

TURNING

The flexible transfer

It has been defined the "static bar multi-spindle": it is the most versatile model of this family of products manufactured by the Brescia company and it represents an important step forward in the productive flexibility.

by **Paolo Beducci**

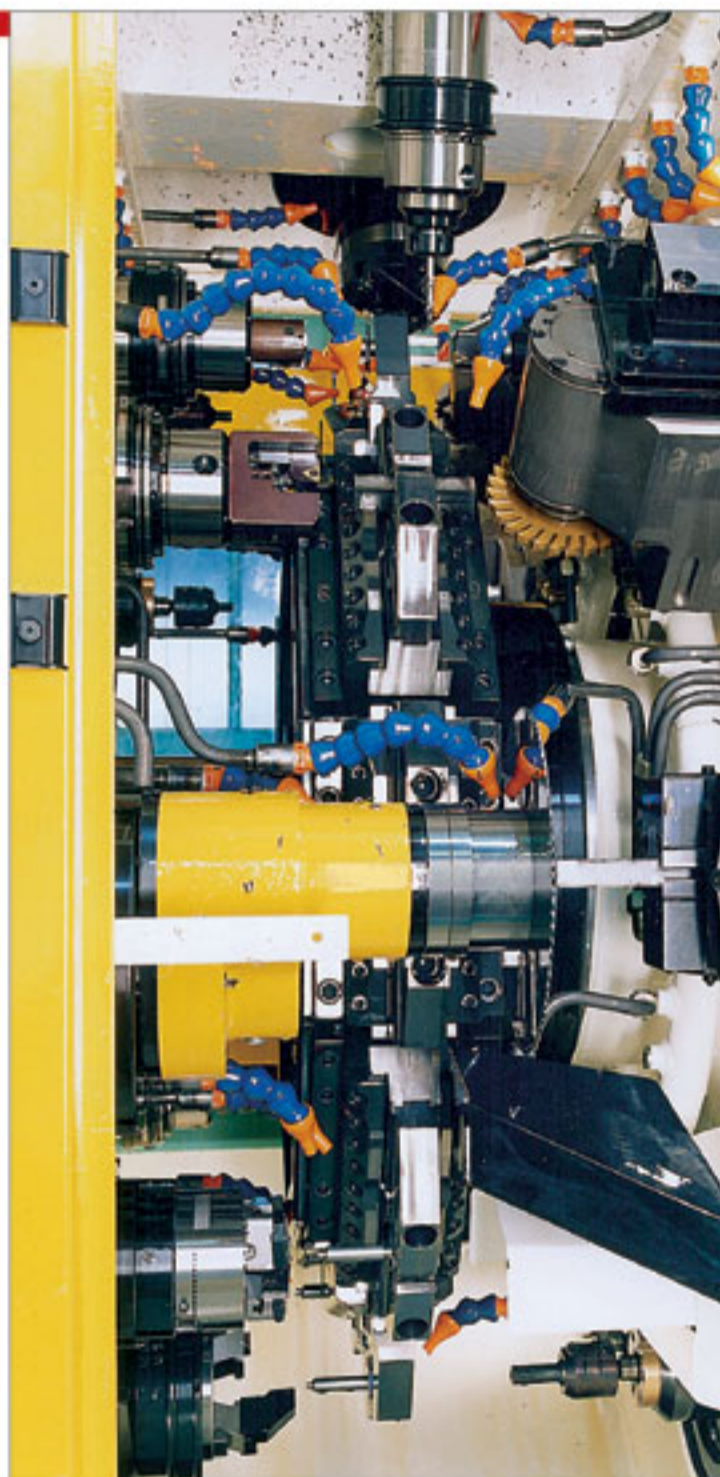
New generation machine tools are more and more conceived and designed to face new multi-purpose modalities with increasing agility, then meeting the needs of market sectors traditionally destined to other types of machine tools.

The highest expression of this more and more evident trend is represented by transfer machines, which were in the past very speedy machines but limited by their productive rigidity and by long re-tooling times and which are becoming in time undoubtedly less rigid and characterized by really competitive re-tooling times in comparison with other types of machines faced in the challenge on the market. The exemplification of this rule, according to which transfers' retooling is flexible and fast, is represented by **Trans-Bar 55+** by Buffoli Transfer, headquartered in Brescia.

Trans-Bar is a family of horizontal axis transfer machines designed and manufactured to offer high efficiency, autonomy, productivity and accuracy in machining of bar turned components. The wide range of rapid change accessories which can be installed permits to machine batches composed by few thousands pieces, with average re-tooling times of 30-60 minutes, and shorter cycles times than a modern multi-spindle system. **Trans-Bar 55+** is the central model of the family **Trans-Bar** which, it is worth reminding, is

completed by other models able to work on bar diameters equal to 7-30 mm, 7-45 mm and 7-75 mm respectively, whose standard versions are equipped with 5, 6, 8, 10, 15 spindles and whose special models with even 38 spindles (single cycle machines) and 48 spindles (double cycle machines). The maximum number of spindles clearly points out the extreme modularity of the design, considering that no piece will ever require the use of such a high number of spindles.

We precise that the term "spindles" identifies the rotary component driving the cutting tool in rotation, above all for those readers not used to the non-rotating bar machining process (much more widespread in the United States and in the North Europe countries than in Italy) Such spindles (or working units), driven by brushless motors, rotate shaped tools (drills, milling cutters, die-plates, taps etc.) or static turning heads. Such heads for facing, profile turning and insert threa-



ding are equipped with radially translating carriages where some standard NC turning inserts are installed, being, therefore, real turning centres rotating around the static piece.

The machining process is the following: the first station of a rotary table (equipped with jaws or collets) is fed by one or more static bars. The bar portion which is necessary for machining a piece is cut. The machining piece is transferred to the following working stations and, thanks to a second machining approximately at half cycle, the whole front and rear surface of the piece can be machined. It is possible to distribute the operations at best or execute

them simultaneously to obtain a higher accuracy (for instance, it is possible to machine simultaneously the left and right side of each piece with a more accurate alignment of the machining than in the pick-up repositioning).

Such process, called "static turning" has been fully developed by Buffoli, thanks to the use of precision clamping systems, of in-house designed heads and of a multi-processor Buffoli Numerical Control. Even if **Trans-Bar** are flexible and characterized by reduced change over times, and anyway competing even with single spindle lathes, allow shorter cycle times than a modern multi-spindle machine and permit to machine completely also tho-



se pieces that lathes can't complete on the second machining side or crosswise, either on brass or aluminium, on AVP or alloyed and stainless steels. Trans-Bar 55+, in particular, is the flexible universal Trans Bar model which is most suitable for being used in the subcontracting sector which - it is common knowledge - needs reduced cycle times but it requires also excellent flexibility and easy changeover. Trans-Bar 55+ combines these excellent characteristics with a particular process capability and a level of operator's autonomy permitting also unmanned machining shifts. Moreover, the process with static bar and rotary tools implies some ad-

vantages, such as accuracy in alignments and operations' orthogonality, in the constant maintenance in time of the machining values and in the concentricity between internal and external operations (executed in the same station). Up to 40 tools machine all sides of the piece, in the front, rear part and crosswise, then giving the possibility of working the whole external and internal surface of various pieces just in few seconds. Concerning the types of products which can be produced by Trans-Bar 55+, they are typical bar pieces, such as connections, nuts, valves, cartridges, connectors....., but also precision pieces for the medical, automotive and conditioning fields.

The structure

The Trans-Bar 55+ structure has the traditional shape by Buffoli Transfer and has been completely designed by CAD, paying a particular attention and care to the aspects of rigidity and stability of the whole machine. Buffoli basis are made of big electrowelded steel sheets, with a double-walled ribbed structure undergoing a long stabilising heat treatment. This guarantees

such rigidity and stability that the execution of heavy roughing operations together with precise finishing operations is made possible. For applications needing extreme accuracy, it is possible to put in the base a tested reactive anti-vibration resin, particularly suitable for the machining of pieces made of alloyed and stainless steel. The system created by Buffoli for fixing the units to the base improves rigidity and, at the same time, it supplies a user friendly, precise, reliable and quick instrument for the centring adjustment. Two other factors characterizing the base of Trans-Bar 55+ and shared by the whole Buffoli production are the easy chip removal and the notable ergonomics. All that combined with wide windows which help in making the machine easily accessible, in assuring high outputs and facilitating the setting up operations which are particularly quick on Trans-Bar 55+. Going on describing the peculiarities of the machine produced by the Brescia company, it is worth underlining that all electrical or electronic components are positioned outside the machining area. In this way, only machining pieces,

besides tools and rotary table, get in contact with chips and coolant. It is clear that this assures notable advantages in terms of overall reliability of the machine.

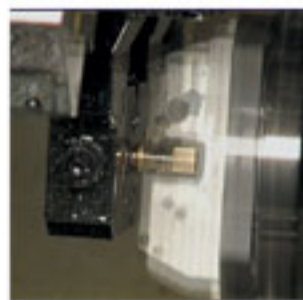
Work table and clamping devices

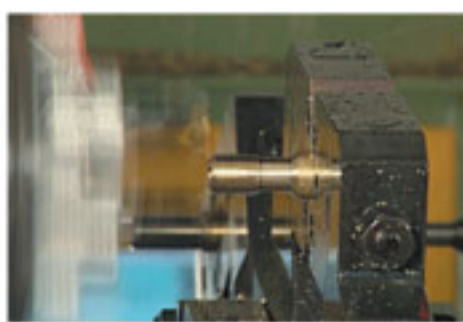
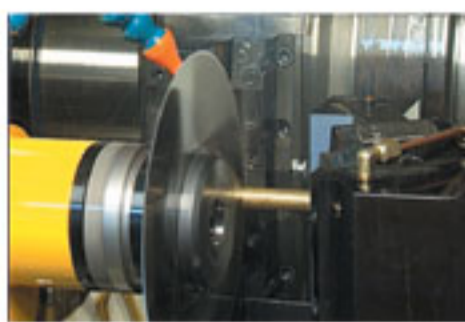
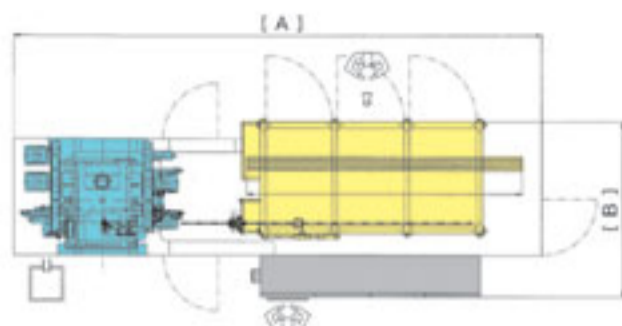
The work table consists of a forged steel monobloc. This is a very important factor: as a matter of fact, this choice assures better rigidity than solutions made of electrowelded steel or cast iron. All hydraulic paths are obtained directly in the solid table through internal holes replacing the most common tubes and connections which - it is common knowledge - might cause oozing phenomena. The work table houses a precision re-positioning device equipped with Hirth crowns, free from the contamination by dirt and chips thanks to the inside pressurization and this represents another noteworthy characteristic. Moreover, a second pair of pre-positioning crowns protects the table from damages whose repair might prove to be very expensive. Finally, to assure the best accessibility for the tool-holder replacement, the work table can stop also in intermediate positions. The particular system of hydraulic delivery on the table permits to

set different levels of pressure for each single clamp, assuring in this way strong clamping while roughing and soft clamping (not deforming) while finishing. The high precision clamps are designed by Buffoli which has paid a particular attention to the aspects related to centring, concentricity and circularity, very important factors in bar machined pieces.

Bar loader and working units

The bar loader is integrated into the machine and the bar cutting is executed in the first of the stations composing the working area. Bars, with a max. length of six-seven meters are loaded in bundles whose max. weight reaches three tons and from here they are sent to the machine. It is important to underline that, thanks to the feeding system which permits to program the piece length, the reject at the bar beginning and end is, anyway, always shorter than the length of a finished piece and is automatically discharged by an independent chute, thus preventing damages to the chip conveyor system. The cutting system is designed respecting the cost of material and tooling. Cutting blades are extremely thin (1-





1.2 mm), then permitting a saving of material. Thanks to the rigidity of the cutting unit, also a long life in the machining of difficult materials is obtained.

The displacement from the first clamping to the second positioning clamping occurs in different stations. The working area is kept perfectly clean thanks to a particularly abundant high pressure coolant delivery (up to 1000 litres per minute), which helps in determining a longer life of tools, a very good chip removal and high machining quality.

Trans-Bar 55+ is equipped with ten horizontal universal machining spindles (five on the right and five on the left), 11 optional horizontal spindles for particular applications and up to five radial optional spindles (for cross machining and turning with rotary piece). Buffoli's universal spindle units (each with a power of 7.5 kW) thanks to their rapid

coupling can be quickly equipped with Buffoli NC heads for static turning, Buffoli mini-revolving type heads with three tools which can be freely positioned in the machining range (tool change in 0.5 seconds), heads for rolling, marking, knurling, broaching, milling etc. etc., for a total number of 29 tools

(nine on the left, nine on the right and 11 transversal), to which further 11 horizontal tools for particular applications can be added.

On Trans-Bar 55+ it is possible to install up to seven mini-revolving heads with three tools, that's to say multi-axis and multi-tool machining modules.



ted mini-machining centres, with very compact dimensions, able to execute x, y positioning or multi-axis interpolations (for instance, milling of hexagons in contouring).

Independent cutting and feeding speeds

it is possible to execute heavy roughing operations and super-finishing operations simultaneously.

To satisfy the needs of high output (up to 3-4 times more than a multi-spindle lathe) Buffoli produces also machines fed by a double bar, enabling the simultaneous execution of two pieces, even differing from each other, in the cycle time of only one piece and with a smaller investment than that necessary for the purchase of two single bar machines (up to 10.000 pieces/hour).

The Numerical Control

It is one of the strong points of Trans-Bar 55+, to the extent that it is covered by a special five-year warranty. Thanks to its exceptional performances, it permits the user to exploit low cost standard inserts to execute interpolated milling and profile turning and

insert threading (single tool) helping, thanks to the minimum costs of tooling, in reducing the costs of each produced piece. Moreover, just thanks to the re-tooling times ranging from 30 to 90 minutes, it constitutes also an instrument to reduce costs and increase productivity.

Buffoli's multiprocessor numerical control is specifical-

ly designed and set up for the control of parallel processes (up to 128 axes simultaneously) and can improve the output performances, the easiness and rapidity of execution of new piece programs and the global reliability, including a very complete diagnostics system. In terms of structure, Buffoli NC is really an unequalled product on the market and the offered five-year warranty confirms the very good work carried out by the technicians of the Brescia company. It can control all the axes of the machine with a time loop equal to only 0.25 milliseconds. In actual facts, this means that the NC can control each motor of the machine 4000 times per second, providing an exceptionally quick processing. Besides developing very advanced technical characteristics, Buffoli's designers have focused on the software part: in fact, the use of this Numerical Control is particularly easy and intuitive and can be executed filling in guided menus and tables with few and easy para-

eters. If required the NC by Buffoli can be used also in the modality of self-learning of the working values. In any case, the knowledge of any programming language is not required and half a day is enough to learn the use of the NC, without needing precise notions of computer science. But there is something more: Buffoli NC and software allow to change the piece programming data "on the fly", that's to say

Accessories

The choice of accessories suitably equipping Trans-Bar 55+ at best is very wide, ranging from the marking units on each surface of the piece or of the bar to the different heads we have already illustrated, to the systems for checking the tool stress and the wear automatic correction, or to the automatic internal cleaning before re-tooling. But they are available also special units able to reach 35.000 rpm, special milling or polygon-generating heads. Finally, Trans-bar 55+ can be equipped with semi-automatic and/or automatic loading systems for castings and drop forged pieces, completing its high application flexibility.

