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Annotation. *The article discusses the methods of teaching the topic “Metal processing technology”, metal processing technology, pouring molten metal, shapes and parameters of metals, metal processing methods.*

Key words: *metal processing technology, metalworking, manufacturing products, pouring molten metal, shapes and parameters, processing methods.*

People began processing metal in the most ancient times, presumably it began before our era. If the primitive inhabitants of the planet used cheese-blowing furnaces for smelting, today metal processing technologies have completely changed.

The use of the latest equipment has significantly simplified all processes, and has made it possible to work even with very durable materials and alloys. Scientific and technical developments in the field of construction of special units are rapidly developing, which is why the metalworking industry is thriving.

To understand how far progress has gone, let's consider modern technologies that are used in metalworking, study their principles and capabilities.

There are the following basic metal processing methods:

- Casting;
- Pressure treatment;
- Cutting;
- Welding;
- Related processes.

For each individual material, the most suitable metal processing technologies are selectively applied. This helps to produce high-class products with excellent mechanical and physical-chemical properties. Let's take a closer look at all these methods.

Casting. This processing method involves pouring molten metal into a special mold, the configuration of which it takes. After cooling, the finished product or part, called a casting, is removed from the mold.

The complexity of the whole process lies in the preliminary melting of the materials, and not all of them, under the influence of high temperature, acquire the consistency necessary for filling the mold.

Metals such as cast iron, tin, copper, aluminum, zinc and their alloys are suitable for casting. Melting of individual materials occurs in furnaces of various designs; they differ from each other in capacity, temperature conditions and energy sources.

Pressure treatment. This type of processing is also used to give parts or finished products the required shape; it involves plastic deformation of workpieces using pressure. At the same time, the integrity of the workpieces is not compromised, and material losses are minimized, which makes this area quite promising.

Metal forming technologies include methods such as drawing, pressing, forging, stamping and rolling.

The choice is made in favor of one or another method of influence after a detailed assessment of the characteristics of the material being processed and the requirements that the finished product must meet.

Cutting. This is another method of giving parts the shape and parameters specified in the drawings. The operating principle of the technology is that the workpiece is processed with cutting tools that remove its top layer until the finished product takes on the required shape and size.

The most popular types of these works are: turning, threading, grinding and polishing.

Welding. The method of joining metal parts at the molecular and atomic level is called welding; it can be contact or non-contact, carried out by exposing the workpiece to thermal energy or mechanical energy.

There are many types of welding, it can be either manual or automatic; the choice of certain welding technologies is made depending on the type of material and the field of production.

Related processes. This category of processing is not primary, but it is often used before or after the main steps. Heat treatment, cladding and spraying are carried out additionally to improve the quality characteristics of finished products or workpieces.

Innovative technologies in metal processing. The rapid development of engineering, mechanical engineering and other industries directly related to metallurgy makes it possible to invent new metal processing technologies that help create very precise and durable parts with high mechanical and chemical characteristics.

The development of innovations in this area is well sponsored by both private and government organizations, so scientists have the opportunity to make discoveries and implement them into production in the shortest possible time.

“Metalworking” is a specialized annual exhibition that will be held at the Moscow Expocentre Fairgrounds. The international event, where the world's best companies will present their innovative machines, tools and metal processing technologies, will be interesting to visit for owners of large and small enterprises, private workshops and factories.

At the exhibition you will be able to explore all the latest inventions and their benefits.

Metalworking is understood as a set of technological processes that change the size, shape and other characteristics of metal workpieces. Conventional

classification of metal processing technologies: casting, machining (cutting and pressure), thermal, welding, electrical, artistic.

One of the most ancient methods of metal processing. Casting is the process of making castings by pouring molten metal into molds. After solidification, the metal melt acquires the configuration of the internal space of the mold. Modern casting technologies provide the ability to produce castings of complex shapes with the minimum possible allowances for further machining.

- Types of metal processing by casting:
- In sand molds. This is the most widespread and inexpensive foundry technology, allowing the production of rough blanks. Holes and cavities in them are formed using rods placed in a casting mold.
- In a mold - a collapsible, most often metal form. The technique allows us to obtain high-quality semi-finished products. The hardened product is removed from the mold.

Under pressure in molds. The method is used mainly for non-ferrous alloys and some grades of steel.

According to lost wax models. This method allows the production of complex shaped products. To do this, a high-precision model of the part is made from stearin and other material, and then a suspension is applied to it to form the shell. The dried and calcined shell mold is filled with a metal melt. Cooling - in open space or in a thermostat.

Main types of mechanical processing of metals. Machining of metal workpieces includes processes that result in changes in the geometric characteristics of parts. It can be divided into two main categories. The first group, called pressure treatment, includes operations that occur without removing the surface layer of the metal. This is rolling, forging, stamping, pressing. The second group is technological operations called cutting. These include turning, milling, planing, chiselling, and drilling.

Main types of metal forming:

Hot rolling. This method of mechanical processing is used in the production

of sheets, pipes, sections and shaped products. Hot-rolled semi-finished products can serve as the starting material for various cold deformation methods.

Cold rolling. Its goal is to increase dimensional accuracy, improve surface quality and other characteristics of hot-rolled semi-finished products.

Cold and hot drawing. It is carried out by pulling the workpiece through a hole of a given shape in order to obtain the required cross-section of long products. The cross-sectional area of the hole is always less than the cross-sectional area of the workpiece. This metalworking method is used in the production of rods (round, square, polygonal) and shaped rolled products with a small cross-sectional size, and thin-walled pipes of small diameter.

Hot and cold stamping. This type of OMD has been known for several centuries. And cold stamping has long been the main method of producing metal utensils due to its simple implementation and low cost of the process. Stamping can be sheet or volumetric. As a result of volumetric stamping, a spatial change in the shape of a volumetric workpiece occurs. Typically, the purpose of such a technological operation is to obtain a product of a more complex configuration from a workpiece of a simple shape (ball, cylinder, parallelepiped, cube). Sheet stamping is a type of metal processing that is used to produce both small parts and bodies of various types of transport.

Forging. It is carried out when the workpiece is heated. It can be manual (this method is now used mainly to create artistic products) and mechanized.

Cold and hot pressing (extrusion). Extrusion involves processing workpieces by extruding them through one or more channels. Soft non-ferrous metals (aluminum, copper) and alloys based on them are usually pressed without heating. Hot pressing is usually used for steel blanks. Extrusion is a modern metalworking method that allows you to produce long profile products.

Combined processing. Very often, to obtain the desired result, several MMD technologies are combined and/or MMD is combined with other types of metalworking.

Types of metal cutting. Cutting is a set of processes that involve cutting off layers of metal and turning them into chips or dividing workpieces into parts. Divide roughing, semi-finishing and finishing. The blanks are: castings, all types of rolled products, stamped, forged, pressed parts. Basic methods of metal cutting:

Turning (turning). It is implemented on turning machines using cutters. Turning allows you to create conical, cylindrical and shaped parts.

Drilling. Additional operations that can be combined with drilling are boring, reaming, reaming, countersinking. Their goal is to obtain holes of the required diameter and depth - through or blind. The equipment used is various types of drilling machines and lathes.

Milling. It is carried out on milling machines using disk, cylindrical, face, end, and corner cutters.

Grinding. This operation is a finishing operation. With its help, the surface roughness is reduced to the value specified in the drawings for the product. The working parts of grinding machines are abrasive wheels, belts, and honing heads.

Operations for dividing workpieces into parts - cutting and chopping. Cutting is carried out with hand or mechanized tools, or alternatively by thermal action. In mass production, guillotine shears, press shears, mechanical and hydraulic presses, and corner cutting machines are used for cutting rolled products.

To implement high-speed cutting methods, CNC metalworking machines are used, which perform all operations automatically in accordance with the computer program embedded in them.

Heat treatment of metals. Heat treatment of metals and alloys is a set of operations of heating to set temperatures, holding and cooling at different speeds and in different environments. Their goal is to obtain a microstructure and physical and mechanical characteristics that correspond to the planned technical task. Main types of heat treatment:

Annealing of the 1st and 2nd kind. Type I annealing for steel workpieces usually involves heating to temperatures at which phase transformations of the steel do not occur. Depending on the conditions, this type of heat treatment includes the

processes of homogenization, recrystallization, removal of residual stresses and some reduction in hardness. Annealing of type II for steels is accompanied by phase transformations. As a result of this type of treatment, the strength and hardness of steel decrease, and its ductility and toughness increase. Typically, type II annealing is used to prepare for various types of machining.

Hardening. It is used for metals and alloys in which phase transformations occur in the solid state when heated to high temperatures and cooled in water or oil. Hardening is always combined with tempering, which reduces the brittleness and stresses characteristic of hardened steels. After hardening and annealing, the strength, hardness, and wear resistance of the steel workpiece increase.

Thermomechanical treatment (TMT). Combines plastic deformation with heat treatment. Hot plastic deformation is combined with hardening, cold - with aging. TMO is used for steels, aluminum and magnesium alloys.

Welding of metals and alloys. The essence of welding is to heat the edges of the parts being welded to the melting temperature and further form a permanent connection between them.

There are several welding methods:

Electric. The most common type of welding process. Electric arc welding is carried out with coated consumable electrodes, non-consumable electrodes in an inert gas environment, using welding wire. Another type of electric welding is contact welding. There are spot and roller electric welding. In the latter case, a conductive roller connects the two parts with a continuous seam.

Gas. *The oxidizing agent in this process is oxygen, and the functions of the flammable gas are performed by: acetylene, its more economical alternative - MAF (methyl acetylene-allen fraction), natural gas, propane-butane mixture, hydrogen, etc.*

Chemical. *The heat generated by a chemical reaction is used to heat the edges. Chemical welding is used in hard-to-reach places and even under water.*

Electrical processing of metals and alloys. Electrical processing of metal workpieces is based on the ability of the metal to be destroyed when high-intensity

electrical discharges are applied. This type of metalworking is used for making holes in thin metal sheets, working with semi-finished products made of hard alloys, and sharpening tools.

In addition to the types of metalworking that serve to obtain the necessary technical characteristics of metal products, there is artistic processing of metal blanks. Its goal is to create decorative objects or decorate products that have practical applications. For this purpose, casting, chasing, forging, and welding are used.

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