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COMBUSTION GAS STACK FOR STEAM GENERATING PLANT

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Fig. 1

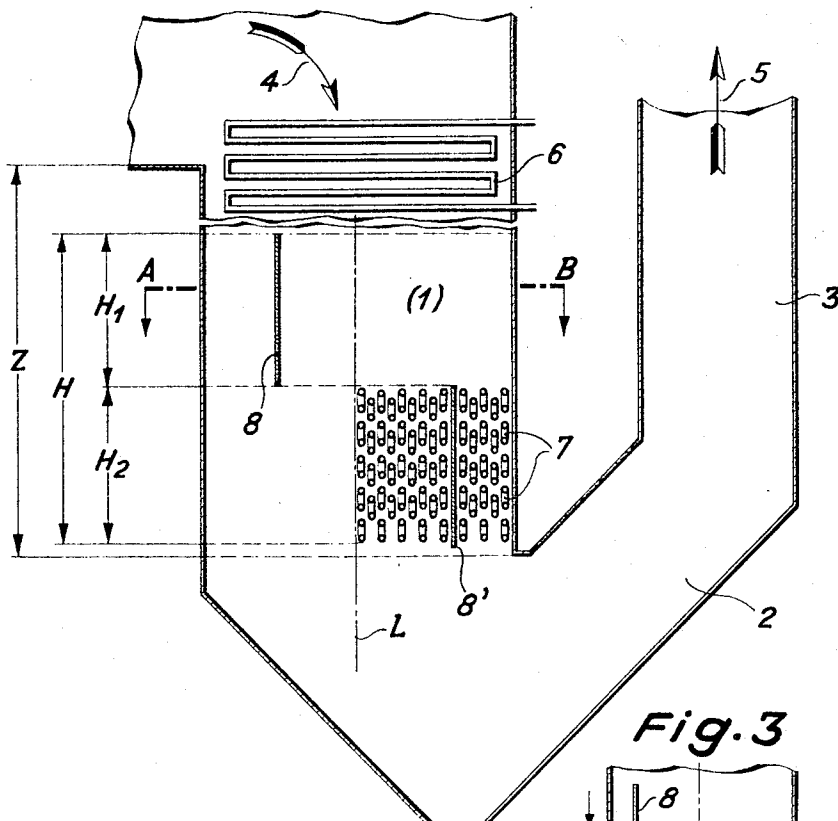


Fig. 3

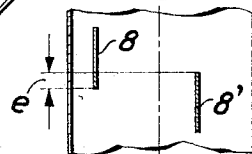


Fig. 2

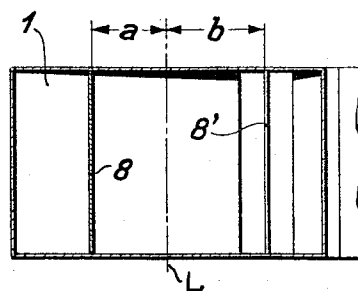
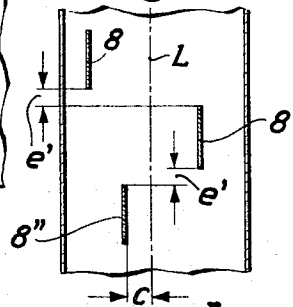


Fig. 4



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1

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COMBUSTION GAS STACK FOR STEAM GENERATING PLANT

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5 Claims. (Cl. 122-4)

The present invention pertains to a combustion gas stack for a steam generator in which stack there are provided tubes, e.g. those of an economizer, which extend transversely of the direction of streaming of the combustion gases. In such a stack, there may occur large amplitude oscillations of the gases transversely of their direction of streaming, brought into existence by the liberation of Karman-type turbulences at the tubes. The oscillations of the gases may in turn provoke oscillation of the stack walls and of the tubes themselves, which generates undesirable noise and which may even cause damage to the tubes.

It is an object of the invention to prevent the generation of oscillations of the stack walls and of the tubes therein. This object is achieved in accordance with the invention by dividing the stack into at least two zones traversed one after the other by the combustion gases, these zones including each at least one wall or partition extending parallel to the direction of gas streaming and to the length of the tubes, with the partitions of adjacent zones being staggered or displaced with respect to each other, as in the cross-section of the stack. By subdivision of the exhaust gas space according to the invention into plural zones traversed by the gases successively and by the provision of partitions as just described, there is achieved the result that each zone possesses transversely of the direction of gas streaming a natural frequency of oscillation widely or discontinuously different from that of the other zones, so that no unitary or massive oscillation of the gases occurs capable of setting into vibration the walls of the stack and the tubes therein. the desired result is obtained with extremely simple means.

The invention will now be described in terms of a number of exemplary embodiments and with reference to the accompanying drawings in which:

FIG. 1 is a longitudinal section through a vertically disposed combustion gas stack of a steam generator;

FIG. 2 is a simplified cross-sectional view taken on the line A-B of FIG. 1; and

FIGS. 3 and 4 represent simplified longitudinal sections similar to that of FIG. 1 but illustrating other embodiments of the invention.

Referring to FIG. 1, reference character 1 identifies a generally vertical combustion gas stack which connects at the upper and left end thereof with the firing space or chamber (not shown) of a steam generator. The lower end of the stack connects via a channel 2 to a chimney 3 not shown in detail. The combustion gases emerging from the firing chamber flow in the direction of arrows 4 and 5 through the structure shown in FIG. 1. In the upper portion of the stack 1, as in known constructions, there are disposed heating surfaces for the transfer of heat to the working substance of the boiler. These surfaces normally take the form of tubes through which there flows (in the usual case) water or steam. For simplicity there is shown in the drawing only a single such surface 6 which may constitute a supplementary superheater or a reheater. Below the heating surface 6 there are disposed in the stack 1 tubular coils 7 of an economizer, of which again for simplicity's sake

2

only a few are shown in the drawing. The coils 7 extend in substantially vertical planes perpendicular to the plane of the figure and they substantially fill the cross-section of the stack over a height H. This constitutes the space in which there may arise combustion gas oscillations transversely of the tubes, generated by Karman-type turbulences, such oscillations being capable of setting the walls of the stack itself into oscillation. The gas oscillations may moreover set the tubes 7 into oscillations directed transversely of the axis of the tubes.

In accordance with the invention the development of such oscillations is prevented by dividing the space H occupied by the tubes into a plurality of zones transversed by the combustion gases successively and to which zones discontinuously different natural frequencies of oscillation are imparted by means of suitably positioned partitions extending parallel to the direction of gas streaming. Thus in the example of FIG. 1 the zone H is divided into two equal zones H_1 and H_2 provided with such partitions 8 and 8'.

The partitions 8 and 8' are disposed at unlike spacings a and b (FIG. 2) from the longitudinal axial plane L of the stack, which plane may be considered to be the plane which bisects the stack longitudinally and which extends parallel to the length of the tubes 7. The partitions 8 and 8' extend over the full depth of the stack as shown in FIG. 2, and their length in the direction of gas streaming is substantially equal to that of their respective zones. Thus, the lower edge of the partition 8 and the upper edge of the partition 8' are disposed at substantially the same position longitudinally of the stack in the direction of gas streaming.

By provision of the partitions 8 and 8', which may be made simply of sheet metal, the invention prevents the generation of disturbing oscillations with a minimum of expense and material.

The invention operates by detuning in each zone with respect to every other zone the natural acoustic frequency of oscillation of the exhaust gases in directions transversely to the axis of the tubes and transversely to the direction of gas streaming.

In accordance with another embodiment of the invention the partitions 8 and 8' may partly overlap in the direction of combustion gas streaming, as illustrated in FIG. 3. The range e of overlapping may then be considered as a further zone in accordance with the invention, the stack being in such case divided into three zones.

Alternatively, however, there may be provided a spacing e' between the lower edge of the partition 8 and the upper edge of the succeeding partition 8', again in the direction of gas streaming, as illustrated in FIG. 4. This spacing e' must not however be too great, in order to exclude the existence between the zones having partitions of a space in which the objectionable oscillations to be suppressed might arise. The space having a height equal to the separation e' can be considered to constitute a further zone in accordance with the invention. FIG. 4 shows an additional zone with a partition 8'' spaced at a distance c from the longitudinal axis L of the stack, this spacing c being again different from the spacings a and b which separate the partitions 8 and 8' from the longitudinal axis L respectively.

The length of the partitions 8, 8' and 8'' measured in the direction of gas streaming should be some 5 to 20 percent of the total length Z of the stack. It is not necessary that the zones H_1 and H_2 be of the same magnitude; they may be unlike.

While the invention has been described herein in terms of a number of preferred exemplary embodiments, the invention itself is not limited thereto, being rather susceptible of numerous modifications upon and departures

from those embodiments, within the spirit and scope of the appended claims.

I claim:

1. A steam generator combustion gas stack comprising stack walls, tubes extending across the stack between said walls in a direction transverse to the direction of combustion gas streaming through the stack, and a plurality of partitions disposed within the stack at positions successively traversed by the gases in streaming through the stack, said partitions extending parallel to the direction of gas streaming and to the length of said tubes, adjacent of said partitions having unlike spacings from said stack walls.

2. A steam generator combustion gas stack comprising stack walls, tubes extending across the stack between said walls in a direction transverse to the direction of combustion gas streaming through the stack, and a plurality of partitions disposed within the stack at positions successively traversed by the gases in streaming through the stack, said partitions extending parallel to the direction of gas streaming and to the length of said tubes, adjacent of said partitions having unlike spacings from a plane bisecting said stack longitudinally and extending parallel to the length of said tubes.

3. A steam generator combustion gas stack comprising stack walls, tubes extending across the stack between said walls in a direction transverse to the direction of combustion gas streaming through the stack, and a plurality of partitions disposed within the stack at positions successively traversed by the gases in streaming through the stack, said partitions extending parallel to the direc-

tion of gas streaming and to the length of said tubes, adjacent of said partitions having a partly overlapping relation longitudinally of the stack and having unlike spacings from the stack walls.

4. A steam generator combustion gas stack comprising means defining stack walls, tubes extending between opposite of said walls in directions transverse to the direction of combustion gas streaming through the stack, and a plurality of partitions disposed within the portion of the stack occupied by said tubes at positions successively traversed by the gases in streaming through the stack, said partitions extending lengthwise of the direction of gas streaming and of the length of said tubes, adjacent of said partitions being non-coplanar.

5. A steam generator combustion gas stack comprising means defining a gas flow space having a longitudinal axis substantially parallel to the direction of streaming of gases through said space, tubes disposed in said space and extending transversely of said axis, and a plurality of partitions disposed in said space longitudinally opposite said tubes, said partitions extending substantially parallel to said tubes and to said axis, adjacent of said partitions longitudinally of said axis having unlike spacings from said axis.

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