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(54) Heat exchanging plate

(57) Heat exchanging plate used in association with heat exchangers between at least two fluids in hot air generators or systems for the application of heat energy in general, advantageously but not exclusively in the proximity of the outlet (23) for the fumes, the plate (10) comprising a metal plate (11) with protrusions (15,16) to increase the surface area on at least one of the faces, the forward one (13) which faces the inside of the heat exchanger and/or the rear one (12) which faces towards the outside, the plate (10) being attached to, but detachable from, a wall (18) of the heat exchanger in cooperation with a hole (19) of mating shape made in the wall (18).

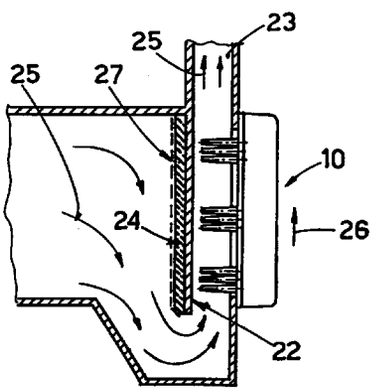

fig.9

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Description

This invention concerns a heat exchanging plate as set forth in the main claim.

The heat exchanging plate according to the invention is used in applications where an intense exchange of heat is required, in a limited space, between two fluids.

A preferential but not limited application of the heat exchanging plate according to the invention is on the exchange walls of hot air generators.

The heat exchanging plate according to the invention is used preferentially in heat generators fed by flame, such as for example gas burners, gas oil burners, kerosene burners or similar, where it is a particular problem to inspect and clean the soot from the end part of the conduit for the discharge of the fumes.

In most applications of heat energy, there is the problem of heat transmission.

A very common case in practice is the transmission of heat between two areas through a wall, as for example happens in heat exchangers, where the maximum exchange of heat between two fluids is desired, in order to have high efficiency and reduced consumption.

In the state of the art, in order to increase the capacity for heat exchange, the walls of the exchangers have an increased surface, generally by means of ribs or fins, this being all the more important as the difference in temperature between the two fluids is reduced.

The smaller the heat difference between the two fluids inside and outside the exchange wall, the greater must be the surface of the wall.

In other cases, in order to reduce the space and increase the heat exchange, tortuous routes are used made of pipes or conduits inside the exchangers, but this compromises the regular flow of the fluid which is necessary in most applications.

A typical application in which this latter solution is often detrimental is in the final part of fumes-air exchangers in hot air generators.

In these heat exchangers there is an attempt to remove most of the heat from the fumes so that they reach the chimney, or the outlet zone, at a low temperature.

To achieve this result in a limited space, it is not possible to make the fumes follow a tortuous route, because the exhaust fumes would draw less efficiently.

Another disadvantage is that it is difficult to inspect and/or clean inside the heat exchangers known to the state of the art.

US-A-3385356, BE-A-550812 and GB-A-529037 disclose integrated heat exchangers where the problem of inspecting and cleaning the final segment of the conduit to discharge the fumes rains clearly evident.

Moreover, in these documents there is no possibility of obtaining a desired increase in the coefficient of heat exchange where the need most exists, and that is to say, in those segments where the difference in temperature of the two adjacent fluids is reduced.

The present applicants have designed, tested and embodied this invention to overcome the shortcomings of the state of the art and to achieve further advantages.

This invention is set forth and characterised in the main claim, while the dependent claims describe variants of the idea of the main embodiment.

The purpose of the invention is to obtain a heat exchanging plate which can achieve a high rate of heat exchange in a limited space and therefore reduce the bulk of the exchanger while at the same time removing a high quantity of heat.

A further purpose of the invention is to enable the inside of the heat exchanger to be inspected and cleaned easily.

A further purpose of the invention is to obtain the greatest efficiency possible of the heat exchange, regardless of the direction of the two fluids between which the heat is exchanged, and also regardless of the difference in temperature of the two fluids.

A further purpose is to obviate the necessity for tortuous routes for the fluids, as they may draw the fumes less efficiently towards the chimney.

The heat exchanging plate according to the invention can be applied in cases when it is necessary to exchange heat between two fluids, for example in correspondence with the fumes-air exchanging walls of hot air generators.

The plate is associated with, but can be detached from, the walls and cooperates with a hole of a mating shape made in the exchange walls themselves.

The heat exchanging plate according to the invention comprises a metal plate, advantageously of high heat conducting material, which has fins, pins, corrugations, grooves or other irregularities on its surface suitable to increase the surface for exchanging heat on at least one of its faces.

The contour of the metal plate is variable depending on the application.

According to the invention, at least the front face has, in a position adjacent to the perimeter edge, a flat band, without any fins, pins or other protrusions, which acts as a seating for a sealing packing.

In one embodiment of the invention, on the perimeter band, there are holes which serve to attach the heat exchanging plate onto the wall of the exchanger by means of connecting elements.

However the plate may be connected to the wall of the heat exchanger in any way, for example by means of clamps, joints, etc.

The plate must be fixed in such a way that the protrusions on one face, for example the fins, protrude into one fluid and the protrusions on the other face, for example the pins, protrude into the other fluid.

The heat exchanging plate is attached with the connection elements and by interposing the sealing packing between the heat exchanging plate and the surface to which the plate is to be attached in such a way as to guarantee the hermetic separation of the two fluids.

At the points where the heat exchanging plate

according to the invention is applied, a high concentration of heat exchange is achieved in a limited space, because the surfaces available for heat exchange for the two fluids are very extensive.

The heat exchanging plate according to the invention is particularly advantageous in applications in correspondence with the end part of the route followed by the fumes, both because at that point the difference in temperature between the adjacent fluids is less and therefore a greater heat exchange is needed, and also because it is the area where soot and dirt most accumulate.

Because the plate can be removed, it is possible to carry out easy and rapid operations of inspection and cleaning.

The attached figures are given as a non-restrictive example and show some preferred embodiments of the invention as follows:

Fig.1 shows a front rear view of the heat exchanging plate according to the invention;
Fig.2 shows a side view from A of the plate in Fig.1;
Fig.3 shows the front view of the plate in Fig.1;
Fig.4 shows a side view from B of the plate in Fig.2;
Fig.5 shows a longitudinal section of the plate according to the invention;
Fig.6 shows a variant of Fig.5;
Fig.7 shows an application of the invention in a fumes-air heat exchanger;
Fig.8 shows a cross-section of the upper part of a heat exchanger in a hot air generator associated with the plate according to the invention;
Fig.9 shows a variant of Fig.8.

Figures 1 to 4 show a first type of the heat exchanging plate 10 according to the invention.

The heat exchanging plate 10 is composed of a metal plate 11 with variable thickness, shape and dimensions according to the applications, advantageously of high heat conducting quality, defined by a rear surface 12 and a front surface 13.

In this case, the metal plate 11 has, along its perimeter band, attachment holes 14 which serve to anchor the heat exchanging plate 10 onto a wall of the heat exchanger to which the plate 10 is associated.

On the rear surface 12, facing towards the outside, there are protrusions, in this case shaped like fins 15, which cross longitudinally and parallelly the rear surface 12 in such a way as to stimulate the flow of the fluid which laps them.

In this case, the fins 15 are substantially at right angles to the metal plate 11 and have a greater surface area at the base than at the top.

On the forward surface 13, facing towards the inside of the heat generator, there are protrusions, arranged at right angles, in this case pins in the shape of truncated cones 16, the shape of which does not prevent the regular flow of the fluid which laps them.

The protrusions shaped like truncated cone pins 16 are arranged to cover most of the forward surface 13 except for the perimeter area composed of a band without protrusions which acts as a seating for the sealing packing 17.

Figure 5 shows the longitudinal section of the plate 10 according to the invention attached to a wall 18, for example the wall of a heat exchanger in a hot air generator.

The wall 18 has a containing hole 19 of a shape mating with the perimeter contour of the metal plate 11 in such a way that the fins 15 on the rear surface 12 protrude into one fluid and the truncated cone pins 16 of the forward surface 13 protrude into the other fluid.

The heat exchanging plate 10 is attached by interposing the sealing packing 17 between the metal plate 11 and the wall 18 in such a way as to guarantee the hermetic separation of the two fluids.

Figure 6 shows a variant of Figure 5 where the metal plate 11 has a channel 20, which follows the perimeter contour of the plate and constitutes the containing seating for the sealing packing 17.

Figure 7 shows an application of the invention in a fumes-air heat exchanger.

In this application there are two heat exchanging plates 10 which are lapped by fumes, indicated by 25, on the forward surface 13, and lapped by air, indicated by 26, on the rear surface 12.

In this application, a high efficiency of heat exchange is achieved between the fumes 25 and the air 26 in a very limited space.

A further advantage is given by the fact that the heat exchanging plate 10 can be easily removed from the wall 18 by acting on the connection elements associated with the attachment holes 14.

This operation allows the inside areas defined by the wall 18 and the forward surface 13 to be inspected and cleaned, which would not otherwise be possible.

Figure 8 shows an application of the invention in the final part of a heat exchanger for a hot air generator 21.

This application permits heat from the fumes near the outlet 23 to be removed, in a very limited space, in spite of the fact that the difference in temperature between the two fluids is very small.

Figure 9 shows a variant of Figure 8.

In this variant, the heat exchanging plate 10 is arranged at the front of a wall 22 lapped by fumes 25 on both sides.

In this application, the fumes directed towards the outlet 23 yield their heat to the heat exchanging plate 10 but, at the same time, they receive heat from the wall 22 which is lapped by hot fumes on the other side.

In order to avoid an increase in temperature of the fumes 25 moving towards the outlet 23 caused by contact with the wall 22, because of the high temperature difference between the fumes which have passed the plate 10 and the hot fumes on the other side, the wall 22 is covered on its inner surface near the outlet 23 with a suitable layer of refractory and insulating material 24.

The layer of refractory and insulating material 24

can be made for example of ceramic wool or other suitable material.

In this case, this layer 24 is attached and held on the wall 22 by means of suitable attaching and holding elements 27, for example metal sheet or mesh.

Claims

1. Heat exchanging plate used in association with heat exchangers between at least two fluids in hot air generators or systems of application of heat energy in general, advantageously but not exclusively in proximity to the outlet (23) of the fumes, the plate being **characterised in that** it comprises a metallic plate (11) with protrusions (15,16) to increase the surface area, on at least one of its faces, the forward face (13) facing the inside of the exchanger and/or the rear face (12) facing towards the outside, the metallic plate (11) being connected to but removable from a wall (18) of the heat exchanger in cooperation with a hole (19) of a mating shape made in the wall (18).

2. Plate as in Claim 1, **in which**, mounted on the wall (18) of the heat exchanger, the protrusions (16) on the forward face (13) of the plate (11) cooperate with at least one heat exchange fluid and the protrusions (15) on the rear face (12) cooperate with the other heat exchange fluid.

3. Plate as in Claims 1 or 2, **in which** at least the forward face (13) has a perimeter seating to position a sealing packing.

4. Plate as in Claim 3, **in which** the perimeter seating comprises an open band without protrusions associated with a sealing packing (17).

5. Plate as in Claim 3, **in which** the perimeter seating comprises a closed channel associated with an annular sealing packing (117).

6. Plate as in any of the claims hereinbefore, **which** is positioned facing the outer side of a wall (22) lapped by fumes on both its sides, the inner side of the wall (22) being covered by a suitable layer of insulating and refractory material (24).

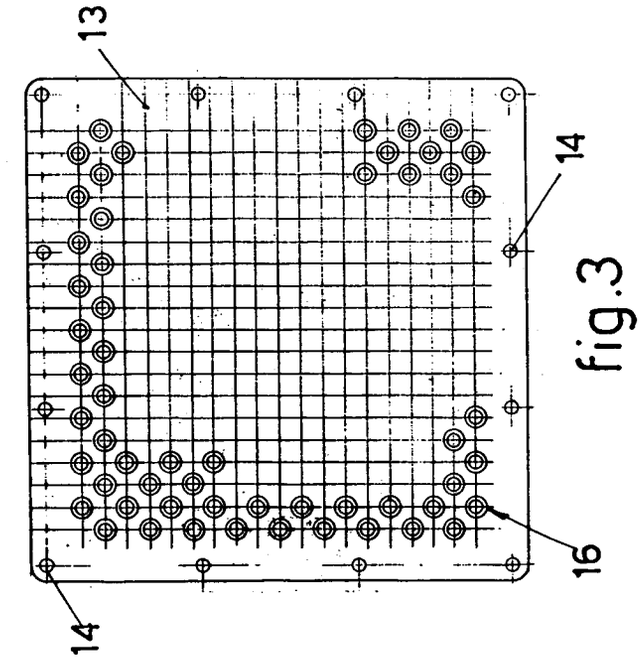

fig.3

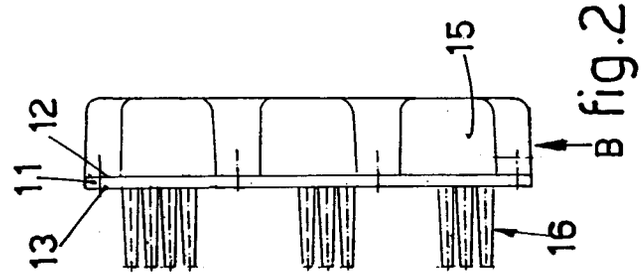

fig.2

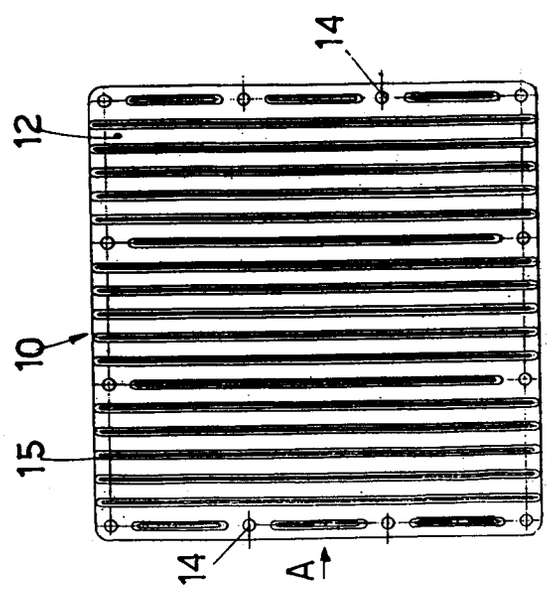

fig.1

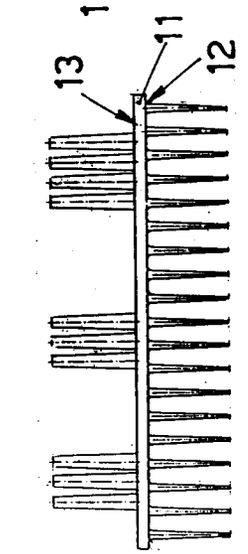

fig.4

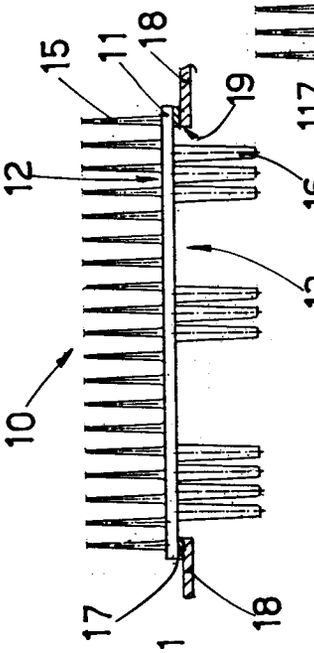

fig.5

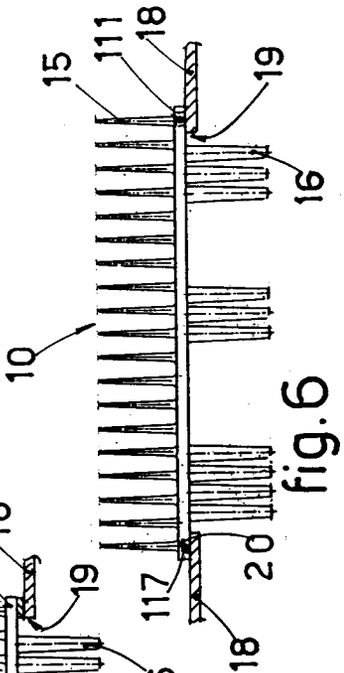

fig.6

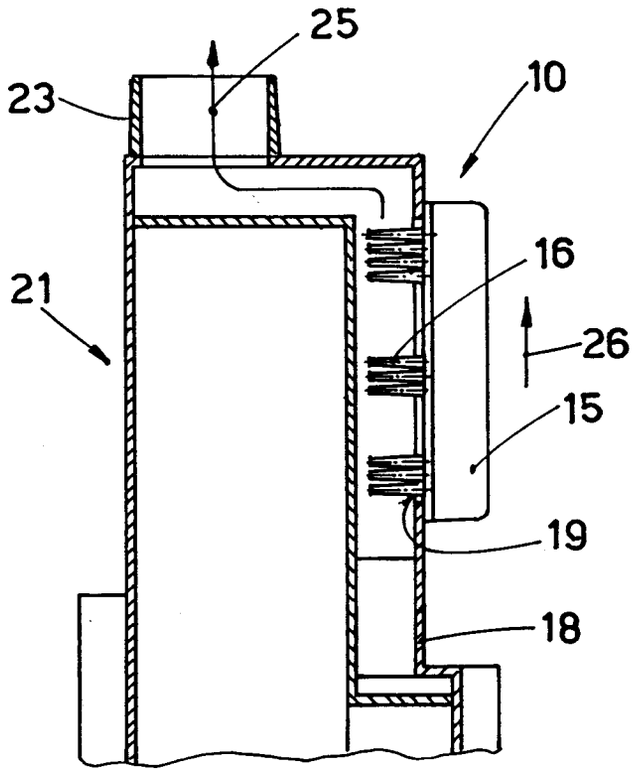

fig.8

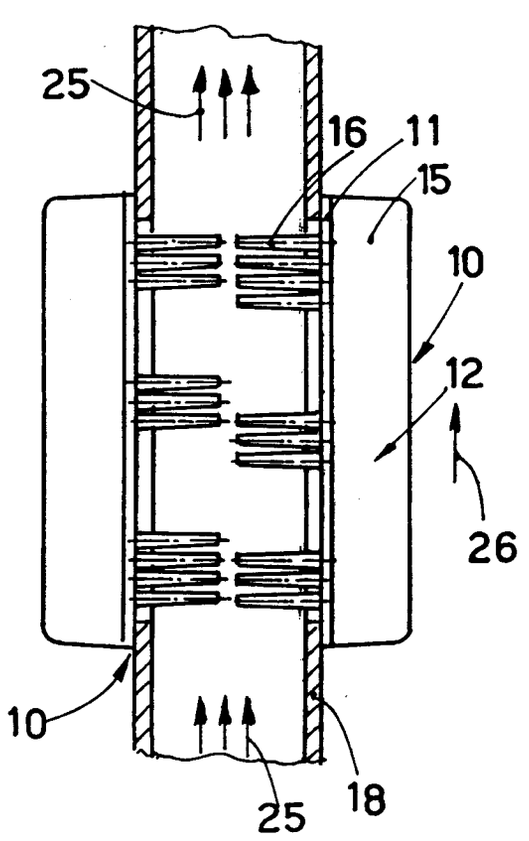

fig.7

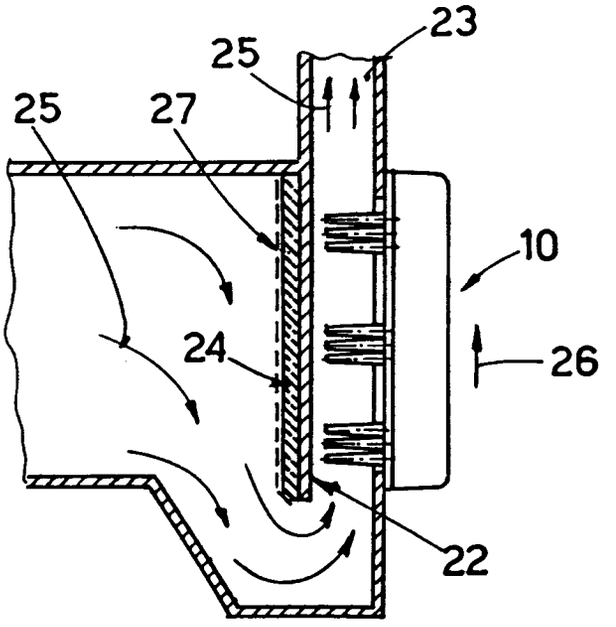

fig.9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 10 4379

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.6)
A,D	US 3 385 356 A (DALIN DAVID) * figures 3,4 *	1,2	F24H3/10 F24H9/14 F28F3/02
A,D	BE 550 812 A (KABLITZ) * figures *	1-5	
A,D	GB 529 037 A (WATKINSON) * figures 6,7 *	1,2,4	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F24H
F28F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 May 1997	Van Gestel, H

CATEGORY OF CITED DOCUMENTS

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