

HIGH SPEED TEST BENCH FOR WEFT INSERTION COMPONENTS

John Lammers¹, Maximilian Kemper¹

¹ *Institut für Textiltechnik of RWTH Aachen University*

John.Lammers@ita.rwth-aachen.de

EXTENDED ABSTRACT

Key Words: HIGH SPEED, TEST BENCH, WEFT INSERTION, WEAVING MACHINE DEVELOPMENT, RAPID PROTOTYPING

1. INTRODUCTION

Rapier and projectile weaving looms are amongst the most popular weaving looms with over 30.000 units sold in 2015 [1]. In order to improve the weft insertion process (e.g. to increase production speeds or improve the quality of the fabric) components involved in the weft insertion process have to be improved. Testing of prototype components is one critically important step to ensure the successful development of new weft insertion components.

Components that can be improved for weaving machines include for example:

- Weft brakes
- Rapier heads
- Weaving projectiles
- alternative weft insertion techniques (e.g. magnetic weft insertion)

1.1 Main Scope of the Problem

To validate improved components, they need to be tested at speeds that sometimes exceed the maximum speeds of existing weaving looms. In addition, existing weaving machines don't necessarily offer the space and accessibility to add new components or measurement devices. Using a (modified) real weaving machine for testing is also very expensive.

1.2 Aims

The first aim of the project is to continuously measure the braking force of an electronic weft brake during the weft insertion process. To achieve this aim, the first objective is to create device that allows a weft yarn to be accelerated to speeds of up to 50 m/s. Ideally the device should be quick and inexpensive to build.

2. MATERIAL AND METHOD

To test components at high speeds, a special test bench was designed. The main components of the test bench are:

- a sport bow (as a source for propulsion)
- 3D-printed high speed projectile
- aluminum profiles (for main structure and as a rail for the high speed projectile)

The bow is attached to the aluminum profile that serves as a guiding rail for the high speed projectile. The projectile is connected to the bowstring by a rope. By pulling back and releasing the bowstring, the projectile is accelerated to speeds of up to 50 m/s. The total costs of materials used for the test bench are less than 300 €. The total build time is about 8 hours. A schematic setup of the high speed test bench is shown in figure 1.

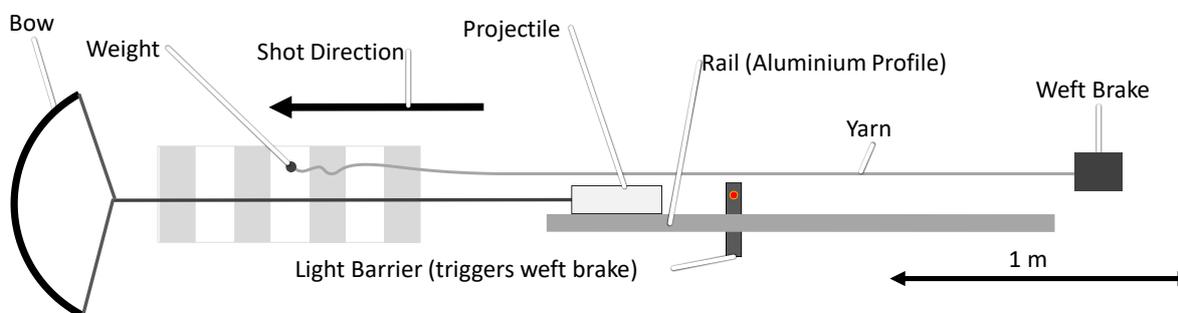


Figure 1. Schematic setup of the high speed test bench

3. EXPERIMENTAL RESULTS AND DISCUSSION

During the first experiment the time behavior of the electrical weft brake is evaluated for higher weft speeds. A weft yarn is placed in the weft brake and connected to the projectile. The weft brake is activated by the projectile crossing a light barrier. The deceleration of the projectile is filmed with a high speed camera in order to determine the changes in speed of the projectile over time.

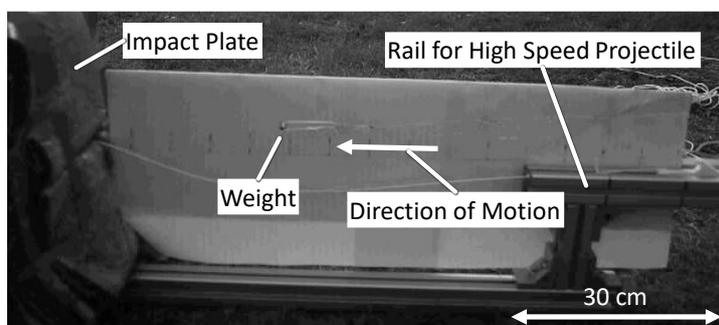


Figure 2. High speed screenshot of weight during braking process

Via a frame by frame analysis of the video the change in position of the projectile per millisecond is determined. Based on the positional changes the speed and deceleration of the weight are calculated. The brake force of the weft brake at each millisecond is calculated using the deceleration data in combination with the weight of the yarn and the flying weight.

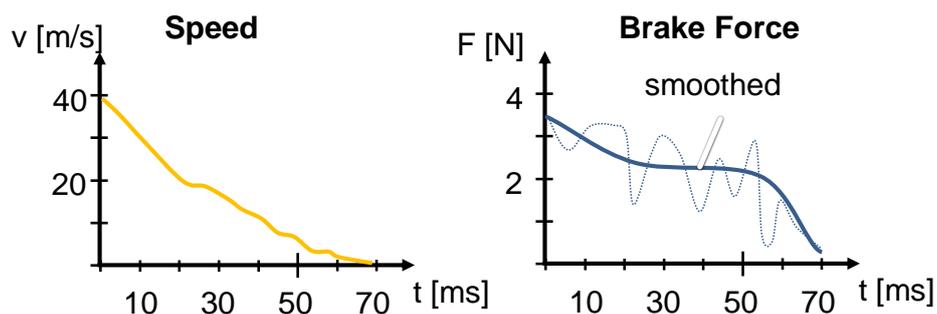


Figure 3. Change in speed and brake force during braking process

4. CONCLUSION

The high speed test bench proved to be a useful tool in determining the weft brake behavior. In addition to testing the behavior of weft brakes the test bench also proved to be suitable for testing rapier and projectile components. Further testing also showed that arbitrary objects of up to 20 g can be catapulted at speeds of over 200 km/h. The high speed test bench represents a simple and inexpensive way to test weft insertion components.

5. REFERENCES

1. Dr. Christian Schindler (Director General ITMF), *International Textile Machinery Shipments Statistic 2015, 2016*, Page 23