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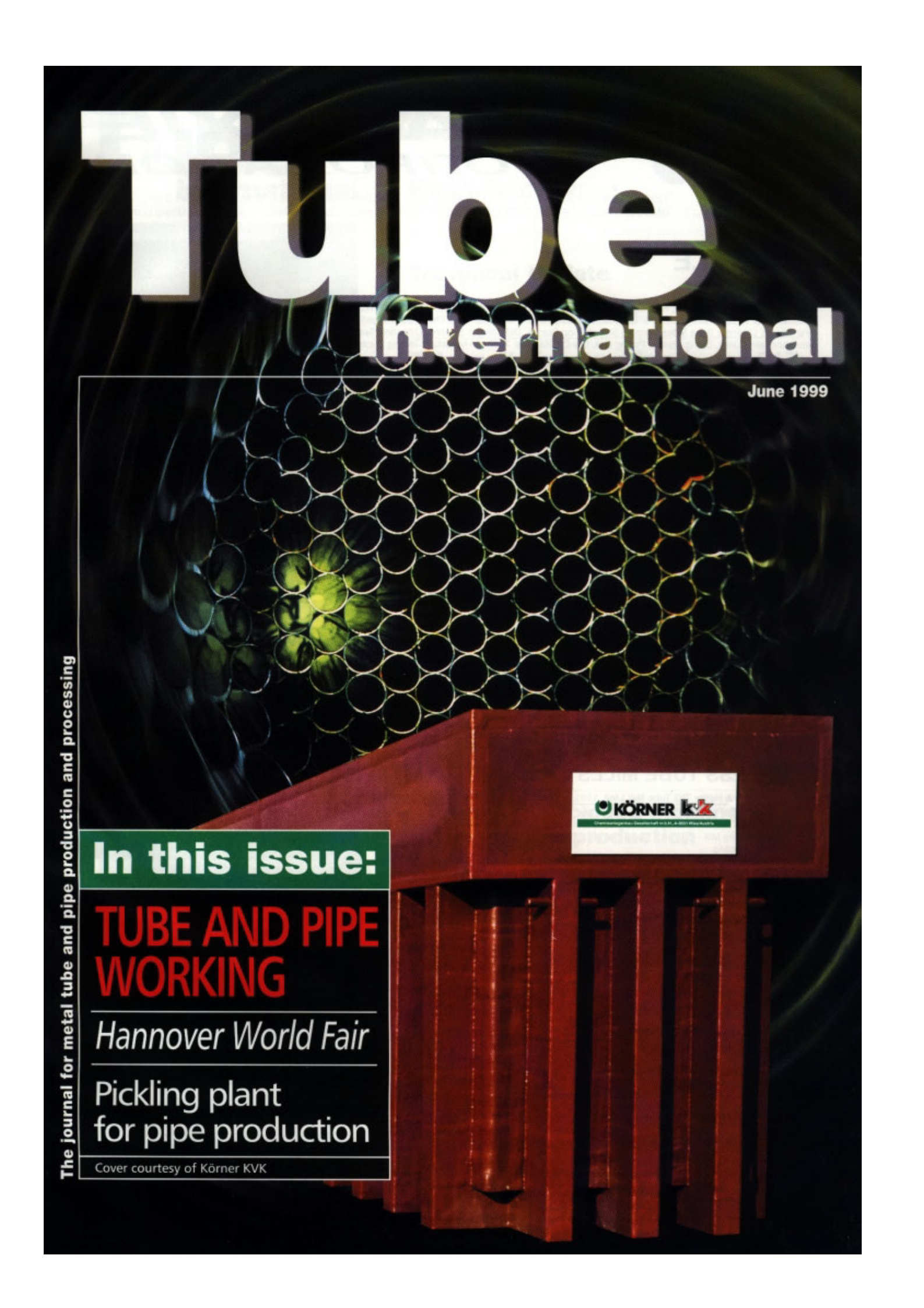

The journal for metal tube and pipe production and processing

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TUBE AND PIPE WORKING

Hannover World Fair

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Tube International

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Automatic enclosed pickling plant for pipe production

Friedrich Nerat studied general mechanical engineering at the University of Technology, Graz, from 1983 to 1990. His thesis was on the modernisation of machine tools (from conventional methods to CNC technology) and he has written numerous publications on this topic. From 1990 to 1994, Mr Nerat was project manager at Maschinenfabrik Andritz, Graz (plant construction and paper making machines). He joined Körner Chemieanlagenbau in 1994 and, since 1996, has headed the sales and project management departments. Automatic enclosed pickling plants are his speciality.

Constantly increasing competition in the pipe manufacturing sector demands maximum quality and productivity from pipe producers. Only those who can supply top quality products at low cost will remain competitive in the future.

The increasing severity of environmental standards demanded by the authorities is an additional factor exerting more and more pressure on pipe producers, and one which also demands maximum effort in respect of job security. Seen from this point of view, chemical pretreatment is without doubt the most critical area in pipe production.

The different kinds of agents for chemical cleaning are used almost exclusively at high temperature, which naturally leads to the emission of fumes. In most pickling plants there is no physical separation between the chemical pretreatment process and the remaining production or storage area. This frequently results in the directly adjoining areas being affected by the emitted chemical fumes. This involves not only increased corrosion of parts of buildings, but also the possibility of damage to stored products.

In response to this problem, over the last few years Körner KVK has developed a fully enclosed, fully automatic pickling plant using a system which has already been very successfully implemented several times in hot dip galvanising plants. This system can also be applied in the pipe industry, either for pretreatment of pipes which will subsequently be galvanised, or as a pure pipe pickling facility for a downstream drawing process.

The first fully automatic enclosed pipe pickling plant in the pipe industry was recently commissioned. The plant was planned and implemented as a joint project with the pipe producer. Using this plant as an example, described here is the concept of the fully automatic enclosed pickling plant, the theory of which was fully described in the Körner article *Pickling technique and pickling technology of the future* in *Tube International* (September 1997, p383). Detailed information on the construction of the pickling tanks is given in the article *Körner – pickling equipment supplier for more than 25 years* (*Tube International*, July/August 1998, p405).

Description of the plant logistics

Planning of the pickling plant was started at a time when a rough concept for the remaining production sequence already existed. In collaboration with the customer, a layout was developed which could be integrated seamlessly into the transport paths of the remaining production areas in order to achieve not only short throughput times but also sufficient intermediate storage and buffer areas.

This plant concept combines the advantages of the longitudinal and transverse movement of the bundle of pipes. At a defined transfer position outside the pickling plant, the material from a storage area or directly from the upstream production sector is transferred to an automatic transport system responsible for the automatic execution and monitoring of the process sequence within the chemical pretreatment facility.

The pipe bundles are transported into the enclosed pickling plant in a longitudinal direction through an automatic sliding gate with the absolute minimum opening of the enclosure. As soon as the bundle of pipes is inside the enclosed plant, the gate closes automatically and encapsulates the chemical sector from the surrounding areas.

Inside the enclosure the transport direction changes through 90° while the alignment of the pipes remains unchanged. This makes it possible to realise short transport paths and a compact arrangement of the processing tanks. The transport system performs the pretreatment process fully automatically in accordance with a freely programmable preset program, whereby all the processes involved can be freely defined and can be reproduced at any time.

At the end of the chemical treatment, the direction of the ▶

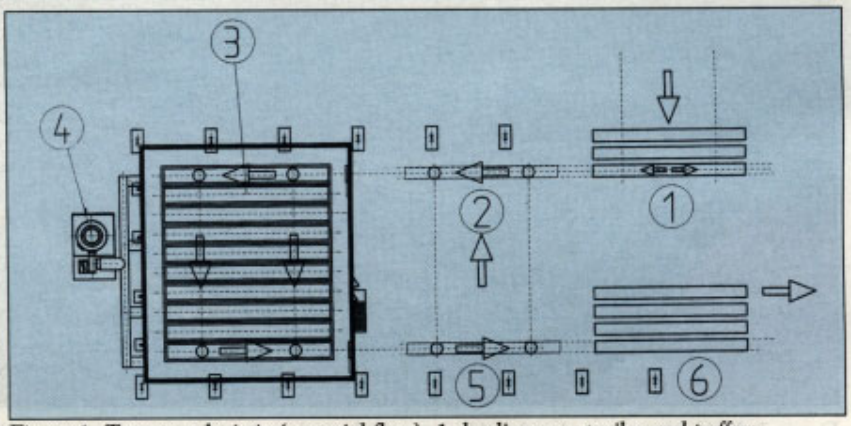

Figure 1. Transport logistic (material flow). 1: loading on a trailer and puffer; 2: handing over to automatic system; 3: closed pickling area; 4: scrubber system; 5: handing over to trailer; 6: unloading and puffer

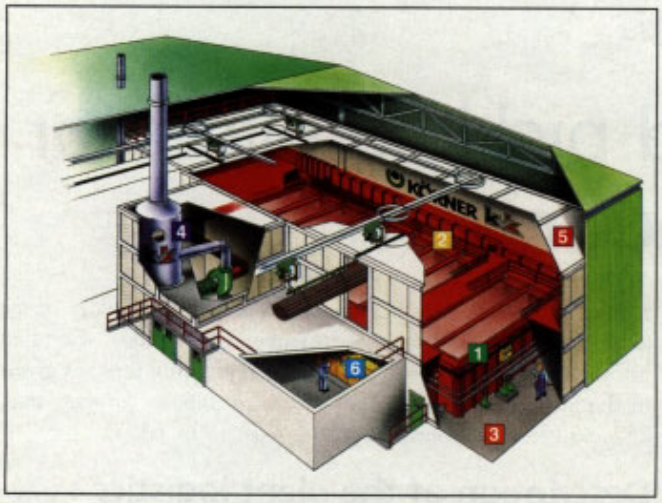

Figure 2. Encapsulated pickling plant. 1: pickling tanks; 2: heating coils; 3: coating system (dry cellar); 4: scrubber system for partial vacuum and purification of extracted air; 5: acid proof enclosure; 6: control equipment

movement of the transport system changes once again through 90° in order to leave the enclosed pickling plant through the smallest possible opening. Transfer to the downstream transport systems takes place at a defined transfer position.

The trolleys then return automatically to the transfer position to collect the next bundle of pipes. The number of trolleys is determined by the capacity requirements of the customer. Inside the enclosed pickling plant, it is possible to either set the individual bundles of pipe down in the processing baths, or to leave them attached to the trolley. Since the process is monitored fully automatically, it is not necessary for the operating personnel to be present inside the pickling plant.

The processing tanks are positioned as compactly as possible (longer sides together) inside a concrete trough with a chemicals-resistant coating. An enclosure of chemically resistant panels is fitted over this trough, which is also designed to act as a collecting sump in the case of leakage of chemicals. These panels and the inside of the coated trough together form a chemically resistant box which ensures that the fumes arising during the chemical processes are retained inside the enclosure. The edges of the tanks are bonded together in a leakproof way, and KVK floor panels installed continuously around this group of tanks. The floor panels are bonded, diffusion-proof, both to the tanks and to the panels of the enclosure.

This construction divides the enclosed pretreatment area further into an emission space (above) and a cellar area which remains dry. Parts sensitive to corrosion, such as electric components, valves, pumps, etc can be installed in this dry cellar area in order to protect them. The floor panels fulfil a second function of leading process chemicals – which would otherwise have landed next to the tank as a result of pulling the pipes out too quickly – back into the bath.

Encapsulated pickling plant installed

In order to guarantee that no chemicals are emitted from the enclosed plant, an extraction plant was installed which generates a slight partial vacuum through extraction of a defined volume, thereby preventing chemicals from escaping into other production areas.

The design of the fume extraction plant is matched exactly to the specifications of the process (chemicals, temperatures, openings in the enclosure, eg access gates). The fume extraction plant must fulfil three main tasks:

- Generation of a sufficient partial vacuum in the pretreatment area to prevent the emission of fumes at all times
- Generation of an adequate exchange of air
- Purification of the extracted air.

In order to fulfil the first of these tasks, it is necessary to take two main operating states into consideration. In the first operating state (the access gate is open and a new bundle of pipes is being conveyed into the pickling plant), a relatively high volume must be selected for the exhaust air since a large area of the enclosure is open.

Figure 3. Inside the encapsulated pickling area, where the transport system operates fully automatically. Note no operating personnel inside the enclosure

Once the gate has been closed again the extraction volume can be considerably reduced. For this reason, the fume extraction plant was equipped with a partial vacuum controller which adapts automatically to the different operating states. Since the energy consumed by the fan motor increases with the extraction volume raised to the power of three, considerable savings can be achieved.

Example: reducing the exhaust air volume from 100% to 80% reduces the energy consumption of the fan by 50%.

The process baths are heated using various heating systems to meet the respective requirements. Control of the bath temperatures is fully automatic. Process baths are supplied with chemicals from a central chemicals store through pipelines connected directly with the baths. This avoids open handling of acids or other chemicals. All piping was laid in close cooperation with the operator and the possibilities of process purification plants were either already implemented or prepared for a future expansion.

The entire project planning focused particularly on realising all the customers' requirements within this concept, with special efforts made to optimise project costs through the use of local suppliers. Eg, structural drawings for several plant components were given to the operator for him to have manufactured locally and to integrate in the overall concept during assembly.

Summary

In order to meet the high demands in respect of productivity, quality and environmental protection, the first fully automatic, fully enclosed pickling plant according to this concept was recently commissioned in the pipe industry. This plant was planned individually for the customer and fulfils all the requirements for the specialised product. The complete enclosure of the pickling plant means that no personnel need to be inside the chemical pretreatment area, amounting to an enormous improvement in working conditions.

Enclosure of the chemical section also leads to a considerable reduction in maintenance costs generated by corrosion damage which would otherwise be suffered by buildings and crane equipment. The plant is operated fully automatically and enables the highest quality standards to be met. These can be documented without difficulty in the sense of a wide range of quality requirements set by ISO 9001 etc and, above all, can be reproduced.

The plant meets the highest standards of environmental and safety and protection: it is even possible to store pipes immediately next to the pickling plant, while the automatic design with fully automatic monitoring minimises the influence of human error.

The enclosed pickling plant system presented here has already been successfully realised in 15 plants within the hot dip galvanising industry and has now also been successfully implemented in the pipe industry. Other pipe pickling plants are already being planned in accordance with this concept.