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⑦① Applicant: **INTERNATIONAL COMBUSTION AUSTRALIA LIMITED, South Street, Rydalmere New South Wales 2116 (AU)**

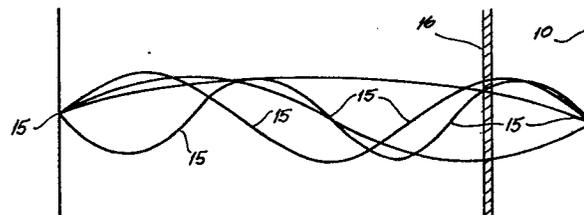
⑦② Inventor: **Byrne, Kerry Patrick, South Street, Rydalmere New South Wales, 2116 (AU)**

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⑦④ Representative: **Simpson, Ronald Duncan Innes et al, A.A.Thornton & Co. Northumberland House 303-306 High Holborn, London WC1V 7LE (GB)**

⑤④ **Vibration damping system for boilers.**

⑤⑦ A boiler assembly including a heat exchange chamber (10) in which are located a plurality of tube banks (12); and transverse vibration absorption baffle (16) extending in a plane normal to the tube banks (12) and parallel to the direction of flow (11) of gas through the chamber.



"VIBRATION DAMPING SYSTEM FOR BOILERS"

The present invention relates to boilers and more particularly to the damping of vibration which occurs within boilers.

5 It has been found that during the operation of some boilers, severe vibrations occur in the superheater, reheater, economiser, airheater or any heat exchanger of the boiler at certain loads. These vibrations were thought to be due to the flow excited vibrations in some or all of the
10 superheater or reheater tube banks as flow excited vibrations occasionally occur in such banks.

 Conventionally the method of controlling flow excited vibrations is to insert single or multiple baffles between the tubes of the bank depending on the harmonics of
15 the standing wave formation, however it is a disadvantage of this method that it is generally expensive as the multiple baffles must be installed in all the tube banks where resonant vibration occurs. This invention replaces the multiple baffles with a single baffle.

20 It is an object of the present invention to overcome or substantially ameliorate the above disadvantages.

 There is disclosed herein a boiler assembly including a chamber within which combustion takes place or burnt gases are ducted, a plurality of tube banks extending
25 across a chamber in a direction generally transverse of the direction of flow of gases through the chamber, and vibration absorption means extending within a plane which is normal to the tube banks but parallel to the direction of flow of gas through the chamber.

30 A preferred form of the present invention will now be described by way of example with reference to the accompanying drawings, wherein:

 Figure 1 schematically depicts a portion of a boiler assembly which includes a bank of tubes which absorb heat
35 from combustion gases passing thereby; and

 Figure 2 schematically depicts transverse wave vibrations which may occur within the passage containing the tube banks.

Upon investigation into the cause of the above-mentioned vibration, it has been proposed that if the shedding frequency of vortices formed behind individual pipes is near a natural frequency of a gas column extending generally transverse of the gas flow, then a strong transverse acoustic oscillation will be excited in the transverse column. Under the influence of this gas column oscillation, the shedding of the vortices from the individual cylinders will be kept in phase. Accordingly, it has been found that the noise and vibration of in line tube heater exchangers can be caused by the vortex shedding driven oscillations of the gas column forcing the walls of the chamber containing the heat exchanger to vibrate and radiate noise into the surrounding environment.

In Figure 1 there is schematically depicted a wall of a chamber through which gas 11 is passed to heat the bank 12 of pipes 13. The pipes 13 extend generally transverse of the direction of gas flow 11 and accordingly the pipes 13 create vortices 14 in the gas 13 which may be shed in phase. If the shedding frequency corresponds to a natural frequency of the gas column, extending transverse of the gas flow 11, then the chamber wall 10 will be caused to vibrate. Four natural frequencies of the gas column are depicted in Figure 2, which depicted natural frequencies are the most likely frequencies to occur upon consideration of the flow conditions particularly with reference to the Reynolds number and Strouhal number.

By providing a single vibration absorbing baffle 16 at a location remote from each node 15, energy will be absorbed thereby inhibiting vibration of the chamber walls 10 and the creation of a transverse oscillating gas column. A preferred location of the baffle is at a position wherein the baffle is remote from each of the nodes 15 depicted in Figure 2. The baffle 16 would extend in a direction generally parallel to the flow of gas 11 while being generally located in a plane extending generally normal to the direction of extension of the pipes 13.

Although higher natural frequencies are possible,

the probability of such high frequencies actually occurring is very small.

The baffle 16 is located at a position of significant gas movement irrespective of the particular
5 transverse frequency given that the possibility of higher frequencies occurring is very small. The baffle 16 could be formed of fibrous material so as to provide good absorption properties in use.

As an alternative the absorption baffle 16 could be
10 formed of a single perforated plate which would perform the same function as the absorption baffle 16 formed of fibrous material but with the advantage of longer life due to the lack of infill material which may degrade or become filled with dust after a period of time.

CLAIMS

1. A boiler assembly including a chamber within which combustion takes place or burnt gases are ducted, a plurality of tube banks extending across a chamber in a direction generally transverse of the direction of flow of gases through the chamber, and vibration absorption means extending within a plane which is normal to the tube banks but parallel to the direction of flow of gas through the chamber.
2. The assembly of claim 1 wherein said vibration damping means is formed of perforated sheet material.
3. The assembly of claim 1 wherein said vibration absorption means is formed of fibrous material.
4. The assembly of claim 1, 2 or 3 wherein said vibration absorption means is an absorption baffle located at a position remote from the walls of the chamber.
5. The assembly of claim 4 wherein said location is such that said baffle is positioned so as to not pass through a node of major natural frequencies of the gas located between the walls of the chamber.
6. The assembly of claim 5 wherein said major frequencies are the first four natural frequencies of the gas located between the walls.
7. The boiler assembly substantially as hereinbefore described with reference to the accompanying drawings.

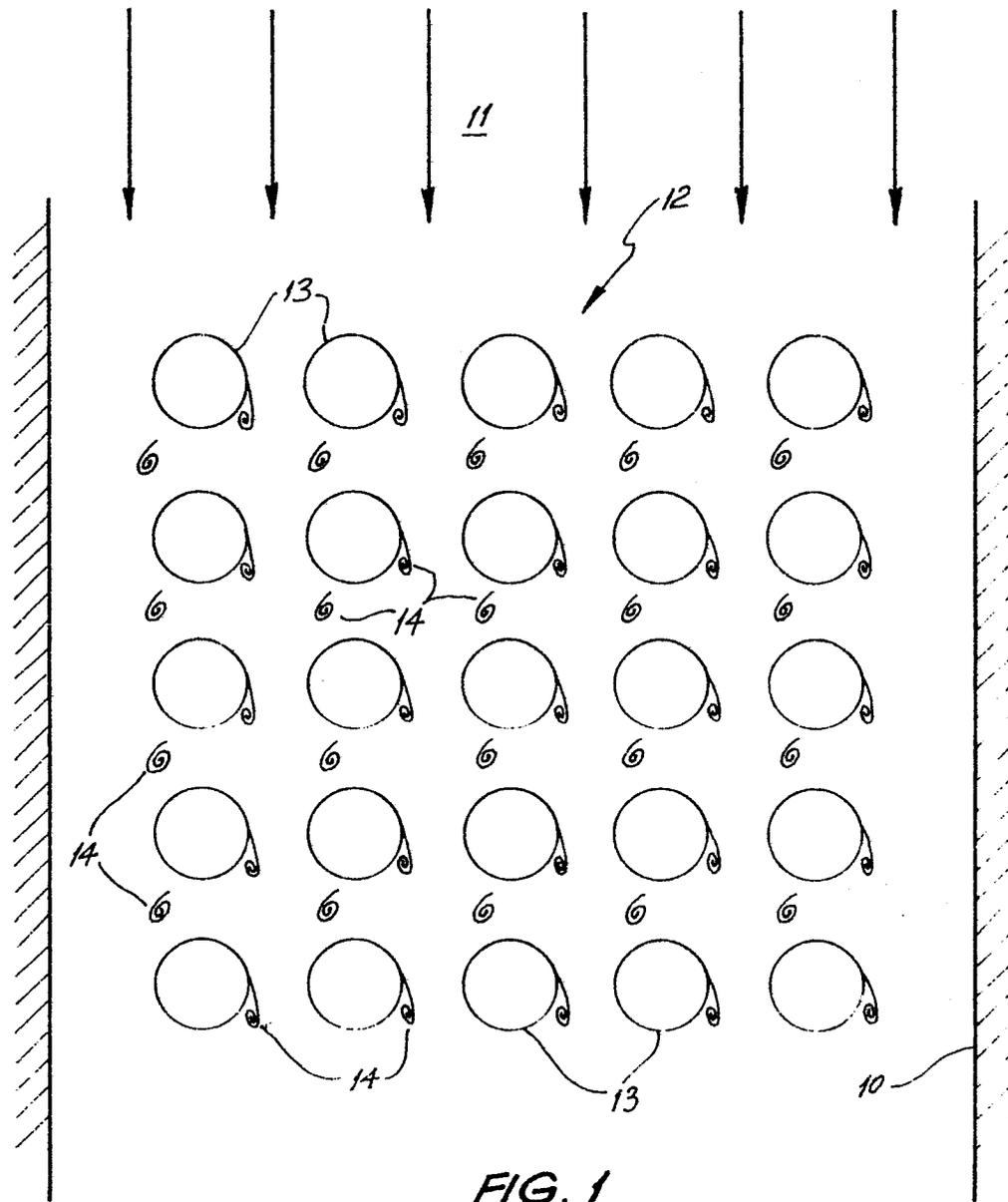


FIG. 1

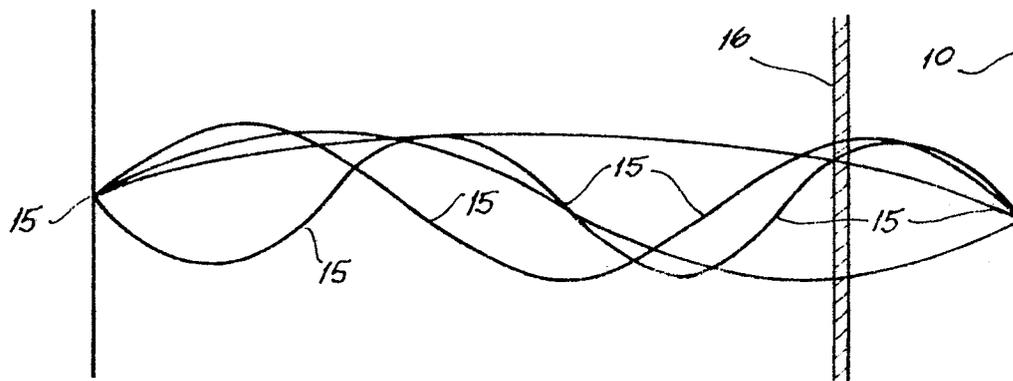


FIG. 2



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. 3)
X	US-A-4 226 279 (EISINGER) * Column 3, lines 31-68; column 4, lines 1-37; figures 1,2,7,12 *	1,2	F 22 B 37/40
X	--- DE-A-1 776 104 (BABCOCK) * Page 3, lines 8-15; pge 4, figures *	1,4	
A	--- GB-A-1 056 734 (COMBUSTION) * page 2, lines 29-125; page 3, lines 1-121; figures *	1,5	
A	--- FR-A-2 214 855 (AEROSPATIALE) * Page 4, lines 36-37; page 5, lines 1-14; figure 11 *	2	
A	--- DE-A-2 920 278 (KÜHNLE) * Page 18, lines 26-27; page 19, lines 1-17; figures *	3	
A	--- DE-C- 523 150 (KLEIN) -----		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
			F 22 B F 28 F F 16 L
Place of search THE HAGUE		Date of completion of the search 14-06-1983	Examiner VAN GHEEL J.U.M.
CATEGORY OF CITED DOCUMENTS 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 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			