

**Production Line for
Stainless Steel Micro Tubes
UNIWEMA® 5L**

UNIWEMA 5L General

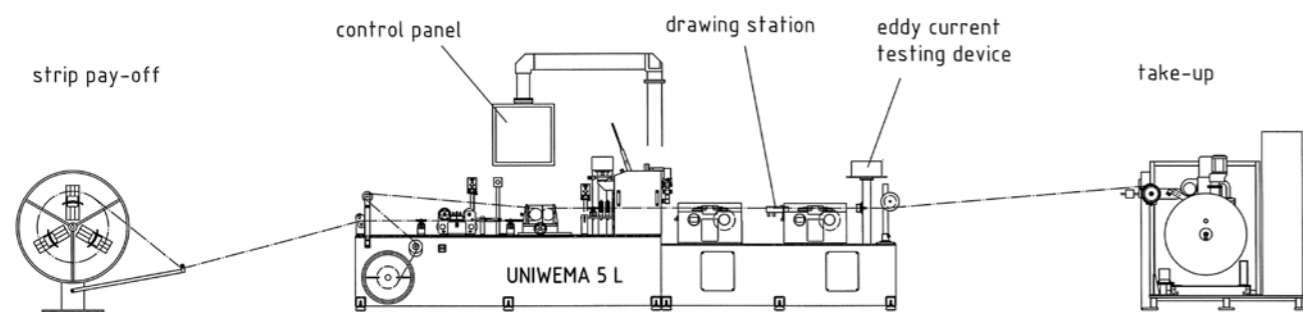
Stainless steel micro tubes are used for a number of different products such as pre-material for all kind of injection needles. To avoid expensive multi-stage drawing, such tubes should be formed and welded in dimensions as close as possible to the final wall thickness/diameter required. In our production line stainless steel micro tubes in a range of different welded diameters and different wall thicknesses can be produced in a single continuous process.

Quick interchange from one dimension to the next results in a low down time of the line. The core equipment of this production line is the UNIWEMA® 5L which perfectly coordinates forming and welding with the other requirements of the production process. The UNIWEMA® 5L is the smallest type of our forming and welding machines UNIWEMA® which are successful in operation around the world for more than 50 years.

Overview

The production line consists of the following major sub-units:

- strip pay-off
- micro tube forming and welding machine UNIWEMA® 5L
- tube drawing and sinking station
- take-up
- control of the production line
- accessories for continuous production



Description of the Production Line

Strip pay-off

The vertical strip pay-off has an expanding head on which standard strip coils with an outer diameter of up to 1,200 mm and a core diameter of approx. 400 mm can be placed. The diameter of the expanding head fits to the core diameter of the strip coil. The dancer controlled drive ensures a smooth paying-off of the strip, as required for the subsequent production steps.

Micro tube forming and welding machine UNIWEMA® 5L

The micro tube forming and welding machine UNIWEMA® 5L is the core equipment of the production line. By the UNIWEMA® process the metal strip coming from the strip pay-off is introduced into the machine and, in a single operation, the strip edges are trimmed and formed into a tube. Then, the opposing strip edges are longitudinally butt welded. Two split-clamp caterpillar capstans loca-

ted downstream from the welding station pull the tube through the machine. The perfect coordination of the forming and welding operation with the first split-clamp caterpillar capstan is a precondition for obtaining a uniform weld seam. This is the basic concept of about 200 UNIWEMA® machines supplied to companies around the world.

For the production of pre-material for e.g. injection needles this basic UNIWEMA® concept has been modified and redesigned. On the UNIWEMA® 5L the steel strip is prepared and formed in a forming tool in two main sections.

The first section of this tool prepares the tape edges, which are to be welded and starts forming the tape into an open u-form. The second part then forms the tape into a circular shape for welding.

The interval can be used as a space to introduce lubrication for the follow-up sinking and drawing process, which takes place

between the first and second split-clamp caterpillar capstan.

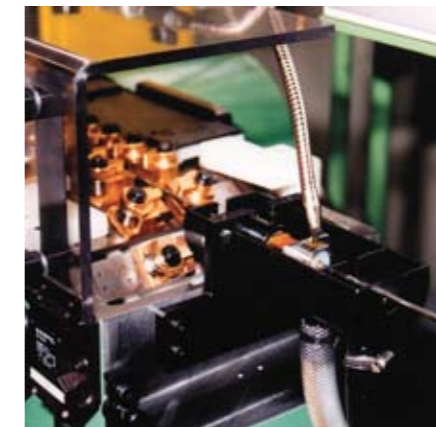
Welding of small diameter/thin wall thickness micro tubes as produced on this line is done by Laser. The standard Laser used for welding these special stainless steel micro tubes is a solid state Laser (Nd:YAG). The standard Laser welding technique is the conduction limited welding which has been optimized for this kind of small diameter/thin wall thickness micro tube production. A very narrow weld seam is achieved by this welding method requiring, however, a precise guiding of the strip edges under the laser spot. The combination of the high precision forming tool and the split clamp caterpillar capstan which holds the seam within the tolerance needed, makes the use of a seam detection and guiding unit obsolete. The weld seam quality is tested in-line by an eddy current testing device.

Tube drawing and sinking station

After the tube is welded, it is sunk to an appropriate diameter between the first and the second split clamp caterpillar capstan. The two capstan units are speed controlled via the PLC, which enables them to draw down the tube diameter with a reduction on the wall thickness and the diameter in a predefined ratio.

Take-up

The micro tube is spooled via dancer control onto a take-up. Due to the small size of the tube it is very important to reel the micro tubes with as little pulling force as possible. The laying process is controlled via modern control software, in which the different requirements can be set. A standard traversing take-up has been modified to meet the special requirements of this production process.



Control of the production line

All individual parameters of the production line such as speeds of the different components, welding power and also all measurable and adjustable parameters are PLC-controlled and adjusted / monitored and stored. The machine operator controls the line from the main control panel at the UNIWEMA® 5L. This panel includes a color

monitor to display the welding zone and a TFT screen, which shows a clear arrangement of all functions of the total line. In addition, quality-relevant data can be monitored and recipes for different products manufactured on the same production line can be stored and recalled at a later date. An optional remote error maintenance system can be integrated in the production line to enable our service to check the electronics of the customer's equipment from our plant with the help of special software via Internet.



Accessories for continuous production

The single length of the micro tube produced on the standard line is limited by the length of the strip coil as supplied by the strip supplier. For long continuous production a continuous strip supply must be ensured, i.e. the strip ends of several coils have to be spliced by cross welding to achieve the required length. This cross welding is done by a strip splicing equipment separa-

ted from the main production line. By such separation any interference of the splicing process with the main continuous production process is avoided. In the strip splicing equipment a unique tape pad magazine is filled with a number of strip coils which are spliced by butt cross welding. For continuous production the in-line strip pay-off consists of a driven turntable on which an exchangeable tape pad magazine, filled with a number of strip coils, is assembled. Via a sophisticated guiding and speed control device the strip runs from the coil into the production line. The change-over from one coil to the next does not affect the production speed.

This strip splicing equipment comprises the coil roll-off stand, a turntable with the exchangeable strip pad magazine and the Laser cross welding equipment. In the strip coil magazine coils are placed above each other, separated by spacers. After the end of the lower coil is butt welded by the Laser cross welder to the beginning of the next coil the spacers are introduced. The quality of the cross weld is as good as the longitudinal weld and does not affect the quality of the final micro tube. The capacity of the strip splicing equipment allows preparation of exchangeable strip coil magazines for several production lines.

Technical Data	Technical Data	
	Diameter of the welded tube	2.0 - 5.5 mm
Diameter of the final tube	1.0 - 5.5 mm	
Wall thickness of the tube	0.05 - 0.2 mm	
Production line speed:	3 - 25 m/min	
	(depending on tube dimensions)	



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