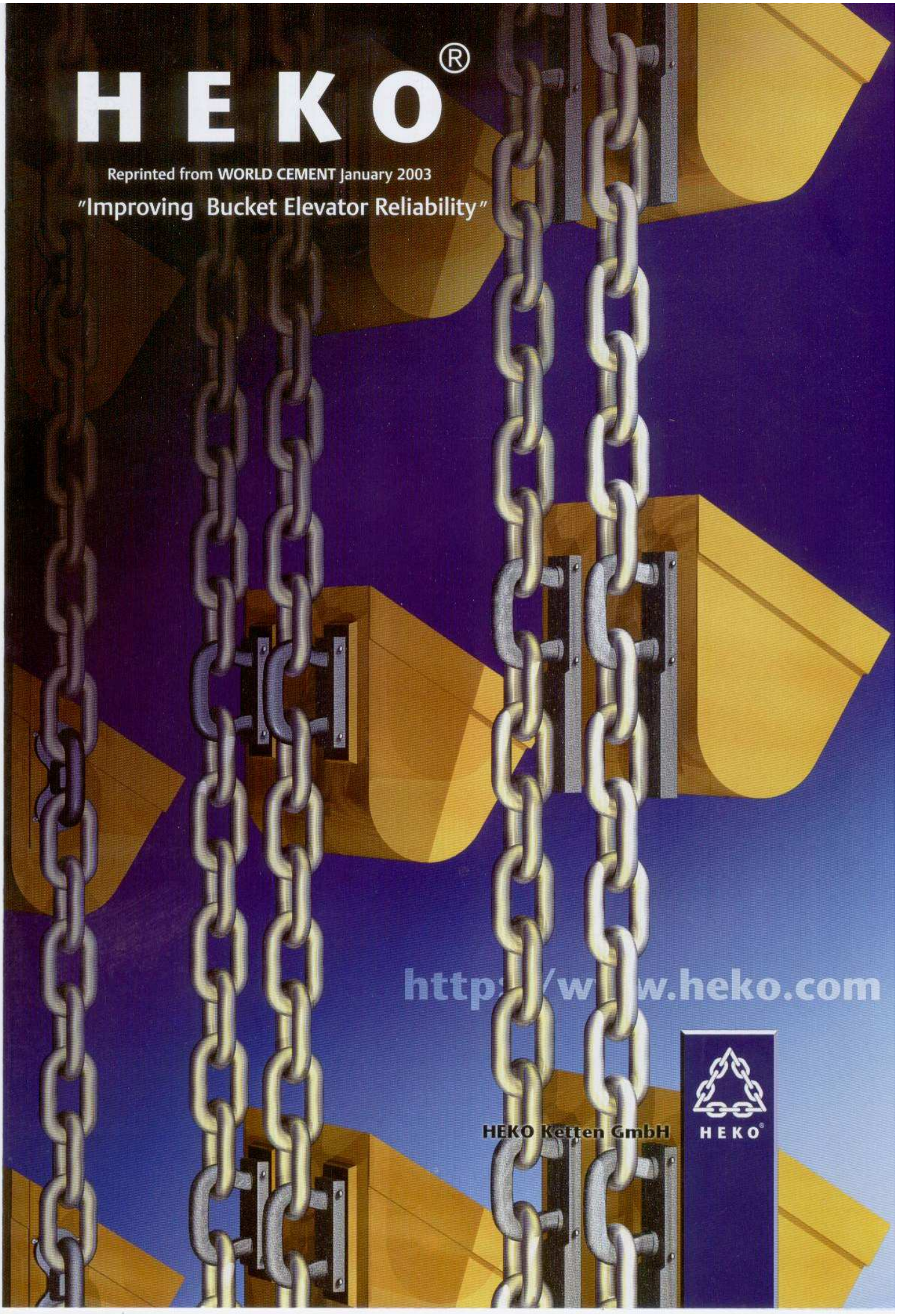
HEKO®
Reprinted from WORLD CEMENT January 2003
"Improving Bucket Elevator Reliability"
HEKO Ketten GmbH
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Improving Bucket Elevator Reliabilty

Bernhard F. Mehring, CMMC, UK, looks at recent improvements to bucket elevator reliability.

Figure A1. Bucket elevator with a traditional tensioning device.

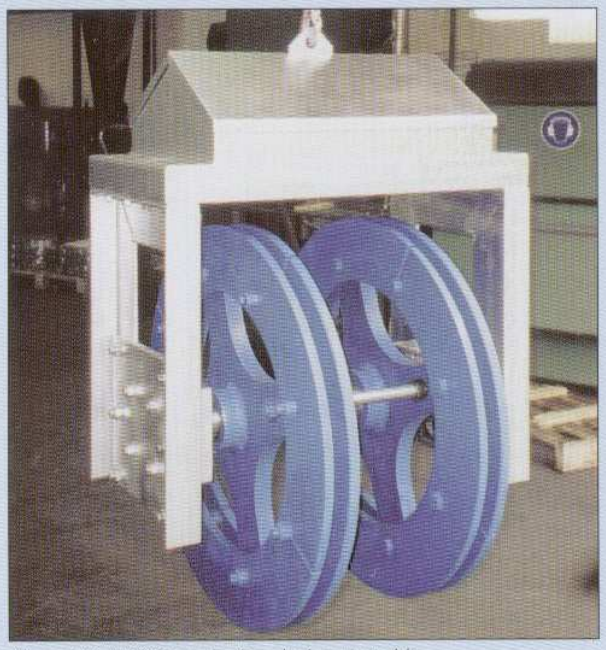

Figure A2. HEKO tensioning device assembly.

Introduction

The increase in periods between plant shutdowns, as well as the reliance on single stream production lines, has led to the need for handling equipment that only requires scheduled maintenance. Bucket elevators (Figure A1) are no exception, and it is for this reason that HEKO engages in continuous development work to improve components for conveyors with round link chains. Two recent developments have substantially improved bucket elevator reliability.

Dust-free tensioning unit

Spillage of material from bucket elevator boots is common place, either due to inadequate slide plate design and/or lack of maintenance. These dusty spillages are environmentally unacceptable and dangerous when handling hot material, or materials that may pose a dust explosion problem. Such spillages also increase maintenance requirements of elevator bearings and adjacent machinery.

HEKO has designed a dust-free tensioning unit (Figure A2), which can be fitted to new as well as existing bucket elevators. The standard unit is capable of handling material, such as clinker, clinker dust and alkaline dust at elevated temperatures, whilst not requiring lubrication. Several new and existing bucket elevators that handle cement, cement raw meal and other minerals, have already been fitted with these tensioning units and are operating to the full satisfaction of the customers.

The tensioning units are supplied partially pre-assembled to simplify fitting. They are available

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with idling wheels, shaft, bearings, internal slide frame with weight box and large, bolted access doors. The unit is totally enclosed to avoid spillage of dusty material and all moving parts are internal to the elevator boot.

Dry, self-cleaning shaft bearing blocks are fitted that are manufactured from wear resistant alloy steel. Shaft ends, which rotate within the bearing blocks, are protected by wear resistant liner sleeves manufactured from hardened tool steel. Both bearing blocks and shaft liners are easily replaceable.

Chain tension is applied with gravity, created by the weight of the whole tensioning assembly. Additional weight, which may be required on elevators with short shaft centres, can be added to the weight box. A mechanical position indicator that can facilitate visual checks of the tensioning device position, is fitted as standard. Electrical position indicators and a rotation monitor can be fitted where condition monitoring is required.

HEKO offer three basic types of return and tensioning units, which are as follows:

- *Type I:* bucket width 160 - 315 mm.
- *Type II:* bucket width 400 - 630 mm.
- *Type III:* bucket width 800 - 1600 mm.

In addition, bespoke units to suit customer requirements are supplied.

Bucket attachments

HEKO's TS-shackle, first installed in the late 1980s, was a major breakthrough in the design of bucket attachments, as it eliminated fatigue failure.

The shackle also allows a complete chain strand to be pre-assembled in a workshop without fitting the buckets. This considerably reduces the re-chaining time on-site. Hundreds of elevators have now been fitted, confirming that the life of the TS-shackle equals that of the chain. Pairing individual calibrated chain lengths between each bucket, five, seven or nine links as standard, ensure bucket alignment. This technique can also be used to form an endless chain with the TS-shackle and overcomes the misalignment problem often experienced with other types of endless chain systems. The company now offers three types of shackles, the TS for horizontal attachments and toothed wheels, the TS-N for all vertical bucket attachments (Figure A3) and the TS-L, the latest design for very heavy applications (Figure A4).

Bucket elevators with dimensions to DIN or similar standards, have a poor weight to capacity ratio which can limit the use of round link systems. The maximum wire size available is 42 mm dia. The weight/capacity ratio can be improved by fitting high capacity buckets, which are deeper and hold approximately the same volume of material as the next width bucket to DIN15234. They also reduce the cost of an elevator. However, a much higher moment is imposed by these buckets onto the shackle and the chain link fitted immediately above, leading to increased wear of components. Handling large hard stones in bucket elevators also creates a high impact load on the bucket and chain that could lead to similar wear problems.

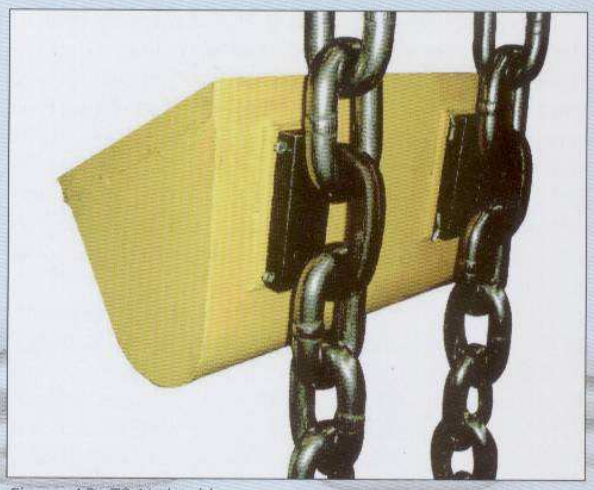

Figure A3. TS-N shackle.

Figure A4. TS-L shackle fitted to a 1.25 m bucket.

Previously, shackles with a larger pitch to that of the chain links were fitted, reducing wear slightly. However, in many cases, this was still excessive and toothed drive wheels could not be fitted. This often resulted in chain slippage on elevators with short shaft centres, where the chain tension imposed by gravity tensioning (i.e. imposed by the chain and wheel weight) was inadequate. Such slippage has previously been reduced by applying an additional load that in turn increases chain wear.

In order to reduce the load on these components, HEKO developed the TS-L shackle, which reduces the moment by providing a third supporting point on one of the lower chain links. This shackle has been successfully tested on a number of larger elevators and first indications are that wear has been substantially reduced.

TS-L shackles with the same pitch as the chain link can now be fitted without any problems. With both chain and shackle pitches being equal, toothed driving wheels can be fitted to bucket elevators where the chain tension imposed by gravity is inadequate.

These shackles are available to suit all sizes and qualities of elevator chain. Shackles are dropforged and induction hardened in the contact areas to 14% of its cross-section as standard and up to 17% for high wear applications. The surface hardness for all TS-shackles is, as with other shackles, 600 HV.

Connecting dimensions for all shackles in the TS-range are to DIN 5699. Therefore, retrofitting to existing elevators with DIN5699 shackles and most DIN745 shackles (pitches 45, 56 and 147 may have different bolt sizes) is easily carried out

The HEKO service and supply programme

- Round link chains and accessories for bucket elevators
- Round link chains and accessories for scraper conveyors
- Kiln chains and accessories for rotary kilns
- Sizing and servicing of conveyors

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