

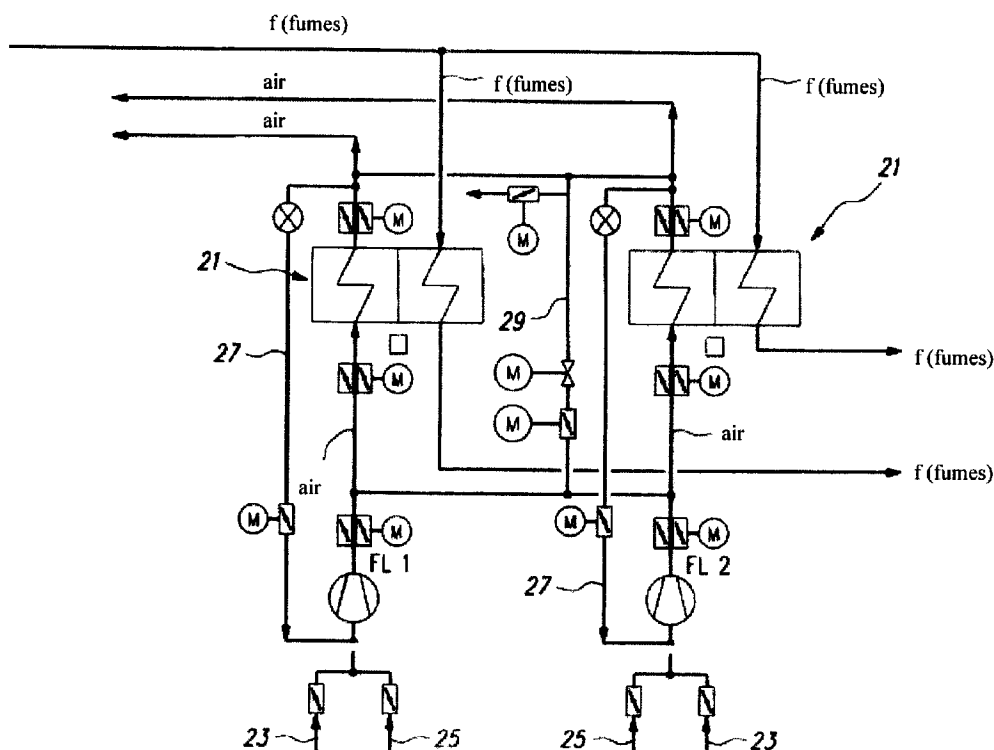


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(71) Demandeur/Applicant:
ALSTOM TECHNOLOGY LTD, CH
(72) Inventeurs/Inventors:
GIETZ, MANFRED, DE;
SCHULER, VOLKER, DE;
FALLER, BERTHOLD, DE
(74) Agent: SMART & BIGGAR

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(54) Title: METHOD FOR OPTIMISED OPERATION OF AN AIR PREHEATER AND AIR PREHEATER



(57) Abrégé/Abstract:

A method for operating an air preheater (21) is disclosed, by means of which the heat transfer capacity can be increased without fear of condensation appearing on the cold side of the rotor or ash deposits on the hot sheets.

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US): **ALSTOM TECHNOLOGY LTD.** [CH/CH]; Brown
Boveri Strasse 7, CH-5400 Baden (CH).

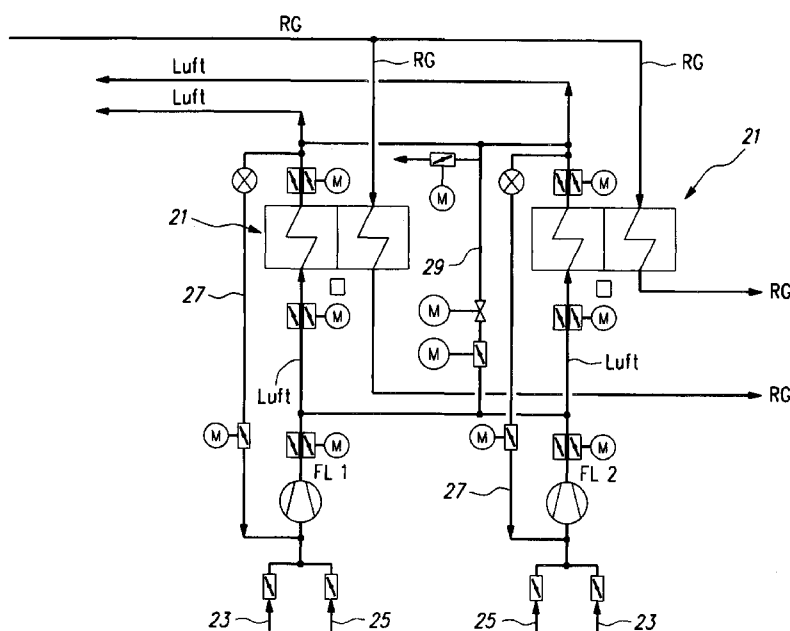
(72) Erfinder; und

(75) Erfinder/Anmelder (nur für US): **GIETZ, Manfred**
[DE/DE]; Mochelstr. 1, 70619 Stuttgart (DE). **SCHÜLER,**
Volker [DE/DE]; Beintweg 2a, 69181 Leimen (DE).**FALLER, Berthold** [DE/DE]; Gerhart-Hauptmann-Str.
21, 69120 Heidelberg (DE).(74) Anwalt: **HELLWIG, Tillmann;** Dreiss, Fuhlendorf,
Steimle & Becker, Postfach 10 37 62, 70032 Stuttgart
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(54) Title: METHOD FOR OPTIMISED OPERATION OF AN AIR PREHEATER AND AIR PREHEATER

(54) Bezeichnung: VERFAHREN ZUM OPTIMIERTEN BETRIEB EINES LUFTVORWÄRMERS UND LUFTVORWÄRMER



Luft = air

(57) Abstract: A method for operating an air preheater (21) is disclosed, by means of which the heat transfer capacity can be increased without fear of condensation appearing on the cold side of the rotor or ash deposits on the hot sheets.

(57) Zusammenfassung: Es wird ein Verfahren zum Betreiben eines Luftvorwärmers (21) vorgeschlagen, mit dessen Hilfe die Wärmeübertragungsleistung erhöht werden kann, ohne dass Kondensationserscheinungen auf der kalten Seite des Rotors oder Ascheablagerungen an den Heizblechen zu befürchten sind.

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Title: Method for optimised operation of an air preheater and air preheater

Description

Regenerative air preheaters have been known of for several
5 decades and have proven themselves in use. The so-termed
Ljungström air preheater with a rotor that has one or more layers
of heating plates is particularly advantageous. In air
preheaters, the air to be heated normally flows, in a housing
with at least one air inlet, at least one air outlet, counter to
10 the fumes to be cooled and at least one fumes outlet. The
transfer of heat from the fumes to the air occurs by means of the
heating plates of the rotor. The invention is not limited to
specific designs of regenerative air preheaters, but can, for
example, be used successfully in bisector and trisector air
15 preheaters with several air inlets and outlets and also several
fumes intakes and outlets.

Naturally, the temperature of the heating plates varies, in
otherwise constant operating conditions, with each rotation of
the rotor. While hot fumes flow round the heating plates, the
20 temperature does not increase. Following this, the heating plates
are flowed over by the cooler air and give off heat into this
air. The temperature of the heating plates further sinks in this
way.

With this, the temperature behaviour of a given point on
25 the heating plates, shown graphically, is comparable to a saw
tooth outline or waved line. The frequency of this waved line
depends on the rotational speed of the rotor. The amplitude of
the waved line depends on the rotor's rotational speed, the
intake temperature and mass flow of the fumes and also the mass
30 flow of the air.

Of course, the characteristics of the heating plates such
as the heat transfer coefficient and the heat storage capacity
also affect the amplitude of the temperature variations.

The point within the rotor has a substantial effect on the position and amplitude of the waveform temperature variations. The highest heating plate temperature is located at an end of the rotor, also known as the hot side, that of the intake of fumes and outlet of air. The lowest heating plate temperature occurs at the other end, also known as the cold side, that of the outlet of the fumes and the air inlet. Since the greater temperature difference between the air and the fumes occurs on the cold end, the temperature amplitude is at its greatest at that point.

10 This relationship can be seen from fig. 4.

In order to prevent condensation or deposition of fumes constituents on the heating plates, an air preheater should be continually operated such that there is no condensation of the fumes at any point on the rotor. This means that the heating plates should at no time, and at no point on the rotor, fall below a minimum temperature $T_{\min}$ that, among other things, depends on the water, SO_3 - and dust content of the fumes.

In order to ensure this, in today's air preheaters, the air intake temperature is frequently raised by means of steam air preheaters or hot air recirculation is raised, more than is strictly necessary, and/or the mass flow of the air through the air preheater is kept lower than is required (with an air bypass channel). With this, the air preheater's capacity is not fully utilized, resulting in a drop in the overall efficiency of the given power unit and hence the economy of the power unit is reduced.

The aim of the invention is to produce a process for operating an air preheater with the aid of which it can, on the one hand, be ensured that the minimum temperature of the heating plates is not fallen below in any operating circumstances or at any point on the rotor, and that simultaneously ensures that maximum possible heat transfer from fumes to air concerned is achieved.

The aim of the invention is achieved by a process for operating a regenerative air preheater, with a rotor, with at least one fumes inlet, with at least one fumes outlet, with at least one air inlet and with at least one air outlet, in which

- 5 1. the temperature and
2. the mass flow of the air at the air inlet is determined, and in which
3. the temperature and
4. the mass flow of the fumes at the fumes inlet is
- 10 determined, and in which
5. the minimum temperature of the heating plates arising for these parameters is determined and controlled such that a set minimum temperature is not fallen below.

Where, in a bisector air preheater for example, an air
15 inlet and a fumes inlet are present, it is enough for a total of two inlet temperatures and two mass flows to be determined.

In this way, it is possible on the one hand to surely prevent corrosion of the heating plates as a result of condensed fume constituents and the deposition of solid fume
20 constituents onto the heating plates, and at the same time to optimize the heat transfer from the fumes to the air.

Since the process in accordance with the invention functions on the basis of the most important parameters, varying operating conditions can also be taken into account with the
25 process in accordance with the invention and the air preheater can consequently be constantly kept at the optimum point of operation.

Since the process in accordance with the invention merely requires knowledge of temperatures and mass flows, which are
30 normally present in any case in the power unit's control means and the control means normally require valves to be present, the costs of carrying out the process are relatively low and very

soon pay for themselves with the savings in fuel costs for the power unit.

It is moreover possible to use the process in accordance with the invention in air preheaters that are already in
5 operation, such that, here also, the increases in efficiency of the power unit, in accordance with the invention, can also be realized.

Operation of the air preheater functioning in accordance with the invention can be further improved by determining the
10 temperature of the fumes at the fumes outlet and of the air at the air outlet, and these parameters are likewise taken into account in determining the minimal temperatures of the heating plates.

In the case of rotors with several layers of heating
15 plates, the minimum temperature of the heating plates is favourably determined at the point of transition from one layer of heating plates to another, since there also there may be localized minimum temperatures of the heating plates.

The minimum temperature of the heating plates can be
20 determined during operation by measuring the actual temperatures arising on the given heating plate. Here it is particularly favourable if these temperatures are determined by measurements made under different operating conditions and these temperature measurements are entered into a performance graph. On the basis
25 of the measured temperatures filed in the performance graph, a control device can determine the actual minimum temperatures of the heating plate and control operation of the air preheater accordingly, with the aid of the given current values of the temperatures and mass flows of the fumes and of the air, by
30 reading off the temperatures set in the performance graph. In this way it is possible on the one hand to carry out the control of air preheaters on the basis of the actually measured values. Additionally, no measuring technology needs to be on the rotor

during the operation of the air preheater. In this way, the process can be very safe, economic and yet accurate.

Alternatively it is also possible to determine the minimum temperature of the heating plates with the aid of a calculation model, by means of a finite elements calculation of the temperatures in the air preheater, particularly though on the rotor heating plates, for example. Here also, it is possible for the minimum temperatures at different operating conditions to be calculated, and for the temperatures calculated in this way to be set down in a performance graph. As explained above, the temperatures stored in the performance graph or characteristic map can be used to control the temperature and/or the mass flow of the air in the air inlet. Alternatively, of course, an FEM calculation can be redone with every change in operating conditions, and the air preheater be controlled in accordance with the calculation results.

It has proven effective and advantageous to raise the air inlet temperature by preheating by means of steam air preheaters or by leading back already heated air from the air outlet to the air inlet, where there is a need to do this. It is moreover favourable if, where necessary, a partial flow of the air to be preheated is skirted past the air preheater in the bypass channel. Both leads to the minimum temperatures on the heating plates rising and consequently the critical minimum temperature is not fallen below. Since these measures can be carried out very easily and the necessary construction of apparatus is easily comprehensible, these measures are particularly suited to controlling an air preheater operated in accordance with the process of the invention.

The aim that is the basis of the present invention is solved by means of a device for controlling an air preheater through its being suited to carrying out the process in accordance with one of the above claims. The same applies to a computer program that is suited to carrying out the said process.

The initially stated aim is likewise solved, by an air preheater with devices for determining the temperature and mass flow of the air at the air inlet and also the temperature and mass flow of the fumes at the fumes inlet, by giving the air
5 preheater a control device operating in accordance with claims 1 to 13.

In an improved variant design of the air preheater in accordance with the invention, the said preheater has devices for determining the temperature and/or the mass flow of the air at
10 the air outlet and/or for making recordings at the fumes outlet.

Further advantages and favourable designs of the invention can be deduced from the attached diagrams, the descriptions of these and from the patent claims. All characteristics shown in the annexed diagrams, or described or mentioned in the
15 description section or the claims can be essential to the invention both separately or in any combination.

The annexed diagrams are as follows:

- Figure 1 a diagrammatic representation of a sectional view through a regenerative air preheater,
- 20 Figure 2 a plan view of a rotor of a regenerative air preheater,
- Figure 3 the temperature behaviour, with time, of a heating plate,
- Figure 4 the most important temperatures, during operation of
25 the air preheater, in relation to the height of the heating blades of the rotor, and
- Figure 5 a circuit diagram of two regenerative air preheaters, with hot air return feed and a cold air bypass channel, operating on the basis of the process in
30 accordance with the invention.

Description of the design examples

Figure 1 shows a lateral view of a regenerative air preheater, with a housing 1 shown sectioned. A rotor 3 is supported in the housing 1 such that it can rotate. The rotor 3 can be set in rotation by means of a drive that is not shown. The rotor's 3 rotation is indicated, in figure 1, by an arrow 5.

Fumes (f) flow, in the direction of the arrows, through the left half of the housing 1. The fumes enter the air preheater at an air inlet 7 and leave the air preheater by a fumes outlet 9. On the way from the fumes inlet 7 to the fumes outlet 9, the fumes flow through the section of the rotor 3 that is located in the left section of the housing 1.

In the design shown in figure 1, the rotor 3 has two layers of heating plates. The so termed hot layer 11 is disposed in the upper part of the rotor 3. The layer 13, known as the cold layer, is located in the section lying below it.

The hot layer 11 and the cold layer 13 differ with regard to their material, their surface coating and geometry and are optimally adjusted to the conditions existing at the time.

An air inlet 15 and an air outlet 17 are disposed on the right-hand side of the air preheater as shown in figure 1. The direction of flow of the air that enters the air preheater by the air inlet 15 and leaves it by the air outlet 17 runs counter to the direction of flow of the fumes.

When the fumes flow through the rotor 3 section, in the left-hand section of figure 1, they give off heat to the heating plates of the rotor 3 and heat the heating plates' hot layer 11 and cold layer 13. The fumes cool simultaneously. This means that an inlet temperature T_f of the fumes at the fumes inlet 7 is higher than an outlet temperature T_f of the fumes at the fumes outlet 9.

If the heating plates, heated in this way, move, through rotation of the rotor, from what is the left-hand section of the air preheater in figure 1 to the right-hand section, then they heat the cold air and themselves cool down. This means that an
5 inlet temperature $T_{a,i}$ of the air at the air inlet 15 is lower than an outlet temperature $T_{a,o}$ of the air at the air outlet 17.

As a result, part of the detectable heat in the fumes is transferred, with the aid of the air preheater, to the air.

In order to prevent mixing of air and fumes, there are
10 axial and radial sealing plates 19 between the left-hand and right-hand sections of the housing 1.

Figure 2 shows a plan view of the rotor 3 of figure 1, diagrammatically showing the radial sealing plates 19. This plan view shows that the rotor 3 comprises different sectors with
15 partitions (tangential faces) (not carrying a reference number). In these segments, the heating plates are packed into containers (not shown). If, for example, the heating plate marked 'X' now turns into the left-hand section of the air preheater, starting from the radial seal, it is then flowed round and heated by the
20 flow of fumes that is present there. This process continues as far as the end of the gas sector. Then, the selfsame segment X leaves the left-hand section of the air preheater, turns through and below the seal 19 and enters the right-hand section of the air preheater. There, the heating plate that is now heated has
25 the cool air flowing round it and thereby gives of heat to the air. This process continues until the end of the air sector is reached.

In figure 3, the temperature behaviour is qualitatively applied to a point on the heating plate over the rotors angle of
30 rotation. At an angle of rotation of approx. 180° , the heating plate leaves the section that is flowed through by the fumes and enters the section of the air preheater that is flowed through by cooler air.

The temperature of the heating plate is marked T_{HP} in figure 3. As can be seen from figure 3, the temperature T_{HP} of the heating plate changes up and down between two temperature limits, namely a maximum temperature $T_{HP, \max}$ and a minimum temperature $T_{HP, \min}$. The
5 average value of the temperature T_{HP} of the heating plate, with time, is marked $T_{HP, a}$ in figure 3.

The heating plate reaches the maximum temperature $T_{HP, \max}$ at an angle of rotation of approx. 180° , while it reaches its minimum temperature at an angle of rotation of approx. 0° or
10 360° .

Obviously, the actual values of the maximum temperature $T_{HP, \max}$ and the temperature $T_{HP, \min}$ depend, among other things, on layout and the point of operation of the air preheater. Hence, the following parameters, for example, are of importance to the
15 temperature T_{HP} of the heating plate: The mass flow m_f and the temperature T_f of the fumes at the fumes inlet 7 and the inlet temperature $T_{a, i}$ and the mass flow m_{air} of the air at the air inlet 15. In particular, the minimum temperature of the heating elements $T_{HP, \min}$ can be raised by changing one of the above
20 quantities.

In order to prevent soiling of the air preheater and the resulting loss of pressure, and also a resulting failure of the power unit block, an air preheater has to be operated such that, on the fumes side, a minimum temperature $T_{\min}$ of the heating
25 elements, particularly on the cold layer of the heating plates, is not fallen below for a long time-period.

The minimum temperature $T_{\min}$ is determined through, among other things, the composition of the fumes. Here, the water, SO_3 - and dust content, and also the ash composition, here especially
30 the Ca- and Mg- content, are of particular importance. If the composition of the fumes is known, then the minimum temperature $T_{\min}$ can be calculated.

In order to ensure safe operation of the air preheater in spite of variations in quantities having an influence, such as the inlet temperature of the fumes T_f , the mass flow m_f of the fumes, the air inlet temperature $T_{a,i}$ and the mass flow m_a of the air, the air preheater is normally operated such that the minimum temperature $T_{HP, \min}$ of the heating plate is higher than the above-mentioned minimum temperature at which the fumes condense or solid constituents of the fumes adhere to the heating plates.

The larger the 'safety gap' between the actual minimum temperature $T_{HP, \min}$ occurring on the heating plate and the minimum temperature $T_{\min}$, the more heat goes lost, unused, in the fumes. This leads to a reduction in efficiency of the power unit block and thereby to increased emissions and fuel costs.

Figure 4 shows essential and characteristic temperatures plotted in relation to heating plate height H , as occurs while the air preheater is in operation.

The heating plate height H is also shown diagrammatically in figure 1. It starts at the upper rim of the rotor 3, where the hot fumes first enter onto the rotor 3.

In figure 4, heating plate height is plotted on the X-axis, and, as for the rotor in accordance with figure 1, is divided up into a hot 11 and a cold 13 layer. The uppermost line in accordance with figure 4 is the fumes temperature T_f , while the lowest temperature is that of the air T_{air} . Both the fumes temperature T_f and the air temperature T_a can of course change with flow through the rotor 3. The heating plate temperatures lie between the upper limit T_f and the lower limit T_{air} . This can be seen from the middle heating plate temperature T_{HP} in figure 4.

Figure 4 also shows the maximum temperatures $T_{HP, \max}$ and the minimum temperatures $T_{HP, \min}$ of the heating plates. During operation, the actual temperature of a rotor 3 heating plate moves up and down.

A minimum temperature $T_{\min}$ that, for example, is a little less than approx. 100°C, is entered in figure 4. No part of the rotor 3 must fall below this temperature at any time. Higher temperatures are not critical and do not therefore require any particular attention.

The behaviour of the minimum temperature $T_{\text{HP},\min}$ of the heating plates is particularly important to problem-free operation of the air preheater. Starting with a height on the heating plates $H = 0$ mm, the temperature $T_{\text{HP},\min}$ lies at almost 300°C and is thereby markedly higher than the minimum temperature $T_{\min}$.

The temperature $T_{\text{HP},\min}$ falls with increasing height on the given heating plate. There is a non-uniformity at the point of transition from the hot layer 11 to the cold layer 13, resulting from the changed heat transfer qualities of the two layers 11 and 13.

Since the heat storage capacity of the cold layer 13 is higher than that of the hot layer 11, the minimum temperature $T_{\min}$ climbs at the point of transition to the hot layer 11 from the cold layer 13 again and then falls again. The temperatures $T_{\text{HP},\min}$ and $T_{\min}$ intersect at $H = 1.250$ mm, that is, at the lower end of the rotor 3 in figure 1. This means that the air preheater is optimally operated. On the one hand, as much heat as is possible is transferred from the fumes to the air and, at the same time, the temperature at no point at any time falls below the minimum temperature $T_{\min}$ of the heating plates.

Both the behaviour of the temperatures $T_{\text{HP},\max}$ and $T_{\text{HP},\min}$ and also the minimum temperature $T_{\min}$ depend on the operating conditions of the air preheater.

The actual temperatures on the heating plates, particularly the minimum temperature $T_{\text{HP},\min}$, can be determined on the basis of the place, and the operating parameters T_f , m_f , T_{air} and m_{air} on the

basis of heating plate temperature measurements in the area of the maximum heating plate height H and at each point of transition from one layer 11 to another layer 13 for example. This process is nevertheless not suited to long-term operation, since the high temperatures arising there and the ash content of the fumes and their corrosive constituents greatly limit the useful life of such measuring technique.

It is therefore provided for in accordance with the invention that the temperature of the heating plates be periodically determined at specific points, with the aid of a calculation model of the air preheater. The most measured process parameters m_f , $T_{f,i}$, m_{air} and T_{air} are used as input variables for the calculation model.

Depending on the results of the calculation model, the air preheater is then operated such that the temperature T_{HP} of the heating plates always lies above the minimum temperature T_{min} . For example, the air preheater can be operated such that a constant separation of, for example 5° Kelvin from the minimum temperature T_{min} is maintained.

One or more of the following parameters can be used to control the air preheater: the proportion of internal air sucked up to the external air sucked up can be varied. The temperature $T_{air,i}$ at the air inlet 15 increases as a result of an increase in the proportion of internal air.

It is moreover possible to increase the air inlet temperature by connecting in a steam air preheater, fed with steam, before the air preheater.

The temperature T_{air} at the air inlet 15 can moreover be increased by returning part of the already preheated air from the air outlet 17 back to the air inlet 15 (hot air return feed).

Part of the air at the air inlet can furthermore be divided off and go past the air preheater in the bypass channel ('air bypass').

Figure 5 shows a block diagram of two air preheaters 21 functioning on the basis of the process in accordance with the invention. Since standard symbols have been used in the block diagram, these and the components used are not further described here. Only the most important sub-assemblies and circuits, that are of particular significance to the invention are explained below.

The air preheaters 21 are supplied with fumes f from a boiler that is not shown. Having left the air preheater 21, the fumes f go into the fumes purification unit (not shown).

Air flows through the air preheaters 21 in a direction running counter to that of the flow of fumes f. The air preheated by the air preheater 21 is then supplied to the boiler that is not shown or is used to dry coal or other carbonaceous material.

The air supplied to the air preheaters 21 can come from an external air suction means 23 or an internal air suction means 25, with which air is sucked from the boilerhouse.

Since the internal and external air are at different temperatures, the temperature of the air at the inlet to the air preheater 21 can, within limits, be controlled through selection of the mixing ratio of internal to external air.

A further possibility for raising the air temperature at the air inlet of the air preheater 21 is for a part of the preheated air to be shunted off to the air outlet 17 and be fed back into the air inlet 15. The conduit for this is characterized as a hot air return means 27. A further possible way to influence the parameters of operation of the air preheater 21 is to shunt off part of the air before the air inlet 15 and to direct it past

the air preheaters 21 in the bypass channel. This bypass channel is marked 29 in figure 5.

Figure 5 shows that there are a number of possible ways of raising the air inlet temperature $T_{air,i}$ and to reduce the mass flow m_{air} through the air preheater 21. Therefore, it is always possible to operate the air preheater 21 such that, on the one hand, maximum heat transfer is achieved and, secondly, such that the temperature T_{HP} of the heating plates does not fall below the minimum temperature T_{min} .

Approximation formula for determining the average heating plate temperature T_{HP-KSm} on the cold side of the air preheater:

$$T_{HP-KSm} = (T_{air,i} + f \times (T_{f,i} + \Delta T_{Le})) / (1+f)$$

where

$$T_{air,i} = 37^{\circ}\text{C}$$

$$T_{f,o} = 184^{\circ}\text{C}$$

$$F = f\alpha \times fg$$

with

f : factor of heat transfer and division of the gas and air side of the air preheater

Example:

taking the following values as a basis for the calculation:

$$\Delta T_{Le} = 8 \text{ K}$$

$$f\alpha = 1.37$$

$$fg = 1.44$$

$$f = 1.97$$

gives the minimum heating plate temperature on the cold side as follows:

$$\begin{aligned} T_{HP-KSm} &= (T_{air,i} + 1.97 \times (T_{f,i} + 8\text{K})) / (2.97) \\ &= 140^{\circ}\text{C} \end{aligned}$$

Patent claims

1. Process for operating a regenerative air preheater (21), with a rotor (3), with at least one fumes inlet (7), with at least one fumes outlet (9), with at least one air inlet (15) and
5 with at least one air outlet (17), characterized by the following process stages:

The determination of the temperature ($T_{air, i}$) of the air at the air inlet or inlets (15),

10 The determination of the temperature ($T_{f, i}$) of the fumes at the fumes inlet or inlets (7),

The determination of the mass flow (m_f) at the fumes inlet or inlets (7) and/or the mass flow (m_{air}) of the air at the air inlet or inlets (15),

15 The determination of the minimum temperature ($T_{HP, min}$) of the heating plates (HP) based on temperatures ($T_{air, i}$, $T_{f, i}$) and the mass flows (m_{air} , m_f) of the air at the air inlet or inlets (15) and/or of the fumes at the fumes inlet or inlets (7) and

20 the control of the temperature ($T_{air, i}$) and/or the mass flow (m_{air}) of the air at the air inlet or inlets (15) and/or the temperature ($T_{f, i}$) and/or the mass flow (m_f) of the fumes at the fumes inlet or inlets (7), so that the minimum temperature ($T_{HP, min}$) of the heating plates does not fall below a set minimum temperature (T_{min}).

25 2. Process in accordance with claim 1, characterized in that the temperature ($T_{f, i}$) and the mass flow (m_f) of the fumes at the fumes outlet or outlets (9) are determined, and in that determination of the minimum temperature ($T_{HP, min}$) of the heating plates (HP) occurs on the basis of the temperature (T_f) and/or the mass flow (m_f) of the fumes at the gas outlet or outlets (9).

3. Process in accordance with claims 1 or 2, characterized in that the temperature (T_{air}) and mass flow (m_{air}) of the air at the air outlet or outlets (17) is determined, and in that the minimum temperature ($T_{HP, min}$) of the heating plates (HE) is determined on the basis of the temperature ($T_{air, o}$) and the mass flow (m_{air}) of the air at the air outlet or outlets (17).
4. Process in accordance with claim 1, characterized in that the minimum temperature ($T_{HP, min}$) of the heating plates (HP) is determined.
5. Process in accordance with claims 1 or 2, characterized in that the minimum temperature ($T_{HP, min}$) of the heating plates (HP) is determined at each point of transition between two layers or heating plates (11, 13).
6. Process in accordance with one of the preceding claims, characterized in that the minimum temperature ($T_{HP, min}$) of the heating plates (HP) is determined by means of measurements of the temperatures (T_{HP}) actually arising on the heating plate (HP).
7. Process in accordance with claim 6, characterized in that the minimum temperature ($T_{HP, min}$) of the heating plates (HP) are determined by measuring the temperatures (T_{HP}) actually present on the heating plate (HP) in the case of different operating conditions, and in that the measured temperatures are set down in a performance graph or characteristics map.
8. Process in accordance with one of the preceding claims, characterized in that the minimum temperature ($T_{HP, min}$) of the heating plates (HP) is ascertained, with the aid of a calculation model, by calculating the temperatures (T_{HP}) arising on the heating plate (HP).
9. Process in accordance with one of the preceding claims, characterized in that the minimum temperature ($T_{HP, min}$) of the heating plates (HP) is determined with the aid of the following approximation formula:

$$T_{HP-KSm} = (T_{air, i} + f \times (T_{f, i} + \Delta T_{Le})) / (1 + f)$$

10. Process in accordance with claim 8 or 9, characterized in that the minimum temperature ($T_{HP, \min}$) of the heating plates (HP) is calculated by calculating the temperatures occurring on the heating plate (HP) at different temperatures, and in that the temperatures are set down in a performance graph or characteristics map.
11. Process in accordance with claim 7 or 10, characterized in that the temperatures (T_{HP}), of the heating plates, stored, in the performance graph or characteristics map, for the control of the temperature ($T_{air, i}$) and/or the mass flow (m_{air}) of the air at the air outlet or outlets (15) and/or the temperature ($T_{f, i}$) and/or the mass flow (m_f) of the fumes are used on the fumes inlet or inlets (7).
12. Process in accordance with one of the preceding claims, characterized in that the minimum temperature ($T_{HP, \min}$) of the heating plates (HP) is determined on the basis of the fumes composition, particularly the water content and/or the SO_3 concentration and/or the composition of the ash contained in the fumes.
13. Process in accordance with one of the preceding claims, characterized in that the inlet temperature ($T_{air, i}$) of the air is raised by feeding back (27) air, which has already been preheated, from the air outlet (17) to the air inlet (15).
14. Process in accordance with one of the preceding claims, characterized in that the mass flow (m_a) of the air is reduced through a part of the air in the bypass (29) going past the air preheater (21).
15. Control means for controlling an air preheater (21), with a rotor (3), with at least one fumes inlet (7), with at least one fumes outlet (9), with at least one air inlet (17) and with at least one air outlet (19), characterized in that it is suited to

carrying out the process in accordance with one of claims 1 to 14.

16. Computer program, characterized in that it is suited to carrying out the process in accordance with one of the claims 1 to 14.

17. Storage medium, characterized in that it is suited to storing a computer program in accordance with claim 16.

18. Air preheater, with a rotor (3), with at least one fumes inlet (7), with at least one fumes outlet (9), with at least one air inlet (15) and with at least one air outlet (17), with devices for determining the temperature (T_{air}) and mass flow (m_{air}) of the air at the air outlet or outlets (15) and the temperature ($T_{f,i}$) and the mass flow (m_f) of the fumes at the fumes inlet or inlets (7), characterized in that the air preheater (21) operates according to a process in accordance with claims 1 to 11.

19. Air preheater in accordance with claim 18, characterized in that it has apparatus for measuring the temperature (T_{air}) and/or the mass flow (m_{air}) of the air at the air outlet or outlets (17) and also of the temperature ($T_{air,i}$) and/or for determining the temperature ($T_{f,i}$) and/or the mass flow (m_f) of the fumes at the fumes outlet or outlets (9).

20. Air preheater in accordance with claim 18 or 19, characterized in that it has a hot air return feed (27) and in that a part of the preheated air can be returned from the air outlet (17) into the air inlet (15) by means of the hot air return feed (27).

21. Air preheater in accordance with one of claims 18 to 20, characterized in that it has a cold air passage (29) and in that a part of the air, which has not yet been preheated, in the bypass channel, can go past the air preheater (21), directed from the air inlet (15) into the air outlet (17) through the cold air passage (29).

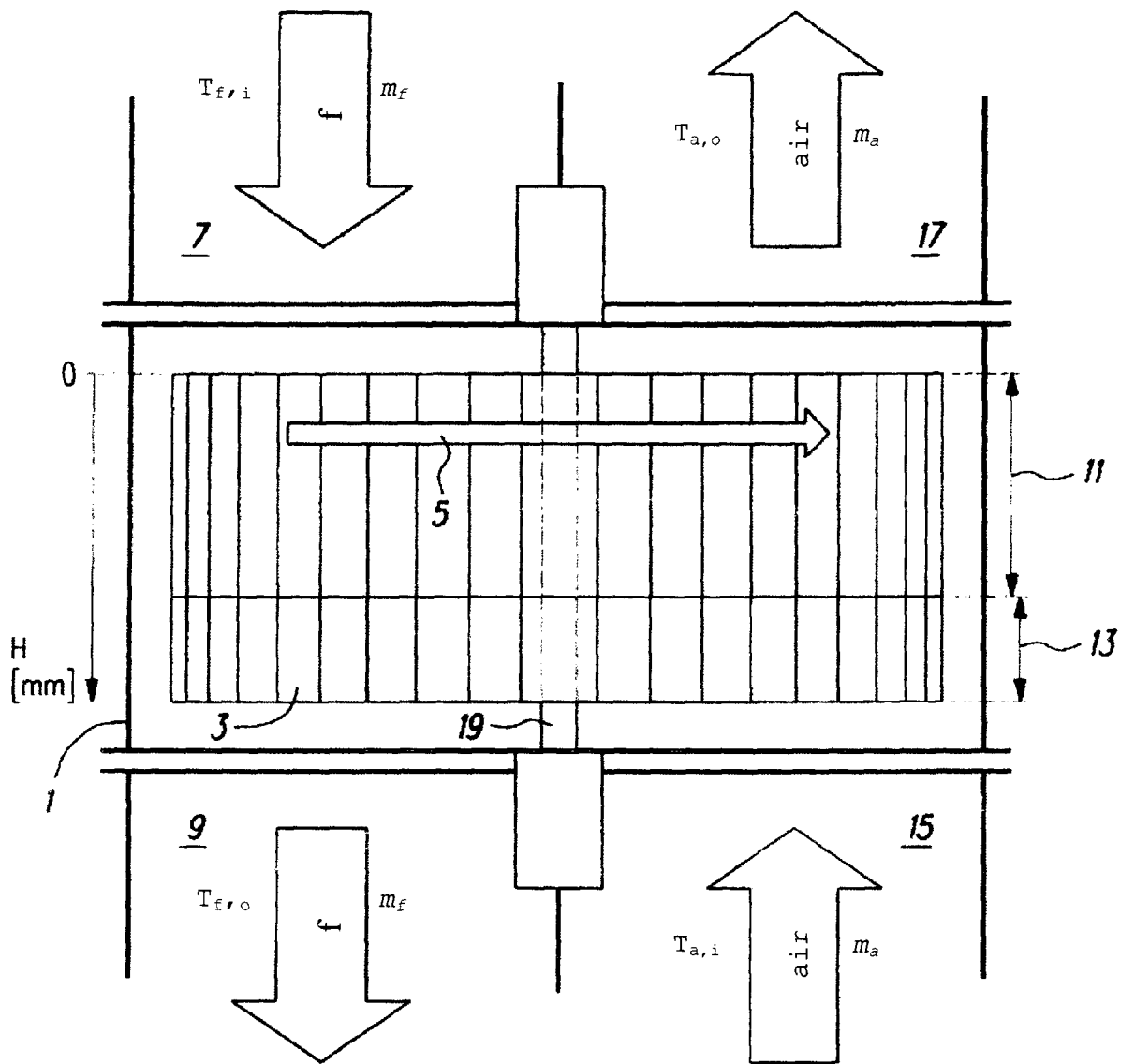
Fig. 1

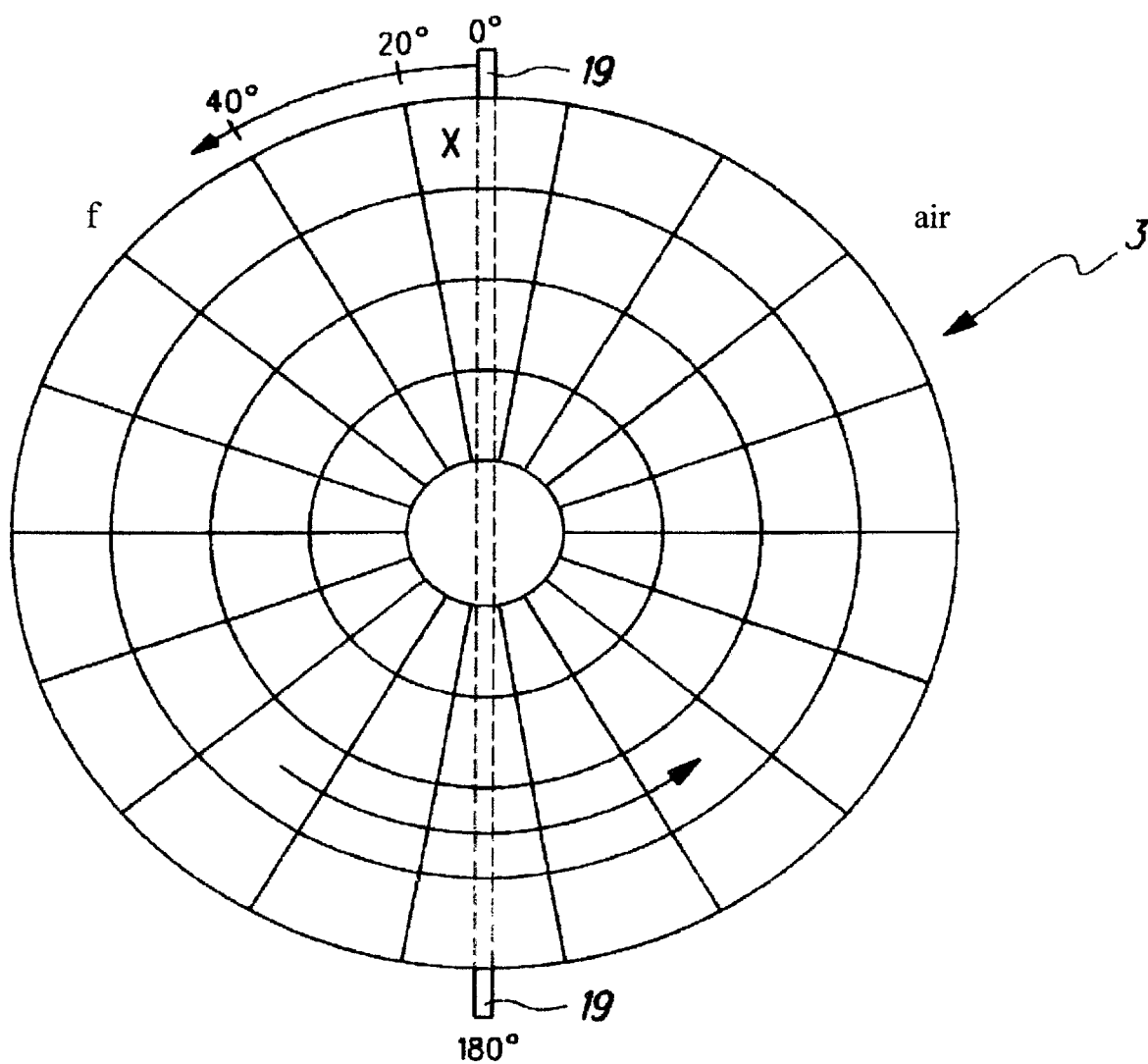
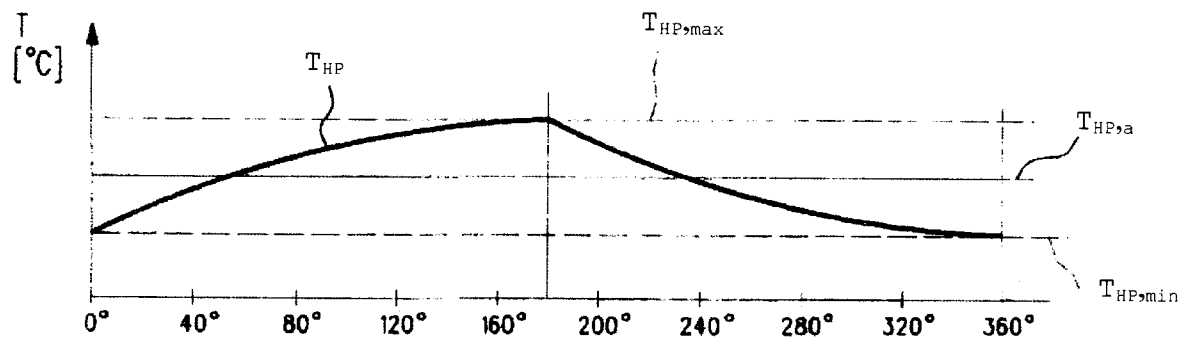
Fig. 2**Fig. 3**

Fig. 4

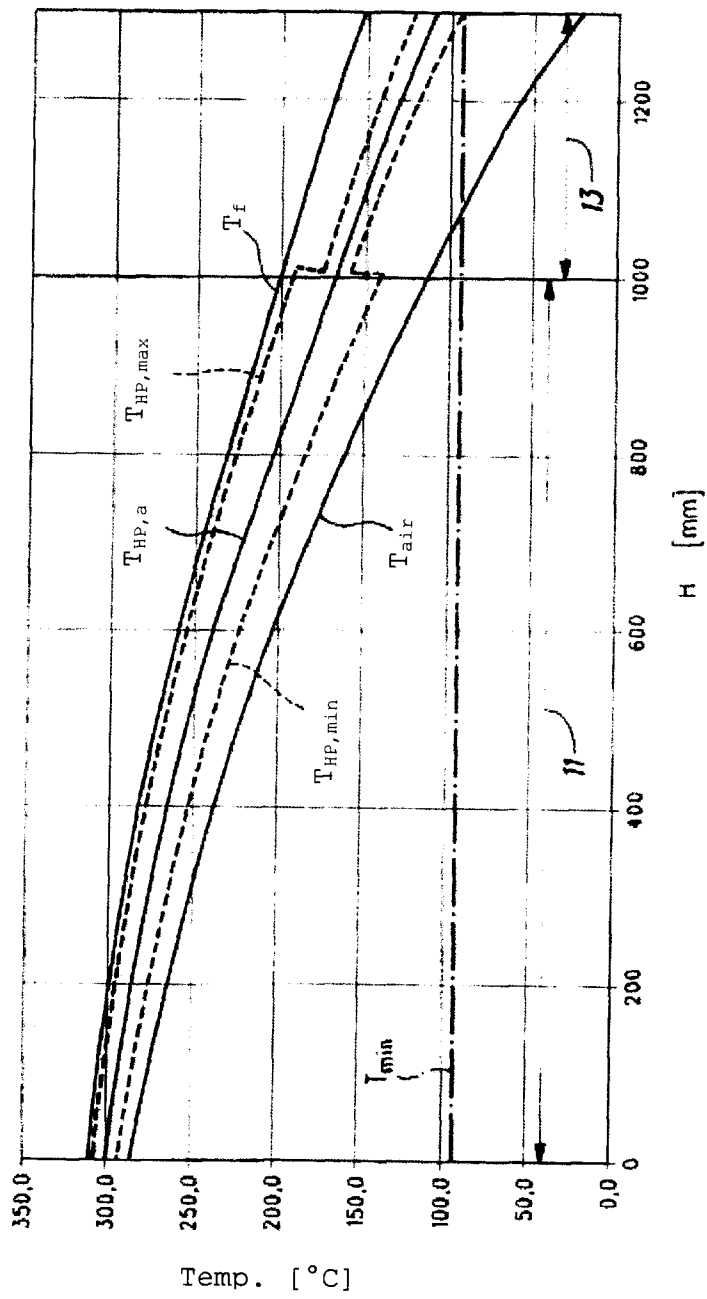


Fig. 5