CLAIMS

1. A reactor for producing a synthesis gas from a fuel, comprising

a housing (2) with a combustion part accommodating a first fluidized bed in operation,

a riser (3) extending along a longitudinal direction of the reactor (1) and accommodating a second fluidized bed in operation,

a down-comer (4) positioned parallel to the riser (3) and extending into the first fluidized bed, and

one or more feed channels (33) for providing the fuel to the reactor (1),

wherein the reactor (1) further comprises

a riser air chamber section (B) connected to a lower part of the riser (3), the riser air chamber section (B) comprising a cylindrical wall (28) with a plurality of circumferentially located nozzle holes (24, 25),

with an ash extraction zone from the riser (3) extending to at least the riser air chamber section (B);

wherein the riser air chamber section (B) comprises two sections of nozzle holes, an upper section with a first plurality of holes (25), and a lower section with a second plurality of holes (24), wherein a total aperture surface of the second plurality of holes (24) is larger than a total surface aperture of the first plurality of holes (25).

2. The reactor according to claim 1, wherein a fluidization air chamber (27) is provided in communication with the first plurality of holes (25).

3. The reactor according to claim 1 or 2, wherein a start-up air chamber (26) is provided in communication with the second plurality of holes (24).

4. The reactor according to any one of claims 1-3, wherein the riser air chamber section (B) further comprises compressible material attached to an outside surface thereof.

5. The reactor according to any one of claims 1-4, wherein the reactor (1) further comprises a riser spool pipe section (E) connected to a bottom part of the riser air chamber section (B).

6. The reactor according to claim 5, wherein

the riser air chamber section (B) comprises an upper mounting flange (22) for connection to the housing (2), and a lower mounting flange (23) for connection to a corresponding mounting flange of the riser spool pipe section (E),

wherein a height (h2) of the cylindrical wall (28) extending above the upper mounting flange (22) is equal to or lower than a height (h1) of the riser spool pipe section (E).

7. The reactor according to any one of claims 1-6,
the housing (2) comprising a first sloped bottom (31) of the first fluidized bed, and a second sloped bottom (32) in a transport zone connecting the first fluidized bed and the second fluidized bed through a transport aperture (39) in the riser (3),
further comprising multiple groups of air nozzles (36, 37, 38) on the first sloped bottom (31) and the second sloped bottom (32), the multiple groups of air nozzles (36, 37, 38) being arranged to direct air along the respective first and second sloped bottom (31, 32).

8. The reactor according to claim 7, wherein the multiple groups of air nozzles (36, 37, 38) comprises a first group of air nozzles (36) on the first sloped bottom (31), of which nozzle flows are directed at the centre of the reactor (1).

9. The reactor according to claim 7 or 8, wherein the multiple groups of air nozzles (36, 37, 38) comprises a second group of air nozzles (37) on the first sloped bottom (31), of which nozzle flows are directed at the transport zone.

10. The reactor according to claim 7, 8 or 9, wherein the multiple groups of air nozzles (36, 37, 38) comprises a third group of air nozzles (38) on the second sloped bottom (32), of which nozzle flows are directed at the transport aperture (39) in the riser (3).

11. The reactor according to any one of claims 7-10, wherein the first and second sloped bottom (31, 32) have a sloping angle of between 5°-35°, e.g. at 15°, with respect to a cross sectional plane of the reactor (1).

12. The reactor according to any one of claims 7-11, wherein the transport aperture (39) in the riser (3) is provided with a cover plate.

13. The reactor according to any one of claims 1-12,
further comprising a gas outlet distributor section (D), the gas outlet distributor section (D) comprising an inner cone (41) and an outer cone (42), wherein the inner and outer cone have a different apex opening angle and form an outlet channel with a constant cross section as function of a height of the gas outlet distributor section (D).

14. The reactor according to claim 13, wherein the housing (2) comprises an inward extending ridge (43) supporting a lower edge of the gas outlet distributor section (D).

15. The reactor according to claim 13 or 14, wherein expansion material (45) is provided on a surface of the outer cone (42) directed at a top part of the housing (2).

16. The reactor according to any one of claims 13-15, wherein the inner cone (41) comprises a lifting lug (46) at a top apex of the inner cone (41).

17. The reactor according to any one of claims 13-16, wherein the inner cone (41) of the gas outlet distributor section (D) is positioned in the reactor (1) at a predetermined distance from a top edge of the riser (3).

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