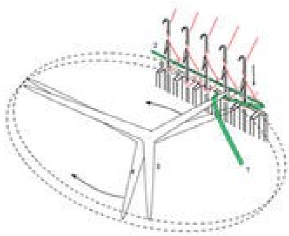

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Figure 1 (left): Wing weft insertion, upper wing leads weft, shortly before weft transfer to lower wing
1 = Weft end coming from the bobbin
2 = weft end in the knitted fabric
3 = upper wing turning counterclockwise, just catching the weft 4 = lower wing turning clockwise to return the weft
Figure 2 (right): Wing shot entry in the demonstrator unit, the lower wing guides the shot.

Description of the “HOWIRK” funding project for the “NRW Patent Validation” funding program

The processes and machines used in warp knitting are characterized by a stitch-forming process. In addition to the stitch-forming yarns, weft yarns can be inserted into the knitted fabric.
In many applications, the insertion speeds reach their process limits. The idea on which the invention is based can provide a solution to this problem.
Previous insertion processes are characterized by machine elements that have to perform an acceleration and braking movement for each insertion in the shortest possible time. The new wing weft feeder can use counter-rotating impellers to move the threads back and forth without having to slow down or accelerate.

Wing traversing systems are known from winding technology and can deposit and vary yarns at speeds of up to 8,000 m/min with a traversing width of 20-30 cm to within a few millimetres. This technology has not yet been considered in warp knitting. As a result, traversing speeds for weft yarns of up to 2,000 m/min could be realized.
Previous processes work at high insertion speeds and widths of up to 3 m with a magazine weft that is inserted several times simultaneously and is therefore prepared for the needles. This cuts the edges of the knitted fabric. Thanks to the new speed dimension for wing weft insertion, the weft yarn can only come from one bobbin and can therefore also be fed back and forth at the edges, creating a “real edge” by itself. Further cutting processes could be omitted.

The new process is also particularly suitable for narrower widths, for example to produce textile reinforcement profiles with longitudinal and horizontal reinforcements. Weft laying without twisting the “threads” (very much in demand for technical ribbons) can be guaranteed in a special way by the wing weft insertion, because the ribbon is guided along the entire width at the wing edge. This is particularly in contrast to conventional weft guides, which guide the thread through eyelets or tubes.

Previous magazine weft insertion systems attempt to increase the time window for weft insertion by inserting several weft threads at the same time. This makes the machine systems very large and requires a lot of installation space. Here too, the new idea could contribute to a reduced installation space thanks to the high insertion speed.

The insertion of diagonal weft yarns can also be adjusted by adapting the blade speeds and phase shift to the machine speed. To analyze the process, a wooden model of a warp knitting machine with blade traverse and a model of a blade traverse in a winding machine were first created. The basic principles were checked and development priorities defined.
The basic principles were checked and development priorities defined.
The construction of the prototype was carried out in cooperation with Christian Pinkert, a company experienced in the construction of warp knitting machines in Hohenstein Ernstthal. Pinkert manufactures, among other things, warp knitting machines using stitch-bonding technology, which have a conventional weft insertion, particularly for technical applications. The North Rhine-Westphalian machine factory Barmag, Remscheid, has a great deal of experience in flyer traverse, so that an integrated flyer traverse from the winding machine sector could be installed in a warp knitting machine.

The testing was carried out on site at Pinkert, partly due to the pandemic. When testing the prototype, attention was paid not only to functionality but also to aspects of occupational safety and process safety.

As part of the project development, further patent applications were filed by the Niederrhein University of Applied Sciences:

- **102017114133.2 (2017)** Device and method for laying threads, textile machine, applicant Niederrhein University of Applied Sciences
- **DE102018120364.0 (2018)** Device and method for feeding threads, applicant Hochschule Niederrhein University of Applied Sciences
- **DE102018127736 (2018)** Device and method for feeding threads, applicant Niederrhein University of Applied Sciences
- **10019 128 607.7 (2019)** Feeder element for a warp knitting machine and warp knitting machine, applicant Hochschule Niederrhein

The wing shot input can be utilized and converted in various ways, e.g:

- Lightweight structures for composites in lightweight profiles, e.g. for wind turbines, automotive, aerospace technology, portal and robot construction with high accelerations, building construction reinforced with concrete
- Textiles in the agricultural sector
- Geotextiles for civil engineering
- Home and clothing textiles

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Contact

Prof. Dr.-Ing. Marcus O. Weber
Textile Technology, in particular Technology of Knitting and Knitting Mills; focus on TUB/Textile Management
- Raum: E 308 (Webschulstr. 20)
- Telefon: +49 2161 186-6033
- marc.weber(at)hs-niederrhein.de

Dr.-Ing. Thomas Mutschler
Development of Textile Technology FTB - Research Institute for Textile and Clothing Doctoral student (Cooperation - HSNR and ENSISA France)
- Raum: E 302, Gebäude E
- Telefon: +49 2161 186 6090
- thomas.mutschler(at)hs-niederrhein.de