Due to the thirty-year development and experience in the field of design and construction of special-purpose machine tools we rank among the most successful producers of special-purpose technological equipment. At the beginning of 60's, we designed and constructed in TAM the first transfer line for complete machining of cylinder heads, which constituted the first solution of this kind in Yugoslavia.
Adaptable Machining Systems

From the production of non-flexible automatic machine tools we switched over to the production of adaptable machining systems featuring the following advantages:

— reduction of waiting times and thus greater utilization of machine tools
— machining of different workpieces simultaneously
— in case of damage of a part of the system the machining is not interrupted, but only the number of workpieces reduced
— reduction of manual work and high productivity even with minor series.

In designing the machining systems we keep to the principle of graduality. The Fig. 1 shows an adaptable machining system with two machines SAMO. In general use are systems with four or more multi-operational machines (Fig. 2).

Fig. 1

1. SAMO
2. Chip removal plant
3. Clamping point
4. Unclamping point
5. Conveying system
6. Pallet magazine
7. Chip conveyor + cleaning plant
8. Tool magazine
9. Tool cassette
10. Cassette conveying vehicle
11. Adjusting — measuring the tools
12. Manipulator
13. System control
14. Chip conveyor
15. Operator
16. Conveying path for tool cassettes
1. SAMO 1
2. Guard rail of pallet magazine
3. Chip removal plant
4. Clamping point
5. Unclamping point
6. Conveying system
7. Pallet magazine
8. Tool magazine
9. Tool cassette
10. Cassette conveying vehicle
11. Adjusting — measuring the tools
12. Manipulator
13. System control
14. Operator
15. Conveying path for tool cassettes
The production systems are set up acc. to the modular design principle from type- or specific modules. The modules are functionally rounded off units and have the ability of integration in higher structures without modifications. Within the system we can adapt the layout and the number of machines, scope of computer-aided operation, level of flexibility and scope of equipment.

**TECHNICAL DATA**

<table>
<thead>
<tr>
<th></th>
<th>SAMO 1</th>
<th>SAMO 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working range acc. DIN 66217</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X-axis:</td>
<td>800 mm</td>
<td>1250 mm</td>
</tr>
<tr>
<td>Y-axis:</td>
<td>500 mm</td>
<td>800 mm</td>
</tr>
<tr>
<td>Z-axis:</td>
<td>500 mm</td>
<td>800 mm</td>
</tr>
<tr>
<td>Spindle head in lower position (Y axis)</td>
<td>130 mm</td>
<td>130 mm</td>
</tr>
<tr>
<td>Working spindle axis up to worktable surface (palette)</td>
<td>Ø900 mm</td>
<td>Ø1250 mm</td>
</tr>
<tr>
<td>Workpiece turning range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working spindle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low bearing dia.</td>
<td>Ø80/100/110 mm</td>
<td>Ø100/110 mm</td>
</tr>
<tr>
<td>Main spindle cone DIN 69871</td>
<td>A 50</td>
<td>A 50</td>
</tr>
<tr>
<td>Rev/min — infinitely variable</td>
<td>20-3900 rev/min</td>
<td>20-3900 rev/min</td>
</tr>
<tr>
<td>Option</td>
<td>(40-7800) rev/min</td>
<td>(40-7800) rev/min</td>
</tr>
<tr>
<td>Working spindle power</td>
<td>21 kW</td>
<td>21 kW</td>
</tr>
<tr>
<td>Working spindle torque</td>
<td>790 Nm</td>
<td>790 Nm</td>
</tr>
<tr>
<td>Tool supply system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two cassettes with 24 tools each, dia.</td>
<td>Ø100 mm</td>
<td>Ø100 mm</td>
</tr>
<tr>
<td>Max. tool dia.</td>
<td>Ø270 mm</td>
<td>Ø270 mm</td>
</tr>
<tr>
<td>Perm. tool weight</td>
<td>25 daN</td>
<td>25 daN</td>
</tr>
<tr>
<td>Perm. tool length (from spindle nose)</td>
<td>450 mm</td>
<td>450 mm</td>
</tr>
</tbody>
</table>

**Accuracy**

X, Y and Z axis are measured directly with linear scales

Uncertainty-of-position factor $T_p$ acc. to VDI/DGQ 3441

Scatter-of-position acc. to VDI/DGQ 3441

<table>
<thead>
<tr>
<th></th>
<th>SAMO 1</th>
<th>SAMO 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_p$</td>
<td>0.017 mm</td>
<td>0.017 mm</td>
</tr>
<tr>
<td>Scatter</td>
<td>0.007 mm</td>
<td>0.007 mm</td>
</tr>
</tbody>
</table>

**Feed rates**

— working range

Feed range X, Y, Z is infinitely variable

Feed rate (100 % ED)

— Rapid traverse rate

in X, Y and Z axis

in B axis

Rotary table — palette

Palette clamping surface

<table>
<thead>
<tr>
<th></th>
<th>SAMO 1</th>
<th>SAMO 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed rate range</td>
<td>5...3500 mm/min</td>
<td>5...3500 mm/min</td>
</tr>
<tr>
<td>Feed rate (100 % ED)</td>
<td>15,000 N</td>
<td>15,000 N</td>
</tr>
<tr>
<td>Rapid traverse rate in X, Y and Z axis</td>
<td>12,000 mm/min</td>
<td>12,000 mm/min</td>
</tr>
<tr>
<td>Rapid traverse rate in B axis</td>
<td>10 rev/min</td>
<td>10 rev/min</td>
</tr>
<tr>
<td>Rotary table — palette</td>
<td>10 rev/min</td>
<td>10 rev/min</td>
</tr>
<tr>
<td>Palette clamping surface</td>
<td>500 x 630 mm</td>
<td>800 x 600 mm</td>
</tr>
</tbody>
</table>

**Version acc. to**

DIN 55201, version 2

Perm. table load

<table>
<thead>
<tr>
<th></th>
<th>SAMO 1</th>
<th>SAMO 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perm. table load</td>
<td>800 daN</td>
<td>2500 daN</td>
</tr>
</tbody>
</table>

Repeatability (4 x 90 deg.)

<table>
<thead>
<tr>
<th></th>
<th>SAMO 1</th>
<th>SAMO 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeatability (4 x 90 deg.)</td>
<td>± 0.002 deg</td>
<td>± 0.002 deg</td>
</tr>
</tbody>
</table>

Accuracy over all positions

<table>
<thead>
<tr>
<th></th>
<th>SAMO 1</th>
<th>SAMO 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy over all positions</td>
<td>± 0.003 deg</td>
<td>± 0.003 deg</td>
</tr>
</tbody>
</table>
The setting up of TAM tool shop goes back to 1947 when the firm TAM was established. The tool shop has since achieved a high level not only in terms of technology, but also in production output, and is as such able to appear on the market as a major Yugoslav manufacturer of tools.
The tool production programme encompasses all kinds of multi-purpose tools required in the manufacture of trucks ranging from light to heavy-duty categories. Moreover, the TAM tool-shop can also produce any other tools that cover the above mentioned programme as regards the requirements, quality and size.

Thanks to the high level of workmanship developed within our plant we are able to guarantee on-time manufacture of top quality up-to-date products. In addition we can offer the customer our complete KNOW-HOW.

Thus the manufacture of tools is based either on the design supplied by the customer, our own design or the documentation complete with all technological solutions.

Tools are produced by the equipment consisting of complex machinery, which is constantly supplemented by up-to-date machines. This enables permanent pursuit of technological development and a high level of machining.

Controlling by modern measuring devices and machines ensures continuous high quality.

Forging Tools

Production Programme:
- Hot forging dies
- Cold hammer dies
- Hot pressing dies
- Cold pressing dies
- Tools for forgings cutting
Cutting-off Tools

Production Programme:
- Milling tools — made of high speed steel & hard metal
- Reamers — made of high speed steel & hard metal
- Twist drills
- Deep hole drilling tools
- Countersinking tools
- Turning tools
- Tools for gear production
- Threading rolls
- Taps
- Broaching tools
- Thread milling cutters
- Hard metal plates tool holders

Tools for Sheet Metal Forming

Production Programme:
- Drawing tools
- Cutting tools
- Bending tools
- Multi-stage tools
- Devices for spot welding of sheet metal assemblies
- Cold extrusion tools

Casting Tools for Metals and Plastic

Production Programme:
- Gravity casting
- Die casting
- Tools for the manufacture of foundry cores and tools
  for shell-molding
- Tools for injection molding of plastic
Fixtures

Production Programme:
- Grinding fixtures
- Milling fixtures
- Turning fixtures
- Assembly equipment
- Welding jig
- Drilling units
- Milling units
- Clamping tools
- Clamping systems for CNC machines

Controlling and Measuring Tools

Production Programme:
- Ring gauges and monitor sockets
- Plug gauges
- External gauges
- Setting gauges
- Measuring devices and accessories

Gears

Production Programme:
- Spur gears with straight gearing
- Spur gears with helical gearing
- Straight bevel gears
- Worm gears
- Gear couplings
- Spur gears with internal gearing
Simultaneously with the development of vehicle production we were also engaged in other activities, one of the main being the maintenance of the machines. Due to diverse machinery in the production of vehicles we are qualified to reconstruct all kinds of machine tools. Besides, we are equipped with most up-to-date gauges and measuring instruments.

We reconstruct:
- NC and CNC machines— if required, we can replace even the type of electronics
- grinding-, milling- and shaping machines for cylindrical and bevel gears
- special-purpose machines
- grinding machines, also thread grinding machines
- milling machines
- lathes and automatic lathes
- presses and forging machines

We manufacture:
- spare parts for machine tools, also work spindles
We recondition also all kinds of measuring tools, e. g.
- micrometers
- dial gauges
- passimeters, etc.

For all measuring tools a certificate is issued upon reconditioning. We can also carry out the inspection for measuring tools alone and issue the certificate upon it.

We sharpen the cutting tools:
- broaches
- milling cutters, also gear cutters and gear shaping cutters
- twist drills and reamers
- circular saws
- and others.
TAM's specialized workshop for hydraulics and pneumatics and the hydraulic-pneumatic design department boast a 30 years tradition and are based on our own knowledge, experience and equipment. Much of our experience was gained at the construction of outfit, diesel engines and vehicles as well as at repairing the hydraulic and pneumatic equipment.

We build our own special-purpose machine tools, jigs and fixtures, hoisting devices, measuring and controlling instruments with hydraulic and pneumatic drives as well as lubricating and cooling technique. We have developed various hydraulic components, from pumps, control- and other valves to cylinders which are adapted to specific characteristics of machine tools. We have designed and manufactured a number of components with non-standard features that are normally not offered by professional manufacturers of hydraulic and pneumatic systems. We also repair defective hydraulic and pneumatic equipment. The hydraulic and pneumatic drives manufactured according to our documentation or by ourselves for the vehicles and superstructures have proved very successful in operation. Thanks to our inventiveness and our own know-how we manage to solve urgent problems brought about by the production processes in TAM and outside TAM.

In cooperation with our experts for automotive electrical equipment and electronics we can offer up-to-date and thought-out solutions — in the field of documentation and manufacture — of even the most intricate problems concerning the control systems in the industry of today.

We offer:
- elaboration of design documentation for hydraulic and pneumatic drives, central lubricating and cooling systems of machines
- elaboration of design documentation for all kinds of hydraulic and pneumatic components, particularly those showing special non-standard features
- manufacture and starting of hydraulic and pneumatic components and systems
- repairing, reconditioning and testing diverse complex systems in the field of hydraulics and pneumatics.
We offer you our knowledge and experience gained in designing and constructing the industrial plants for our own requirements in the field of conveying systems and degreasing plants.

We offer the following equipment belonging to the conveying systems:
- conveyor belts for assembly of engines and vehicles
- conveyors
- floor conveyors with special-purpose trolleys
- chip conveyors
- bridge and monorail cranes with a capacity up to 50 kN
- plane-parallel scissors lift with a capacity of up to 100 kN
- wall cranes with a capacity of up to 5 kN
- manipulator with a capacity of up to 1.6 kN
- roller conveyors
- trailers for heavy loads
Metal Parts Degreasing- and Washing Plants

The metal parts degreasing and washing plants are used for:
— washing and degreasing of metal elements with warm washing agents (60—80°C)
— washing at workroom temperature.

The washing liquid can be heated by vapour, hot water or electric current. Washing at workroom temperature is a more recent method and is ecologically more favourable (without phosphates). The special-purpose washing machines (for crankcase, crankshaft, cylinder head etc.) are integrated in the machining line.

We manufacture chamber- and tunnel-type washing machines, the latter operating in cycle- or continuous mode. The largest tunnel-type washing machine has an opening of 2400×600 mm and a length of 17.3 m.
More than thirty years of experience acquired in the execution of several thousand electric projects are a guarantee that we are a reliable partner in the implementation of standard relay- or CNC electrical equipment for machine tools, conveying- and industrial plants and equipment for automation of production.

We offer the following services:
- consulting
- designing
- development of modules
- manufacturing, starting and testing the equipment
- maintenance.

On hand of your draft project or a project that is prepared in cooperation with you and by means of the CAD system we can elaborate the most extensive and complex projects.

Up-to-date fitting methods ensure efficient, precise, aesthetic and reliable installation of electrical equipment.

We can develop software for diverse PLC and CNC systems of different manufacturers e.g. ISKRA, ILR, FESTO, OMRON, SIEMENS etc.

We design and construct various special-purpose electronic modules for the control of lubricating units, power supply modules, brakes of induction motors, two-hand trip guards etc.

We perform maintenance of electrical equipment produced by different foreign and home manufacturers, e.g. ISKRA, ENERGOINVEST, SIEMENS, BOSCH, HEIDENHAIN, INDRAMAT, and installed in diverse machine tools and generating plants.

The entire range of activities is covered by a few expert teams in the design-, assembly- and maintenance departments. Our experts have acquired the necessary technical knowledge by attending numerous training courses at home and abroad.