Смазочно-охлаждающие жидкости (СОЖ)

- Введение:
  - Что такое СОЖ
  - Объем рынка
  - Предприятия-потребители
  - Конкуренты
- Металлообработка - типы операций
- Функции СОЖ, типы СОЖ
- Продукция Шелл
- Поставка

Shell Metal Working

Назначение СОЖ

- **Обеспечивать охлаждение, смазку и защиту инструмента и обрабатываемой поверхности**

Îáúåì ðûíêà **50000 - 100000 ò**

Ïîòðåáëåíèå ïðîìûøëåííîãî ïðåäïðèÿòèÿ îò …êã äî 5000 òîíí

Shell Metal Working

Îòðàñëè ïðîìûøëåííîñòè -ïîòðåáèòåëè ÑÎÆ

- Àâòîìîáèëüíàÿ
- Ïîäøèïíèêîâàÿ
- Ìîòîðíûå ïðåäïðèÿòèÿ
- Ìàøèíîñòðîèòåëüíûå çàâîäû
- Ëþáûå ïðåäïðèÿòèÿ ñî ñòàíî÷íûì îáîðóäîâàíèåì äëÿ îáðàáîòêè ìåòàëëîâ

Êîíêóðåíòû Øåëë

- Castrol
- Stuart
- Fuchs
- Quaker
- Blazer

Ñèëüíûå ñòîðîíû Øåëë

- **Ðàçâèòåëåííàÿ ñåòü äèñòðèáüþòîðîâ**
- **Îòëàæåíà ñõåìà ïîñòàâîê ÷åðåç ôèíñêèé ñêëàä**
- **Óíèâåðñàëüíûé ïîðòôåëü ïðîäóêòîâ**

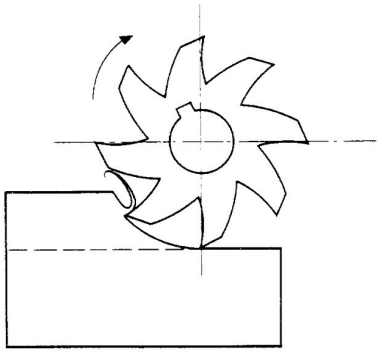
Ïðîöåññû îáðàáîòêè ìåòàëëîâ

Îñíîâíûå ïðîöåññû

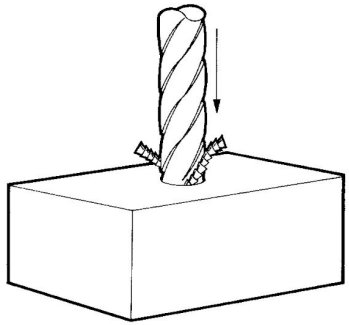
- **Ðåçàíèå (îáðàçîâàíèå ñòðóæêè)**
- **ÎÌÄ**
- **Ýëåêòðîýðîçèîííàÿ îáðàáîòêà ìåòàëëîâ**
- **Çàùèòà îò êîððîçèè**
- **Çàêàëêà**
- **Î÷èñòêà**

ÎÌÐ

ÎÌÐ âêëþ÷àåò â ñåáÿ:



Ôðåçåðîâàíèå



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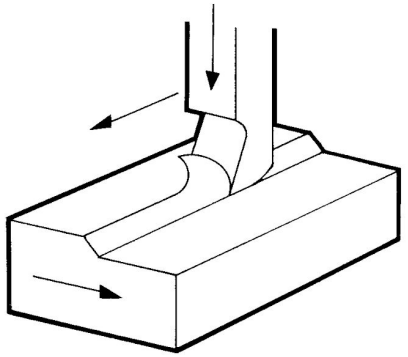

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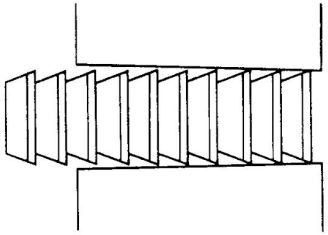
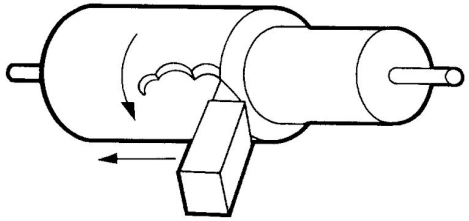


Ðàçâåðòêà



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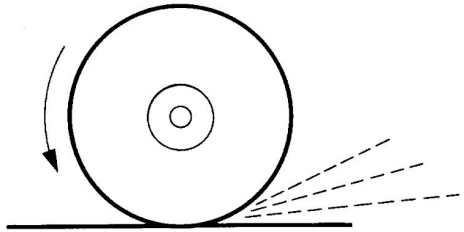
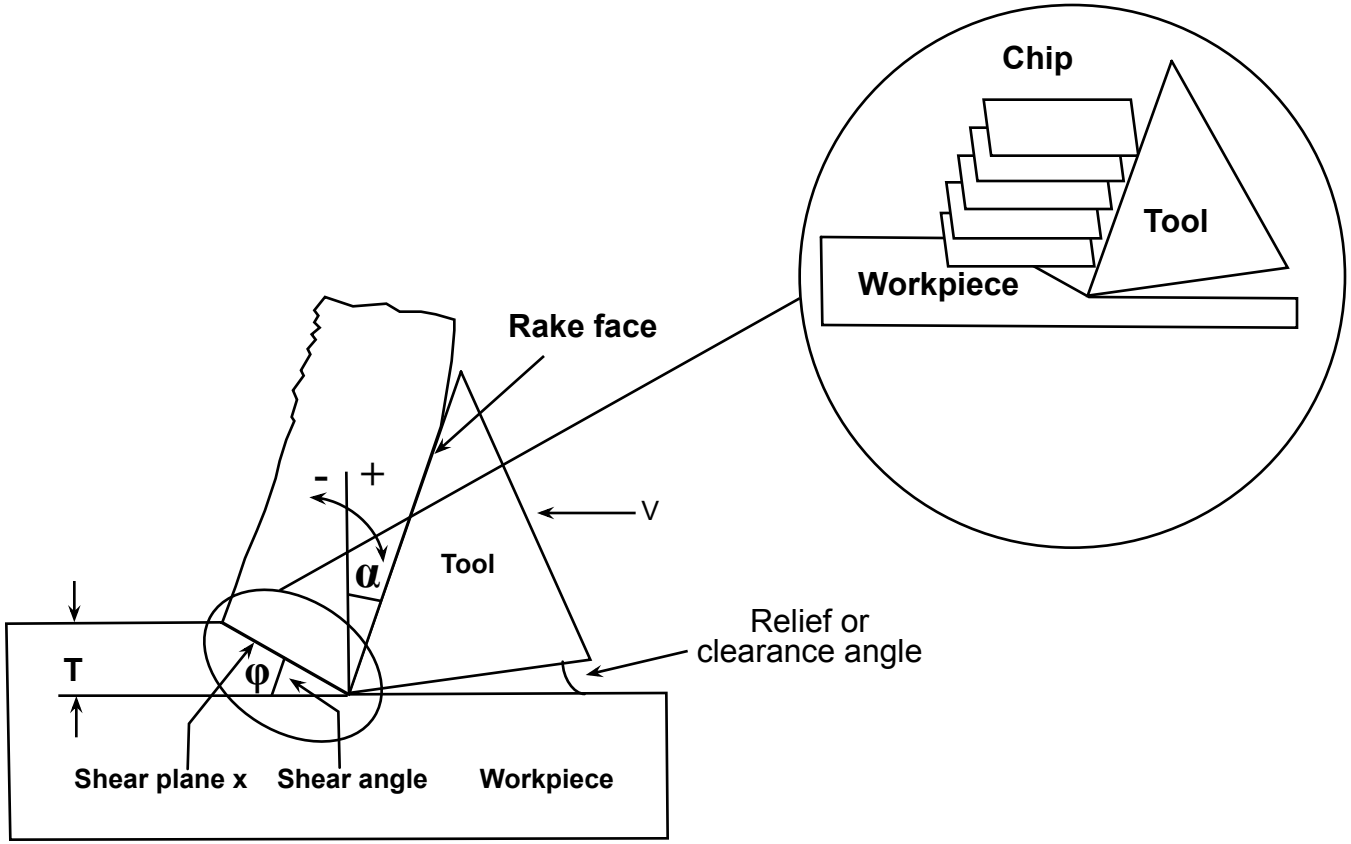


Îáðàçîâàíèå ñòðóæêè

- **Îáðàçîâàíèå ñòðóæêè - êàê ñäâèã êàðò â êîëîäå (òðåíèå ñêîëüæåíèÿ)**
- **Â çàâèñèìîñòè îò ìàòåðèàëà è êà÷åñòâà ïîâåðõíîñòè èãðàþò ðîëü ïàðàìåòðû :**
  - **ñêîðîñòü ðåçàíèÿ V**
  - **ïîäà÷à èíñòðóìåíòà**
  - **óãîë ðåçàíèÿ**
  - **ãëóáèíà ðåçàíèÿ T**

Îáðàçîâàíèå ñòðóæêè



Íàçíà÷åíèå ÑÎÆ

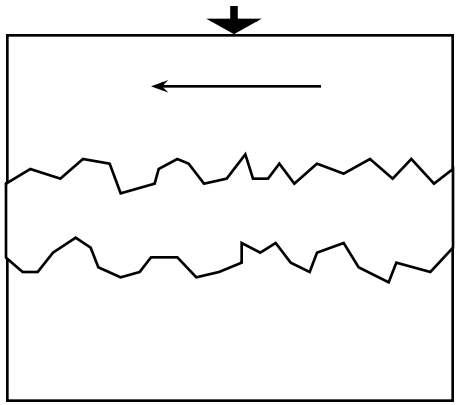
- Reduce friction and wear thus (See lubrication regimes):
  - Improving tool life and surface finish
  - Reducing forces and energy consumption
- Cool the cutting zone, thus reducing temperature and distortion. (See diagram for typical temperature distribution.)
- Wash away the chips from the cutting zone
- Protect the newly machined surfaces from corrosion

Íàçíà÷åíèå ÑÎÆ

Lubrication Regimes

Full film Lubrication

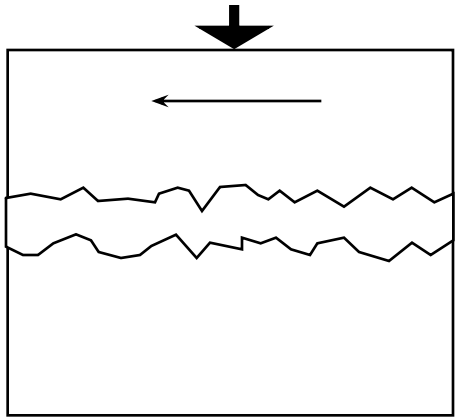
Load



Modest load, complete separation of surfaces. Load completely supported by fluid.

Boundary conditions

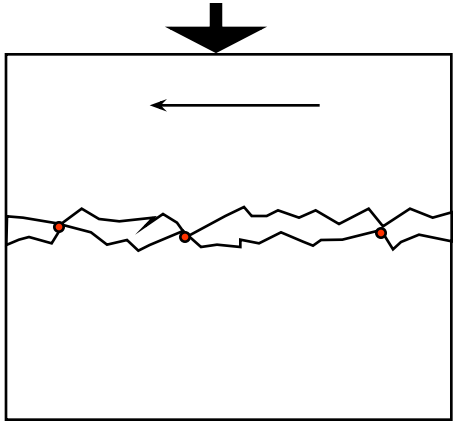
Load



Higher load, oil film almost squeezed out. Additional support needed from polar fatty oils / additives.

EP conditions

Load

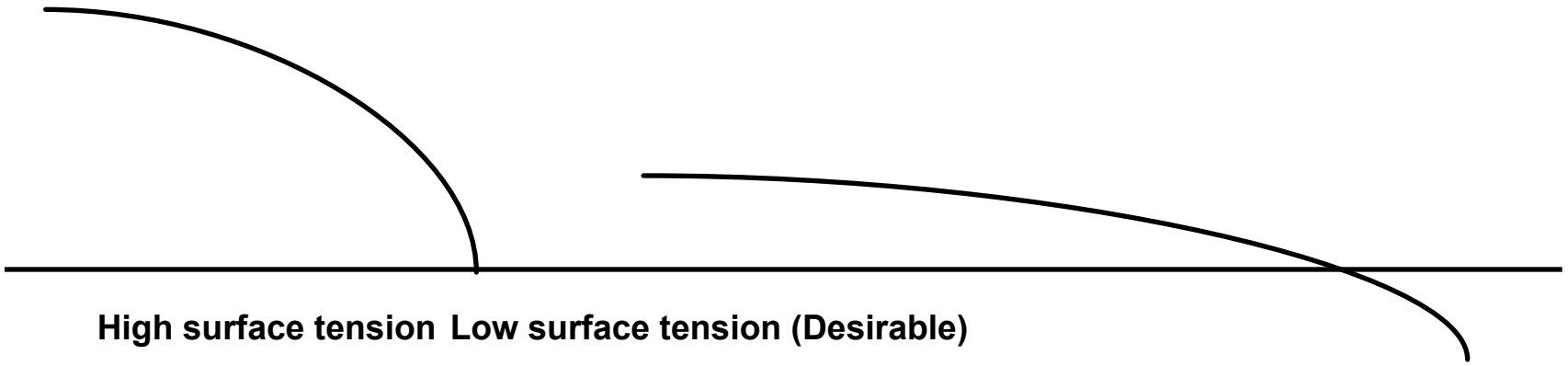


Very high load, high friction, collision of asperities. EP additives prevent welding.

Íàçíà÷åíèå ÑÎÆ

Action of Cutting Fluid

- **Penetration of the fluid to the interface is difficult because of high pressures and relative sliding speed.**
- **Therefore for the cutting fluid should have appropriate molecular size, good wetting properties and the right viscosity.**

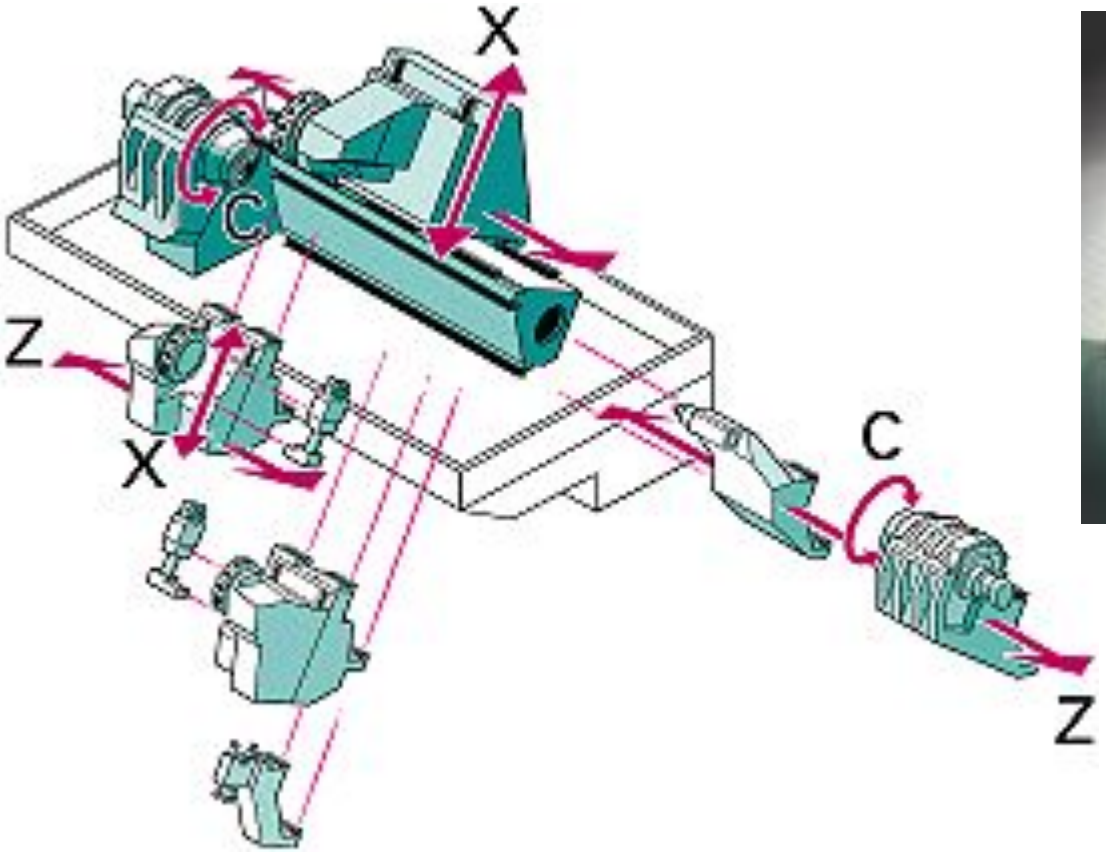


High surface tension Low surface tension (Desirable)

Íàçíà÷åíèå ÑÎÆ

Key Parameters

Machining process:	• **Turning, milling, etc.**
Work piece material:	• **Machinability**
Tooling:	• **Tool material** • **Shape or profile of tool**
Cutting conditions:	• **Depth of cut** • **Speed / Feed rate** • **Application of fluid to cutting zone**
Quality required:	• **Surface quality** • **Precision** • **Corrosion protection**



Compact single spindle CNC lathe

Ïðîöåññû ÍÌÐ

Ôðåçåðîâàíèå

- Among the most versatile machine tools because of the variety of cutting operations.
- Metal chips are removed by rotating a circular multi-point tool which brings teeth into the workpiece one at a time as the work feeds into the cutter.
- Two basic types of milling machine:
  - Horizontal: cutter rotates on an horizontal arbor.
  - Vertical: cutter rotates in a vertical plane located in the column spindle.
- Other types of milling machine are available for special purposes such as the planer miller for heavy duty operations.

Ïðîöåññû ÎÌÐ

Ãëóáîêîå ñâåðëåíèå, Ñâåðëåíèå è êîëüöåâîå ñâåðëåíèå (1)

Deep hole drilling:

- **the production of holes in which the length is 5 x up to 100 x the diameter**
- **The major difficulty is in removing the metal chips from, and maintaining coolant supply to, the cutting zone**
- **Three different deep drilling systems are employed to overcome this problem:**
  - **BTA system (Boring Trepanning Association)**
  - **Ejector system**
  - **Gun drilling**

Ïðîöåññû ÎÌÐ

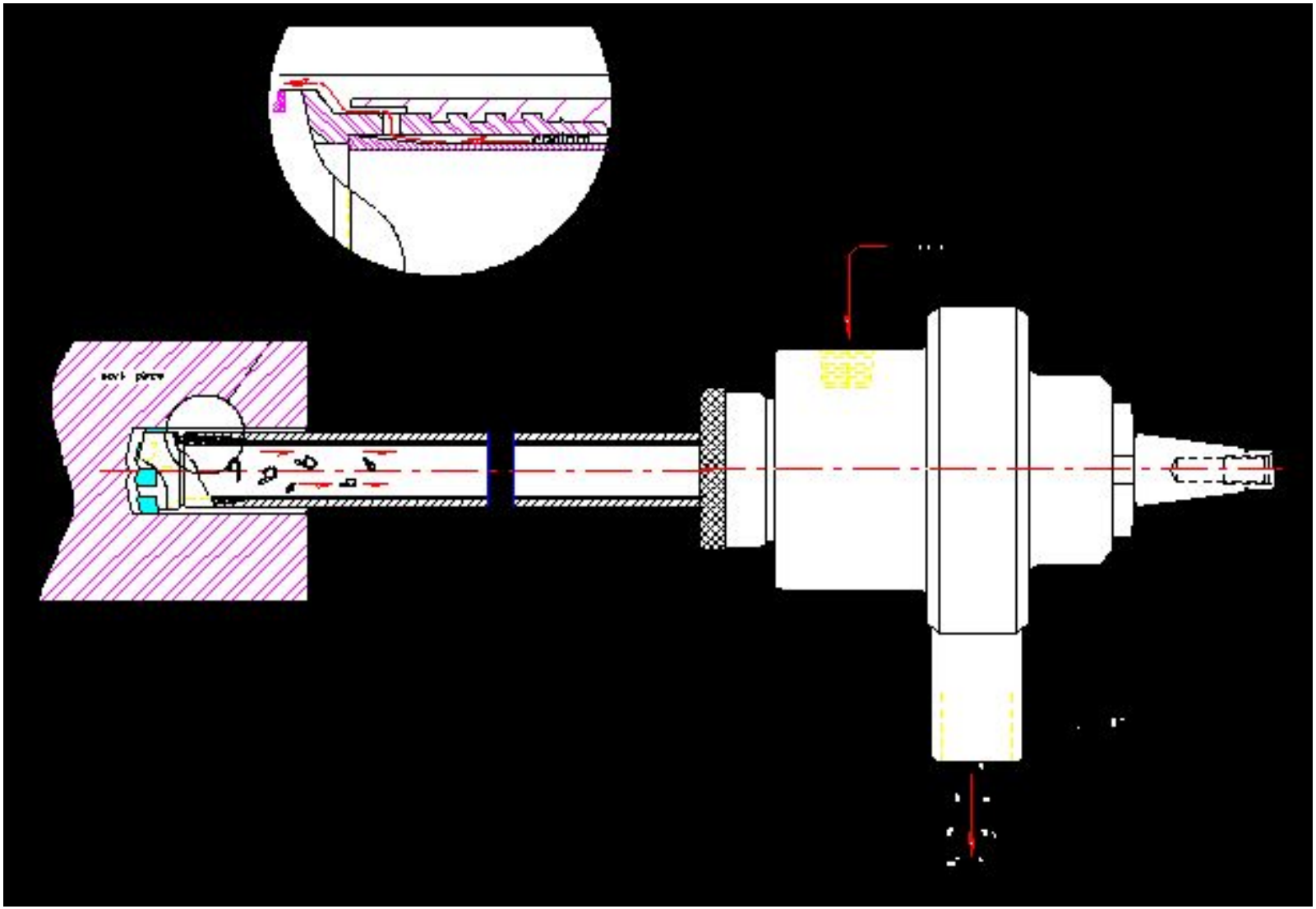
Ãëóáîêîå ñâåðëåíèå, Ñâåðëåíèå è êîëüöåâîå ñâåðëåíèå (2)

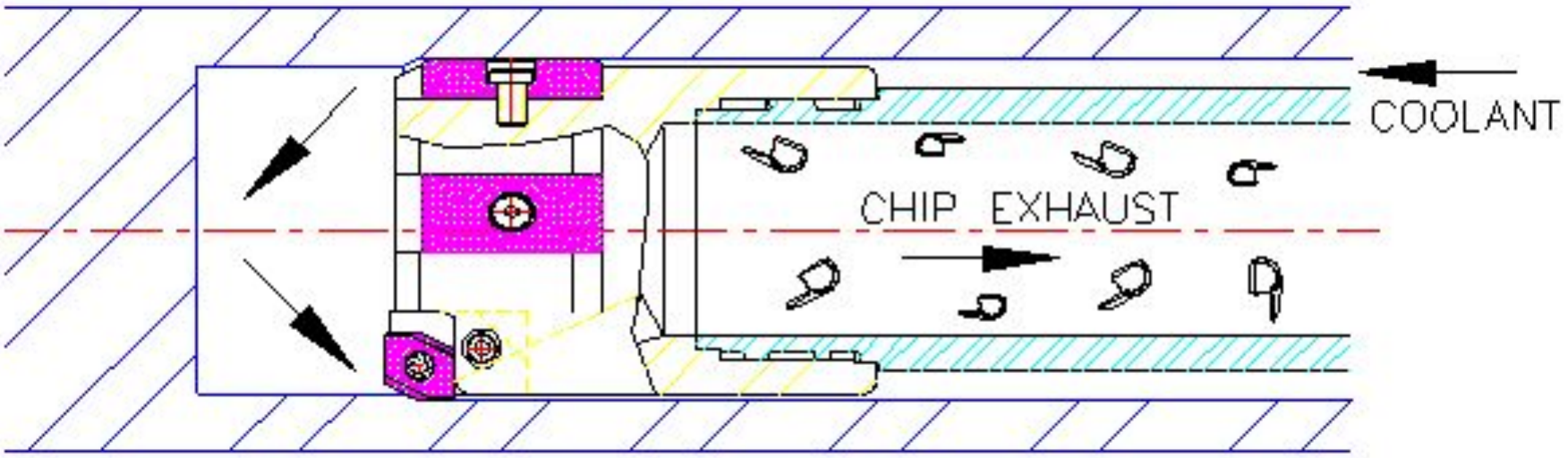
Boring:

- **Used to enlarge a hole to an exact size using a single point tool**
- **In horizontal boring, self supporting and guided boring bars with an inserted tool are used**

Trepanning:

- **similar to that of solid drilling except that a solid core of metal is produced**
- **Trepanning requires less power than solid drilling since less metal is removed in the process**





Đàçâåðòûâàíèå

Ïðîöåññû ÎÌÐ

Çóá÷àòûå êîëåñà / ìåòîäû ðåçàíèÿ

Several methods of gear making:

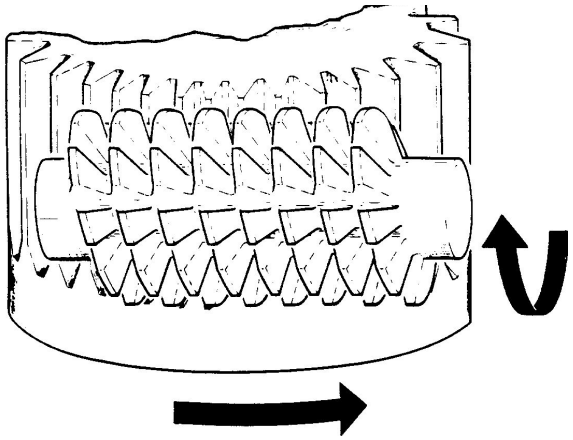
- **Íàêàòêà: Favoured for high-volume production; continuous process where both workpiece (or blank) and the tool rotate and mesh as though it were an actual gear.**
- **Íàðåçàíèå: Often used for internal short gears. A rotary / reciprocating gear-shaped cutter is progressively fed into a rotating blank until the complete form of the gear is made. This is a non- continuous process exerting rapid intermittent tool load.**
- **Ôðåçåðîâàíèå: Employs a milling cutter shaped like the tooth form to be generated.**

Ïðîöåññû ÎÌÐ

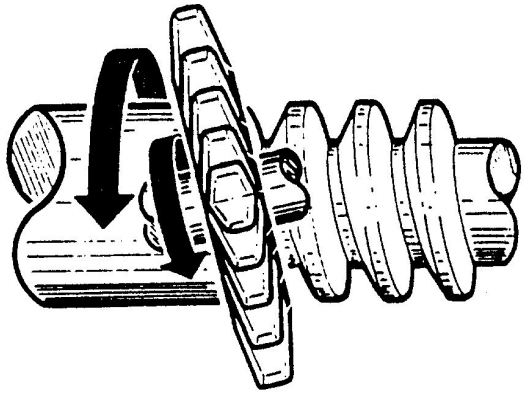
Çóá÷àòûå êîëåñà / ìåòîäû ðåçàíèÿ

- **Gear Shaving: Used as a finishing operation and used to improve surface finish and precision of gears formed by hobbing or shaping.**
- **Gear grinding: Used as a finishing operation. Two options:**
  - **Continuous gear grinding: Tool with the opposite form of the gear**
  - **Teeth flank grinding: Small, high speed and very precise tool moving in between gear teeth**

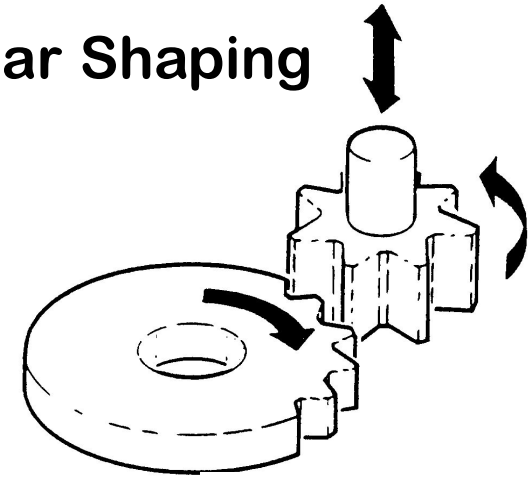
Gear Hobbing



Gear Cutting



Gear Shaping



External

Worm Gear Cutting

Ïðîöåññû ÎÌÐ

Ðàçâåðòêà

- The most severe of machining operations -
- Used to produce holes, grooves and slots in a variety of shapes and sizes.
- The broach is in effect a linear multi-tooth tool with spaced teeth which makes progressively deeper cuts.
- Broaching can machine complex shaped holes to precision limits in one pass
- Although the tool is expensive to manufacture, broaching can be a highly efficient process.
- Both horizontal and vertical broaching is possible.

Ïðîöåññû ÌÌÐ

Øëèôîâàíèå

- The grinding process is usually employed to impart a high standard of finish and accuracy to a machined component.
- Typical grinding processes include:
  - Surface grinding of flat surfaces - workpiece is clamped to a reciprocating, horizontal work table which is fed in small increments across the surface of the workpiece. Grinding wheel rotates at high speed and the wheel head remains stationary.
  - Cylindrical Grinding - Workpiece slowly rotating and driven between centres. The wheel rotates at high speed and on an axis parallel to that of the workpiece. The table is traversed longitudinally along the length of the workpiece to be ground.
  - Centreless Grinding - Similar to cylindrical grinding process, except the workpiece depends upon a regulating wheel running parallel to the grinding wheel for its location (see picture).
  - Other, more complicated types: flute grinding, creep feed grinding, tool grinding, etc.

Ïðîöåññû ÎÌÐ

Õîíèíãîâàíèå, Ñóïåðôèíiøèðîâàíèå, Äîâîäêà

- Honing: special type of grinding, combined linear and rotating movement resulting in well defined “grid-like” roughness. Also called cross-grinding. E.g. the inside of hydraulic cylinders.
- Super finishing: also called external honing. Small occilating movements of the tool. E.g. runway of ball bearings.
- Lapping: special type of grinding with mixture / paste of ceramic / diamond grains and oil. Polishing operation. E.g. Balls of ball bearing.

Ïðîöåññû ÎÌÐ

Ïèëåíèå

- **Very common**
- **Three options:**
  - **Circular saw: very common**
  - **Belt saw: faster but takes more space**
  - **Occilating saw: creates high friction on tool, high temperature**

Îïåðàöèè îáðàáîòêè ìàòàëëîâ

Operation **Most severe**

Internal Broaching, Surface or External broaching

Sawing

Tapping

Gear Cutting and Gear Shaving

Reaming, Deep Hole Drilling and Boring

Multiple Spindle Automatic Work

Milling and Form Turning

Planing and Shaping

Single Point Turning and Shallow Drilling

Least severe

Õàðàêòåðèñòèêè ðåæ.èíñòðóìåíòà

Tool Materails	Machining operation and cutting speed range	Modes of tool wear or failure	Limitations
Carbon steel	Tapping, drilling, reaming (low speed)	Build-up, plastic deformation, abrasive wear, microchipping	Low hot hardness, limited hardenability, limited wear resistance
Low / medium alloy steels	Tapping, drilling, reaming (low speed)	Build-up, plastic deformation, abrasive wear, microchipping	Low hot hardness, limited hardenability, limited wear resistance
High-speed steels	Tapping, drilling, milling, broaching (medium speed)	Flank wear, crater wear	Low hot hardness, limited hardenability, limited wear resistance
Cemented carbides	Tapping, drilling, milling, broaching (medium speed)	Flank wear, crater wear	Cannot use at low speed due to cold welding of chips and microchipping
Coated carbides	Turning (medium to high speed)	Flank wear, crater wear	Cannot use at low speed due to cold welding of chips and microchipping
Ceramics	Turning (high speed to very high speed)	Depth-of-cut line notching, chipping, oxidation, graphitisation	Low strength, low thermalmechanical fatigue strength
Cubic boron nitride	Turning, milling (medium to high speed)	Depth-of-cut line notching, chipping, oxidation, graphitisation	Low strength, low chemical stability at higher temperatures
Carborundum	Grining, honing, super finishing and lapping	To much metal particles, abbrasive granulate limited	-
Diamond	Turning, milling and grinding (high to very high speed)	Chipping, oxidation, graphitisation	Low strength, low chemical stability at higher temperatures

Òåõíîëîãè÷íîñòü ìàòåðèàëîâ

Material	Tensile strength N/mm²
Brass	500
Steel	500 - 1300
Titanium alloys	1725
Aluminium alloys	700 - 1500 HB
Cast iron	1500 - 4500 HB

HB = Brinell Hardness

Òåõíîëîãè÷íîñòü ìàòåðèàëîâ

Magnesium alloys
Brass (Cu/Zn alloy)
Bronze (Cu/Sn alloy)
Aluminium alloys
Mild steel
Low / medium carbon steel
Wrought iron / cast iron alloys
Stainless steel
Nickel
Nickel / cobalt alloy
Titanium and titanium alloys

Ease of machinability

Ìàòåðèàë èíñòðóìåíòà vs. ñêîðîñòü ðåçàíèÿ

(in metres/min) - Turning

	High-speed steel		Cemented carbide	
Work Material	Roughening	Finishing	Roughening	Finishing
Free Cutting steels	35	50	85	175
Low carbon steel	14	25	70	85
High carbon steel and tougher steels	12	17	60	85
Cast Iron	20	35	60	105
Aluminium alloys	105	170	210	350
Brass	70	115	175	285
Titanium alloys	9	15	35	65

The se figures are only an indication and may be significantly higher in some cases

Ïðîäóêòû Øåëë äëÿ ìåòàëëîîáðàáîòêè

ÏÎÐÒÔÅËÜ ÑÎÆ ØÅËË

ÏÐÅÈÌÓÙÅÑÒÂÀ ØÅËË

- Íîâûé ïîðòôåëü ÑÎÆ Øåëë
  - ÷åòêàÿ êëàññèôèêàöèÿ ÑÎÆ ïî ñîñòàâó è íàçíà÷åíèþ ïðîäóêòîâ
  - óïðîùåííûé ïîäáîð ïðîäóêòà
  - ññûëêè íà ìèðîâîé ïîûò
  - èñïîëüçîâàíèå íîâåéøèõ òåõíîëîãèé
  - ñîêðàùåíèå ÷èñëà ïðîäóêòîâ
- Ïðåèìóùåñòâî Øåëë ïåðåä êîíêóðåíòàìè
  - øèðîêèé îõâàò òåððèòîðèè - äèñòðèáüþòîðñêàÿ ñåòü
  - íàëàæåííàÿ ñõåìà ïîñòàâîê