

Tread carefully

It goes without saying that wheels and tyres are an essential part of any piece of mobile equipment, unless of course they are tracked. However when it comes to aerial work platforms, with their wide variety of types and sizes and the equally wide range of applications - indoor non-marking, outdoor, rough terrain, rough terrain non-marking, foam/poly fill, solid etc - there are literally thousands of types and variations. Mark Darwin visited OTR Wheel Engineering near Ilkeston, Derbyshire, in the UK and spoke to managing director Gavin Morrison about the industry and what to look for when choosing a wheels and tyres for access platforms.

OTR Wheel Engineering is a division of US-based OTR Group which boasts annual revenues of around \$300 million. One of the main market sectors that it covers is construction with a focus on aerial work platforms and the agricultural sector.

Company founder Fred Taylor started with a small wheel shop in Rome, Georgia, USA in 1987, manufacturing and distributing wheels and components to customers in the South East. He secured his first major customer in 1995, and began approaching the large aerial lift manufacturers with the concept of purchasing

wheels and tyres, assembling and delivering them the finished product along 'just-in-time' manufacturing principles. This helped the manufacturers reduce material carrying costs, while outsourcing a fiddly process. As customers such as Genie and JLG came on-board, he realised there was an opportunity to become a complete one stop shop, in terms of supplying wheels, tyres and foam fill.

The concept moved up a notch when Taylor started designing tyres and rims specifically for the aerial lift market. He introduced the square edge low profile Outrigger tyres which provide better stability,



Boom lift tyres have to cope with a wide variety of ground conditions



A Niftylift boom with non-marking tread on top of a standard black carcass



performance and safety while reducing the amount of poly-fill required and thus reducing weight. As the company expanded and needed more resources, Taylor partnered with a tyre manufacturer, spinning off that part of the business into a new company called Blackstone OTR.

Types of wheels and tyres

Different types of equipment require specific wheel and tyre combinations, almost all slab scissor lifts for example, use solid polyurethane or rubber tyres on steel wheels. For booms and telehandlers it is pneumatic with foam/poly fill a legal requirement on lifts in Europe. Self-propelled booms have to cope with a range of wheel loadings as the boom extends and slews - far different than for most other construction equipment. Solid foam filled tyres on larger machines create massive point loadings, particularly with traditional tyres. By designing a tyre specifically for work platforms with a flat square profile, the maximum tyre area is in contact with the ground, spreading the load over a wider area. They also mean that the fulcrum point for stability calculations is the edge of the tyre, rather than the centre, providing greater stability. Today OTR supplies Snorkel, Niftylift, Dinolift, ELS Makine, PB Lifttechnik, Manitou,

Skyjack, Haulotte and MEC.

"Tyre companies only want to sell tyres, and wheel companies only want to sell wheels," says Morrison, "whereas we provide the complete service and on a just-in-time basis."

Because of the critical aspect of just in time delivery, the company tends to locate facilities on site - if possible - or if not within 30 minutes of its major customers. In the UK it is based in Ilkeston, while the rest of Europe is covered from a location in Belgium, two in Italy and one in the Czech Republic. It also has a new wheel factory in Sri Lanka and three in China. However it is strongest in the USA with three manufacturing facilities and more than 20 distribution centres in North America.

"The aerial lift wheel and tyre side of the business is the largest sector of the company's sales but we are also expanding by applying the low profile tyre concept to other sectors such as telehandlers, supplying Terex and JLG, which use our Lightning low profile tyre for improved stability and safety. When an OEM approaches us with an idea for a new machine with higher loadings and forces etc....we look at existing wheel/tyre combinations to determine if a new design is needed or not," he said. "If they plan a bigger machine with higher

loadings etc we strive to produce the best solution. One example of this is our relationship with Genie. Over the years its booms have increased from 100ft to 125ft, to 135ft and now 180ft, and each time we needed to design a product that could handle the higher loadings. On the SX180 we considered one-piece or multi-piece wheels, different ply ratings and looked at pneumatic versus solid tyres. The expanding X type chassis also places different demands on the tyre, because of the enormous side loadings when it opens or closes particularly while stationary rather than on the move, creating a whole new set of challenges. At the design and concept stage we carry out 3D modelling & FEA finite element analysis. The modelling allows us to investigate FMEA (Failure Mode Effect and Analysis) and then we follow with samples, extensive testing and approval."

"Another example is when JLG asked us to find a tyre that could handle the fine sandy conditions ('sugar sand') found in Florida. This resulted in the Sand Master tread pattern which is designed not to dig into the sand. The tyre has proven to be very successful."

Types of tyres

OTR claims to be the first company to use its patented, non-marking capping process which involves taking a standard tyre carcass, and applying a non-marking compound on top. This means the same basic tyre is made, whatever the application but then has the specific tread pattern applied. The trend in Europe is towards non-marking rough terrain tyres for booms led by Germany, but now growing in other markets. This is partly driven by contractors putting floors in first and then building the structure, but also by the growth of the electric and hybrid booms, which can work inside as well as

An alternative to non-marking are tyre covers, widely used in North America, and becoming increasingly popular in Europe

out on rough terrain. An alternative to non-marking are tyre covers, widely used in North America, and becoming increasingly popular in Europe, to the point where US manufacturer TireSocks will be on display at Vertikal Days for the first time this year.

Flat proofing options

Off road tyres by their very nature operate in challenging environments, resulting in punctures on pneumatic tyres, a major inconvenience on site. Flat proofing is a financial decision that depends on the equipment, application, operating conditions, loads and speeds etc. Options for pneumatic tyres include sealants, polyurethane foam fills and liners as well as special rubber compounds, steel belts in the tread face, bead locks for safety, run-flats inserted in the tyre and continuous tyre inflation systems.

"The cost of foam fill may be £50 a tyre, less than the cost of a single tyre repair. It is however difficult to sell this to rental companies as they tend to recharge the customer for a tyre repair call-out," says Morrison.

Sealant can be inserted at any time in the life of the tyre whereas the liner has to be inserted at the factory. Foam fill is a two-part polyurethane which when mixed transforms from liquid to solid, taking three days to cure. The sealant liquid can be pumped in through the tyre valve and on a small tyre this may be less than a litre while a big tyre may take five to 10 litres. If there is a puncture, Kevlar fibres in the liquid which is being forced out by the pressure inside the tyre, interlock and plug the hole. The problem is when you hit a stone and break the seal, the plug can drop out and then form again. If this repeats too often you may lose all the liquid, depending on the size of the hole.

The polyurethane liner has a texture like marzipan and forms about a 10mm thick barrier across the tread and self-seals around the object - nail or rebar etc. If the object is pulled out it plugs the hole as well. Conventional non-pneumatic tyres include pressed-on wheels, moulded tyres, airless and semi-pneumatic tyres. Each method for flat-proofing comes with a trade-off or performance compromise as well as financial considerations.

There are 3 different methods for slab scissor wheels - press on, mould on and bolt together



A Haulotte HLA 16 PX with Garden Master tyres

Another option is solid tyres and more recently aperture tyres with a network of openings through the tyre wall to try to emulate the cushioning effect of a pneumatic tyre while eliminating punctures.

Retreads - service exchange

Rather than offering a re-tread service, OTR offers a service exchange programme sending out a replacement foam filled wheel and tyre assembly or set which then just needs to be fitted to the machine. The old wheels are taken back, and if not too damaged refurbished to an 'as new' standard, ready for the next call out.

Scissor lift wheels

There are several different ways of making wheels for slab scissor lifts - press-on, mould-on and back-to-back bolt together. The press-on, where the tyre is pressed onto a steel band, while mould-on tyres are wrapped, put into a mould and the tyre bonded/cured on. Wheels can also be refurbished by replacing the worn surface with a new material although OTR does offer this option nor recommend it.



A selection of OTR products



OTR supplies companies including Scorkel, Niftylift, Dinolift, Manitou and Haulotte



A large Holland Lift scissor using aperture tyres



Solidboss aperture tyre

Green Carbon

Fred Taylor is also president of a recycling company Green Carbon, and has found a way of breaking down the tyres into carbon black, oil and steel. He formed a research and development team to devise a process that takes whole tyres - even large earthmoving tyres - and automatically separates them into the three main useable constituent parts, carbon black, oil and steel.

The carbon black can be blended for manufacturing new tyres and other applications, the oil is a biofuel and can be reused and the steel is recycled while the process captures all the polluting gases emitted from burning tyres. Businesses are now responsible for the life cycle of their products from creation to disposal and the carbon footprint they create. Green Carbon helps generate carbon credits that can be used to offset carbon footprints.



3 Revolutionary Updates



Front Wheel Steering



Touch Screen Control System



Active Pothole Protection



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Wheel refurbishment

Rather than purchasing a new solid wheel, it is possible to refurbish by replacing the polyurethane coating. Several companies offer this including TVH in Belgium and QW Wheels in the UK. The Gloucester based company has 40 years experience in the polyurethane industry. Its four stage refurbishment programme is a development of its industrial wheel re-bonding process.

But why polyurethane? Well QW says that it has many advantages over a standard rubber coating, with superior abrasion and tear resistance, resulting in less damage, with good non-marking qualities and is available in a range of colours.

After the old wheels arrive at the QW factory, they are checked for defects and then stripped of the old rubber. The bare wheels are then checked again for defects before being cleaned and power coated in the original colour. The wheel centres are then sent to be re-coated in fresh polymer in the required tread pattern. After the wheels have been coated and cured they are trimmed to the final product size and undergo a final inspection before being delivered back to the customer.



Rather than purchasing a new solid wheel, it is possible to refurbish by replacing the polyurethane coating. Here are some from QW Wheels

New Mitas CR-02 crane tyre

Mitas has launched the new 445/95R25 CR-02 tyre designed for mobile cranes, featuring a new tread design that extends the current CR-01 range. The company says that the CR-02 has improved operating efficiency thanks to a lighter construction.

It is also possible to mount CR-02 tyres on a one-piece rim adding to the weight saving. The tyre is designed for speeds of up to 85kph and has a symmetrical tread pattern, which can be re-treaded. It also meets the requirements for winter conditions and works well in mud.

Mitas offers three sizes - 525/80R25, 445/95R25 and 385/95R25 - of the CR-01 crane tyres which are used by manufacturers such as Liebherr and Manitowoc. Mitas claims a six percent lower rolling resistance in comparison to standard mobile crane tyres - thanks to its all-steel construction - providing improved fuel efficiency.



Mitas CR-02 is designed for speeds up to 85km per hour.

Magna MA03+

Magna Tyres has also launched a new All Terrain crane tyre - the MA03+ to join the existing MA03.

Magna says the new tyre is optimised for long distance travel and offers greater fuel efficiency, while and operator comfort due to the new improved, irregular wear pattern, while a special compound



Magna Tyres has also launched a new All Terrain crane tyre - the MA03+.



Emerson Crane Hire in the UK and German rental company Bruns Schwerlast are just two rental companies using the MA03+

offers longer tyre life and shorter breaking distances. The radial tyre is available in the most requested sizes of 385/95R25, 445/95R25 and 525/80R25.

Several crane rental companies are already using the Magna MA03

including Emerson Crane Hire in the UK and German rental company Bruns Schwerlast. Emerson says that over the past few years it has used various brands but after testing the MA03, concluded that it had the lowest cost per mile as well as being very reliable.

Tyre covers, booties or socks

While North American rental companies have used tyre covers for many years, most European end users have 'got by with make shift solutions including plastic sheeting to cover floors from being marked or even covering black tyres with masking tape! Companies have been selling 'tyre covers' 'booties' or 'socks' for years, but it was the arrival of TireSocks that took it mainstream in the USA, becoming synonymous with the product. The company has now appointed EuroGate International as its master dealer for Europe and sales here are on the increase. TireSocks are constructed using heavy duty rip resistant fabrics, and designed to ensure they stay on during heavy use. The company produce a wide range of sizes to suit most, if not all aerial lift and telehandler tyres. They also self-centre as you drive.



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