JPRS L/10495

6 May 1982

USSR Report

CONSTRUCTION AND EQUIPMENT

(FOUO 3/82)

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

APPROVED FOR RELEASE: 2007/02/09: CIA-RDP82-00850R000500060008-2

JPRS L/10495

6 May 1982

USSR REPORT

CONTRUCTION AND EQUIPMENT

(FOUO 3/82)

CONTENTS

METALWORKING EQUIPMENT

UDC [061.4:621.822]"1981"

REPORT ON EXPOSITION "PODSHIPNIKI-81" [BALLBEARINGS-81]

Moscow STANKI I INSTRUMENT in Russian No 10, Oct 81 (signed to press 12 Oct 81) pp 33-37

[Article by V. I. Antipov and V. A. Potapov: "'Ballbearings-81' Exhibit"]

[Test] The international "Ballbearings-81" exposition, in which more than 100 companies from 15 countries took part, was held from 25 March through 8 April 1981 at the Sokol'niki Exhibition Complex in Moscow. The exhibit occupied over 7,000 m^2.

Here, we offer descriptions of the designs and specifications of several exhibits by foreign companies.

Spindle assembly ballbearings were shown by Gamet, Nadella and Timken France (France) and FAG (FRG). A majority were precision bearings, which high manufacturing precision and high-quality connecting surfaces, resulting in a high upper limit and extended range of spindle rotation speeds for spindles mounted on these bearings.

Gamet offered single- and double-roller bearings with full rollers for lubricants. The following types are produced: single-row (type C) with or without bearing collar (25-506 mm fit openings, rotation speeds of 10,200 to 760 rpm); single-row (type P) with a wide outer race and lubricant holes, as well as holes along the outer race face for installing springs (25 - 177.8 mm fit openings, rotation speeds of 10,200 to 1,800 rpm); single-row (type Hydro P) with a wide outer race with lubricant holes and holes around the face for installing springs using an additional pretightened race whose tension is regulated by outside pressure; fit opening diameter and rotation speeds are as in the type P bearings; double-row (type G) with a flush outer race and lubricant openings (25 - 506 mm fit openings, rotation speeds of 10,200 to 760 rpm); double-row with a wide outer race with collar, fit openings and rotation speeds as for type G bearings; double-row (type HVE) for use in high-speed spindle assemblies (35 - 210 mm fit openings and rotation speeds of 9,500 to 2,100 rpm).

Gamet also demonstrated a lathe spindle with chuck. The spindle design uses special ballbearings through which the chuck drive pressure fluid moves. This permits eliminating the hydraulic cylinder usually located on the spindle's rear race, inasmuch as it is designed as part of the chuck. It is the company's opinion that this permits decreasing the spindle's moment of inertia and freeing the rear race for the addition of other mechanisms or devices (if necessary).

One merit of this spindle design is the use of a double-row roller bearing, with the races located a considerable distance from each other, significantly increasing the unit's rigidity. The pressure fluid is fed through a baffle race clamped between the inner bearing races and precisely centered on the spindle at a point where the spindle strain under external load is minimal. A small gap is anticipated between the outer bearing race and the baffle race.

The precision parameters of the Gamet ballbearings used in the spindle units are described by the following data: clearance along inner fit diameter (d) and outer diameter -- +0.005 mm (for $d \leq 180$ mm) and +0.010 mm (for d>180 mm); radial play for inner and outer race rotation -- 0.0015 and 0.003 mm, respectively ($d \leq 180$ mm) and 0.001--0.004 and 0.003-0.006 mm, respectively (d>180 mm); end play of both the inner and outer races -- 0.003 mm (for $d \leq 180$ mm) and 0.008 mm (for d>180 mm).

Nadella demonstrated a wide range of needle bearings for various machine tools, including ones for drilling and boring machine gear boxes controlling wobble in various types of machine tools and spindles in lathes, boring and grinding machines, and other machine tools.

Figure 1 shows a boring machine spindle mounted on precision needle bearings (with retainer and control clearance) of the Na204Delta (forward race) and Na2035Delta (rear race) types . The outer bearing race strain is compensated for by plate-type springs adjusted to a certain tension. The unit also uses two needle thrust bearings of the AXJ7 4062 type, between which a baffle race is installed. This spindle design ensures a rotation of up to 8,000 rpm. [Caption to Figure 1, not reproduced for this report: Boring machine spindle mounted on Nadella (France) needle bearings.]

Figure 2 shows the forward bearing assembly of a milling head using a Na2025 Delta precision needle bearing with no outer race, but with retainer and control clearance; an HRC 60 tempered spindle journal serves as the race. The bearing is preloaded by a screw to a special-shaped spring resting on the expansion race lugs. Maximum spindle rotation speed is 1,400 rpm. [Caption to Figure 2, not reproduced for this report: Forward bearing assembly of a milling head with Nadella (France) bearings.]

The Timken France exhibit offered materials showing examples of the use of company bearings in machine tool spindle assemblies. A majority of the spindle assemblies (using this company's bearings) are of the double-seat type. For example, in the spindles of the MD5 NPC [numerical preset control] lathe (Gildemeister, FRG), the Heynumat 2 (Heyligenstaedt, FRG), the Producent S1 (Bohle, FRG) and BZ30 (Steinel, FRG) multiple-operation machines, the UF21 multipurpose milling machine (SHW, FRG) and the 200-8 eight-spindle chuck automatic machine (Wickman, Britain).

The company recommends that Hydra-Rib bearings with a sliding race permitting adjustment of bearing clearance during operation be used in spindle assemblies with high rotation speeds. Spindle units with such races have optimum dynamic specifications. Figure 3 shows a Producent S1 spindle mounted on Hydra-Rib bearings (100 mm fit opening, rotation speed of 11,200 to 4,500 rpm, transferable power of 11 kW). [Caption to Figure 3, not reproduced for this report: Bohle (FRG) Producent S1 multiple-operation machine tool spindle on Timken France (France) Hydra-Rib bearings.]

The FAG exhibit was one of the most representative. It demonstrated bearings, grinder spindle units, apparatus for monitoring parts quality (including bearing races)

and so on. This company's bearings are used in various types of machine tools, as for example, spindle assemblies and swivel tables of heavy-duty NPC boring and turning lathes (the Innocenti Company, Itals) with ϕ7000 mm faceplates. Moreover, FAG bearings are used in machine tools made by Pittler, Traub, Hüller-Hille and Kieserling (FRG) and Saimp Utita and Canavese (Italy).

Figure 4 shows a Heysomat 20 (the Heyligenstaedt Company) duplicating lathe spindle using a series FAG NNU 4924 SK MSP roller bearing on the front race and two series FAG 751124 MA.SP thrust bearings (angle contace) and a series FAG NN 3019'K.S.P. roller bearing on the rear race. Maximum spindle rotation is 2,800 rpm and transferable power is 45 kW. [Caption to Figure 4, not reproduced for this report: Heysomat 20 duplicating lathe spindle (Heyligenstaedt Company, FRG) with FAG bearings (FRG).]

Nine foreign companies demonstrated equipment (21 units) for abrasion-machining rocker bearing parts. Inasmuch as the machines are intended basically for mass production, they are not equipped with NPC installations.

The largest number of grinders was presented at the GDR display. Among them, we should note the SWäAGL50 automatic cylinder-and-cone grinder (Figure 5), which is intended for grinding inner bearing races to ϕ13-63 mm. This machine, which is built into an MLRWR63 automatic line, does the final machining of a raceway set on stationary supports. Maximum circumferential speed of the grinding wheel installed on the FAG radial thrust bearings is 100 m/sec. The cutting feed is done by a moving grinding headstock equipped with flat and V-shaped race guides. A static frequency transformer is used to regulate the grinding wheel rotation speed. Precision is: tolerance -- 0.008 mm; out-of-round, faceting and rippling -- 0.0015 mm; roughness of machined surface -- R_a=0.4 μm. [Caption to Figure 5, not reproduced for this report: SWäAGL50 automatic cylinder-and-cone grinder (GDR).]

The centerless automatic cylinder-and-cone grinder based on the SASL 125 (GDR) in the traditional configuration (with a movable drive wheel headstock) is intended for maching barrle-type shaping rollers and is equipped with a loading-unloading installation. Two rollers in-feed grind profile circles simultaneously. The circles are guided by a contour follower using single-point diamend tools. The roller monitoring measurements are made outside the machine tool working zone. The control installation makes adjustments based on measurement results.

Enterprises of the GDR and Czechoslovak SSR and Japan's Seiko-Seiki Company demonstrated internal grinders for machining bearing races. Gamfior (Italy) demonstrated several high-speed race-mounted spindles and one spindle on hydrostatic mounts.

Specialists took an interest in an experimental Czech BDL 50A NPC equipped and intended for grinding holes 10-50 mm wide and up to 40 mm long in bearing races. The transverse feed drive and table pitch are changed by hydraulic cylinders controlled by servo valves. Inductive pick-ups provide feedback on table pitch and grinding heatstock position.

Switches on a broad connected to the control cabinet set cutting speed, feed and machining allowance, oscillation frequency and amplitude, amount of compensation, number of cycles between wheel adjustments or adjustment orders within a cycle, as well as operation by cycle, with an active monitoring device or with on-track monitoring. Diameter precision is 6 μm, taper precision -- 1.5 μm, out-of-round -- not

more than 2 μm and roughness -- R_a=0.32 μm. Electric grinding spindles are set in motion by static frequency transformers which ensure a spindle rotation speed (stepless regulation) of 20,000 to 87,000 rpm.

In the Sig-0-MB automatic internal grinder (Figure 6) offered by Seiko-Seiki (Japan), the item is set in a rigid chock and roller; the unit is for making bearing race fit openings (external diameter -- 1.5 - 16 mm, internal diameter -- 1-9 mm). It is turned by a drive roller, and a hydraulic cylinder clamps the piece to the end race. This eliminates knurling on the parts. The transverse and axial adjustment tables and sealed hydrostatic guides are independent units installed on a welded base. The machining can be ordered with an adaptive control system (stabilizing piece precision by maintaining a constant removal speed when taking off the final allowance), as well as a machined-piece monitoring system. The high-frequency grinding spindle drive (also manufactured by the company) is 0.35 kW, wheel rotation speed is 100,000 to 150,000 rpm and warranteed service life is 1,000 hours. [Caption to Figure 6, not reproduced for this report: Seiko-Seiki (Japan) SIG-0-MB automatic internal grinder.]

The unitized machine tools offered by CZM (Strakonice, Czechoslovak SSR) for (in-feed) grinding internal ballbearing races comes either automatic (model BEL214) or semi-automatic and automatic (model BEL 217). The grinding headstock and piece headstock are installed on the machine's stand. The piece headstock has magnetic clamping and feed devices and two sliding supports for the piece being fed in. All working movements in the cycle are done by the grinding headstock. The wheel is adjusted automatically at a prescribed adjustment interval determined by the number of raceways being machined: 1-63 (model BEL 214) or 1-31 (model BEL 217).

The cycle is controlled pneumatically and the control impulses are electrical. The machine can be ordered with an active monitoring device. The diameter of the race being ground (at speeds of up to 55 m/sec) is 5-30 mm (model BEL 214) or 55-225 mm (model BEL 217). Piece dimensional precision is ±0.01 mm, surface roughness is R_a= =0.024 μm and rippling is less than 0.8 μm.

Superfinishing and finishing machines were offered by Grieshaber, Supfina, Thielenhaus and Peter Wolters (FRG) and ZVL (Považska Bystrica, Czechoslovak SSR). The SM450 automatic centerless superfinishing machine equipped with bunder feed (Figure 7) offered by Supfina (with several superfinishing heads) is intended for machining 0.8- to 10-mm needle bearings in one pass. Each head has rail clamping force adjustment independent of the piece being machined. Needle speed across the rollers is 2 m/min. Machined surface roughness is R_a=0.02÷0.03 μm, out-of-round is less than 0.1 μm and noncylindricity is less than 1 μm. [Caption to Figure 7, not reproduced for this report: SM450 superfinishing machine, Supfina Company (FRG).]

The SFM 7702 automatic superfinisher made by Grieshaber is intended for superfinishing the bearing races, shafts and bushings (ϕ10-40 mm, length 20-170 mm) of water pumps. It has four working positions, in which two races can be worked simultaneously on one shaft. Shaft productivity for ϕ15 mm is five pieces per minute, surface roughness is R_a=0.06 μm and race out-of-round is less than 0.5 μm.

The automatic superfinishing machines produced by the Czechoslovak SSR are intended for machining outer and inner radial single-row bearing races with outside diameters of 6-16 mm (model DSLT 1/16) and 16-35 mm (model DSLT 2/35). The DSLT 1/16 is a single-spindle machine and the DSLT 2/35 is a double-spindle. Races on sliding

supports are secured using electromagnets and adjustments are made hydraulically. On these machines, surface quality is improved 80-90 percent and rippling and out-of-round decrease 65-75 and up to 50 percent, respectively.

Peter Wolters Company demonstrated double-disk vertical finishing machines. On the AL1H, with active monitoring and set up to work the faces of bearing races up to 200 mm in diameter and 80 mm high, the operating cycle can be set from a control panel. The finishing disks, the upper one of which is hydraulically clamped, are 690 mm in diameter.

The AL00-1Z (Peter Wolters Company), which is equipped with 445-mm wide finishing disks, is intended for machining needle and cylindrical rollers up to 35 mm wide and 100 mm long. The blank is first precision-ground. The AL-00 (same company) is intended for plane-parallel machining (between 310-mm finishing disks) the faces of bearing races 1-80 mm in diameter. The faces are set in retainers and make a planetary motion produced by a lantern reduction gear. The disk rotation speed is continuously variable. The machine is equipped with active monitoring.

The automatic MLRWR 63 line (GDR) is intended for abrading the inner races of ball-bearings with races 25-63 mm in diameter and 12-30 mm long. The line, consisting of an automatic SWäAGL50 cylinder-and-cone grinder (for external grinding of the race), a S1W3B automatic internal grinder (for grinding the inner race opening) and a SZW4 automatic superfinisher (for superfinishing the raceway), uses magazines with removable bins, which increases its productivity.

Up to 6,000 races can be put into the removable bin, which is in the shape of a cube with sides 1,000 mm long. Each bin consists of 24 flat casettes into which the races are placed. The transport installation includes hoists and a pan system in the form of flexible belts. Transfer storage units with a capacity of 250-300 races each are located between machines. The presence of parts in the transport system is monitored by pneumatic sensors. The line's use coefficient is determined basically by the operation of the internal grinder, whose efficiency is in turn dependent on the durability of the grinding wheel (approximately 100 races). The electrical equipment element base of the line is very reliable. The electrical control circuits are contactless sensors with a signal voltage of 12 V.

Cutting and auxiliary tools were exhibited by Sandvik (Switzerland), which showed an extensive line of cutting tools (various types of blades, cutting points, drills with multifaceted rotating blades, milling cutters), as well as the Varilock auxiliary tool set (Figure 8, not reproduced for this report. Caption: Varilock auxiliary tool set (Sandvik Company, Switzerland): a) system 80; b) system 63; c) system 50).

The Varilock set was conceived as a multipurpose system for fastening tools in the spindles of multiple-operation machine tools and was structured on a base of mandrels with ISO40 (system 50), ISO45 (system 63) and ISO50 (system 80) couplings, reducers, chucks, extensions and tool assemblies. The tools comprising the set are intended for a broad range of operations, from rough milling to precision boring.

The system 80 and 63 reducers are interchangeable. The elements comprising the system are connected by a central bolt (with a cutting-fluid opening), permitting use of internal cutting-fluid supply tools (the T-MAX, for example) and tools for machining shallow openings. When special tools are used, the set includes movable hone holders

and semifinished blanks for manufacturing various tools (multiple-blade honing tools, for example).

Measuring devices were demonstrated by Marposs (Italy), Rank Taylor Hobson (Britain), FAG (FRG) and Steyr (Austria), as well as by CEMA member-nations. The Marposs Company demonstrated a Minialsar active monitoring unit used in circular grinding of smooth and noncontinuous shafts. The range of adjustment of the two-contact clamp is 3-90 mm. The company also offered devices for step-monitoring shafts and openings. The device consists of a Testar-type metering unit and manual internal gages, clamps and races with inductive transformers. The company demonstrated a multipurpose modular measuring device for monitoring six parameters of variable-speed shafts.

One feature of the Rank Taylor Hobson Company's exhibits was the use of computer equipment for processing measurement results, permitting automation of that process and significantly increasing measurement precision. The computer equipment is used in combination with a Talyrond 73-3R "kruglomer" ["roundness meter"] (enlargement factor up to 200,000) and with a Talyserf 5T-120-3A for measuring surface roughness and rippling. In addition to greater measurement precision, this provides an opportunity for increasing the number of parameters being measured. The company also demonstrated a Talycontor macroprofilograph for monitoring the shape of circular parts, and bearing races in particular. The device has automatic vertical bit movement drive with a stop (when necessary) in the middle of the measurement range.

The FFA "roundness meter" made by Steyr is intended for monitoring bearing races (outside diameter 26 - 160 mm, inside siameter 10 - 105 mm). The device can be built into automatic complexes intended for machining bearing races.

11052
CSO: 1821/028

END