

МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ  
ФЕДЕРАЛЬНОЕ АГЕНТСТВО ПО ОБРАЗОВАНИЮ  
Государственное образовательное учреждение  
высшего профессионального образования  
«Оренбургский государственный университет»

Индустриально — педагогический колледж

Отделение автоматизации информационных и технологических процессов

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# **АНГЛИЙСКИЙ ЯЗЫК**

МЕТОДИЧЕСКИЕ УКАЗАНИЯ ПО РАБОТЕ СО  
СПЕЦИАЛИЗИРОВАННЫМИ ТЕКСТАМИ

Рекомендовано к изданию Редакционно-издательским советом  
государственного образовательного учреждения  
высшего профессионального образования  
«Оренбургский государственный университет»

Оренбург 2009

УДК 802.0 (076.5)  
ББК 81.2 Англ я 73  
Р 77

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**Р 77**                    **Россошанская, Т.Б.**  
**Английский язык: методические указания по работе со**  
**специализированными текстами / Т. Б. Россошанская,**  
**Е.Н. Михайлова, Н.А. Данилов. – Оренбург: ГОУ ОГУ,**  
**2009. - 56 с.**

Методические указания разработаны для подготовки студентов к самостоятельному чтению на английском языке оригинальных текстов по специальности.

Данные методические указания предназначены для студентов I и II курсов специальностей 050501 «Профессиональное обучение» (очная и заочная форма обучения), 151001 «Технология машиностроения», 150411- "Монтаж и техническая эксплуатация промышленного оборудования".

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## **Введение**

Данные методические указания разработаны в соответствии со спецификой изучения дисциплины «Иностранный язык» в Индустриально-педагогическом колледже ГОУ ОГУ. Методические указания предназначены для студентов I и II курсов специальностей: «Профессиональное обучение» (очная и заочная форма обучения), «Технология машиностроения», «Монтаж и техническая эксплуатация промышленного оборудования».

Основной целью методических указаний является подготовка студентов к самостоятельному чтению на английском языке оригинальных текстов по специальности, что соответствует требованиям программы по иностранному языку в неязыковых учебных заведениях.

# 1 Text

## A visit to a plant

### Words and word combinations to the text

- |                               |   |
|-------------------------------|---|
| 1) chief engineer             | - главный инженер                                 |
| 2) forge                      | - кузнечный цех                                   |
| 3) assembly line              | - конвейер (сборочный)                            |
| 4) to weld                    | - сваривать(ся)                                   |
| 5) to prevent accidents       | - предотвратить несчастный случай                 |
| 6) the shops                  | - зд. цеха  |
| 7) foundry                    | - литейный цех                                    |
| 8) to cast                    | - отливать, лить (металл)                         |
| 9) safety techniques          | - техника безопасности                            |
| 10) to purify                 | - очищать   |
| 11) dust-collecting apparatus | - пылесосбиратели, пылепоглощатели                |
| 12) up-to-date                | -современный                                      |
| 13) labour saving devices     | - приспособления (механизмы),<br>облегчающие труд |
| 14) equipment                 | - оборудование                                    |

### Read and translate the text

A group of students was going to visit a machine-building plant. They were met by the chief engineer. He told them a few words about the history of the plant and its work. After the introduction made by the chief engineer, the students were taken over the shops. They visited a forge, a foundry and the main assembly line. In the shops they watched the forging, casting and welding processes. The students were told about safety techniques, the aim of which is to prevent accidents. The air in the shops was purified by modern ventilators and dust-collecting apparatus.

Experimental work was conducted on a large scale, labour-saving devices were constantly being introduced.

The plant had several sanatoriums and rest homes where the workers could spend their holidays.

The students were much impressed by their visit to the plant and learned many interesting things about up-to-date equipment.

#### 1.1 Exercises to the text

##### 1.1.1 Ask 5 questions to the text in written form.

##### 1.1.2 Tell about your visit to a plant.

### **1.1.3 Make up a story about choosing profession and your plans for the future using the next words and word combinations:**

- |                                      |                                   |
|--------------------------------------|-----------------------------------|
| 1) after graduating from the college | - после окончания колледжа        |
| 2) I'd like to get work at...        | - мне бы хотелось получить работу |
| 3) I'm going to be...                | - я собираюсь стать               |
| 4) I want to enter the university    | - я хочу поступить в университет  |
| 5) entrance exams                    | - вступительные экзамены          |
| 6) full-time student                 | - студент дневного отделения      |
| 7) a half-time student               | - студент вечернего отделения     |
| 8) a turner                          | - токарь                          |
| 9) a fitter (a bench worker)         | - слесарь                         |
| 10) a miller                         | - фрезеровщик                     |
| 11) a radio assembler (operator)     | - радиомонтажник                  |
| 12) a technician                     | - техник                          |
| 13) a mechanic                       | - механик                         |
| 14) an electrician                   | - электромонтер                   |
| 15) an engineer                      | - инженер                         |
| 16) a driver                         | - шофер                           |

## **2 Text**

### **Our work at the plant**

#### **Read and translate the text**

I study at the college. I have practice on my profession at a big plant. My work is interesting and important. I am fond of my work. The workers of the plant fulfil and overfulfil the plan. The automation is introduced in many shops. The production is being constantly increased. My friends and I take part in social life of the plant.

I study and work three days a week. I'm learning many subjects. My favourite subjects are Physics and Literature. Besides, we have many special subjects. I study a trade of a turner and I operate a modern universal lathe. My foreman is an old worker. He is a skilled worker. He performs the most difficult operations.

After graduating from the college I'm going to become a worker and study at the university.

#### **2.1 Exercises to the text**

##### **2.1.1 Answer the following questions using the text**

- 1 Where do you study?
- 2 Where do you work?

- 3 Is your work interesting and important?
- 4 Do you take part in social life of the plant?
- 5 What subjects do you learn at the vocational school?
- 6 What trade do you study?
- 7 Is your foreman a skilled worker?
- 8 What are your future plans?

### **2.1.2 Translate the sentences from Russian into English in written form:**

1. Я изучаю профессию слесаря в колледже. 2. Мои друзья и я довольны своей работой. 3. Во всех цехах завода введена автоматизация. 4. Мастер нашей группы - квалифицированный рабочий. 5. После окончания колледжа я буду работать в машиностроительной промышленности. 6. Мы изучаем в колледже много специальных предметов.

### **2.1.3 Translate the word combinations into English using the possessive case of pronouns (притяжательные местоимения):**

моя работа, наш цех, их завод, его друзья, ее мастер

### **2.1.4 Translate the word combinations using the possessive case of pronouns where necessary:**

1. Профессия моего отца. 2. Детали токарного станка. 3. Изобретение Попова. 4. Территория завода.

### **2.1.5 Open the brackets using the Future Indefinite Tense (простое будущее время) and translate the sentences from English into Russian:**

1. I (to study) a trade of a miller. 2. My friend (to pass exams) to the institute. 3. My younger brother (to enter) the vocational school. 4. We (to be) skilled workers. 5. By the end of this year we (to overfulfil) the plan by 20% (per cent). 6. After graduating from the vocational school pupils (to perform) the most difficult tasks.

## **3 Text**

### **At work**

#### **Words and word combinations to the text**

- |                 |             |
|-----------------|-------------|
| 1) to introduce | - вводить   |
| 2) constantly   | - постоянно |
| 3) subject      | - предмет   |



|                        |                            |
|------------------------|----------------------------|
| 4) foreman             | - мастер                   |
| 5) engineering works   | - машиностроительный завод |
| 6) cloakroom           | - раздевалка               |
| 7) to greet            | - приветствовать           |
| 8) moving belt         | - конвейер                 |
| 9) to get rusty        | - ржаветь                  |
| 10) highly skilled job | - квалифицированная работа |
| 11) automation         | - автоматизация            |
| 12) to increase        | - повышать                 |
| 13) to overfulfil      | - перевыполнять            |
| 14) lathe              | - токарный станок          |
| 15) engineering        | - машиностроение           |
| 16) endless stream     | - нескончаемый поток       |
| 17) overalls           | - спецодежда, халат        |
| 18) to attach          | - прикреплять              |
| 19) to oil             | - смазывать                |
| 20) to repair          | - чинить, ремонтировать    |
| 21) break              | - перерыв                  |

### **Read and translate the text**

There are many large factories in our country. Engineering is one of the main industries. Imagine you are standing at the entrance of an engineering works at 8 o'clock in the morning. You will see masses of men and women. They are pouring through the gates in an endless stream.

First of all the workpeople go to the cloakroom to change their clothes. They are putting on their overalls. They are greeting each other.

Let us follow the man who is just passing. He is wearing an overall. He is going to his machine. He operates a lathe in a large workshop.

The foreman is telling him what work he has to do today. His tools are on the bench. Soon he will attach the tool to his machine. His lathe goes round and round and drills a hole in a small steel cube. He has to hold this work piece in place with tongs. The steel cubes come to him on a moving belt.

Many different metals are used at this factory. This year, it is mainly steel. Last year they were using copper. Next year it will be brass.

Another man is oiling the machines. The machines are oiled regularly. If they are neglected, they will get rusty. All the working parts of the machine must, be reached.

One of the machines is being repaired. This is highly skilled job. The man who is doing it is a skilled worker.

### 3.1 Exercises to the text

#### Answer the following questions to the text

- 1 Where do the workers change their clothes?
- 2 What machine does the worker operate?
- 3 What do the workers put on?
- 4 What metals are used at the factory?
- 5 Why must the machines be oiled regularly?
- 6 What operation must be done by a highly skilled worker?

### 4 Text

#### Machine - tools

#### Words and word combinations to the text

- |                |   |
|----------------|---|
| 1) shape       | - форма                                     |
| 2) rolling     | - прокат                                    |
| 3) piercing    | - прохождение отверстия                     |
| 4) casting     | - отливка                                   |
| 5) welding     | - сварка                                    |
| 6) trimming    | - обрезка (заделка краев)                   |
| 7) spinning    | - выдавливание (на токарно-давилном станке) |
| 8) drawing     | - черчение; зд. вытягивание                 |
| 9) chuck       | - зажим; патрон, держатель                  |
| 10) carriage   | - каретка                                   |
| 11) milling    | - фрезерование                              |
| 12) surface    | - поверхность                               |
| 13) grinding   | - дробление (измельчение), шлифовка         |
| 14) convenient | - удобный                                   |
| 15) to equip   | - снаряжать, оборудовать                    |
| 16) shaping    | - придание формы                            |
| 17) thread     | - резьба; нарезка                           |
| 18) bending    | - сгибание                                  |
| 19) headstock  | - передняя бабка                            |
| 20) tailstock  | - задняя бабка                              |
| 21) lathe      | - токарный станок                           |
| 22) drilling   | - сверление                                 |
| 23) cutting    | - резание                                   |
| 24) high-speed | - скоростной                                |
| 25) efficient  | - эффективный                               |

- |             |                      |
|-------------|----------------------|
| 26) forging | - ковка              |
| 27) boring  | - бурение, сверление |
| 28) steel   | - сталь              |

## **Read and translate the text**

Metal undergoes a number of processes before it is formed into the required shape: casting, rolling, welding, piercing, trimming, spinning, bending, drawing, etc.

The machines which perform all these kinds of works are called machine-tools. The most common machine-tool found in almost any workshop is the lathe. The main parts of it are: the headstock, the chuck, the tailstock, the carriage.

The automatic lathe is a perfection of the ordinary lathe. Its tools are changed automatically. A worker skilled in the use of a lathe is called a turner.

There are many other machine-tools that work on plane surfaces, for example, milling machines, planning and shaping machines. Circular holes are drilled by a drilling machine or bored by a boring machine or a boring mill. Thread milling machines are used in the production of different machine elements. Gear cutting machines include gear milling machines. All these machines use cutting tools made of high-speed steel.

### **Lathes**

There are three types of lathes produced by our machine-tool manufacturing works: heavy, medium and light types. The type of a lathe depends upon the size of diameter of work pieces.

A most convenient and efficient machine is the model combination lathe for turning, milling, drilling, grinding, slotting, and tool-sharpening jobs. It can be used both in stationary and mobile repair shops, on ships, etc.

### **Drilling machines**

The most drilling machines are equipped with mechanisms, permitting not only drilling, countersinking and reaming, but also cutting female threads with the help of taps.

Both universal and special-purpose type radial drills are built.

## **4.1 Exercises to the text**

### **4.1.1 Answer the following questions to the text**

- 1 What processes does metal undergo before it is formed into the required shape?
- 2 How are the machines which perform this work called?
- 3 What is the most common machine-tool in any workshop?
- 4 What are the main parts of a lathe?

- 5 What is the automatic lathe?
- 6 How do we call a worker, skilled in the use of a lathe?
- 7 What machine-tools that work on plane surfaces do you know?
- 8 What do the drilling machines drill?
- 9 Where are the thread milling machines used?
- 10 What are the main types of lathes?
- 11 What is the most convenient and efficient machine?
- 12 What are the most drilling machines equipped with?

## 5 Text

### Milling practice

#### General

#### Words and word combinations to the text

- |                                 |  |
|---------------------------------|--|
| 1) milling                      | - фрезерование                               |
| 2) multipoint cutter            | - многозубая фреза                           |
| 3) relative                     | - относительно                               |
| 4) face (milling) cutter        | - фреза для обработки плоскостей             |
| 5) feed motion                  | - движение подачи (вспомогательное движение) |
| 6) revolution                   | - оборот                                     |
| 7) cutting speed                | - скорость резания                           |
| 8) feeding the work             | - подача обрабатываемой детали               |
| 9) teeth                        | - зубья                                      |
| 10) peripheral (milling) cutter | - фреза для торцевой обработки               |
| 11) primary cutting motion      | - главное движение                           |
| 12) spindle                     | - шпиндель                                   |
| 13) per minute                  | - в минуту                                   |
| 14) rotation                    | - вращение                                   |

#### Read and translate the text

Milling is the process of removing metal by feeding the work past a rotating multipoint cutter.

The position of the teeth relative to the cutting surface classifies all milling cutters into the following two broad types: peripheral and face milling cutters. All cutters can be conventionally regarded as belonging to the above two main types.

The rotation of a cutter is called the primary cutting motion while the forward movement of the work is known as the feed motion. Both of those motions are available on a milling machine.

The primary cutting motion, i. e., rotation of the cutter, is characterised by the number of spindle revolutions per minute (rpm) and determines the cutting speed.

## 5.1 Exercises to the text

### 5.1.1 Answer the following questions to the text

- 1 What is milling?
- 2 What two broad types of cutters do you know?
- 3 What is primary cutting motion?
- 4 What motions are available on a milling machine?

### 5.1.2 Translate the sentences from Russian into English:

1. Имеется много разновидностей фрез. 2. Основная часть фрезерного станка - фреза. 3. Количество оборотов шпинделя в минуту определяет скорость резания.

## 6 Text

### Main types of milling machines

#### Words and word combinations to the text

- |                   |                                 |
|-------------------|---------------------------------|
| 1) versatile      | - многосторонний                |
| 2) formed surface | - фасонная поверхность          |
| 3) drilling       | - сверление                     |
| 4) flat surface   | - гладкая (плоская) поверхность |
| 5) thread         | - резьба                        |
| 6) boring         | - расточка; сверление; бурение  |

#### Read and translate the text

Milling machines are extremely versatile machine-tools. They can be used to machine flat and formed surfaces, to cut splines, teeth and threads and even to perform drilling and boring operations. Milling machines are an important part in all metal - cutting machines installed in Russia — 10 per cent— and their number is continuously increasing.

Milling machines in Russia are mainly Russian-made types, for example:

1 Column-and-Knee Type Milling Machine (вертикально-горизонтальный фрезерный станок). This is the most extensively used type of milling machine.

2 Fixed-Bed and Planer-Type Milling Machine (бесконсольно-фрезерный станок).

3 Continuous Action Machine (станок непрерывного действия).

4 Special Milling Machine. These machines are employed in the clock and watch industry, as well as in the automobile, tractor and machine-tool industry.

## 6.1 Exercises to the text

### 6.1.1 Answer the following questions to the text

- 1 Are milling machines versatile machine-tools?
- 2 What can they be used to machine?
- 3 What is the most extensively used type of milling machine?
- 4 What milling machine can you operate?

**6.1.2 Find the words with -ing in the text and determine their function in the sentence.**

**6.1.3 Find the predicate in the sentences and determine its tense (грамматическое время) and mood (наклонение):**

1. Milling machines can be used to machine flat and formed surfaces.
2. Milling machines are extremely versatile tools.

## 7 Text

### Milling machines maintenance

#### Words and word combinations to the text

- |                         |                            |
|-------------------------|----------------------------|
| 1) chips                | - стружка                  |
| 2) to coat              | - покрывать                |
| 3) waste                | - ветошь                   |
| 4) to prevent corrosion | - предохранять от коррозии |

#### Read and translate the text

The machine should always be free from dirt, dust, chips. Clean the machine while it stands idle. Dirt and oil are washed off with cotton waste dipped in kerosene. Then wipe off the machine with dry waste. Before off-days the whole machine should be coated with oil to prevent corrosion. After the machine has been cleaned, all used waste should be stowed in a special box.

### 7.1 Exercises to the text

#### 7.1.1 Answer the following questions to the text

- 1 What do you clean milling machine with?
- 2 Why should you coat the machine with oil?
- 3 Where should you keep all used waste?

## 8 Text

### Milling cutters

#### Words and word combinations to the text

|                              |  |
|------------------------------|--|
| 1) wedge-shaped              | - клинообразный                        |
| 2) particles                 | - частицы                              |
| 3) sharp                     | - острый                               |
| 4) to denote                 | - обозначать                           |
| 5) to break                  | - ломать(ся)                           |
| 6) smoother performance      | - более гладкая обработка              |
| 7) right-hand helix          | - правая спираль                       |
| 8) rough milling operation   | - черновая обработка                   |
| 9) cohesion                  | - сцепление                            |
| 10) layer                    | - слой                                 |
| 11) lip angle                | - угол заострения фрезы (угол заточки) |
| 12) to crumble               | - крошить(ся)                          |
| 13) helical teeth            | - спиральные зубья                     |
| 14) left-hand helix          | - левая спираль                        |
| 15) preference               | - предпочтение                         |
| 16) finish milling operation | - чистовая обработка                   |

#### Read and translate the text

The cutting element of any tool is wedge-shaped. The force applied to the tool causes its wedge to enter the material being cut, destroy the cohesion of its particles and push the separated layer aside.

The sharper the wedge, i. e., the smaller the angle formed by its sides, the less effort is required to feed it into the cut. The angle included between the sides of the wedge is called the "lip angle" and is denoted by the Greek letter  $\beta$  (beta). We can say, therefore, that the smaller the lip angle  $\beta$ , the more easily the cutter will penetrate into the metal and, conversely, the greater the lip angle, the greater the force that must be applied to remove the metal.

Much depends on the material to be cut. If a hard material is to be cut with a tool having a small lip angle  $\beta$ , the thin edge will be too weak and will either crumble or break.

Milling cutters with helical teeth provide much smoother performance. Cutter teeth may have either a left-hand or a right-hand helix. For ordinary milling, preference is given to right-hand helices. Milling cutters with a small number of teeth are employed for rough milling operations.

Conversely, cutters with a large number of teeth are used for finish milling operations.

## 8.1 Exercises to the text

### 8.1.1 Answer the following questions to the text

- 1 What form is the cutting element of any tool?
- 2 What is called the "lip angle"?
- 3 How is the lip angle denoted?
- 4 What cutters are used for finish milling operations?

### 8.1.2 Find the adjectives (прилагательные) in the text and determine their degrees of comparison (степени сравнения).

### 8.1.3 Form the degrees of comparison for the next adjectives:

little, small, good, bad

### 8.1.4 Name the antonyms of the next words:

easy, thin, weak, rough

## 9 Text

### Cutting fluids

#### Words and word combinations to the text

- |                      |                           |
|----------------------|---------------------------|
| 1) coolant           | - охладитель              |
| 2) to apply          | - применять               |
| 3) to prolong        | - продлить, удлинить      |
| 4) mist cooling      | - эмульсионное охлаждение |
| 5) fluid             | - жидкость                |
| 6) to reduce         | - снижать                 |
| 7) continuous stream | - непрерывный поток       |
| 8) soluble           | - растворимый             |

#### Read and translate the text

Coolants or cutting fluids are applied to reduce the heating of a tool and to prolong its life. Milling cutters are cooled with special cutting fluids. Cutting fluids should be supplied in a continuous stream and immediately that milling has begun.

Mist cooling is a recent development at the Soviet plants. For this purpose, the machine is equipped with a mixer filled with soluble oil. The mist prolongs tool life and enables the cutting speed to be increased.



## 9.1 Exercises to the text

### 9.1.1 Answer the following questions to the text

- 1 What cooling processes do you know?
- 2 Why must you cool milling cutters?
- 3 What is a recent development in cooling?
- 4 Is it possible to operate a milling machine without cooling milling cutters?

## 10 Text

### Metal works (bench works)

#### General

#### Words and word combinations to the text

- |                    |                            |
|--------------------|----------------------------|
| 1) marking-out     | - разметка                 |
| 2) straightening   | - правка, рихтовка         |
| 3) cutting         | - резка                    |
| 4) drilling        | - сверление                |
| 5) scraping        | - шабрение                 |
| 6) soldering       | - пайка                    |
| 7) grinding        | - шлифовка                 |
| 8) shears          | - ножницы                  |
| 9) repair mechanic | - слесарь-ремонтник        |
| 10) chiselling     | - рубка                    |
| 11) bending        | - гибка                    |
| 12) filing         | - опиловка                 |
| 13) riveting       | - клепка                   |
| 14) lapping        | - притирка                 |
| 15) tinning        | - лужение                  |
| 16) hack saw       | - ножовка                  |
| 17) tool maker     | - слесарь-инструментальщик |
| 18) assembly       | - сборка                   |

#### Read and translate the text

Metals are the fundamental materials used in the metal working and machine-building industries.

Bench work consists of various technological operations, which include marking-out, chiselling, straightening, bending metals, cutting them with the hack saw or shears, filing, drilling, riveting, scraping, lapping, soldering, tinning, etc. The

aim of all operations is to give a piece of metal the required shape, dimensions and surface quality. There are jobs requiring additional operations, such as scraping, grinding, lapping and finishing when thin layers of metals are removed from the detail being produced.

Mechanics (or bench workers) of machine-building enterprises perform many types of jobs. They make special tools, fixtures and some parts of machines, match one part to another and assemble the whole mechanism. When necessary, they do soldering jobs and machine repair work.

The operators fulfil one or several definite operations, while the skilled workers distributed in groups or teams and sometimes concentrated in special shops (depending on the nature of the work) perform mostly manual work, as, for instance, assembling. Groups or teams and special shops usually consist of tool makers, assembly, set-up, repair mechanics and other grades of workers.

In any industry possessing machines, mechanisms, fixtures and various devices made of metal, mechanics are absolutely necessary.

## **10.1 Exercises to the text**

### **10.1.1 Answer the following questions to the text**

- 1 What operations does bench work consist of?
- 2 What is the aim of all operations?
- 3 What jobs require additional operations?
- 4 What work do the operators fulfil?
- 5 Where are mechanics needed?

### **10.1.2 Translate the next sentences from English into Russian:**

1. Bench workers perform various technological operations such as marking-out, straightening, bending metals and many others. 2. Metal working and machine-building industries use metals as the fundamental materials. 3. Mechanics are needed nearly in all kinds of enterprises possessing metal works.

### **10.1.3 Translate the next sentences from Russian into English:**

1. Я изучаю профессию слесаря в колледже. 2. Мои товарищи и я будем работать в машиностроительной промышленности. 3. Много квалифицированных рабочих работает на нашем предприятии.

## 11 Text

### The bench worker's working place

#### Read and translate the text

The main equipment required by the bench worker for performing the various tasks is a bench with a vice mounted on it, a safety net, an electric lamp, a shelf for measuring tools, drawings, drawers for tools and a seat.

When doing bench work, tools are needed for holding and tightening the jobs being processed. Such tools, which must be securely bolted to the bench, are called bench vice.

The most suitable for most bench work are parallel and hand vices.

The bench is a special table for carrying put bench and vice work. The bench is provided with drawers wherein tools can be stored. The height of the bench is 800—900 mm, its length is 1,000—1,200 mm and the width is 700—800 mm (for single-seated bench). Benches can be single-seated (for one worker), or multi-seated.

#### 11.1 Exercises to the text

##### 11.1.1 Answer the following questions to the text

- 1 What equipment is required for the bench work?
- 2 What tools are needed?
- 3 What are the sizes of the bench?

## 12 Text

### Mechanic's tools

#### Words and word combinations to the text

- |                                 |                             |
|---------------------------------|-----------------------------|
| 1) chisel                       | - долото, зубило            |
| 2) scraper                      | - шабер                     |
| 3) spanner                      | - гаечный ключ              |
| 4) vernier caliper              | - штангенциркуль с нониусом |
| 5) combination bevel protractor | - угломер                   |
| 6) file                         | - напильник                 |
| 7) screwdriver                  | - отвертка                  |
| 8) oilstone                     | - оселок, шлифовальный круг |
| 9) steel rule                   | - стальная линейка          |
| 10) accuracy                    | - точность                  |

## Read and translate the text

Many tools are used by the bench workers, among them are: chisels, files, scrapers, screwdrivers, spanners and others.

**Chisels** are widely used for chipping off layers of metal from the surface of jobs, for cutting blanks in parts, as well as for cutting grooves, slots and keyways.

**Files** are cutting tools. They are of different sizes and shapes, with a series of small cuttings or teeth on their working surfaces - sides and edges. Files are manufactured in sizes ranging from 100 to 400 mm in length.

**Scrapers** are rectangular or triangular steel strips with cutting edges on one end. These cutting tools are used for precise finish of flat and curved surfaces in cases when it is necessary to obtain perfect mating surfaces on contacting parts.

**Screwdrivers** are used for most ordinary works such as screwing in and out screws.

**Spanners** are used for tightening and removing bolts and nuts.

**Oilstones** are necessary for sharpening and dressing practically every kind of straight-edge cutting tools after, they have been ground.

**The vernier caliper** is an instrument used for measuring inside or outside linear dimensions with greater accuracy than can be obtained with the rule.

**The steel rule** is used for measuring inside and outside linear dimensions.

**The combination bevel protractor** (angle) is used for measuring and laying out various angles on surfaces being marked out.

### 12.1 Exercises to the text

#### 12.1.1 Answer the following questions to the text

- 1 What mechanic's tools do you know?
- 2 What processes are chisels used for?
- 3 What are the sizes of files?
- 4 What tool is used to perform the most ordinary work such as screwing in and out screws?

## 13 Text

### Operations

#### Words and word combinations to the text

- |                     |                 |
|---------------------|-----------------|
| 1) metal chiselling | - рубка металла |
| 2) straightening    | - рихтовка      |
| 3) drilling         | - сверление     |
| 4) riveting         | - клепка        |

|                    |                        |
|--------------------|------------------------|
| 5) scraping        | - шабрение             |
| 6) soldering       | - пайка                |
| 7) bending         | - гибка                |
| 8) filing          | - опиловка             |
| 9) boring          | - расточка             |
| 10) lapping        | - притирка             |
| 11) tinning        | - лужение              |
| 12) soft soldering | - пайка мягким припоем |

## Read and translate the text

**Metal chiseling.** This operation may be manual or mechanized. Hand chiseling is hard work and takes up much time. It can be made easier when mechanized with the aid of a pneumatic hammer.

**Straightening.** This operation is being performed when bench workers receive bent or twisted blanks of metal. The elimination of these defects of the blanks is called straightening. Metal can be straightened either mechanically (with the aid of straightening rolls, presses or other devices) or manually, by using hand hammers.

**Bending operations** are applied when making many articles from sheet, flat and round steel. Workpieces are bent to a definite radius or to a rounded up angle.

**Filing** is the process of removing a layer of metal from a workpiece with cutting tool called a file.

**Drilling** is an operation of making holes in a solid piece of material by means of cutting tool known as a drill.

**Boring** is the operation of increasing the diameter of an existing hole with a drill.

By **riveting** we understand the operation of fastening two or more parts with rivets. Rivets are cylindrical metal rods, with heads. They are employed for fastening parts, metal plates, bars, which are not to be subjected to disassembly.

**Lapping** is a refined process which is applied in facing up external and internal surfaces of parts, cylindrical, flat, formed, requiring great precision and extremely fine quality of face finish. It is performed with a special tool, called a lap. It is one of the most accurate methods.

By **scraping** is understood the operation of accurately finishing the surface of a workpiece by removing a very thin layer of metal with a cutting tool called a scraper.

**Tinning** is a protective coating of tin or solder applied to the surface of metals.

**Soldering** is the process of permanently joining two parts with special alloys, known as solders.

### 13.1 Exercises to the text

#### 13.1.1 Answer the following questions to the text

- 1 What operations do you know?
- 2 What operations can you perform?
- 3 What is your favourite operation?

### **13.1.2 Translate the next word combinations:**

to take up much time; with the aid of; by means of

### **13.1.3 Name the operation and the instrument with the help of which this operation is fulfilled:**

For example, chiselling - chisel

filing, spanner, hammer, bending, straightening, tightening, sharpening, screwdriver, oilstones, screwing, rivets, lapping, riveting.

## **14 Text**

### **Safety engineering**

#### **Words and word combinations to the text**

- |                       |                                |
|-----------------------|--------------------------------|
| 1) safety engineering | - техника безопасности         |
| 2) lack               | - нехватка, отсутствие         |
| 3) training workshop  | - учебный цех (мастерская)     |
| 4) accident           | - несчастный случай            |
| 5) safety rules       | - правила техники безопасности |
| 6) to ensure          | - обеспечивать                 |

#### **Read and translate the text**

Accidents to people in industrial enterprises are called industrial traumatism (injury). They occur when workers have not acquired the requisite for skill and lack the necessary experience in handling tools and equipment. Accidents are also caused through neglect of safety rules and regulations in the factories and training workshops.

The purpose of safety engineering is to prevent accidents and to create such conditions of work in industry which will ensure maximum productivity of labour.

When taking up new duties or when first going to work at any industrial enterprise each worker is obliged to acquaint himself thoroughly with, and to master the safety instructions.

### **14.1 Exercises to the text**

#### **14.1.1 Answer the following questions to the text**

- 1 How are the accidents to people in industrial enterprises called?
- 2 When do the accidents to people occur?

- 3 What must one do to prevent accidents?
- 4 What is the purpose of safety engineering?
- 5 What is a worker obliged to do when taking up new duties?

**14.1.2 Find the verbs in passive voice in the text, determine their tense and do of these verbs.**

For example, are called - call

## 15 Text

### Lathe practice General

#### Words and word combinations to the text

- |                       |                                 |
|-----------------------|---------------------------------|
| 1) linear feed motion | - прямолинейное движение подачи |
| 2) headstock          | - передняя бабка                |
| 3) feed gearbox       | - коробка подач                 |
| 4) carriage           | - каретка                       |
| 5) speed gearbox      | - коробка скоростей             |
| 6) chips              | - стружка                       |
| 7) to lubricate       | - смазывать                     |
| 8) plug               | - зд. пробка                    |
| 9) to clog            | - забивать, засорять            |
| 10) bed               | - станина                       |
| 11) tailstock         | - задняя бабка                  |
| 12) apron             | - фартук                        |
| 13) to clamp          | - закреплять                    |
| 14) shift             | - смена                         |
| 15) oil can           | - масленка                      |
| 16) friction          | - трение                        |
| 17) pollution         | - загрязнение                   |
| 18) to maintain       | - обслуживать, содержать        |

#### Read and translate the text

The lathe is the most general and useful of all machine-tools and is used in producing many types of machine parts.

In machining operations on lathes, the work is rotated, while the cutting tool has a linear feed motion.

Although there are many types of lathes employed in industry, they have many

units and parts in common. The principle units of an engine lathe are the bed, headstock, tailstock, feed gearbox, apron and carriage. All the principle units of the lathe are mounted on the bed. The latter has ways along which the carriage and tailstock traverse. The work is clamped and rotated by the headstock which contains the spindle and speed gearbox. In all lathe work it is most important to clamp the work and the tool as firmly as possible.

The separate parts and mechanisms of the lathe can be maintained in proper operating condition only by attentive care.

One of the principal rules of lathe maintenance is-timely lubrication of all friction surfaces. The bearings of the rotating lathe parts should be lubricated with special care.

After lubricating, the oilers should always be closed with their covers, plugs or screw to prevent pollution of the oil. Never plug oilers with cotton as they may get between and clog the friction surfaces.

## **15.1 Exercises to the text**

### **15.1.1 Answer the following questions to the text**

- 1 What machine-tools are most general and useful?
- 2 Where is it used?
- 3 What are the main parts of an engine lathe?
- 4 Where are all the principal units of the lathe mounted?
- 5 What should the lathe be cleaned of at the end of every working shift?

**15.1.2 Find the sentences with the verb *should* in the text and explain its using.**

**15.1.3 Name the main parts of the lathe.**

**15.1.4 Form nouns with the help of suffix -tion from the next verbs:**

to produce, to operate, to rotate, to translate, to dictate

**15.1.5 Translate the next word combinations and explain the meaning of the verb *should*:**

should be closed, should be cleaned, should be lubricated, should be coated



## 16 Text

### Threads

#### Words and word combinations to the text

|                      |                            |
|----------------------|----------------------------|
| 1) thread            | - резьба                   |
| 2) to transmit       | - передавать               |
| 3) screw             | - винт                     |
| 4) size              | - размер                   |
| 5) carbon            | - карбонадо (черный алмаз) |
| 6) tap               | - метчик                   |
| 7) chaser            | - резьбовой резец          |
| 8) to decrease       | - снижать                  |
| 9) right-hand        | - правый                   |
| 10) upward           | - вверх                    |
| 11) die              | - плашка                   |
| 12) high speed steel | - закаленная сталь         |
| 13) handbook         | - справочник               |
| 14) design           | - конструкция              |
| 15) productivity     | - производительность       |
| 16) to join          | - соединять                |

#### Read and translate the text

Threads are one of the commonest elements of mechanical engineering. They serve both to join parts together and to transmit motion. Threads may be external and internal. When thread is seen from the side, the thread of a right-hand screw will advance upward from the left to the right. For left-hand screws the thread will advance upward from the right to the left.

Small size external thread may be cut with a die. Dies are made of either carbon or high-speed steel. Internal thread of small size is cut with a tap. Small thread is usually tapped immediately after drilling the hole for the thread. For large size thread, the hole is bored to the required diameter for tapping after drilling. The diameter of the hole for tapping is very important; it should be somewhat larger than the minor diameter of the thread. The diameter of holes for lapping may be found in a handbook.

The most common method for cutting threads in a lathe is with threading tools. External and internal threads may also be cut with chasers.

It is absolutely necessary to use cutting oil in thread cutting operations.

Skilled lathe operators considerably increase productivity in thread cutting by improving the design of threading tools, by increasing the cutting speed, and by decreasing the number of passes.

## 16.1 Exercises to the text

### 16.1.1 Answer the following questions to the text

- 1 What purposes do the threads serve?
- 2 What types of threads do you know?
- 3 What is the most common method for cutting threads?
- 4 What tools are used to cut external and internal threads?

## 17 Text

### Measuring tools

#### Words and word combinations to the text

- |                       |                             |
|-----------------------|-----------------------------|
| 1) vernier caliper    | - штангенциркуль с нониусом |
| 2) micrometer caliper | - микрометр                 |
| 3) inside micrometer  | - микрометрический нутромер |
| 4) limit gauge        | - предельный калибр         |
| 5) dimension          | - размер                    |
| 6) length             | - длина                     |
| 7) thread gauge       | - резьбовой калибр          |
| 8) precision          | - точность                  |
| 9) thickness          | - толщина                   |
| 10) to check          | - проверять                 |

#### Read and translate the text

Machined workpieces are measured by accurate measuring tools, such as precision vernier calipers, micrometer calipers, inside micrometers and limit gauges.

In performing accurate work a precision vernier caliper is required. The micrometer caliper, or simply micrometer, is used for more accurate measurements of external dimensions of work, such as diameters, thickness and lengths. Internal dimensions may be measured with an accuracy of 0.01 mm using inside micrometers.

The best measuring tools for checking threads are standard and limit thread gauges.

## 17.1 Exercises to the text

### 17.1.1 Translate the text from English into Russian in written form

## 18 Text

### Lapping Knurling

#### Words and word combinations to the text

- |                     |                            |
|---------------------|----------------------------|
| 1) lapping          | - притирка                 |
| 2) hermetical joint | - герметическое соединение |
| 3) to advance       | - двигать, продвигать      |
| 4) to rotate        | - вращать(ся)              |
| 5) finishing        | - чистовая обработка       |
| 6) knurling         | - накатка, насечка         |
| 7) to force         | - зд. вдавливать           |
| 8) grip             | - захват                   |

#### Read and translate the text

##### Lapping

Lapping is a particular method of finishing different surfaces. It is also used in making hermetical joints. This method is most widely employed in tool manufacture and in machine building. The quality of surface finish after lapping may be from the 10th to the 14th class.

##### Knurling

To knurl a surface, advance the knurling tool and force the knurls into the surface of the rotating work. To provide a better grip of cylindrical handles they should be knurled. This operation is called knurling.

#### 18.1 Exercises to the text

##### 18.1.1 Answer the following questions to the text

- 1 What is a particular method of finishing different surfaces?
- 2 Where is this method widely used?
- 3 What is the quality of surface finish after lapping?
- 4 What operation should be done to provide a better grip of cylindrical handles?

## 19 Text

### Metals

#### Words and word combinations to the text

- |                     |   |
|---------------------|---|
| 1) property         | - свойство                                      |
| 2) metallurgy       | - металлургия                                   |
| 3) separation       | - разделение, интервал                          |
| 4) dense            | - плотный                                       |
| 5) arrangement      | - расположение                                  |
| 6) regularly        | - регулярно, правильно                          |
| 7) to slide         | - скользить                                     |
| 8) malleable        | - ковкий, податливый, способный деформироваться |
| 9) bent or bend     | - гнуть   |
| 10) to fracture     | - ломать  |
| 11) ductil          | - эластичный, ковкий                            |
| 12) to draw         | - волочить, тянуть                              |
| 13) wire            | - проволока                                     |
| 14) lead            | - свинец  |
| 15) iron            | - железо, чугун                                 |
| 16) grain           | - зерно   |
| 17) size            | - размер, величина                              |
| 18) to depend       | - зависеть                                      |
| 19) shape           | - форма, формировать                            |
| 20) composition     | - состав  |
| 21) coarse          | - грубый, крупный                               |
| 22) treatment       | - обработка                                     |
| 23) quenching       | - закалка                                       |
| 24) tempering       | - отпуск после закалки, нормализация            |
| 25) annealing       | - отжиг, отпуск                                 |
| 26) rolling         | - прокатка                                      |
| 27) to hammer       | - ковать (напр. молотом)                        |
| 28) extrusion       | - экструзия                                     |
| 29) metal fatigue   | - усталость металла                             |
| 30) creep           | - ползучесть                                    |
| 31) stress          | - давление, напряжение                          |
| 32) failure         | - повреждение, разрушение                       |
| 33) vessel          | - сосуд, котел, судно                           |
| 34) lathe           | - токарный станок                               |
| 35) milling machine | - фрезерный станок                              |
| 36) shaper          | - строгальный станок                            |
| 37) grinder         | - шлифовальный станок                           |

- |             |                                 |
|-------------|---------------------------------|
| 38) to melt | - плавить, плавиться расплавить |
| 39) to cast | - отливать, отлить              |
| 40) mould   | - форма для отливки             |

## **Read and translate the text**

Metals are materials most widely used in industry because of their properties. The study of the production and properties of metals is known as metallurgy.

The separation between the atoms in metals is small, so most metals are dense. The atoms are arranged regularly and can slide over each other. That is why metals are malleable (can be deformed and bent without fracture) and ductile (can be drawn into wire). Metals vary greatly in their properties. For example, lead is soft and can be bent by hand, while iron can only be worked by hammering at red heat.

The regular arrangement of atoms in metals gives them a crystalline structure. Irregular crystals are called grains. The properties of the metals depend on the size, shape, orientation, and composition of these grains. In general, a metal with small grains will be harder and stronger than one with coarse grains.

Heat treatment such as quenching, tempering, or annealing controls the nature of the grains and their size in the metal. Small amounts of other metals (less than 1 per cent) are often added to a pure metal. This is called alloying (легирование) and it changes the grain structure and properties of metals.

All metals can be formed by drawing, rolling, hammering and extrusion, but some require hot-working. Metals are subject to metal fatigue and to creep (the slow increase in length under stress) causing deformation and failure. Both effects are taken into account by engineers when designing, for example, airplanes, gas-turbines, and pressure vessels for high-temperature chemical processes. Metals can be worked using machine-tools such as lathe, milling machine, shaper and grinder.

The ways of working a metal depend on its properties. Many metals can be melted and cast in moulds, but special conditions are required for metals that react with air.

### **19.1 Exercises to the text**

#### **19.1.1 Answer the following questions to the text**

- 1 What are metals and what do we call metallurgy?
- 2 Why are most metals dense?
- 3 Why are metals malleable?
- 4 What is malleability?
- 5 What are grains?
- 6 What is alloying?
- 7 What is crystalline structure?
- 8 What do the properties of metals depend on?
- 9 What changes the size of grains in metals?

- 10 What are the main processes of metal forming?
- 11 How are metals worked?
- 12 What is creeping?

**19.1.2 Find the following words and word combinations in the text:**

- 1 Свойства металлов
- 2 расстояние между атомами
- 3 правильное расположение
- 4 сильно отличаются по своим свойствам
- 5 кристаллическая структура
- 6 размер зерен
- 7 форма зерен закалка
- 8 отжиг
- 9 волочение
- 10 прокатка
- 11 ковка
- 12 экструзия
- 13 структура и свойства зерна
- 14 горячая обработка
- 15 усталость металла
- 16 ползучесть металла
- 17 плавка и отливка в формы
- 18 способы обработки металлов

**19.1.3 Complete the following sentences:**

- 1 Metals are...
- 2 Metallurgy is...
- 3 Most metals are...
- 4 The regular arrangement of atoms in metals...
- 5 Irregular crystals...
- 6 The properties of the metals depend...
- 7 Metals with small grains will be...
- 8 ...controls the nature of the grains in the metal.
- 9 Alloying is...
- 10 All metals can be formed by...
- 12 Creep is...
- 13 Metals can be worked using...

**19.1.4 Explain in English the meaning of the following words:**

- 1 malleability
- 2 crystalline structure
- 3 grains

- 4 heat treatment
- 5 alloying
- 6 creep

### 19.1.5 Translate into English:

1 Металлы - плотные материалы потому, что между атомами в металлах малое расстояние.

2 Металлы имеют кристаллическую структуру из-за правильного расположения атомов.

3 Чем меньше зерна, тем тверже металл.

4 Закалка и отжиг изменяют форму и размер зерен в металлах.

5 Легирование изменяет структуру зерен и свойства металлов.

6 Металл деформируется и разрушается из-за усталости и ползучести.

## Text 20

### Steel

#### Words and word combinations to the text

- |                          |   |
|--------------------------|---|
| 1) alloy                 | - сплав                                 |
| 2) carbon                | - углерод                               |
| 3) stiff                 | - жесткий                               |
| 4) to corrode            | - разъедать, ржаветь                    |
| 5) rusty                 | - ржавый                                |
| 6) stainless             | - нержавеющей                           |
| 7) to resist             | - сопротивляться                        |
| 8) considerably          | - значительно, гораздо                  |
| 9) tough                 | - крепкий, жесткий, прочный, выносливый |
| 10) forging              | -ковка                                  |
| 11) welding              | -сварка                                 |
| 12) brittle              | - хрупкий, ломкий                       |
| 13) cutting tools        | - режущие инструменты                   |
| 14) surgical instruments | - хирургические инструменты             |
| 15) blade                | - лезвие                                |
| 16) spring               | - пружина                               |
| 17) inclusion            | - включение                             |
| 18) to affect            | - влиять                                |
| 19) manganese            | - марганец                              |
| 20) silicon              | - кремний                               |
| 21) rust-proof           | - нержавеющей                           |
| 22) nitrogen             | - азот                                  |
| 23) tungsten             | - вольфрам                              |

## **Read and translate the text**

The most important metal in industry is iron and its alloy - steel. Steel is an alloy of iron and carbon. It is strong and stiff, but corrodes easily through rusting, although stainless and other special steels resist corrosion. The amount of carbon in steel influences its properties considerably. Steels of low carbon content (mild steels) are quite ductile and are used in the manufacture of sheet iron, wire, and pipes. Medium-carbon steels containing from 0.2 to 0.4 per cent carbon are tougher and stronger and are used as structural steels. Both mild and medium-carbon steels are suitable for forging and welding. High-carbon steels contain from 0.4 to 1.5 per cent carbon, are hard and brittle and are used in cutting tools, surgical instruments, razor blades and springs. Tool steel, also called silver steel, contains about 1 per cent carbon and is strengthened and toughened by quenching and tempering.

The inclusion of other elements affects the properties of the steel. Manganese gives extra strength and toughness. Steel containing 4 per cent silicon is used for transformer cores or electromagnets because it has large grains acting like small magnets. The addition of chromium gives extra strength and corrosion resistance, so we can get rust-proof steels. Heating in the presence of carbon or nitrogen-rich materials is used to form a hard surface on steel (case-hardening). High-speed steels, which are extremely important in machine-tools, contain chromium and tungsten plus smaller amounts of vanadium, molybdenum and other metals.

### **20.1 Exercises to the text**

#### **20.1.1 Answer the following questions to the text**

- 1 What is steel?
- 2 What are the main properties of steel?
- 3 What are the drawbacks of steel?
- 4 What kinds of steel do you know? Where are they used?
- 5 What gives the addition of manganese, silicon and chromium to steel?
- 6 What can be made of mild steels (medium-carbon steels, high-carbon steels)?
- 7 What kind of steels can be forged and welded?
- 8 How can we get rust-proof (stainless) steel?
- 9 What is used to form a hard surface on steel?
- 10 What are high-speed steels alloyed with?

#### **20.1.2 Find the following words and word combinations in the text:**

- 1 сплав железа и углерода
- 2 прочный и жесткий
- 3 легко корродирует
- 4 нержавеющей сталь
- 5 низкое содержание углерода



- 6 ковкость
- 7 листовое железо, проволока, трубы
- 8 конструкционные стали
- 9 пригодны дляковки и сварки
- 10 твердый и хрупкий
- 11 режущие инструменты
- 12 хирургические инструменты
- 13 инструментальная сталь
- 14 упрочнять
- 15 добавление марганца (кремния, хрома, вольфрама, молибдена, ванадия)

## 21 Text

### Metalworking processes

#### Words and word combinations to the text

- |                   |   |
|-------------------|---|
| 1) useful         | - полезный  |
| 2) shape          | - форма, формировать                                  |
| 3) rolling        | - прокатка  |
| 4) extrusion      | - экструзия, выдавливание                             |
| 5) drawing        | - волочение   |
| 6) forging        | - ковка   |
| 7) sheet          | - лист  |
| 8) to subject     | - подвергать  |
| 9) amount         | - количество  |
| 10) condition     | - состояние, условие                                  |
| 11) perform       | - выполнять, проводить                                |
| 12) to harden     | - делаться твердым, упрочняться                       |
| 13) at least      | - по крайней мере                                     |
| 14) common        | - общий   |
| 15) billet        | - заготовка, болванка                                 |
| 16) orifice       | - отверстие   |
| 17) die           | - штамп, пуансон, матрица, фильера, волочильная доска |
| 18) cross section | - поперечное сечение                                  |
| 19) window frame  | - рама окна   |
| 20) tube          | - труба   |
| 21) hollow        | - полый   |
| 22) initial       | - первоначальный, начальный                           |
| 23) thick-walled  | - толстостенный                                       |
| 24) mandrel       | - оправка, сердечник                                  |

|                  |                             |
|------------------|-----------------------------|
| 25) impact       | - удар                      |
| 26) loosely      | - свободно, с зазором       |
| 27) fitting      | - зд. посадка               |
| 28) ram          | - пуансон, плунжер          |
| 29) force        | - сила                      |
| 30) gap          | - промежуток, зазор         |
| 31) to determine | - устанавливать, определять |

## Read and translate the text

Metals are important in industry because they can be easily deformed into useful shapes. A lot of metalworking processes have been developed for certain applications. They can be divided into five broad groups:

- 1 rolling,
- 2 extrusion,
- 3 drawing,
- 4 forging,
- 5 sheet-metal forming.

During the first four processes metal is subjected to large amounts of strain (deformation). But if deformation goes at a high temperature, the metal will recrystallize - that is, new strain-free grains will grow instead of deformed grains. For this reason metals are usually rolled, extruded, drawn, or forged above their recrystallization temperature. This is called hot working. Under these conditions there is no limit to the compressive plastic strain to which the metal can be subjected.

Other processes are performed below the recrystallization temperature. These are called cold working. Cold working hardens metal and makes the part stronger. However, there is a limit to the strain before a cold part cracks.

### Rolling

Rolling is the most common metalworking process. More than 90 percent of the aluminum, steel and copper produced is rolled at least once in the course of production. The most common rolled product is sheet. Rolling can be done either hot or cold. If the rolling is finished cold, the surface will be smoother and the product stronger.

### Extrusion

Extrusion is pushing the billet to flow through the orifice of a die. Products may have either a simple or a complex cross section. Aluminum window frames are the examples of complex extrusions.

Tubes or other hollow parts can also be extruded. The initial piece is a thick-walled tube, and the extruded part is shaped between a die on the outside of the tube and a mandrel held on the inside.

In impact extrusion (also called back-extrusion) (штамповка выдавливанием), the workpiece is placed in the bottom of a hole and a loosely fitting ram is pushed against it. The ram forces the metal to flow back around it, with the gap between the ram and the die determining the wall thickness. The example of this process is the manufacturing of aluminum beer cans.

## **21.1 Exercises to the text**

### **21.1.1 Answer the following questions to the text**

- 1 Why are metals so important in industry?
- 2 What are the main metalworking processes?
- 3 Why are metals worked mostly hot?
- 4 What properties does cold working give to metals?
- 5 What is rolling? Where is it used?
- 6 What is extrusion? What shapes can be obtained after extrusion?
- 7 What are the types of extrusion?

### **21.1.2 Find the following in the text:**

- 1 могут легко деформироваться
- 2 нужные формы
- 3 подвергать большим деформациям
- 4 зерна свободные от деформации
- 5 температура перекристаллизации
- 6 пластическая деформация сжатия
- 7 самый обычный процесс обработки металла
- 8 самое обычное изделие проката
- 9 отверстие фильеры
- 10 первоначальный
- 11 сложное сечение
- 12 пустотелые детали
- 13 свободно входящий плунжер
- 14 зазор между плунжером (пуансоном) и штампом
- 15 толщина стенки

### **21.1.3 Translate into English:**

1 Способность металла перекристаллизовываться при высокой температуре используется при горячей обработке.

2 Перекристаллизация — это рост новых, свободных от деформации зерен.

3 Во время горячей обработки металл может подвергаться очень большой пластической деформации сжатия.

4 Холодная обработка делает металл тверже и прочнее, но некоторые

металлы имеют предел деформации.

5 Листовой прокат может производиться горячим или холодным.

6 Поверхность холоднокатаного листа более гладкая и он прочнее.

7 Поперечное сечение фильеры для экструзии может быть простым или сложным.

8 Алюминиевые и медные сплавы являются наилучшими для экструзии из-за их пластичности при деформации.

9 Алюминиевые банки, тубики для зубной пасты являются примерами использования штамповки выдавливанием.

10 Толщина стенки алюминиевой банки определяется зазором между пуансоном и штампом.

## 22 Text

### Drawing

### Sheet metal forming

### Forging

## Words and word combinations to the text

- |                       |   |
|-----------------------|---|
| 1) to pull            | - тянуть                                  |
| 2) reduction          | - сокращение                              |
| 3) to achieve         | - достигать                               |
| 4) in series          | - серия, последовательно                  |
| 5) beyond             | - выше, свыше                             |
| 6) yield point        | - точка текучести металла                 |
| 7) to retain          | - сохранять, удерживать                   |
| 8) to bend            | - гнуть                                   |
| 9) shearing           | - обрезка, отрезание                      |
| 10) edge              | - край                                    |
| 11) to grip           | - схватывать                              |
| 12) lower die         | - нижний штамп                            |
| 13) upper die         | - верхний штамп                           |
| 14) forming operation | - операция штампования                    |
| 15) dimension         | - измерение, размеры                      |
| 16) required          | - необходимый                             |
| 17) increase          | - увеличение                              |
| 18) open-die forging  | - ковка в открытом штампе<br>(подкладном) |
| 19) hammering         | - ковка, колотить                         |
| 20) within            | - внутри, в пределах                      |
| 21) to enclose        | - заключать                               |
| 22) rod               | - прут, стержень                          |

|               |                         |
|---------------|-------------------------|
| 23) bar       | - прут, брусок          |
| 24) involved  | - включенный            |
| 25) tolerance | - допуск                |
| 26) upsetting | - высадка, выдавливание |
| 27) blow      | - удар                  |
| 28) coining   | - чеканка               |
| 29) imprint   | - отпечаток             |
| 30) clamp     | - зажим                 |
| 31) to hit    | - ударять               |

## **Read and translate the text**

### **Drawing**

Drawing consists of pulling metal through a die. One type is wire drawing. The diameter reduction that can be achieved in one die is limited, but several dies in series can be used to get the desired reduction.

### **Sheet metal forming**

Sheet metal forming (штамповка листового металла) is widely used when parts of certain shape and size are needed. It includes forging, bending and shearing. One characteristic of sheet metal forming is that the thickness of the sheet changes little in processing. The metal is stretched just beyond its yield point (2 to 4 percent strain) in order to retain the new shape. Bending can be done by pressing between two dies. Shearing is a cutting operation similar to that used for cloth.

Each of these processes may be used alone, but often all three are used on one part. For example, to make the roof of an automobile from a flat sheet, the edges are gripped and the piece pulled in tension over a lower die. Next an upper die is pressed over the top, finishing the forming operation (штамповку), and finally the edges are sheared off to give the final dimensions.

### **Forging**

Forging is the shaping of a piece of metal by pushing with open or closed dies. It is usually done hot in order to reduce the required force and increase the metal's plasticity.

Open-die forging is usually done by hammering a part between two flat faces. It is used to make parts that are too big to be formed in a closed die or in cases where only a few parts are to be made. The earliest forging machines lifted a large hammer that was then dropped on the workpiece, but now air or steam hammers are used, since they allow greater control over the force and the rate of forming. The part is shaped by moving or turning it between blows.

Closed-die forging is the shaping of hot metal within the walls of two dies that come together to enclose the workpiece on all sides. The process starts with a rod or

bar cut to the length needed to fill the die. Since large, complex shapes and large strains are involved, several dies may be used to go from the initial bar to the final shape. With closed dies, parts can be made to close tolerances so that little finish machining is required.

Two closed-die forging operations are given special names. They are upsetting and coining. Coining takes its name from the final stage of forming metal coins, where the desired imprint is formed on a metal disk that is pressed in a closed die. Coining involves small strains and is done cold. Upsetting involves a flow of the metal back upon itself. An example of this process is the pushing of a short length of a rod through a hole, clamping the rod, and then hitting the exposed length with a die to form the head of a nail or bolt.

## **22.1 Exercises to the text**

### **22.1.1 Answer the following questions to the text**

- 1 How can the reduction of diameter in wire drawing be achieved?
- 2 What is sheet metal forming and where it can be used?
- 3 What is close-die forging?
- 4 What is forging?
- 5 What are the types of forging?
- 6 What types of hammers are used now?
- 7 Where are coining and upsetting used?
- 8 What process is used in wire production?
- 9 Describe the process of making the roof of a car,

### **22.1.2 Find the following word combinations in the text:**

- 1 протягивание металла через фильеру
- 2 волочение проволоки
- 3 уменьшение диаметра
- 4 толщина листа
- 5 растягивать выше точки текучести
- 6 сохранить новую форму
- 7 края отрезаются
- 8 конечные размеры
- 9 уменьшить необходимое усилие
- 10 увеличить пластичность металла
- 11 воздушные или паровые молоты
- 12 сила и скорость штампования
- 13 внутри стенок двух штампов
- 14 отделочная обработка
- 15 малые допуски

### 22.1.3 Translate into English:

1 При волочении проволоки диаметр отверстия волочильной доски каждый раз уменьшается.

2 Штамповка листового металла включает в себя ковку, изгиб и обрезку.

3 Небольшая деформация листа при растяжении помогает сохранить новую форму детали.

4 Изменение формы при штамповке производится путем сжатия между двумя штампами.

5 Края листа при штамповке отрезаются для получения конечных размеров.

6 При проковке деталь должна быть горячей для уменьшения необходимых усилий и увеличения пластичности металла.

7 Послековки в закрытых штампах детали не требуют большой механической обработки.

8 При чеканке деформация металла невелика и отпечаток формируется на поверхности металла.

9 Высадка используется для изготовления головок гвоздей и болтов.

## 23 Text

### Metalworking and metal properties

#### Words and word combinations to the text

- |                      |                             |
|----------------------|-----------------------------|
| 1) feature           | - черта, особенность        |
| 2) to provide        | - обеспечивать              |
| 3) improvement       | - улучшение                 |
| 4) property          | - свойство                  |
| 5) eliminate         | - ликвидировать, исключать  |
| 6) porosity          | - пористость                |
| 7) directional       | - направленный              |
| 8) to segregate      | - разделять                 |
| 9) casting           | - отливка                   |
| 10) elongated        | - удлиненный                |
| 11) to weaken        | - ослабевать, ослаблять     |
| 12) transverse       | - поперечный                |
| 13) flow             | - течение, поток            |
| 14) finished         | - отделанный                |
| 15) thinning         | - утончение                 |
| 16) fracture         | - разрушение                |
| 17) strain hardening | - деформационное упрочнение |
| 18) brass            | - латунь                    |

|                       |  |
|-----------------------|--|
| 19) beverage          | - напиток  |
| 20) can               | - консервная банка                               |
| 21) to exhibit        | - проявлять                                      |
| 22) inner             | - внутренний                                     |
| 23) flaws             | - недостатки, дефекты<br>кристаллической решетки |
| 24) inclusion         | - включение                                      |
| 25) trapped           | - зд. заключенный                                |
| 26) refining          | - очищать, очистка                               |
| 27) to avoid          | - избегать                                       |
| 28) to undergo        | - подвергаться                                   |
| 29) tensile ductility | - пластичность при растяжении                    |

## Read and translate the text

An important feature of hot working is that it provides the improvement of mechanical properties of metals. Hot-working (hot-rolling or hot-forging) eliminates porosity, directionality, and segregation that are usually present in metals. Hot-worked products have better ductility and toughness than the unworked casting. During the forging of a bar, the grains of the metal become greatly elongated in the direction of flow. As a result, the toughness of the metal is greatly improved in this direction and weakened in directions transverse to the flow. Good forging makes the flow lines in the finished part oriented so as to lie in the direction of maximum stress when the part is placed in service.

The ability of a metal to resist thinning and fracture during cold-working operations plays an important role in alloy selection. In operations that involve stretching, the best alloys are those which grow stronger with strain (are strain hardening) - for example, the copper-zinc alloy, brass, used for cartridges and the aluminum-magnesium alloys in beverage cans, which exhibit greater strain hardening.

Fracture of the workpiece during forming can result from inner flaws in the metal. These flaws often consist of nonmetallic inclusions such as oxides or sulfides that are trapped in the metal during refining. Such inclusions can be avoided by proper manufacturing procedures.

The ability of different metals to undergo strain varies. The change of the shape after one forming operation is often limited by the tensile ductility of the metal. Metals such as copper and aluminum are more ductile in such operations than other metals.

### 23.1 Exercises to the text

#### 23.1.1 Answer the following questions to the text

- 1 What process improves the mechanical properties of metals?
- 2 What new properties have hot-worked products?



3 How does the forging of a bar affect the grains of the metal? What is the result of this?

4 How are the flow lines in the forged metal oriented and how does it affect the strength of the forged part?

5 What are the best strain-hardening alloys? Where can we use them?

6 What are the inner flaws in the metal?

7 Can a metal fracture because of the inner flaw?

8 What limits the change of the shape during forming operations?

### **23.1.2 Find the following in the text:**

1 важная особенность горячей обработки

2 улучшение механических свойств металла

3 необработанная отливка

4 направление максимального напряжения

5 способность сопротивляться утончению и разрушению

6 проявлять большее деформационное упрочнение

7 разрушение детали при штамповке

8 внутренние дефекты в металле

9 неметаллические включения

10 способность металлов подвергаться деформации

11 ограничивается пластичностью металла при растяжении

### **23.1.3 Translate into English:**

1 Горячая обработка металла улучшает его механические свойства и устраняет пористость и внутренние дефекты.

2 Удлинение зерен в направлении текучести при ковке значительно улучшает прочность металла в этом направлении и уменьшает его прочность в поперечном.

3 Хорошая проковка ориентирует линии текучести в направлении максимального напряжения.

4 Деформационное упрочнение металла при холодной обработке очень важно для получения металлов с улучшенными свойствами.

5 Внутренние дефекты металла - это неметаллические включения типа окислов или сульфидов.

6 Изменение формы при штамповании металлических деталей ограничивается пластичностью металла при растяжении.

## 24 Text

### Mechanical properties of materials I

#### Words and word combinations to the text

|                           |                               |
|---------------------------|-------------------------------|
| 1) bar                    | - прут, брусок                |
| 2) completely             | - полностью, совершенно       |
| 3) compres                | - сжатие                      |
| 4) creep                  | - ползучесть                  |
| 5) cross-sectional        | - площадь поперечного сечения |
| 6) cyclic stress          | - циклическое напряжение      |
| 7) decrease               | - уменьшение                  |
| 8) elastic deformation    | - упругая деформация          |
| 9) elastic limit          | - предел упругости            |
| 10) exceed                | - превышать                   |
| 11) external forces       | - внешние силы                |
| 12) fatigue               | - усталость металла           |
| 13) fracture              | - перелом, излом              |
| 14) loosen                | - ослаблять, расшатывать      |
| 15) permanent deformation | - постоянная деформация       |
| 16) remaining             | - оставшийся                  |
| 17) shear                 | - срез                        |
| 18) simultaneously        | - одновременно                |
| 19) to stretch            | - растягивать                 |
| 20) technique             | - методы                      |
| 21) tension               | - напряженность               |
| 22) to propagate          | - распространять(ся)          |
| 23) to bend               | - гнуть, согнуть              |
| 24) to extend             | - расширять, продолжаться     |
| 25) to meet the needs     | - отвечать требованиям        |
| 26) to occur              | - происходить                 |
| 27) to respond            | - отвечать реагировать        |
| 28) to suffer             | - страдать                    |
| 29) torsion               | - кручение                    |
| 30) twisting              | - закручивание, изгиб         |
| 31) volume                | - объем, количество           |
| 32) rupture               | - разрыв                      |

#### Read and translate the text

Materials Science and Technology is the study of materials and how they can be fabricated to meet the needs of modern technology. Using the laboratory techniques and knowledge of physics, chemistry, and metallurgy, scientists are

finding new ways of using metals, plastics and other materials.

Engineers must know how materials respond to external forces, such as tension, compression, torsion, bending, and shear. All materials respond to these forces by elastic deformation. That is, the materials return their original size and form when the external force disappears. The materials may also have permanent deformation or they may fracture. The results of external forces are creep and fatigue.

Compression is a pressure causing a decrease in volume. When a material is subjected to a bending, shearing, or torsion (twisting) force, both tensile and compressive forces are simultaneously at work. When a metal bar is bent, one side of it is stretched and subjected to a tensional force, and the other side is compressed.

Tension is a pulling force; for example, the force in a cable holding a weight. Under tension, a material usually stretches, returning to its original length if the force does not exceed the material's elastic limit. Under larger tensions, the material does not return completely to its original condition, and under greater forces the material ruptures.

Fatigue is the growth of cracks under stress. It occurs when a mechanical part is subjected to a repeated or cyclic stress, such as vibration. Even when the maximum stress never exceeds the elastic limit, failure of the material can occur even after a short time. No deformation is seen during fatigue, but small localised cracks develop and propagate through the material until the remaining cross-sectional area cannot support the maximum stress of the cyclic force. Knowledge of tensile stress, elastic limits, and the resistance of materials to creep and fatigue are of basic importance in engineering.

Creep is a slow, permanent deformation that results from a steady force acting on a material. Materials at high temperatures usually suffer from this deformation. The gradual loosening of bolts and the deformation of components of machines and engines are all the examples of creep. In many cases the slow deformation stops because deformation eliminates the force causing the creep. Creep extended over a long time finally leads to the rupture of the material.

## **24.1 Exercises to the text**

### **24.1.1 Answer the following questions to the text**

1 What are the external forces causing the elastic deformation of materials? Describe those forces that change the form and size of materials.

2 What are the results of external forces?

3 What kinds of deformation are the combinations of tension and compression?

4 What is the result of tension? What happens if the elastic limit of material is exceeded under tension?

5 What do we call fatigue? When does it occur? What are the results of fatigue?

6 What do we call creep? When does this type of permanent deformation take place? What are the results of creep?

### 24.1.2 Find the following in the text:

- 1 отвечать требованиям современной технологии
- 2 используя лабораторные методы
- 3 новые способы использования металлов
- 4 сжатие, растяжение, изгиб, кручение, срез
- 5 возвращать первоначальный размер и форму
- 6 внешняя сила
- 7 постоянная деформация
- 8 уменьшение объема
- 9 растягивающие и сжимающие силы
- 10 превышать предел упругости материала
- 11 повторяющиеся циклические напряжения
- 12 разрушение материала
- 13 развитие и распространение мелких трещин
- 14 сопротивление материалов ползучести и усталости

### 24.1.3 Translate into English the following sentences:

1 Упругая деформация - это реакция всех материалов на внешние силы, такие, как растяжение, сжатие, скручивание, изгиб и срез.

2 Усталость и ползучесть материалов являются результатом внешних сил.

3 Внешние силы вызывают постоянную деформацию и разрушение материала.

4 Растягивающие и сжимающие силы работают одновременно, когда мы изгибаем или скручиваем материал.

5 Растяжение материала выше предела его упругости дает постоянную деформацию или разрушение.

6 Когда деталь работает долгое время под циклическими напряжениями в ней появляются небольшие растущие трещины из-за усталости металла.

7 Ползучесть - это медленное изменение размера детали под напряжением.

## 25 Text

### Mechanical properties of materials II

#### Words and word combinations to the text

- |            |               |
|------------|---------------|
| 1) ability | - способность |
| 2) amount  | - количество  |
| 3) absorb  | - поглощать   |
| 4) amount  | - количество  |

|                      |                                    |
|----------------------|------------------------------------|
| 5) application       | - применение                       |
| 6) brittle           | - хрупкий, ломкий                  |
| 7) car body          | - кузов автомобиля                 |
| 8) constituent       | - компонент                        |
| 9) crack             | - трещина                          |
| 10) creep resistance | - устойчивость к ползучести        |
| 11) definition       | - определение                      |
| 12) density          | - плотность                        |
| 13) ductility        | - ковкость, эластичность           |
| 14) failure          | - повреждение                      |
| 15) gradual          | - постепенный                      |
| 16) permanent        | - постоянный                       |
| 17) rigid            | - жесткий                          |
| 18) to sink          | - тонуть                           |
| 19) square root      | - квадратный корень                |
| 20) stiffness        | - жесткость                        |
| 21) strain           | - нагрузка, напряжение, деформация |
| 22) strength         | - прочность                        |
| 23) stress           | - давление, напряжение             |
| 24) tensile strength | - прочность на разрыв              |
| 25) toughness        | - прочность, стойкость             |
| 26) yield strength   | - прочность текучести              |
| 27) Young modulus    | - модуль Юнга                      |

### Read and translate the text

Density (specific weight) is the amount of mass in a unit volume. It is measured in kilograms per cubic metre. The density of water is  $1000 \text{ kg/m}^3$  but most materials have a higher density and sink in water. Aluminium alloys, with typical densities around  $2800 \text{ kg/m}^3$  are considerably less dense than steels, which have typical densities around  $7800 \text{ kg/m}^3$ . Density is important in any application where the material must not be heavy.

Stiffness (rigidity) is a measure of the resistance to deformation such as stretching or bending. The Young modulus is a measure of the resistance to simple stretching or compression. It is the ratio of the applied force per unit area (stress) to the fractional elastic deformation (strain). Stiffness is important when a rigid structure is to be made.

Strength is the force per unit area (stress) that a material can support without failing. The units are the same as those of stiffness,  $\text{MN/m}^2$ , but in this case the deformation is irreversible. The yield strength is the stress at which a material first deforms plastically. For a metal the yield strength may be less than the fracture strength, which is the stress at which it breaks. Many materials have a higher strength in compression than in tension.

Ductility is the ability of a material to deform without breaking. One of the

great advantages of metals is their ability to be formed into the shape that is needed, such as car body parts. Materials that are not ductile are brittle. Ductile materials can absorb energy by deformation but brittle materials cannot.

Toughness is the resistance of a material to breaking when there is a crack in it. For a material of given toughness, the stress at which it will fail is inversely proportional to the square root of the size of the largest defect present. Toughness is different from strength: the toughest steels, for example, are different from the ones with highest tensile strength. Brittle materials have low toughness: glass can be broken along a chosen line by first scratching it with a diamond. Composites can be designed to have considerably greater toughness than their constituent materials. The example of a very tough composite is fiberglass that is very flexible and strong.

Creep resistance is the resistance to a gradual permanent change of shape, and it becomes especially important at higher temperatures. A successful research has been made in materials for machine parts that operate at high temperatures and under high tensile forces without gradually extending, for example the parts of plane engines.

## **25.1 Exercises to the text**

### **25.1.1 Answer the following questions to the text**

- 1 What is the density of a material?
- 2 What are the units of density? Where low density is needed?
- 3 What are the densities of water, aluminium and steel?
- 4 A measure of what properties is stiffness? When stiffness is important?
- 5 What is Young modulus?
- 6 What is strength?
- 7 What is yield strength? Why fracture strength is always greater than yield strength?
- 8 What is ductility? Give the examples of ductile materials. Give the examples of brittle materials.
- 9 What is toughness?
- 10 What properties of steel are necessary for the manufacturing of: a) springs, b) car body parts, c) bolts and nuts, d) cutting tools?
- 11 Where is aluminium mostly used because of its light weight?

### **25.1.2 Find the following words and word combinations in the text:**

- 1 количество массы в единице объема
- 2 килограмм на кубический метр
- 3 мера сопротивления деформации
- 4 отношение приложенной силы на единицу площади к частичной упругой деформации
- 5 жесткая конструкция
- 6 прочность на сжатие

- 7 способность материала деформироваться не разрушаясь
- 8 поглощать энергию путем деформации
- 9 обратно пропорционально квадрату размера дефекта
- 10 постепенное изменение формы
- 11 повышенные температуры
- 12 высокие растягивающие усилия

### 25.1.3 Translate into English the following:

- 1 Плотность измеряется в килограммах на кубический метр.
- 2 Большинство материалов имеют более высокую плотность, чем вода и тонут в воде.
- 3 Плотность материала очень важна, особенно в авиации.
- 4 Модуль Юнга - отношение приложенной силы к упругой деформации данного материала.
- 5 Чем более металл жесткий, тем менее он деформируется под нагрузкой.
- 6 Когда металл растягивают, он сначала течет, то есть пластически деформируется.
- 7 Свинец, медь, алюминий и золото - самые ковкие металлы.
- 8 Сопротивление ползучести является очень важным свойством материалов, которые используются в авиационных моторах.

## 26 Text

### Machine-tools

#### Words and word combinations to the text

- |                        |                             |
|------------------------|-----------------------------|
| 1) machine-tools       | - станки                    |
| 2) electrically driven | - с электроприводом         |
| 3) shape               | - форма                     |
| 4) workpiece           | - деталь                    |
| 5) accurate            | - точный                    |
| 6) development         | - развитие                  |
| 7) to allow            | - позволять, разрешать      |
| 8) interchangeable     | - взаимозаменяемый          |
| 9) facility            | - приспособление            |
| 10) relative           | - относительный             |
| 11) amount             | - количество                |
| 12) fluid              | - жидкость                  |
| 13) to lubricate       | - смазывать                 |
| 14) spark erosion      | - электроискровая обработка |
| 15) discharge          | -разряд                     |

|                 |                         |
|-----------------|-------------------------|
| 16) by means of | - посредством           |
| 17) beam        | - луч                   |
| 18) drilling    | - сверление             |
| 19) flexible    | - гибкий                |
| 20) range       | - ассортимент, диапазон |

## Read and translate the text

Machine-tools are used to shape metals and other materials. The material to be shaped is called the workpiece. Most machine-tools are now electrically driven. Machine-tools with electrical drive are faster and more accurate than hand tools: they were an important element in the development of mass-production processes, as they allowed individual parts to be made in large numbers so as to be interchangeable.

All machine-tools have facilities for holding both the workpiece and the tool, and for accurately controlling the movement of the cutting tool relative to the workpiece. Most machining operations generate large amounts of heat, and use cooling fluids (usually a mixture of water and oils) for cooling and lubrication.

Machine-tools usually work materials mechanically but other machining methods have been developed lately. They include chemical machining, spark erosion to machine very hard materials to any shape by means of a continuous high-voltage spark (discharge) between an electrode and a workpiece. Other machining methods include drilling using ultrasound, and cutting by means of a laser beam. Numerical control of machine tools and flexible manufacturing systems have made it possible for complete systems of machine-tools to be used flexibly for the manufacture of a range of products.

### 26.1 Exercises to the text

**26.1.1 Translate the text in written form. Pay attention to the table with words and word combinations to the text before.**

## 27 Text

### Lathe

#### Words and word combinations to the text

|                           |                               |
|---------------------------|-------------------------------|
| 1) lathe                  | - токарный станок             |
| 2) circular cross-section | - круглое поперечное сечение  |
| 3) surface                | - поверхность                 |
| 4) stationary             | - неподвижный, стационарный   |
| 5) sideways               | - в сторону                   |
| 6) variety                | - разнообразие, разновидность |



|               |                      |
|---------------|----------------------|
| 7) depth      | - глубина            |
| 8) headstock  | - передняя бабка     |
| 9) spindle    | - шпиндель           |
| 10) chuck     | - зажим, патрон      |
| 11) faceplate | - планшайба          |
| 12) lathe bed | - станина станка     |
| 13) to enable | - давать возможность |
| 14) tolerance | - допуск             |

## **Read and translate the text**

Lathe is still the most important machine-tool. It produces parts of circular cross-section by turning the workpiece on its axis and cutting its surface with a sharp stationary tool. The tool may be moved sideways to produce a cylindrical part and moved towards the workpiece to control the depth of cut. Nowadays all lathes are power-driven by electric motors. That allows continuous rotation of the workpiece at a variety of speeds. The modern lathe is driven by means of a headstock supporting a hollow spindle on accurate bearings and carrying either a chuck or a faceplate, to which the workpiece is clamped. The movement of the tool, both along the lathe bed and at right angle to it, can be accurately controlled, so enabling a part to be machined to close tolerances. Modern lathes are often under numerical control.

### **27.1 Exercises to the text**

#### **27.1.1 Answer the following questions to the text**

- 1 What are machine-tools used for?
- 2 How are most machine-tools driven nowadays?
- 3 What facilities have all machine-tools?
- 4 How are the cutting tool and the workpiece cooled during machining?
- 5 What other machining methods have been developed lately?
- 6 What systems are used now for the manufacture of a range of products without the use of manual labour?
- 7 What parts can be made with lathes?
- 8 How can the cutting tool be moved on a lathe?
- 9 How is the workpiece clamped in a lathe?
- 10 Can we change the speeds of workpiece rotation in a lathe?
- 11 What is numerical control of machine tools used for?

#### **27.1.2 Find English equivalents in the text:**

- 1 обрабатываемый материал
- 2 электропривод
- 3 более точный

- 4 отдельные детали
- 5 процесс массового производства
- 6 приспособления для держания резца и детали
- 7 операции по механической обработке детали
- 8 высоковольтный разряд
- 9 сверление ультразвуком
- 10 резание с помощью лазерного луча
- 11 гибкие производственные системы
- 12 детали круглого сечения
- 13 поворачивать деталь вокруг ее оси
- 14 двигать в сторону, двигать по направлению к детали
- 15 глубина резания
- 16 непрерывное вращение детали
- 17 движение резца вдоль станины

### **27.1.3 Translate into English:**

- 1 Токарный станок позволяет производить детали круглого сечения.
- 2 Деталь зажимается в патроне или на планшайбе токарного станка.
- 3 Резец может двигаться как вдоль станины, так и под прямым углом к ней.
- 4 Современные токарные станки часто имеют цифровое управление.

## **28 Text**

### **Milling machine Drilling and Boring Machines Shapers and Planers Grinders**

#### **Words and word combinations to the text**

- |                    |                        |
|--------------------|------------------------|
| 1) milling machine | - фрезерный станок     |
| 2) series          | - серия, ряд           |
| 3) cutting edge    | - режущий край, острие |
| 4) circumference   | - окружность           |
| 5) to feed         | - подавать             |
| 6) longitudinal    | - продольный           |
| 7) horizontal      | - горизонтальный       |
| 8) vertical        | - вертикальный         |
| 9) versatile       | - универсальный        |
| 10) flat           | - плоский              |
| 11) contoured      | - контурный            |

|                  |                           |
|------------------|---------------------------|
| 12) angle        | - угол                    |
| 13) slot         | - прорезь, паз            |
| 14) gear teeth   | - зубы шестерни           |
| 15) drill        | - дрель, сверло, сверлить |
| 16) hole         | - отверстие               |
| 17) to enlarge   | - увеличивать             |
| 18) thread       | - резьба                  |
| 19) portable     | - портативный             |
| 20) unit         | - единица, целое, узел    |
| 21) previously   | - ранее                   |
| 22) to slide     | - скользить               |
| 23) stroke       | - ход                     |
| 24) lateral      | - боковой                 |
| 25) displacement | - смещение                |
| 26) straight     | - прямой                  |
| 27) idle         | - на холостом ходу        |
| 28) workshop     | - цех, мастерская         |
| 29) to mount     | - крепить                 |
| 30) holder       | - держатель               |
| 31) to execute   | - выполнять               |
| 32) simultaneous | - одновременный           |
| 33) multiple     | - многочисленный          |
| 34) grinder      | - шлифовальный станок     |
| 35) wheel        | - круг, колесо            |
| 36) bonded       | - скрепленный             |
| 37) to remove    | - удалять                 |
| 38) pass         | - проход                  |
| 39) fine         | - точный                  |
| 40) conventional | - обычный                 |
| 41) device       | - устройство, прибор      |
| 42) fragile      | - хрупкий                 |

## **Read and translate the text**

### **Milling machine**

In a milling machine the cutter (фреза) is a circular device with a series of cutting edges on its circumference. The workpiece is held on a table that controls the feed against the cutter. The table has three possible movements: longitudinal, horizontal, and vertical; in some cases it can also rotate. Milling machines are the most versatile of all machine tools. Flat or contoured surfaces may be machined with excellent finish and accuracy. Angles, slots, gear teeth and cuts can be made by using various shapes of cutters.

## **Drilling and Boring Machines**

To drill a hole usually hole-making machine-tools are used. They can drill a hole according to some specification, they can enlarge it, or they can cut threads for a screw or to create an accurate size or a smooth finish of a hole.

Drilling machines (сверлильные станки) are different in size and function, from portable drills to radial drilling machines, multispindle units, automatic production machines, and deep-hole-drilling machines.

Boring (расточка) is a process that enlarges holes previously drilled, usually with a rotating single-point cutter held on a boring bar and fed against a stationary workpiece.

## **Shapers and Planers**

The shaper (поперечно-строгальный станок) is used mainly to produce different flat surfaces. The tool slides against the stationary workpiece and cuts on one stroke, returns to its starting position, and then cuts on the next stroke after a slight lateral displacement. In general, the shaper can make any surface having straight-line elements. It uses only one cutting-tool and is relatively slow, because the return stroke is idle. That is why the shaper is seldom found on a mass production line. It is, however, valuable for tool production and for workshops where flexibility is important and relative slowness is unimportant.

The planer (продольно-строгальный станок) is the largest of the reciprocating machine tools. It differs from the shaper, which moves a tool past a fixed workpiece because the planer moves the workpiece to expose a new section to the tool. Like the shaper, the planer is intended to produce vertical, horizontal, or diagonal cuts. It is also possible to mount several tools at one time in any or all tool holders of a planer to execute multiple simultaneous cuts.

## **Grinders**

Grinders (шлифовальные станки) remove metal by a rotating abrasive wheel. The wheel is composed of many small grains of abrasive, bonded together, with each grain acting as a miniature cutting tool. The process gives very smooth and accurate finishes. Only a small amount of material is removed at each pass of the wheel, so grinding machines require fine wheel regulation. The pressure of the wheel against the workpiece is usually very light, so that grinding can be carried out on fragile materials that cannot be machined by other conventional devices.

### **28.1 Exercises to the text**

#### **28.1.1 Answer the following questions to the text**

- 1 What is the shape of a cutter in a milling machine?
- 2 What moves in a milling machine, a table or a cutter?
- 3 What possible movements has the table of a milling machine?

- 4 What kind of surfaces and shapes may be machined by a milling machine?
- 5 What can we use a drilling machine for?
- 6 What kinds of drilling machines exist?
- 7 What is rotated while boring, a cutter or a workpiece?
- 8 Describe the work of a shaper (planer).
- 9 What must be done to execute multiple simultaneous cuts on a planer?
- 10 What is the working tool in a grinder?
- 11 Can we obtain a very smooth surface after grinding and why?
- 12 Can we grind fragile materials and why?

### 28.1.2 Translate into English:

- 1 Токарный станок все еще остается самым важным станком.
- 2 Все современные токарные станки оборудованы электроприводами.
- 3 Движение инструмента контролируется с высокой точностью.
- 4 Электропривод позволяет обрабатывать заготовку на различных скоростях.

## 29 Text

### Dies

#### Words and word combinations to the text

- |                |                            |
|----------------|----------------------------|
| 1) chip        | - стружка                  |
| 2) sharp       | - острый                   |
| 3) friction    | - трение                   |
| 4) content     | - содержание               |
| 5) range       | - диапазон                 |
| 6) inexpensive | - недорогой                |
| 7) to permit   | - позволять, разрешать     |
| 8) common      | - обычный                  |
| 9) tungsten    | - вольфрам                 |
| 10) ingredient | - ингредиент               |
| 11) diamond    | - алмаз                    |
| 12) tips       | - наконечники              |
| 13) ceramic    | - керамический             |
| 14) truing     | - правка, наводка, заточка |
| 15) die        | - матрица, штамп           |
| 16) matrix     | - матрица                  |
| 17) to employ  | - применять                |
| 18) to pierce  | - протыкать, прокалывать   |
| 19) to punch   | - пробивать отверстие      |

|                  |                        |
|------------------|------------------------|
| 20) matching     | - сочетающийся, парный |
| 21) coarse       | - грубый               |
| 22) wire         | - проволока            |
| 23) to draw      | - тащить, волочить     |
| 24) thread       | - резьба               |
| 25) hardened     | - закаленный           |
| 26) to lubricate | - смазывать            |
| 27) to screw     | - привинчивать         |
| 28) nut          | - гайка                |
| 29) outside      | - наружный, внешний    |
| 30) inside       | - внутри, внутренний   |

## Read and translate the text

Dies are tools used for the shaping solid materials, especially those employed in the pressworking of cold metals.

In presswork, dies are used in pairs. The smaller die, or punch, fits inside the larger die, called the matrix or, simply, the die. The metal to be formed, usually a sheet, is placed over the matrix on the press. The punch is mounted on the press and moves down by hydraulic or mechanical force.

A number of different forms of dies are employed for different operations. The simplest are piercing dies (пробивной штамп), used for punching holes. Bending and folding dies are designed to make single or compound bends. A combination die is designed to perform more than one of the above operations in one stroke of the press. A progressive die permits successive forming operations with the same die.

In coining, metal is forced to flow into two matching dies, each of which bears an engraved design.

## Wiredrawing Dies

In the manufacture of wire, a drawplate (волочильная доска) is usually employed. This tool is a metal plate containing a number of holes, successively less in diameter and known as wire dies. A piece of metal is pulled through the largest die to make a coarse wire. This wire is then drawn through the smaller hole, and then the next, until the wire is reduced to the desired measurement. Wiredrawing dies are made from extremely hard materials, such as tungsten carbide or diamonds.

## Thread-Cutting Dies

For cutting threads on bolts or on the outside of pipes, a thread-cutting die (резьбонарезная плашка) is used. It is usually made of hardened steel in the form of a round plate with a hole in the centre. The hole has a thread. To cut an outside thread, the die is lubricated with oil and simply screwed onto an unthreaded bolt or piece of pipe, the same way a nut is screwed onto a bolt. The corresponding tool for cutting an inside thread, such as that inside a nut, is called a tap (метчик).

## **29.1 Exercises to the text**

### **29.1.1 Find English equivalents in the text:**

- 1 удалять металлическую стружку
- 2 острый режущий край
- 3 содержание углерода
- 4 режущая способность
- 5 сталь для скоростного резания
- 6 правка шлифовальных кругов
- 7 гидравлическое или механическое давление
- 8 различные формы штампов

### **29.1.2 Translate the following sentences into Russian:**

- 1 Все резцы и фрезы должны иметь острую режущую кромку.
- 2 Во время резания режущий инструмент и деталь имеют высокую температуру и должны охлаждаться.
- 3 Углеродистые стали часто используются для изготовления резцов потому, что они недорогие.
- 4 Быстрорежущие стали содержат вольфрам, хром и ванадий.
- 5 Алмазы используются для резания абразивных материалов и чистовой обработки поверхности твердых материалов.
- 6 Для различных операций используют различные штампы.
- 7 Волочильные доски для проволоки делаются из очень твердых материалов.
- 8 Резьбонарезные плашки и метчики используются для нарезки резьбы снаружи и внутри.

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