Free wheeling

The application of micro-porous lubricants can significantly reduce wheel flange wear on overhead cranes. Alan Heckler and Brandon Collins, research and technology, PhyMet Inc. explain.

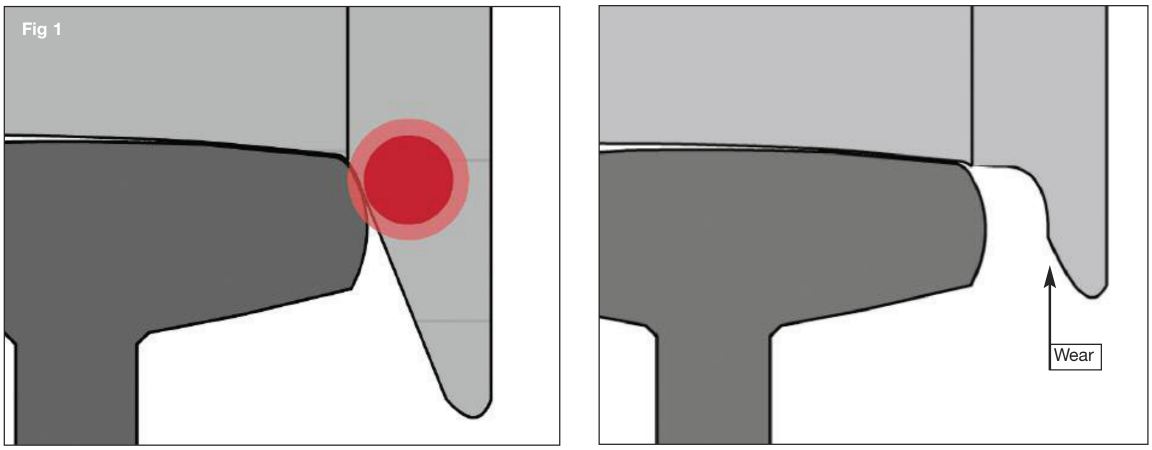

Figure 1: The wear that occurs to the wheel flange

The friction between the mating surfaces can cause noise, increases energy consumption and cause safety problems. The wear on the wheel flange results in the expense of replacing or refurbishing the crane wheel.

In extreme cases, friction between the wheel flange and rail is so great that the crane will ride up the rail until it slips and crashes back down. Worse, the crane could derail.

Conventional lubrication methods such as automated oiling and greases have many disadvantages including storing, mounting, and refilling the lubricant container.

Controlling the amount of lubricant applied to the wheel flange is important in order to avoid getting the lubricant on the tread of the wheel. This could reduce the braking action of the crane leading to safety issues. The environment below the crane can also be compromised if excess lubricant drips from the wheels or rails.

As conventional lubrication systems are often heavy and difficult to mount, most rely on the lubricant rubbing from the wheel flange onto the rail and carrying back to subsequent flanges. The amount of lubricant being shared with subsequent wheel flanges is not easily controlled.

It is well known that misalignment occurs between the rail and wheel flange due to the vertical and horizontal movements of the wheel and deflection of the wheel caused by the loading and unloading of the crane.

Rail alignment will also contribute to wheel flange wear. Since there will always be alignment problems, it is important that the wheel flange lubrication system can track the position of the wheel flange relative to the rail to maintain constant contact of the lubricant with the flange.

Solution

The MicroPoly wheel flange lubricator (patent pending) developed by PhyMet Inc. consists of two arc shaped MPL (micro-porous polymeric lubricant) blocks and a mounting system to lubricate the wheel flange.

Each block has a contact surface that matches the profile of the wear surface of the wheel flange. The lubricator uses springs as a means to

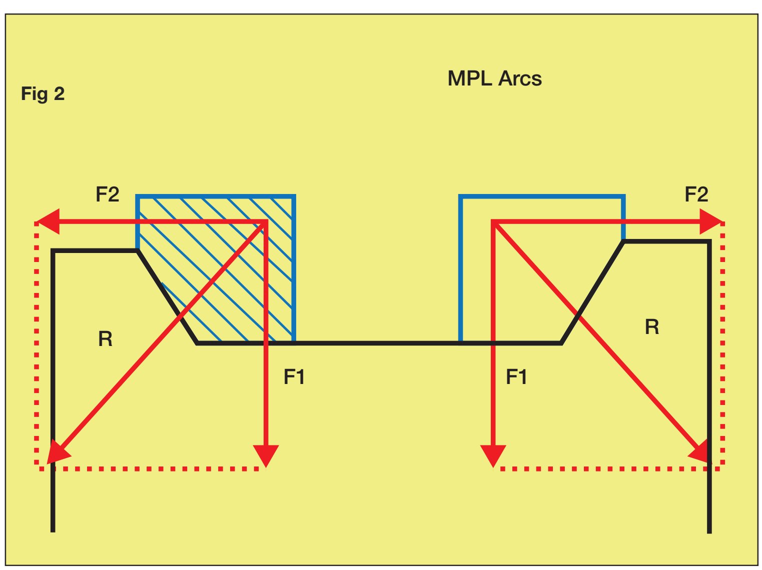

Figure 2: Two independent force vectors are used to push the lubricants against the wheel flange

Fig 3

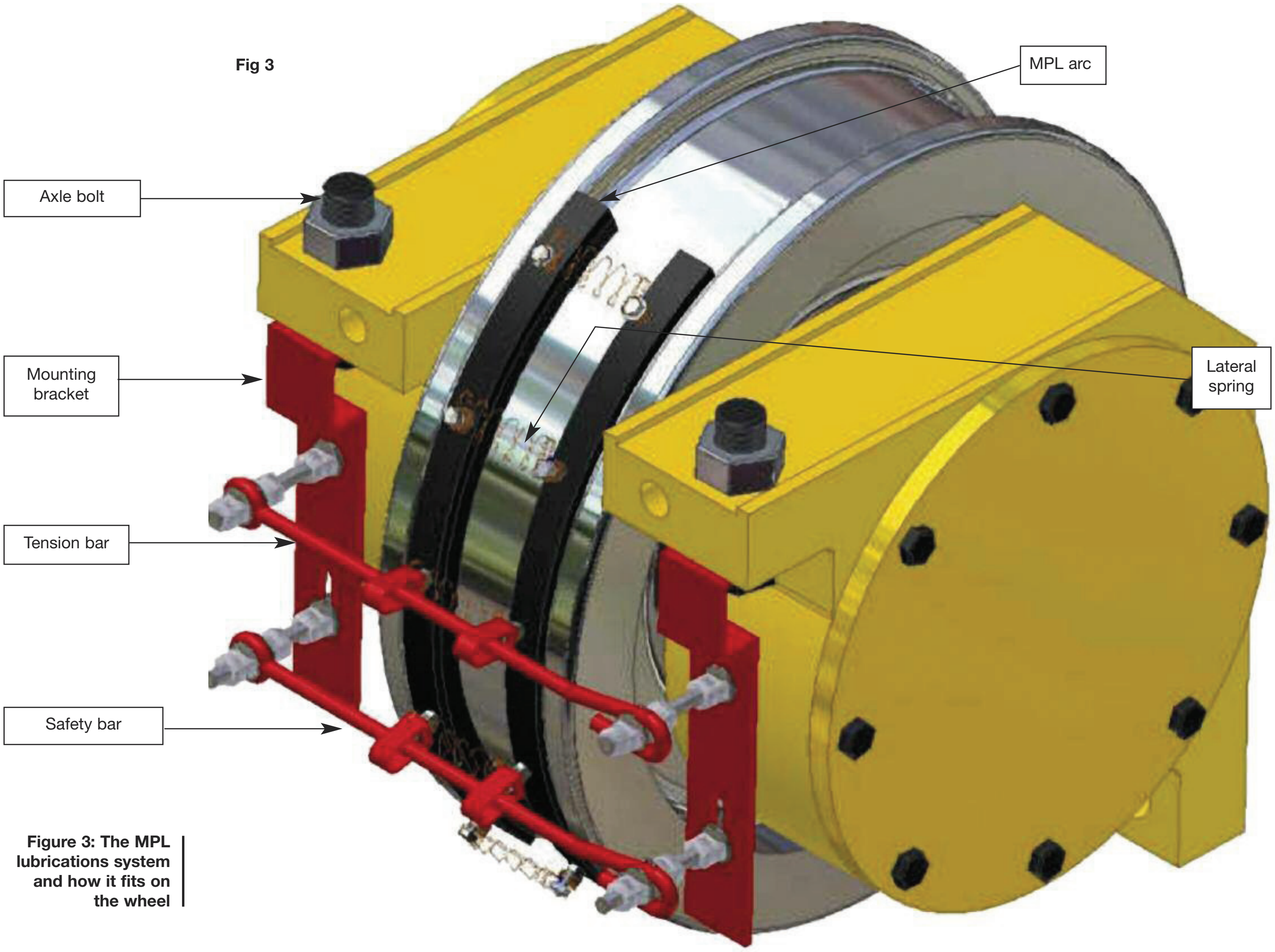

Figure 3: The MPL lubrications system and how it fits on the wheel

provide force to the contact side of the lubricant block laterally against the wheel flange and radially into the crotch of the wheel.

The rigid block has independent radial and lateral force means for improved control of the position of the blocks relative to the wear surface (Figure 2). Improved control minimises lubricant contact on the tread of the wheel and concentrates it in the areas where lubrication is needed. It is important that the tread remains un-lubricated so that the braking on the overhead crane is not compromised.

The MPL blocks are held in place by a pair of brackets that attach to the crane using the existing axle bolts on each side of the crane wheel (Figure 3). This means that no special modifications, such as welding, will be necessary in order to attach the lubrication system to the end truck.

Installing the system consists of a few relatively easy steps. Simply connect one bracket to the end truck using the front bolts on each side of the wheel. Align the holes in the tension bar and safety bar with the corresponding stand off bolt in the mounting brackets, while pushing the MPL blocks against the tread of the wheel.

Four spring washers and four nylon locking nuts are used to attach the tension bar and safety bar to the mounting bracket and the installation is complete.

Each mounting bracket is specially designed for each individual application, allowing the system to be flexible enough to overcome obstacles such as rail sweeps, which might get in the way of other lubrication systems. As the mounting brackets are specially designed, a print of the overhead crane is necessary to complete the design.

MicroPoly arc lubricators

They are comprised of two major components, a polymer containing a continuous micro-porous network and oil contained within these pores. The type of oil incorporated into the polymer can be tailored to the requirements of the application. Examples include FDA/USDA/NSF-approved food-grade lubricants to eliminate product contamination and improve housekeeping and safety, or oils with an extreme pressure (EP) additive for high-load applications. Other additives can also be used to alter the lubricant's properties.

Examples include oil property enhancers such as corrosion and oxidation inhibitors and coefficient-of-friction modifiers and lubricating solids such as molybdenum disulfide, graphite and Teflon.

The oil content in the polymer can be controlled during processing and

Fig 4

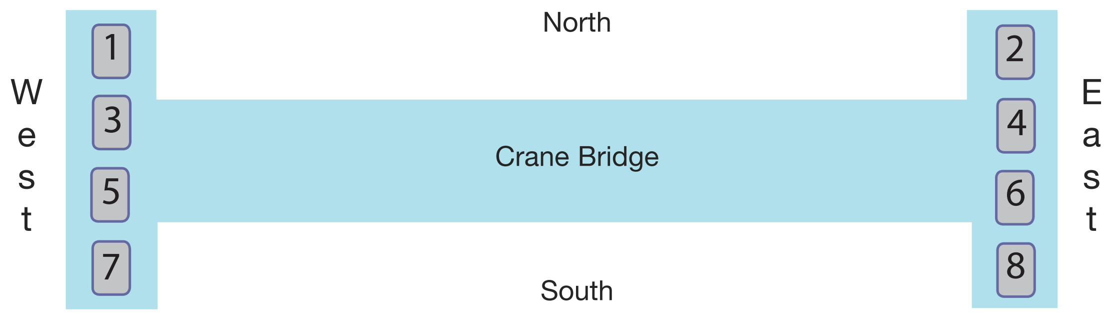

Figure 4: Schematic of the crane wheel configuration

the MPL can contain more than 50% oil by weight.

The micro-porous polymer acts like a sponge releasing and absorbing the oil. The oil is released from the polymer through capillary action to its surface and is transferred to any high energy surface it contacts to provide the necessary lubrication.

Case study

An automotive manufacturer in Liverpool, UK has experienced excessive wheel flange wear on a 3x50 ton overhead crane; they had to change these wheels every 12 to 18 months. In August 2008 the MicroPoly wheel flange lubricators were installed by DT Engineering onto wheels 3, 4, 5 and 6 (Figures 4 and 5).

The four inside wheels of the eight wheels on the end carriages of the crane were selected for an initial test since they were already in service and wear rates had been measured prior to the start of the test.

Following the installation of the MicroPoly wheel flange lubricator, the thickness of each wheel flange was measured by DT Engineering every two weeks, over a 12 month period and compared to the wear data that was collected prior to the installation.

The measurements were made across the top of the inside flange of each wheel, as this is the flange that experiences the most wear. The results are shown in Figure 6.

Between August and December 2008 the four wheels that were not fitted with the lubricator had a wear rate of over 10% while the wear of the four wheels fitted with the lubricator had an immeasurable amount of wear.

In December 2008 additional lubricators were fitted onto these second set of four wheels (labeled 1, 2, 7 and 8 in Figure 4). The results are shown in Figure 7.

As can be seen in Figure 6 and 7 once the system was installed onto the wheels there was an immediate reduction of the wear rate. The four wheels fitted in December 2008 had an average thickness loss of 18% or 3.6% per month from July to December 2008. From December 2008 to April 2010 the average thickness loss was 3% or 0.14% per month. This dramatic reduction in wear rate led the automotive manufacturer to install the system on two additional cranes. H

Fig 5

Figure 5: Photo of two of the inner wheels in the crane fitted with the wheel flange lubricator

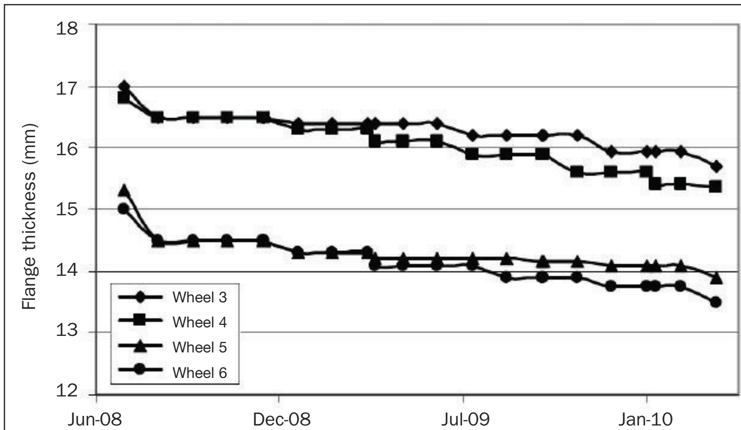

Fig 6

Figure 6: Wear measurements from first four wheels fitted with the MicroPoly wheel flange lubricator

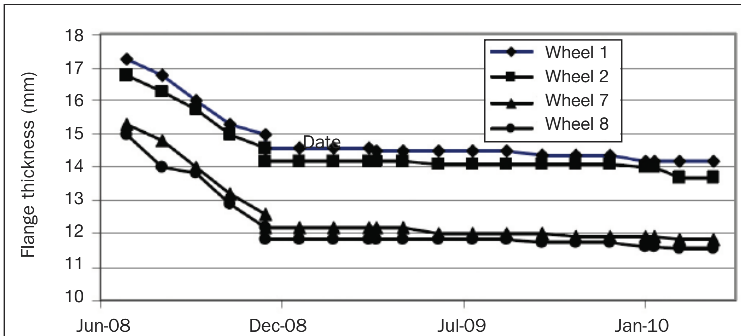

Fig 7

Figure 7: Wear measurements from second four wheels fitted with the MicroPoly wheel flange lubricator