J. Pronk *Ontwerpen van grijpers voor stortgoed.*
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Transport of ore and coal between ship and quay is mainly done by grabs. In the past the only grab was the pole-grab, but nowadays the scissors-grab and the trem-grab are an option.
The design of grabs takes place through experienced design engineers. Many parameters have been found empirically, most of the design is done by experience. This research investigates the design rules that can be used to design bulk grabs. Furthermore a search in literature has been made for theoretical models of bulk grabbing, in order to consider them for practical use in this design of grabs.
Conclusions of this survey are as follows. The actual design process is not structured very well. All knowledge of the design comes from the designer's knowledge and experience.
The change in closing force is mainly determined by the choice of grab mechanism and the number of guiding pulleys. This is shown by the use of virtual work-studies.
With help from these studies it is possible to determine the closing force of the grab. This force deviates from a calculation of the NEMAG company, because that calculation neglects the effect of listing of the centre of mass.
The theoretical research according to grabs has been concentrated on the resistance of the grab-knives in the bulk. Researchers found some equations, but these are not directly applicable in the design process.
The most important recommendation is that it should be tried to redesign the theoretical models so they can be implemented in the design process, with the goal to achieve an optimisation in grab's design.

Reports on Transport Engineering and Logistics (in Dutch)
