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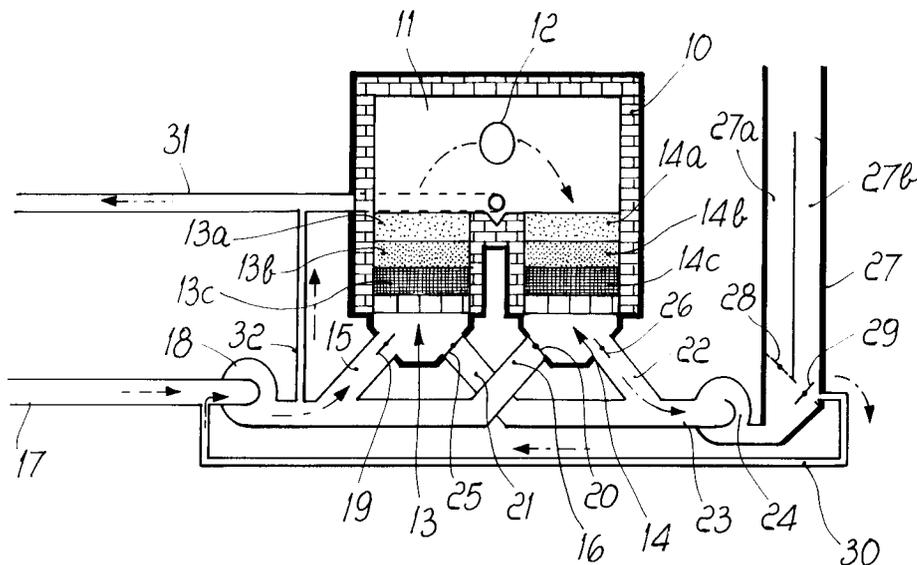
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**Improved thermal disposal unit.**

A thermal disposal unit of the type which comprises a combustion chamber (11) which communicates with a plurality of thermal buffers (13, 14) each selectively connectable, at an opposite side thereof with respect to the combustion chamber (11), to a forced-flow duct (17) for conveying gases to be purified and to a gas emission duct (23) for conveying purified gases. Each thermal buffer (13, 14) is constituted by an accumulation mass (13a,

13b, 14a, 14b) for exchanging heat with the conveyed gases. Furthermore, the emission conduit (23) communicates with a flue divided into two chambers (27a, 27b) which are open to the atmosphere. One of the chambers (27b), which acts as a plenum chamber, is in constant communication with an aspiration zone of the duct (17) for conveying gases to be purified.



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The present invention relates to a thermal disposal unit; more particularly, it relates to a regenerative thermal disposal unit.

It is known that many industrial processes, for example the resin-bonding of fiber mats, generate gaseous emissions which must be purified before being discharged into the atmosphere.

Maximum allowable concentrations for pollutants are determined by the laws in force in each country.

Particularly in the case of resin-bonding of fiber mats, in which the raw material used is phenol-formaldehyde thermosetting resin with the addition of hexamethylenetetramine, the generated pollutants are phenol, formaldehyde and ammonia; these substances are currently eliminated by regenerative reheating, i.e. in a process in which recovery of the heat contained in the outgoing purified gases occurs by direct contact between the gases and a mass of material capable of accumulating and giving back heat without interposing exchange surfaces.

The heat generated in thermal disposal is also used to heat the raw materials during the process.

A first type of regenerative thermal disposal unit used downstream of industrial processes which emit gaseous pollutants comprises a combustion chamber with which two thermal buffers are connected; each buffer is constituted by an accumulation mass made of refractory material, generally a mass of ceramic fragments having the most disparate shapes.

Each one of the thermal buffers is selectively connected, on the side opposite to the combustion chamber, to a forced-flow duct for gas to be purified and to a forced-flow duct for the emission of purified gases.

In a first step of the process, the polluted gas to be purified passes into the combustion chamber through the first thermal buffer and then into the second thermal buffer and into the stack or flue through the emission duct.

The first thermal buffer transfers heat to the incoming cold gas, and the second thermal buffer stores heat contained in the gas which has just flowed through the combustion chamber.

In a second step, the flows are reversed and the gas to be purified passes through the second thermal buffer, the combustion chamber, the first thermal buffer and then flows into the stack.

During the transitory period in which the flows are switched, the quality of the emission discharged into the atmosphere is intolerable, since any pollutants which have remained trapped for example in the first buffer and have not passed into the combustion chamber are removed and thus discharged into the environment without being eliminated.

In order to avoid this phenomenon it is necessary to resort to complicated and expensive plant, with solutions entailing three or more thermal buffers which are used in a cyclic manner to: transfer heat to the cold gas entering the combustion chamber; accumulate the heat of the hot gas arriving from the combustion chamber; flush the mass before using it to accumulate the heat contained in the outgoing purified gas; incinerate the residues which have accumulated in the mass and which simple flushing has failed to remove.

However, the industrial plant required to implement such solutions are very complicated, sophisticated and expensive.

Furthermore, the heat accumulation masses used so far have proved to have a limited accumulation capacity.

An aim of the present invention is to provide an improved regenerative thermal disposal unit which provides an equivalent performance despite constructive solutions which are simpler and less expensive than those described above.

A primary object is to maximize the total heat accumulation capacity and minimize the cost of the material to be used.

Another important object is to have direct and immediate use of all the heat required for the technological cycle to which the thermal disposal unit is coupled.

Another important object is to eliminate the flushing and incineration sections despite eliminating uncontrolled emissions.

Another object is to provide a thermal disposal unit which can be constructed with conventional equipment and facilities.

With the foregoing aim and objects in view, the invention provides an improved thermal disposal unit of the type which comprises a combustion chamber to which a plurality of thermal buffers are connected, each thermal buffer being constituted by an accumulation mass adapted for exchanging heat with flowing gas, each one of said thermal buffers being selectively connected, on the side opposite to the combustion chamber, to a forced-flow duct for gas to be purified and to a forced-flow duct for gas emission, said thermal disposal unit being characterized in that said emission duct is selectively connected to a chamber acting as a plenum chamber and constantly connected to the intake region of said duct for the gas to be purified.

Advantageously, said chamber acting as a plenum chamber is open onto the atmosphere, since it constitutes part of a stack which is divided into two selectable chambers, the other chamber being suitable for the discharge of the purified gases into the atmosphere.

Advantageously, two thermal buffers may be provided.

Conveniently, the accumulation mass is diversified by layers, from the side closest to the combustion chamber to the opposite side.

Further characteristics and advantages of the present invention will become apparent from the following detailed description of an embodiment thereof, illustrated only by way of non-limitative example in the accompanying drawing, wherein the single drawing figure is a schematic view of the thermal disposal unit according to the invention.

With reference to the above figure, a regenerative thermal disposal unit according to the present invention comprises, within an appropriate refractory external covering 10, a combustion chamber 11, with an associated burner 12, which is arranged above two thermal buffers, respectively 13 and 14, which each have an upper part connected to said chamber.

Each one of said thermal buffers is constituted by an accumulation mass suitable to exchange heat with the flowing gas.

The accumulation mass is diversified by layers which are constituted, from the side closest to the combustion chamber to the opposite side, by a first layer, respectively 13a and 14a, of sintered silica pellets; by a layer, respectively 13b and 14b, made of small pieces of ceramic material which expediently have a small saddle-like shape; and by a stack, respectively 13c and 14c, of layers of drawn iron net.

On the side opposite to the combustion chamber 11, the thermal buffers 13 and 14 are connected to a duct 17 for gas to be purified, respectively by means of ducts 15 and 16; said duct 17 is conveniently of the forced-flow type by means of a blower 18.

The ducts 15 and 16 can be closed by means of high-efficiency (high-tightness) gates, respectively 19 and 20, which are located at their outlets into the thermal buffers 13 and 14.

Also on the side opposite to the combustion chamber 11, the thermal buffers 13 and 14 are connected, respectively by means of ducts 21 and 22, to a gas emission duct 23 which is conveniently of the forced-flow type which is activated by means of a blower 24.

The ducts 21 and 22 can be closed by means of high-efficiency (high-tightness) gates, respectively 25 and 26, which are located at the outlets of said ducts into the thermal buffers 13 and 14.

The gas emission duct 23 ends with a stack or flue 27 which is open onto the atmosphere and is longitudinally divided into two chambers, respectively 27a and 27b, the inlet whereof can be closed by means of high-efficiency (high-tightness) gates, respectively 28 and 29.

One of these chambers, particularly the chamber 27b, acts as plenum chamber and is constantly

connected by means of a duct 30 to the intake of the blower 18 of the duct 17.

The thermal disposal unit is completed by a duct 31 for conveying the hot gases from the combustion chamber to the area where the industrial process to which it is coupled is used, and by a gas recycling duct 32 which connects the delivery of the blower 18 to the duct 31 and is suitable to adjust the temperature of the hot gas sent to the user.

As regards the operation of the thermal disposal unit described above, in a first step the gas to be purified as illustrated in figure 1, drawn by the blower 18, is fed into the thermal buffer 13, with the gate 19 open and the gate 25 closed; the gas is preheated and passes into the combustion chamber 11 and then into the thermal buffer 14, purging it from the residues accumulated during its preceding function of preheating the polluted gas.

The flushing gas, with the gate 20 closed and the gate 26 open, is sent into the chamber 27b of the stack 27, with the gate 28 closed and the gate 29 open.

The large available volume of the chamber 27b acts as a plenum chamber.

Very hot gases present in the combustion chamber 11 are recycled for use in an amount which is more than sufficient to provide all the heat required by the technological process.

Only purified gases flow out of the chamber 27a.

In a second step, the gas to be purified, drawn by the blower 18, is fed into the thermal buffer 13, with the gate 19 open and the gate 25 closed, and is preheated therein.

The gas then flows into the combustion chamber 11 and preheats the thermal buffer 14 (where by this time all the residues have been eliminated).

The flushing gas, previously accumulated in the chamber 27b of the stack 27, continues to be drawn by the blower 18 so as to be subjected to further purification.

The large volume of the chamber 27b provides the time necessary for the progressive elimination of all the substances accumulated therein during the purging of the thermal buffer 14.

In a third step, the gas to be purified, drawn by the blower 18, is fed into the thermal buffer 14, with the gate 20 open and the gate 26 closed, and is preheated therein.

The gas then flows into the combustion chamber 11 and purges the thermal buffer 13.

The flushing gas, with the gate 19 closed and the gate 25 open, is sent into the chamber 27b of the stack 27 to be sent conditioning through the duct 30, by means of which it is connected to the intake of the blower 18.

After the third step, the situation described earlier reoccurs, with the only difference that the thermal buffers swap their functions.

The functions of the two parts into which the stack is divided remain unchanged, i.e. the chamber 27b still acts as plenum chamber, whereas the chamber 27a, discharges into the atmosphere the gases which are fully oxidized and contain no pollutants.

At this point the fact should be stressed that in the described thermal disposal unit there are only two thermal buffers, and that purging/flushing occurs in them with the gas flow directed from the combustion chamber outwards, i.e. in the same direction in which incineration is normally performed.

The thermal disposal unit thus effects a flushing process taken to the limit of incineration.

The emission of polluted gas produced by purging/flushing is confined in one of the two chambers into which the stack is divided, and said chamber is constantly connected to the negative-pressure branch upstream of the thermal disposal unit.

There is no risk of leakage into the atmosphere, since:

- the volume of the chamber suitable for accumulating the flushing gas is oversized with respect to the amount to be stored;
- the accumulation chamber of the stack is connected to the manifold which draws the gas to be purified, and is thus constantly subjected to a gas recycling action, thus preventing the escape of the gas from the free upper end of said chamber.

It should also be stressed that the differentiation of the filling mass has the advantage, with respect to known solutions, in addition to a lower overall cost of the material employed, of exploiting the most favorable combination of the product of specific heat and relative density of the iron, with consequent greater heat accumulation capacity.

Another advantage of the thermal disposal unit according to the present invention resides in that 100% of the heat required for the technological process is produced in the combustion chamber.

In practice it has been observed that the apparatus according to the present invention is much simpler and much less expensive than current ones, and it constitutes an environmental protection means. Therefore the aim and objects of the present invention have been achieved.

The invention thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the inventive concept.

All the details may furthermore be replaced with other technically equivalent elements.

In practice, the materials employed, so long as they are compatible with the contingent use, as well as the dimensions, may be any according to the requirements.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

## Claims

1. Improved thermal disposal unit of the type comprising a combustion chamber to which a plurality of thermal buffers are connected, each thermal buffer being constituted by an accumulation mass adapted for exchanging heat with flowing gas, each one of said thermal buffers being selectively connected, on the side opposite to the combustion chamber, to a forced-flow duct for gas to be purified and to a forced-flow duct for gas emission, said thermal disposal unit being characterized in that said emission duct is selectively connected to a chamber acting as a plenum chamber and constantly connected to the intake region of said duct for the gas to be purified.
2. Thermal disposal unit according to claim 1, characterized in that said chamber acting as a plenum chamber is open onto the atmosphere and is part of a stack which is divided into two selectable chambers, the other chamber being suitable to emit purified gas into the atmosphere.
3. Thermal disposal unit according to claim 1, characterized in that there are two of said thermal buffers.
4. Thermal disposal unit according to claim 1, characterized in that said accumulation mass is composed of layers of different material from the side of said combustion chamber to the opposite side.
5. Thermal disposal unit according to claim 4, characterized in that said layers comprise at least one first layer of sintered silica pellets, at least one second layer of pieces of ceramic material, and a plurality of layers of drawn iron net.
6. Thermal disposal unit according to one or more of the preceding claims, characterized in

that selection of the passages in said forced-flow ducts is performed by means of gates.

7. Thermal disposal unit according to one or more of the preceding claims, characterized in that said chambers of said stack are selected by means of gates. 5
8. Thermal disposal unit according to one or more of the preceding claims, characterized in that the flow of said ducts is forced by means of respective blowers. 10
9. Thermal disposal unit according to one or more of the preceding claims, characterized in that said combustion chamber is connected to the user by means of a hot gas conveyance duct. 15
10. Thermal disposal unit according to one or more of the preceding claims, characterized in that it comprises a duct for gas recycling between the delivery region of said duct for the gas to be purified and said duct for conveying hot gases to the user. 20  
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11. Thermal disposal unit according to one or more of the preceding claims, characterized in that the volume of said chamber which acts as a plenum chamber is oversized with respect to the amount of gas to be stored and is constantly subjected to a recall action from said duct for the gas to be purified. 30

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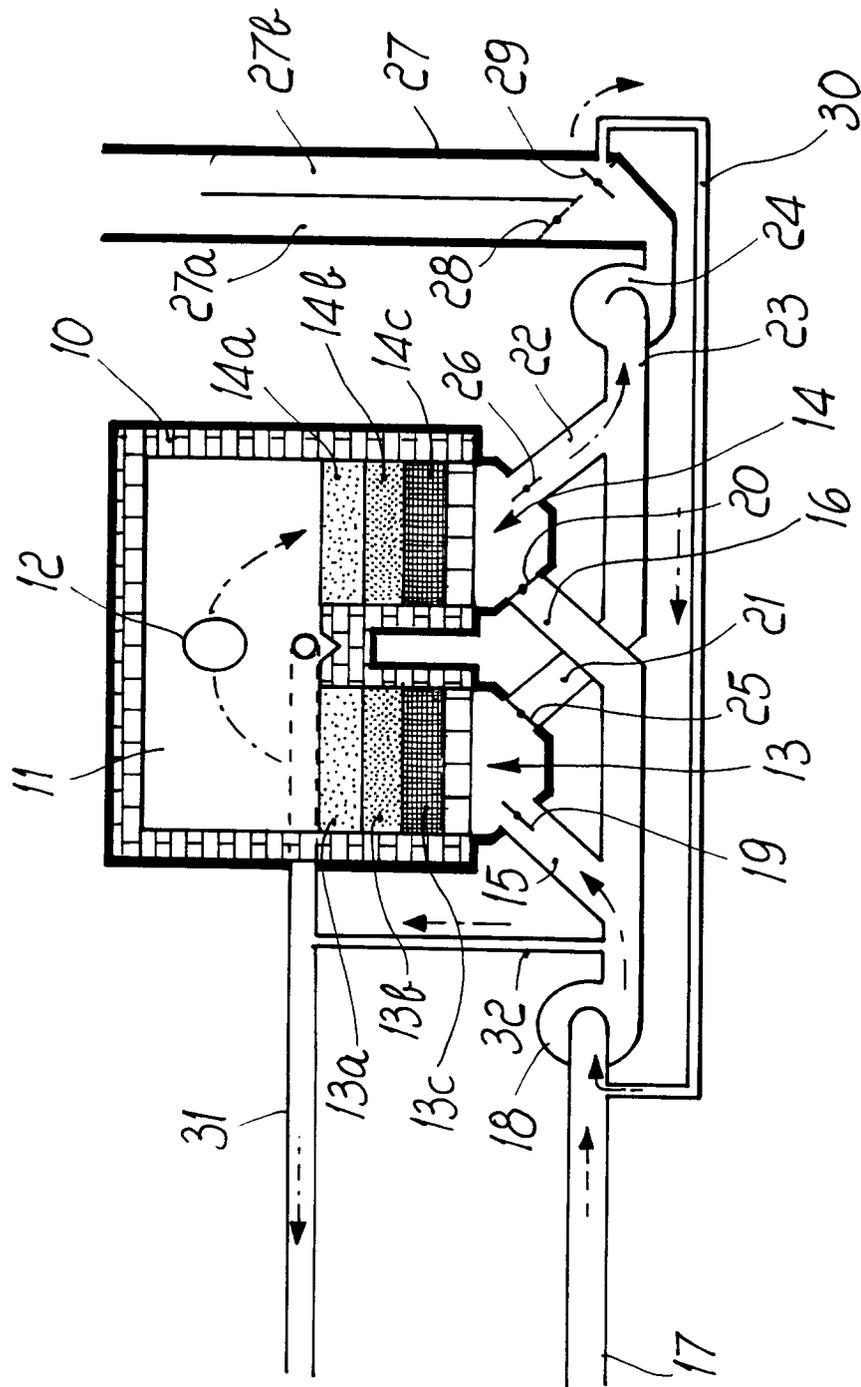
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	WO-A-86 00389 (HEED) * page 5, line 14 - page 6, line 28; figure *	1,3,6,7, 11	F23G7/06
Y	---	4	
Y	US-A-3 404 965 (SHILLER) * column 3, line 40 - line 44; figure 4 *	4	
A	EP-A-0 365 262 (HALDOR TOPSOE) * page 3, line 50 - page 4, line 34; figure 2 *	1	
A	FR-A-2 473 695 (ALUMINIUM PECHINEY) * page 5, line 22 - page 6, line 19; figure 1 *	4	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			F23G F28D F23L
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 6 December 1993	Examiner Coli, E
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			