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Advanced Technology for Crane Braking

Twiflex® Limited

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Advanced Technology for Crane Braking

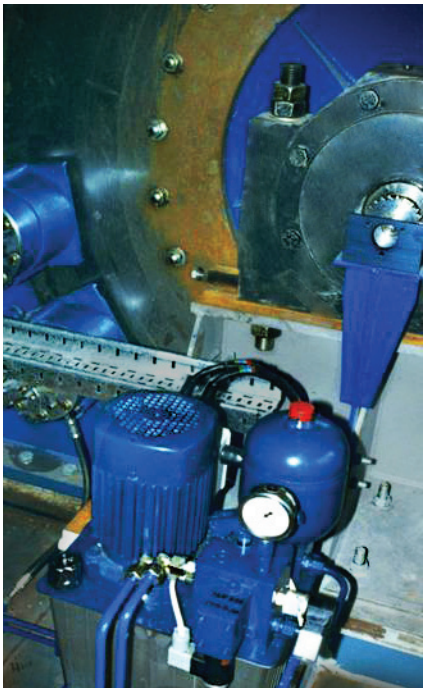
Many new cargo handling cranes are installed with the latest in superior braking technology, making braking and load holding safer and more controllable.

An ever increasing number of operational authorities are focusing on the safe handling of large and expensive loads. This clearly applies to crane safety, and in particular, to the provision of an emergency brake to prevent a load drop due to a coupling, shaft or gear failure.

High compensation claims for injury and cargo damage are forcing many authorities to consider emergency brakes, the safest location being directly on the main hoist rope barrel. Because this is the high torque side of the hoist drive train, it requires brakes of a much higher capacity than those installed between the motor and gearbox. As an example, the main boom hoist on a typical 70 ton container crane would require two emergency brakes, each capable of generating a braking force of 119kN.

These brakes need to be "fail safe," which means that a nest of powerful springs are used to generate the required force and hydraulic pressure in excess of 160 bar is needed to compress the springs in order to effect brake release.

This hydraulic pressure is provided by a small power pack which typically consists of a 1.5 kW motor mounted on a tank top driving a positive displacement pump. This discharges its flow through a check valve to an accumulator and is automatically switched off when the system pressure is reached.



Typical Emergency Braking System showing calipers and hydraulic power pack

Two solenoids are employed: one on the flow line into the brake and the other on the discharge side. In normal operation with the drive hoist energized, the discharge valve would be closed and the input flow valve open. This condition permits the oil to maintain pressure on the springs and effect brake release.

The solenoids are connected to the hoist drive motor circuitry and when de-energized open the discharge valve and close the input flow valve. This immediately releases the oil from the calipers and arrests the input flow allowing the springs to force the pads against the flange of the drum.

Failure of the transmission drive or normal service brake will activate an overspeed switch mounted on the drum shaft. This will then trip the power supply and consequently automatically apply the emergency brakes.

An alternative to an overspeed switch is a "mis-matched" control which constantly monitors the hoist motor speed relative to the drum speed. The ratio of these speeds will always be constant parameters determined by gear backlash.

An alternative to an overspeed switch is a “mis-matched” control which constantly monitors the hoist motor speed relative to the drum speed. The ratio of these speeds will always be constant within the parameters determined by gear backlash. Therefore any deviation will activate the trip switch and cut the power.

The “mis-matched” method of detecting a mechanical transmission failure can be set within closer limits and is more reliable than an overspeed switch. This again leads to greater safety control as the emergency brakes can be activated sooner, thus reducing the load dropping distance.

Designers of crane braking control systems calculate load dropping distances by considering the total system of inertia, the static “out of balance torque” and the drum speed. With this data the speed profile during an emergency stop can be accessed and the consequent load dropping distance calculated.

If the emergency brakes are activated during a lifting operation the load can be “inched” onto the dockside by operating a hand valve on the brake discharge line and manually pumped to achieve system pressure.
As this system of emergency brake control becomes more widely specified, the logical progression is to utilize the available hydraulic pressure to also control the service brakes instead of using an independent thruster brake.

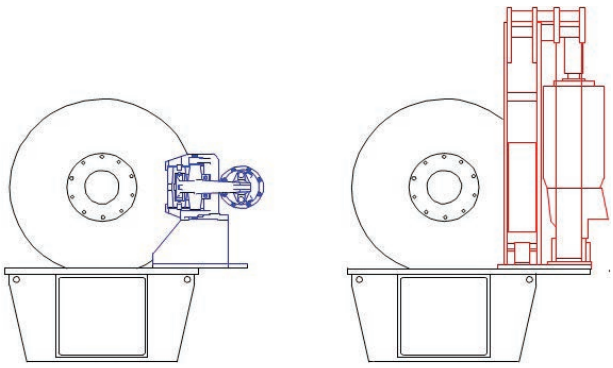
Up until recently the independent thruster brake has been widely used as a service brake between the motor and gearbox. However, because more authorities are legislating emergency braking, crane designers are realizing the advantages of an internal system.

The integral system of total brake control has a number of advantages, namely the following:

Balanced Braking Control

Thruster brakes have a slower response time than calipers controlled by the release of high pressure oil. This imbalance can result in difficulties with brake control settings. A system operated from a single source can be controlled through a PLC and tuned within fine limits.

Size and Weight



Twiflex GMR-SH-15
Brake Torque 11900Nm

Thruster brake
Brake Torque 9710Nm

Price

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Reduction in Maintenance

Thruster brakes have many linkages, pins and bushes; all of which need regular maintenance. In addition, their size and weight may require lifting tackle for removal or inspection. In comparison, the equivalent hydraulic caliper can be hand carried, is self adjusting and only requires a simple five-minute pad change.

Spares and Standardization

One size of hydraulic caliper can cover a wide range of different braking forces; it simply means replacing its operational actuator with one of a different rating. Thruster brakes require a number of different sizes to accommodate various braking force requirements which means a larger stock holding and a more complicated inventory system.

These advancements in braking technology certainly mean the new generation of cargo handling cranes will be safer, more controllable and less expensive to maintain.

About Altra Industrial Motion

Altra Industrial Motion (NASDAQ:AIMC) is a leading multi-national designer, producer and marketer of a wide range of electromechanical power transmission products. The company brings together strong brands covering over 40 product lines with production facilities in nine countries.

Altra's leading brands include Boston Gear, Warner Electric, TB Wood's, Formsprag Clutch, Wichita Clutch, Industrial Clutch, Ameridrives Couplings, Kilian Manufacturing, Marland Clutch, Nuttall Gear, Stieber Clutch, Twiflex Limited, Bibby Transmissions, Matrix International, Inertia Dynamics, Huco Dynatork, Ameridrives Power Transmission, Delroyd Worm Gear and Warner Linear. For information on any of these technology leaders, visit www.AltraMotion.com or call 815-389-3771.

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