IMPROVEMENT OF THE PERFORMANCE OF KNITTING MACHINES BY DECREASE IN VIBRATIONS

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Authority responsible for the project:	BMWi - Gewiplan	
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Initial situation

In the new Federal States, Karl Mayer Malimo Maschinenbau GmbH in Chemnitz is the only company that still manufactures and upgrades knitting machines.
The manufacturer endeavours to increase the efficiency of the machines. This efficiency, however, is often limited by excessive vibrations. In many cases, the machines are run in the vicinity of resonance conditions. On a large Maliwatt machine, for instance, resonance conditions occurred in the working speed range so that textile production was made impossible by extreme vibrations. Extensive tests carried out with additional braces on the machine frame, additional weights (sand fillings) and additional rubber vibration absorbers under the machine allowed to reduce the effects of resonance.
The frames of knitting machines differ in design. The problem of vibrations is particularly serious on stitchbonding machines equipped with two-wall traverse frames because the fabric forming elements are attached to two opposite traverses. Relative movements caused by vibrations considerably impair the positioning of the fabric forming elements relative to each other.

Research target

The particular research target was to show that vibration reducing measures permit to overcome critical speed ranges of the machines in order to achieve an increase in efficiency/speed.
The particular feature of the vibration problem dealt with in this case is that frame components (traverses in this case) vibrating relative to each other must not be linked with each other by additional braces, whereas vibration absorbing elements and mass dampers installed in other places on the machine are able to reduce these relative movements.

Research result

The vibration tendency of the *gear box* and *stitching yarn traverse* can be reduced by vibration absorbers placed under the two traverses of the *bottom locking bar*. A higher effect, however, is achieved by means of a mass damper attached to the rear of the bottom locking bar (cf. Fig. 1). Investigations were extended in the course of the research work:

- increase in speed to 3,000 r.p.m. for the examined width of N 5600
- additional examination of the vibration eliminating element for the nominal width of N 3600

Vibration absorbing was to be effected with hydraulic braking cylinders for which a design was drafted. A test showed that additional vibration absorbers on the mass damper are not needed. For N 5600, the mass damper permits an increase in speed from the existing 1,650 to approximately 2,400 or even 2,500 r.p.m. For N 3600, a critical range appears at 2,280 to 2,520 r.p.m. which, however, can be overcome with the mass damper so that speed can be increased to about 3,000 r.p.m.

Application and economic advantages

Tests carried out on the narrow and wide machines after the completion of the above measures confirmed the research results and, in particular, the effectiveness of the mass damper (cf. Fig. 2). As to the general application, no decision has been made yet because testing was performed either with no textile material at all or with textile material having a low weight per unit area (small exciting forces). For processing materials of higher weights per unit area, use of the mass damper will be necessary. A patent was filed for the mass damper which may also be used on other two-wall traverse frames, e.g. of embroidery machines.

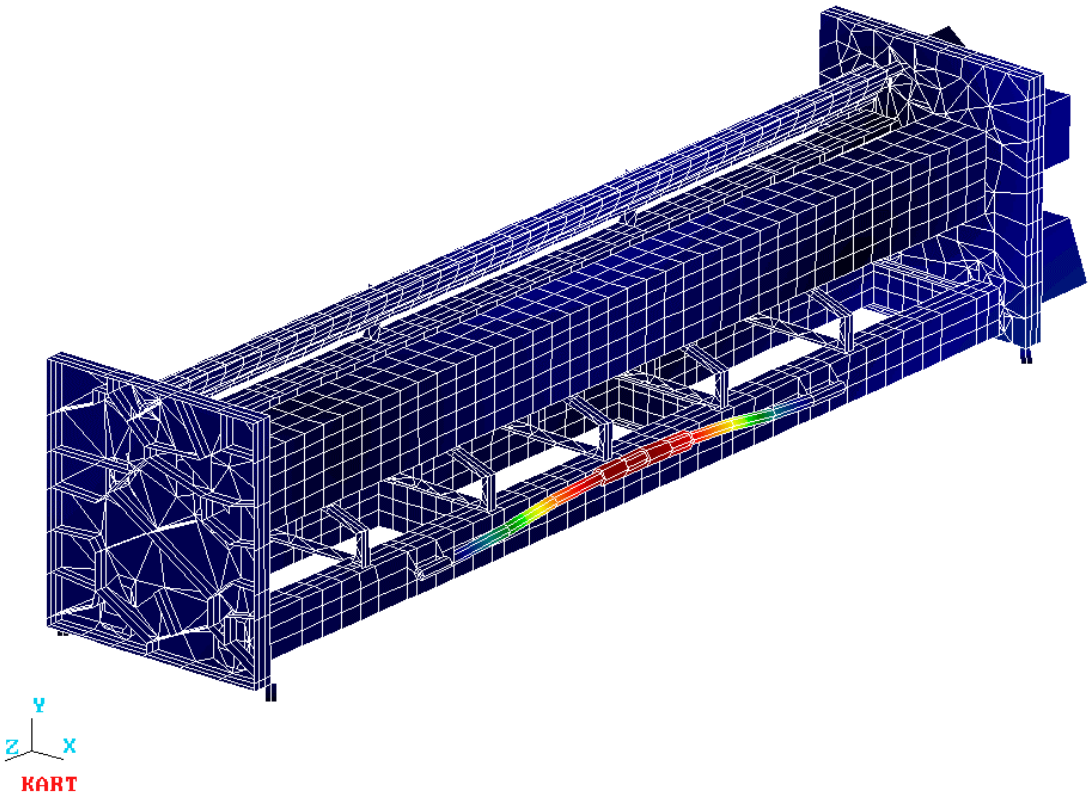

Fig. 1: N5600 - Vibration with mass damper for the relevant frequency range of 20...25 Hz

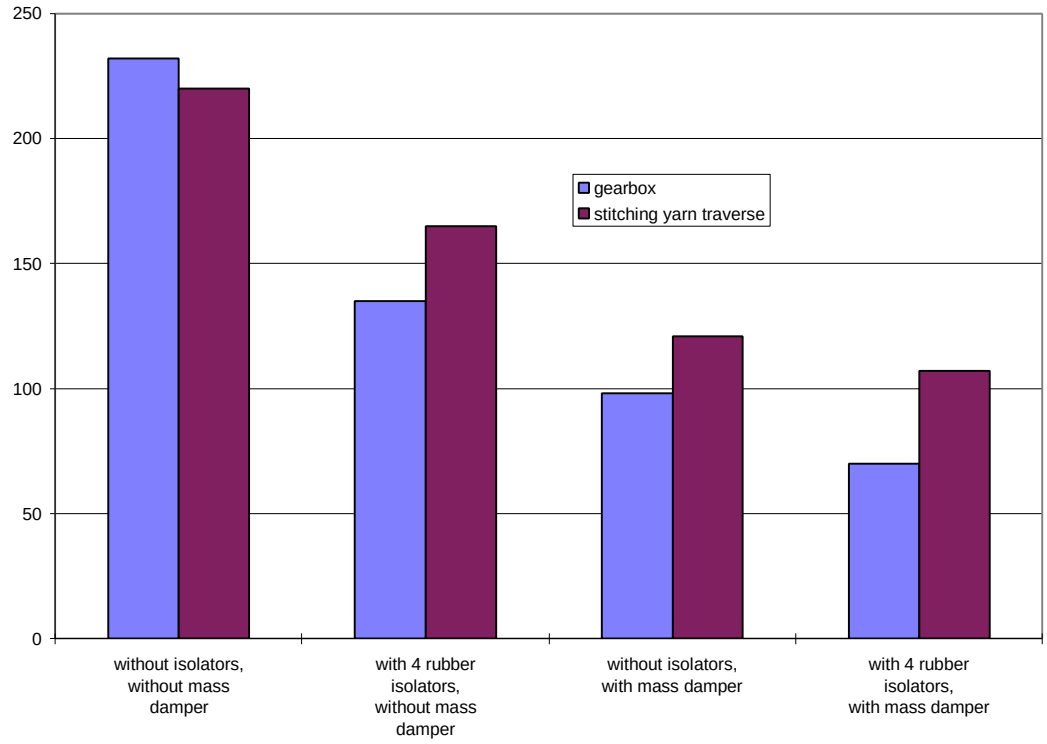

Fig. 2: N 6000 - Maximum amplitudes of the vibration vectors (µm) within a speed range of n = 500 - 2100 rpm