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Interview with Paolo Gaboardi, Pomini Roll Grinders Business Unit

Reduction of pollutant emissions during cold rolling

Rolling oil vapours containing organic substances can now be removed from the exhaust air by means of the innovative regenerative condensation process with partial exhaust air recirculation. This new process largely reduces the amount of pollutant emissions and especially the share of the gas phase. Further advantages are that no investment and operating costs are incurred for expensive gas scrubbing and that it is not necessary to heat up the inflowing air. The new Sundwig 20-roll cold rolling mill installed at Vacuumschmelze Hanau is the world's first to use this innovative technology from Schuh Anlagentechnik.

Also existing plants can be retrofitted with this regenerative condensation technology.

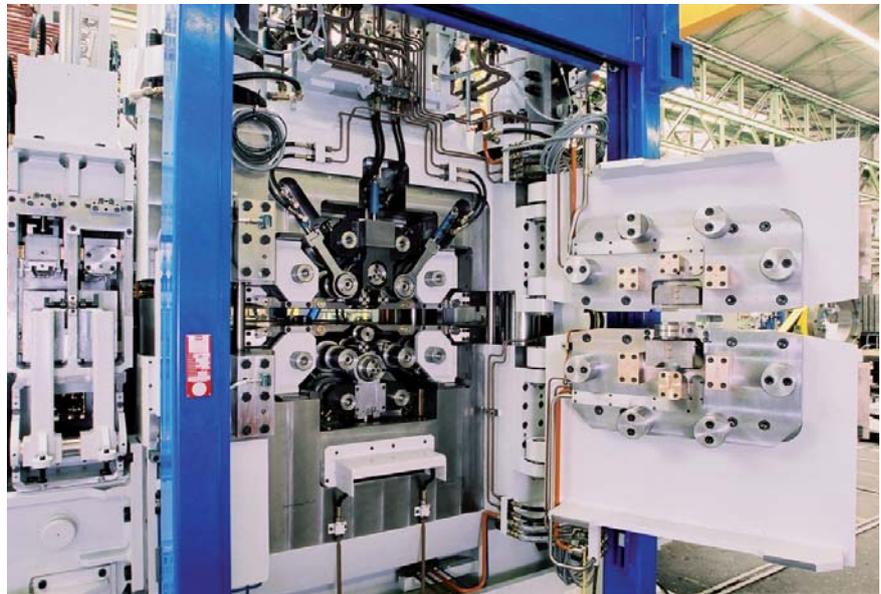


Figure 1. A 20-roll cold rolling mill (Courtesy: Sundwig)

Vacuumschmelze Hanau (VAC) develops, produces and markets special materials, in particular magnetic materials and products manufactured from these materials, such as refined products for further processing, constructional units, parts, components and systems. From automotive engineering, communications and data technology through to the aviation and aerospace industries, clockmaking and medical engineering: VAC products find use in versatile applications in virtually all electrical engineering and electronic fields. The headquarters in Hanau is the company's main production location with a total of about 1,500 employees. Other production facilities are in Slovakia, Malaysia and China.

VAC was the first company in the world to melt and cast metals under vacuum on an industrial scale to produce nickel, iron, cobalt and chromium alloys with lowest contents of carbon, nitrogen, oxygen, hydrogen and non-metallic inclusions (oxides, nitrides and carbides). The application of the rapid solidification technology, applied among others by VAC, enables the production of metal strips in 15 - 50 µm gauges in a single process step.

New 20-roll cold rolling mill

The range of products manufactured by Vacuumschmelze (VAC) Hanau includes special magnetic materials melted and poured under vacuum. The growing demand for special materials, in particular magnetic materials, and the introduction of new products with more exacting quality demands led to the decision to invest in a new 20-roll cold rolling mill. The rolling mill, supplied by Sundwig, will roll special-alloy strips between 0.025 and 1.8 mm thick and up to 420 mm wide (figure 1).

The rolling mill is equipped with two separate roll bending systems, a mechanism for axial shifting of the first intermediate rolls and automatic passline adjustment. Sundwig supplies the mill complete with mechanical ancillary equipment, such as hydraulics and rolling oil system. The electrical equipment includes automatic gauge control, automatic flatness measurement and control system as well as a visualization and rolling mill management system. Construction started in 2006. Commissioning is scheduled to take place in the second half of 2007.

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Simple separator design to minimize oil vapours

Decisive factors for VAC's decision in favour of the new mill were not only the economy and optimization of the rolling process but also environmental compatibility aspects. A key objective was to minimize the emission of rolling oil vapours.

The company also intensively reviewed the investment costs of the ancillary equipment and the costs of consumables such as rolling oil. The cleaning of waste air from rolling mills used to be handled by vapour separators, mist collectors or dry electrostatic precipitators. The implementation of the new regulations according to the German Clean Air Act (TA-Luft) - the transitional period for which expires at the end of 2007 - partly requires the installation of additional equipment, such as gas scrubbers or wet electrostatic precipitators or activated carbon filters. As the systems required for this are very complex and cost-intensive, the company looked for more favourable alternatives.

VAC decided to install on the new mill the first-ever regenerative condensation system (figure 2) newly developed by Schuh Anlagentechnik GmbH because this technology provides high efficiency at low investment and operating costs. The joint basic approach to the development of the new process was to cool down the waste air with the objective of transferring the gaseous phase into the liquid phase. In the process the rolling oil vapour condenses into drops which can be reliably separated by simple technological means. Simple mechanical components are used instead of expensive and complex gas scrubbing equipment.

The recovered rolling oil can be reused or - after conditioning - recycled to a higher percentage than in the past. The advantage is twofold, because the environment is not polluted by the disposal of rolling oil and VAC saves money on rolling oil.

Swirl tube technology saves energy

To optimize the efficiency of waste air capturing Schuh Anlagentechnik uses the swirl tube technology jointly

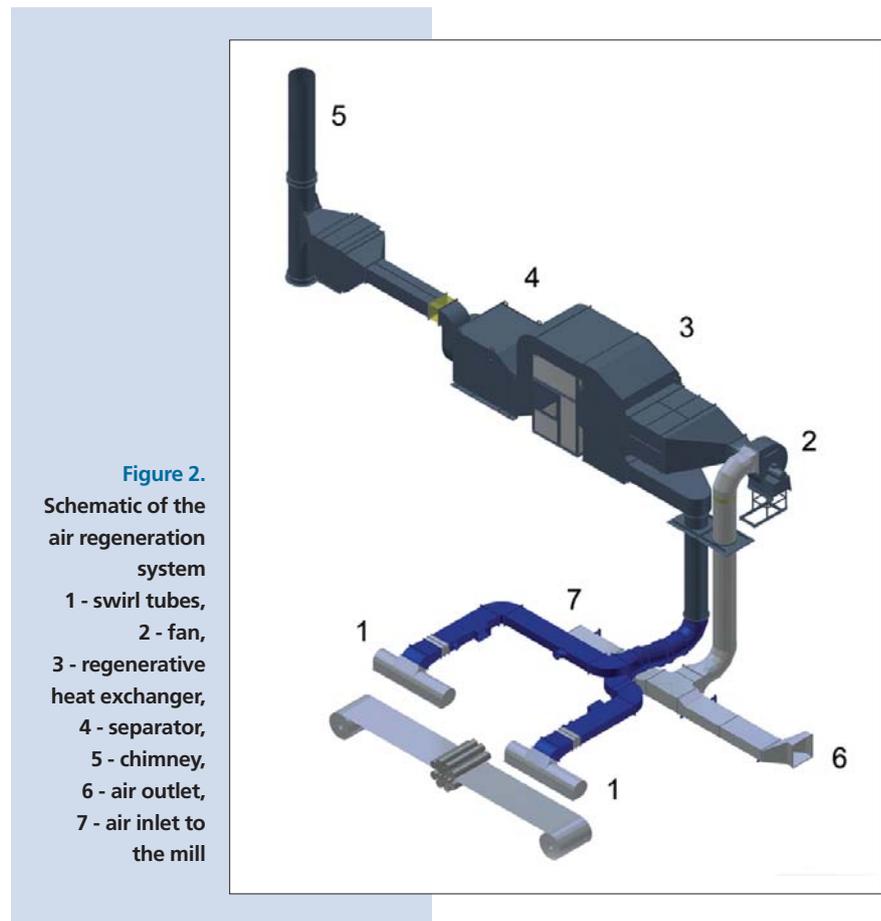
developed with the Institute for Industrial Aerodynamics of the Technical University of Aachen. This technology achieves the same suction efficiency as the classical hood technology with a volumetric flow reduced by up to 40 percent and much smaller space requirements (figure 3).

The mill stand is completely housed as a measure to abate noise and prevent waste air from escaping. Nevertheless convenient access is guaranteed through the provision of safety doors and a removable top (figure 4).

To save space inside the building the complete waste air system including the plate-type heat exchangers are mounted on top of the building (figure 4).

Efficient environmental protection at low costs

The regenerative condensation process is an attractive alternative to the classical methods by gas scrubbing or activated coal filtration that both



The waste air released by the rolling mill is first guided to a condenser which operates as a regenerative heat exchanger using cold external air. It cools the waste air down until the rolling oil vapour changes from the gaseous to the liquid phase. In the first vapour separator stage the resulting droplets coalesce into larger drops, a high percentage of which is separated in the downstream impact separator.

After this procedure the waste air is so clean that it can be directly released to the ambient atmosphere.

involve much higher investment and operating costs.

There are a number of cost-reducing design features about the new technology which make it distinctly less expensive than wet electrostatic precipitators, gas scrubbing equipment or activated coal filters:

- For a comparable capturing rate the swirl tube technology requires only 60 percent of the suction capacity of a classical hood-type solution.
- Heating the incoming air in a heat exchanger by means of the waste air from the mill stand saves much of

the energy otherwise required for incoming air heating.

This results in significantly lower operating costs due to the smaller volumetric flow for air extraction, the smaller condenser and the fact that additional heating energy is only required under extreme weather conditions. The efficiency calculation according to VDI 2071 demonstrates that the heat exchanger recovers more than one million kWh energy per year. The pay-back period for the extra investment in the system is less than a year.

Versus gas scrubbing methods, wet electrostatic filtration or activated coal filtration, the new system provides higher efficiency in a more compact design and with a less energy consuming technology. Investment costs are less than one third of those required for gas phase filtration. In contrast to previously used systems the rolling oil is almost completely recovered. The impact precipitators have the advantage of being virtually maintenance-free.

Specialists in clean air technology

Schuh Anlagentechnik GmbH was established in Bochum, Germany, in 2001 by the team of engineers dedicated to "Special applications of industrial ventilation engineering" at the Wuppertal-based company Spelleken. The technology provided by the company ranges from suction equipment for various waste materials, disposal plants for waste material from production plants via ventilation and air extraction systems through to numerous special applications in the iron and steel, aluminium, plastics and paper industries.

The applications include smoke extraction, ventilation and air extraction, especially suction systems for rolling mills and grinding plants, chip suction at milling machines, suction equipment for paper shredding and edge trim removal systems as well as dust extraction systems for most diverse areas of manufacturing. The provided services span from problem

mapping on site, support during approval processes through to project planning and management, assembly and commissioning of ventilation systems.

Outlook

Already today the new system provided by Schuh Anlagentechnik is an economic solution for new cold rolling mill projects in compliance with the limit values stipulated by the German Clean Air Act. Consequently waste air filtration by regenerative condensation is an approvable process provided that the overall balance of emissions units does not exceed the permissible threshold values.

Also for rolling mill modernization regenerative condensation is a viable solution. The components can be easily retrofitted because they are more compact than those of existing rolling mills.

Summary

The new concept for the air recovery system at the VAC 20-roll mill combines several technologies for efficient and cost-effective waste air filtration which reduce both investment and operating costs.

Heating the incoming air in a heat exchanger by the waste air released by the rolling mill saves a large part of the energy otherwise required for heating up the incoming air. The pay-back period for the system is less than a year.

The swirl tube technology requires lower volume flows than a classical hood-type system, namely only 60 percent for an equivalent capturing rate.

Through the use of regenerative condensation complex equipment for the filtration of the gas phase can be dispensed with and replaced by simple mechanical systems. The investment in regenerative condensation amounts to less than a third of the costs of gas filtration equipment.

Regenerative condensation is an approvable technology in new rolling mill projects. For modernizations of existing rolling mill stands the regenerative condensation components can be easily retrofitted. ■



Figure 3.
Swirl tube inlet



Figure 4.
Components installed on the roof of the building



sauber | sicher | flexibel