

AUTOMATIC NEEDLE CHANGE

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Duration: 04/97 - 03/98

Initial situation

Optimal-quality and optimal-performance sewing and embroidering processes require the use of sewing needles adapted to the specific duties to be performed, in terms of diameter, surface quality, and needle tip shape. If the sewing job is changed, using different sewing threads or materials to be sewn, needles must be changed, too.

Internationally, considerable efforts are undertaken to use an automated multiple-thread colour changing system instead of the system allowing for a limited number of threads as currently employed on small-sized embroidery machines. This work is aimed at opening up new opportunities by processing larger numbers of various embroidery threads. To attain this objective, needles matching the wide range of differing embroidery threads must be provided. Similar issues need to be solved in connection with automation equipment for sewing processes.

Research target

This project covers the development, design, manufacture and testing of a facility for the automatic change of needles in industrial sewing machines and embroidery machines. Efforts are aimed at reducing machine downtime when changing needles, reducing manual operations, and ensuring a smooth needle change including optimal needle adaptation to the sewing and/or embroidering parameters used.

Research result

Preliminary research work showed that the use of about 4 different needles may meet the essential requirements of specific embroidering duties.

After having systematically examined a number of solutions concerning the principal functions needed, an automatic needle handling system was developed and designed. The system uses a three-level manipulator and is intended for a wide range of applications on sewing and embroidery machines. The solution is based on the withdrawal of the needle adapter from the needle bar by means of a gripper and the subsequent depositing of it in a magazine arranged outside of the stitch formation area. This solution requires relatively minor changes at the sewing and/or embroidery head and is particularly suitable for industrial sewing machines.

For small-sized embroidery machines, focus was on a further simplification of the system, a considerable reduction of costs, and fast change-over times. The solution is based on a sliding magazine arranged in the immediate vicinity of the stitch formation area. The needles are accommodated in adapters for the purpose of storing and handling. The adapters are equipped with coupling elements for connection with the needle bar, and with additional surfaces for accommodation in a magazine. The coupling is non-positive, and the needle gear unit performs an additional lifting motion for coupling purposes.

Using original assemblies of embroidery machines, a prototype of the needle changing device was developed, manufactured, and tested.

For the drive and control operations, a combination of pneumatic and electromotive drive systems as well as a computer-controlled network of partial functions to be executed in form of a sequence control arrangement were established. The project furnished proof of the reliable functioning of the assemblies and the entire equipment intended for automatic needle change.

Application and economic advantages

The solution principle, the test results as well as the documentation provide a sound basis for and justify the prompt industrial exploitation of the results of research. The results of the project are planned to be directly applied on the premises of our project partner, ZSK Stickmaschinen GmbH Krefeld. The respective patent application has been filed.

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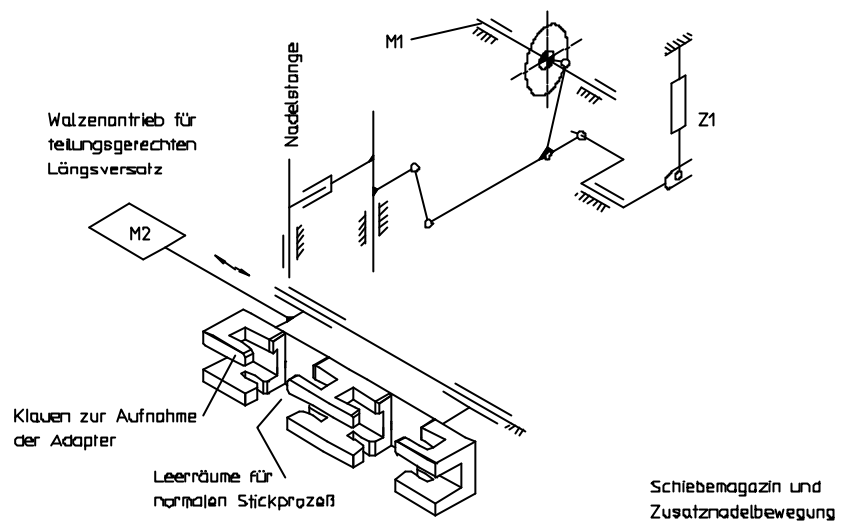


Figure 1: Schematic diagram of the realised solution

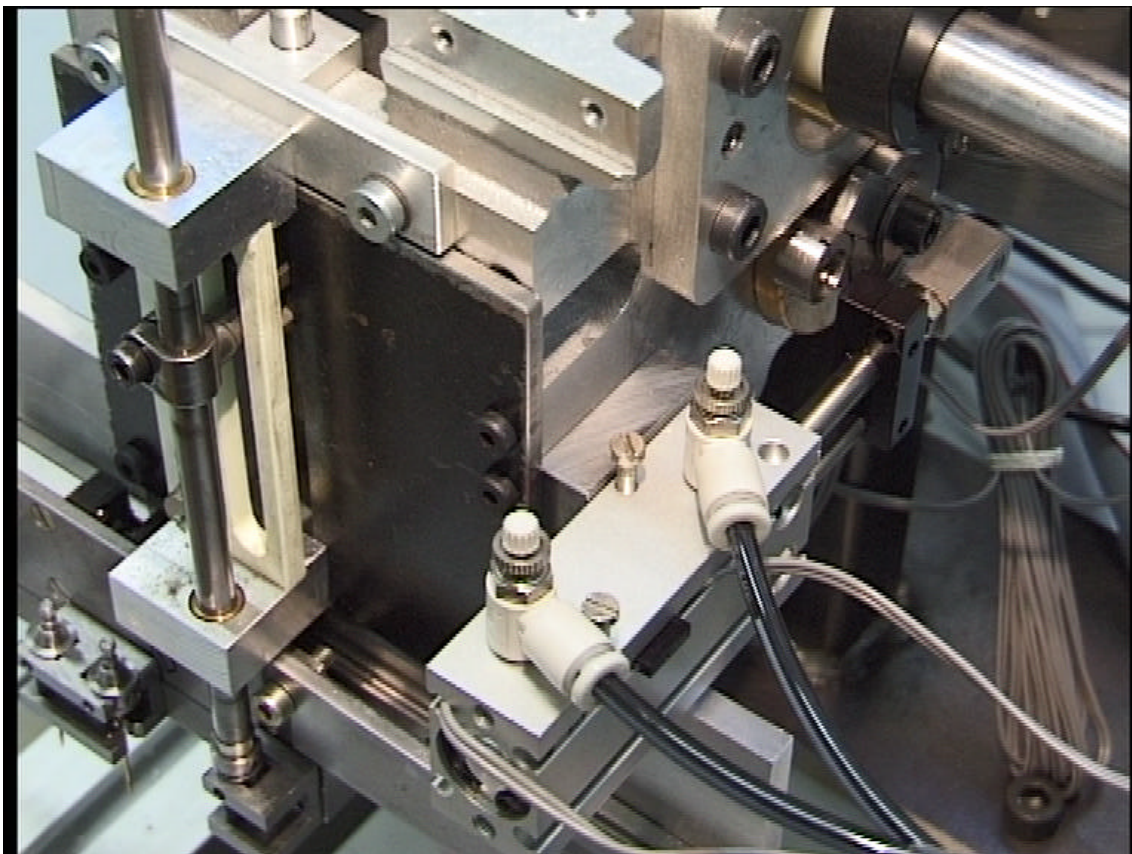


Figure 2: Model of the equipment for automatic needle change in laboratory scale