NON-CONTACT TEXTILE WEB CONTROL SYSTEMS

Project manager: H.-J. Heinrich, Dipl.-Ing. Duration: 07/97 - 06/98

Initial situation

Finishing machines and installations are using mechanical cloth guides for centring and spreading textile webs. A disadvantage of using cloth guides is the mechanical action they apply on the web's selvedges. On warp-knitted fabrics, this action may result in the slippage of individual threads or of complete areas of the textile fabric.

Research target

Research efforts are aimed at developing a universally usable textile web control system allowing for a non-contact, selvedge-oriented, centric guiding of cloth runs, in particular wet runs, through the use of pneumatic cloth guides. The project includes the design and testing of continuous and discontinuous regulation versions.

Discontinuous regulation systems are acting via a stepwise variation of the cross section of the inlet channel of cloth guides, whereas continuous regulation systems perform their action through a continuous control of the fan motors by means of an upstream frequency converter.

Research result

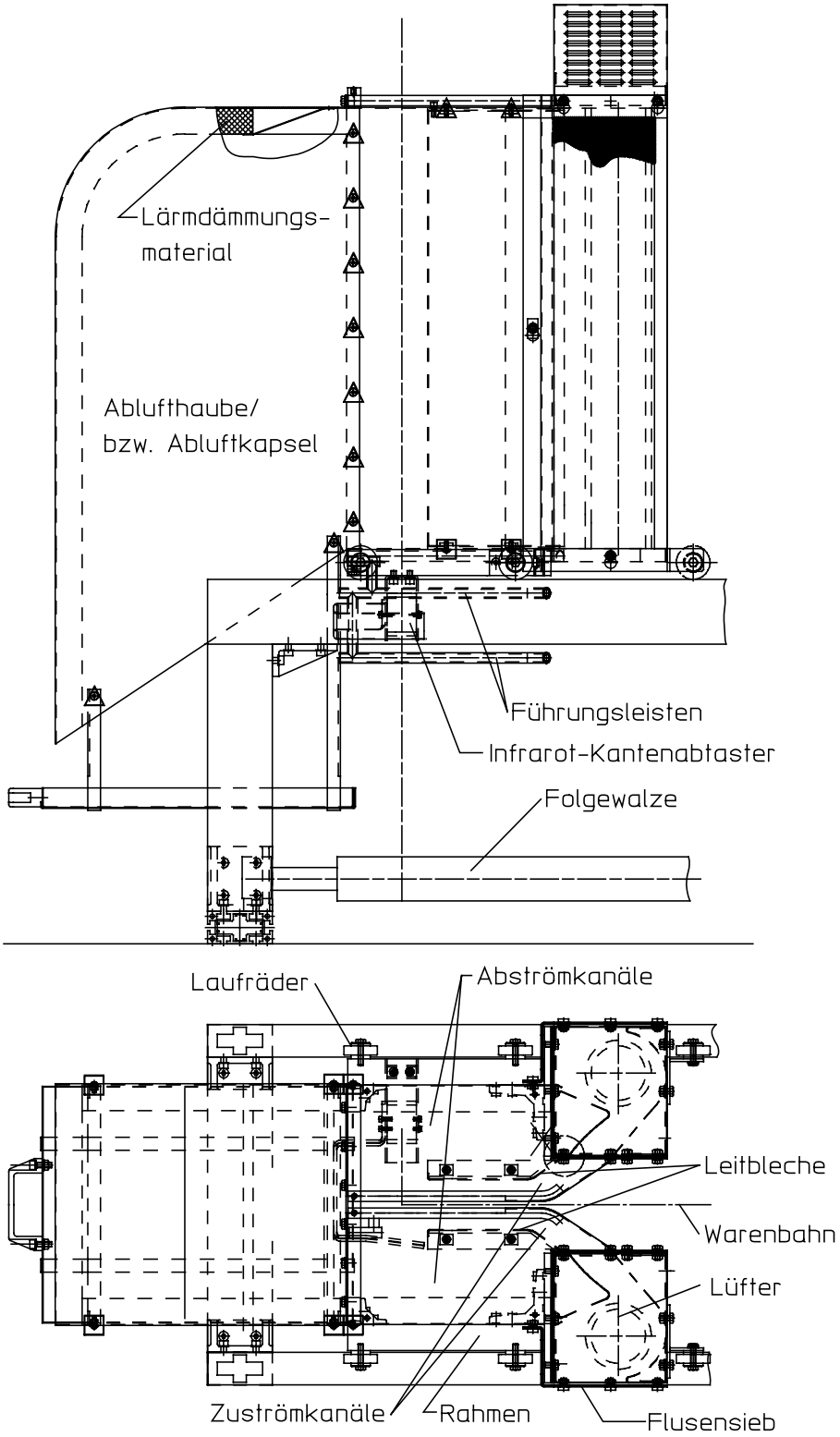
The functional prototype of a pneumatic cloth guide was designed and tested under practical conditions.

Preliminary theoretical discussions and a careful interpretation of preliminary tests have shown that the creation of a generally valid mathematical model of the controlled system is practically unfeasible in economic terms, as the operation of such a system heavily depends upon the fabric to be produced and the parameters employed.
Consequently, designers were aiming at developing a regulation system not exposed to such influences. It was found that pneumatic two-point regulation systems and textile web control systems using self-optimizing PI controllers are suitable options. Compared with conventional mechanical textile web control systems, non-contact textile web control systems provided with pneumatic cloth guides are appropriate for reaching the specified technical standards in terms of regulation accuracy and use of plant parameters.
The regulation accuracy in the selvedge-oriented guiding of cloth runs is ± 1mm for both versions. However, a few reservations should be made in respect of the web running parameters when using a two-point regulation system. In such case, the specified regulation accuracy may be obtained only if low racking rates of ≤ 25mm and low web speeds are employed. Also, the settling times of the two-point regulation system are considerably longer than those of self-optimizing PI controllers. An advantage of the two-point regulation system is its cost-effective construction. The regulation version using a self-optimizing PI controller was tested at web speeds of up to 80m/min. The self-optimization of the PI controller takes place via a vibration detection system integrated in the controller. As web running conditions change, the controller parameters are automatically adapted to the new conditions in the controlled system, in the shortest possible time.

Application and economic advantages

Textile web control systems based on pneumatic cloth guides are mostly used in the production of high-quality articles for which there has been no appropriate solution available so far, at least in the textile industries of Germany and Europe as a whole.

Besides applications in textile finishing, the system may be used in the production of film materials and paper where pneumatic cloth guides using fresh air may be replaced by less costly guides using recirculated air, as the webs to be guided are less soiled.



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