DECO MAGAZINE

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TOOL OFFSET CONCEPT

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DECO MAGAZINE

No 4

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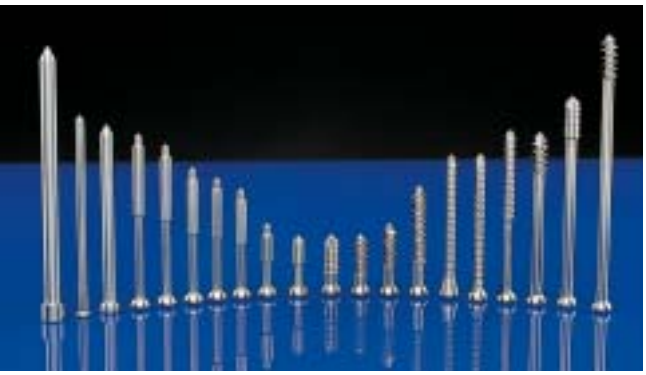
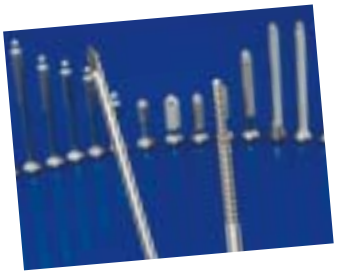
CONTENTS





The asian market returns to TORNOS-BECHLER single Spindle machines, thanks to the DECO 2000 Range

For many years the Japanese competitors have had the stranglehold on the Asian market, originally held by TORNOS-BECHLER.

Today, TORNOS-BECHLER has resumed that pioneering role in an even more difficult market. The DECO 2000 concept and it's many advantages has been recognised by the Asian customers.

In Japan, Korea, Hong Kong and South Eastern Asian countries, they have the same requirements as the rest of the world, including high production speed, precision and time saving.

They too have recognised the difference between DECO 2000 and our competitor's «SWISS TYPE» sliding head automatics, i.e. Cam Machine Productivity-TORNOS-BECHLER offers this with the new DECO 2000.

This, allied with the enthusiasm of our sales network in promoting this unrivalled product line has seen the conclusion of numerous contracts, particularly to the connector, electronic data processing and complex part machining industries.

Let us hope that the current financial crises in the Far East does not affect the long term success for TORNOS-BECHLER on the other side of the world.

To further increase the impact into these markets, TORNOS-BECHLER are exhibiting at the following exhibitions in Asia:

SIMTOS	Seoul, Korea	22nd - 27th April
METALTECH	K.L., Malaysia	13th - 17th May
METALWORK	Shanghai, China	5th - 9th October
JIMTOF	Osaka, Japan	28th October - 4th November
METALASIA	Singapore	17th - 21st November

Tool offset concept

Stéphane Carroza

Problem encountered

Machining the part below. Dia. 5 is machined using tool T12 which is associated with offset 12 and, to achieve greater flexibility you wish to use a second offset – e.g. T52 which is associated with offset 52 for an 8 mm diameter.

Figure 1

Depending on the values entered in the machine for offsets 12 and 52 for X and Z axes, the contour which has been programmed (Fig. 1) is not executed correctly. Errors (Figs. 3 to 6) appear. Why?

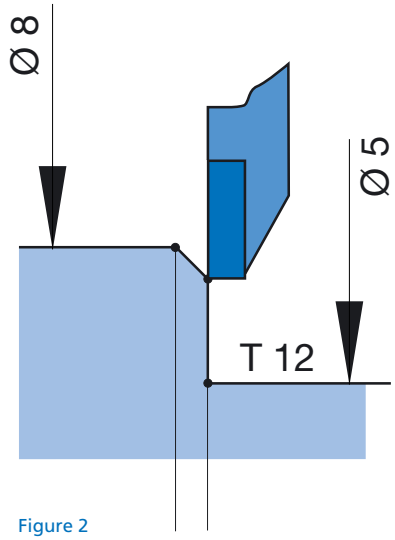


Figure 2

Explanation

In a conventional CNC, tool offset is directly taken into account when calculating the distance to be covered. However, the TB-DECO concept does not have a tool offset but only the tool geometries. Consequently, a link, which is defined by the operator, is carried out between the tool catalogue containing the geometries of each tool and the corresponding axis tables. The PNC DECO control instantaneously corrects the offset value when it is called up whilst the programme sequence is being run on the machine.

This is one reason why contour faults may occur. The difference between the offset values - in our case T12 and T52 – is immediately taken into account when a new offset is called up.

Solution

The link between tool geometry and locating the offset in the corresponding axis table is selected by default for all axes, but can be individually deactivated axis by axis using the form «Offset selection» of the «Tool edition» menu (see TB-DECO operating aid).

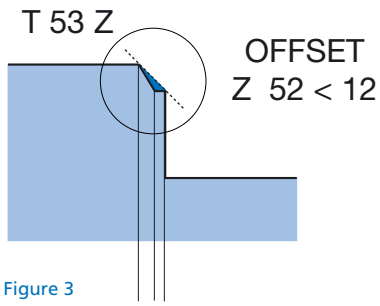


Figure 3

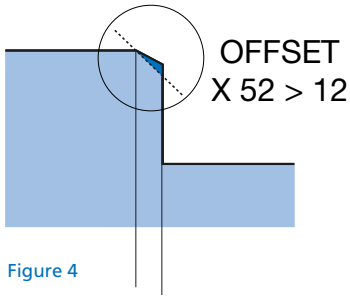


Figure 4

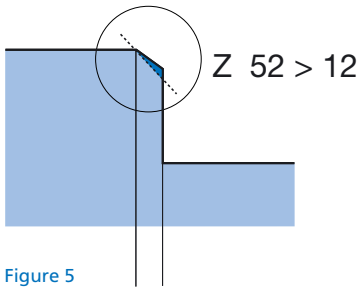


Figure 5

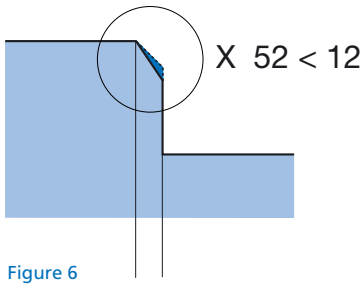


Figure 6

Requested form layout

Obtained form

Example

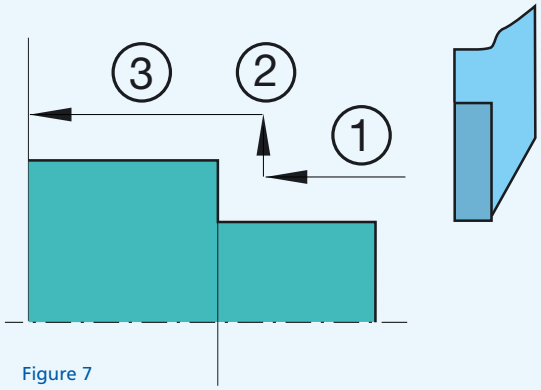


Figure 7

Offset selection:			
T..	X	Y	Z
12	3	3	3
52	3		
53			3

ISO Code
G1 X1 = 5 Z1 = 0 T12
G1 Z1 = -10 F0.05
G1 X1 = 8 T52
G1 Z1 = -15 F0.07 T53

When moving to segment 1, all axis offsets are active whilst, on the other hand, when the offset changes to segment 2, then only the offset for axle X is placed. This means that provided there is a difference between offset 12 and 52 on axle Z, there is no risk of a contour fault.

If an offset is required for the length, for segment 3, then T53 is added.

Next number:

Example of a transverse tapping progamme using a thread milling cutter

Conclusion

If the machining process allows, it would be preferable to quit the part contour, activate the second offset outside the part material and then to re-integrate the part contour. Thus compensation for the difference between the two offsets takes place outside the part contour.

If the machining process requires you to remain in the contour, then the «offset selection» method indicated above can be used, so as to avoid any errors in the contour.

Conversation with an English turned parts manufacturer

The way to success

In the heart of Gloucester's historic docklands is a turned parts manufacturer who has become one of the South West's latest success stories. Now fully installed in their new 7000 Sq Ft premises and employing 17 people, Alphatool Productions are very confident for the future.

From left to right: Mr Erich Schmid, Mr Tim Norman, Mr David Wilcock, Mr Dave Gwilliam and Mr Anton Menth.

Since the start of Alphatool in 1982, partners Doug Gwilliam & David Norman have run a traditional cam auto shop based on TORNOS-BECHLER & Petermann sliding head machines & turret type autos. They mainly catered for mid to high volume production runs with smaller batches being produced on their fixed head CNC lathes.

Increasingly Doug & David were asked to take on more complex components with 2 to 3 operations in addition to the turning. These type of components made production challenging, as it was relatively simple to produce first operation turned parts but the subsequent operations were labour intensive, gave longer lead times, needed more quality control monitoring & increased work scheduling. The search was on for a more effective way.

Conventional CNC sliding head machines were looked at in some detail and although they could produce the components complete, they could not compete against the production cycle times of the cam autos and the overlapped subsequent operations. So this solution was not cost effective. Rotary transfer machines were another alternative, but again this was only a part solution to the problem and still not cost effective.

In January 1996 Alphatool were presented with the DECO 2000 concept by TORNOS-BECHLER, the new generation of PNC (Parallel Numeric Control) – sliding heads that would replace the current CNC generation. The DECO would enable Alphatool to produce their existing components at their cam machine production rates but also include the subsequent operations in the same cycle time. This seemed too good to be true.

In February '96 Dave Gwilliam & Tim Norman the sons of Doug & David visited the TORNOS-BECHLER Factory in Moutier Switzerland to see the official launch of the DECO 2000. The machine was initially launched with 7 mm bar capacity in the 9 & 5 axis formats. Tim & Dave confirmed their order for the first TORNOS-BECHLER DECO 2000 to be supplied to the UK.

When delivered in **October '96**, their 9 axis DECO was set on a component that they had been turning on Tornos cam machines in 30 seconds and then carrying out manual second operation drilling & tapping and third operation slotting. Even the Tornos Engineers were pleased to see the parts coming off the DECO in 20 seconds complete, using feeds and speeds that would give reliable unmanned running. In addition to the above savings Alphatool were now also able to make complete parts unmanned & not have to wait for the manned shift to complete operations 2 and 3.

By April '97 the success of the first machine led to the ordering of a 2nd TORNOS-BECHLER DECO 2000 machine, this time a 10 mm diameter 9 axis configuration.

In June '97 again in Moutier the TORNOS-BECHLER DECO 2000 20 mm machine was launched. Amongst many customers from the UK visiting was David Norman, who could now see an increasing work load on larger diameter parts. Reading across the cost savings from the smaller DECO and the nature of the larger parts being more complex, Alphatool needed no persuading as to what the next step would be. Tim & Dave visited the Emo Show in Hannover and ordered the 10 axis version of the DECO 20 mm. By that time the machine was also available in 25.4 mm capacity. (Inset photograph shows Dave & Tim after negotiating DECO 20 order together with Mr Anton Menth MD TORNOS-BECHLER SA, Mr Erich Schmid - Sales Director TORNOS-BECHLER SA and Mr David Wilcock - MD TORNOS Technologies UK Ltd.

Unusually for the industry, Alphatool have a low average age work force. This is actively encouraged, as it is seen by Doug & David as *«the only way the business will keep its skills long into the future. There is a healthy learning environment where the more senior setters help develop the skills of the more junior engineers»*. Supplementary courses with the local college are also encouraged. David Norman says *« The introduction of state of the art technology machines like the TORNOS-BECHLER DECO 2000 are much more easily absorbed into the cam shop environment when the work force has a wide skill range. Bringing together the traditional setting skills and metal cutting knowledge with current computer systems is very important in getting the best from the equipment and keeping your competitive edge»*.

As the software for programming the range of DECOs is the same, Alphatool will still be using the same PC that they purchased for the first DECO to run all three. This also gives them the flexibility of more people having the skills to run more machines and all programmes stored centrally for quick access.

All at Alphatool feel that the DECO machines have bought about a turn around for their once traditional cam shop. Says Doug Gwilliam *«This is the beginning of the end of the cam operated machine. Now that high speed machines like the TORNOS-BECHLER DECO 2000 can compete with cam machine production rates but can be reset-up on a new job in a fraction of the time, give consistent high quality and eliminate subsequent operations, all jobs become viable on these machines. This is the way forward »*.

The thread whirling process in the hands of the surgeon

**What could be more complicated to achieve than thread cutting or tapping on a lathe...
However – thanks to a whirl-type process and the DECO 2000, what used to be impossible has now become reality at high output.**

Of course, this is becoming easier and easier with present-day numerical controls because the turn-key sub-programs make it possible to manage the material and successive passes well in advance. But despite this programming facility, machining by chip removal still remains a tricky operation especially when having to tackle alloys such as titanium and stainless steels, especially for thread cutting or tapping, where the useful life of the tools is considerably reduced. But a method does exist and meets the wide demand from the medical and dental sectors. TORNOS-BECHLER has taken the lead and adapted itself to the high quality standards required for such applications. Surgeons in the dental and medical fields need surgical implants of all shapes and sizes, including bridges and screws. These parts are made from stainless steel, recast under vacuum, or titanium, so as to ensure complete biological compatibility and above all, prevent any risk of rejection.

These constraints, coupled with the high precision demanded, especially of screws used in orthodontia or micro-surgery, stimulated the company to improve the potential of its lathes by developing procedures suitable for this purpose. One of the most striking specialities is the technique of machining internal and external threads according to the whirl threading principle, which is now possible on the DECO 2000.

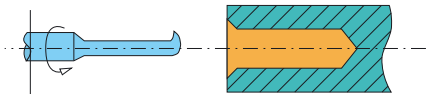
Thread whirling – an interesting alternative to thread cutting

As opposed to thread cutting and tapping, thread whirling produces clean contours without burrs. The tools used, also have a greater useful life, the machining time is shorter and tool breakage is a thing of the past. The main applications of whirl threading are dental implants with internal threads, screw-to-bone implants, surgical screws and maxilla-facial screws with external threads. This process also dispenses with the long withdrawal of the bar from the guide channel, thus avoiding seizure due to an excessively long projection.

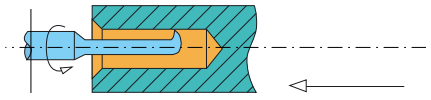
Thread whirling can be executed both for external thread cutting and internal tapping. This machining process, which is carried out on the bar or in counter-operation on an automatic lathe, requires a high-frequency spindle turning at speeds up to 30,000 rpm. During internal tapping, the spindle axle must run parallel with the part being machined, whilst for external tapping, this axle is inclined, depending on the screw pitch angle. The hard metal tool must have a shape similar to the thread profile being executed.

Description of the process

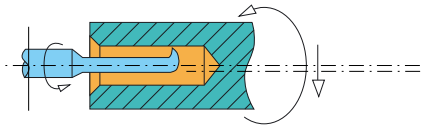
Let us now examine the machining of an internal tapped hole by whirl threading. The procedure, which is illustrated in the figure alongside, is as follows:



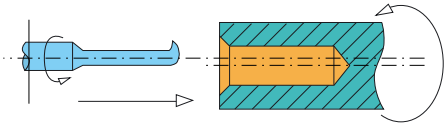
1. *The part is presented before the tool which is turning at high speed.*



2. *The tool is introduced to the inside by the sliding headstock driving the part.*



3. *The part turns slowly, either in the tool direction or in the opposite direction, depending on the type of thread being cut (left pitch/right pitch). The tool, which is conveyed by a numeric axis penetrates the material of the revolving part by lateral displacement. This offset is equal to the depth of the thread being machined.*

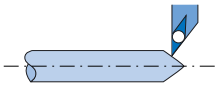


4. Start of tapping at the base of the hole. The thread is executed in a single pass. Both the part and tool are turning. The part is withdrawn at the speed of one pitch per turn of the spindle.

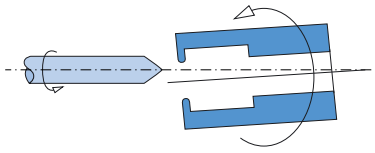
This process is 60 % faster than conventional tapping. The useful life of the tooling is also far superior. More than 2500 titanium parts can thus be tapped without breaking. Coupled with this, is the fact that the cutting speed can reach 200 m/min, thus ensuring an irreproachable thread quality. As for precision, this is guaranteed by numeric incrementation, both in depth and diameter. There are no burrs or residual chips and the thread cutting depth can be more than three times the diameter of the thread. It is even possible to machine right down to the bottom of a blind hole or even very small threads, e.g. M 1.4.

External thread cutting

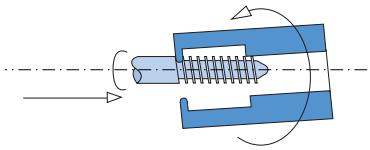
Thread whirling can also be used for external threads, but this is a little more complicated. What is required is a high-speed spindle revolving at a speed of up to 12,000 rpm and a device which is specially fitted to the end of the lathe which can rotate and incline in relation to the thread pitch angle. This mechanical inclination is set once manually for each thread line. Machining is carried out using a bell-shaped tool comprising three cutters of the same section as the thread undergoing machining. This tool can, of course, be re-sharpened as required. The entire threading depth is executed in a single pass. We shall now describe the process.



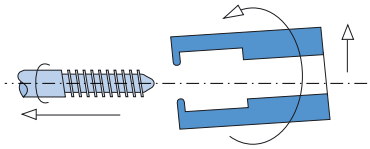
1. *The surface facing the part is turned, if necessary.*



2. *The spindle, which drives the whirl threading tool is positioned in front of the point of the part undergoing machining. It revolves at high speed whilst the part simultaneously turns in the opposite direction at slow speed.*



3. *Machining can start by longitudinal penetration of the part into the bell-shaped tool. The feed rate, which is synchronised with the two rotation speeds, continues until the required threading length is achieved. It should be pointed out that only one tooth is in contact with the part at any time, thus guaranteeing a fine cut.*



4. *Once thread cutting of the part is complete, the whirl threading spindle (the tool) is released to the side and the part can be longitudinally withdrawn. The length of the thread cut may be as much as 30 mm.*

This process offers several benefits, the first being the excellent useful life of the tool with its constant contours which can be re-sharpened up to 40 times.

The surface state of the threads is perfect because the tools rotate at high speed in the opposite direction to that of the part, thus avoiding the undesirable lands of the face which are sometimes found with conventional threading by milling.

Special features, such as left or right threading, threading from above a screw head or even conical threads can also be achieved because of the flexibility of programming the TB DECO software and through the multi-axis interpolation of the DECO 2000.

Medical applications

In order to understand the requirements of the medical implant market, TORNOS-BECHLER worked in very close co-operation with specialists in this field and executed parts made from titanium or stainless steel 316L, in particular. These are materials which, based on current research, are best tolerated by the human body. Those industrial engineers working very closely with the dental medical sector and surgery have become very demanding. They will only be happy with the best. This pledge of excellence with respect to implant materials and screws in particular, is met by the whirl-threading machine, coupled with the flexibility of the DECO 2000 concept. At present, this provides the best threading / tapping quality on offer in the small parts turning industry. In approaching the medical implants sector, TORNOS-BECHLER is penetrating an innovative market that is in the throws of development. It is doing this for several reasons: fixing techniques are making progress; we have not heard the end of materials such as stainless steel recast under vacuum, titanium and the alloys of the future; new machine tools can now machine these difficult materials far more easily and, to cap it all, the machine tools of the DECO 2000 range can now execute operations which were still only dreamt about yesterday.

The latest amongst a series of recent developments

Evolving towards perfection

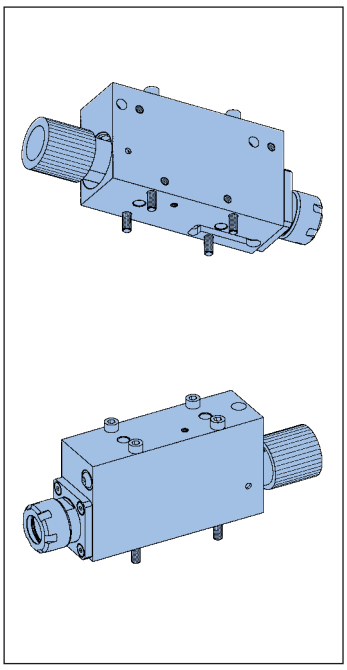
We never become tired of repeating the fact that technical developments, especially those affecting industry, would leave our ancestors open-mouthed. In fact, these developments could even qualify as mini-revolutions.

The advent of electronics in machine tools, culminating in CNC, was a gigantic step towards simplifying machining processes, to such a point that some design engineers, with their work stations and CAD software, end up designing parts from time to time which, despite all technical progress, remain an unfeasible proposition. Happily such instances are rare despite on-going technical progress, but the designers are daily demanding more innovation and know-how from the "workshop".

The range of DECO 2000 automatic lathes, for example, now makes it possible to execute operations which, barely five years ago, would have appeared utopian. The potential of such machines hardly has limits. Given the various applications, we regularly find that these limits are pushed back even further by the arrival of new functionalities and the addition of new units and accessories. What is more, the practical engineers at the Tornos Bechler test centre are developing and testing innovative programming and machining methods before launching these on the market.

In this DecoMagazine, Stéphane Carozza will impart his latest tricks of the trade which will make it possible to simplify software programming. On the other hand, this article presents new horizons which have opened up at practical machine operation level, such as simplified machining or increasing the potential of the machine.

In this first, of what we hope, will be a long series of articles, we shall purely refer to the DECO 2000 with a 20 mm capacity.



Innovations anticipated for March '98

Novel features emerge every month, but we shall now talk about the three innovations for the month of March which further extend the flexibility of the DECO 2000 machines. The contented operator of such a machine, who places an order for the new "Option 1650", will have all the time he needs to carry out milling and slitting work using the circular ESX 25 type chucks. In fact, this new feature, which has already been available in the form of a similar unit known as the "Option 1600", is an independent unit with a revolving spindle, making it possible to use circular milling cutters having a diameter exceeding that of the previous model.

Features of the "Option 1650" – revolving spindle milling/slitting unit for circular ESX 25 chucks

Maximum diameter of circular milling cutters: **63 mm**

Type of collet chucks: **ESX 25 (max. 16 mm)**

Maximum rotation speed: **8000 rpm**

Assembly position: **comb No. 2 in T22-T25 position.**

Increased profitability thanks to the addition of devices which will further increase the number of tools used on a DECO 2000 / 20 mm.

A second novel feature has just seen the light of day - this being the "Option 2100".

This is a revolving spindle designed for light drilling, milling and slitting operations. The feature of this accessory is that it can rotate at high frequency and reach a maximum speed of 15,000 rpm.

Designed to perform drilling / transverse milling operations, either inclined or at the end on the die stock chaser on the bar or as a counter-operation, it executes the end slitting operations from the combination slide.

Features of the "Option 2100" – high-frequency revolving spindle for drilling, milling and slitting operations, running at 15,000 rpm for light operations.

Speed of rotation:
75 – 15,000 rpm

Output: 210 W

Assembly positions: die stock chaser 1 in T11 – T15 position

End unit: at T31, T34

Counter-operations: at T51 to T53

Can be inclined to 90° and, depending on inclination, two tool positions are required.

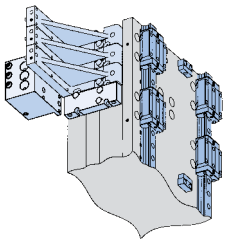
In order to increase the number of tools available even further, the TORNOS-BECHLER engineers designed the Option 3240. This is a triple "end" toolholder with Bore of 20 mm, which is compatible with the standard tooling available on the market. This particular accessory will offer possible extensions for end machining the part from the combination and for counter-operation. As a result of this innovation, the total number of tools which can be simultaneously assembled on a DECO 2000/20 mm is 25, of which 11 are rotating tools on 10 axis which are simultaneously managed, i.e. 10 tools on plattens 1 and 2, 3 tools on the counter-operation spindle, 6 for the end units destined for counter-operation and finally 6 tools for the end attachment, for main operation.

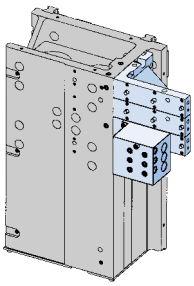
Features of the "Option 3240" – Triple toolholder for end boring for commercial tooling

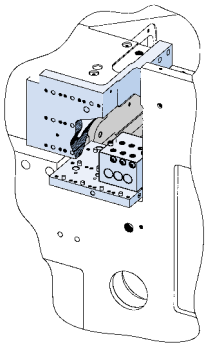
Possible assembly: on the combination T31 to T33 or for T41 to T44 counter-operations.

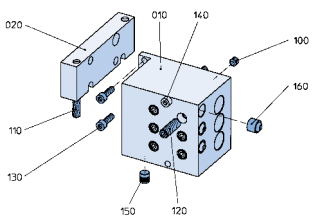
Maximum number of units: 2 on the combination and 2 for counter-operations.

In each new edition of DECO Magazine, we shall take a look at the latest hardware innovations for the DECO 2000. Because there are so many, we shall have to keep the report on these fairly brief. However, further, more detailed information can, of course, be supplied by the manufacturer, from one of the subsidiaries or from the TORNOS-BECHLER sales network.









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FLashback on both last years

Anton Menth

« Renouveau de TORNOS-BECHLER »

Two years ago, our company initiated the program called « Renouveau de TORNOS-BECHLER ». This « renewal » concerns as well our infrastructure as our products, our production processes and a better position on the market, with the aim of recovering the leading position that TORNOS-BECHLER once had.

What has been realized during these last two years ?

With regard to the infrastructure, we have renovated two buildings and considerably improved the flow of the production by applying a concept of production cells. Concurrently, we are concentrating our activities on the TORNOS site. These steps have allowed us to reduce the throughput time for the manufacture of a machine from what used to be in excess of 6 months to about 6 weeks. This reduction permitted us to significantly lower our operating capital, setting free the necessary funds for the renewal of our basic equipment and production means, as well as for reducing our debts.

Presently, we are installing production cells in the «Grande halle» which has been restored for this purpose. We also are converting the shed-roof building called «Grand shed» for installing the assembly department of our DECO single spindle automatics. This new assembly quarter will be operational on the TORNOS site from mid February. All these measures will allow an additional reduction of the throughput time for producing a machine. This mainly will generate the funds necessary for financing the program and expanding our production.

During the last 18 months, we significantly renewed our range of products. In spring 1996, we presented to our customers the DECO 7 automatic and in fall of the same year, the DECO 10. These machines have met a great success on the market. This success induced us to adopt a much more agressive sales politic and to launch the DECO 20 machine as soon as possible on the market. As we inaugurated our «Halle de précision» on June 20, 1997, this machine has been shown to our guests and customers during a week. Its sales success has been really overwhelming. The orders entered have doubled with regard to 1996 and the orders on hand at the end of 1997 represent a very good base for the year 1998.

Thanks to our new automatics and to the constant development of our range of products, we have obtained in the past three years a yearly turnover increase of 10%, as well as positive net results. We are starting 1998 with much optimism and on a basis which allows us to go ahead with our developments.

In the course of this year, we shall accelerate the replacement of our production means, as our infrastructure already has been considerably improved. These investments will significantly increase our productivity and consequently our margin on our products and our competitivity. New products will be developed in order to complete our range.

A program for replacing the administrative means, including the production planning, is presently in progress. Complementary steps will have to be taken this year, as our accounting system has to be replaced in view of the century change.

Furthermore, we hope to obtain the ISO 9001 qualification by this summer. This will represent an additional amelioration of our services and of our competitivity. Our customers' satisfaction always remains our first consideration.

The quality of the TB work place has been increased thanks to our new production quarters, but also to other improvements as for example the restored locker-rooms. These improvements will be carried on in the future, as in our opinion a high performance can be reached only in appropriate surroundings.

A program for early retirement has modified the professional background of our staff and reduced the age average. The number of collaborators has increased in the course of 1997, due to our important sales success.

The «Renouveau de TORNOS-BECHLER» represents a considerable modernization of our company and allows our customers as well as our staff to have an increased confidence in our company. We really can say that every work place at TB has felt the impact of this «renewal» program.

A. Menth - C.E.O

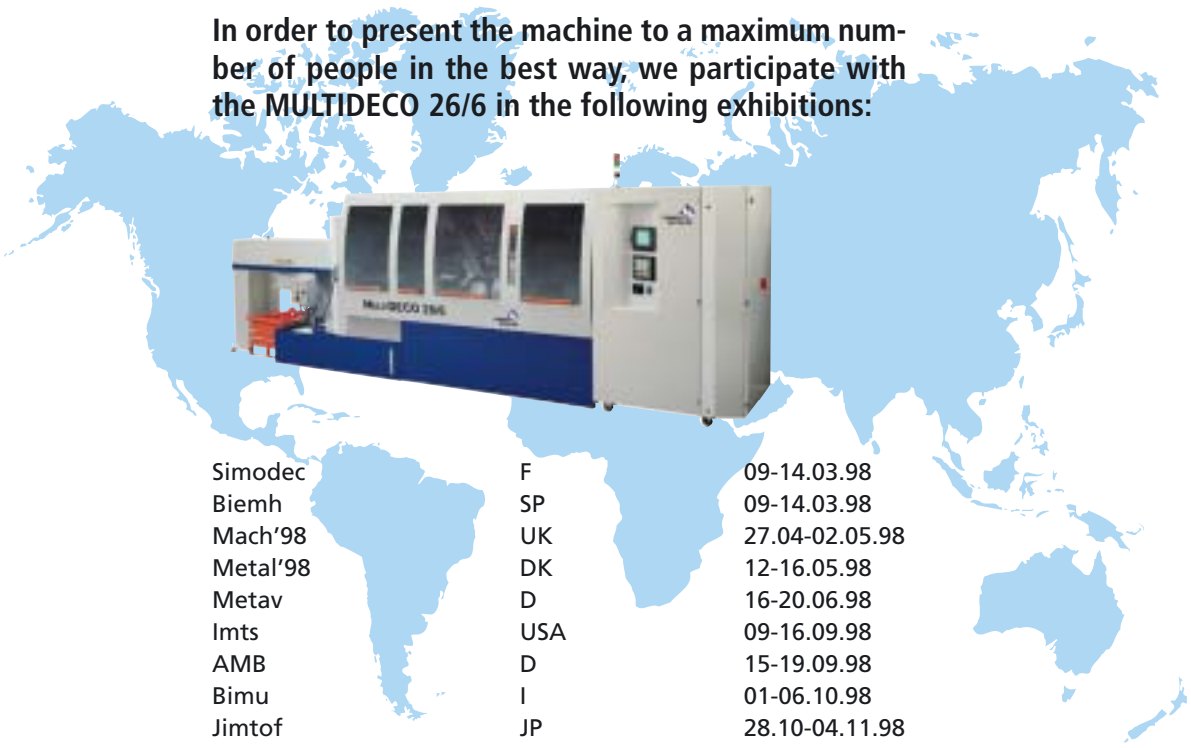
Internet competition

Our Internet server contains a competition regarding DECO 2000 and MULTIDECO. The first draw among the right answers has taken place at the end of December. Here the list of the winners whom we congratulate:

Switzerland:	Frau Schwab, Herren Lorenzo, Pfister, Chevalier, Jaggi und Nielsen
Czeck Republic:	Herr Prigyl
USA:	Herr Randy

New MULTIDECO 26/6

In order to present the machine to a maximum number of people in the best way, we participate with the MULTIDECO 26/6 in the following exhibitions:

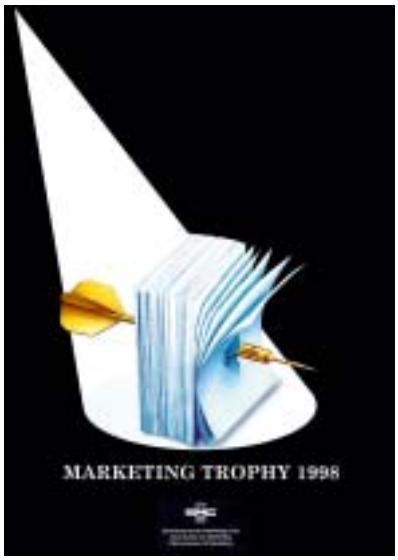


Simodec	F	09-14.03.98
Biemh	SP	09-14.03.98
Mach'98	UK	27.04-02.05.98
Metal'98	DK	12-16.05.98
Metav	D	16-20.06.98
Imts	USA	09-16.09.98
AMB	D	15-19.09.98
Bimu	I	01-06.10.98
Jimtof	JP	28.10-04.11.98

Thank you

On 21st January TORNOS-BECHLER won the Marketing Trophy 1998 for their concept DECO 2000 and the launching of DECO 2000 Capacity 20 mm. This yearly prize, which in Switzerland is awarded by the Marketing-Club Switzerland, rewards the marketing actions, which aim at better satisfying the needs and the desires of the customers.

The management insists on thanking here publicly the partners, customers, suppliers and subcontractors, who have enabled this distinction.



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