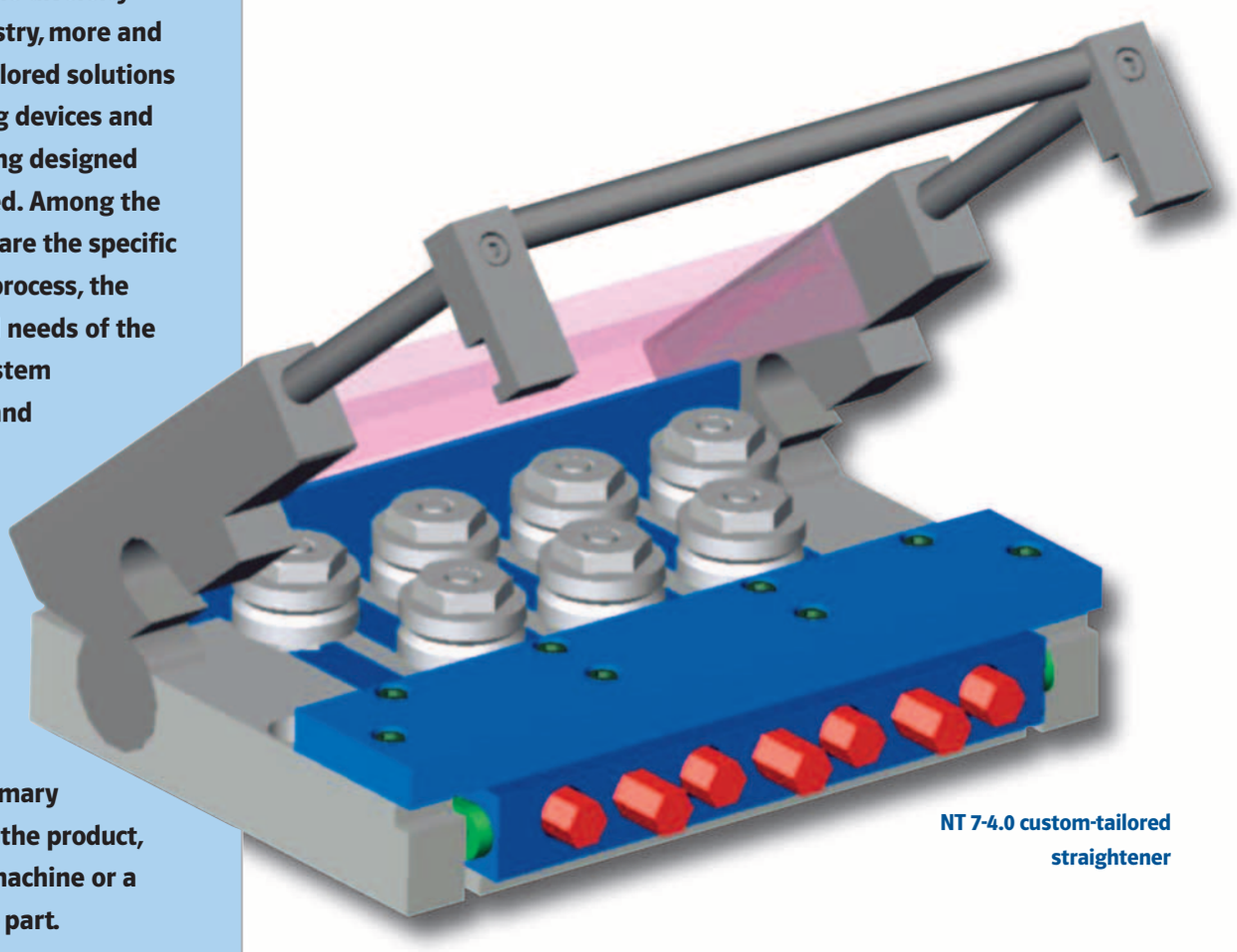
Custom-tailored straighteners

In response to the diversity of the wire industry, more and more custom-tailored solutions for straightening devices and systems are being designed and implemented. Among the reasons for this are the specific features of the process, the experiences and needs of the machine and system manufacturers and users, and requirements arising from economic considerations and continuous improvement processes.
As a rule, the primary consideration is the product, whether it is a machine or a pre-formed wire part.



NT 7-4.0 custom-tailored straightener

At Witels-Albert GmbH, customized straightening equipment is always designed with a view to the specific requirements, and is implemented efficiently through the use of up-to-date tools. During the development, bidding, and manufacturing stages, the desired variants can be achieved, for example, by employing aids such as CAD/CAM, simulation techniques, and modern CNC machining centers. A fundamental goal is to ensure the shortest possible *time to market*.

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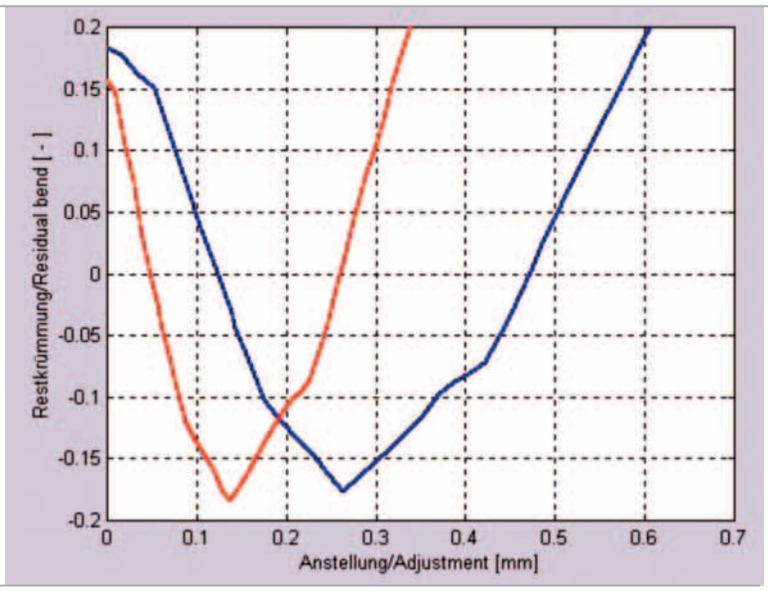

Residual bend variation depending on roller adjustment

Development and manufacture of a customized straightener is naturally followed by its use. Subsequent observation shows that experience gained by operating personnel on standard straighteners is no longer useful, or only partially useful, when positioning rollers on custom-tailored straighteners.

Observation during positioning

As a result of altered geometric parameters such as different roller diameters or spacing, the straightening rollers may have to be positioned very sensitively in order to achieve the desired residual bend. This observation from practice in the wire industry is also evident when analysing simulation results, as shown in the example. The illustration shows the residual bend variation depending on roller adjustment for two different straightening processes. The two straightening processes differ in the design of the straightener used, the only difference being the roller distance.

When working with the same process material, the curve shapes are similar, but have different rates of rise at the characteristic points. Considering that the goal is to produce straight process material, the zero points of each curve are of particular interest, since they correspond to the roller adjustment which can be used to achieve the desired quality in the finished product. The sensitivity with which the straightening roller must be positioned is directly proportional to the rate of rise at a zero point. In the interest of making a straightener easier to set, therefore, it is advantageous to use a design variant in which the zero points of a curve lead to small rates of rise.

Support from simulation

It becomes clear that simulation of the straightening process [1] provides useful support when dimensioning and setting specially-designed straighteners, since the characteristics of the straightening process can be investigated and demonstrated virtually and *a priori*. Using simulation of the straightening process, Witels-Albert can offer modern, custom-tailored systems and objective recommendations for the use and setting of products to achieve defined goals.

In this context the software SimData [2] is mentioned, which enables cost-effective determination of roller positions. It can be used for both standard solutions and specifically-designed straighteners. Its use leads, in particular, to reduced consumption of process material and less time and work needed for setting the rollers, thus lowering costs. Using SimData, even inexperienced operating personnel are able to determine the roller positions for a defined straightening quality and to make the corresponding settings.

To calculate the roller positions using the software, the operator specifies the type and size of the straightener, as well as the diameter, yield point and modulus of elasticity of the process material. The adjustment values are then automatically calculated and displayed. The values can be saved, meaning that the opportunity also exists to set the rollers in the future in a defined and reproducible manner.

Custom-tailored double straightener

One example of a custom-tailored solution is the DRS 7-5.0/8.0 double straightener. In close cooperation with Wafios AG, Reutlingen/Germany, a straightener was designed which reflects a tendency noted in machines for the manufacture of springs and pre-formed parts: very compact construction and specific tools which can be adjusted quickly and easily. The area of application of the double straightener is in the FMU 6 winding, coiling and bending center from Wafios. The fundamental objective of this development project was to replace the traditional procedure of changing out complete straightener sets when the process material dimensions or the straightening range is modified.

The double straightener is notable for its two different straightening ranges,

each of which has a precision main body integrated in its mechanical elements. The roller diameter and spacing have been optimised for each of the two straightening ranges, making it possible to process wire diameters from 2.0mm to 5.0mm on one side of the straightener, and from 5.0mm to 8.0mm on the other side. All rollers can be positioned either manually or through the use of the *Computerized Tool*.

To switch from one straightening range to the other the straightener is unlocked, rotated 180° and locked again. Additional characteristics are minimal distortion of elements of the straightener located directly in the flow of force (high stiffness) and a fast and reliable locking mechanism for each of the straightening ranges (particularly useful when processing high-strength wires).

Attention to the smallest details

Like the DRS 7-5.0/8.0 straightener, the NT 7-4.0 is another example of a specific solution using a precision main body. It accommodates the elements needed for roller positioning, the components of the quick-action locking device, and a transparent protective cover. The locking handle of the quick-action locking device is designed with a telescoping handle, allowing maximum locking force to be applied when desired. Positive-fit levers on the locking handle keep the straightener reliably closed during the straightening process.

As an option, hard alloy liners can be used to guide the process material at the input and output sides. The roller diameters and distances between rollers have been optimised in order to allow straightening of process materials in a wide range of diameters. Straighteners in the NT series are available in three sizes at the present time. Depending on the specific range of wire dimensions for the straightening process, the use of either the NT 7-2.0 (straightening range from 0.8mm to 2.0mm), the NT 7-4.0 (straightening range from 2.0mm to 4.0mm), or the NT 7-6.0 (straightening range from 4.0mm to 6.0mm) is recommended. The development work carried out on the NT series was focused on the straightener's potential area of application, namely the processing of spring steel wires.

DRS 7-5.0/8.0 double straightener

DRS 7-5.0/8.0 double straightener (front view)

Experience has shown that the design of custom-tailored straighteners requires close cooperation with the customer and that relevant data and information must be provided. Therefore anyone potentially interested in specific or customized straightening equipment is asked to formulate the requirements objectively and to collect and make available the necessary data and information. On request, Witels-Albert will send you a simple question sheet to assist in the requirements identification process. ■

Literature

[1] Guericke, W.; Paech, M.; Albert, E.: Simulation of the Wire Straightening Process. Wire Industry, 8 (1996), pp. 613-620

[2] Paech, M.: The Positioning of Straightening Rolls. WIRE 52 (2002) 2, pp. 82-83

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