



Walter Ebeling, director, Pan Mixers.

Handling concrete – from mixing

MechTech talks to Walter Ebeling, director of Pan Mixers South Africa (PMSA), about automating the processing of concrete and the solutions available from his company.

Pan Mixers South Africa (PMSA) was established in 1976 by HH Ebeling, father of the current directors, Walter and Robert Ebeling. Today, PMSA is the largest manufacturer in Africa of machinery for the concrete, refractory, foundry and ceramic industries – turbine, counter-current and planetary pan mixers; concrete brick and paving machinery and fully automated batching plants. "We make concrete brick, block and paving making machines and a range of mixers and weigh-batching systems for all kinds of concrete products," says Walter Ebeling.

Central to the company's product range and to the manufacture of all cement products are mixers. "Our mixers are designed to

mix very intensively and are suitable for mixing dry concrete for bricks, blocks, roof tiles and paving. They are also used for specialised concretes – resins and epoxy types – and dry mixing powders," says Ebeling. "The mixers we manufacture are not drum-type mixers, good for mixing wetter concrete with relatively more moisture and larger aggregates, but a drum mixer won't mix properly if the concrete is too dry. Our mixers are upright pan mixers, ideal for dry or more difficult mixes. Imagine a pot being stirred," he tells *Mechtech*. "A turbine pan mixer has rotating arms inside the pan to mix the concrete and a counter-current pan mixer has the whole pan rotating in one direction while the arms are rotated in the opposite direction."

Pan mixers mix intensively for several reasons: "Firstly because of a shearing action – the material is split in half horizontally, vertically upwards and it is also moved outwards from the centre of the mix, ie, material is being continually chopped and split in all three dimensions as it is repeatedly fed from the centre to the outside of the mixer. This results in a very thorough mix," says Ebeling. "Also important is the scraper to remove material off the sides and drive it back into the mixing tools."

Turbine pan mixers fill the smaller range from 100-500 l mixing capacity. "The 100 l mixer can mix around 1,5 m³ of concrete every hour. It was initially developed as a lightweight mixer for on-site refractory lining of furnaces and kilns. Instead of making the concrete outside and transporting it into the kiln, you can take a small mixer to the



The mixing action of a planetary pan mixer. The whole pan is rotating in one direction while the arm is rotated in the opposite direction. Pan mixers mix very intensively because material is being continually chopped and split in all three dimensions as it is repeatedly fed from the centre to the outside of the mixer.

kiln and reline by placing smaller batches of material exactly where you need it," he says.

But there is an effective limit to the size of a turbine pan mixer: "As you increase the diameter, the outer speed of the rotating arm will be moving too fast and the inner one too slow, so mixing only happens in the middle. This makes it pointless to use this technology with a diameter bigger than about 1,5 m," he explains. "For larger capacity, we use a counter-current pan mixer. On these, the complete mixing drum rotates and arms inside rotate in the opposite direction."

The biggest PMSA pan mixer has a capacity of 1 500 l. Two mixing stars are used, one rotating clockwise and one rotating anticlockwise. "This allows you to mix with low material to tool speeds. By keeping the tool speeds low, you reduce abrasion and get much better wear life. Also, because it is a counter-current mixer, the concrete will be mixed very intensively, because the concrete can't hide. There are no spaces which the tools can't reach," says Ebeling.

A third pan mixing option is the planetary solution, developed in Europe based on a large turbine mixer design. "Instead of a single rotating mixing star, a planetary mixer has a large gearbox with extended arms and mixing stars attached to those arms. These are not as good as counter current mixers



PMSA extractor conveyors extract aggregates from the bins and deposit them onto the weigh-scale conveyor. The key stage at the start of any concrete process is to accurately weigh each aggregate so as to achieve consistent batches of concrete.

to stacking

because all the material is moving in the same direction, but it is much better than a large turbine mixer. We import these in capacities of up to 3 500 ℓ," he tells *MechTech*.

Completing PMSA's mixer range, are the small counter current mixers in the 10 to 50 ℓ range for laboratory and specialised mixing applications – such as resins, clays and special powders.

The leap into automation

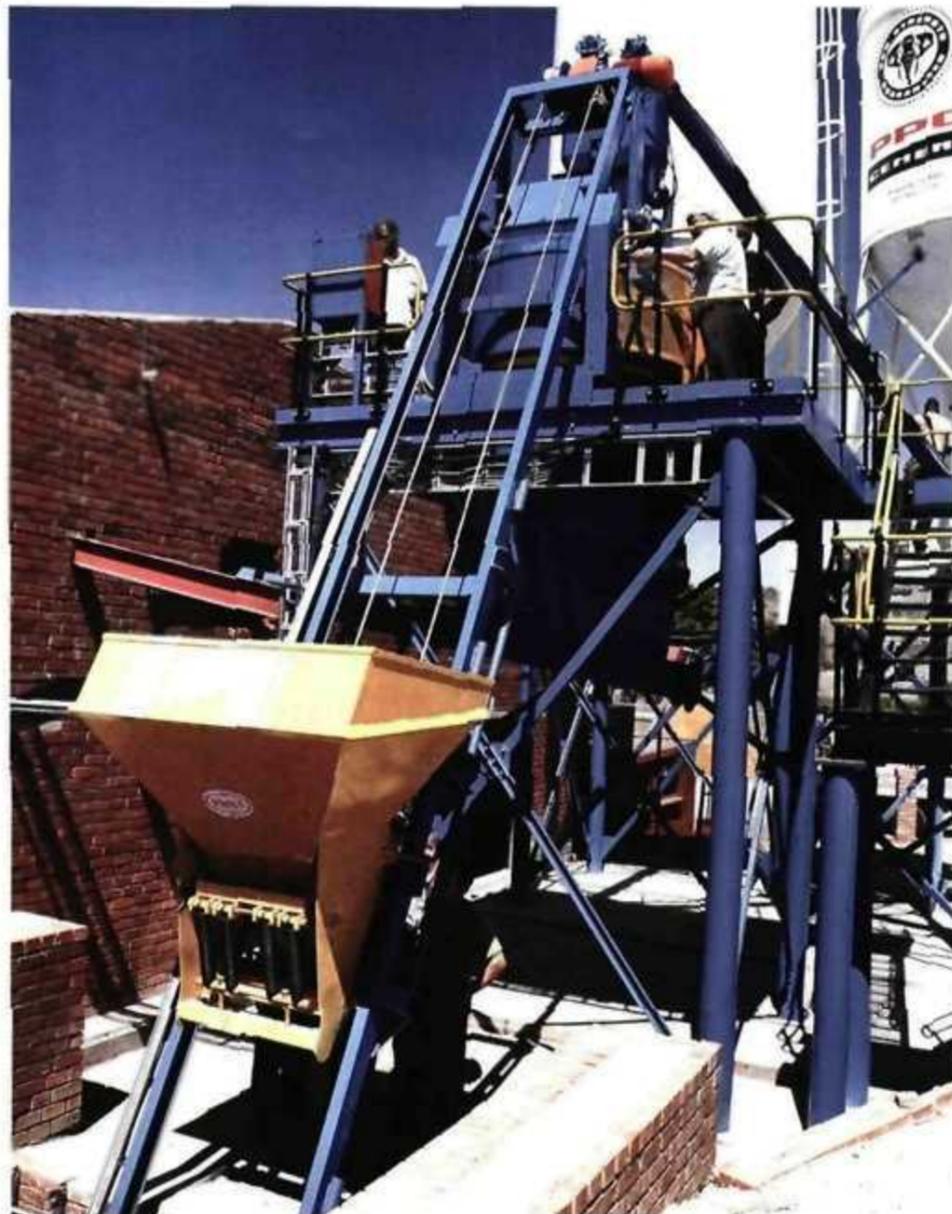
"We now manufacture whole process lines for handling cement products, from storing and batching of the aggregates – sand, stone and crusher run – all the way to the curing bay and out into the stacking yard," claims Ebeling.

He describes a typical process starting with the aggregate materials. At the starting point of an automatic system is a store of the different materials needed. "We use either a bulkhead system – with three or four walled divisions to separate aggregates and a scraper winch to scrape material up – or an aggregate bin system – which can use gates or a conveyor to store the aggregates.

"To manufacture a paver, for instance, you need some fine material, some medium-sized material and some coarse material. If you have too much fine material, you need more cement to bind it all together. If you have too much coarse material, then you also need more cement because the material has fewer contact points for the cement to bind onto. Therefore, quality cement has a careful balance of fine, semi-course and course material. You need to get it right because, at around R1 200 per ton, you want to use as little cement as possible."

So the key stage at the start of the process is to accurately weigh each aggregate to achieve consistent batches of concrete. "We place our aggregate scales either under the bulkhead wall or underneath the aggregate bins." He shows us a typical set-up which uses a bulkhead system. Hoppers above the scale are kept full with each aggregate. Each hopper has a gate underneath it feeding into the scale. Aggregates are weighed into the scale one at a time, then once all the aggregates necessary for one batch of concrete have been accurately weighed out, the scale is emptied and the materials carried on up to the mixer.

"No cement or binder has yet been



A batch of weighed aggregates is transferred to the loading bucket and carried up to the mixer. Weighed cement is then added via a screw conveyor, followed by water. The concrete is then mixed.

added," Ebeling emphasises, "because if it was, any wet materials would cause lumping and all sorts of other associated problems."

A loading bucket then takes the weighed mix from the scale and drops it into a pan mixer, usually on a platform close to a cement silo. "In this case, a counter-current pan mixer is being used, ie, the drum turns one way driven by a motor and gearbox and a second motor and gearbox turns two mixing arms in opposite directions to each other," he points out.

While weighing the aggregate, a screw conveyor pumps cement from a silo into a separate scale. The aggregate mix is loaded into the mixer first and mixed dry for a few seconds. Then the cement is added and mixed dry for a few seconds before water is added to the mix.

"What you do with the concrete is then up to you," says Ebeling. "You can make concrete pipes, lintels or wet cast concrete products, or you can put a block machine underneath the mixer to make bricks, blocks or paving products. We offer machines to make all of these products."

He cites state-of-the-art automatic facilities in northern Namibia built for a company called Henning Crushers: "We are currently building a state-of-the-art automatic plant for this customer, the third fully automated manufacturing plant it has ordered from us. My father originally did business with the now-retired Henning father. Thirty years later, the sons from the two companies are still doing business with each other."

The new system being installed in Namibia uses aggregate bins and a weigh-belt

system: "On an automatic system, when you use a gate to control the flow of material onto a scale, an alarm is set to close the gate at a predefined percentage. In some cases, the material flows so fast that the gate begins to close at 15% of its required value. By the time the gate is actually closed, the bin will be 70% full. We then oscillate the gate, and by controlling how much the gate opens and the speed at which it oscillates, we can measure out exact quantities of each aggregate. Everything happens very quickly. We weigh and mix 1 500 l of aggregate in 1,2 to 2,5 minutes," he claims.

Rather than using a pneumatic gate system, this customer is using extractor belt conveyors. Ebeling explains why: "Belt conveyors are more suitable for materials that don't flow, ie, materials that will bridge in the bins, because they can be made with a bigger discharge opening. If an opening with a gate has a large area, then too much material will flow out before you are able to shut it. So, instead of making a gate bigger, we replace the gate with a belt." Material is drawn out of the bin when the belt is moving, and when the belt stops, material backs up on the belt and stops the flow from the bin above.

At Henning Crushers, an extractor conveyor underneath the bins pulls out aggregate material and places it onto another conveyor, which is a scale hanging on load cells connected to a supporting frame. Once all of the aggregates have been weighed, the whole batch is transferred to the loading bucket, and then taken up to the mixer, a PMSA 1 500 l counter-current pan mixer, where cement and water is added to make the concrete.

Henning Crushers makes bricks, blocks and paving using a PMSA VB4XA blockmaking machine. "When you make concrete bricks and paving, you use a very dry concrete mix. On a dry mix, you use vibration to agitate the concrete to make it compact in the mould, a dry cement product can be stripped away from the mould immediately, ie, the product can be placed on a production board and the mould can then be reused. One mould in a block machine can make anything between 10 and 60 bricks at once, and it would take, depending on the machine and the control system, anything between 10 and 30 seconds to make each mould of concrete product," he explains.

"But for curbs we use something different," Eberling adds, showing us a photo of a brand new plant in Pretoria. "They are made

with wet concrete, which would usually have to be left in a mould for 10 hours or more," he says. "For this installation, the concrete is poured into a mould on a rotating table with three process stations. At the first station, the mould is filled with concrete. The second process is to compress the water out of the concrete. For this you use very large pressures, 400 t, over smaller surface areas, eg, the area of a curb, 1 000 by 300 mm. This squeezes the water out of the concrete. Filters on top and underneath the mould are used to allow the water to escape.

"The now dry concrete product can be pushed out of the mould immediately in the third stage of the process on the table," he adds. "All the water has been removed, and it is actually possible to lift the curb off the table with a vacuum attachment and place it onto a transfer plate, which turns it onto its edge and puts it onto a high-quality curing board. After curing, the pallets are stacked onto delivery pallets and strapped for transport and delivery. "With this automatic system, up to two kilometres of curb can be made every day," Ebeling estimates.

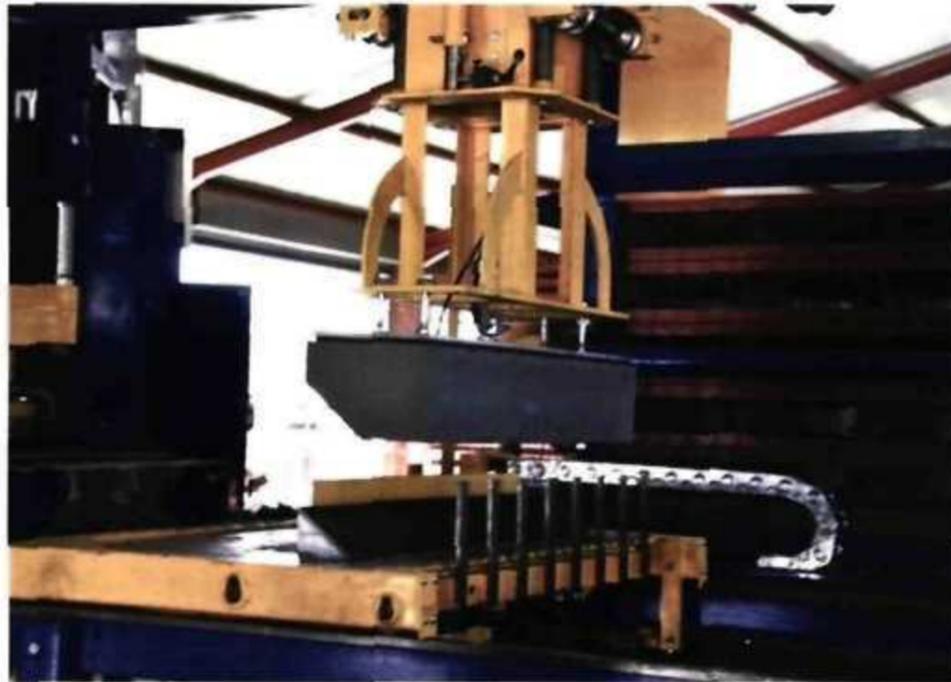
We ask about the future outlook. "Our local market share on mixers and block machines is now about 65-70%, Ebeling responds. "Angola, which was hit by the recession, is now coming back and we are experiencing good strong continual growth in Namibia. Botswana is also recovering and one of our clients in Ruanda is now looking to expand from small to medium sized



A 400 t press is used on a three-station revolving turntable to remove the water from the wet concrete.

machines. So, exports are now climbing back up towards the 35% mark.

"Our products are well known in South Africa, and we pride ourselves on the same service delivery on spare parts and service on offer since 1976. The fact that clients like Henning Crushers are still doing business with us 30 years later shows our ongoing commitment to quality," he concludes. □



The concrete curb can be removed from the mould immediately as it is dry enough to be lifted and moved by a vacuum attachment.