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АНГЛИЙСКИЙ ЯЗЫК

СБОРНИК ТЕКСТОВ И УПРАЖНЕНИЙ
для студентов 1 и 2 курсов специальности
«Подъёмно-транспортные машины»

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WHAT ARE THE DIFFERENT TYPES OF CRANES?

Cranes are machines that use **levers** and/or pulleys to lift significant weights. A crane one passes on the road may look like a fairly modern invention, but these machines have actually been used for at least the past 2000 years, if not longer. The Romans used cranes to build huge monuments. Medieval churches were constructed with them. Also, the Egyptians may have used them to create pyramids. The modern version can be either simple or complex, and cranes vary based on their **application**.

A relatively simple crane is the mobile crane. A telescopic boom (arm) or **steel truss** mounts its movable platform. Either pulleys or levers raise the boom. Generally a hook suspends from the boom. The platform of a mobile crane can either have traditional wheels, wheels designed for railroad tracks, or a **caterpillar** track, which is useful for navigating unpaved and uneven surfaces. Mobiles can be used for **demolition** or earth-moving by replacing the hook with an appropriate tool, such as a wrecking ball or **bucket**. Telescopic cranes, with a series of hydraulic tubes fit together to form the boom, can also be mobile.

Truck mounted and rough terrain cranes are both essentially mobile as well. The truck-mounted crane generally has **outriggers** to increase its stability. Rough terrain cranes tend to have a base that resembles the bottom of a 4-wheel drive vehicle. Outriggers also stabilize these cranes. They tend to be used in rough terrain, as the name suggests, and are frequently used to pick up and transport materials.

Loader cranes have hydraulic powered booms fitted onto trailers. They load goods onto the trailer and the jointed sections of the boom are folded down when not in use. The loader may also be considered telescopic, as one section of the boom, in some designs, may telescope for ease of use.

Stacker cranes are most frequently seen in automated warehouses where they tend to follow an automatic **retrieval** system. For example, in huge automated freezers, these cranes, equipped with forklift apparatus, can work by **remote**, stacking or obtaining foods as needed. This retrieval system makes it possible to keep workers out of the cold.

Gantry cranes are most often found in ports and railroads, where they unload and move huge containers off of ships and trains. The bases are huge **crossbeams** which run on rails, so lifted containers can be moved from one location to another. The **portainer** is a special type of gantry that lifts materials on and off ships.

Floating cranes mounted on barges or **pontoons** are also essential to the shipping industry. Situated in water, they are used to construct ports, salvage ships or build bridges. Like portainers, floating cranes also can unload ships. They are able to handle very heavy loads and awkwardly shaped containers.

Tower cranes, conversely, do not generally have a moveable base. These are often the tallest cranes, and have to be assembled piece by piece. The base looks like a long ladder, and the boom is perpendicular to the base. Tower cranes are used to construct tall buildings, and in the case of skyscrapers, the tower crane is often assembled and affixed inside the building itself during construction.

All cranes represent a meeting of simple machines, used for the purpose of reducing **workload**. However simple they may seem, they are instrumental in many aspects of industry. They can dig, move, create, or destroy, depending on their type. Cranes exemplify that sometimes the oldest ideas are the best ones.

VOCABULARY

lever – рычаг
application – применение
steel truss – кронштейн, ферма
caterpillar – гусеница
demolition – разрушение, уничтожение
bucket – ковш
outrigger – выносная стрела
loader – погрузчик
stacker – механический укладчик
retrieval – выборка, поиск
remote – дистанционное управление
crossbeam – перекладина
pontoon – понтонный мост, наплавной мост
workload – рабочая нагрузка

VOCABULARY EXERCISES

1. Any English word can be translated into Russian in several ways. Find several translations for the following words: *demolition, retrieval, outrigger, lever, stacker, caterpillar, bucket.*

Ведро, жадный человек, накопитель, нахлебник, снос, восстановление, выносная стрела, гусеница (зоол.), приёмник, средство воздействия, посторонний человек, уничтожение, возвращение, черпак, консольная балка, ниспровержение, черпать.

2. Find synonyms for the following words: *outrigger, demolition, bucket, caterpillar (there may be several synonyms for one word).*

Destruction, tub, extortioner, pail, devastation, outsider, overthrow, onhanger.

3. Translate the word combinations and sentences into Russian.

a) Shift lever, card stacker, brake lever, demolition work, metal bucket, demolition torpedo, wooden bucket, empty bucket.

b) 1. A door handle is a type of lever. 2. The Greek, that great well whence we bucket up our abstract terms. 3. The old man levered himself out of the armchair. 4. The blackmailer used the threat of scandal as a lever to get money.

TEXT EXERCISES

1. Complete the sentences:

1) Cranes can … .
2) Tower cranes are assembled … .
3) Floating cranes are essential in … .
4) Mobile cranes are used for … .
5) Caterpillar track is useful for … .

2. Answer the questions.

1) How do the cranes vary?
2) For how long have the cranes been used?
3) How did the Romans and the Egyptians use cranes?
4) What does the mobile crane consist of?
5) What increases the stability of the truck-mounted cranes?
6) What are the truck-mounted cranes used for?
7) What type of crane has the jointed sections of the boom which are folded down when not in use?
8) Where are stacker cranes most frequently seen?
9) Which cranes can unload ships?
10) Which cranes are the tallest?
11) What is the main purpose of cranes?

HISTORY OF CRANES

Ancient Greek cranes

The crane for lifting heavy loads was invented by the ancient Greeks in the late 6th century BC. The archaeological record shows that no later than c. 515 BC distinctive cuttings for both lifting tongs and lewis irons begin to appear on stone blocks of Greek temples. Since these holes point at the use of a lifting **device**, and since they are to be found either above the centre of gravity of the block, or in pairs **equidistant** from a point over the centre of gravity, they are regarded by archaeologists as the positive **evidence** required for the existence of the crane.

The introduction of the winch and pulley hoist soon lead to a widespread replacement of **ramps** as the main means of vertical motion. For the next two hundred years, Greek building sites witnessed a sharp drop in the weights handled, as the new lifting technique made the use of several smaller stones more practical than of fewer larger ones. In contrast to the archaic period with its tendency to ever-increasing block sizes, Greek temples of the classical age like the Parthenon invariably featured stone blocks weighing less than 15–20 tons. Also, the practice of erecting large monolithic columns was practically **abandoned** in favour of using several column drums. Although the exact **circumstances** of the shift from the ramp to the crane technology remain unclear, it has been argued that the volatile social and political conditions of Greece were more suitable to the employment of small, professional construction teams than of large bodies of unskilled labour, making the crane more preferable to the Greek polis than the more labour-intensive ramp which had been the norm in the autocratic societies of Egypt or Assyria.

The first literary evidence for the existence of the compound pulley system appears in the Mechanical Problems (Mech. 18, 853a32–853b13) attributed to Aristotle (384–322 BC), but perhaps composed at a slightly later date. Around the same time, block sizes at Greek temples began to match their archaic **predecessors** again, indicating that the more sophisticated compound pulley must have found its way to Greek **construction sites** by then.

Ancient Roman cranes

Reconstruction of a 10,4 m high Roman Polyspastos at Bonn, Germany. The heyday of crane in ancient times came under the Roman Empire, when construction activity soared and buildings reached enormous

dimensions. The Romans adopted the Greek crane and developed it further. We are relatively well informed about their lifting techniques thanks to rather lengthy accounts by the engineers Vitruvius and Heron of Alexandria.

The simplest Roman crane, the Trispastos, consisted of a single-beam **jib**, a winch, a rope, and a block containing three pulleys. Having thus a mechanical advantage of 3:1, it has been calculated that a single man working the winch could raise 150 kg, assuming that 50 kg represent the maximum effort a man can exert over a longer time period. Heavier crane types featured five pulleys (Pentaspastos) or, in case of the largest one, a set of three by five pulleys (Polyspastos) and came with two, three or four masts, depending on the maximum load. The Polyspastos, when worked by four men at both sides of the winch, could already lift 3000 kg. In case the winch was replaced by a treadwheel, the maximum load even doubled to 6000 kg at only half the crew, since the treadwheel possesses a much bigger mechanical advantage due to its larger diameter.

However, numerous Roman buildings which feature much heavier stone blocks than those handled by the Polyspastos indicate that the overall lifting capability of the Romans went far beyond that of any single crane. It is **assumed** that Roman engineers accomplished lifting these extraordinary weights by two measures: First, as suggested by Heron, a lifting tower was set up, whose four masts were arranged in the shape of a quadrangle with parallel sides, with the column in the middle of the structure. Second, a multitude of capstans were placed on the ground around the tower, for, although having a lower leverage ratio than treadwheels, **capstans** could be set up in higher numbers and run by more men (and, moreover, by draught animals).This use of multiple capstans is also described by Ammianus Marcellinus (17.4.15) in connection with the lifting of the Lateranense obelisk. The maximum lifting capability of a single capstan can be established by the number of lewis iron holes bored into the monolith.

VOCABULARY

device – устройство, приспособление
equidistant – равноудалённый
evidence – доказательство
ramp – наклонная плоскость, скат, уклон
abandon – прекратить, оставить, бросить
circumstance – обстоятельство

predecessor – предшественник
construction site – строительная площадка
jib – стрела подъёмного крана
to feature – характеризовать, быть отличительной чертой
to assume – предполагать
capstan – ворот, ведущий вал

VOCABULARY EXERCISES

Translate the sentences into English.

1. Он оставил надежду завершить свой проект. 2. Обстоятельства не позволили ему найти необходимые доказательства. 3. Это устройство было изобретено в 18 веке. 4. Работа на строительной площадке скоро будет завершена. 5. Я не знаю, кто был его предшественником, но предполагаю, что это был не очень честный человек.

TEXT EXERCISES

1. Say whether these statements true or false. If they are false – correct them.

1) The crane for lifting heavy loads was invented by Greeks in the 8^{th} century.
2) The winch and pulley hoist were the main means of vertical motion.
3) The practice of using several column drums was abandoned.
4) The Mechanical Problems" was written by Aristotle.
5) Political and social conditions of Greece were more suitable for the employment of large construction teams.

2. Answer the questions.

1) When and where did the heyday of crane come?
2) What type of crane did the Romans adopt?
3) What was the simplest Roman crane?
4) What mechanical advantage did it have?
5) How many pulleys did heavier crane types have?
6) How much could Polyspastos lift?
7) How did Roman engineers accomplish lifting weights?
8) How can the lifting capability of a single capstan be established?

MEDIEVAL CRANES

During the High Middle Ages the **treadwheel** crane was reintroduced on a large scale after the technology had fallen into disuse in western Europe with the demise of the Western Roman Empire. The earliest reference to a treadwheel (magna rota) reappears in archival literature in France about 1225, followed by an illuminated depiction in a manuscript of probably also French origin dating to 1240. In navigation, the earliest uses of **harbor** cranes are documented for Utrecht in 1244, Antwerp in 1263, Brugge in 1288 and Hamburg in 1291, while in England the treadwheel is not recorded before 1331.

Generally, vertical transport was done safer and cheaper by cranes than by **customary** methods. Typical **areas of application** were harbors, mines, and, in particular, building sites where the treadwheel crane played a pivotal role in the construction of the lofty Gothic cathedrals. Nevertheless, both archival and pictorial sources of the time suggest that newly introduced machines like treadwheels or wheelbarrows did not completely replace more labor-intensive methods like **ladders**, **hods** and handbarrows. Rather, old and new machinery continued **to coexist** on medieval construction sites and harbors.

Medieval port crane with building overhanging in the former Hanse town of Danzig. Apart from treadwheels, medieval depictions also show cranes to be powered **manually** by **windlasses** with radiating **spokes**, **cranks** and by the 15th century also by windlasses shaped like a ship's wheel. To smooth out irregularities of impulse and get over 'dead-spots' in the lifting process **flywheels** are known to be in use as early as 1123.

The exact process by which the treadwheel crane was reintroduced is not recorded, although its return to construction sites has undoubtedly to be viewed in close connection with the **simultaneous** rise of Gothic architecture. The reappearance of the treadwheel crane may have resulted from a technological development of the windlass from which the treadwheel structurally and mechanically evolved. Alternatively, the medieval treadwheel may represent a deliberate reinvention of its Roman **counterpart** drawn from Vitruvius' De architectura which was available in many monastic libraries. Its reintroduction may have been inspired, as well, by the observation of the labor-saving qualities of the waterwheel with which early treadwheels shared many structural similarities.

The medieval treadwheel was a large wooden wheel turning around a central **shaft** with a treadway wide enough for two workers walking side

by side. While the earlier 'compass-arm' wheel had spokes directly driven into the central shaft, the more advanced 'clasp-arm' type featured arms arranged as **chords** to the **wheel rim**, giving the possibility of using a thinner shaft and providing thus a greater mechanical advantage.

Contrary to a popularly held belief, cranes on medieval building sites were neither placed on the extremely lightweight **scaffolding** used at the time nor on the thin walls of the Gothic churches which were incapable of supporting the weight of both **hoisting machine** and load. Rather, cranes were placed in the initial stages of construction on the ground, often within the building. When a new floor was completed, and massive tie beams of the roof connected the walls, the crane was **dismantled** and reassembled on the roof beams from where it was moved from **bay** to bay during construction of the vaults. Thus, the crane ‘grew’ and ‘wandered’ with the building with the result that today all extant construction cranes in England are found in church towers above the vaulting and below the roof, where they remained after building construction for bringing material for repairs aloft. Less frequently, medieval illuminations also show cranes mounted on the outside of walls with the stand of the machine secured to putlogs.

In contrast to modern cranes, medieval cranes and hoists-much like their counterparts in Greece and Rome – were primarily capable of a vertical lift, and not used to move loads for a considerable distance horizontally as well. Accordingly, lifting work was organized at the workplace in a different way than today. In building construction, for example, it is assumed that either the crane lifted the stone blocks from the bottom directly into place, or from a place opposite the centre of the wall from where it could deliver the blocks for two teams working at each end of the wall. Additionally, the crane master who usually gave orders at the treadwheel workers from outside the crane was able to manipulate the movement laterally by a small **rope** attached to the load. **Slewing cranes** which allowed a rotation of the load and were thus particularly suited for dockside work appeared as early as 1340. While **ashlar** blocks were directly lifted by **sling**, other objects were placed before in containers like pallets, baskets, wooden boxes or barrels.

It is noteworthy that medieval cranes rarely featured **ratchets** or **brakes** to forestall the load from running backward. This curious absence is explained by the high **friction force** exercised by medieval treadwheels which normally prevented the wheel from accelerating beyond control.

VOCABULARY

treadwheel – колесо-топчак, рабочее колесо
harbor – гавань
customary – обычный
areas of application – сферы применения
ladder – лестница
hod – лоток для кирпичей, корыто, ведёрко
to coexist – сосуществовать
manually – вручную
windlass – лебёдка, ворот
spoke – спица колеса
crank – кривошип, колено, коленчатый рычаг, рукоятка
flywheels – маховик, маховое колесо
simultaneous – одновременный
counterpart – двойник, дубликат
shaft – ось
chord – соединение
wheel rim – обод колеса
scaffolding – строительные леса
hoisting machine – подъёмная машина
to dismantle – демонтировать, разбирать
bay – пролёт
rope – канат
slewing cranes – поворачивающиеся краны
ashlar – тёсаный камень
sling – канат
ratchet – храповик
brake – тормоз
friction force – сила трения

VOCABULARY EXERCISES

1. Find definitions for the following words*: to dismantle, harbor, brake, simultaneous, ladder, scaffolding, counterpart, treadwheel, ashlar, to coexist*.

1) large square-cut stones used as the surface layer of a wall;
2) occurring, operating, or done at the same time;
3) a structure consisting of a series of bars or steps between two

uprights, used for climbing up or down;

4) mill that is powered by men or animals walking on a circular belt or climbing steps;

5) exist together;

6) take off or remove, take apart into its constituent pieces;

7) a person or thing having the same function or characteristics as another, a duplicate copy;

8) a restraint used to slow or stop a vehicle;

9) a system of scaffolds;

10) a sheltered port where ships can take on or discharge cargo.

2. Fill in the blanks with the suitable words: *scaffold, brake, spokes, counterparts, simultaneously, coexist, hoisting machines.*

1) Each nation must learn to …….with the neighbouring countries.

2) Young people today already leave home sooner than their a generation ago.

3) The government put a on plans for expansion.

4) The four wheels of a car move ….

5) are capable of picking up loads at one location and depositing them at another anywhere within a limited area.

6) For use in bicycles, heavy wooden-spoked wheels were replaced by lighter wheels with … made of tensioned, adjustable metal wires, called wire wheels.

7) The purpose of a working … is to provide a safe place of work with safe access suitable for the work being done.

TEXT EXERCISES

1. True or false?

1) During the High Middle Ages the **treadwheel** crane was invented.

2) Typical areas of application of treadwheel cranes were harbors, mines, and, in particular, building sites.

3) Treadwheels or wheelbarrows completely replaced more labor-intensive methods like ladders**, hods** and handbarrows in the Middle Ages.

4) Cranes on medieval building sites were placed on the on the walls of the building.

5) Medieval cranes were used to move loads for a considerable distance horizontally.

2. Answer the questions:

1) When was the treadwheel crane reintroduced?

2) What role did the treadwheel crane play in the construction of buildings?

3) Why, do you think, old and new machinery continued to coexist on medieval construction sites and harbors?

4) Why was the treadwheel reintroduced in the Middle Ages?

5) What was the medieval treadwheel like?

6). Where were the cranes placed on the medieval construction sites?

7) How was the lifting work organized?

8) Why did medieval cranes rarely featured ratchets or brakes?

HOISTING MACHINES

Hoisting machines are mechanisms for raising and lowering material with intermittent motion while holding the material freely **suspended**. Hoisting machines are capable of **picking up loads** at one location and depositing them at another anywhere within a limited area. In contrast, elevating machines move their loads only in a fixed vertical path, and monorails operate on a fixed horizontal path rather than over a limited area.

The principal components of hoisting machines are: **sheaves** and **pulleys**, for the hoisting mechanisms; **winches** and **hoists**, for the power units; and **derricks** and cranes, for the structural elements.

Sheaves and pulleys or blocks are a means of applying power through a rope, wire, cable, or **chain**. Sheaves are wheels with a grooved periphery that change the direction or the point of application of a force transmitted by means of a rope or cable. Pulleys are made up of one or more sheaves mounted in a frame, usually with an attaching **swivel hook**, eye, or similar device at one or both ends. Pulley systems are a combination of blocks.

Normally, winches are designed for **stationary** service, while hoists are mounted so that they can be moved about, for example, on wheel trolleys in connection with overhead crane operations. A winch is basically a drum or cylinder around which **cordage** is coiled for hoisting or hauling. The **drum** may be operated either manually or by power, using a **worm gear** and **worm wheel**, or a **spur gear** arrangement. A **ratchet** and **pawl** prevent the load from slipping; large winches are equipped with brakes, usually of the external band type.

A derrick is distinguished by a **mast** in the form of a **slanting boom** pivoted at its lower end and carrying load-supporting tackle at its outer end. In contrast, **jib cranes** always have horizontal booms. Derricks are

standard equipment on construction jobs; they are also used on freighters for loading and unloading cargo, and on barges for dredging operations. Hoisting machines with a bridgelike structure spanning the area over which they operate are **gantry cranes**.

VOCABULARY

hoisting machines – подъёмные машины
suspend – подвешивать
pick up – поднять
load – груз
sheave – шкив, блок
pulley – ворот
winch – лебёдка, кривошип
hoist – подъёмник, лебёдка
derrick – деррик-кран, мачтовый кран
wire – провод
chain – цепь
swivel hook – вертлюжный крюк
stationary – стационарный, неподвижный
cordage – трос, верёвки
drum – барабан, цилиндр
worm gear – червячный привод
worm wheel – червячное колесо
spur gear – зубчатое цилиндрическое колесо
ratchet – храповик
pawl – предохранитель
mast – грузоподъёмный механизм, грузоподъёмник, мачта (*погрузчика*)
slanting boom – наклонная стрела
jib crane – стреловой кран
gantry crane – козловой кран

VOCABULARY EXERCISES

1. Find definitions for the following words: *wire, ratchet, stationary, load, derrick, boom, drum.*

1) mechanical device consisting of a toothed wheel or rack engaged with a pawl that permits it to move in only one direction;

2) weight to be borne or conveyed;

3) any of various more-or-less horizontal spars or poles used to extend the foot of a sail or for handling cargo or in mooring;

4) a hollow cast-iron cylinder attached to the wheel that forms part of the brakes;

5) a simple crane having lifting tackle slung from a boom;

6) not capable of being moved;

7) a metal conductor that carries electricity over a distance.

2. Say in what meaning the word is used in the text.

1) ***Mast:***

- a vertical spar for supporting sails;
- any sturdy upright pole;
- nuts of forest trees used as feed for swine.

2) ***Cordage:***

- the ropes in the rigging of a ship;
- the amount of wood in an area as measured in cords.

3) ***Suspend:***

- bar temporarily; from school, office, etc.;
- make inoperative or stop;
- hang freely;
- stop a process or a habit by imposing a freeze on it.

4) ***Chain:***

- a series of (usually metal) rings or links fitted into one another to make a flexible ligament;
- a necklace made by a stringing objects together;
- anything that acts as a restraint;
- a number of similar establishments (stores or restaurants or banks or hotels or theaters) under one ownership;
- a series of things depending on each other as if linked together;
- British biochemist (born in Germany) who isolated and purified penicillin, which had been discovered in 1928 by Sir Alexander Fleming (1906–1979);
- a unit of length;
- a series of hills or mountains.

5) ***Pick up:***

- receive;
- buy casually or spontaneously;
- get in addition;
- take up by hand;

- give a passenger or a hitchhiker a lift;
- take and lift upwards.

TEXT EXERCISES

1. Number the ideas in order they appear in the text.

1) Derricks are used on freighters for loading.

2) Winches are normally designed for stationary service.

3) Hoisting machines are capable of picking up loads at one location and depositing them at another.

4) Pulley systems are a combination of blocks.

5) The drum may be operated either manually or by power.

2. Say what is meant by:

1) wheels with grooved periphery;

2) eye or a similar device;

3) it is basically a drum or cylinder;

4) it has a mast in the form of a slanting boom pivoted at its lower end;

5) hoisting machines with a bridgelike structure.

3. Answer the following questions:

1) What are hoisting machines?

2) What's the difference between hoisting and elevating machines?

3) Where do monorails operate?

4) What are the principal components of hoisting machines?

5) What changes the direction of application of a force transmitted by a means of rope, chain?

6) What is a winch?

7) How can the drum be operated?

8) What prevents the load from slipping?

9) What booms do jib-cranes have?

10) Where are derricks used?

4. Say what the functions of the following components are:

- elevating machines;
- pulleys;
- ratchets;
- booms;
- sheaves.