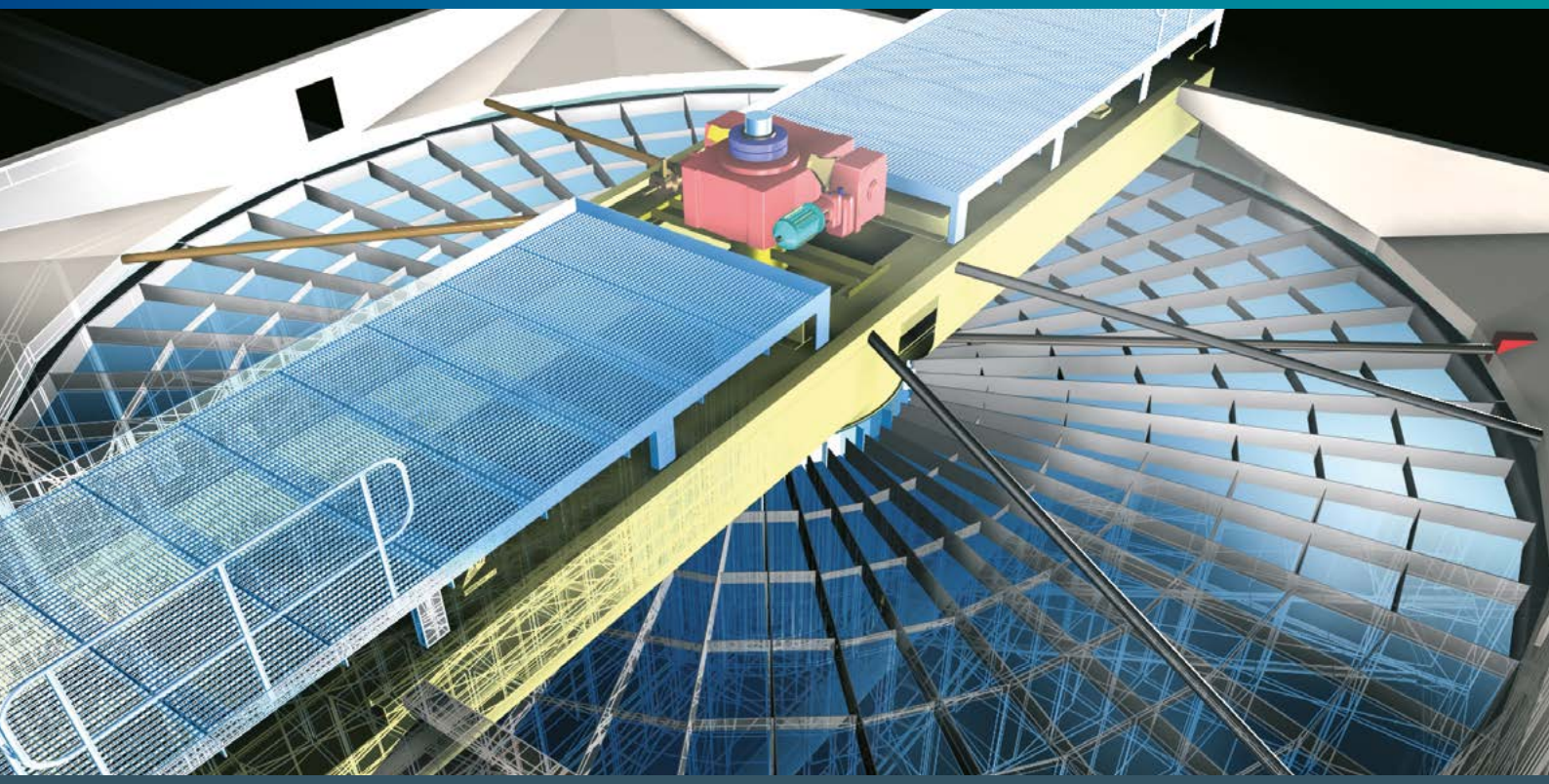
Howden heaters centenary



Regenerative heat exchangers – the evolution of an idea

In his lecture, to the Institute of Mechanical Engineers, Dr Fredrik Ljungström explained, “my idea of the rotor carrying the regenerative material from one side of the heater, where it was heated, to the other side, where the fresh air was entering, was proposed as an improvement of the application. The development along air-preheater lines ensued.”

Efficiency within the application was the goal and his invention succeeded in delivering this bringing with it lower fuel consumption and therefore lower costs. The original thought related to an air-cooled condenser for a steam locomotive. The main application turned out to be preheating air used for combustion within steam boilers. Since the initial test site at a factory in Sweden in 1921, the invention has been fully commercialised by companies such as Howden (originally, through the Howden Ljungström Air Preheater company formed in 1923). Many tens of thousands of air preheaters have been contributing to cost effective boiler plant operations across the world and this is still the primary application today.

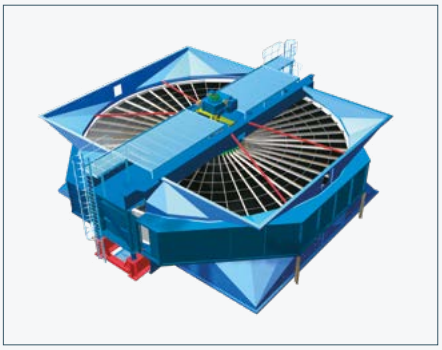
The Howden air preheater (APH) is available as a site assembled heater with bi-, tri- or quad-sector arrangements as well as a pre-engineered and manufactured model for small capacities (typically under 200 tonnes per hour).

The bi-sector has two sections, for air intake and output. This model of APH is used when the plant has separate main and mill heaters, therefore each requiring an APH. It offers low leakage within the application, but comes at a higher cost and larger space demand.

As a result, it has become common practice in today’s power market to consolidate combustion air and coal mill air pre-heating into a single larger unit. This is where the tri-sector arrangement is ideal with two air sections feeding the boiler and mill. Cost is reduced, although it does result in slightly higher air to gas leakage.

A further arrangement is the quad-sector APH, carrying the benefits of the tri-sector in that it supplies both main and mill in a single heater, but with improved leakage management. The improvement is achieved by having the mill air outlet section (of higher pressure) located between two main air sections, thereby limiting leakage.

Most boiler based power plants with over 100MWe of output opt for a rotary regenerative APH over recuperative technology due to its superior efficiency relative to footprint and better long term operating returns. This is also the case in smaller industrial power plants and fired-heater applications within refineries, but served with a pre-engineered model.



Bi-sector, Tri-sector and Quad-sector arrangements.

APH lift onto an FGD unit.

Quadsector APH installation

Beyond the preheating of air, the technology has been seized upon to bring efficiencies in environmental emission reduction plants. Flue Gas Desulphurisation (FGD) systems take advantage of the heater to reheat waste gas streams being treated (gas gas heater – GGH). This ensures sufficient plume buoyancy and prevents ground level SO2 and NOx concentrations rising above specified limits. It eliminates the visible plume and reduces the water usage of the absorber (wet stack typically 40% higher than the water usage with a GGH). It also avoids high stack renovation costs and maintenance issues caused by acid corrosion and drain blockage.

Similar benefits are gained in heavy NOx emitting plants, adopting the use of Selective Catalytic Reduction (SCR) at the tail end of their process. In this case, the heater acts as a gas preheater, increasing the efficiency of the NOX emissions system by reducing additional heating required to reach the reaction temperature for the catalyst (250-330°C). Howden has seen particular uptake in the metals industry for this application.

Continuing the theme of environmental treatment, the developing carbon capture field is also turning to rotary heaters. These are similar to the FGD GGHs being used to reduce flue gas temperature before the capture plant and re-introducing the heat prior to the stack for plume visibility and buoyancy reasons.

Post combustion carbon capture technologies such as Oxy-fuel combustion can gain process efficiencies by deploying regenerative heaters. The heater acts as an APH transferring heat to the oxygen-enriched air, with two recirculated gas sectors bounding the expensive oxygen (similar to a Quadsector APH).

A hundred years since Howden first began manufacturing and selling Fredrik Ljungström's technical breakthrough, the principal continues to deliver value to industrial processes. As the path continues with new demands and solution technologies all seeking the key ingredient of process heat efficiency, the future for an old idea looks bright.

Find out more about our heater range:
www.chartindustries.com/Products/Air-Preheater or
www.chartindustries.com/Products/Gas-Heater

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