

Focusing on capping and closing machines immediately raises an important question. How many cappers and closers are still supplied as separate machines and how many as modules in combined filling and closing systems? Would it be more appropriate to talk about the activities of capping and closing rather than thinking of them as standalone machines?

The trend in packaging machinery in recent years has been to combine the functions of a growing number of what used to be separate machines into one system. In addition to filler-cappers we now have combined cartoners and casepackers, combined casepackers and palletisers and combined tray-packers and shrinkwrappers. Rotary filler-cappers have been common for many years and combinations of a bottle cleaner, rotary filler and rotary capper are now quite usual.

So is the logical conclusion of these developments, that all machines in a line will be combined together as one vast mechanism? Judging from current developments in capping machines the answer seems to be no, because while there is undoubtedly a trend towards combined machines for rotary filling applications the need to maximise line flexibility is ensuring the future of the individual, standalone capping machine.

Rotary fillers and cappers were the first machines on the bottling line to be combined, to solve the problems of transferring unstable filled

containers at high-speed from the discharge of the filler to the infeed of the capper.

The first steps were to synchronise the filler and capper together mechanically, controlling filled bottles with long feed scrolls, but then came the now familiar monobloc which combines the functions of filling and capping in one machine, with the filled containers being transferred from the filling turret to the capping turret using one or two starwheels.

Incorporating a rotary capping head in monobloc with a rotary filler is unquestionably the solution favoured for most high-speed fill-

Standalone or combined?



Standalone and combined: US Bottlers Machine Co has just developed a small frame filler-capper for pharmaceutical work (top), but also specialises in custom standalone cappers, such as this 14 head version (above)

Although the trend in packaging machinery has been to combine the functions of a growing number of what used to be separate machines, the need to preserve line flexibility is ensuring the future of the standalone capping machine, writes Martin Keay.

ing applications, although the capping heads involved can often be employed as free-standing units.

For example, the cappers produced by the Corniani division of Acma GD are supplied as standalone machines or on a monobloc frame while machines can also include equipment to assemble the components of the closure immediately prior to application.

The standard range of Corniani cappers comes with 4-20 capping heads for speeds of 60-600 caps a minute, while the special models for angle neck bottles give 60-450 caps a minute

and those for trigger or pump applicators give 60-300 a minute. Torque is controlled by magnetic or friction clutches, although Corniani also builds electronic versions, with independent motors driving each capping head, for applications where high accuracy torquing is required or where caps need to be orientated before application.

US Bottlers Machinery Co, represented in the UK by Glenvale Packaging, has developed a new small-frame piston filler-capper monobloc for a pharmaceutical job, incorporating a 14-valve piston filler and a seven-head rotary capper.

CAPPING

This is a particularly compact design using a 720mm diameter filler turret and 360mm diameter capper turret, that requires minimum floor space. The machine is filling and capping a vial with medical serum at speeds of 180 a minute.

The piston filler itself features a revolving diaphragm and seal-less piston design, and provides ± 1 per cent accuracy on a 20ml fill. The rotary capper features new magnetic clutches with single point torque setting to maintain uniform and accurate torque values. There is a touch-screen control panel, while the drive train components are all enclosed in the cabinet, providing a clean and unobstructed cabinet surface.

Custom capper design

In fact, US Bottlers Machinery Company specialises in custom design and manufacture of capping equipment for a wide variety of applications, including typical plastic threaded caps, sports caps, fitments, overcaps, roll-on pilfer-proof (ROPP) caps, and press-on caps, and recks that almost any closure configuration can be handled by one of its machines.

Fine control over torque is achieved through the use of hysteresis magnetic clutches combined with independent spindle speed control. Machines are available for speeds up to 1200 a minute.

Italian manufacturer OMAS, represented in the UK by Nupol Machinery, produces a wide range of filling systems including several monobloc filling-capping units for liquids, pastes and creams and powders. These monobloc machines incorporate plugging and capping stations that are able to insert plugs and stoppers and apply crimp, screw or ROPP caps at speeds that match that of the filling station. All capping units incorporate a magnetic clutch.

The latest unit in the range is a semi-automatic table-top monobloc filler-capper for liquids. It can fill small containers at speeds up to 35 a minute and the in-line stoppering and capping unit can seal the containers with a full variety of closing systems.

The larger G2 is another monobloc machine capable of handling up to 80 containers a



Servo drive: Ronchi has added servo cappers to its existing range of mechanically driven machines



Multi-part: Components handled by PKB machines for Puig, Spain

minute and there are also the OMAS G3, G4 and G6 machines. All are in-line monobloc units, although each is designed to handle different types of products. The G3 is for liquid and semi-liquid products, the G4 for hot products and the G6 for dense products.

Indexing carousel

Another method of combining the functions of filling and capping in the one machine is to carry out the tasks using a series of heads positioned around an indexing carousel. This technique is particularly favoured for small containers such as those used in the perfume and cosmetics industries.



Torquing: Rubber lined fingers used by Cap Coder

Indeed, the perfumery and cosmetics industry's capping requirements pose a different challenge to other industries, because the closures often have several parts, are easily damaged and can vary in design significantly from one product to the next. These very particular demands have encouraged companies such as PKB to specialise in making machinery specifically for the perfume and cosmetics industry.

PKB closing machines, which are in widespread use in the French perfume industry, handle neck-plugs, stoppers, pipette-style droppers, nail varnish brushes, screw caps, finger pumps and overcaps, with decorative neck rings, shoulder trims and crimped closures.



Versatility: DT King's CS60 capper will handle a full range of cap styles and can be changed over quickly

The multiple heads on PKB's Robo model allow several placing and closing operations to be performed in one machine. For instance PKB's UK agent Propack Automation advises that containers can be air cleaned, filled by volume or to a level, a pump can be inserted and crimped, and a cap applied, all on the same machine.

In a recent PKB installation for Antonio Puig in Spain the containers were made from several parts, including a crimp-on pump, a magnet, a screw-on cap, a decorative neck-trim and a push-button dispensing device. All of these capping operations were performed by two PKB Robo machines operating at a speed of 60 containers a minute.

The logic of doing as many things to the container once you have got hold of it in the correct orientation, before letting it go again, is easy to appreciate. It eliminates some of the opportunities for the container to fall over, reduces the line length and should provide increased efficiency and reduced cost compared to a line comprising separate machines.

However there may be drawbacks with combining machines. For instance, experiments

with combined filler-capper-labellers demonstrated that these combinations were less efficient than lines with separate labellers and it is now generally acknowledged that line efficiencies are higher if the labeller is run as a separate machine, linked to the filler-capper with an accumulation conveyor.

Limit line flexibility

Another problem with combining machines is that it can limit the ability of a line to handle a wide range of product shapes, sizes and closure types.

The trend towards low and medium speed bottling lines that can handle a wide range of bottle and product types, in place of high-speed single product lines is now well established. This demand has led to the increased use of fixed head in-line filling machines in preference to rotary fillers, largely because in-line machines can be changed to handle a new bottle size more easily than a rotary machine. (See *Machinery Update*, July/August 2000.)

This has created a demand for standalone rotary cappers that match the versatility of an in-line filling machine.

CAPPING

DT King's CS60 capping machine has the capability of being able to apply screw-on, press-on and roll-on puffer-proof (ROPP) closures, making it ideal for use in the pharmaceutical and personal care industries where production lines are frequently called upon to run several different packs styles in quick succession.

The machine can be changed from ROPP to press-on or to screw capping in under 10 minutes, using interchangeable capping chucks and quick-change container size parts. Operating programmes to suit the three closure styles can be selected using a three position key switch, while there are two vibratory bowl feeders to suit the different handling characteristics of the closures.

A two line message display on the CS60 is used to alert the operator when caps need to be added, or if a fault condition occurs.

Masterfil has re-engineered its single spindle capper, raising speed and, on 1-5 litre containers, allowing the machine to match the output of an eight-head filler where previously a more expensive rotary multi-spindle capper would have been required.

"This is part of a programme to re-engineer the mechanical elements of the Masterfil range of fillers and cappers, following a period in which the accent has been largely on improving control systems," explains Masterfil sales and marketing director Brian Potiphar.

A new gearbox design has been adopted which provides smoother indexing of the capper's starwheel, so allowing faster transfer between infeed and capping station without risk of slopping. This means that the machine will handle 5 litre containers at speeds up to 47 a minute, rather than the 30-35 of its predecessor.

Other design changes include a wider cabinet to improve access for changeover and a larger diameter starwheel to cater for containers with a longer footprint. Also, the scissor lift previously employed to change the height of the capping head for a different container has been replaced with motor-driven spindles, giving smoother and more accurate adjustment.

Dico has just supplied two six-head multi-spindle capping machines to Seven Seas in Hull, to handle inner and outer caps on the containers for its latest cod liver oil capsule. Both can run at over 150 caps a minute, the first applying a standard screw cap closure and the second press-fitting a decorative overcap.

One of the most significant developments in capping in recent years has been the use of individual servo motors to drive every capping



Modular range: Deckert AVM 738 capper for use in pharmaceutical, food and cosmetics industries

chuck on a multi-head machine. Separate drives and the use of software controlled servo motors allows much greater control of the capping process compared with traditional mechanical transmission systems.

Count the revolutions

For instance, it is possible for a servo motor capper head to not only tighten each cap to the same torque, but also to count how many revolutions this has taken. Too many revolutions indicates a broken cap or a cap with a missing wad, while reaching the correct cap torque too quickly may indicate either a cross threaded cap or that the cap or bottle is out of specification. These bottles can then be rejected, avoiding the risk of potential leakers which are otherwise difficult to detect.

Another benefit of servo motor driven capping heads is that they can rotate a closure to its correct orientation and cope with a much wider range of closure styles than conventional mechanical machines.

Ronchi has now added servo capping to its existing range of mechanical cappers to cater specifically for the capping demands of the personal care industry. A servo machine is more cost effective than a mechanical capper for a typical personal care application, because the same line will frequently need to handle screw caps, snap-on caps and flip-top caps which require orientation and so, using conventional machines, would need different machines. UK agent Propack Automation reports that two Ronchi servo machines have just been ordered

by a major British manufacturer of personal care products.

Similar techniques are also required for household products where some closures have bayonet fittings that need to be orientated correctly before being pushed on and then turned. Programmes selected from the machine's menu allow the Ronchi servo capper to change from one operating mode to another and to handle different closures with a minimum of simple change-parts.

The Ronchi servo capper can be supplied both as a capping module in a filler-capper monobloc or as a standalone capping machine.

Meanwhile, the importance of the process of separating and orientating closures from a bulk supply is often overlooked, but when the closure is complex or easily damaged this can be the most important part of the capping operation.

Most conventional designs of screw cap or push-on plug can be handled quite successfully in a vibratory bowl feeder, but these may not be suitable for delicate closures or complex dispensing devices.

Closure sorting machine

The Halbach HLS700 is a linear closure sorter, which handles components gently even at high running speeds. Propack Automation, Halbach's UK agent, explains that the HLS7000 is ideal for composite aerosol caps, very large caps and the metering assemblies typically used for fabric softeners.

There are several methods used for placing closures on containers, but one of the simplest



Cappers for Seven Seas: *One of the two Dico 150-a-minute machines for cod liver oil tablet containers*

and fastest is to drop the cap onto the neck of the container using a guide or escapement mechanism.

This method of cap placing is used on Swiftpack's Starcap Plus capper, which incorporates a 12 pocket star wheel head, combined with a patented push through cap placement mechanism, together with a pneumatically driven final torque down station. This allows a wide range of containers and closures to be handled, including screw caps, child resistant closures (CRCs), and snap-on caps, at speeds up to 100 bottles a minute.

The latest version of the Star Cap plus features the option of an integrated induction cap sealing station which allows the machine to cap and induction seal in one operation, so reducing line space and cost.

Heat sealed tamper-evident closures are now being used extensively in the agrochemical, pharmaceutical, food, beverage, healthcare and cosmetics industries. One of the simplest methods is to use induction sealing.

This technique avoids the need for a foil dispensing and placing mechanism, because the foil is supplied next to the cap wad in a conventional screw cap. There is also no need for direct heating of the sealing membrane because

heat is provided by passing the capped container through an electromagnetic field. The electromagnetic field causes the aluminium foil of the sealing membrane to heat up, which then melts the thermoplastic layer, fusing it to the container.

Hermetically sealed

Enercon's latest induction cap sealer is the Super Seal Max, which is capable of sealing caps on containers that are conveyed at a rate of 100 metres a minute.

This means that screw-on, child-resistant or dispensing closures of between 20mm and 120mm in diameter can be hermetically sealed at rates of up to 1500 bottles a minute, which is a substantial increase over current production speeds. Indeed, the unit's air-cooling system means it can operate continuously at full speed without the need for a separate cooling water supply.

The Super Seal Max incorporates detectors to prevent container jams and to identify containers with missing foils. The stainless steel electrical enclosure is rated as IP65, making the system suitable for use in high-care washdown environments, typically found in the food and pharmaceutical industries.

CAPPING

However, as Cap Coder points out, the process of getting the machine to tighten the cap is normally the easy part of designing a capping machine. What matters particularly is how to get the cap onto the bottle in the first place. There are a number of options:

- Neck transfer, where caps are fed cavity-down along an inclined track to an escapement and the bottle is transferred past the bottom of the escapement, collecting the cap, which is assisted by a spring-loaded device to sit square onto the bottle. However, in practice, only a small number of caps and bottles with plain engaging skirts and necks lend themselves to this method, says Cap Coder. It is, however, a fast method if the geometry is right.
- Coaxially dropping the cap through an escapement onto the bottle is relatively fast for some caps with high aspect ratios or involving brushes or spatulas.
- Manual placement is often quite adequate for low volume work.
- Pick-and-place, where the cap is picked up from a register position and placed in the bottle. One useful variation of this is to pick up the cap with the torque head.

"There is little doubt that the most versatile

way of automatic capping is to pick up the cap with the torque head and to use rubber-lined gripping jaws to tighten the cap," says Cap Coder. "It may not always be the fastest way, but it does lend itself to more product variations than other methods."

Cap Coder's CC720 torque heads are available with pneumatic or electric drive and can be provided with digital read-out. Also available is the smaller Tri-Torque torque head with three gripping jaws.

Rotary capper

Swiftpack's rotary capper is capable of handling both screw and press-on closures, including child resistant and induction sealed components. Each cap is positioned and fitted onto the container using a chuck fitted with a magnetic clutch assembly, which provides consistent cap torque. Machines are available with four, six or eight capping heads to suit speeds of up to 240 bottles a minute.

German manufacturer Rudolf Deckert is now represented in the UK by Ultracpac and has introduced a new modular capper design for use in the pharmaceutical, cosmetic and food industries. The intermittent motion screw cap-

ping machines can run with speeds up to 70 items a minute using capping spindles with adjustable permanent magnetic clutches. Servo-driven spindles are also available.

All types of closures can be handled including screw caps, press-on caps, stoppers, droppers, pipettes, dip tubes, spray pumps and roll-on caps. Membrane heat sealing for jars can also be included on the machines. ■

FOR FURTHER INFORMATION:

Acma GD	enter 158
Cap Coder	enter 159
Dico	enter 160
Enercon	enter 161
Glenvale Packaging	enter 162
DT King	enter 163
Masterfil	enter 164
Nupol Machinery	enter 165
Propack Automation	enter 166
Swiftpack	enter 167
Ultracpac	enter 168

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