GRAB THE SAVINGS THAT TECHNOLOGY OFFERS!

Colin Granger's review of developments in rotating workholding illustrates that many companies don't realise their full production capabilities because they do not take advantage of enabling technology.

Even in the 1950s sub-contractors couldn't afford to be complacent, as John Leader reflects on the time when he joined his father's sub-contracting company. Competition was tight, he says, and much of the business' success is attributed to the company's flexible attitude and its ability for lateral thinking, particularly regarding workholding.

"In the early '60s we were developing numerous components, but one particular aluminium part being produced on a capstan lathe was taking as long to load as it was to machine," says John Leader. "A powered chuck was the obvious solution — but these were not configured for removal and exchange with a standard unit, which was essential for the varied work we were undertaking.

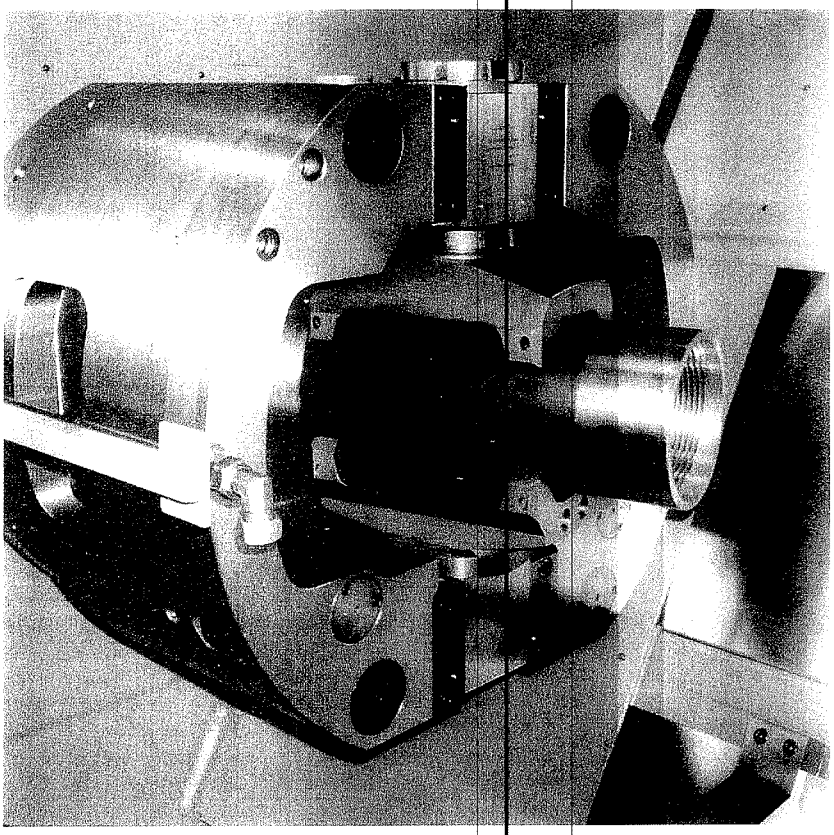
"So, we developed our own power chuck that was no harder to remove than a key chuck. And while this unit, which is still available today, launched us into the manufacture and distribution of workholding, it also opened our eyes to the appalling lack of attention accorded to this technology area.

"We still find that companies buying new lathes and turning centres will draw up short-lists, and look at finance options and tooling but give little thought to even standard chucking, let alone units suited to specific applications. Indeed, many lathe users have a very blinkered approach and do not seem to see beyond the use of a standard three-jaw chuck. Having purchased a machine they are reluctant to even consider the cost justifications for alternatives."

JIT ECONOMIES

John Leader cites quick-change collets and chuck jaws as items that can achieve dramatic reductions in changeover times and, in turn, permit smaller batches to be produced more economically — J-I-T economy with the flexibility of smaller batches.

"Sub-contractors make profit by screwing the most out of their machines. They have to minimise downtime when changing jaws and collets. Our answer to this is the MicroCentric range which offers a top jaw fixing that uses linear bushes that are a light interference on their location pins and guarantee a re-position accuracy of 0·0001 inch TIR. This avoids the need to regrind top jaws, reduces changeover times and is suited to both lathes and grinders.



Rohm's auto-clamping/auto-indexing chuck provides one-hit machining on a two-axis lathe

"To achieve close tolerance workholding, the top jaws must be machined on the chuck during set-up. That said, when a series of MicroCentric LB chucks are qualified to one another, top jaws can be interchanged among these and concentricity (0·0003 inch TIR) maintained without machining — and both soft and hard jaws are available."

Another quick change approach is offered by the German company Hainbuch, for which John Leader's company, Leader Chuck Systems, is UK agent. Its clamping chucks offer changeover times of just 15 to 20 seconds and are available for bar sizes up to 200 mm. The collet is changed from the front of the chuck by inserting a hand-held pneumatic tool; no screw threads are involved or loose parts to drop.

Hainbuch chucks are operated by pull back of the drawbar, a mode of operation which although in the minority is claimed as the most rigid — most collets are the dead-length type operated by pushing to lock with the stock bar located against an external dead stop for length setting. Indeed, when it comes to volume metal removal, John Leader suggests they are significantly superior. And while some regard bar pull back to be a disadvantage — invariably zero to just a few thou — internal

dead stops are available, as are ejectors for automated operation.

Barry Long of Rohm (Great Britain) confirms John Leader's observations about many companies' mental blockage when it comes to essential workholding. Indeed, he suggests that while users are happy to spend £150 000 on a CNC turning centre, some are more than reluctant to spend just 10 per cent of this on appropriate workholding.

RECOUPED COST

"If you can't hold the workpiece securely and accurately, it doesn't matter how much the machine has cost. Yet detailed analysis frequently shows that the cost of optimal workholding can often be recouped over a short period — and frequently special chucks and fixtures are the only method of achieving the ever-tightening tolerances being demanded."

Barry Long highlights the instance of an automotive manufacturer that modified both its processing and chucking to achieve a tighter tolerance specification on a new brake drum. While standard chucking achieved the more open tolerances of earlier designs, the distortion of this approach during finish machining was sufficient to create out-of-tolerance roundness relative to the new quality demands.

The solution was to incorporate the machining of a register on the drum outer diameter, then locate and clamp from this and using a special Rohm 'collet' chuck, finish the brake surface and hub location.

Barry Long also highlights that distortion from clamping on an outside diameter is frequently a problem, as was the case when hard turning the tapered bores of railway wheel bearings. Rohm's solution was to use the outer diameter for location only and obviate distortion by face clamping — and interchangeable locating jaws and clamps accommodate a family of parts with a single chuck.

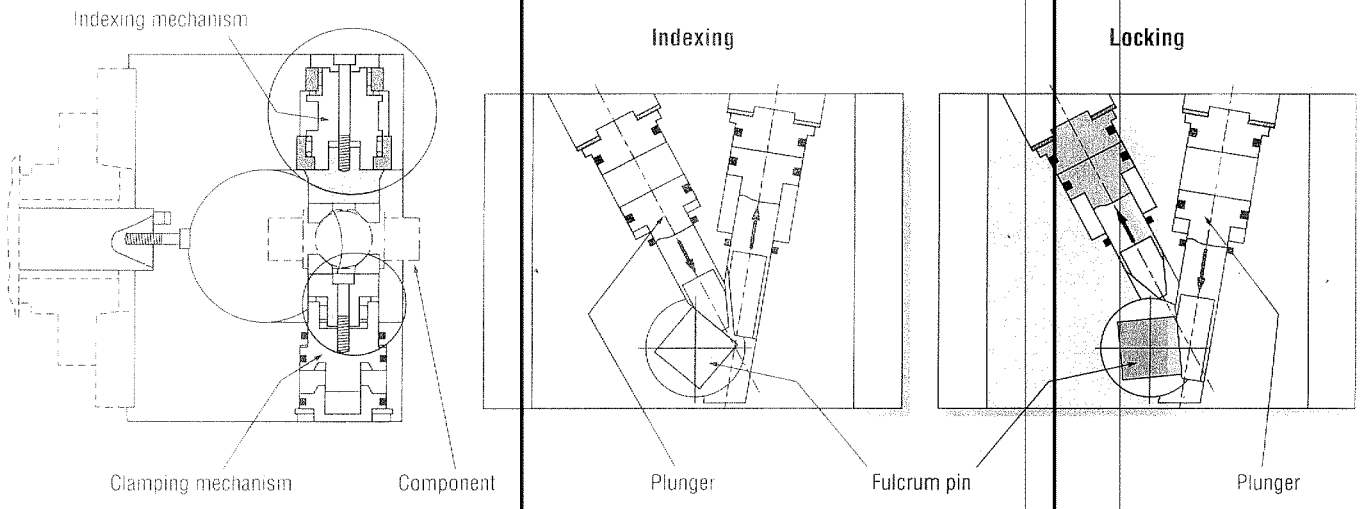
ECONOMY FROM ONE SET-UP

The consensus among specialist chuck suppliers is that the more times a part is picked up, the more it costs. So, once a component is located and clamped it should be finished in one setting — a premise that also ensures all features are accurately relative. Barry Long says this is highlighted with the use of combination chucks, units that combine a fixed centre, face driver and retractable jaws.

"Renold of Rochdale, a manufacturer of reduction boxes, produces a wide variety of shaft work. Starting with faced and centred billets, it locates between the chuck centre — which also acts as the lateral datum — and the tailstock centre, and using the hydraulically-applied face driver, turns a clamping band at the chuck end. The jaws then automatically advance out of the chuck to offer a rigid set-up that allows material to be 'hogged off' and production time minimised. And when machining is completed —as far as the jaws allow — the jaws retract allowing the part to be finished with the location maintained by the two centres and drive continuing from the face driver."

This configuration ensures concentricity and alignment of features along the length of the component and in many instances obviates the need for grinding to achieve geometry and tolerance. And both jaws and face drivers are readily interchangeable.

However, the philosophy of not letting go



The principles of operation of the HSR hydraulic indexing chuck from Forkardt

once you've located a part is probably best demonstrated by indexing chucks which, in the words of Forkardt England's Dave Russell, "are more than a chuck — they're a complete technology".

He says: "Although not a new concept, indexing chucks are optimal for many difficult-to-hold components where multiple chuckings would introduce error. Rarely used for complex machining, they initially found application in the volume automotive and valve industries for components such as trunnions, couplings, universal joint spiders, valve bodies and multi-way connectors. Component accuracy is derived from the indexing accuracy of the chuck as all machining is effectively related to the one setting."

Over the 30 or so years indexing chucks have been in use (Forkardt GmbH took out the first patent in 1960), the range of components tackled has become increasingly diverse and even includes bottle moulds. Furthermore, designers/production engineers are more enlightened, and flats and dimples for location and clamping are increasingly being cast and forged into components. Such features simplify location and in some instances reduce the size of chuck required.

And with the emphasis on J-I-T, the ability to fixture a part just the once helps justify even shorter batches — provided chucks can be kept busy. Indeed, over the past five years Dave Russell has seen a trend among users taking both indexing and conventional chucks of the quick-change variety, so machines need not be tied up with a specific type of work — though in practice, he finds indexing chucks are rarely off the machines (the interchangeability is seen as an insurance policy) particularly as change time is typically 30 to 45 minutes. And while many users believe that if they're going to be using an expensive indexing chuck — a typical package for a 10 inch chuck costs £17 000 — they need a high specification and expensive machine, Dave Russell suggests that a two-axis machine is usually a good partner.

INDEXING CHUCK TYPES

Forkardt indexing chucks used on horizontal turning centres comprise the fully-enclosed hoop design where the chucking and indexing mechanism are fully enclosed within the chuck; and C frame type with its chucking and indexing mechanisms mounted on the chuck face.

In general, the enclosed units offer greater rigidity and obviate jaw opening, but they do restrict machining access and ID type tooling such as boring bars are invariably required to gain access to the chuck body. However, Dave Russell highlights that although there is a standard range of chucks, there is scope for considerable 'tuning' for specific applications. For example, when machining aluminium and softer materials, it is possible to increase the opening and reduce the hoop strength as less forces are required for clamping — the machining forces are less. This offers greater tooling access.

"There are many considerations in the selection of the right sized chuck," he confirms, "and it is not possible to divorce the tooling requirements from chucking requirements when it comes to tool access for complete machining. Indeed, sometimes a larger chuck is required to provide tool access." That said, the C frame allows greater access and tooling flexibility, though this configuration does sacrifice some rigidity.

Usually, the clamping jaws are configured for specific applications and chucks feature one clamping jaw and one static that additionally provides the index drive. This configuration does not offer a self-centring facility, but this is rarely of concern. Where self-centring is required, Forkardt provides centrical-clamping hydraulic indexing chucks (type ZHSR, ZHSRST) with simultaneously-driven clamping jaws that offer a centring accuracy comparable with standard power chucks of the same size.

Forkardt offers both automatic and semi-automatic indexing chucks. Once the workpiece is loaded and clamped, it is automati-

change

Although quick change jaw power chucks are not new, Pratt Burnerd International suggests there are many factors that justify their use.

With the recession reducing batch sizes and the growing influence of J-I-T, reduced set-up times become ever more critical. And putting into practice what it preaches, PBI fitted its own high-speed quick change chucks (HSQC) to two of its turning centres for chuck production.

When PBI introduced these a few years ago, batches were typically 5 to 10 and total set-up time using standard chucks 80 mins, which included 16 mins for changing chuck top jaws — and these were being changed on average four times per day on each of the two machines. In total, machine downtime per day was two hours. But using HSQC chucks, jaw change time is just 1 min and total set-up time is 35 to 40 mins.

It is practice to set top jaws on a spare set of base jaws and a setting fixture while the machine is cutting metal, so there is no lost cutting time while setting. And with serrated locations, most applications can be undertaken without having to rebore the jaws.

As PBI asserts, what is the point of having a CNC lathe with ATC if you spend 15 mins changing jaws? And, if when buying a new CNC lathe with a HSQC chuck costing £1000 more than a standard power chuck, and chuck jaws are changed jaws just twice a day, one can recoup the additional chuck cost in a matter of months.

For more information enter 760

[illegible] solves fuel line machining problem

Alloy fuel lines for aircraft come in a high variety of diameters and lengths, from just a few centimetres to a metre or more long — and each line invariably comprises a number of differing diameters and turned lengths, plus cross-drilled holes. These pipes are invariably machined using opposed-spindle turning centres.

Stock tube is fed through a collet at the left-hand end and supported by a chuck at the right-hand, so allowing the tube to be progressively pulled through and machined fully supported. Smiths Industries at Basingstoke uses this method but initially experienced problems with the standard chuck marking or crushing these components — even when using wrap-around jaws — and accommodating the often significant diameter differences.

Rohm's solution was to design a special six-jaw chuck that provided secure clamping and location without marking the tube —and it accommodated the diameter variation.

For more information enter 761

cally processed until complete; M-codes in the CNC program initiating each indexing cycle. Its semi-automatic chucks are designed to be interchangeable with conventional two-, three- or four-jaw rear-actuated power chucks and feature manual clamping and automatic indexing via the CNC program by using the hydraulic actuator and drawbar from the conventional chuck — though a limiting factor of semi-automatic units is that four indexes are the most that can be programmed.

In conclusion, John Leader suggests that with a more enlightened approach, cycle times can be reduced and quality significantly improved. "When a customer had a problem machining non-concentric bores in lock barrels, we developed an eccentric rotating two-jaw chuck that emphasised that with difficult-to-hold parts, once you've gripped it you don't let go until it's finished." □

For more information	Enter
Forkardt England	762
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