Compact immersed combustors (C.I.C.) applied to gypsum production.

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1 - DEHYDRATION OF GYPSUM

The preliminary phase of gypsum production consists in heating the milled gypsum with the aim of reducing the moisture content.
The old fashioned solution was to use a kettle filled with gypsum, heated by a conventional burner system (Fig 1).

Answering the gypsum producers need to reduce energy costs and to increase capacity, PILLARD proposed to improve the efficiency by using a Compact Immersed Combustor (C.I.C.) associated with a heat exchanger immersed in the gypsum bath.

The flow capacity of dehydrated gypsum for each kettle unit can be increased by 20 to 30% without major modification of the existing equipment, as shown in Fig.1.

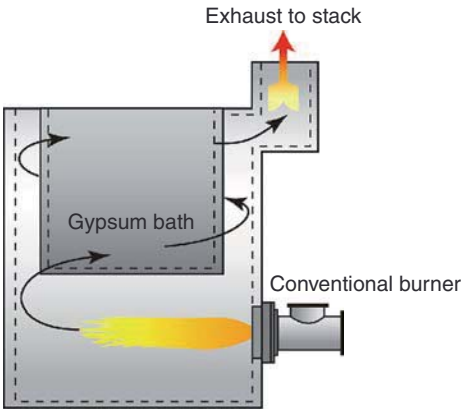

Fig.1 : Kettle with conventional burner system

2 - THE COMPACT IMMERSED CHAMBER

The counter rotation burner principle which is used in order to introduce the combustion air, results in a homogenous air/gas mix giving a stable, pollution-free flame.

Another important equipment feature is the two-pass air flow circuit of the combustion chamber which provides pre-heating of the combustion air together with cooling of the internal combustion chamber wall.

This technique prevents both an excessively hot wall and flame quenching by cold air (see Fig 2).

Heat release range = 300 kW to 6 MW per unit.

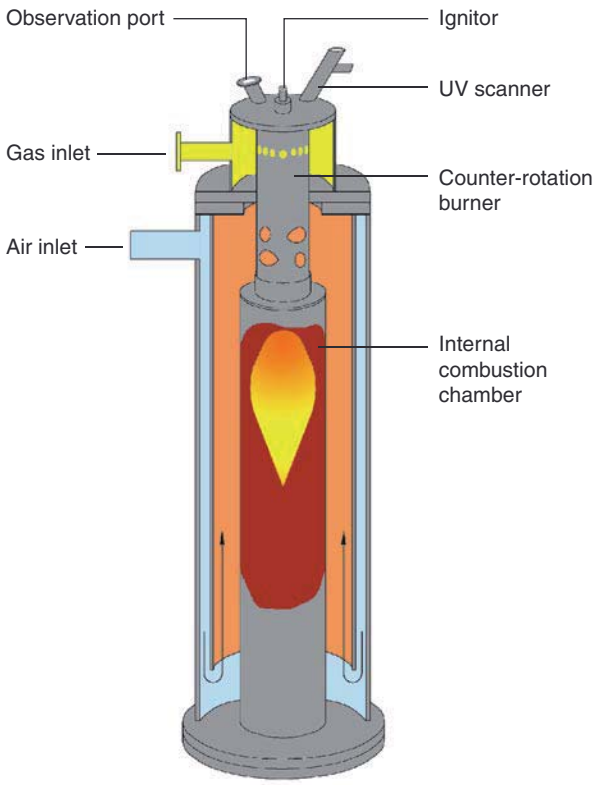

Fig.2 : Compact Immersed Chamber

3 - THE COMPLETE SYSTEM

A heat exchanger tube ③ fed by the compact immersed chamber ② is immersed into the bath.
The flue gases circulate through this exchanger tube and heat is transferred through the tube surface.

A prime feature of such a C.I.C. when compared with conventional immersed tubes, is the reduced diameter of heat exchanger tube, which improves performance by as much as twice that of a conventional immersed tube.
Combustion is completed before entering the exchanger tube, thus avoiding the formation of unburned carbon, which makes internal corrosion negligible. The flue gases are not in contact with the bath.

The efficiency depends on the length of the immersed exchanger tube, the burner excess air, the flue gas pressure drop, and the bath temperature. The C.I.C.'s are designed to reach a thermal efficiency greater than 80%.

① Kettle with conventional burner system (unmodified)
② Compact Immersed Chamber (Fig.2)
③ Heat exchanger tube

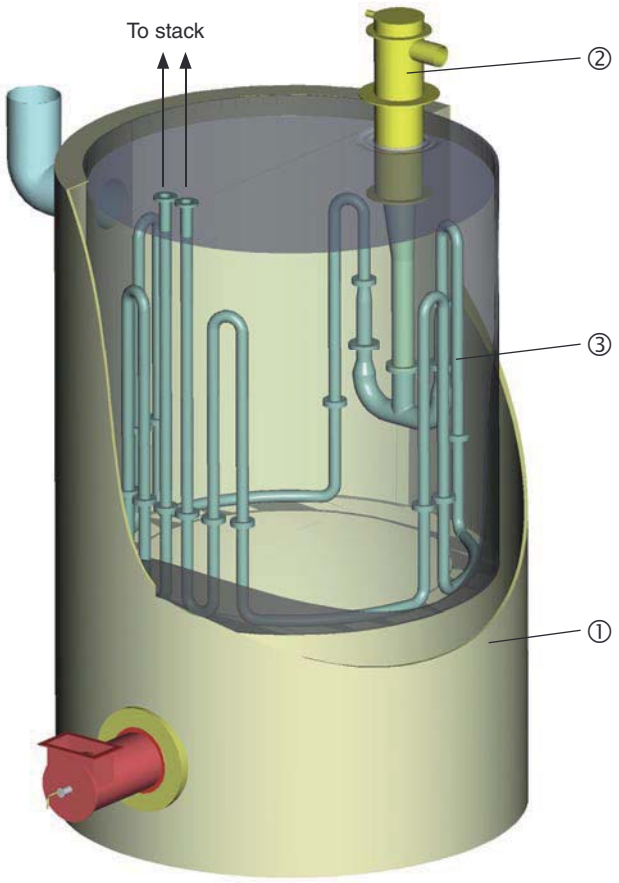

Fig.3 : C.I.C. : the complete system inside the kettle

4 - CONCLUSION

The C.I.C. design leads to significant cost savings over traditional bath heating methods.

More than 200 units have been installed by PILLARD in miscellaneous industries using baths, such as food industry, textiles, metal treatment, and notably for gypsum production in WINSTONE WALLBOARD, NZ.