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P.B.de Jong ***Ontwerp van een volledig elektrisch aangedreven containerspreader***
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A container spreader is a device, which is attached to hoisting devices for handling of standardised containers. It plays an important role in transhipment and (temporary) storage of shipping containers at container terminals. A common type, with telescoping spreader beams, is capable to automatically adjust the spreader length for handling containers with different lengths.

The current design with hydro-electric drive systems is increasingly replaced by all-electric drive systems. Some competitors of Stinis Holland B.V. already offer all-electric driven container spreaders. The main advantage of this type is the absence of oil leakage. Reduction of energy- and maintenance costs is other advantages.

This report presents a design of an all-electric driven container spreader. The design is highly influenced by the rough operation of container spreaders.

Telescoping of the spreader beams

The telescoping beams are adjusted by a toothed belt drive system. An endless made toothed belt revolves about two belt pulleys and is connected to the beams. The beams are extended or retracted when the pulleys rotate. The telescoping beams are sliding along each other in the central chassis using sliding blocks.

The toothed belt drive system remains identical while the hydro motors are replaced by gearmotors. These compact gearmotors, with planetary gear sets, can easily be applied in the current design. There is an in-line version as well as a right-angle version available. Squirrel cage induction motors (2,2 kW) without brake or fan are applied. One frequency controller controls both motors. The current positioning system with inductive proximity sensors is maintained.

The resistance during (the start up) of the sliding movement depends mainly on the condition of the friction surface and the position of the telescoping beams. Overloading the motor for short periods does not give problems due to the intermitted characteristic of the movement.

Locking and unlocking of the twistlocks

A twistlock is a device, which has to be inserted into the cornerfittings of a shipping container. It is turned or twisted, thus locking the container for the purpose of securing or lifting. The twistlocks, which are located in the end beams (at the end of the telescoping beams), have a little flexibility ("floating twistlock" principle) and are turned by a hydraulic cylinder in the current design.

A lever connected to a shaft drives a rod mechanism for locking and unlocking the twislocks. Sliding bushings support the (splined) shaft. A compact gearmotor with planetary gearsets drives the shaft. The motor is a squirrel cage induction motor (0,22 kW) without brake, fan or cooling. The twistlock drive system is designed to deal with shock loads and high acceleration forces. The "floating twistlock" principle remains identical.

The lock/unlock time is less than one second. Inductive proximity sensors and a frequency controller equipped with a brake resistor are used for control of the drive system.

Blocking system telescoping beams

The blocking system restrains the telescoping beams for moving. A steel plate is pushed in a cutout between wedge-shaped blocks at the telescoping beam by springs. A small hydraulic actuator does de-blocking of the system.

The current blocking system remains identical. The drive of the system is located at the side of the central chassis because a lack of space in the neighbourhood of the blocking system. This drive is (except some details) the same as the twistlock drive. The force for pushing the springs is transmitted from the blocking system to the drive by a steel-wired rope. This rope revolves about a rope pulley. De-blocking is carried out in less than one second.

Automated central lubrication system

The lubrication system consists of a pump, which delivers grease to a number of lubrication points using a tube network. The current hydraulic driven pump has to be replaced by an electric driven one. It is assumed that grease up to level NLGI-0 is used and that the tube network remains identical. In that case a piston pump from manufacturer Groeneveld is appropriate to replace the current pump. This pump has a delivery rate of 50 cm3/min at a maximum pressure of 100 bar.

Costs and prototyping

An estimation of the costs for an all-electric drive system shows a cost reduction of about €1350,- in comparison to the current electro-hydraulic drive system. The mass reduction is about 240 kg.

Production of a prototype gives insight in the cost structure of the different drive systems. After testing the prototype in the workshop, it could be put into service at a container terminal. This test reveals the resistance of the spreader under rough circumstances.

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