|  |
| --- |
| **Text 1 «Metals»**  **1) Find answers to questions in the text:**  1.What are metals and what do we call metallurgy?  2. Why are most metals dense?  3. Why are metals malleable?  **2) Complete the following sentences:**  1. Metalls are…  2. Metallurgy is…  3. Most metals are… |
| **Text 1 «Metals»**  **1) Find answers to questions in the text:**  1. What is malleability? 2. What are grains? 3. What is alloying?  **2)Complete the following sentences:**  1. The regular arrangement of atoms in metals…  2. Irregular crystals…  3. The properties of the metals depend… |

**Учебная дисциплина:** Английский язык 1 курс **Электронный адрес:** [nona41771@mail.ru](mailto:nona41771@mail.ru) **Дата сдачи задания:** 06.04-17.04.2020

|  |
| --- |
| **Text 2 «Steel»**  **1) Find answers to questions in the text:**  1. What is steel?  2. What are the main properties of steel?  3. What are the drawbacks of steel?  **2) Find the following words and word combinations in the text:**  1. сплав железа и углерода  2. прочный и жестокий  3. легко коррозирует |

|  |
| --- |
| **Text 2 «Steel»**   1. **Find answers to questions in the text:** 2. What kinds of steel do you know? Where are they used? 3. What gives the addition of manganese, silicon and chromium to steel?   3. What can be made of mild steels (medium – carbon steels, high- carbon steels)?  **2) Find the following words and word combinations in the text:**  1. нержавеющая сталь  2. низкое содержание углерода  3. ковкость |
| **Text 3 «Methods of steel heat treatment»**   1. **Find answers to questions in the text:** 2. What can serve as the indicator of metal temperature while heating it? 3. What temperature range is used for tempering?   3. What are the methods of steel heat treatment used for?  **2) Find the following words and word combinations in the text:**  1. закалённая сталь  2. состав стали  3. окисная плёнка |

|  |
| --- |
| **Text 4 «METALWORKING PROCESSES»**   1. **Find answers to questions in the text:**   1. Why are metals so important in industry? 2. What are the main metalworking processes? 3. Why are metals worked mostly hot?  **2) Find the following words and word combinations in the text:**  1. могут легко деформироваться  2. нужные формы 3. подвергать большим деформациям |
| **Text 4 «METALWORKING PROCESSES»**   1. **Find answers to questions in the text:** 2. What properties does cold working give to metals? 3. What a rolling? Where is it used? 4. What is extrusion? What shapes can be obtained after extrusion? 5. **Find the following words and word combinations in the text:**   1. зерна свободные от деформации 2. температура перекристаллизации 3. пластическая деформация сжатия. |

|  |
| --- |
| **Text 5 «METALWORKING AND METAL PROPETIES»**   1. **Find answers to questions in 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?  **2) Find the following words and word combinations in the text:**  1. важная особенность горячей обработки 2. улучшение механических свойств металла 3. необработанная отливка |
| **Text 5 «METALWORKING AND METAL PROPETIES»**   1. **Find answers to questions in the text:** 2. How are the flow lines in the forged in the forged metal oriented and how does it affect the strength of the forged part? 3. What are the best strain- hardening alloys? Where can we use them? 4. What are the inner flaws in the metal?   **2) Find the following words and word combinations in the text:**  1. направление максимального напряжения 2. способность сопротивляться утончению и разрушению 3. проявлять большее деформационное упрочнение | |

|  |
| --- |
| **Text 6 «From the History of Welding»**  **1) True or false?**  1. Only heat is used for joining metallic parts in welding.  2. The process of carburization of iron is rather new.  3. The blacksmith and the jeweler continue to use welding techniques in their work.  **2) Answer the following questions:**  1. What is welding?  2. How was welding discovered?  3. Who were the first welders? |
| **Text 6 «From the History of Welding»**  **1) True or false?**  1. Welding is the only technique of joining metallic parts.  2. The modern electrode consists of a bare wire with asbestos.  3. Arc welding was not used after World War II.  **2) Answer the following questions:**  1. What did the first welding technique for making blades involve?  2. Did the improvement in iron-making techniques conduce to the  development of welding?  3. Is it efficient to apply riveting for making boilers? |

|  |
| --- |
| **Text 7 «Welding & Machine Trades»**  **1)Answer the following questions on the text.**  1. Where can welders work?  2. What are the advantages of having formal training for making a welding career?  3. What does it take to be s low-skilled/skilled welder?  **2) Translate into Russian.**  1. They may also be trained to work in a variety of  materials, such as plastic , titanium or aluminum .  2. For those considering to prepare themselves to a meaningful  welding-career, there are many options available.  3. Welders work in a variety of  environments, both indoors and out, using heat to melt and fuse separate  pieces of metal together. |

|  |
| --- |
| **Text 8 «ARC WELDING»**  **1 )Answer the following questions on the text.**  1. What is used to supply the necessary current?  2. What contains the electrode holder?  3. Нow to move the electrode?  **2) True or False?**  1. For thicker workpieces, the current may be 200 A.  2. In order to carry this current, the cables from the transformer should be quite thick or else they will overheat.  3. The electrode must be moved across the joint continuously. |

|  |
| --- |
| **Text 9** «**Welding»**  **1) Answer the questions.**  1. How can a process of welding be defined?  2. What are the two main groups of processes of welding?  3. How can we join metal parts together?  **2) Read in the text.**  1. …… are laser welding, and electron-beam welding.  2. …… in all productions where metals are used.  3. …… on the properties of the metals. |

|  |
| --- |
| **Text 9** «**Welding»**  **1) Answer the questions.**  1. What is welding used for nowadays?  2. Where is welding necessary?  3. What do the welding processes of today include?  **2) Read in the text.**  1. …… or a combination of both.  2. …… when the weld is achieved by heat.  3. …… in all productions where metals are used. |

|  |
| --- |
| **Text 10 «Gas Welding»**  **1) Answer the questions.**  1. What do the welding processes of today include?  2. What are the principles of gas welding?  3. What kinds of welding can be used for joining steels?  **2) Сontinue offer**  1. Gas welding has the advantage of using …  2. It requires a continuous supply of …  3. Fluxes are not necessary in … |

|  |
| --- |
| **Text 11**  «**Welding methods»**  **1) Answer the questions:**  1. What is the difference automatic welding from semiautomatic welding?  2. What are the basic methods of welding you know?  3. What method of welding is the most common?  **2) True or False?**  1. Semiautomatic welding is not the most popular welding method.  2. The welding operator manually adjusts the position of the electrode to  maintain a constant arc length.  3. A welder can use manual position during semiautomatic welding. |

|  |
| --- |
| **Text 12 «Types of welding»**  **1) Answer the questions.**  1. What is the difference between the arc welding and non-consumable electrode arc welding?  2. What are the disadvantages of the non-consumable electrode arc welding?  3. How is electrode protected from the air in gas-metal arc welding?  **2) Translate into Russian.**  1. The heat from the arc melts the edges of the metal.  2. Electrodes are clamped on each side of the parts to be welded.  3. Resistance causes heat, which melts the metals and creates. |

|  |
| --- |
| **Text 13**  «**This is a story about welding materials and equipment»**  **1) Answer the questions** 1. What of electrodes are applied in welding? 2. How is a filler metal provided? 3. What is the difference between the two of cables?  **2) Translate to English**  1. Между держателем электрода и сварочным аппаратом используется очень гибкий кабель.  2. Электроды делятся на расходные и непроизводительные электроды.  3. Размер кабелей, используемых при сварке, зависит от типа сварного материала и расстояния между источником питания. |

|  |
| --- |
| **Text 14**  «**This is a story about welding materials and equipment»**  **1) Answer the questions** 1. What will you say about the electrode holder? 2. How are the welder’s face and eyes protected from welding rays? 3. Say a few words about welding helmet.  **2) Translate to English**  1. Для защиты лица и глаз оператора от прямых лучей дуги необходимо использовать лицевой щит или шлем.  2. Держатель электрода представляет собой зажимное устройство для удержания электрода и снабжен изолированной ручкой для руки оператора.  3. В любом сварочном цехе можно найти оборудование для проведения сварочного осмотра. |

|  |
| --- |
| **Text 15 «The welding technique»**  **1) Answer the questions.**  1. What welding is described in the text? 2. What electrode do we use in the process? 3. How many electrodes are applied in this method?  **2) Find in the text.**  1. Маленькая сварочная ванна  2. Равномерная скорость  3. Прочное сварное соединение |

|  |
| --- |
| **Text 5 «METALWORKING AND METAL PROPETIES»**   1. **Find answers to questions in 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?  **2) Find the following words and word combinations in the text:**  1. важная особенность горячей обработки 2. улучшение механических свойств металла 3. необработанная отливка |
| **Text 6 «From the History of Welding»**  **1) True or false?**  1. Only heat is used for joining metallic parts in welding.  2. The process of carburization of iron is rather new.  3. The blacksmith and the jeweler continue to use welding techniques in their work.  **2) Answer the following questions:**  1. What is welding?  2. How was welding discovered?  3. Who were the first welders? |

|  |
| --- |
| **Text 12 «Types of welding»**  **1) Answer the questions.**  1. What is the difference between the arc welding and non-consumable electrode arc welding?  2. What are the disadvantages of the non-consumable electrode arc welding?  3. How is electrode protected from the air in gas-metal arc welding?  **2) Translate into Russian.**  1. The heat from the arc melts the edges of the metal.  2. Electrodes are clamped on each side of the parts to be welded.  3. Resistance causes heat, which melts the metals and creates. |

**Text 1 Metals**

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. 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 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.

**Text 2 «Steel»**

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 a 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 . Hight-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 strengh 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. Quenching is a heat treatment when metal at a high temperature is rapidly cooled by immersion in water or oil. Quenching makes steel harder and more brittle, with small grains structure. Tempering is a heat treatment applied to steel and certain alloys. Hardened steel after quenching from a high temperature is too hard and brittle. Tempering, that is re-heating to an intermediate temperature and cooling slowly, reduces this hardness and brittleness. Tempering temperatures depend on the composition of the steel but are frequently between 100 and 650\*C. Higher temperatures usually give a softer, tougher product. The colour of the oxide film produced on the surface of the heated metal often serves as the indicator of its temperature. Annealing is a heat treatment in which a material at high temperature is cooled slowly. After cooling the metal again becomes malleable and ductile (capable of being bent many times without cracking) All these methods of steel heat treatment are used to obtain steels with certain mechanical properties for certain needs.

**Text 3 «METHODS OF STEEL HEAT TREATMENT»**

Quenching is a heat treatment when metal at a high temperature is rapidly cooled by immersion in water or oil. Quenching makes steel harder and more brittle, with small grains structure. Tempering is a heat treatment applied to steel and certain alloys. Hardened steel after quenching from a high temperature is too hard and brittle for many applications and is also brittle. Tempering, that is re-heating to an intermediate temperature and cooling slowly, reduces this hardness and brittleness. Tempering temperatures depend on the composition of the steel but are frequently between 100 and 650\*C. Higher temperatures usually give a softer, tougher product. The colour of the oxide film produced on the surface of the heated metal often serves as the indicator of its temperature. Annealing is a heat treatment in which a material at high temperature is cooled slowly. After cooling the metal again becomes malleable and ductile (capable of being bent many times without cracking) ll these methods of steel heat treatment are used to obtain steels with certain mechanical properties for certain needs.

**Text 4 «METALWORKING PROCESSES»**

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 stain (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 cracts.

**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 smother 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. Aluminium 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 aluminuim beer cans.

**Text 5 METALWORKING AND METAL PROPETIES**

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-2orked 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 forking makes the flow lines in the finished part oriented so as to lie in the direction of maximum stress when the part if 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 if ofter limited by the tensile ductility of the metal. Metals such as copper and aluminum are more ductile in such operations than other metals.

**Text 6 From the History of Welding**

Welding is a technique used for **joining** metallic parts usually through the application of heat. This technique was discovered during efforts to manipulate iron into useful shapes. Welded blades were developed in the first millennium AD, the most famous being those produced by Arab **armour**ers at Damascus, Syria. The process of **carburization** of iron to produce hard steel was known at this time, but the resultant steel was very **brittle**. The welding technique - which involved **interlayering** relatively soft and tough iron with **high-carbon** material, followed by **hammer forging -** produced a strong, tough blade. In modern times the improvement in iron-making techniques, especially the introduction of **cast iron**, restricted welding to the **blacksmith** and the **jeweler**. Other joining techniques, such as fastening by bolts or rivets, were widely applied to new products, from bridges and railway engines to kitchen utensils. Modern **fusion** welding processes are an outgrowth of the need to obtain a continuous **joint** on large steel plates. **Rivetting** had been shown to have disadvantages, especially for an enclosed container such as a **boiler**. Gas welding, arc welding, and **resistance** welding all appeared at the end of the 19th century. The first real attempt to adopt welding processes on a wide scale was made during World War I. By 1916 the **oxyacetylene** process was well developed, and the welding techniques employed then are still used. The main improvements since then have been in equipment and safety. Arcwelding, using a **consumable** electrode, was also introduced in this period, but the bare wires initially used produced brittle welds. A solution was found by wrapping the **bare** wire with **asbestos** and an entwined aluminum wire. The modern electrode, introduced in 1907, consists of a bare wire with a complex **coating** of minerals and metals. Arc welding was not universally used until World War II, when the urgent need for rapid means of construction for shipping, power plants, transportation, and structures spurred the necessary development work. Resistance welding, invented in 1877 by Elihu Thomson, was accepted long before arc welding for **spo**t and **seam** joining of **shee**t. **Butt** welding for chain making and joining **bar**s and **rod**s was developed during the 1920s. In the 1940s the tungsten-inert gas process, using a nonconsumable **tungsten** electrode to perform fusion welds, was introduced. In 1948 a new gasshielded process utilized a wire electrode that was consumed in the weld. More recently, electron-**beam** welding, laser welding, and several solidphase processes such as diffusion **bonding**, friction welding, and ultrasonic joining have been developed.

**Text 7 «Welding & Machine Trades»**

Welding is a skill used by many trades: sheet metal workers, ironworkers, diesel mechanics, boilermakers, carpenters, marine construction, steamfitters, glaziers, repair and maintenance personnel in applications ranging from the hobbyist to heavy fabrication of bridges, ships and many other projects. A variety of welding processes are used to join units of metal. As a welder, you may work for shipyards, manufacturers, contractors federal , state, county, and city governments, firms requiring maintenance mechanics, and repair shops. Welding, while very physically demanding, can be very rewarding for those who enjoy working with their hands. Welders need good eyesight, manual dexterity and hand-eye coordination. They should also be able to concentrate for long periods of time on very detailed work, as well as be in good enough physical shape to bend and stoop, often holding awkward positions for long periods of time. Welders work in a variety of environments, both indoors and out, using heat to melt and fuse separate pieces of metal together. Training and skill levels can vary, with a few weeksof school or on-the-job training for the lowest level job and several years ofschool and experience for the more skilled welding positions. Skilled welders often select and set up the welding equipment, execute the weld, and then examine the welds in order to make sure they meet the appropriate specifications. They may also be trained to work in a variety ofmaterials, such as plastic , titanium or aluminum . Those with less training perform more routine tasks, such as the welds on jobs that have already been laid out, and are not able to work with as many different materials. While the need for welders as a whole should continue to grow about as fast as average, according the U.S. Bureau of Labor Statistics, the demand for low-skilled welders should decrease dramatically , as many companies move towards automation. However, this will be partially balanced out by the fact that the demand for machine setters , operators and tenders should increase. And more skilled welders on construction projects and equipment repair should not be affected, as most of these jobs cannot be easily automated . Because of the increased need for highly skilled welders, those with formal training will have a much better chance of getting the position they desire. For those considering to prepare themselves to a meaningful welding-career, there are many options available. There are also different professional specialties and levels, that should be understood to make an informed choice. Some of these are: welder, welding machine operator, welding technician, welding schedule developer, welding procedure writer, testing laboratory technician, welding non destructive testing inspector, welding supervisor , welding instructor, welding engineer.

**Text 8 ARC WELDING**

1. In arc welding the workpieces are not melted by a flame. They are melted by an electric arc. In order to create the arc, a powerful electric current must be provided.

2. The current must be at least 60 A, otherwise the arc will not create enough heat. For thicker workpieces, the current may be 250 A. In order to carry this current, the cables from the transformer should be quite thick or else they will overheat.

3. To supply the necessary current the transformer is used and to complete the electric circuit an earth clamp is used, which is attached to the workpiece. Then the current flows around the circuit and the arc appears. It must be securely attached, otherwise an arc will appear between the clamp and the workpiece. To strike the arc, the transformer should be switched on first.

4. The electrode holder contains an electrode rod which provides the filler metal to join the work pieces. As the current flows between the electrode and the workpiece, the tip of the electrode melts and falls onto the workpiece. The electrode must be moved across the joint continuously, if it is moved too quickly neither the electrode nor the workpiece will melt.

5. While choosing an electrode type it is necessary to know:

a. Position to which the workpiece is to be welded.

b. Type and thickness of metal used.

c. Type of welding current.

d. Class of work: deep penetration, surface quality, etc.

**Text 9** **Welding.**

Welding is a process when metal parts are joined together by the application of heat, pressure, or a combination of both. The processes of welding can be divided into two main groups:

•pressure welding, when the weld is achieved by pressure and

•heat welding, when the weld is achieved by heat. Heat welding is the most common welding process used today.

Nowadays welding is used instead of bolting and riveting in the construction of many types of structures, including bridges, buildings, and ships. It is also a basic process in the manufacture of machinery and in the motor and aircraft industries. It is necessary almost in all productions where metals are used.

The welding process depends greatly on the properties of the metals, the purpose of their application and the available equipment. Welding processes are classified according to the sources of heat and pressure used: gas welding, arc welding, and resistance welding. Other joining processes are laser welding, and electron-beam welding.

**Text 10** **Gas Welding.**

Gas welding is a non-pressure process using heat from a gas flame. The flame is applied directly to the metal edges to be joined and simultaneously to a filler metal in the form of wire or rod, called the welding rod, which is melted to the joint. Gas welding has the advantage of using equipment that is portable and does not require an electric power source. The surfaces to be welded and the welding rod are coated with flux, a fusible material that shields the material from air, which would result in a defective weld.

**Arc Welding**

Arc-welding is the most important welding process for joining steels. It requires a continuous supply of either direct or alternating electrical current. This current is used to create an electric arc, which generates enough heat to melt metal and create a weld.

Arc welding has several advantages over other welding methods. Arc welding is faster because the concentration of heat is high. Also, fluxes are not necessary in certain methods of arc welding. The most widely used arc-welding processes are shielded metal arc, gas-tungsten arc, gas- metal arc, and submerged arc.

**Text 11**  **Welding methods.**

There are three basic welding methods: manual, semiautomatic and automatic.

Manual welding is the oldest method, and though its proportion of the total welding market diminishes yearly, it is still the most common. Here an operator takes an electrode, clamped in a hand-held electrode holder, and manually guides the electrode along the joint as the weld is made. Usually the electrode is consumable; as the tip is consumed, the operator manually adjusts the position of the electrode to maintain a constant arc length.

Semiautomatic welding is becoming the most popular welding method. The electrode is usually a long length of small-diameter bare wire, usually in coil form, which the welding operator manually positions and advances along the weld joint. The consumable electrode is normally motor-driven at a preselected speed through the nozzle of a hand-held welding gun or torch.

Automatic welding is very similar to semiautomatic welding, except that the electrode is automatically positioned and advanced along the prescribed weld joint. Either the work may advance below the welding head or the mechanized head may move along the weld joint.

**Text 12** «**Types of welding»**

1. As a non-consumable electrodes tungsten or carbon electrodes can be used. In gas-tungsten arc welding a tungsten electrode is used in place of the metal electrode used in shielded metal-arc welding. A chemically inert gas, such as argon, helium, or carbon dioxide is used to shield the metal from oxidation. The heat from the arc formed between the electrode and the metal melts the edges of the metal. Metal for the weld may be added by placing a bare wire in the arc or the point of the weld. This process can be used with nearly all metals and produces a high-quality weld. However, the rate of welding is considerably slower than in other processes.

2. In shielded metal-arc welding, a metallic electrode, which conducts electricity, is coated with flux and connected to a source of electric current. The metal to be welded is connected to the other end of the same source of current. An electric arc is formed by touching the tip of the electrode to the metal and then drawing it away. The intense heat of the arc melts both parts to be welded and the point of the metal electrode, which supplies filler metal for the weld. This process is used mainly for welding steels.

3. In gas-metal welding, a bare electrode is shielded from the air by surrounding it with argon or carbon dioxide gas and sometimes by coating the electrode with flux. The electrode is fed into the electric arc, and melts off in droplets that enter the liquid metal of the weld seam. Most metals can be joined by this process.

**Text 13 «This is a story about welding materials and equipment»**

Welding current is conducted from the source of power to the arc by an insulated copper or aluminum cable. A very flexible cable is used between the electrode holder and the welding machine. This cable is designed for welding service.  
For grounding the welding circuit, a less flexible, but equally wear resistant cable is used. The size of the cables used in welding depends upon the type of the material to be welded and the distance of the source of power.  
 The electrode is an important component of the electric circuit. We know electrodes to be divided into consumable and non-consumable electrodes. Tungsten and carbon electrodes are non-consumable. In the case of carbon and tungsten arc welding a filler metal may be fed from aside to supply an additional metal to the molten pool. As for the consumable electrodes, they are produced in the form of metal rod or wire, and for this reason provide a filler metal.  
 All the consumable electrodes are divided into bare and coated electrodes. An important advantage of arc welding is in the protection that a special mineral flux composition provides for the molten deposit. It is know that metal electrodes for the covered with flux coatings produce stronger welded joints as compared with those made with bare electrodes.

**Text 14**  **This is a story about welding materials and equipment.**

As it was mentioned, the electrodes are held in a special device-an electrode holder. The electrode holder is a clamping device for holding the electrode and is provided with an insulated handle for the operation’s hand. It should be mechanically strong, light in weight and hold the electrode firmly in position during welding.  
 We know that the arc is very hot and therefore it throws off both light and heat. To protect the operator’s face and eyes from the direct rays of the arc it is necessary to use a face shield or helmet. These shield or helmets are produced of pressed insulating material black in colour. The shield should be light in weight and comfortable to the welder. Shields are provided with special welding coloured lens absorbing the infrared rays, special goggles are used by welder’s assistants, foremen, inspectors and others working near the welder.  
 In addition to the equipment and materials described above, there should be available steel brushes for cleaning welds, tools for removing scale and slag from the surface of the weld and other shop equipment. Of course, in any welding shop you may find the equipment for welding inspection.

**Text 15 «The welding technique»**

If you want to join two metals by arc welding you should know the welding technique, i.e. the technological process of welding.  
To begin welding it is necessary to strike an arc. The electrode held in a holder is brought in contact with the metal surface, withdrawn (separated) and held as so to create and maintain an arc. Since the space between the electrode and the base metal has highest resistance in the circuit, a tremendous amount of heat is developed by the electric arc at this point.  
Intense heating results in melting the workpiece metal and forming a small molten metal pool or crater. The depth of the crater indicates the amount of penetration or depth of fusion.  
Since the electrode is also melted by the heat of the electric arc, the electrode metal is deposited in a molten pool on the base metal. In this case the electrode metal served both electrical pole and the filler metal. As we see, the metal electrode supplies additional metal to the base metal, but in the case of carbon or tungsten arc, filler metal rod may be used, it being usually fed from aside.  
After an electric arc has struck, it is maintained by a uniform continuous movement of the electrode toward the work to compensate for that portion of the electrode which has been melted and deposited in the weld. At the same time, the arc should be advanced at a uniform speed along the line of welding, i.e. the weld groove.  
As for the metal in the crater, it is agitated and mixes the molten electrode metal with the base metal, forming a strong weld joint. After the weld is completed it is necessary to clean and inspect it.