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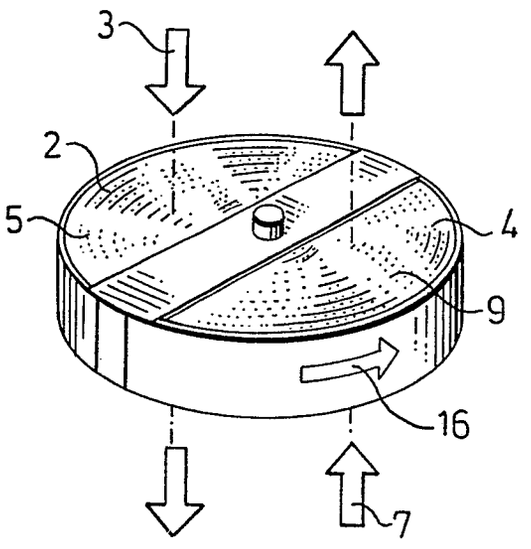
(54) An apparatus for purification of gases.

(57) An apparatus for purification of gases comprises a combustion device, through which a gas is intended to be conducted for combustion and/or conversion of contaminants in the gas. Means are provided to conduct the contaminated gas in one direction (3) through one part (5) of the combustion device (2) and in opposite direction (7) through a second part (9) of the combustion device. As an alternative, the oppositely directed flow can be constituted of a second medium. Said means and/or the combustion device are designed such that each of said opposition directed flows will successively pass through different parts of the combustion device.

Fig. 1



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Description

An apparatus for purification of gases.

The present invention relates to an apparatus for purification of gases, comprising a combustion device, through which a gas is intended be to conducted for combustion and/or conversion of the contaminants of the gas.

In Swedish laid-open specification No. 8403330-7, a method and an apparatus are described for combustion or decomposition of contaminations in gases, the contaminated gas being conducted into a combustion device having a bed of sand, stones or another heat accumulating substance and a heating device for heating the bed to the required temperature. In such a device it is desirable that the maximum temperature and consequently the most efficient combustion and decomposition are attained in the central region of the bed. However, during the operation of the device the temperature gradient in the bed will drift in the direction of the gas flow. In order to solve this problem the direction of the gas flow through the combustion device is changed periodically such that the maximum temperature will be maintained essentially in the central region of the bed. However, this solution requires a complicated gas flow direction changing device.

The purpose of the present invention is to solve, in a much simpler way, the problem related to the drifting temperature gradient in this type of purification apparatus, and to provide in a simpler way an apparatus, which can be operated continuously while maintaining the desired temperature conditions in the combustion device without the need for reversal of the gas flow direction through the combustion device.

This purpose is obtained by an apparatus of the type stated in the introduction with the characteristics set forth in claims 1 or 2.

By constructing the apparatus such that the contaminated gas is conducted in one direction through one part of the combustion device and the contaminated gas or another medium in opposite direction through a second part of the combustion device, each of the two oppositely directed flows being successively passed through different parts of the combustion device, the tendency of the temperature gradient to drift, which is caused by the one flow in a certain part of the combustion device, will be brought back, when subsequently the oppositely directed flow will flow through this part of the combustion device. Thus, by continously reversing the flow direction in the different parts of the combustion device the drift of the temperature gradient is avoided in a simple way.

It appears to be an advantage to utilize the contaminated gas as a sole medium in the two oppositely directed flows. However, it is also possible to utilize a second (clean) medium in the oppositely directed flow. However, this second medium will have a cooling effect on the combustion device and consequently this embodiment is less attractive from the point of view of energy consumption.

According to an advantageous embodiment the combustion device is mounted in a rotor, stationary supply means being provided to conduct the flows mainly parallel to the axis of the rotor in opposite directions through different parts of the rotor. Due to the rotation of the rotor the oppositely directed flows will then successively pass through different parts of the combustion device.

According to another advantageous embodiment said supply means comprise a system of movable ducts for the oppositely directed flows, which are passed through the different parts of the combustion device due to the motion of the ducts, the combustion device being stationary.

The combustion device comprises a bed of sand, a ceramic material or another heat resistant material and a source of heat for heating the bed. The source of heat can be formed of electric heating coils or burners for a suitable fuel, such as a gas, oil or a solid fuel, the embodiment with stationary bed being particulary advantageous, since feeding of electric current or gas, oil or another fuel to the bed is possible by simple solutions, from electric sources or fuel containers situated outside the combustion device.

Exemplary embodiments of the apparatus according to the invention will be described in more detail with reference to the accompanying drawings, on which

Fig. 1 shows a first embodiment of the apparatus according to the invention with the bed positioned in a rotor;

Fig. 2 a second embodiment having a system of movable ducts for supply of oppositely directed flows to the bed;

Fig. 3 a third embodiment having a rotating bed positioned in a combustion chamber; and

Fig. 4 a fourth embodiment having a stationary bed in a combustion chamber.

In fig. 1 an embodiment having a slowly rotating rotor 2 is shown. A combustion device for combustion and/or conversion of the contaminations of the gas is disposed in the rotor. The combustion device comprises a bed 4 of sand, a ceramic material or another heat resistant material and a source of heat, not shown in detail, for heating the bed to the required temperature.

The gas, which is to be purified, is passed through one half 5 of the bed 4 in one direction 3 and in the opposite direction 7 through the other half 9 of the rotor 2. The tub flows 3 and 7 are preferably both constituted of contaminated gas, to be purified, but it is also possible that one of the two flows is constituted of another (pure) medium, e.g. exterior air, supplied or recirculated air to a process. The gas flows, which are schematically illustrated by the arrows 3 and 7, are supplied to the combustion device in a known manner through supply ducts (not shown).

As the rotor 2 is slowly rotating in the direction of the arrow 16, the flows of contaminated gas will

continuously pass through different parts of the combustion bed and those parts of combustion bed 4, through which the gas has passed in a certain direction during a certain period of time will successively reach that part of the device, where an oppositely directed flow passes through the bed, the tendency of the temperature gradient to drift, arisen during the passage of the contaminated gas in the one direction 3, being corrected by the flow 7 in the opposite direction. Thus, in this way only a very limited temperature gradient drift will be possible, such that the maximum temperature will be maintained substantially in the center of bed 4, where it is desirable that the combustion or the conversion mainly is to take place.

The heating of the bed 4 is preferably realized in this embodiment by electric heating coils in the bed (not shown in detail), which coils are fed in known manner by means of slip rings, because the bed is rotating.

However, it is also possible to provide the heating by burning gas, oil or another suitable fuel, fuel containers then being suitably mounted inside the rotor. This is quite possible, since in practice the dimentions of the rotor are substantial. Since the apparatus according to the invention is particularly adapted for purification of large gas volumes having a comparatively low concentration of contaminants the diameter of the rotor is typically of the order of 10 m.

In fig. 2 a second embodiment is shown, in which the combustion device with its bed 6 is stationary, while a system of movable ducts 8,10 is arranged for supply of the contaminated gas in oppositely directed flows through different parts of bed 6.

Thus, a flow of the contaminated gas is introduced at 12 and passes through the bed 6 from the top downwards to the bottom in fig. 2, an oppositely directed flow passing through the bed 6 and the duct 10.

The duct 10 is rotatable around a vertical axis in fig. 2 inside the duct 8, such that the flow 14 through the duct 10 successively passes through different parts of the bed 6, while the flow 12 simultaneously passes in the opposite direction through other parts of the bed 6, which are positioned outside the duct 10, the temperature gradient drift thus being continuously corrected or counteracted so that the maximum temperature will all the time remain within a comparatively narrow region in the center of the bed 6.

In fig. 3 an embodiment having a rotating bed 16 is shown, disposed in a combustion chamber 18, in the upper part of which a burner 20 is mounted. The flow 22 of contaminated gas is first conducted through a first part of the bed 16, through the space 24 and in the opposite direction, at 26, through another part of the bed 16. Because of the rotation of the bed 16 the flows 22 and 26 will successively be moved to different parts of the bed.

As mentioned above, the embodiments according to fig. 1 and 2 are designed such that the temperature is maximum in the central region of the bed. In the embodiment according to fig. 3 on the contrary the maximum temperature of the bed 16 will be in its upper part due to the position of the source of heat 20. The gas flow 22 will then be heated when passing through the bed 16. In the space 24 the gas can be further heated due to the combustion of fuel supplied from outside and due to possible combustion of e.g. solvents present in the gas. When passing in the opposite direction through the bed 16 the gas 26 will be cooled again, the temperature at the outlet from the bed 16, however, being somewhat higher than at the inlet into the bed 16.

In fig. 4 an embodiment is shown having a stationary bed 28 in a combustion chamber 30, in the upper part of which a burner 32 is disposed. The temperature conditions in the apparatus are in this embodiment mainly the same as in the embodiment according to fig. 3.

The contaminated gas is supplied under pressure to the bed 28 through a rotating duct 34 and due to the rotation of duct 34 the flow 36 of contaminated gas will be moved successively to different parts of the bed 28, the gas flow 38 passing through the bed in the opposite direction outside the area of supply duct 34 also being displaced to different parts of the bed due to the rotation of the duct 34 in a way analogous to that of the embodiment according to fig. 2.

It is possible in the embodiments according to fig. 3 and 4 that it is not necessary to operate the burners continuously with fuel from exterior. It can e.g. be sufficient to operate the burners only during an initial period of time until the temperature in the combustion chamber is sufficiently high, after which the combustion of contaminants, e.g. solvents, in the gas may be sufficient in order to maintain the required temperature for a continued operation.

The embodiments with a stationary bed have certain practical advantages, because the feeding of the sources of heat of the apparatus may be carried out in a simple way from electric sources or fuel containers situated outside the apparatus.

In the apparatus according to the invention the gas to be purified can of course be supplied to the combustion device in more than two flows, every second flow passing the combustion device in one direction and every second flow in the opposite direction.

The apparatus according to the invention can be generally used for purification of gases. As examples can be mentioned destructions of solvents from paint industry, printing trade and car manufacturing plants. The apparatus is particularly suitable for purification of large gas volumes having a low concentration of contaminants.

Claims

1. An apparatus for purification of gases, comprising a combustion device, through which a gas is intended to be conducted for combustion and/or conversion of contaminants of the gas, **characterized** in that means are provided to conduct the contaminated gas in one direction through one part of said combustion device and in opposite direction through a

second part of the combustion device, said means and/or said combustion device being designed such that each of the oppositely directed gas flows will successively pass through different parts of said combustion device.

2. An apparatus for purification of gases, comprising a combustion device, through which a gas is intended to be conducted for combustion and/or conversion of contaminants of the gas **characterized** in that means are provided to conduct the contaminated gas in one direction through one part of said combustion device and a second medium in opposite direction through a second part of the combustion device, said means and/or said combustion device being designed such that each of the oppositely directed flows of the gas and said second medium will successively pass through different parts of said combustion device.

3. The apparatus according to any of claims 1 and 2, **characterized** in that said combustion device comprises a bed of sand, a ceramic material or another heat resistant material and a source of heat for heating said bed.

4. The apparatus according to claim 3, **characterized** in that said bed is disposed in a rotor and in that said means are arranged to conduct the flows substantially parallel to the axis of the rotor in opposite directions through different parts of the rotor, said flows being moved to different parts of said bed by rotation of the rotor.

5. The apparatus according to claim 3, **characterized** in that said bed is mounted stationary and in that said means comprise a system of movable ducts, which are disposed to successively move each of said oppositely directed flows so that they will pass through different parts of said bed.

6. The apparatus according to any of claims 3-5, **characterized** in that said source of heat comprises an electric heating coil embedded in said bed or a burner for gas, oil or another fuel.

7. The apparatus according to claims 4 and 6, said source of heat comprising a burner for gas, oil or another fuel, **characterized** in that a fuel container is disposed in said rotor.

8. The apparatus according to any of claims 1-5, **characterized** in that said combustion device comprises a combustion chamber with said source of heat positioned outside said bed.

9. The apparatus according to any of claims 1-8, **characterized** in that said means are disposed to conduct more than two flows having alternately opposite directions through different parts of said combustion device.

Fig. 1

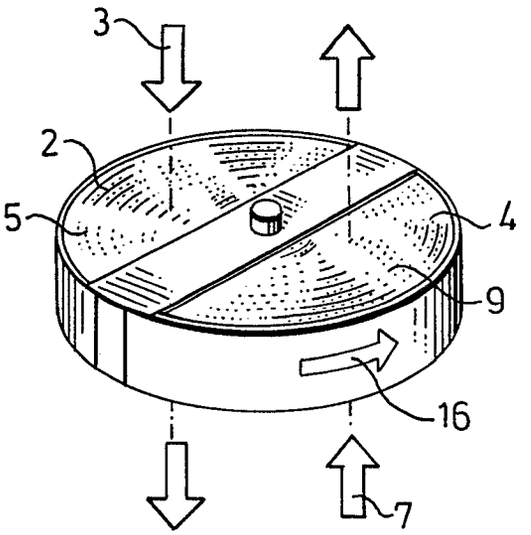

Fig. 2

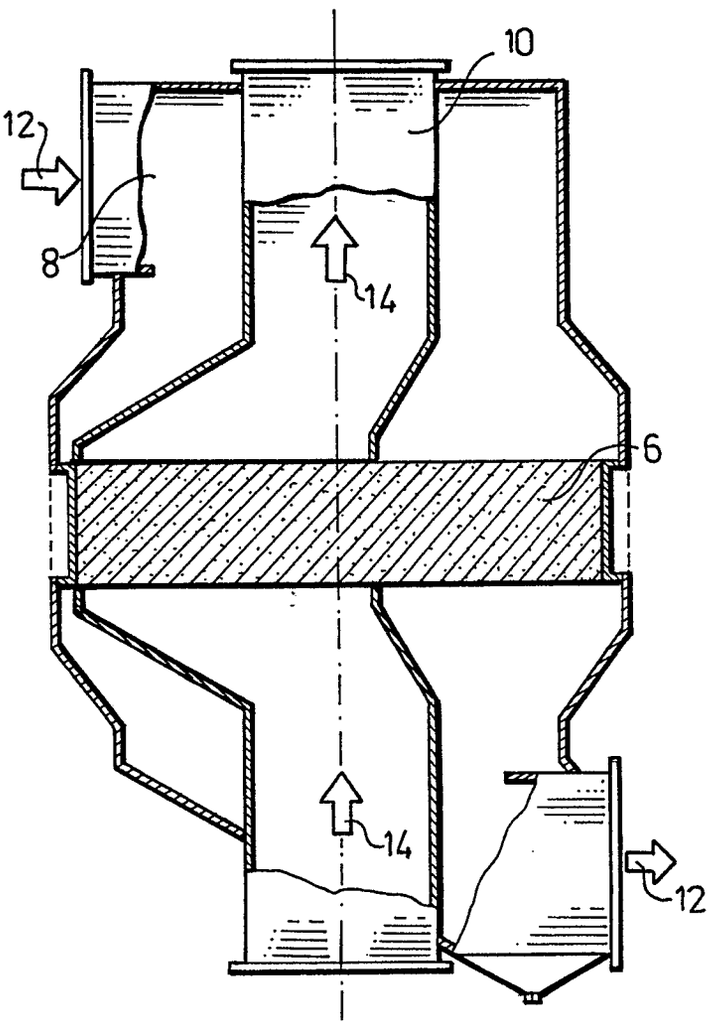

Fig. 3

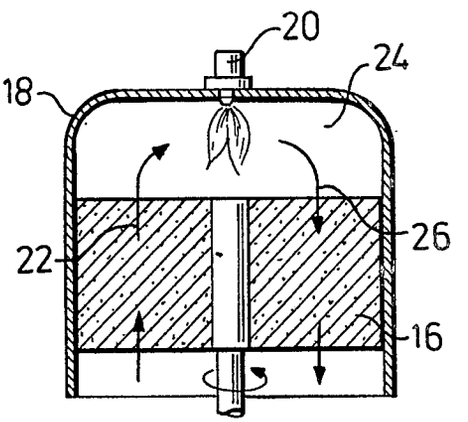

Fig. 4