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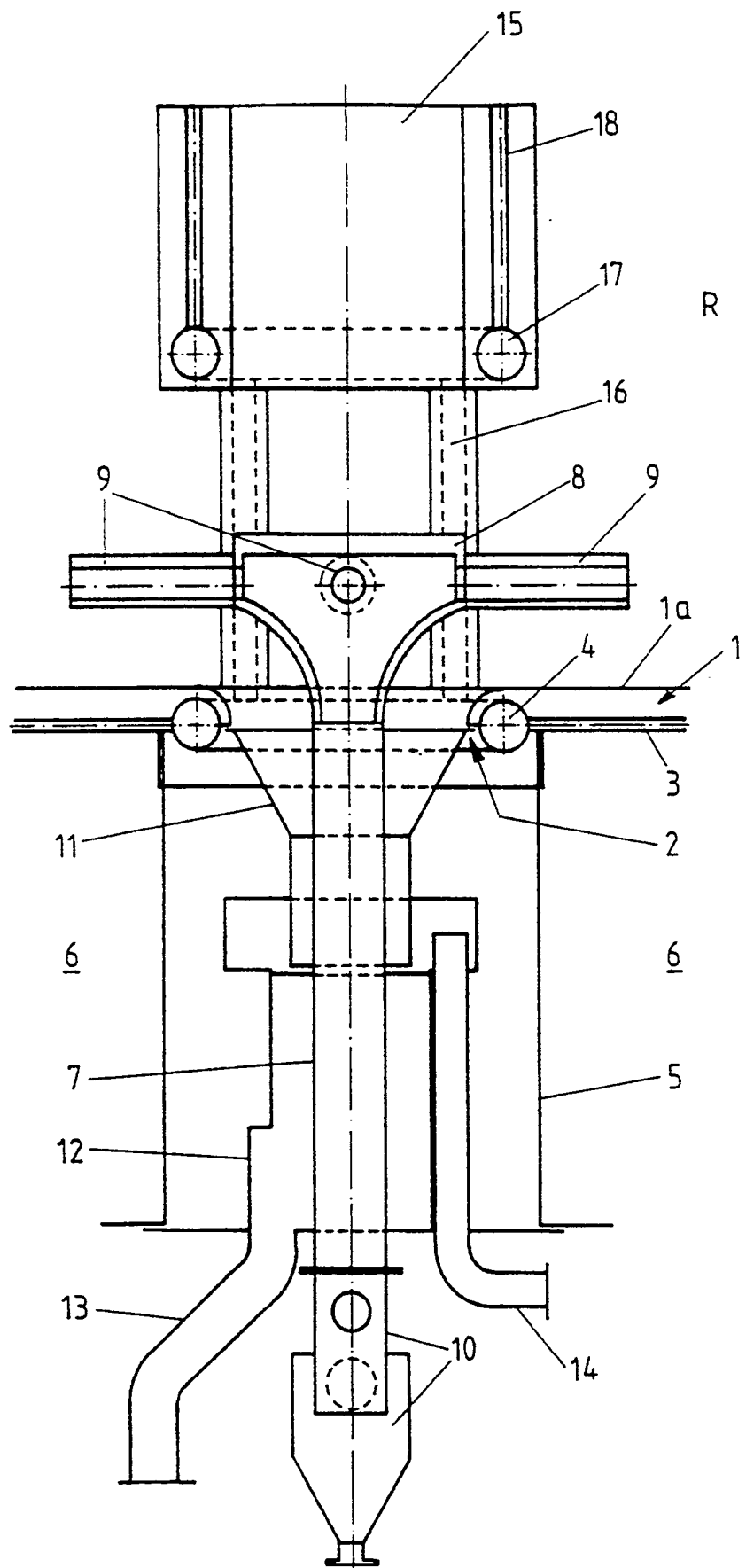
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⑤④ **Combustion unit.**

⑤⑦ The combustion unit provides a circulation process and comprises a reactor chamber (R), where the lower part is provided with a grate structure (1) for forming a so-called fluidized bed. Fuel is supplied to the upper side of the grate structure into the fluidized bed, and means are provided for removing the coarse material of the fluidized bed from the grate structure and for supplying air into the fluidized bed.

The combustion unit further comprises at least one particle separator which is provided with means for purifying the flue gases from solid material, the flue gases being generated in the fluidized bed and containing solid material. A return duct returns the solid material to the fluidized bed. The means (7, 8, 9) for supplying fuel to the grate structure and the means (11) for removing the coarse material in the fuel are formed into at least one group which penetrates the grate structure essentially at a same point.



The invention relates to a combustion unit of the type comprising a reactor chamber in combination with at least one particle separator for the purpose of obtaining a circulation process. The lower part of the reactor chamber is provided with a grate structure for forming a so-called fluidized bed, the grate structure having means for supplying fuel, means for removing coarse material of the fluidized bed from the grate structure and means for supplying air to the grate structure. The particle separator can have a structure of a so-called cyclone separator where there are two casings, one placed essentially inside the other, the casings having parallel and essentially coincident centre lines. The first, i.e. the outer casing, is provided with an inlet for the flue gases generated in the fluidized bed of the reactor chamber and which contain solid material, and at least one return duct for the solid material, which is separated in the particle separator. The return duct leads to the proximity of the grate structure of the reactor chamber for returning the solid material back to the fluidized bed. The second, i.e. the inner casing, is connected to the subsequent process stage for carrying the flue gases essentially free of solid material through said inner casing to said process stage subsequent to combustion. The wall structure of the reactor chamber is usually arranged to form essentially a heat transfer surface comprising a tubular structure and flow of a heat transfer medium is arranged inside the tubular structure.

Combustion units of the above type exist in several different constructions. Usually the particle separator is placed outside the reactor chamber. But it is a known practice to place the particle separator inside the reactor chamber. The present invention can be applied to both basic constructions.

One problem which typically exists in the present combustion units is their complexity and their liability to breakdowns when constructed for fuel supply and removal of so-called coarse material. Thus, it is an object of this invention to provide a combustion unit where the aforementioned critical factors of the circulation process are accommodated in such a manner that an improved and particularly efficient construction is obtained.

To obtain these objectives the combustion unit according to this invention is mainly characterized in that the means for supplying fuel to the grate structure and the means for removing the coarse material in the fuel are formed in at least one group which penetrates the grate structure essentially at a same point. This solution brings about a structure which is constructionally simple to realize and leaves material transport undisturbed.

According to one particularly advantageous embodiment of the invention the outlet opening of the return duct coming from the particle separator, for the coarse material, is placed on top of at least one of the

5 aforementioned groups. This solution brings about a compact structure wherein fuel supply, removal of the coarse material and return of the solid material can all be brought into connection with the grate structure to constitute a single unit.

Some further advantageous embodiments of this invention are presented in the other subclaims.

10 The invention will now be illustrated more closely in the following description referring to the enclosed drawing which shows a cross-sectional view of the combustion unit according to the invention, at the point where the grate structure is located.

As far as the general structure of the combustion unit is concerned, reference is made to the prior art in the field and especially to Finnish application N° FI-90 0436 entitled "Combustion unit", parallel with the present application, which primarily relates to the special arrangement for flue gas inlet placed inside the reactor chamber and the fact that the outer casing of the particle separator is arranged to form a heat transfer surface.

15 In the drawing, the reference number 1 shows a cooled part of the grate structure in the reactor chamber R, which part is provided with an opening 2 delimited by an annular feed chamber 4 which engages with the cooling tubes 3 of the grate structure. The annular feed chamber 4 is used when the heat transfer medium is fed to the return duct.

20 The opening 2 below the grate structure 1 is provided with a casing 5, on the exterior of which is formed an air distribution space 6, within the reactor chamber. The combustion air is transferred from the air distribution space 6 through the nozzles penetrating the grate structure to the upper side thereof, into the fluidized bed (not shown). A vertical feed pipe 7 penetrating the bottom of the reactor chamber is led through the casing 5, and terminates at a distribution chamber 8, at the level of the grate structure 1. In the embodiment shown, four essentially horizontal fuel supply pipes 9 extend from the sides of the distribution chamber casing. These fuel supply pipes are located vertically above the grate structure 1 and placed at 90° with respect to each other as seen from above. The lower part of the feed pipe 7 is provided with a separator unit 10 for obtaining a fuel feed of a suitable composition. Parts 7, 8, and 9 constitute the means for supplying fuel to the grate structure essentially in a radial direction relative to the longitudinal direction of the feed pipe 7,

25 30 35 40 45 50 55 The discharge pipe 11 for the coarse material, which has a conically shaped upper part, extends from the plane of the upper side 1a of the grate structure 1, which is covered with a ceramic material, at the point where the feed chamber 4 is located, and the lower part of the discharge pipe 11 extends inside the casing 5 to a pressurized chamber 12 by means of which the finer material among the coarse material is returned back to the fluidized bed utilizing a so-called

counter flow separation principle. The lower part of the pressurized chamber 12 is provided with a discharge pipe 13 for the coarse material and a blowpipe 14 for blowing the gaseous pressure medium into the pressurized chamber 12 as required by the principle of counter flow separation. The discharge pipe 11 surrounds the feed pipe 7 and therefore the coarse material goes out through an annular duct formed therewith. It is to be noted that the feed pipe 7 is also placed inside the pressurized chamber 12.

The outlet opening of the return duct 15 is placed above the distribution chamber 8 at a distance from its upper surface or the like. In the embodiment of the figure, the return duct 15 is configured as a heat transfer surface. Vertical feed pipes 16 (4 pipes) lead from the feed chamber 4 upwards to an annular distribution chamber 17 at the lower part of the return duct 15. From there on tubes 18, located inside a ceramic protective layer of the wall of the return duct 15 lead the heat transfer medium upwards e.g. to the lower part of the outer casing of the particle separator as described particularly in the parallel application N° FI-90 0436. It is advantageous that in the above-mentioned case at least one of the groups formed by the elements 7, 8, 9 and 11 is placed on the centre line of the reactor chamber R, the latter having a circular cross-section and being placed in a vertical position. In this way, the centre lines of the feed pipe 7 and the discharge pipe 11 coincide with said centre line of the reactor chamber R. Accordingly, a symmetric fuel supply and return of the coarse material is obtained. Therefore, the return duct 15 for the solid material can advantageously be a vertical tube whose upper end is connected to the lower part of the cyclone separator, whereupon its centre line essentially coincides with the centre line of the reactor chamber R.

Claims

1. Combustion unit which for attaining a circulation process comprising :

- a reactor chamber (R), where the lower part is provided with a grate structure (1) for forming a so-called fluidized bed, means for supplying fuel to the upper side of the grate structure into the fluidized bed, means for removing the coarse material of the fluidized bed from the grate structure and means for supplying air into the fluidized bed and
- at least one particle separator which is provided with means for purifying the flue gases from solid material, which flue gases are generated in the fluidized bed and contain solid material, and a so-called return duct for returning the solid material especially to the fluidized bed,

characterized in that the means (7, 8, 9) for sup-

plying fuel to the grate structure and the means (11) for removing the coarse material in the fuel are formed into at least one group which penetrates the grate structure essentially at a same point.

2. Combustion unit according to claim 1, **characterized** in that the outlet opening or the like of the return duct (15) is placed on top of at least one of said groups.
3. Combustion unit according to claim 1, **characterized** in that the means for supplying fuel comprise :
 - essentially a vertical feed pipe (7) and a plurality of elements (8, 9) connected to the upper part of the feed pipe (7) above the grate structure (1) for supplying fuel to the grate structure (1) essentially in a radial direction with respect to the longitudinal direction of the feed pipe.
4. Combustion unit according to claim 3, **characterized** in that said plurality of elements (8, 9) comprises a chamber (8) provided with several feed elements extending radially in the horizontal direction, said elements being preferably tubular elements (9).
5. Combustion unit according to claim 1 and 3, **characterized** in that there is provided, essentially longitudinally around the feed pipe (7), a tubular discharge pipe (11) or the like for the coarse material, which discharge pipe is joined to the opening (2) of the group in question.
6. Combustion unit according to claim 5, **characterized** in that the discharge pipe (11) is arranged to terminate at a separation chamber (12), which is provided with a flow of gaseous pressure medium for separating the finer material, acting according to the counterflow separation principle, from the coarse material and for returning the finer material through said discharge pipe (11) to the fluidized bed onto the grate structure (1) and which separation chamber is provided with an outlet pipe (13), connected at the lower part thereof, for the coarse material.
7. Combustion unit according to claim 5, **characterized** in that the upper part of the discharge pipe (11) is conically enlarged to engage with the edge of the opening (2) of the group in question.
8. Combustion unit according to claim 1, **characterized** in that at least one group formed by the elements (7, 8, 9 and 11) is placed on the vertical centre line of the reactor chamber (R) having a

circular horizontal cross-section.

9. Combustion unit according to claims 1, 2 and 8 5
characterized in that the return duct (15) is vertical and placed so that its centre line coincides with the centre line of the reactor chamber (R).
10. Combustion unit according to claims 1 and 2, 10
characterized in that the opening (2) through which said group penetrates the grate structure comprises, preferably at the side portion thereof, a feed chamber (4) into which the heat transfer medium is arranged to be fed via the grate structure (1) and which is provided with connection tubes (16) or the like, for feeding the heat transfer medium to the return duct, which is preferably configured as a tubular heat transfer surface. 15

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