



METAL-WORKING EQUIPMENT

LECTURE 2

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Each machine tool is divided into several sections which are called units.

Unit – a part of a machine tool or a machine, which is a detachable or permanently attached several items that can be assembled separately from other components of the machinery or equipment, and that can perform definite functions in the products of one purpose only together with other components.

An important feature of units is that they can perform their function only in a part of the device. Specific examples of the units can be welded casing, hydraulic and pneumatic cylinders, planetary gear, brakes, spindle units, freewheel clutches, safety valves, etc.



Unit 1 – a main drive. It gives movement to the tool or workpiece for the cutting process with the necessary speed. The main drive of the majority of machines transmit the rotational movement from drive to a spindle which fixes the tool or workpiece.

Unit 2 – a feed drive. This movement is necessary to move the tool relative to the workpiece to form a processed surface.

Unit 3 – a position drive. Require to move a machine unit from some initial position to another predetermined position, for example, during sequential processing of multiple holes or multiple parallel planes on the same workpiece. Many modern machine tools with numerical control (CNC) function drives feeding and positioning are performed by a single common drive.

Unit 4 – a carrier system of the machine. This system consists of a serial set of basic components which connected to each other. Connections can be fixed (joints) or movable (guides). The carrier system provide right position of the cutting tool and the workpiece under the influence of force and temperature factors.

Unit 5 – manipulating devices. These devices needed to automate various support movements in the machine tool, for example, for changing the workpieces, for clamping them, moving or turning, for changing cutting tools, for chip removal, etc. Modern multi-operational machine has a set of manipulators, conveyors, turning devices, and in some cases served by universal manipulator with program management (industrial robot).



Unit 6 – control and measuring devices. These devices are required in the machine to automate the monitoring that machine tool is working correctly. They help to control condition the most critical parts of the machine tool, the operability of the cutting tool and also they are measured the size of the workpiece and products. At a high level of automation the results of measurement are transmitted to the control device, and thence in the form of control signals adjust the position of the unit of the machine.

Unit 7 – a control device. The control can be manually operated by the operator with a mechanical control system or the CNC. Currently, there is wide implementation of microprocessor control for the management of all types of machine tools.

The classification of machine tools is based by technological attributes. Each of the nine groups of machine tools contains the machines which divided by a characteristic trait. Each group is divided into nine types describing application of machine tools, their layout, degree of automation or the type of applied tool.



CLASSIFICATION OF MACHINE TOOLS

Group of machine tools	Number of group	Number of types									
		0	1	2	3	4	5	6	7	8	9
Reserved	0										
Lathe	1	Automatic and semiautomatic			Drilling and Cutting	Vertical-turning	Screw-cutting and surface	Multiple-tool	Specialized	Other lathes	
		Single Spindle	Multi-spindle	Turret							
Drilling and boring	2	Vertical Drilling	Semiautomatic		Jig Boring	Radial drilling	Horizontal boring	Diamond boring	Horizontal drilling and centering	Other drilling and boring	
			Single Spindle	Multi-spindle							
Grinding and honing	3	Round grinding	Inside grinding	Rough-grinding	Specialized grinding	Longitudinal grinding	Sharpening	Surface Grinding	Lapping and Polishing	Different machine tools which process abrasive	
Machine tools for electro-physical-chemical treatment; combined	4	Universal	Semi-automatic	Automatic	Electro-chemical	Electro-spark	-	EDM and ultra-sonic	Anode-mechanical	-	

Group of machine tools	Number of group	Number of types									
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Gear cutting and thread processing	5		Tooth-slotting cylindrical cogwheels	Gear cutting for cylindrical cogwheels	Tooth milling for cylindrical cogwheels	Tooth milling for worm gears	For the treatment of end faces of teeth of cogwheels	Thread milling	Tooth-finishing and flow forming	Toothed and threaded grinding	Different gear cutting and thread processing
Milling	6		Vertical	Continuous action	Longitudinal milling with single column	Copying and engraving	Vertical without cantilever	Longitudinal milling with two column	Widely-universal	Horizontal cantilever	Different milling
Planing, slotting and broaching	7	Planning			Cross-planing	Slotting	Horizontal broaching	Vertical broaching		-	Different planing
		Single column	Two column	For internal broaching				For external broaching			
Cutting	8	Cutting processing				Straightener cutting machines	Band saws	Circular saws	Hacksaws	-	-
		Lathe tool	Abrasive wheel	Fixed disk							
Different	9		Coupling and pipe processing	Saw cutting	Straightener and centerless rough	-	To test the tool	Dividing machine	Balancing	-	-



According to the degree of specialization there are the following machines:

- **universal**, to perform various operations on the workpieces of many types;
- **wide application**, to perform certain operations on workpieces of many types;
- **specialized** for machining of the typical workpieces, but different sizes;
- **special**, for certain operations in the manufacture of a specific, usually a single detail.

According to the degree of accuracy:

- **Normal precision.** Provide machining of parts with precision up to 7 quality class;
- **Enhanced precision.** Made on the basis of machines of normal accuracy, while ensuring higher quality of parts production and their mates (supports, guides, etc.);
- **High precision.** High accuracy is ensured by special design elements, high quality of their production;
- **Very high precision.** The same, are made with higher requirements to major components than the machines of high precision.
- **Extremely accurate.** Special master-machines that are essential for the fabrication of parts, determining the accuracy of precision machine tools, dividing and master gears. Ensure accurate processing to 1 micron or higher.

By weight:

- **Light.** Weight of the machine to 1.0 tons.
- **Medium.** Weight of the machine from 1.0 to 10 tons.
- **Heavy:** large with a mass of 10 to 30 tons; heavy from 30 to 100 m; aggravated over 100 tons.

According to the degree of automation the machine tools are divided into automatic, semi-automatic and manually controlled. In automatic machine tools all the main and supporting movements required for the technological cycle of processing of the workpieces, are carried out without human intervention. Semi-automatic machine tools the entire cycle of machining is performed automatically, but for installation of workpieces, start-up of machine tool and the removal of parts requires the intervention of the machine operator.

Manually operated machine tool – a mechanized machine tool that can have only one automatic function (workpiece clamping or feed of the tool).