

Line integration and speed: Robots hold the key

LOWER COST PICK-AND-PLACE ROBOTS ARE OPENING UP A ROUTE TO MUCH FASTER TOP-LOAD CARTONING WHILE ALSO PROVIDING A FLEXIBLE MEANS OF INTEGRATING CARTONERS GENERALLY WITH OTHER EQUIPMENT IN A LINE.

Just as servo drives tended to dominate development of cartoners, and indeed most other packaging machinery during the 1990s, so robotic loading in one form or another – particularly linked to vision systems – looks set to play a major role in the cartoning process over the coming years.

One line of thought is that lower cost robots will tend to reverse the European trend to end-load cartoning as opposed to the top-load approach more widely favoured in the USA.

Another view, by no means contradictory, is that robots will serve increasingly as a principal tool in integrating cartoners with upstream equipment and provide a particularly flexible, programmable alternative to mechanical collation systems when loading the buckets of high speed end-load machines.

The experience of Bradman-Lake, which builds cartoners in the UK, USA and Germany, helps set the scene. Chief executive Graham Hayes explains that while some 80 per cent of the company's sales in the USA are for top-load machines, the opposite is the case in Europe where some 80 per cent of sales are for end-load machines.

That, he points out, is purely the Bradman-Lake experience, and may not of course necessarily reflect the entire market.

"The job of cartoning machines is simply to put things into boxes, either by pushing them in from the side or dropping from above," he says. "Commonsense dictates that it's easier to load through a big aperture on top rather than insert them accurately through an opening in the smallest dimension."

So why has end-load tended to dominate the European market for so long? The reasons are speed and cost, explains Graham Hayes.

"End-load operations have until recently been a lot faster than top-load. And it has also been more costly to design and custom build

top-load systems than to produce bespoke end-load equipment. The pros and cons of both methods have been hotly argued in recent years but the cost benefit balance has shifted to top load as the price of robots has come down."

The question of the relative speed of the two methods is, he suggests more complex.

"Top-loading cartons in the past has always been quite slow. End-load running speeds of 300cpm are certainly being achieved, but outside the pharmaceutical industry most end-load lines run at 200cpm. Now, product collation and pick-and-place robots can top load at very high speeds. Simple products like confectionery bars are already being packed in the US at 700 a minute to give filled pack rates fully comparable with the fastest end load machines."

Easier to apply

At the same time, robot technology has become much easier for the packaging industry to apply, says Mr Hayes, with much more user friendly software that makes it very much simpler to set up a robotic loader, change collation pattern or pick-and-place configuration.

A current example is pizza packing where Bradman-Lake has been chosen by a major international manufacturer to equip its latest packaging lines, first in America and now in Germany.

During 2002 the company designed and installed a fully automatic, robotic, top-load cartoning system to handle output of 800 pizzas a minute for a new product line in the USA. Several high speed Bradman-Lake LJ robotic collator and pick-and-place units were installed to load the flow-wrapped products into cartons, which are also erected and sealed on Bradman-Lake equipment.

Success in the USA led to a European launch and a new pizza plant in Germany where Bradman-Lake was commissioned to supply all

machinery and construct a complete packaging line to serve the whole European market.

Central to the operation are four high performance Bradman-Lake machines, two AMI/S erectors and two SMH/K linear carton closers.

Output from both erectors, each equipped with three forming heads, is fed by a specially designed conveyor system to three filling stations. The open top cartons are initially being loaded by hand but the line is designed to allow future conversion to robotic loading. The three lanes of filled cartons are then merged and fed into the two closers to be sealed with hot melt adhesive.

In addition to the cartoning operation, Bradman-Lake was responsible as the turnkey lead contractor for supply of primary wrapping machinery, shrink tunnels, metal detectors and the installation of the entire conveyor system from freezer to tray packers.

Overall plant control is through a central operating control desk. Specially developed software reacts instantly to constant changes in product flow and automatically adjusts machine speeds throughout the process.

In fact, to date, Bradman-Lake has installed 34 packaging robots in the USA and Canada and the company was named as the largest integrator of ABB pick and place robotics in 2003. This year, two more Flexpicker installations are coming into operation in the UK with another two in Asia. A dozen more projects are under way, says the company.

Meanwhile at Dutch cartoning machine manufacturer Langenpac – part of Molins Packaging Machinery – managing director Kees van Dam sees robots as a valuable alternative to mechanical systems for collating and loading products into the infeed buckets of end-load cartoners.

"This arrangement gives the best of both worlds because you keep the product under

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control and you have all the flexibility of high speed on the cartoner. Also, in terms of layout, it's much smaller than separate erectors, loaders and closers."

Another advantage, he points out, is the ability to create collations from a number of primary infeeds and to alter the proportions within those collations at the press of a button. One recent application involved creating and cartoning a collation of several different flavour food sachets while another concerned a mix of different grade tampons in a single carton.

Robots are, of course, also an integral part of the larger world of integration which, at Bradman-Lake, has assumed a much higher profile of late with the acquisition of flow-wrapper and roll-wrapper manufacturer Autowrappers and end-of-line machinery specialist Europack.

Controlling own destiny

"We have been integrating complete lines for some time but we wanted to control our own destiny," says Bradman-Lake sales and marketing director Simon Wheatley. "We wanted to create a larger group to control the interfaces between different machines and, in a way, work to eliminate integration as a separate process.

"Some 80 per cent of our pick-and-place robot sales are for transferring packs from a flow-wrapper to a cartoner or another wrapper, while 75 per cent of Bradman-Lake machinery is installed in a line where there is some form of case-packing or shrink-wrapping."

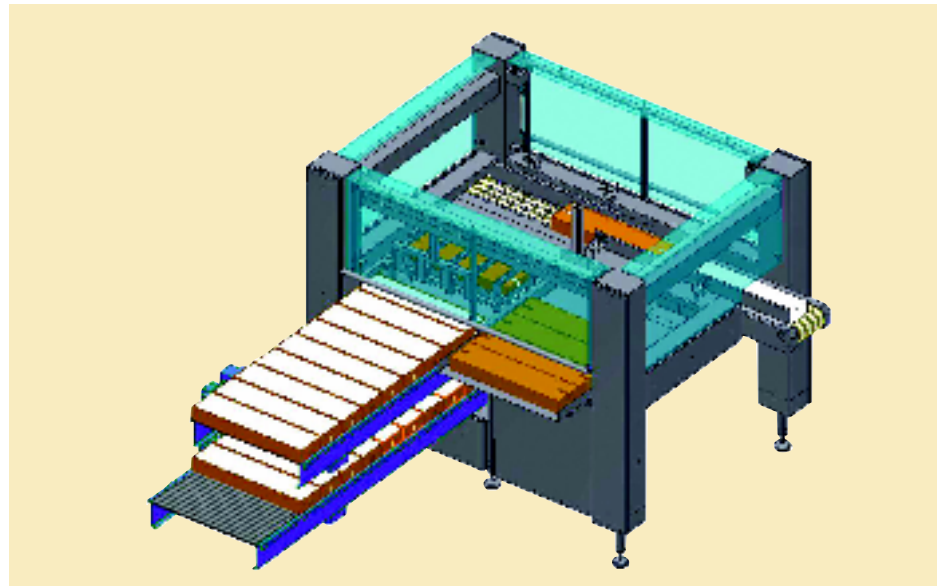
Reaction from machinery users reflects, he believes, the growing desire by many for turnkey contracting by a single supplier.

"In the first month after the acquisition we had eight enquiries that we would not have been given until the announcement, one of them for a £1.8 million system. In that month we were also able to go back to nine further potential customers to offer a new solution based on the new capabilities of the group."

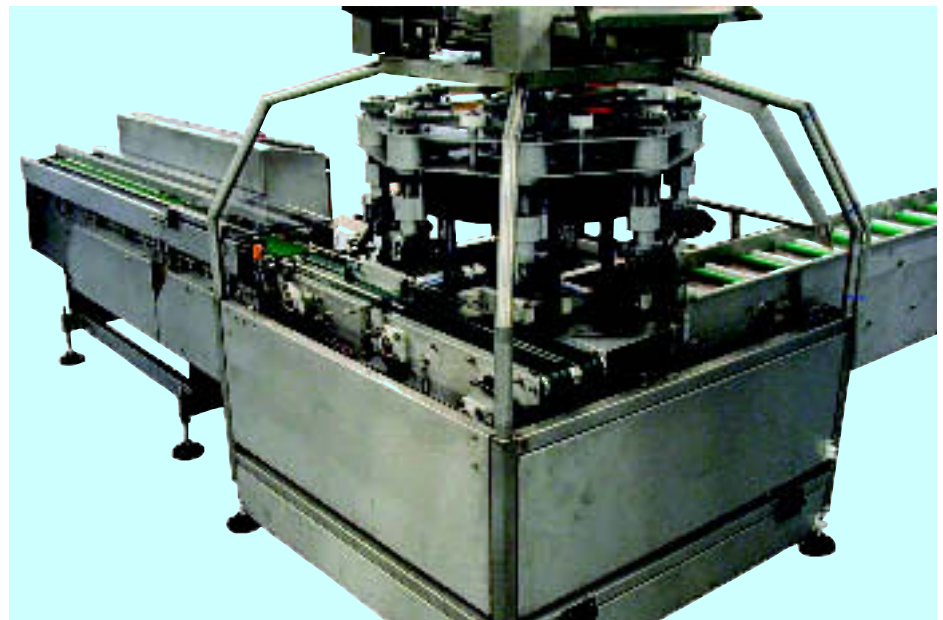
Graham Hayes points out that 'integration' can mean different things to different people.

"Integration to some people is that you get everything together and, despite different control systems, control panels, working heights and so forth you link it all up and make it work.

"Our view is that integration is when the operator looks at the same screen with the same symbologies all the way down the line. It is when the electronics are all compatible, and when the operator has complete familiarity, one end to the other."



Blank feeding: Langenpac system keeps high speed cartoners fed with blanks



Feeding trays: The Rotary Transfer System from Kliklok Woodman

At Langenpac, Kees van Dam agrees. "When we are called on to carry out a line integration we need to tell our subcontractors what we expect, for example, in terms of the layout of the HMI. The layout must be the same; the logic must be the same. If you press a button on one machine or you press a button on another machine you should expect the same sort of functionality."

Product handling, he adds, is a key element, keeping control of the product at all times.

Indeed, a range of product handling equipment has also been designed by Kliklok Woodman to complement its end-load cartoning machines. Automatic product infeed timing, collating, orientating and stacking equipment is available and can be fitted retrospectively to existing KW machinery.

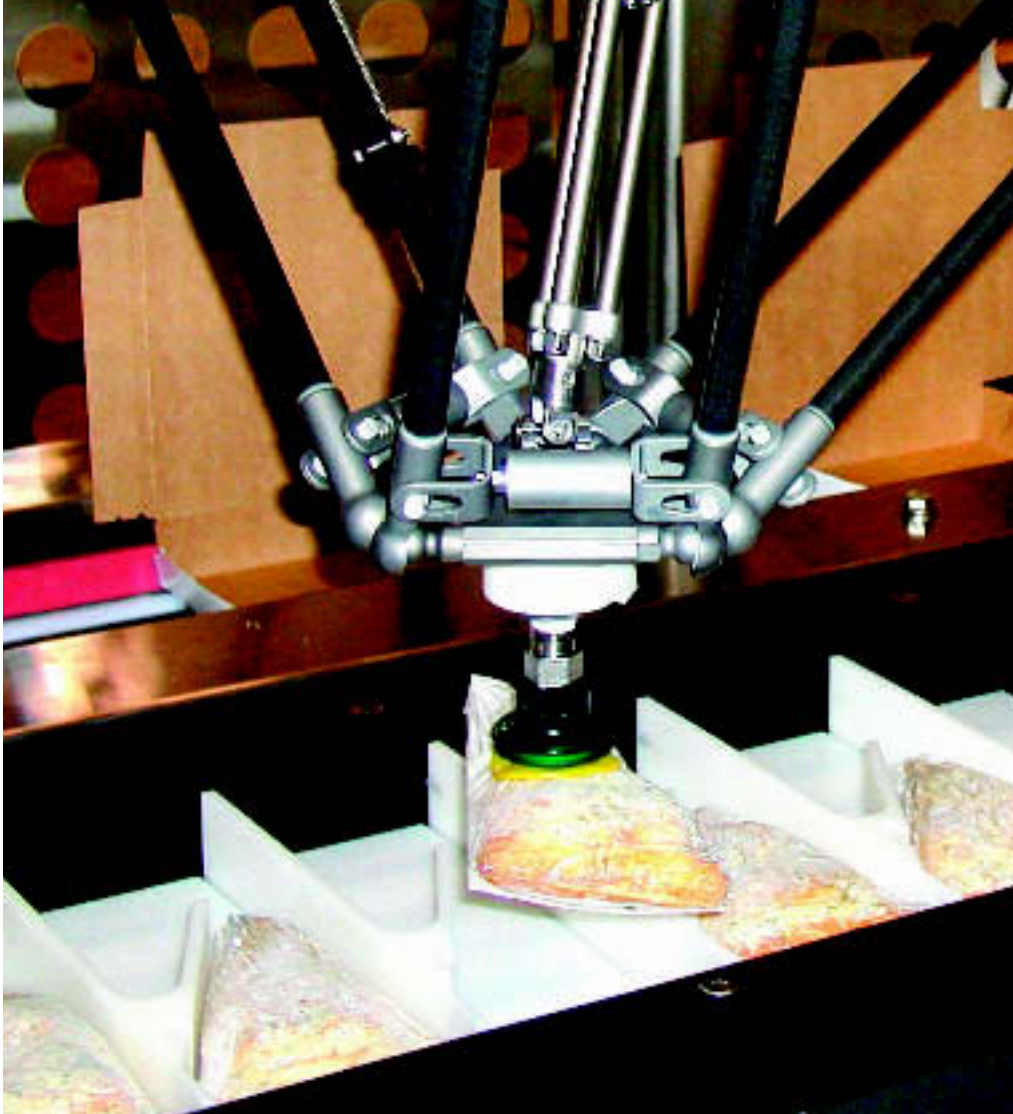
The company's latest Stacking TRAC system

for example is capable of collating and stacking up to four flow-wrapped pizzas prior to the infeed of the cartoner.

Rotary transfer system

Other product handling equipment includes the RTS, Rotary Transfer System, one of which is about to be supplied to a major US bakery – integrated with a new Kliklok HSR end-loader, and running a special 'hood cover' style carton in which the end-load carton is made with a top flap that opens for consumer access.

The system starts with a Kliklok Smooth IPTU multi-belt feeder, employed to time randomly spaced trays of frozen product, short edge leading, into the lugs of the RTS, which is



High speed pizza packing: Part of a Bradman-Lake line handling 800 portions a minute in the USA



Mid-range cartoner: RA Jones has introduced the Meridian large pitch machine

equipped with a carousel carrying a circular array of transfer heads. Since the outfeed is at 90deg in this case, the heads travel round without changing orientation.

Product arriving on the lugged conveyor is checked for position and height by two sensors. If the product is over-height or incorrectly positioned the transfer head will pass over, allowing unsuitable product to continue off the end of the conveyor to the abort chute.

If the product is suitable for transfer, the

head lowers, and the tray is swept away at 90deg to be placed positively, long edge leading, in the flights of the Kliklok HSR cartoner. In-line versions of the RTS are also available and employ transfer heads that rotate the product 90deg as they travel round.

Recent Kliklok installations have included Kliklok's newest end-loader, the Servo HSR, at a major frozen food company in the USA, packing ready meals. Built in stainless steel, this machine offers on-board diagnostics, ergonomic

guarding, and is said to allow easy repeatable size changing – a three dimensional change in 10 minutes – with speeds up to 300 cartons a minute.

Several special shaped cartons, including hexagonal, octagonal and tapered styles are also being handled on various Kliklok Woodman end-load models. A specialist chocolate manufacturer in France recently chose the Kliklok SFR to pack bags of truffles into a high quality tapered carton. "Not only did this machine fulfil the customer's requirement to run this special carton, the short footprint of the machine was vital for the space restriction of their plant," says Kliklok.

Auto feed for cartons

Automated feeding equipment for high speed end-load cartoners clearly does not stop with the product. Replenishing the carton blank magazine on high speed machines can be a time-consuming affair.

So Langenpac has developed an automatic system for loading the carton blank magazine on its Chinook end-load machine, which is capable of speeds up to 450 cartons a minute. The system can be retro-fitted to existing cartoners – Langenpac or others – and can be sized to offer as much accumulation as required although, as standard, 20 minutes running with no need for operator intervention has proved most popular, says Langenpac's UK representative Springvale Equipment.

Carton blanks are introduced to the system held in trays carrying one row. These trays are placed on an accumulating conveyor and move in turn to the transfer station, where the tray is inverted and positioned directly behind the existing stack in the horizontal magazine, acting as a book-end and supporting the stack as it moves forward to the erecting mechanism. As soon as there is sufficient clearance, the next tray is brought into the magazine and the previous tray can be lifted clear of its cartons, which are now supported by the new tray.

Langenpac has now also supplied a number of cartoning systems to handle high volumes of daily and monthly disposable contact lenses, which are supplied in sealed blister packs, extending from the initial handling of the lens blisters as they exit the autoclave process, through to the collection of individual batches of selected lens packs for dispatch.

The Langenpac cartoning machine receives lens blisters in batches of different specifications and inspects each blister for validation

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purposes, before collating and nesting as required. Speed is up to 300 blisters a minute and a leaflet can be added if required.

Meanwhile RA Jones has announced the Meridian, a large pitch end-load machine which, says the company, is aimed price-wise at the middle of the market. Designed to offer a high degree of flexibility and be future-proof, the machine is available with 9 or 12in pitch and occupies a small footprint, with the overall base frame being no longer than 4.8 metres.

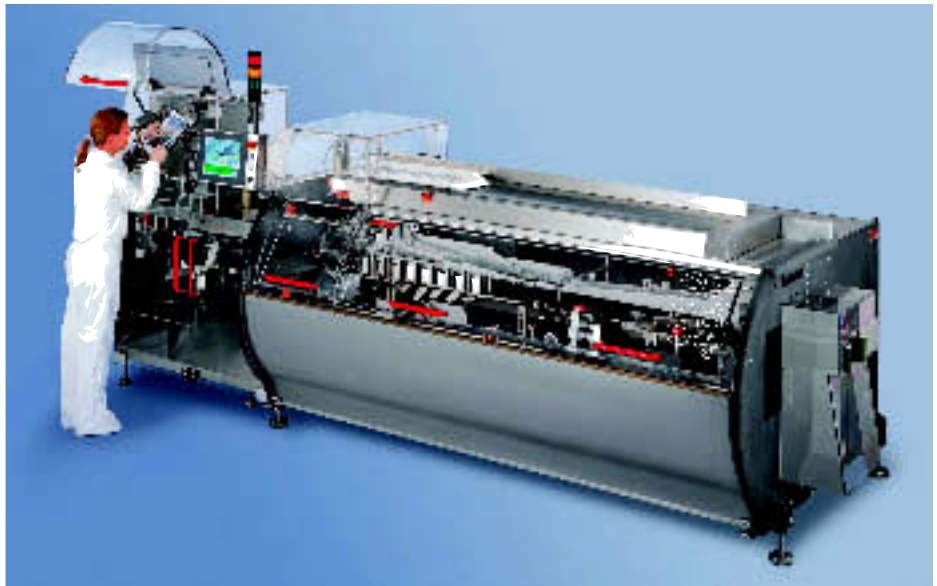
There is a rotary carton feed and speed is up to 200 a minute with a 9in pitch and 160 a minute with a 12in pitch. Construction is in stainless steel as standard.

IWK has introduced a range of end-load cartoning machines for the pharmaceutical and personal care industries, designed on a modular basis. This, explains UK representative IWKA PacSystems, allows a variety of optional equipment to be readily included initially, while also taking care of possible future needs for upgrades with retrofits and further add-ons.

Indeed, this modular approach also means that the IWK Cartopac machines share a high proportion of common parts – over 80 per cent – despite being available in a number of versions covering intermittent and continuous motion, as well as 100 or 150mm pitch.

Key features of the range, which is built in balcony style for ease of cGMP compliance, include a new rotary carton pick-up and erecting system, fed by a motorised conveyor in place of the conventional gravity hopper. Here the modular approach is immediately apparent.

On the intermittent motion machines, the rotary drum is equipped with just one pick-up head to provide speeds up to 120 cartons a minute. But the same drum can carry up to three pick-up heads, allowing the 100mm pitch continuous motion Cartopac SC4 to reach speeds of 500 cartons a minute.



Easy access: Guards on the new Bosch CUC range of cartoners swing up and down

The carton erection system employs a pre-break system to open the cartons and avoid problems with poor quality creasing or internal glue spots, but also incorporates an arm that moves into place to hold the carton square as the transfer is made into the carton chain.

Polymer carton supports

Here, to prevent risk of scuffing, IWK has departed from the conventional arrangement in which the carton is carried between flights and supported either end on steel guide rails. Instead, each carton is carried by the chain in a pair of facing L-shaped polymer supports that adjust for pitch in the same way as the flights on a traditional four-chain system.

Controls on the Cartopac range are PC based, which allows a Windows style operating system to be employed for operator familiarity and ease of use. However, the PC also carries the machine's operating manual, maintenance manual and parts lists and identification, providing a ready reference source for both the

operator and maintenance staff.

Adco Manufacturing's range of end-load cartoners now extends from the semi-automatic 15DZ, an entry level hand-loaded machine capable of running at 60 a minute, up to the BC barrel cam continuous motion automatic loading machine, offering speeds of 400 a minute and an auto-retract system within the product inserter to protect against jams.

In between there is the 15D-1054, a continuous motion hand-loaded machine with space for three operators to give speed up to 125 a minute and the "economic" auto load 15DBC-105. This is a 12in pitch machine with speed up to 125 a minute and standard features that include a two-head rotary carton feeder and a 1220mm long horizontal powered carton magazine.

Servo driven, the new CUC end-load cartoners from Bosch are built on a balcony basis for GMP, with any product or packaging debris falling through onto an inclined plate below. There is a choice of 4, 6 or 8in maximum pitch,

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giving speeds up to 400, 260 and 200 a minute respectively.

Product insertion is from the rear of the machine via servo controlled pushers which, says Bosch, reduces the footprint of the machine while also providing uninterrupted access to the carton erection and transport system via curved guards at the front.

The lower metal guard can be swung down, underneath the machine, while the upper transparent plastic guard can be swung up and the conveyor belt carton magazine – which runs the entire length of the machine – pushed to the rear.

New carton conveyor

Bosch has also replaced the conventional flighted carton chain with a new type of carton conveyor that eliminates the stationary support rails on which cartons can rub and get marked. The absence of chains also avoids the need for lubrication and periodic adjustment for stretch.

The carton conveyor consists of a series of linked plates, injection moulded in engineering grade polymer, with a gear profile at the base to take the drive and the flight and carton base support at the top. Twin conveyors, at front and back, adjust for pitch in the normal way.

Italian manufacturer CAM's HV continuous motion end-load cartoning machine is the latest development from the company and is available in two pitches of 5 or 7.5in to suit a wide variety of applications.

Cantilever construction meets GMP hygiene requirements and provides ease of access, points out UK representative Campak, with the mechanical drives completely separated from the product and carton handling areas.

The HV uses CAM's rotary carton erection system to give progressive and positive carton opening at speeds up to 400 cartons a minute while speedy size change, by the operator, is via the CAM Mechanical Memory system. This series of colour coded dials, together with simple release and slide mechanisms, is said to provide quick and repeatable operator size changes, with no need for fine tuning.

The AS range of end-load cartoning machinery built in Italy by Bergami is now marketed in the UK by Propack Automation and includes the AS150, a balcony style intermittent motion machine developed specifically to meet GMP requirements within the pharmaceutical, toiletries and cosmetics markets.

It is available with a wide range of infeed systems to suit blisters, vials, syringes, bottles,



Twin lane erector: The new KA 390-S from Vepatec can produce 150 cartons a minute

sachets and tubes while a counting system can also be fitted to the machine for products such as tissue wipes

In particular, points out Propack, the machine has an extremely small footprint of 1350 x 2480mm yet can achieve speeds up to 140 a minute. A complete size change is said to take 10-15 minutes, using spindles with digital read-out.

All contact parts are in stainless steel while the carton chain incorporates polymer supports, raising the carton above the level of the chain guides to avoid risk of scuffing. There is the option of reel-fed leaflet cut-and-fold equipment or a magazine feed.

Top load revival

High speed robotic loading apart, one good reason for a resurgence of interest in top load cartoning is the ease with which multi-component packs can be handled, such as kits of medical devices or personal care products.

One recent example is the TopLoader T 2060 cartoning line developed by Uhlmann, to provide a modular system that can load a number of different items into a carton, such as blisters, bottles, syringes, ampoules and leaflets, at speeds up to 60 cartons a minute.

Up to eight different loading modules – each

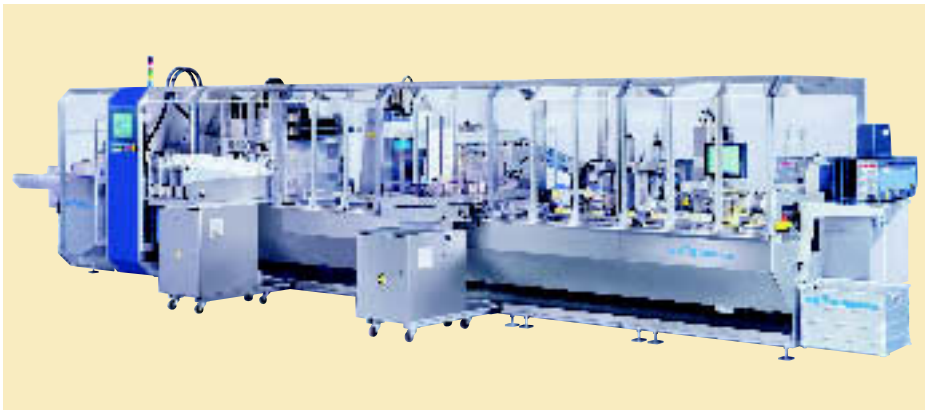
with their own drive – can be linked up between the carton erecting module and the final closing and checkweighing module, although at last year's Achema exhibition – where the machine was launched – it was shown with four. These allowed the machine to create a combination pack consisting of a small bottle held in a board fitment, blister strips and a leaflet.

All units are built on a balcony basis for good GMP – with drives and control units at the rear of the machine – while the guarding is designed to provide a clear view of all parts and easy access, despite the machine being fairly wide to accommodate a broad carton size range.

There are top hinged 'gull wing' plastic panels and, below them, metal side panels that can be slid forward towards the centre of the machine, allowing the operator to get in closer and reach easily to the far side of the conveyor.

The controls, which use a fibre-optic communication system, also include a safety door bus, which allows the interlocks of individual guards to be selected via an access code and overridden. This means that only those guards that need to be opened during maintenance without stopping the machine are affected while full guarding is maintained over the rest of the machine.

The TopLoader is able to handle blanks up to



Multi-component packs: T 2060 TopLoader from Uhlmann can have up to eight loading stations

600 x 745mm – giving a maximum carton 250mm long, 210mm wide and 150mm high, a minimum of 70 x 50 x 15mm – and employs a waist height horizontal magazine in which blanks are supported on two individually driven feed belts. These advance at different speeds, if necessary, to correct any misalignment and deliver blanks precisely at 90deg to the swing arm that makes the transfer to the tracks of the erector.

A photocell sights across the blanks, for belt speeds to be adjusted automatically, while air jets above the blank at the pick-off point ensure clean separation.

Squat cartons

Generally, Uhlmann anticipates that the TopLoader will be used for cartons that are fairly squat, which means quite large top flaps. Therefore, to speed up the plunge forming process, one side of the female tool opens once the body of the carton has been formed, allowing the carton with its erect top flap to be moved sideways out of the tool immediately. This avoids the need for the entire carton to pass right through the tool, so reducing the stroke, and hence cycle time, considerably.

The first loading module shown on the machine working at Achema adds a board fitment with an aperture to hold a small bottle. It consists of two parallel erectors fed with skillets from two magazines and a single pick-and-place arm to load fitments into two cartons at a time. Glue dabs secure the fitments in place.

The bottle, its contents checked by a VisioNIR near infra-red inspection system, is then loaded by a Scara robot. Next, a small stack of blisters is added from a conventional blister feeder – supplied direct from the blister packer – and a booklet fed from a pile feeder via belts that place it accurately in the carton.

Finally, the top flap of the carton is turned

and glued, the carton passed through a pressing station and the presence of all contents verified by a checkweighing station.

All the way down the machine, 2D security codes on each item are scanned at the transfer point between each station to ensure the correct item is included while the reject system, installed immediately after the checkweighing station, operates on the fail-safe positive-accept basis.

All security scanning systems can be set up centrally from the main control panel, built into the carton erecting station.

One of the latest examples of high speed top-load cartoning from Kliklok Woodman is a double headed Genesis erector which is now making lock form cartons for an Australian meat company at speeds up to 180 a minute. The machine is linked to the lugless Genesis closer by a packing conveyor system that integrates with automatic filling equipment.

Kliklok Woodman has also launched a new version of the ECT top load carton and tray former able to handle blanks up to 500 x 1000mm, and the VariRight right-angle three-flap closer which offers lugged carton control and yet can accept randomly spaced cartons. Variable pitch pop-up lugs control the carton through the machine, which is able to reach speeds of 120 a minute.

Extended erector range

German manufacturer Vepatec has extended its family of top-load carton erectors for the food, confectionery and snack industries with the launch of the new KA Series, said to be capable of erecting a wide variety of carton styles and carton shapes in either corrugated or solid board. These include cartons with or without hinged lids, triangular, hexagonal and octagonal cartons, and double-wall, frame-wall and wave-shaped cartons; as well as tapered trays

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for transit display packs in the snacks and confectionery industries.

UK representative Partners in Packaging points out that the twin lane KA 390-S model is particularly suitable for ready meal trays or difficult triangular sandwich wedge packs and is capable of erecting 150 cartons a minute.

Like other machines in the new KA Series it employs a rotary principle in which blanks are extracted from the magazine onto the male forming heads which then index in four 90 degree cycles, during which adhesive is applied and the cartons are formed using an indexing female forming tool.

Two styles simultaneously

The KA 390-S can run two different carton styles at the same time – for example a base and lid, or two different sizes or formats.

The new KA 490-S carton erector is capable of handling larger sized cartons – die cut blanks up to 750 x 950mm – at speeds up to 50 a minute in corrugated or other board materials. It forms part of an integrated system recently installed at an Australian ice-cream company, where it is linked to a Vepatec product handling system that automatically loads ice-cream tubs

into boxes in three different collations.

The tubs are arranged top-to-tail to maximise carton utilisation prior to being placed in the cartons using a Vepatec servo operated Triplex pick-and-place system.

Top-load cartoning equipment from Adco Manufacturing includes the VHL, a hand-loaded continuous motion model capable of giving speeds up to 125 a minute and the VAL racetrack machine for loose fill products that can run at speeds up to 1000 a minute.

There is also the AF series of plunger style carton and tray erectors and the AFS series in which mechanical drive trains have been replaced by independent motors.

The SLC-200 is an in-line carton closer that employs servo powered squaring belts and overhead belts with flexible grippers to compensate for oversize cartons. Speed is up to 200 cartons a minute.

One of the first roles for vertical cartoners and now a traditional application is of course filling free-flowing products such as porridge oats, rice or washing powder directly into a carton. Italian machinery specialist Betti Cartoning Systems, now represented in the UK by Oniki Packaging Systems, has a range of equip-



Special shapes: Betti cartoners are available to handle a range of different carton formats

ment for detergent packaging and has also developed cleaning and powder suction systems to reduce operator contact with the product, which may contain enzymes.

Betti has also designed fast changeover systems which, for example, allow machines to be turned from a 150g to 1kg pack in some 20-30 minutes without tools or specialised personnel

while automatic repositioning of mechanical parts is also optionally available.

Betti produces vertical cartoners to handle a variety of products and special carton designs, with equipment ranging from models for hand loading at speeds up to 25 cartons a minute to fully automatic systems capable of 400 cartons a minute.

A new vertical cartoner aimed particularly at healthcare products and speeds up to 60 a minute has just been announced by Isopak, UK representative of the Italian manufacturer V2 Engineering. Built on a balcony basis for hygiene, the machine employs toothed belts for carton transport, avoiding risk of slippage and damage from friction between cartons and the usual guides, and is a compact monobloc design that allows it to be moved around easily.

Compact lid closer

German manufacturer Mohrbach has announced a new compact carton lid closing machine which occupies a footprint of 1.5 x 1.6 metres and, with little modification, can handle cartons with a front flap closure as well as three-flap versions. Speed is around 60 cycles a minute and UK agent Integrapak says the new closing technique guarantees that the lid is completely rectangular, with no risk of distortion.

Two ranges of vertical cartoners are built by CAM, represented in the UK by Campak: the AV intermittent and AVC continuous motion machines, which are available to suit most applications including powders and granules.

The AV intermittent cartoner is a low cost, short lead time machine that operates at speeds up to 70 cartons a minute and can be fed by either hand or a range of ex-stock automatic systems, while the AVC machine operates at speeds up to 300 cartons a minute, and incorporates CAM's Mechanical Memory system.

Finally, two new companies have been founded by the Optima Packaging Group:

Q-Bag has taken over the Gorig range of vertical cartoning equipment, including carton erection, filling and closing, and will be responsible for development of existing designs, including bag in box systems. Typical products handled include salt, rice, pet food and washing powder while outputs up to 400 packs a minute can be achieved.

The second company, PPS, specialises in horizontal high speed cartoning and top load cartoning, particularly for the cosmetics, pharmaceutical and paper products markets. ■

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For full details of all PPMA members able to supply cartoning machinery, consult the PPMA machinery finder service, tel: 020 8773 8111, or visit www.ppma.co.uk