent to the nozzles.

[0020] The first embodiment of a grate 16 according to Figure 4 comprises only movable nozzles 20 in the profile elements 19 and the second embodiment of a grate 23 according to Figure 5 comprises only fixed nozzles in the air channels 26. In a preferred embodiment the grate comprises fixed and movable nozzles to achieve the advantage that the gasification agent gets distributed through the fixed nozzles and the nozzles of the movable scrapers. This ensures an equal distribution of the gasification agent into the ash and biomass.

Claims

1. Updraft gasifier (4) for a biomass gasification system (2) to generate gasifier product gas to be burned in a combustion unit (6), which gasifier (4) comprises:

   - a first inlet (9) for biomass in the upper area (12) of the gasifier (4), and
   - a first outlet (11) for ash in the lower area (13) of the gasifier (4), and

- a second inlet (14) for a gasification agent in the lower area (13) of the gasifier (4), and
- a second outlet (15) for the gasifier product gas in the upper area (12) of the gasifier (4), and
- a grate (16; 23) between the first inlet (9) and the first outlet (11) to handle the ash;

characterized in, that the

- grate (16; 23) is arranged in a cross-sectional area of the gasifier (4) and comprises at least one air channel (17; 25, 26, 31) connected to the second inlet (14) and at least one nozzle (20; 32) connected to the air channel (17; 25, 26, 31) to transport the gasification agent into the cross-sectional area of the gasifier (4).

2. Updraft gasifier (4) of claim 1 **characterized in, that** the air channel comprises a manifold system and in particular a ring channel area (25) to distribute the gasification agent to at least two nozzles (32) of the grate (23).

3. Updraft gasifier (4) according to any of the preceding claims **characterized in, that** the updraft gasifier (4) comprises a grate drive (29) to periodically move a scraper (18; 28) of the grate (16; 23) to transport ash into an ash conveyer (24) connected to the first outlet (11) of the gasifier (4).

4. Updraft gasifier (4) according to claim 3 **characterized in, that** the movable scraper (18; 28) comprises at least one nozzle (20) connected to the air channel (17; 25).

5. Updraft gasifier (4) according to claim 3 **characterized in, that** the ash conveyer (24) within the gasifier (4) comprises at least one nozzle (32) connected to the air channel (25, 31).

6. Updraft gasifier (4) according to any of the preceding claims **characterized in, that** the air channel (25) comprises at least one cleanout (30).

7. Updraft gasifier (4) according to any of the preceding claims **characterized in, that** the nozzles are shielded by a cover (27) to avoid plugging with ash.

8. Grate (16; 23) for an updraft gasifier (4) of a biomass gasification system (2) to generate gasifier product gas to be burned in a combustion unit (6), **characterized in that** the grate (16; 23) comprises the features **characterized in** the preceding claims.

9. Stirling plant (1) to generate heat and/or electricity from biomass which plant (1) comprises at least one Stirling motor (3) to transform heat into electricity, **characterized in, that** the plant (1) comprises the updraft gasifier (4) according to any of the claims 1 to 7.

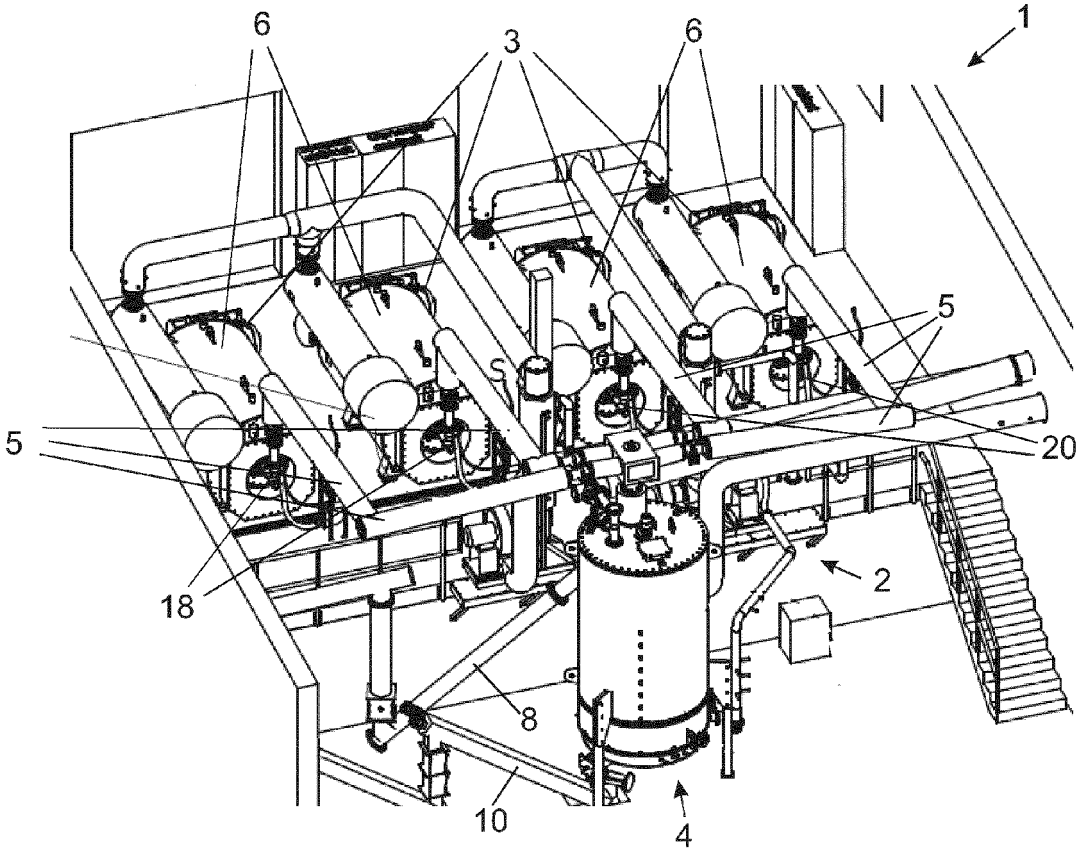

FIG.1

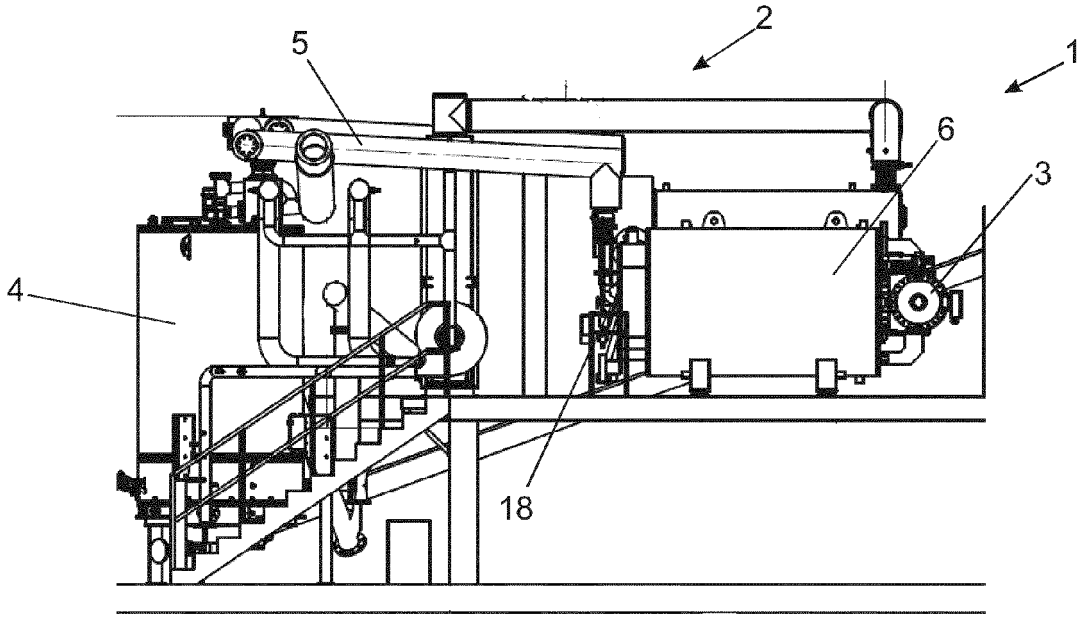

FIG.2

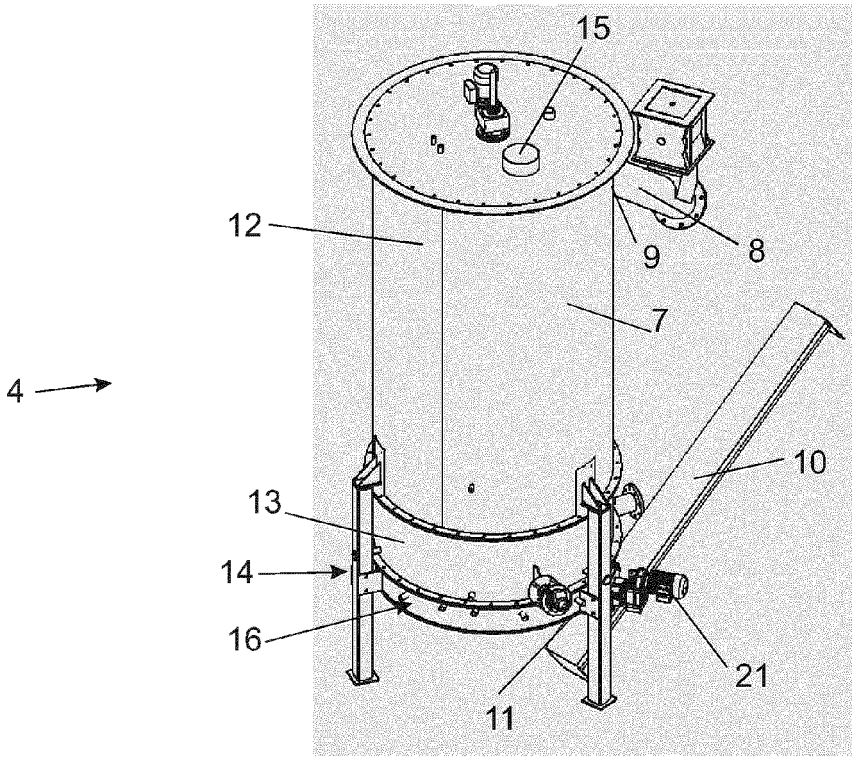

FIG.3

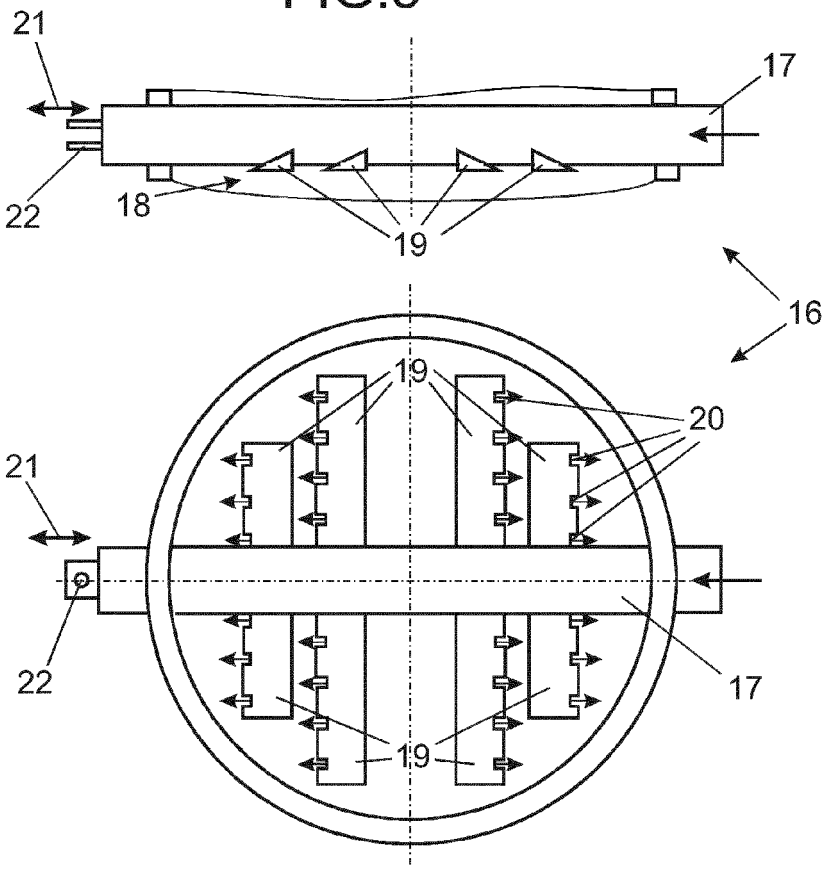

FIG.4

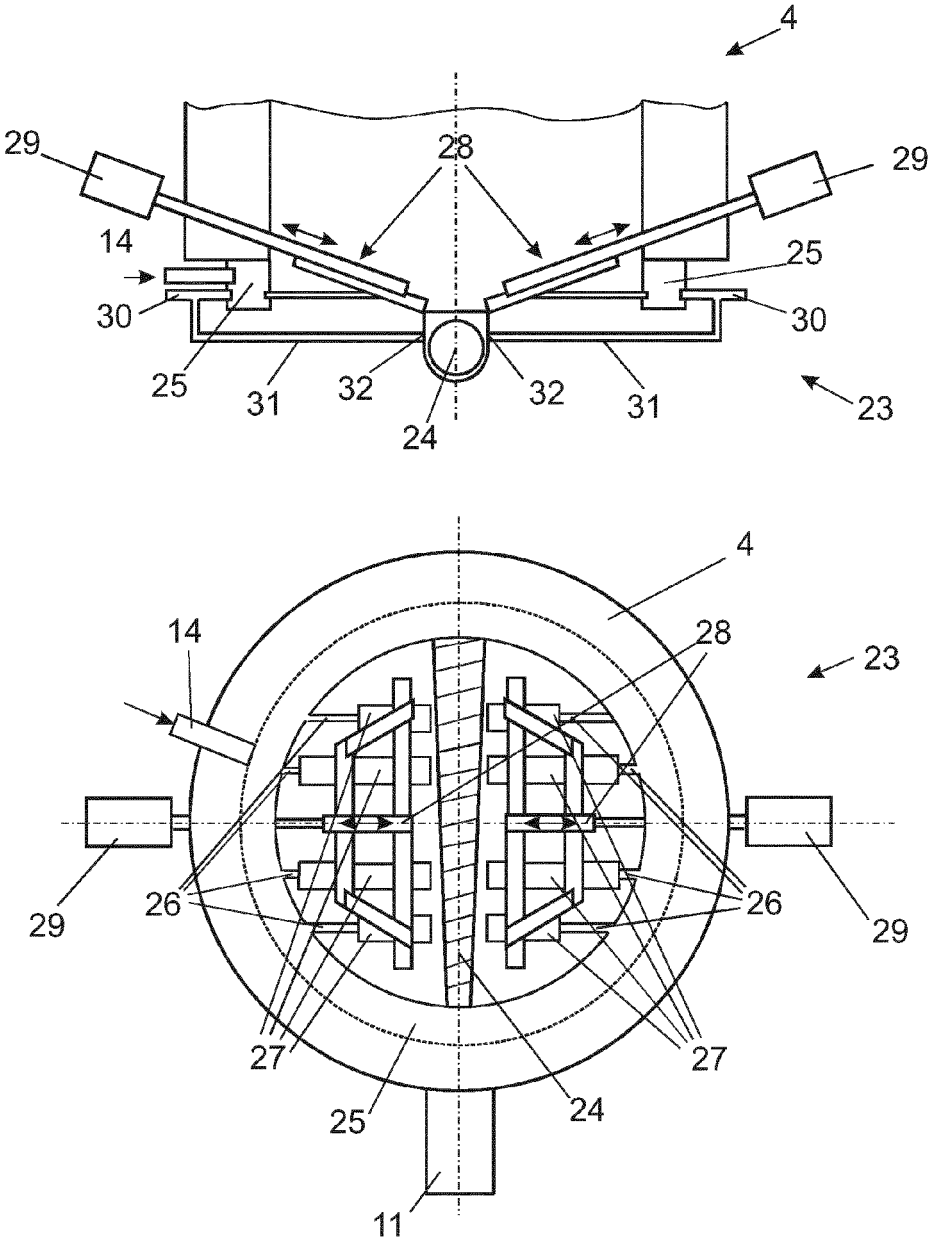
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FIG.5

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EUROPEAN SEARCH REPORT

Application Number
EP 11 18 7993

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 March 2012	Lachmann, Richard

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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