

## Special-Purpose Whirling Machines and -Attachments

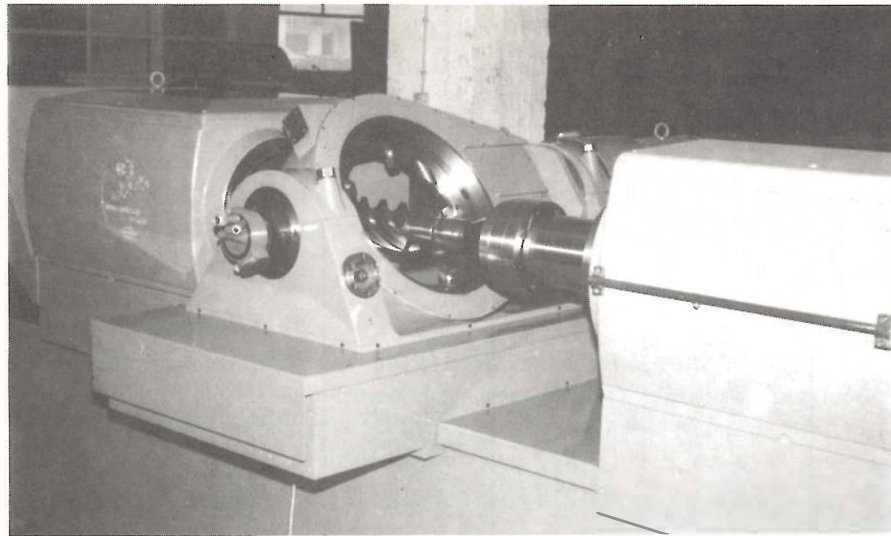


Illustration 11.  
HAW  
Horizontal generating whirling machine  
with electric sequential control producing  
compressor screws in only one pass

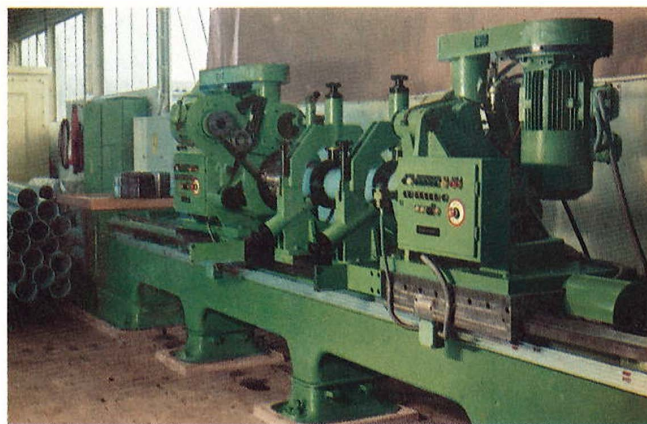


Illustration 12.  
Automatic thread whirling machine consisting  
of two whirling units on one bed, for the simultaneous  
machining of two opposing threads — one internal,  
one external — on a stationary workpiece

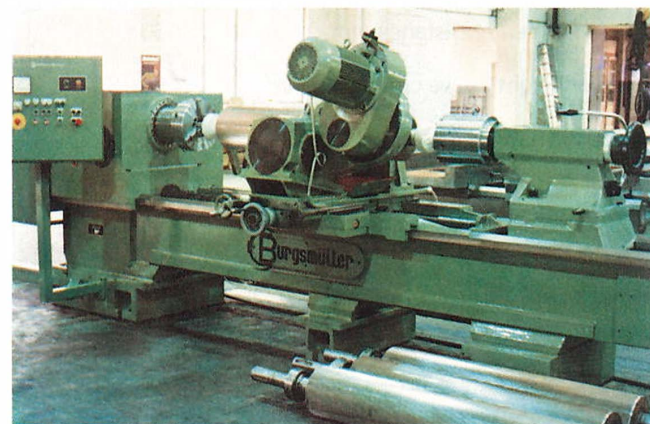


Illustration 13.  
Special machine for producing crushers of oil mills.  
Saved machining time 70 % to 90 %.  
The crushers include high pitch angles.  
Multi starts by NC control.

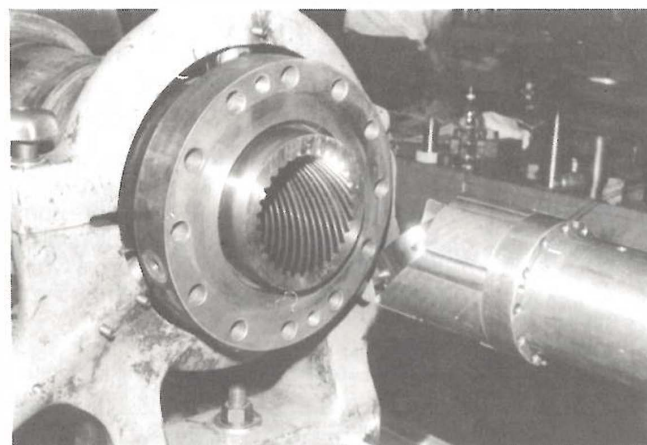


Illustration 14.  
LM5 whirling unit for long internal threads  
producing multi start internal threads with  
extremely accurate pitches. Even internal  
keyways may be machined with this unit.

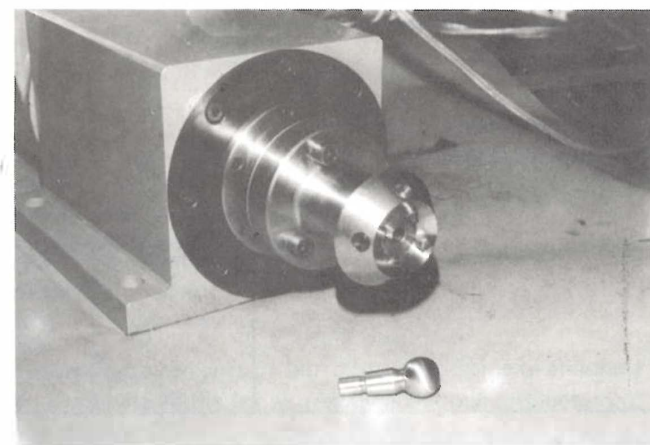
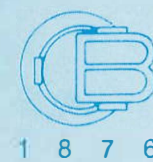


Illustration 15.  
Special ball whirling unit K 1 for machining balls.  
The tailor-made bearings of very high precision give  
the opportunity of high production efficiency combined  
with an accurate geometry of the produced balls.

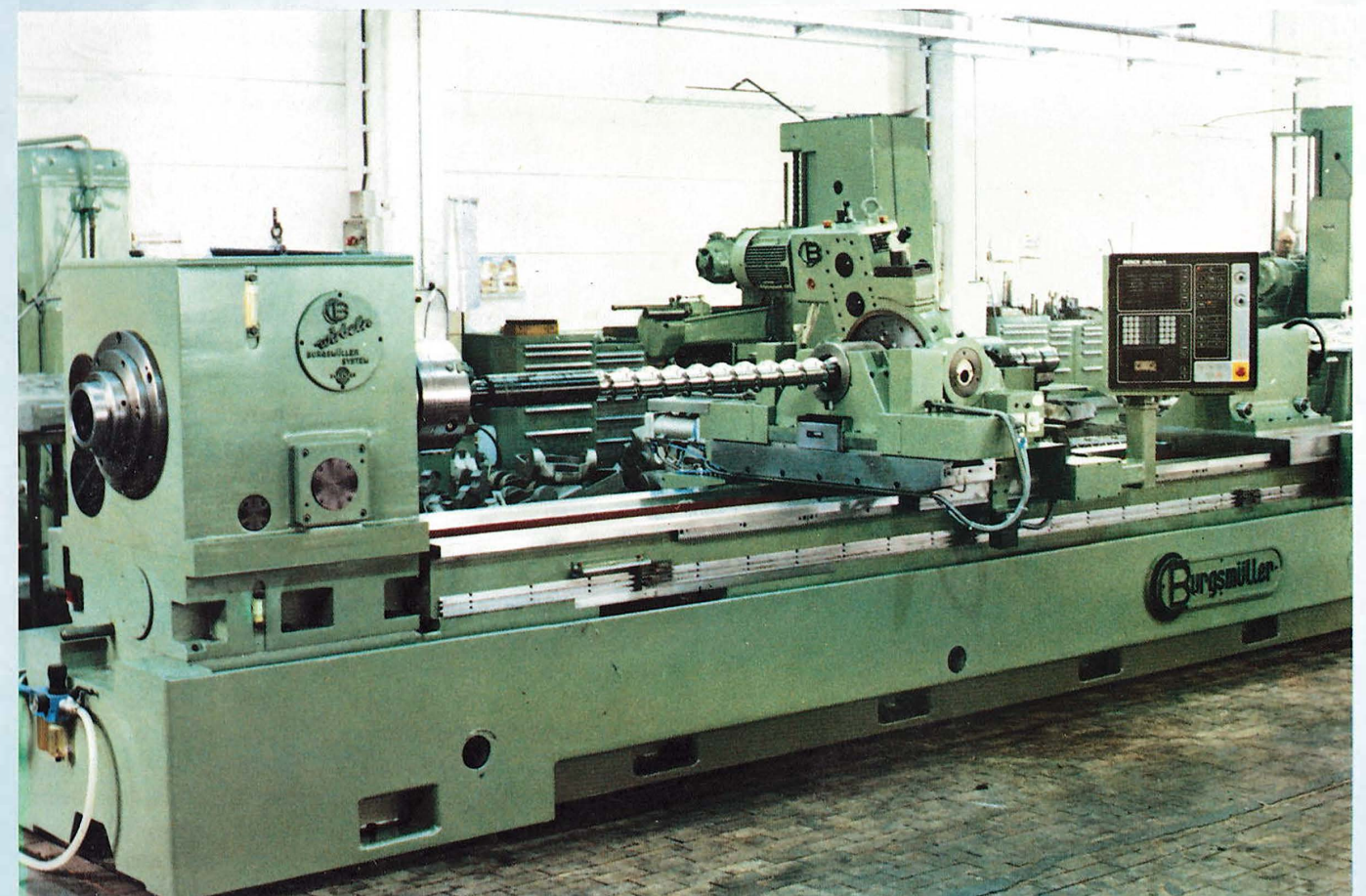
**H. BURGMÜLLER & SÖHNE GMBH · D-3350 KREIENSEN**  
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# BURGMÜLLER

## KREIENSEN

### Whirling-Information



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A SURVEY OF WHIRLING MACHINES



## The whirling technique

For the accurate production of all types of threads economically, the Burgsmueller whirling machines and attachments are designed to give savings of up to 90% on machining times compared to conventional machining methods.

An assumption that no distortion of the workpieces, such as leadscrews, will occur, even at high cutting speeds, is based on the following theory. (III. 1). The workpiece (A), leadscrew with a thread depth of 5 mm, is rotated slowly counter clockwise at 9 r.p.m. about a centre (a). The toolholder ring (B) equipped with four carbide tipped cutting tools (c, d, e, f) is eccentrically displaced by the dimension (a-b) and rotates, also counter clockwise at 900 r.p.m., i.e. 100 times faster than the workpiece. Due to the eccentric displacement of the whirling head, the tools only cut on their way (g-h). The tendency of any heat generated to flow into the workpiece is indicated by the small arrows. However, before the heat can enter the workpiece, the next cut follows almost in the same place, thus rapidly removing nearly all the heated area.

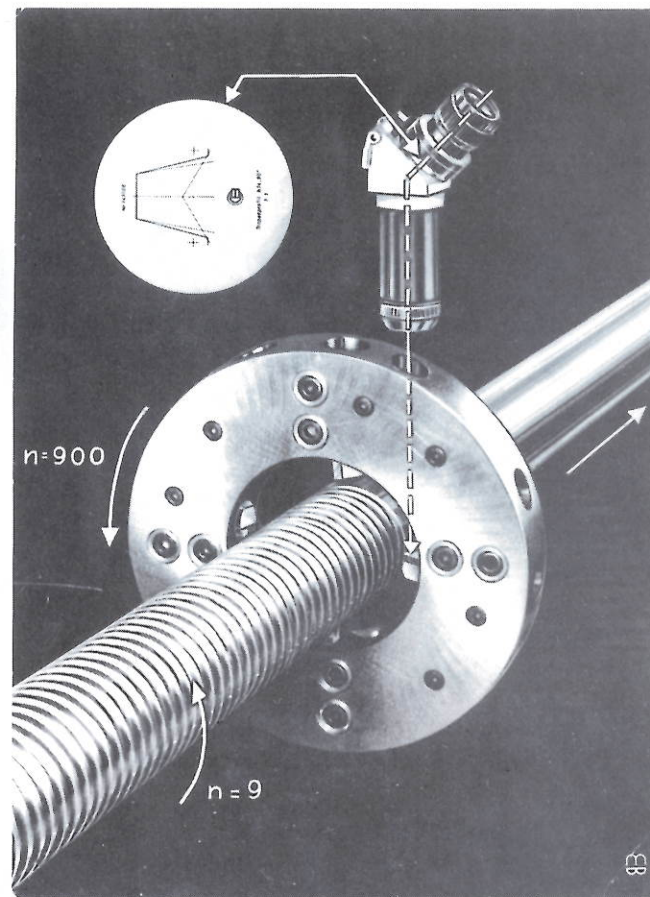


Illustration 2.  
Optical setting of tools with profile graticule

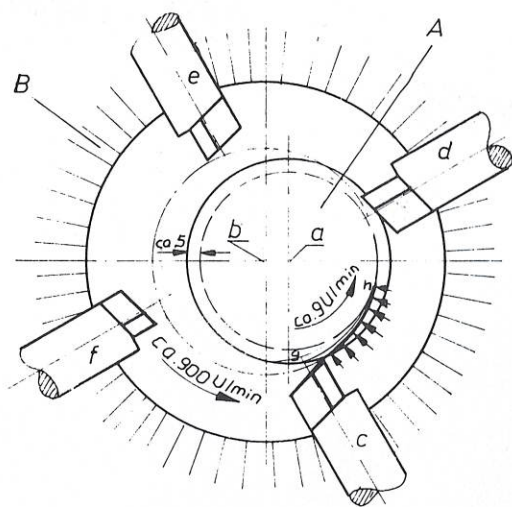


Illustration 1.  
Diagram of the whirling practice

The rapid and accurate setting of the tools in the toolholder rings done with the built in Burgsmueller microscope (III. 2). In this optical system, an interchangeable profile graticule, supplied by us, is installed, using the tool profile corresponding to the profile of the thread to be machined. The tool profile may even be divided into different cutting edges. The profile of the tool shown in the graticule with a 10x or 5x magnification is calculated for highly accurate trapezoidal threads and also for threads with special profiles (and includes correction of profile) with our own computer, by means of an ED programme developed and patented by us. This usually requires the co-ordinates or dimensions of the thread profile at right angles to the thread. If these dimensions are not available, we are able to accurately measure a finished workpiece supplied by the customer.

To avoid the loss of expensive machining time, different systems of clamping tools or caskets with throw-away tips have been developed. With this pre-setting facility of setting the tools outside the machine or the attachment, the graticules may be used in a pre-setting microscope which can be supplied by us.

## Basic information on standard whirling machines WM 145 - WM 450

The best condition for the production of threads or screws with special profiles, requiring absolute pitch accuracy and a high degree of precision, is by the use of a suitable whirling machine. The design of these machines allows machining of nearly all external and internal threads and keyway profiles by the quick and simple exchange of different attachments.

A range of machines is available, differing in size and equipment relative to the workpiece diameter and production requirements. These can be supplied as completely mechanical (III. 7) or equipped with C.N.C. 3 or 4 axis.

These whirling machines may also be used for the very efficient production of keyway shafts or nuts by installing the corresponding attachments. When producing keyway shafts, each keyway is whirled separately in one pass. During the automatic indexing, the support and whirling unit pass in rapid traverse to the headstock, ready for commencing the next keyway (III. 8).

A rigid base bed with high precision flat guideways gives the provision for continuous production even under arduous machining conditions. There are no special foundation requirements for the machines.

The main spindle is housed in a robust ribbed headstock and is supported by extra-dimensioned special roller bearings, thus providing the optimum condition for the whirling cut and producing the best possible surface finish of the whirled profiles. The drive of the main spindle is through a worm gear and is infinitely variable and corresponds in power to the relative machine size and requirement.

The clamping of the workpiece (chuck and tailstock) may be done manually or automatically.



Illustration 3.  
Front steady rest with coolant pipe

Screws with a length of more than 8x diameter should be supported in steady rests with suitable bushes containing a coolant circuit (III. 3 and 4). The oil emulsion coolant is of benefit in the dampening of vibrations. When whirling close to the chuck, the steady rest may be separated if necessary.

For the production of tapered external and internal threads or extruder and mixer feed screws with tapered core, a mechanical copying device with interchangeable master bars is mounted to the rear of the cross slide.

### Correction of pitch error

When whirling machines with mechanical equipment, a mechanical pitch correction device is available. The correction is applied via a lever with a scale of 5/100 mm. More precise corrections (1/100 mm) are performed with a dial indicator. The complete correction range is 0-2 mm constant. For the performance of variable corrections, a whirling machine equipped with C.N.C. is necessary.

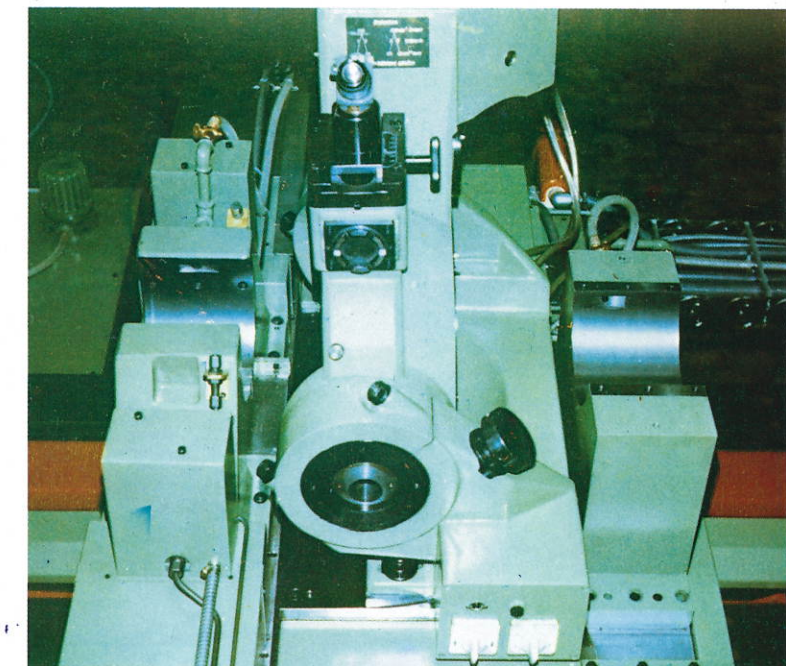


Illustration 4.  
Assembly of steady rests. Front steady rest divided

### The Numerical Control

Whirling machines type WM 145 to WM 450 may be supplied with an interpolating 2, 3, or 4 axis C.N.C. system (front page). The complete whirling programme is fed into the panel and may be stored by a recorder on a magnetic tape. Corrections of pitch as low as 1/1000 per revolution, constant or variable, in any thread length may be achieved. The change of pitch is no longer achieved by change gears, but is programmed through the numerical control, while the drive is applied to the leadscrew by means of a worm gear with all backlash eliminated.



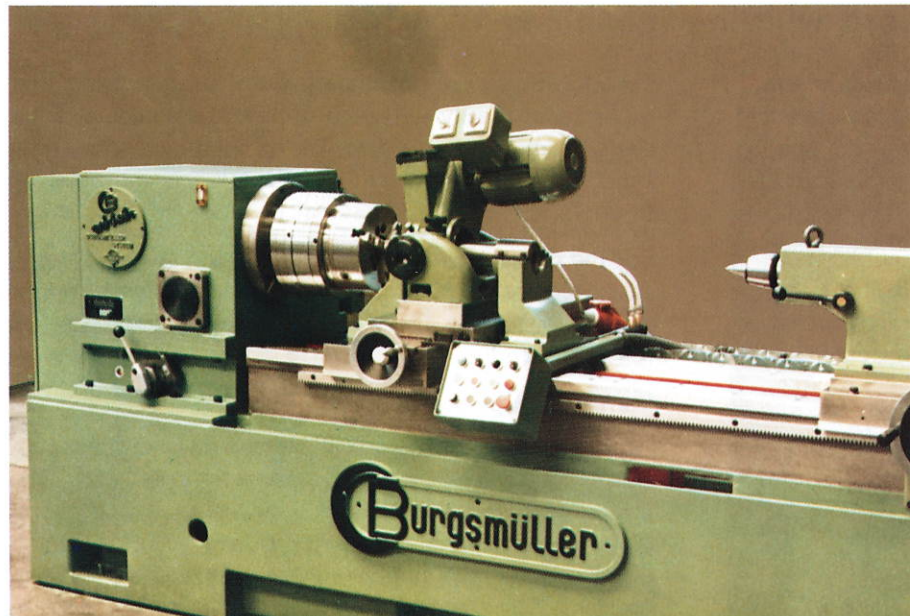


Illustration 5.  
WM 145 mechanical with L 3/Min  
whirling unit for  
external threads



Illustration 8.  
WM 220 C.N.C.  
with N 3 producing  
keyway shafts

Illustration 6.  
WM 220 x 6000 CNC  
with L 4 unit  
producing ballcrews

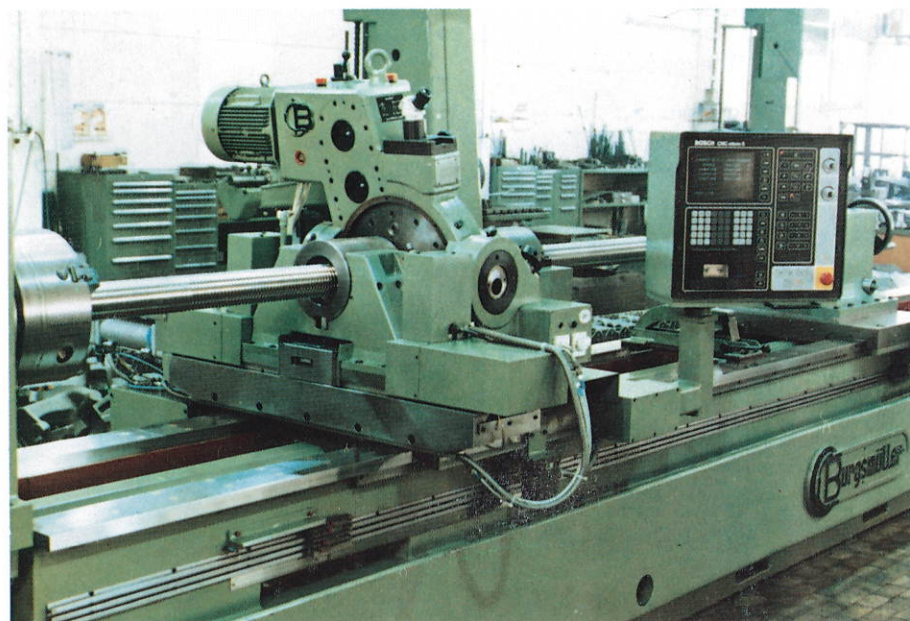


Illustration 9.  
WM 280 x 2000 mechanical  
with L 5/min unit  
for the production of  
multistart worms

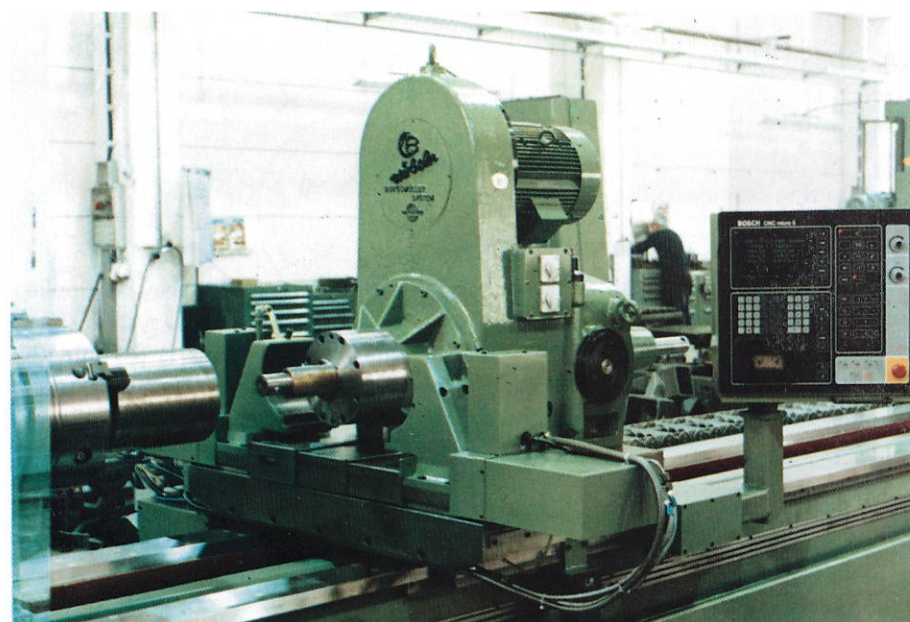
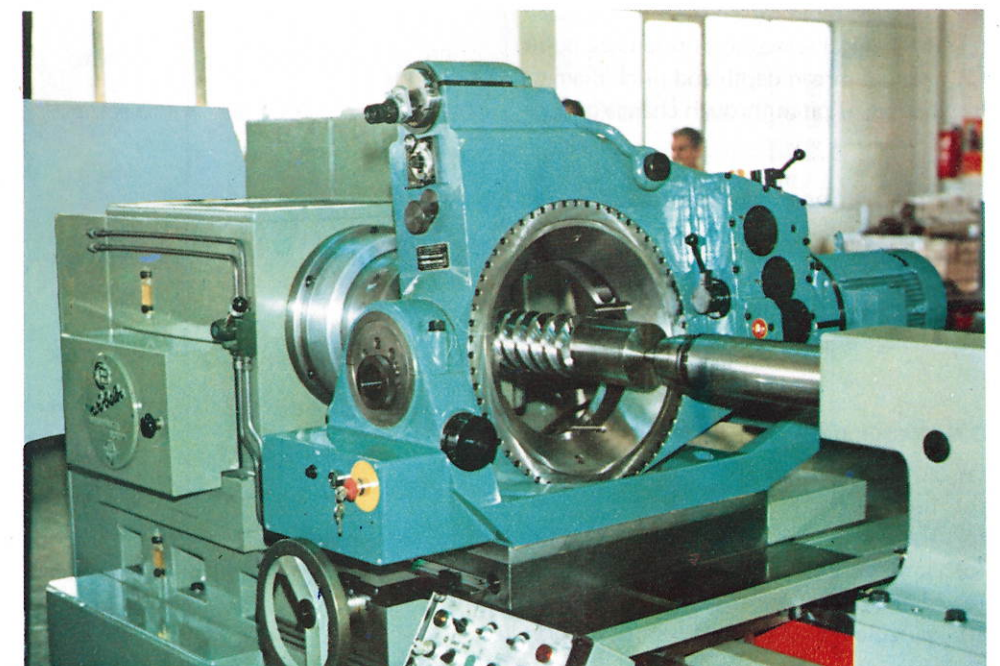


Illustration 7.  
WM 220 CNC  
with HW 2 whirling unit  
for internal threads

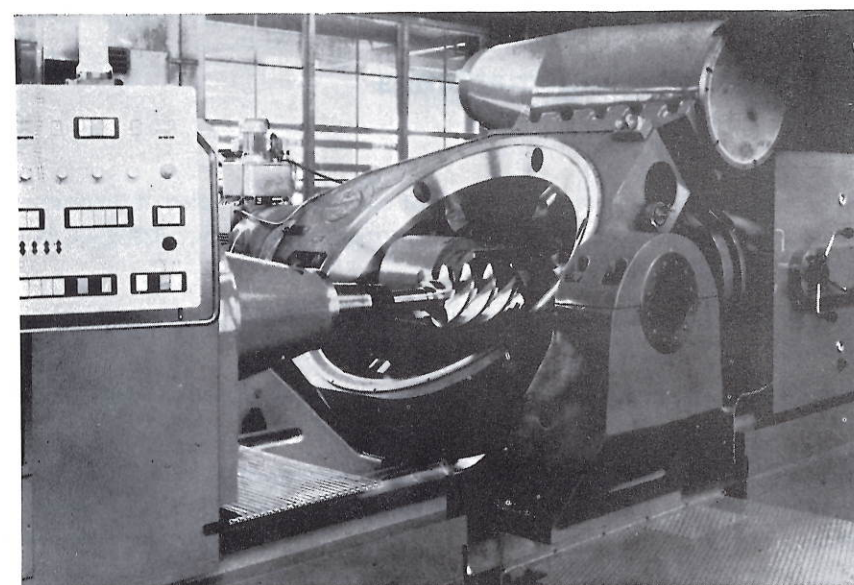


Illustration 10.  
WM 900 mechanical,  
equipped with electric sequence control  
and an L 7 whirling unit producing a rotor  
for screw compressors,  
in continuous cycle  
(each start individually)



# Description of standard whirling machines

## WM 145. Mechanical equipment

- (a) manual thread depth and pitch diameter correction
- (b) dividing by change gears
- (c) constant rapid return travel of support
- (d) mechanical selection of reference point
- (e) change of pitch through change gears

## WM 145. Sequence control

- (a) automatic thread depth and manual correction of pitch diameter
- (b) manual dividing, but with special indexing device on headstock for rapid indexing
- (c) rapid return travel of support with automatic selection of reference point
- (d) change of pitch through change gears

Mechanical adjustments of pitch correction and pitch diameter also available.

## WM 180. 220. 280. 450. Mechanical equipment

- (a) manual dividing (rapid indexing)
- (b) constant rapid return travel of support
- (c) mechanical selection of reference point
- (d) manual thread depth and pitch diameter corrections
- (e) change of pitch through change gears

## WM 180. 220. 280. 450. Electric sequence control

- (a) fully automatic cycle for external and internal threads and keyway shafts
- (b) manual dividing (rapid indexing)
- (c) constant rapid return travel of support
- (d) change of pitch through change gears

## C.N.C. equipment

- (a) automatic dividing
- (b) fully automated production
- (c) automatic selection of reference point
- (d) automatic thread depth and pitch diameter correction also when whirling in two passes (roughing and finishing)
- (e) changing and correction of pitch by NC system
- (f) variable rapid return travel of support

# HAW, MA and other special purpose whirling machines

Many special whirling machines have been developed covering the special requirements of our customers. Some of these are shown in Illustrations 11 — 13; eg. the horizontal generating whirling machine allows for extremely economic production of multi-start worms and rotors for compressors requiring a high degree of accuracy.

Different multi-action whirling machines operating on a common base, using the planetary movement of the rotating toolholder around the workpiece and in the bore of a workpiece.

With these machines, the advantages of the whirling process may even be used for the production of components which may be stationary or only rotating slightly.

A detailed description of these special purpose machines is not possible in the confines of this survey of whirling machines. Please do not hesitate to ask for information, which may be of benefit to your special problem or application. A brief description is given of some of these illustrated below.

# Technical Data of Standard-Whirling Machines

	Typ					
	WM 145	WM 180	WM 220	WM 280	WM 450	WM 900
Rotation of main spindle (workpiece) min. <sup>-1</sup>	ca. 1—50	ca. 1—30	ca. 0,5—30	ca. 0,05—6 o. ca. 0,1—10	0,05—20	0,05—5
Driving Power KW	ca. 1,5	ca. 2,5	ca. 2,5	ca. 2,5	ca. 5	17
High speed travel up to mm/min.	3000	3000	3000	3000 infinitely variable	2000 infinitely variable	2000 infinitely variable
Bore of main spindle mm	60	81	101	101	220	—
Bore of main spindle special mm		101	121	121		
Spindle nose (DIN 55022)	Gr. 8	Gr. 8	Gr. 11	Gr. 11	Gr. 15	special
Range of center distance mm	1000—6000	1000—6000	1000—6000	1000—8000	1000—8000	1500
Center height above cross slide mm	145	180	220	280	450	900
Bed width mm	ca. 400	ca. 400	ca. 630	ca. 630	ca. 800	970
Total height mm	ca. 1200	ca. 1500	ca. 1500	ca. 1600	ca. 1800	ca. 1750
<b>Purposes:</b>						
External threads, max. Ø mm	50	100	200	300	420 larger diameter on request	Tr. — 1000 rotors up to
Internal threads, max. Ø mm	250	400	500	700	1000	—
Worms, max. Ø mm up to module	30 4	60 8	110 12	160 16	— 20 larger diameter on request	800 ca. 36
Workpiece diameter of keyway shafts, max. Ø mm		200	250	350	500 larger diameter on request	—
<b>Especially suitable for the production of:</b>	Screws of small diameter, all types of drills, small internal threads, worms	High precision threads on lead screws and nuts, modular threads, all types of drills.	Modular worms, extruder- screws, lead screws keyway shafts, all types of drills	Extruder- and mixing screws, heavy internal and external threads, large keyway profiles.	See WM 280	Rotors for screw compressors multi start worms with high pitches.

You will find the technical data of our HAW, MA and other special purpose whirling machines in the corresponding special information leaflets.