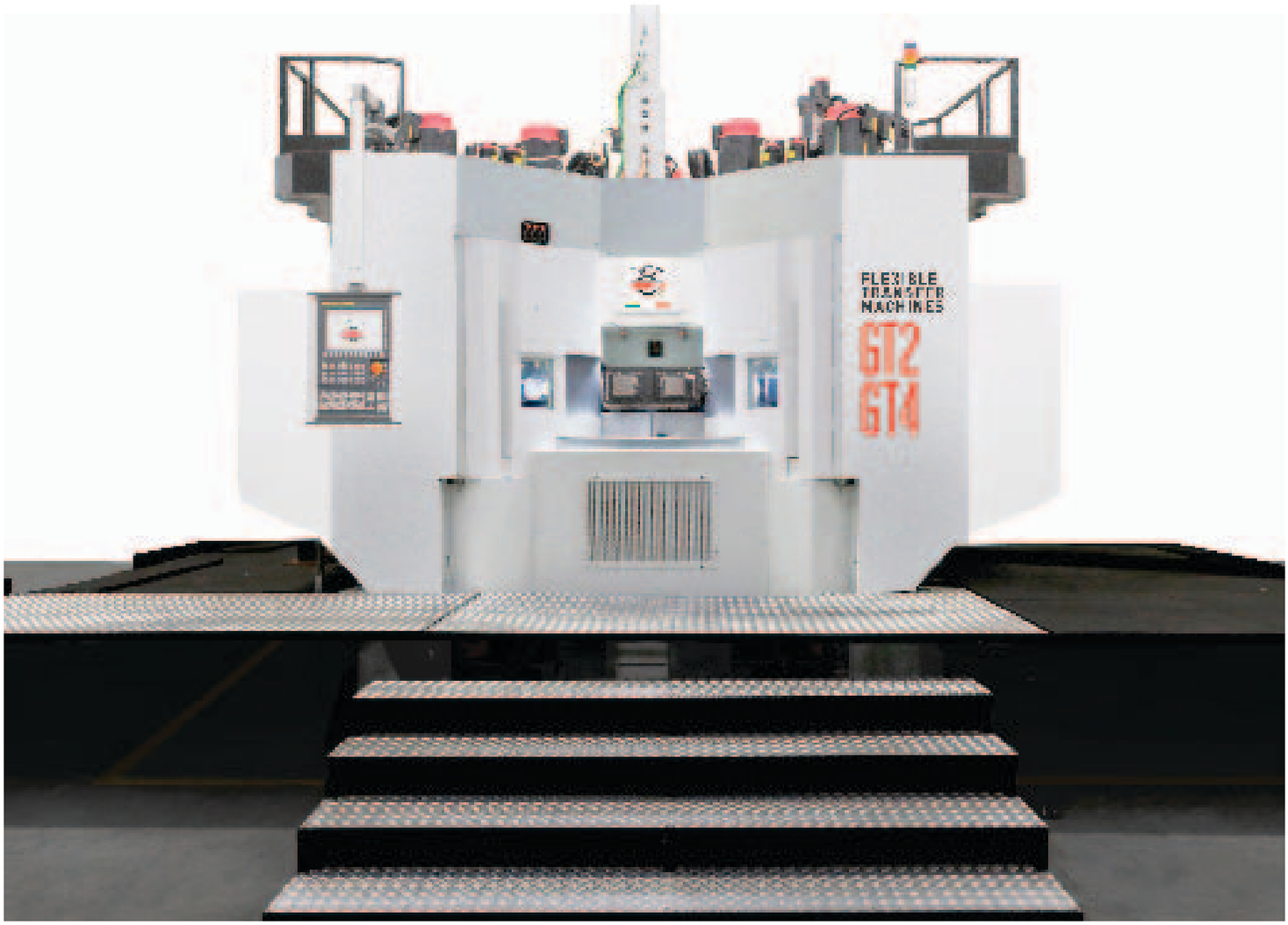
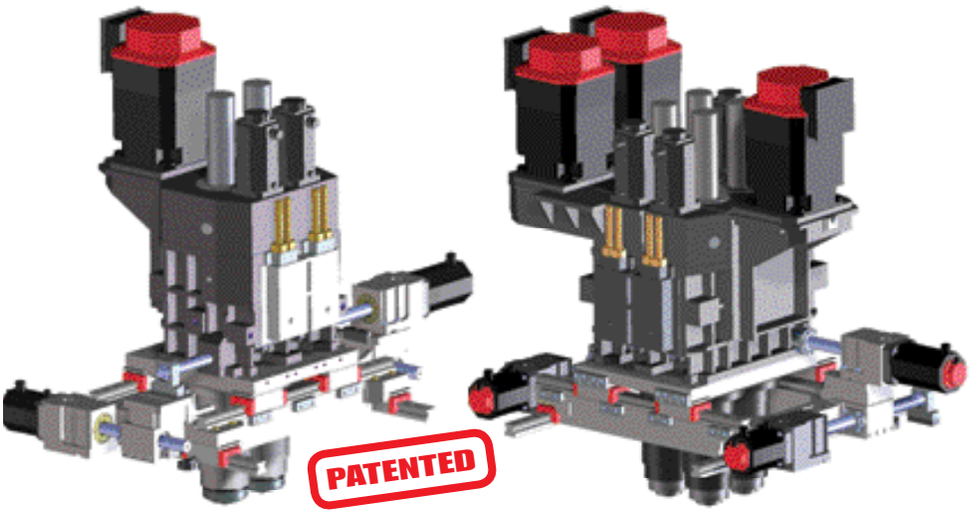
TRANSFER

Matching the typical output of a transfer with the flexibility of a machining center: with GT2 and GT4, Gnutti Transfer has achieved a winning result under all aspects

by ANDREA PAGANI

GT2 GT4, *the flexible* solution





The transfer machine world has deeply changed over the last few years. The reason is simple: different are the requirements of the market, where productions of millions of pieces (ideal condition for this machine typology) have been joined by low volumes or medium-size batches that periodically repeat. This has resulted in the birth of a range of solutions able to combine the new requirements with the latest manufacturing technologies. Relying on over 60 years of experience, Gnutti Transfer was able to understand this trend and to satisfy it with products and solutions keeping pace with users' demands, such as the latest GT2 and GT4, the two- and four-spindle units that the Brescia company call *Flexible Transfer Machines*.

NATURAL EVOLUTION

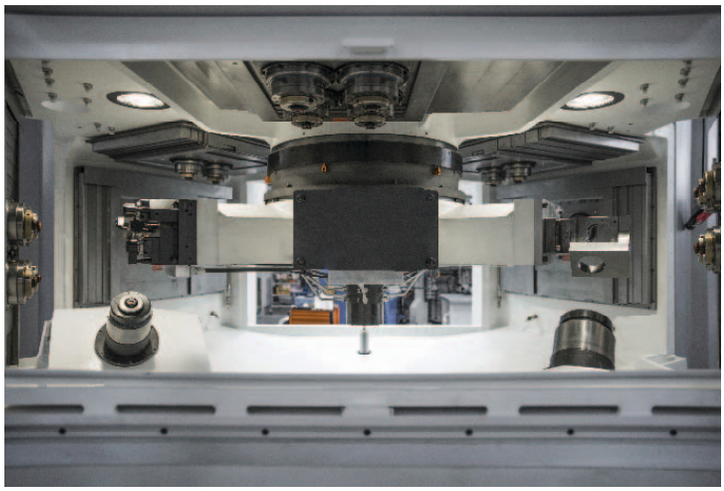
The first machine equipped with GT2 and GT4 units was devised for the automotive industry: a market calling for top performances and imposing challenging economic, qualitative and productive performances to its suppliers.
The market has immediately appreciated their specifications and has urged Gnutti Transfer technical division to widen the machine performances to satisfy demands coming from other application areas, concerning for instance different materials (brass, aluminium, cast iron and so on) and medium-size batches.
The uniqueness of these units grounds its foundations on consolidated designs and on models running for years now in primary workshops worldwide. The choice that has made these solutions winning is not technical, but related to use, to enhance the use flexibility while keeping the typical transfer productivity unchanged.
Therefore, GT2 and GT4 do not replace other comparable solutions but enlarge the family of high-output machines by Gnutti Transfer, taking up a well-defined niche and meanwhile highly benefitting from the other models in technological terms.
Starting from a single idea – a 6-station machine with 30 spindles – today the high-end range version features 8 stations with 36 spindles.

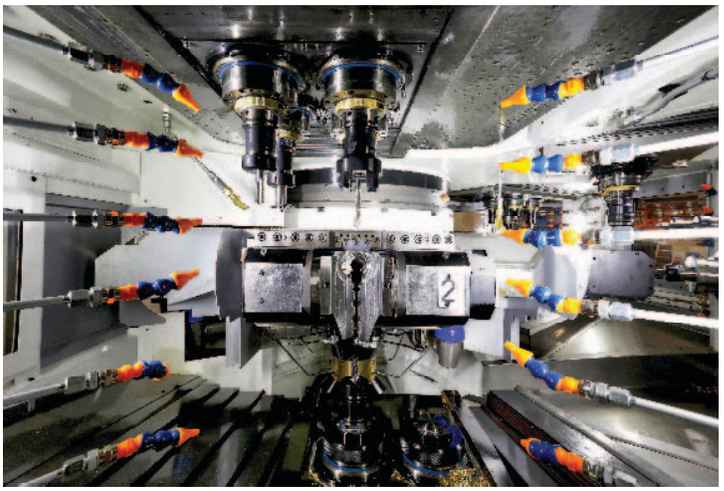
A SIMPLE CONCEPT TO PERFORM COMPLEX TASKS

GT2 and GT4 succeed in a difficult mission: matching the productivity of a transfer machine with the flexibility of machining centers.
Until now, the solution for such a requirement consisted in modular transfer machines equipped with machining centers with tool changer or indexing multiple tool head. Gnutti Transfer has decided to replace the tool changer using the two (or four) spindles of GT2 and GT4 in independent manner, i.e. providing each of them with the possibility of travelling on three axes (X/Y/Z) and in sequence.
To understand the cleverness of this approach at best, it is necessary to analyse since the early phases the solution devised and patented by Gnutti Transfer in structural terms.
Conventional multi-spindle units feature a single body with two spindles driven by one re-circulating ball screw (Z-axis) and one motor that controls both.
With GT2 and GT4, it is instead possible to choose two more flexible alternatives: the first one is equipped with a single body with two re-circulating ball screws that operate Z-axes independently (useful for the tool presetting or for specific operations such as tapping) and a single motor that performs the rotation of the two spindles. The second provides for both two Z-axes and two separate motors: this allows a significant process optimization because one motor can be dedicated to operations such as drilling or tapping while the other carries out high-speed machining processes (deep boring, use of tools with small diameter etc.).
Compared to transfers that machine with more tools simultaneously, GT2 and GT4 spindles operate in sequence: against a slightly longer cycle time, it is possible to achieve up to four distinct operations in each station. Besides, due to the possibility of distinguishing the single machining units with different motors in terms of delivered power, revolution numbers and torque, better performances and results on the workpiece are feasible.
The 3 available axes on the spindle, coupled with the fourth axis on the chuck, make these machines as flexible as a machining center but as productive as a transfer.

FLEXIBLE AND MODULAR

A flexible machine is expected to have another fundamental quality: a very short retooling time.
Today companies no longer wish to produce for stock, displacing the problem more upstream in the manufacturing chain and compelling subcontractors to manage small-size batches periodically occurring.
GT2 and GT4 assure a short retooling time, from a minimum of 20 minutes to about 2 hours according to the modifications needed, all that with cycle times comparable to conventional

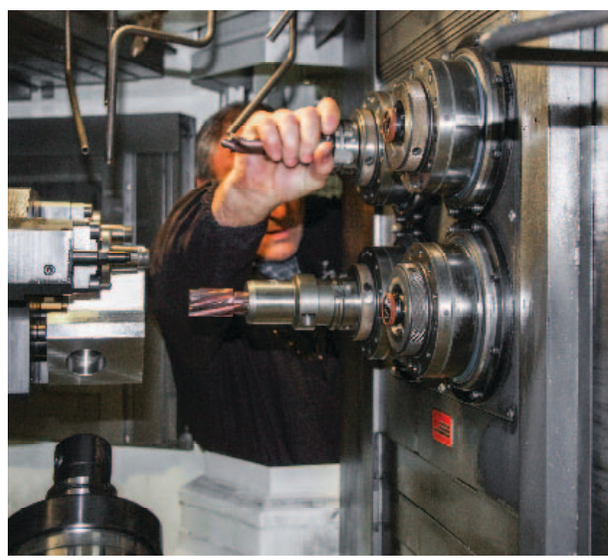


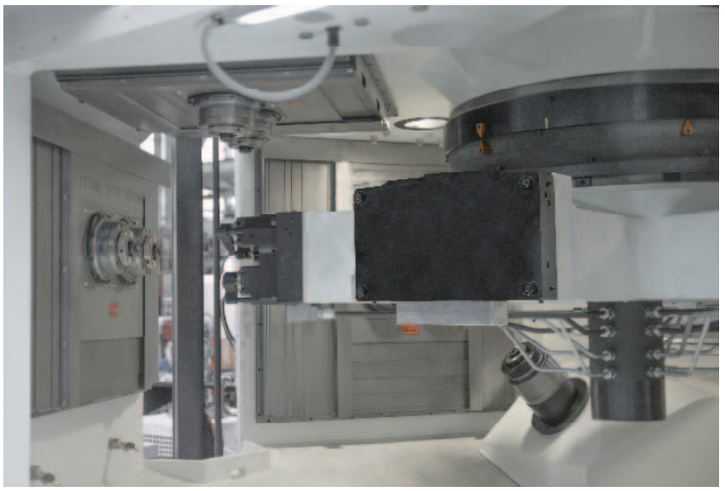


transfers'. This result has been attained thanks to the use of specific equipment: with 4 spindles, for instance, it is possible to use a head for recessing and profile turning. This alternative is not feasible on a machining centre but, on the contrary, it will be necessary to use very light non-hydraulic heads.
On the contrary, the availability of independent units for each spindle paves the way to a much higher optimization of the machining cycle because each unit can be entrusted with a specific operation, exploiting the most suitable motors in terms of revolution number, torque, power, transmission ratio etc.
From this point of view, Gnutti Transfer has devised various options and sizes. We start from the smallest one, called Size 125, with a Z-axis stroke of 150 mm and X/Y strokes of 230x85 mm (GT2) or 230x230 mm (GT4) respectively. Motors can be chosen with 5.5 and 7.5 kW power versions, all with maximum rotation rate of 6,000 rpm.
The size increase (Size 150) goes hand in hand with the increment of the Z-axis stroke (75 mm), as well as the one of the other linear X-and Y-axes, with a machining range that reaches 260x85 mm (GT2) and 260x260 mm (GT4). In this case, motors feature 7.5 or 11 kW, with maximum rotation rate of 4,500 rpm.
Finally, for those users that prevailingly work on aluminium or in general on light alloys, Gnutti Transfer has recently introduced the variants 120 HS and 130 HS (High Speed), which maintain the strokes of the 125 and 150 versions but offer motors with 7.5 kW power, able to reach 10,000 rpm, for instance ideal for deep drilling, machining with small-diameter tools etc.
The fast retooling makes advantageous also the machining of workpieces with very different geometries one another: often, the trend is using a transfer for a specific family of pieces to avoid the idle times needed by tool changer and equipment, while with GT2 GT4 these times are reduced to the extent of making their use convenient, irrespective of the piece geometry variation, obtaining a strong advantage in terms of productivity and part cost.

UTMOST RELIABILITY

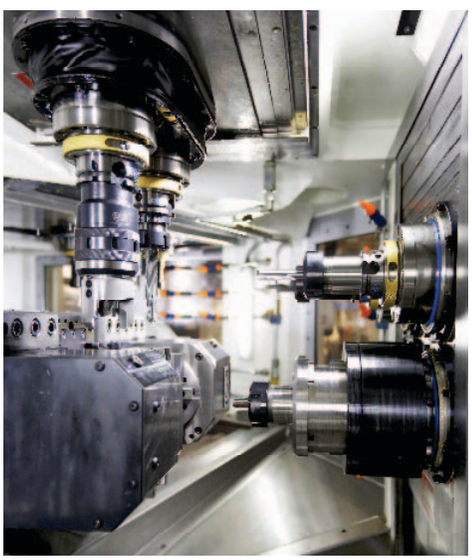
The machining in sequence of the various spindles implies a relevant advantage: each motor operates for one fourth of the time, reducing wear and possible failures. Unlike a machine equipped with tool changer, furthermore, they eliminate the possibility that chips enter the taper in tool change phase or the wear of the release spring.
Moreover, the working compartment is very open and accessible to the operator which can work comfortably to perform the tool change or the retooling.
As mentioned, finally, the technical solutions adopted on GT2 and GT4 are the same already running on other machines in operations for decades, then tried&tested and guaranteed.
They are undoubtedly advancements that, together, share in notably improving the machine reliability (it is a transfer and, as such, a manufacturing system that must tend to 100% of reliability) and that simplify all those operations requested in piece change phase.





TECHNICAL CHARACTERISTICS

The GT2 and GT4 units can be installed on transfers with 4, 6 or 8 stations: the table and the units are made of cast iron, in order to improve the vibration absorption wherever they are generated (the indexing motion and tool force on the part), while the frame is made of properly sized electrowelded steel.
The version with 4 stations is available both in vertical-axis configuration and horizontal, whereas with 6 or 8 stations the machining axis is only vertical. The spindle size can be independent both inside a single unit and among more units: selection according to the grade of material. Naturally, in case of need, it is possible to equip the spindle with an overdrive on the spindle, featuring 11 kW and 4,000 rpm, to attain a solution able to face also different machining operations, like for instance small-diameter drills.
Each station can machine with different pressures (up to 100 bars) to optimize the manufacturing process, station by station: for a deep drilling, it will be indispensable to work with high-pressure coolant, while the standard 40 bars can be sufficient for the standard operations.
The flexibility of these models is accomplished also by clamping systems: concerning this, Gnutti Transfer does not fix any limit, offering options of all kinds and for whatever need.
We are speaking of the standard fixed self-centring chuck, the interchangeable system with quick change on rotary vice, the self-centring chuck on rotary vice and further hydraulic clamping devices on vice or jaw.
Moreover, it is possible to mount any accessory device such as multiple, recessing, profiling and CNC heads, overdrives or polygon-shaping machines: with GT2 and GT4 each station can be intended for a specific machining simply adding or modifying the related equipment.



PRECISION BEYOND PRODUCTIVITY

However the cycle time of a part is important as well as the precision with which it is implemented.
From this point of view, the machines equipped with GT2 and GT4 are properly sized; the presence of axes fully controlled by the Numerical Control (Fanuc 30i or Siemens 840D sl, on demand) has allowed further enhancing precision, meanwhile decreasing setup times. A simple solution is used to counterbalance the increased mass of the 2 & 4 spindle units: in particular 4-spindle ones, have a significant weight that is suitably managed by a counter-balancing system with gas cylinders. Concerning thermal part growth, an adjustable cooling system for cutting fluids is used for keeping temperatures under control and operating under conditions of substantial geometrical stability. The availability of NC-controlled axes introduces a further possibility: using probing systems that, depending on the clamping tool, can carry out the zero setting for each single tool and dedicate the offsets of each module according to clamping tools, which are so compensated. The operator, in retooling phase, will not have to control that all equipment is the same but instead, after its assembling, he will have the possibility of launching a fast probing cycle that will characterize the origins of each equipment.