Reprinted from Machinery and production engineering 2 May 1973

Developments by Newall Tooling Division

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Significant progress by a producer of tooling equipment

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Attention was drawn in *Machinery, 117/8–1/7/70,* to aspects of the activities of the Tooling Division of The Newall Engineering Co Ltd, Fakenham, Norfolk, and it may be recalled that the location for the organization – in an area primarily dependent on agriculture for employment – was deliberately chosen to take advantage of a small local pool of trained industrial workers. Considerable success has been achieved with the project, and since production was started in August 1968, turnover is reported to have increased to a value of more than £300,000/year, which represents a growth rate as high as 30 per cent/year. Expansion on this scale quickly necessitated a production area larger than that afforded by the original premises, with a floor area of 3,500 ft², and in July 1971, the Division occupied the entirely new, purpose-built factory seen in the heading illustration. This building provides a basic floor area of 10,000 ft², together with storage area of 3,000 ft² on an upper floor, and there are now 53 employees, as compared with 22 at the time of the previous report on the division's activities.

Products of the Tooling Division may be classified broadly in four groups, comprising boring heads and bars, of both standard sizes and designs and those to suit specific applications; tapping heads of reversing and non-reversing type; collet chucks; and specialized tapping lubricants. Facilities provided in the new factory cover virtually all the machining requirements for the production of tooling items, and they include individual Newall type 1520 and 2443 jig borers, installed in separate cubicles. Particular attention is devoted to the problems of heat treatment, and there is a well-equipped section for performing this work, mostly by the salt-bath technique. An extensive stores houses considerable stocks of completed units, to permit immediate delivery of virtually any tooling item from the standard range.

Effective management systems

In view of the inevitably small-batch nature of the production activities, and the inherent difficulty to obtain economies by investigation of manufacturing methods, particular attention has been given to the application of advanced management techniques, to ensure maximum efficiency. These techniques are reported to have been of considerable success in providing for high morale among the staff and development of notable co-operation with the management.

An example of the effectiveness of the techniques occurs in connection with the bonus provided twice yearly, to supplement the weekly-based pay of employees. Whereas this bonus is related to the overall profitability of the Tooling Division, the amount in each case is determined in accordance with an assessment of the usefulness of an employee, expressed in such terms as punctuality and willingness to perform unusual tasks. In addition to promoting the maximum effectiveness of the work force, this system has been found to result in such concern in the activities in general that employees have, for example, indicated interest in the potential benefits of foreign trips planned by members of the

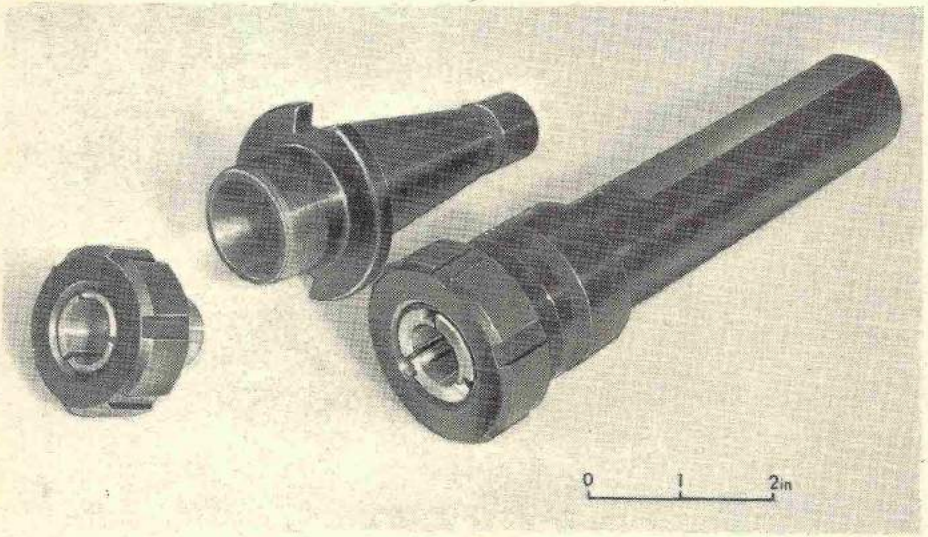

Fig 1

Newall-Balas collet-type tool-holders here shown include a unit to suit a spindle nose of the standard milling machine design (shown with the collet assembly removed) and a straight-shank unit, intended mainly for lathe tool-post applications. In the collet assembly, a needle-roller thrust race and a hardened steel washer, or merely the washer, are interposed between the inner face of a lip on the clamping nut and a shoulder on the single-piece Flexi-Grip collet.

management, as compared with the costs to be incurred.

An unusual scheme has been adopted to ensure good housekeeping, and for this purpose, the entire works area – including the stores, toilets, and canteen – is divided into small sections, under the responsibility of individual workers. In the machine shop, for example, the man responsible for each section is the operator of the principal machine therein. At irregular intervals of approximately one week, the sections are assessed for cleanliness, tidiness, and general conditions for effective performance of the relevant functions. On the basis of this assessment, the responsible workers are awarded numbers of trading stamps. The work of assessing is undertaken by a female member of the office staff, and her conclusions are accepted by the workers without demur, whereas disagreements sometimes occurred when the function was initially performed by a member of the management. Trading stamps, it has been found, are a particularly acceptable form of award, and they are also provided in recognition of accepted proposals, made by way of a suggestions scheme.

Activities of the sales force have been the subject of considerable investigation, to ensure the maximum effectiveness consistent with providing the optimum service to customers. On account of the latter factor, it was considered at the outset that members of this force should be trained and experienced tooling engineers, capable in their own right of providing advice and recommendations on machining practice. High costs are involved in building up and maintaining such a force, and accordingly, the travel programme of each sales engineer, within his designated area, is directed from the Fakenham works, where it is planned geographically with the aid of a coding system based on the National Grid. Unusually high utilization of the time of an engineer is obtained, without detriment to the engineer or the service he can offer his customers. At the works, the adoption of a mainly open-plan form for the office area facilitates communication and the transfer of documents between different sections concerned with the receipt of customers' orders, the initiation of works orders, process planning, and production planning and control, also design.

Newall-Balas collet-type tool-holders

An important development as regards the units offered by the Tooling Division stems from the conclusion, in December 1972, of an agreement covering the production and marketing in Great Britain and the remainder of Europe of the entire range of tooling items developed by the Balas Collet Division of The Warner & Swasey Co, USA. Initially, it is intended to make available the entire range of collet-type tool-holders, under the name Newall-Balas. Advantages claimed for the system include the fact that the housing bore for a unit can readily be machined by means of conventional tools, so that production of cutter spindles by a machine-tool builder is facilitated. Typical units are seen in Fig 1.

An important feature of the Flexi-Grip collet in a Newall-Balas chuck is that the slots machined therein, to permit radial contraction and expansion, are arranged so that adjacent sections of the member are connected together by a spring arm, which extends for virtually the entire length. As a result, it is stated, items of a relatively wide range of diameters can be gripped effectively. A 'slow' operating taper, of a single angle, is said to ensure the application of high gripping force, with considerable uniformity and the maintenance of high accuracy for concentricity. Drills can be satisfactorily gripped over the flute portions, it is claimed. In a completed assembly, a collet is retained in the clamping nut by a snap action, and it can be removed readily with the aid of a simple extractor or by hand. An ejection arrangement inside the nut facilitates the disengagement of the collet from the shank of a tool, in normal use.

The range of Newall-Balas tool-holders includes types with taper shanks from No 1 to 5 Morse, to accommodate collets with capacity from 3/64 to $\frac{1}{4}$ in and $\frac{3}{4}$ to $1\frac{1}{2}$ in diameter for the smallest and largest sizes, respectively. Units with parallel shanks from $\frac{5}{8}$ to 3 in diameter provide for collets with gripping ranges up to 1 to $2\frac{1}{2}$ in diameter, and the shank of each holder can have two opposed flats, also a shoulder or a groove for a circlip, to facilitate pre-setting. Holders designated 'automotive type' are of plain- and threaded-shank designs, and th e shank of each unit has a Woodruff key-slot, also an

inclined flat, for engagement by a retention screw. Collets to grip diameters from $\frac{1}{8}$ to 1 in can be mounted in the largest size. So-called milling machine holders have No 30, 40, or 50 steep-taper shanks and accept collets for diameters from $\frac{1}{16}$ to $\frac{3}{8}$ in, up to $\frac{3}{4}$ to 2 in, and the range also includes units with shanks of various Brown & Sharpe taper forms. Straight-shank toolholders of various sizes can be supplied, each with a head portion that can be offset relative to the shank, to compensate for errors in axial alignment between a spindle and a tool-holder bore, for example.

The threaded axial bore through the shank of each holder permits the use of an adjustable back-stop, to control the distance by which a tool extends from the chuck. Four broached slots in the bores of straight-shank or automotive-type units of $\frac{3}{4}$- or 1-in collet capacity, provide for engagement by a member whereby drive is imparted positively to the tang of a drill gripped in the chuck. This member is of cube form, to suit drills of four sizes, and only one such member is needed to cater for the entire range of drills that can be accommodated in the smaller toolholders, members of two different sizes being needed for the larger tool-holders. An adaptor can be mounted at the rear end of the through-bore in a tool-holder to enable coolant to be delivered by way of this bore, direct to the flutes or integral passages in a drill.

Other new activities

Progressive extension of the activities is envisaged, to meet specialized requirements for work-holding, and in this connection, it may be noted that the agreement with Balas Collet covers the designs developed by the American company for expanding mandrels. The first step into the field of specialized work-holding, however, is represented by a recently-developed chuck, for use on a Newall crankshaft grinder, and a typical unit is seen in Fig 2.

This chuck was designed in conjunction with British Leyland Motor Corporation, and an important feature is that on the pillars whereby it is supported, the plate carrying the jaw assemblies can float in a plane at right-angles to the axis. With this arrangement, a workpiece can be located on a centre point in the workhead-spindle of a grinding machine and gripped at the periphery for driving, despite the fact that there may be considerable eccentricity between a centre hole and the periphery. There is no risk that radial stresses may be imposed, which may otherwise result in damage to the centre point or the centre hole in the workpiece. In operation, drive to the plate carrying the jaw assemblies is transmitted by way of the pillars whereon this plate is supported.

Other features of the chuck include mounting of the pivot pin for each jaw in opposing holes in wings that extend from the block that houses an associated stack of Belleville washers. Arcuate adjustment for this block and the other similar members, on the screws whereby they are secured to the mounting plate, enables the chuck readily to be re-set, for gripping at different nominal diameters over a range of $\frac{1}{4}$ in. Working faces of the jaws are of arcuate shape, to obtain a wedging action against a workpiece, and they are provided with a fine diamond pattern of grooves, which has been found

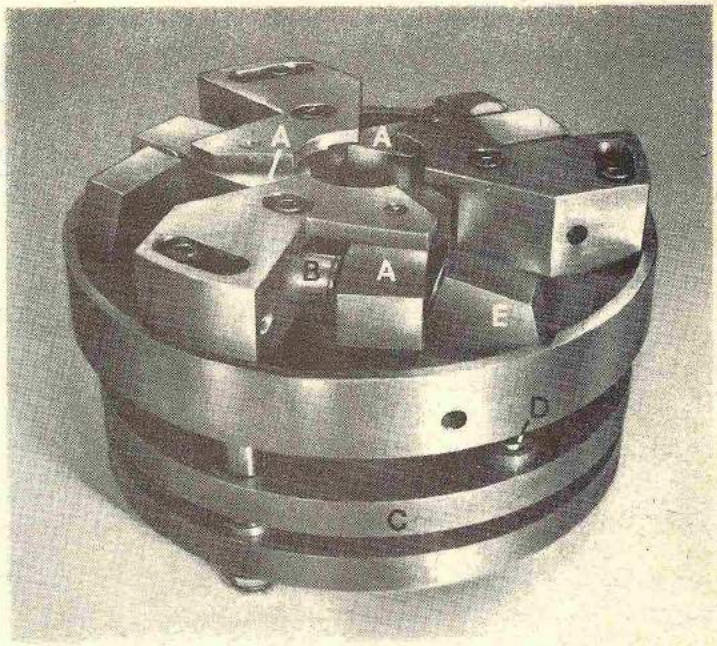

Fig 2

With this chuck for a Newall crankshaft grinder, three jaws, as at A, *are mounted on pivot pins that extend parallel with the axis of the unit. The jaws are swivelled to grip a workpiece by force applied against tail portion of each by plungers as at* B, *actuated by stacks of Belleville washers. Separate circular plates, spaced apart by three pillars, carry the jaw assemblies and provide for mounting the unit on the workhead spindle of a machine, and to release the jaws from a workpiece, the intermediate plate* C *is moved axially outwards, by a hydraulic cylinder. Anvils, as at* D, *thus are engaged with robust members as at* E. *These members effectively form banjo plates, and they are swivelled to apply thrust, through ball pads, to the tails of the gripper jaws, to overcome the force from the stacks of washers*

to ensure that a part is adequately gripped without risk that the surface will be unduly marred. The chuck illustrated has capacity for gripping at a diameter of approximately 50 mm. It is 9 in diameter, and with a more recent design, whereon the jaws are of stepped form, the overall length is $3\frac{1}{4}$ in. Total forces of 600 and 2,400 lb are applied for gripping and releasing, respectively.

Important new projects on which work is in progress include the development of a range of quick-change holders to suit tooling units of entirely standard ISO type, and it is envisaged that holders will be made available for those of No 30, 40, and 50 size. Design of these holders is based on patents owned by The Warner & Swasey Co, and each incorporates a collet of special shape. In operation, this collet engages with the chamfer at the lower edge of the flange on a tooling unit, to draw the unit inwards prior to gripping at the periphery of the flange. Adjustable boring heads of a new design are also under development, and they incorporate cartridge-type cutter assemblies of throwaway-tip form, which are arranged for adjustment from the front. ⊙