The early days of the Automobile

1. One of the earliest attempts to propel a **vehicle** by **mechanical po**wer was suggested by Isaac Newton. But the first **self-propelled** vehicle **was constructed** by the French military engineer Cugnot in 1763. He built a **steam-driven engine** which had three **wheels,**carried two **passengers** and run at maximum **speed**of four miles. The supply of steam lasted only 15 minutes and the carriage had to stop every 100 yards to make more **steam.**

2. In 1825 a steam engine was built in Great Britain. The vehicle carried 18 passengers and covered 8 miles in 45 minutes. However, the progress of **motor cars**met with great opposition in Great Britain.

3. In Russia there were cities where motor cars were **outlawe**d altogether. When the editor of the local newspaper in the city of Uralsk bought a car, the governor **issued**these instructions to the police: «When the vehicle appears in the streets, it is to be stopped and **escorted**to the police station, where its driver is to be **prosecuted».**

4. From 1860 to 1900 was a period of the application of **gasoline engines** to motor cars in many countries. The first to perfect gasoline engine was N. Otto who **introduced the four-stroke cycle of operation**. By the time motor cars got a standard shape and **appearance.**

In 1896 a procession of motor cars took place from London to Brighton to show how **reliable**the new vehicles were.

The cars of that time were very small, **two-seated cars** with no roof, driven by an engine placed under the **seat.** Motorist had to carry large cans of **fuel** and separate **spare tyres**, for there were no **repair** or filling stations to serve them.

After World War 1 it became possible to achieve greater **reliability** of motor cars, **brakes** became more **efficient**. **Multi-cylinder engines** came into use; most commonly used are **four-cylinder engines**.

5. Gradually the development of vehicles driven by **international combustion engine** – cars, as they had come to be known, led to the **abolition** of earlier **restrictions.** Huge capital began to flow into the **automobile industry**.

From 1908 to 1924 the number of cars in the world rose from 200 thousand to 20 million; by 1960 it had reached 60 million!

6. There are about 3,000 Americans who like to **collect antique cars**. They have several clubs such as Antique Automobile Club. **Collectors** can also advertise in the magazine published by their clubs. The best collection-100 old cars of great rarity – is in possession of William Harrah. He is very **influential** in his field. The value of his collection is not only historical but also practical: photographs of his cars are used for films and **advertisements.**

1. **Переведите на русский язык следующие слова и словосочетания:**

*Vehicle, mechanical power, self-propelled, was constructed, a steam-driven engine, wheels, passengers, motor cars, issued, prosecuted, of gasoline engines,*

*introduced the four-stroke cycle of operation, two-seated cars, efficient, international combustion engine, abolition, automobile industry, collect antique cars, advertisements.*

1. **Переведите письменно первые два абзаца**
2. **Закончите предложения, выбрав их из текста**

1*) In ….. a steam engine was built in Great Britain.*

*2) From 1860 to 1900 was a period of the application…*

*3) The cars of that time were very small…*

*4) Multi-cylinder engines came into use, most commonly used are…*

*5) The best collection-100 old cars of great rarity –…*

Different kind of land transport

**What was the reaction of the people after the invention of the steam engine?**

In Washington the story is told of the Patent Office who in the early thirties of the last century suggested that the Office be closed because «everything that could possibly be invented had **been invented».** People experienced a similar feeling after the **invention of the steam engine.**

But there was a great need for a more **efficient engine** than the **steam engine**, for one without **a huge boiler**, an engine that could quickly be started and stopped. This problem was solved by the invention of the **international combustion engine.**

**Who introduced the first cheap motor car?**

The first practical internal combustion engine was **introduced** in the form of a gas engine by the German engineer N. Otto in 1876.

Since then **motor transport** began to spread in Europe very **rapidly.** But the person who was the first to make it really popular was Henry Ford, an American **manufacturer**who introduced the first **cheap motor car**, the famous Ford Model «T».

**When did diesel-engine Lorries become general?**

**The rapid development** of the internal combustion engine led to its use in the farm **tractors,** thereby creating a revolution in agriculture. The use of motor vehicles for carrying heavy loads developed more slowly until the 1930s when **diesel-engined Lorries** became general.

**The motor cycle** steadily increased in popularity as engines and tyres became **more reliable** and roads improved. **Motor cycles** were found well suited for **competition races** and sporting events and were also recognized as the cheapest form of fast transport.

**When were the trams introduced** **first?**

Buses were started in Paris in 1820. In 1828 they were introduced in London by George Shillibeer, a coach builder who used the French name Omnibus which was **obtained**from the Latin word meaning «for all». His **omnibuses** were driven by three horses and had seats for 22 passengers. Then in then 20th century reliable **petrol engines** became **available,** and by 1912 the new motor buses were fast replacing **horse-driven buses.**

Trams were introduced in the middle of the 19th century. The idea was that, as the rails were **smoother**than the roads, less **effort**was needed **to pull**a tram than a bus. The first **trams**were horse-drawn but the later trams were almost all driven by electricity. The **electric motor** driving the tram was usually with electric **current from overhead wires**. Such wires are also used **by trolleybuses**, which run on **rubber tyres** and do not need **rails.**

Another form of transport used in London, Paris, Berlin, Moscow, St.Petersburg,

Kiev and some other crowded cities is the underground railway.

London’s first underground railway of the **«tube» type** was opened in 1863, the Moscow underground in 1935.

**What do the longest oil pipe-lines connect?**

**The pipe-lines**, which were in use by the ancient Romans for carrying water supplies to their houses, are now mainly used to **transport petroleum**. The first **pipe-line** of this kind was laid in Pennsylvania, the United States, in 1865.

Some of the longest oil pipe-lines **connect oil-fields** in Iraq and near the Persian Gulf with ports on the Mediterranean coast. A famous Pipe-line Under the Ocean was laid across the English Channel in 1944.

**What are the cableways used for?**

A form of transport which is quite common in some mountainous parts of the world, especially in Switzerland, is the aerial **cableway.** Cableways are used at nearly all winter sport centers to pull or carry **skiers** to the top **of the slopes**. Cableways are used by many Alpine villages which lie high up the mountain-sides for bringing up their supplies from the valley bellow.

1. **Распределите правильно слова, в соответствии с развитием транспорта**

*Omnibus, cableway, steam engines, pipe-lines, motor cars, diesel engines*

2. **Найдите в правой колонке русские эквиваленты английских слов и словосочетаний:**

*Invention of the steam engines усилие*

*efficient engine дизельный двигатель*

*internal combustion engine. омнибус*

*motor transport изобретение парового двигателя*

*The rapid development бензин для транспорта*

*diesel-engine троллейбусы*

*Trams продуктивный двигатель*

*Omnibuses связь с нефтяной сферой*

*horse-driven buses. двигатель внутреннего сгорания*

*Effort моторный транспорт*

*The electric motor трамваи*

*trolleybuses, лошадиная сила*

*pipe-lines электрический мотто*

*transport petroleum. трубопровод*

*connect oil-fields бензин*

3. **Закончите предложения, выбрав их из текста**

*1. People experienced a similar feeling after the….*

*2. The first practical internal combustion engine was introduced in the form of a gas engine by…*

*3. The use of motor vehicles for carrying heavy loads developed more slowly until…*

*4. The first trams were horse-drawn but the later trams were…*

*5. The first pipe-line of this kind was laid…*

*6. A form of transport which is quite common in some mountainous parts of the world, especially in Switzerland, is…*

Automobile production

Specialists in automobile industry deal with **designing and manufacturing cars,** so they should know that the production of the automobile comprises the following phases:

1. **Designing**
2. Working out the technology of manufacturing processes
3. **Laboratory tests**
4. **Road tests**
5. Mass production

Why is it necessary to know all these facts?

It is important to know them as before the automobile (car or truck) is **put into** **mass production**, it should be properly designed and the automobile must **meet-up-to-date requirements.**

What are these **requirements?**

The automobile must have **high efficiency, long service life, driving safety, ease of maintenance and pleasant appearance.**

In order to obtain all these **qualities** engineers should develop **up-to-date methods** **of designing cars,**using new types of resistant**to corrosion** **light materials.** Also it is important to know computer science because it is intended to shorten the time between designing and manufacturing. Computers **offer quick and optimal solutions**of problems.

But before the car is put **into mass production** all its units and mechanisms are **subjected to tests**, first in the plant’s laboratory, then the car undergoes **a rigid quality control in road tests.** Only then the car is put into mass production. Why are these tests **required**? What qualities are required of the automobile? The modern automobile must be **rapid in acceleration, must have smooth acting clutch, silent gearbox, dependable brakes and steering system,**as well as pleasant appearance. Also it must be **comfortable**and have all **conveniences.**

1. **Найдите в правой колонке русские эквиваленты английских слов и словосочетаний:**

1*. mechanical engineer  а) долгий срок службы*

*2. to deal (with) б) запустить в массовое производство*

*3. designing cars  в) подвергать испытаниям*

*4. to put into mass production  г) плавное сцепление*

*5. long service life  д) отвечать современным требованиям*

*6. driving safety  е) иметь дело*

*7. to meet up-to-date demands  ж) надёжные тормоза и рул. упр-я*

*8. smooth-acting clutch  и) безопасность езды*

*9. silent gearbox й) бесшумная коробка передач*

*10 .dependable brakes and steering system  к) инженер-механик*

*11. to subject to test  л) конструирование автомобилей*

2. **Ответьте на вопросы по тексту**

1. *What phases does the production of the automobile comprise?*
2. *What requirements must the automobile meet?*
3. *Why are cars subjected to road tests*
4. *What qualities are required of the automobile?*
5. *Why is it important for the specialists in automobile industry to know computing methods?*

3. **Закончите предложения, выбрав соответствующий вариант окончания:**

1. **The cars are subjected to road tests in order…**
	1. *to shorten the time between designing and manufacturing*
	2. *to meet up-to-date requirements*
	3. *to work out new technological processes*
2. **The car must have the following units….**
	1. *high efficiency, long service life, driving safety and pleasant appearance*
	2. *smooth acting clutch, silent gearbox, dependable brakes and steering system*
3. **The car must have the following qualities**….
	1. *high efficiency, long service life, driving safety and pleasant appearance*
	2. *smooth acting clutch, silent gearbox, dependable brakes and steering system*

Components of Automobile

Basically, the automobile consist of three parts: **the power plants, or the engine, the chassis and body.**To these may be added **the accessories**: the **heater, lighter, radio, speedometer** and other devices. The **power plant** or engine is the **source**of power that makes **the wheels rotate** and the car move. It includes **electric, fuel, cooling and lubricating systems**. Most automobile engines have **six or eight cylinders**.

The chassis consists of a **power train, frame with axles, wheels and springs.** The **chassis**includes **brakes and steering system**.

The **power train** carries the power from the engine to the **car wheels** and **contains the clutch, gearbox, propeller or cardan shaft, differential and the final drive.**The **clutch is a friction** device connecting (or disconnecting) the engine **crankshaft**to the gears in the **gearbox.** It is used for freeing the gearbox from the engine and is controlled by the **clutch pedal**. Brakes are important mechanisms of the car. They are used to slow or to stop the car. Most **braking systems** in use today **are hydraulic**. They are operated by the brake pedal. When the driver **pushes down on the brake pedal**, they **are applied** and the car stops.

1. **Переведите на русский язык встречающие в тексте интернациональные слова:**

*Automobile, chassis, speedometer, electric, system, cylinder, cardan, control, hydraulic, pedal, accessories, differential*

1. **Подберите соответствующие ответы на вопросы и напишите их в той последовательности, в которой заданы вопросы**.

**Вопросы**

1. *What are the main basic parts of the automobile?*
2. *What does the chassis consist of?*
3. *What units does the power train contain?*
4. *What is the function of the clutch?*
5. *Why are brakes needed?*

**Ответы**

1. *The clutch, gearbox, cardan shaft and the final drive*
2. *Freeing the engine from the gearbox*
3. *The power plant, the chassis and the body*
4. *A power train, frame with axles, wheels and springs*
5. *To slow or stop the car*
6. **Закончите предложения, выбрав соответствующий вариант окончания:**
7. **The mechanism used for stopping the car is…**
	1. *clutch*
	2. *gearbox*
	3. *brakes*
8. **The mechanism used for changing the speed is…**

*1. clutch*

*2. gearbox*

*3. brakes*

1. **The mechanism used for connecting the engine from the gearbox is…**
	1. *brakes*
	2. *clutch*
	3. *steering system*
2. **The unit carrying the power from the engine to the car wheels is…**
	1. *power plant*
	2. *power train*
	3. *chassis*
3. **The instrument measuring the speed of the car is…**
	1. *heater*
	2. *lights*
	3. *speedometer*

Internal-combustion Engines

**Internal-Combustion engines** are very important components of Automobile. It have the following a**dvantages**: small specific **weight**(**weight-to-power ratio**), quick start, a relatively high **fuel economy** (high **efficiency)**, small quantity of water required (only for cooling), and even this not in all engines, speeds**, adjustment** over a certain **range.**

On the other hand, international-combustion engines cannot be reversed directly or **endure high overloads**, and as a result when selecting an engine the required power should be **determined**from **the highest load**duty; they also cannot be started under load, which calls for the use of **clutches.** An international-Combustion engine should be provided with a **gear box**(**transmission**) to change **the torque,** since the torque developed by the engine at various **crankshaft**speeds changes **insignificantly.**

Internal-Combustion engines utilize for their operation **the thermodynamic processes**which occur in **the clutches** during **fuel combustion**.

In ***carburetor* engines**the combustible mixture is prepared outside the engine cylinders in a carburetor and is then delivered by the cylinders. The mixture is **ignited**by an electric spark generated by a special **source of current**.

In ***diesel*engines** the combustible mixture is formed inside the cylinders as the fuel is being injected through a **nozzle.** The fuel is **injected**at the moment when the cylinder **contains**strongly compressed and therefore **heated air**, which causes the mixture to **self-ignite**. For this reason diesel engines are frequently called **compression ignition engines**.

A ***gas turbine***is a rotary engine which transforms the **kinetic energy** of gas produced by fuel burned in a combustion chamber into mechanical work. Gas turbine units consist of a compressor, **fuel pump**, combustion chamber with nozzle, and a gas turbine. So far the high temperature of the gas has **prevented** gas turbines from being used widely on automotive vehicle.

* 1. **Переведите на русский язык следующие слова и словосочетания**

*Internal-Combustion engines, advantages, weight-to-power ratio, fuel economy, adjustment, endure high overloads, the highest load, clutches, gear box*

*(transmission), the torque, the thermodynamic processes, carburetor and diesel types, combustible mixture, source of current, injected, compression ignition engines, gas turbine, fuel pump.*

* 1. **Закончите предложения, выбрав соответствующий вариант окончания**

*1.****Combustion engine should be provided with***

*a) clutch*

*b) gearbox*

*c) springs*

*2.****Internal-Combustion engines utilize for their operation…***

*a) the thermodynamic processes*

*b) with steering system*

*3.****In carburetor engines the combustible mixture is prepared****…*

*a) outside the engine cylinders*

*b) inside the engine cylinders*

*4.* ***A gas turbine is a rotary engine which transforms…***

* 1. *mechanical work.*
	2. *kinetic energy*

*3*. **Ответьте на вопросы по тексту**

1. *What are the advantages have the Internal-Combustion engines?*

*2.**What energy does engine transform in gas turbine?*

*3. What is the Internal - Combustion engine?*

Diesel Engine

If you know something about ordinary **gasoline engines**, such as those in automobiles, you know have noticed that diesel engines in many respects, work in the same way.

Both types of engines **are internal combustion engines**, that is, they burn the fuel inside their **cylinders** Most gasoline engines and many **diesel engines** work on the **four-stroke cycle**, that is, the **piston**makes **a suction stroke**, a **compression stroke**, a **power stroke**and an **exhaust stroke**.

What are the main differences between diesel engines and **gasoline engines**?

1. A diesel engine has no ignition system- It has no **spark plug fed** with high-tension electricity from a **distributor, spark-coil, timer, and battery.**

2. A diesel engine draws into its cylinder air alone, and it compresses this air on its **compressions stroke** before any fuel enters the cylinder

3. Diesel engines use greater compression than gasoline engines. The compression in a diesel engine is not limited by the possibility **of pre-ignition** because a diesel engine compresses air only. Therefore, diesel engines use compression ratios of about 16 to 1, and so achieve greater **efficiency** in the use of fuel.

Why are diesel engines used so much? Not **merely** because they can produce **power**- there are many other ways of producing power.

**Advantages of Diesel Engines.**

1. Small **Consumption** of Fuel
2. Cheap fuel
3. Economy at Light Loads
4. **Greater Safety**
5. Economy in small Sizes
6. Independence **of Water Supply**
7. Quick Starting

1. **Переведите слова и словосочетания на русский язык:**

*gasoline engines, internal combustion engines, diesel engines, four-stroke cycle, the piston, suction stroke, a compression stroke, a power stroke and an exhaust stroke, spark plug fed, distributor, spark-coil, timer, and battery, pre-ignition, water supply*

2. **Заполните таблицу**

**«The main differences between diesel engines and gasoline engines»**

**DIESEL ENGINE**

**GASOLINE ENGINE**

**1.**

**1.**

**2.**

**2.**

**3.**

**3.**

1. **Закончите предложения, выбрав их из текста:**
2. *Most gasoline engines and many diesel engines work on the…*
3. *A diesel engine draws into its cylinder air alone, and it compresses this air on its…*

*3. Diesel engines use ……………… than gasoline engines*

1. *Therefore, diesel engines use compression ratios of about…*

Four-Stroke Engine and Two-Stroke Engine

(DISEGN OF INTERNAL-COMBUSTION ENGINES)

The majority of present-day **internal-combustion engines** operate on the **four-cycle principle.** According to the processes occurring in the **cylinder**, each of the four strokes is named as follows:

**1 stroke – admission**

**2 stroke – compression**

**3 stroke – power stroke**

**4 strokes- - exhaust**

**Admission Stroke**. The **intake valve** is open, the **piston**moves from **TDC to BDC.** A **rarefaction**is built up in the cylinder end above the piston which in different engines. In view of the difference in **pressure in the cylinder** and **carburetor,** the **combustion mixture** flows from the carburetor into the cylinder.

***Compression Stroke***. At the end of the **admission stroke** **both valves** are shut off. As the **crankshaft** continues to rotate it drives the piston from BDC to TDC. The temperature of the mixture at the end of the compression stroke reaches about 300c.

***Power Stroke*.**At the end of the upward stroke of the piston the compressed mixture **is ignited by an electric spark.** Both valves are closed

***Exhaust Stroke***. The exhaust valve is open, the piston moves from BDC to TDC and ejects the **used gases** from the cylinder. At the end of the exhaust stroke, the temperature of the gases drops to 700-800c.

In **a two – stroke engine** all the **four processes comprising the working**

**cycle** are completed during two stroke of the piston, during one revolution of the crankshaft. This offers the following advantages:

1 with the **same basic dimensions**, **a two – stroke engine**should develop theoretically **twice the power** of a four – stroke engine

2 the engine **operates** more **smoothly** since the power strokes **occur twice as frequently.**

1. **Переведите слова и словосочетания на русский язык:**

*internal-combustion engines, four-cycle principle, cylinder, admission Stroke, intake valve, pressure in the cylinder, combustion mixture, Compression Stroke, Power Stroke, Exhaust Stroke, a two – stroke engine, smoothly.*

2. **Распределите правильно и переведите:**

1 stroke – power stroke

2 stroke – admission

3 stroke- - exhaust

4 stroke – compression

3. **Закончите предложения, выбрав их из текста**

* 1. *The majority of present-day internal-combustion engines operate on the…*
	2. *The intake valve is open, the piston moves from…*
	3. *As the crankshaft continues to rotate it drives the piston…*
	4. *At the end of the exhaust stroke, the temperature of the gases…*
	5. *In a two – stroke engine all the four processes comprising the working cycle are completed during two stroke of the piston*…

Fuel System

**The fuel System** is designed **to store liquid gasoline** and to deliver it to the **engine cylinders** on the intake **stroke**in the form of **vapor mixed** with air. The fuel system must vary the proportions of air and **gasoline vapor** to meet the requirements of the various operating conditions. Thus for **initial starting** with a cold **engine** a very rich mixture of about 9 pounds of air to 1 pound of gasoline is needed. After the engine has warmed up, it will run satisfactorily on a leaner mixture of about 15 pounds of air for each pound of gasoline. For **ensuring acceleration** and full **load** or high **speed operation**, the mixture must again **be enriched**.

The fuel system consist of a tank in which **the liquid gasoline is stored**, a fuel line, or **tube,** through which the gasoline can be brought from the tank to the engine, **a pump**, which **pulls the gasoline** through the fuel line, and a carburetor, which mixes the gasoline with air. **The carburetor is designed** to mix each pound of gasoline with 9 to 15 pounds of air under various operating conditions. The richer mixtures of about 9 pound of air per pound of gasoline are for starting, **initial** warm-up, and acceleration, while the **leaner**mixtures of about 15 pounds of air per pound of gasoline are for normal over-the road operation.

1. **Переведите на русский язык следующие слова и словосочетания:**

*The fuel System, store liquid gasoline, engine cylinders, vapor mixed, initial starting, acceleration, or tube, pulls the gasoline, the carburetor is designed*

1. **Переведите текст**
2. **Переведите на русский язык встречающие в тексте интернациональные слова:**

*Design system, carburetor, normal.*

4. **Закончите предложения, выбрав их из текста**

1. *The fuel System is designed…*
2. *After the engine has warmed up, it will run satisfactorily on a leaner mixture of about...*
3. *The fuel system consists of a tank in which…*
4. *The carburetor is designed to mix each pound of gasoline*

Cooling system

Then an **internal-combustion engine** operates, the parts coming in contact with hot gases are strongly heated. If the temperature of **the pistons**, cylinder heads, valves and cylinders becomes too high, **undesirable effects** appear such as **deterioration of cylinder filling, power reduction ignition of fuel.** Very often the oil **burns out**and loses **its lubricating properties.**

If the engine is excessively cooled, the **portion** of heat that goes for useful work **diminishes and the power of the engine drops.**

The cooling system consists of the aggregate of all the devices **ensuring** the required thermal duty of the engine.

A water cooling system operates in the following manner: the water present between the cylinder walls and the cylinder heads cools **the heated inner walls** and become heated itself in the process. It often flows to **the radiator**, where it is cooled down by air. The cooled water is again **redirected** to the engine water **jacket.**

Forced cooling, when the water is circulated by a pump, is most common in modern engines. Cooling systems may be open or closed. In the first case, the volume of the system is not closed **tightly**. In the second case **the plug**of the cooler is provided with **a two-way steam-air valve,** which is opened by an excess **pressure** of steam in the system and also when the pressure in **the cooler drops** below atmospheric by 0.05-0.02 kg/cm2.

To enable the engine to operate normally, the temperature of the cooling water should be maintained at 80-90 irrespective of the load and the temperature of the environment. For this purpose and also to speed up the warming of the engine in starting, provision is made for **adjusting** the cooling rate which can be varied by changing the volume of the air stream passing through the cooler and also by changing the rate of water **circulation.**

In addition to water cooling, modern international-combustion engines, especially **low-power types,** often air-cool **the ribbed** cylinder surfaces with the aid of **fans.**

1. **Переведите на русский язык следующие слова и словосочетания**

*internal-combustion engine, the pistons, undesirable effects, lubricating properties, diminishes and the power of the engine drops, ensuring, the heated inner walls, the plug, a two-way steam-air valve, the cooler drops, circulation,*

*low-power types,* *cooling system.*

2. **Переведите следующий абзац**

***To enable the engine to operate normally, the temperature of the cooling water should be maintained at 80-90 irrespective of the load and the temperature of the environment. For this purpose and also to speed up the warming of the engine in starting, provision is made for adjusting the cooling rate which can be varied by changing the volume of the air stream passing through the cooler and also by changing the rate of water circulation.***

3. **Закончите предложения, выбрав их из текста**

1) *The cooling system consists of the aggregate of all the devices…*

*2) Cooling systems may be open or closed. In the first case, the volume of the system is…*

*3) Cooling systems may be open or closed. In the first case, the volume of the system is…*

*4) To enable the engine to operate normally, the temperature of the cooling water should be…*

*5) In addition to water cooling, modern international-combustion engines, especially…*

Lubricating System

**Lubricants**may **be supplied** to **rubbing surfaces by splashing, by gravity or under pressure.**Modern engines generally have **lubrication systems** in which all the three methods are **simultaneously**employed.

The lubrication systems of various engines and how they work differ but little at present. Pressure is used to lubricate main and **crankpin bearings of crankshafts**, **piston pins, crankshaft bushes, timing gears and valve rocker** arms. The rest of the parts are splash lubricated.

**Gear oil pump** delivers oil through **channel and oil line to coarse-mesh filter.** After passing through the coarse-mesh filter the oil passes under the cap **of fine-mesh filter**. With the engine warmed up, the oil flows farther along oil line to oil cooler **mounted** in front of the water cooler. The cooled oil returns to the filter unit and then to central main.

**Oil pumps** employed in engines can **be subdivided** into three types – **gear, rotary and plunger.** Gear pumps are the simplest and most **reliable in operation** and are therefore the most **widespread.** They are mounted on all modern Soviet engines.

**Filters remove** the products of wear**, particles of carbon, resin and dust and other mechanical impurities from the lubricant.** Three types of filters – **gauze, coarse-mesh and fine-mesh – are installed in modern engines.**

**Oil coolers** are used in many automotive engines. They are mounted outside as a rule, near the water cooler, and serviced by **a common fan.** In this case the **design**of the oil and water coolers is almost **identical.**

**Control instruments indicate the condition of oil in the system.**

* 1. **Переведите слова и словосочетания на русский язык:**

*Lubricants, splashing, gravity, pressure, lubrication systems, piston pins, timing gears, valve rocker, Gear oil pump, coarse-mesh filter, plunger, widespread, fine-mesh, carbon, condition*

2. **Закончите предложения, выбрав их из текста**

1. *Modern engines generally have ….*
2. *Gear oil pump delivers oil through channel and oil line to…*
3. *Oil pumps employed in engines can be subdivided into three types…*
4. *Oil coolers are used in…*

Transmission

GENERAL-PURPOSE MECHANISM

A large number **of machines** differing in purpose, principle and design are provided with mechanisms which perform similar **functions**. Among such mechanisms are **transmissions,** which are combinations of parts for **conveying energy**from the prime mover to the operating members. Transmissions can be classified as follows:

a) by the **mode** of energy transmission**: mechanical, electric, hydraulic, pneumatic and combination types**

b) by the mode of **energy distribution**: to one, two or several operating members

c) by operating conditions: **continuous or intermittent**

In electric, hydraulic or pneumatic transmissions the mechanical energy **obtained**from the **prime mover** should be **converted** by a generator unit into the kind of energy employed in the given transmission.

**Direct current** for the mechanism servicing engines is produced by a generator unit consisting of an electric current generator **rotated** by a diesel or by an a-c **electric motor powered** from the mains.

Direct current gives much better possibilities for **adjusting** the speed and changing the **torque**of the engine when the machine operates **under variable load.**

1. **Переведите слова и словосочетания на русский язык:**

*Functions, transmissions, mechanical, electric, hydraulic, pneumatic and combination types, energy distribution, continuous or intermittent, prime mover, rotated, adjusting, torque, under variable load.*

2. **Закончите предложения, выбрав их из текста**

1. *Among such mechanisms are…*
2. *By the mode of energy transmission…*
3. *In electric, hydraulic or pneumatic transmissions the mechanical energy obtained from the…*
4. *Direct current gives much better possibilities for adjusting the speed and changing the torque…*

3. **Переведите на русский язык встречающие в тексте интернациональные слова:**

*Mechanism, transmissions, classified, mechanical, electric, hydraulic, pneumatic and combination types, energy, a generator, diesel*,

1. **Заполните таблицу**

**Number**

**Classify**

**1**

**2**

**Словарь технических терминов**

**A**

Appearance - появление

Advertisement - объявление

Abolition - отмена

Automobile industry – автомобильная промышленность

Advantage - преимущество

Adjustment – порядок

Acceleration - акселерация

Available – имеющий в распоряжении

Admission stroke – доступ такта

**B**

Battery - батарея

Body - кузов

Braking systems – тормозная система

Burns out – выгорать, сжигать

**C**

Collect antique cars –коллекционировать антикварные машины

Construct - конструировать

Clutches - сцепление

Carburetor engines –коорбюраторный двигатель

Compression - компрессия

Cooling system – система охлаждения

Cooler drops – холодная капля

Circulation - циркуляция

Crankshaft – коленчатый вал двигателя

Cardan - кардан

Control - контроль

Corrosion -коррозия

Comfortable - удобный

Conveniences - удобства

Connect - связывать

Cableway –канатная дорога

Combustion mixture –горючая смесь

Channel -канал

Carbon - карбон

Condition – условия, состояние

Conveying energy – передавать энергию

Combination types –комбинированный тип

Convert – конвертировать, преображать

**D**

Determine - определять

Diesel engine –дизельный двигатель

Design - дизайн

Distributor - распределитель

Differential - дифференциал

Dependable brakes – устойчивые тормоза

Dimension - величина

Distribution - распределение

**E**

Escort - сопровождать

Efficient -эффективный

Engine - двигатель

Endure high overloads – тяжёлая загрузка

Ensuring - обеспечение

Enrich - обогащать

Exhaust stroke – выхлопная труба

Electric - электрический

Effort - усилие

Energy - энергия

**F**

Four-cylinder engines – четырёх цилиндровый двигатель

Fuel economy – экономия топлива

Fuel pump – топливная помпа

Fuel System – топливная система

Fan - вентилятор

Frequently -частотность

Formation - формация

Functions -функции

**G**

Gasoline engines –газовый двигатель

Gas turbine – газовая турбина

Gear box – коробка передач

Gasoline vapor - выхлоп

General - общий

Gravity -гравитация

Gear oil pump –топливный насос

Generator - генератор

**H**

Highest load –самая высокая загрузка

Heated inner walls – отопление стен

Heater -отопление

Hydraulic - гидравлический

Horse-driven buses – лошадиные силы автобуса

**I**

Issue -выпуск

Introduce -представлять

Internal-Combustion engines – двигатель внутреннего сгорания

Initial starting –начальный запуск

Invention - изобретение

Instrument – инструменты

Indicate -указывать

Intermittent -

Inject – инжектор

**J**

Jacket - чехол

**K**

Kinetic energy – кинетическая энергия

**L**

Lubricating property – смазочные устройства

Liquid -жидкость

Lubricating systems – система смазки

Laboratory tests – лабораторные тесты

Long service life – долгий срок службы

Lorry -грузовик

**M**

Mode formation – метод формации

Manufacturing cars –производство автомобилей

Mass production – массовое производство

Method - метод

Material - материал

Motor cycles -цикл

Multi-cylinder engines

Motor car - автомобиль

Mixture -смешивание

**N**

Normal - нормальный

**O**

Outlawed -

Operation - операция

Omnibuses - омнибус

Oil - масло

Obtain - получать

Offer - предлагать

Optimal solutions – оптимальное решение

**P**

Process - процесс

Prevent -предотвращать

Portion –доля, порция

Plug – вилка, вставлять

Pressure -давление

Pulls the gasoline – спускать бензин

Pump - помпа

Power train – силовая передача

Power plants – силовая установка

Propeller - пропеллер

Pushes down - нажимать

Put into mass production – запустить в массовое производство

Pipe-line - трубопровод

Petrol engines –бензинный двигатель

Power stroke – рабочий ход поршня

Piston –поршень

**Q**

Quality – качество

**R**

Range - ряд

Reduction - снижение

Redirect - переворот

Road tests – дорожные тесты

Requirement - требование

Rigid quality control –качественный контроль

Rapid in acceleration – ускорение

Reliable -надёжный

Rotate - вращать

**S**

Steam engine – паровой двигатель

Speed - скорость

Seat - место

System - система

Source of current – источник

Suction stroke – секция хода

Safety - безопасность

Splash -брызги

Speedometer - спидометр

Steering system – рулевая система

Stroke engine –ход двигателя

Simultaneously - симуляция

Subdivided - разделено

**T**

Torque – крутящий момент

Thermodynamic – термодинамик

Turbine - турбина

Transport - транспорт

Trams - трамвай

Trolleybuses - троллейбус

Timing gears – легкая передача

Transmission - трансмиссия

**U**

Use - использовать

**V**

Vehicle – транспортное средство

Valve - клапан

**W**

Wheels -колесо

Weight - вес

Water supply – поставка воды

Way - путь

Widespread –широко распространенный

**Z**

Zone –зона

**Extra Reading**

**AUTOMATED MANUAL TRANSMISSION**

Automated Manual Transmission (AMT, also called Freechoice) from Magneti Marelli is a electro-hydraulic mechanism for automating manual transmission which derives from Formula 1. It combines comfort of use with a reduction in consumption, and can be applied to any transmission, with production costs that are consequently lower compared to traditional automatic transmissions.

 AMT is based on an electronic control unit and a hydraulic system that supervise the use of the clutch and the gear shifting, allowing the driver to change gear without using the clutch, either sequentially or fully automatically.

 The device from Magneti Marelli operates on the manual transmission of a car in the same way as the driver would: it opens and closes the clutch, engages and disengages the gears and, when necessary, it also controls the choice of transmission (automatic or sequential mode for changing gear). These three control movements are ensured by three specific hydraulic actuators, controlled by hydraulic electro-valves.

 All the components in the hydraulic unit are gathered together in a single kit. It is delivered to the car manufacturer sealed and ready to be installed in the gearbox. Once assembled in the gearbox, the hydraulic kit mechanically interfaces with the gear drive shaft.

 The heart and intelligence of the gear control system is the TCU (Transmission Control Unit). Taking into account the driver’s requirements and the operating conditions of the vehicle, it manages the gear changes by controlling the clutch, the gears and the engine.

 Thanks to the electronic optimization of the gear change and the coupling with the engine control means the AMT is able to ensure less consumption than a car with manual transmission: lower consumption also means lower emissions, especially of CO2. In some of the best applications of the AMT on mass-production automobiles, a 5% reduction in fuel consumption was recorded compared to the automatic transmission version of the same automobiles, as well as a reduction in emissions equal to 5 g/km of CO2.

 The latest generation of AMT is known as “mechatronic”, as for the first time, it combines the electronic control part and the hydraulic actuation part of the transmission in a single kit. This allows considerable improvements to performance, both in terms of speed and comfort when changing gear. This is the latest step in the evolution of a product which was first introduced to the car market with the Ferrari 355 F1 in July 1997. The product is still undergoing “sharp” growth in performance.

**CONSTRUCTION OF AN AUTOMOBILE**

The primary components of a**car** are the power plant, the power transmission, the running gear, and the control system. These constitute the chassis, on which the body is mounted.

The power plant includes the engine and its fuel, the carburettor, ignition, lubrication, and cooling systems, and the starter motor.

*The Engine*

The greatest number of cars use piston engines. The four-cycle piston engine requires four strokes of the piston per cycle. The first downstroke draws in the petrol mixture. The first upstroke compresses it. The second downstroke—the power stroke—following the combustion of the fuel, supplies the power, and the second upstroke evacuates the burned gases. Intake and exhaust valves in the cylinder control the intake of fuel and the release of burned gases. At the end of the power stroke the pressure of the burned gases in the cylinder is 2.8 to 3.5 kg/sq cm. These gases escape with the sudden opening of the exhaust valve. They rush to a silencer (muffler), an enlarged section of piping containing expanding ducts and perforated plates through which the gases expand and are released into the atmosphere.

Greater smoothness of operation of the four-cycle engine were provided by the development of the four-cylinder engine, which supplies power from one or another of the cylinders on each stroke of the cycle. A further increase in power and smoothness is obtained in engines of 6,8,12, and 16 cylinders, which are arranged in either a straight line or two banks assembled in the form of a V.

*Carburation*

Air is mixed with the vapour of the petrol in the carburettor. To prevent the air and the carburettor from becoming too cold for successful evaporation of the fuel, the air for the carburettor is usually taken from a point close to a heated part of the engine. Modern carburettors are fitted with a so-called float-feed chamber and a mixing or spraying chamber. The first is a small chamber in which a small supply of petrol is maintained at a constant level. The petrol is pumped from the main tank to this chamber, the float rising as the petrol flows in until the desired level is reached, when the inlet closes. The carburettor is equipped with such devices as accelerating pumps and economizer valves, which automatically control the mixture ratio for efficient operation under varying conditions. Level-road driving at constant speed requires a lower ratio of petrol to air than that needed for climbing hills, for acceleration, or for starting the engine in cold weather. When a mixture extremely rich in petrol is necessary, a valve known as the choke cuts down the air intake, permitting large quantities of unvaporized fuel to enter the cylinder.

*Ignition*

The mixture of air and petrol vapour delivered to the cylinder from the carburettor is compressed by the first upstroke of the piston. This heats the gas, and the higher temperature and pressure facilitate ignition and quick combustion. The next operation is that of igniting the charge by a spark plug. One electrode is insulated by porcelain or mica; the other is grounded through the metal of the plug, and both form part of the secondary circuit of an induction system.

The principal type of ignition now commonly used is the battery-and-coil system. The current from the battery flows through the coil and magnetizes the iron core. When this circuit is interrupted at the distributor points by the interrupter cam, a current is produced in the primary coil with the assistance of the condenser. This induces a high-voltage current in the secondary winding. This secondary high voltage is needed to cause the spark to jump the gap in the spark plug. The spark is directed to the proper cylinder by the distributor, which connects the secondary coil to the spark plugs in the several cylinders in their proper firing sequence. The interrupter cam and distributor are driven from the same shaft, the number of breaking points on the interrupter cam being the same as the number of cylinders.

The electrical equipment controls the starting of the engine, its ignition system, and the lighting of the car. It consists of the battery, a generator for charging it when the engine is running, a starter and the necessary wiring. Electricity also operates various automatic devices and accessories, including windscreen wipers, directional signals, heating and air conditioning, cigarette lighters, powered windows and audio equipment.

*Lubrication*

In the force-feed system, a pump forces the oil to the main crankshaft bearings and then through drilled holes in the crankpins. In the full-force system, oil is also forced to the connecting rod and then out to the walls of the cylinder at the piston pin.

*Cooling*

At the moment of explosion, the temperature within the cylinder is much higher than the melting point of cast iron. Since the explosions take place as often as 2,000 times per minute in each cylinder, the cylinder would soon become so hot that the piston, through expansion, would «freeze» in the cylinder. The cylinders are therefore provided with jackets, through which water is rapidly circulated by a small pump driven by a gear on the crankshaft or camshaft. During cold weather, the water is generally mixed with a suitable antifreeze, such as alcohol, wood alcohol, or ethylene glycol.

To keep the water from boiling away, a radiator forms part of the engine-cooling system. Radiators vary in shape and style. They all have the same function, however, of allowing the water to pass through tubing with a large area, the outer surface of which can be cooled by the atmosphere. In air cooling of engine cylinders, various means are used to give the heat an outlet and carry it off by a forced draught of air.

*The Starter*

The petrol engine must usually be set in motion before an explosion can take place and power can be developed; moreover, it cannot develop much power at low speeds. These difficulties have been overcome by the use of gears and clutches, which permit the engine to work at a speed higher than that of the wheels, and to work when the vehicle is at rest. An electric starter receiving its current from the storage battery, turns the crankshaft, thus starting the petrol engine. The starter motor is of a special type that operates under a heavy overload, producing high power for very short periods. In modern cars, the starter motor is automatically actuated when the ignition switch is turned on.

*The Power Transmission*

The engine power is delivered first to the flywheel and then to the clutch. From the clutch, which is the means of coupling the engine with the power-transmission units, the power flows through the transmission and is delivered into the rear-axle drive gears, or differential, by means of the drive shaft and universal joints. The differential delivers the power to each of the rear wheels through the rear-axle drive shafts.

*The Clutch*

Some type of clutch is found in every car. The clutch may be operated by means of a foot pedal, or it may be automatic or semi-automatic. The friction clutch and the fluid coupling are the two basic varieties. The friction clutch, which depends on solid contact between engine and transmission, consists of: the rear face of the flywheel; the driving plate, mounted to rotate with the flywheel; and the driven plate, between the other two. When the clutch is engaged, the driving plate presses the driven plate against the rear face of the flywheel. Engine power is then delivered through the contacting surfaces to the transmission.

Fluid coupling may be used either with or without the friction clutch. When it is the sole means of engaging the engine to the transmission, power is delivered exclusively through an oil medium without any contact of solid parts. In this type, known as a fluid drive, an engine-driven, fan-bladed disc, known as the fluid flywheel, agitates the oil with sufficient force to rotate a second disc that is connected to the transmission. As the rotation of the second disc directly depends on the amount of engine power delivered, the prime result of fluid coupling is an automatic clutch action, which greatly simplifies the requirements for gear shifting.

*Manual and Automatic Transmissions*

The transmission is a mechanism that changes speed and power ratios between the engine and the driving wheels. Three general types of transmission are in current use: conventional or sliding-gear, Hydra-Matic, and torque-converter systems.

The conventional transmission provides for three or four forward speeds and one reverse speed. It consists of two shafts, each with gears of varying diameters. One shaft drives the other at a preselected speed by meshing the appropriate set of gears. For reverse speed/an extra gear, known as the idler gear, is required to turn the driven shaft in the opposite direction from normal rotation. In high gear, the two shafts usually turn at the same speed. In low, second, and reverse gears, the driven shaft turns more slowly than the driving shaft. When a pair of gears permits the driven shaft to turn more rapidly than the driving shaft, the transmission is said to have overdrive. Overdrive is designed to increase the speed of a car.

The Hydra-Matic type of transmission combines the automatic clutch provided by fluid coupling with a semiautomatic transmission. A mechanical governor, controlled by the pressure exerted on the accelerator pedal, regulates gear selection through a system of hydraulically controlled shift valves. Hydra-Matic transmission provides for several forward gears.

The torque-converter type of transmission provides an unlimited number of gear ratios with no shifting of gears. The torque converter is a hydraulic mechanism using engine power to drive a pump, which impels streams of oil against the blades of a turbine. The turbine is connected to the drive shaft and causes it to rotate.

Both Hydra-Matic and torque-converter systems are controlled by a selector lever on the steering column, which provides also for reverse and sometimes for emergency-low gears.

*The Running Gear*

The running gear of the car includes the wheel-suspension system, the stabilizers, and the wheels and tyres. The frame of the car may be considered the integrating member of the running gear. It is attached to the rear axle and to the front wheels by springs. These springs, along with the axles, the control and support arms, and the shock absorbers, constitute the wheel-suspension system. In modern cars the front wheels are independently suspended from the frame in a manner that permits either wheel to change its plane without appreciably affecting the other. This type of front-wheel suspension is known popularly as independent suspension. The stabilizers consist of spring-steel bars, connected between the shock-absorber arms by levers, to decrease body roll and improve steerability.

*The Control System*

Steering is controlled by a hand wheel, mounted on an inclined column and attached to a steering tube inside the column. The other end of the tube is connected to the steering gear, which is designed to provide maximum ease of operation. Power steering, adapted for passenger cars in the early 1950s, is generally a hydraulic mechanism used as a booster to reduce the effort of steering.

A car has two sets of brakes: the hand or emergency brake and the foot brake. The emergency brake generally operates on the rear wheels only. The foot brake in modern cars is always of the four-wheel type, operating on all wheels. Hydraulic brakes on cars and hydraulic vacuum, air, or power brakes on lorries apply the braking force to the wheels with much less force on the brake pedal than is required with ordinary mechanical brakes. The wheel brakes are generally of the internally expanding type, in which a convex strip of material is forced against a concave steel brake drum.

**TWO-STROKE AND DIESEL ENGINES**

Most diesels are also four-stroke engines. The first or suction stroke draws air, but no fuel, into the combustion chamber through an intake valve. On the second or compression stroke the air is compressed to a small fraction of its former volume and is heated to approximately 440°C by this compression. At the end of the compression stroke vaporised fuel is injected into the combustion chamber and burns instantly because of the high temperature of the air in the chamber. Some diesels have auxiliary electrical ignition systems to ignite the fuel when the engine starts and until it warms up. This combustion drives the piston back on the third or power stroke of the cycle. The fourth stroke is an exhaust stroke.

The efficiency of the diesel engine is greater than that of any petrol engine and in actual engines today is slightly over 40 per cent. Diesels are in general slow-speed engines with crankshaft speeds of 100 to 750 revolutions per minute (rpm) as compared to 2,500 to 5,000 rpm for typical petrol engines. Some types of diesel, however, have speeds up to 2,000 rpm. Because diesels use compression ratios of 14 or more, they are generally more heavily built than petrol engines, but this disadvantage is counterbalanced by their greater efficiency and the fact that they can be operated on less expensive fuel.

*Two-Stroke Engines*

By suitable design it is possible to operate a diesel as a two-stroke or two-cycle engine with a power stroke every other stroke of the piston instead of once every four strokes. The efficiency of such engines is less than that of four-stroke engines, and therefore the power of a two-stroke engine is always less then half that of a four-stroke engine of comparable size.

The general principle of the two-stroke engine is to shorten the periods in which fuel is introduced to the combustion chamber and in which the spent gases are exhausted to a small fraction of the duration of a stroke instead of allowing each of these operations to occupy a full stroke.

In the simplest type of two-stroke engine, the valves are the openings in the cylinder wall that are uncovered by the piston at the end of its outward travel. In the two-stroke cycle the fuel mixture or air is introduced through the intake port when the piston is fully withdrawn from the cylinder. The compression stroke follows and the charge is ignited when the piston reaches the end of this stroke. The piston then moves outward on the power stroke, uncovering the exhaust port and permitting the gases to escape from the combustion chamber.

**DIRECT-CURRENT (DC) GENERATORS**

If an armature revolves between two stationary field poles, the current in the armature moves in one direction during half of each revolution and in the other direction during the other half. To produce a steady flow of unidirectional, or direct, current from such a device, it is necessary to provide a means of reversing the current flow outside the generator once during each revolution. In older machines this reversal is accomplished by means of a commutator (коллектор) — a split metal ring mounted on the shaft of the armature. The two halves of the ring are insulated from each other and serve as the terminals of the armature coil. Fixed brushes of metal or carbon are held against the commutator as it revolves, connecting the coil electrically to external wires. As the armature turns, each brush is in contact alternately with the halves of the commutator, changing position at the moment when the current in the armature coil reverses its direction. Thus there is a flow of unidirectional current in the outside circuit to which the generator is connected. DC generators are usually operated at fairly low voltages to avoid the sparking between brushes and commutator that occurs at high voltage. The highest potential commonly developed by such generators is 1500 V. In some newer machines this reversal is accomplished using power electronic devices, for example, diode rectifiers.

Modern DC generators use drum armatures that usually consist of a large number of windings set in longitudinal slits in the armature core and connected to appropriate segments of a multiple commutator. In an armature having only one loop of wire, the current produced will rise and fall depending on the part of the magnetic field through which the loop is moving. A commutator of many segments used with a drum armature always connects the external circuit to one loop of wire moving through the high-intensity area of the field, and as a result the current delivered by the armature windings is virtually constant. Fields of modern generators are usually equipped with four or more electromagnetic poles to increase the size and strength of the magnetic field. Sometimes smaller interpoles are added to compensate for distortions in the magnetic flux of the field caused by the magnetic effect of the armature.

DC generators are commonly classified according to the method used to provide field current for energizing the field magnets. A series-wound generator has its field in series with the armature, and a shunt-wound generator has the field connected in parallel with the armature. Compound-wound generators have part of their fields in series and part in parallel. Both shunt-wound and compound-wound generators have the advantage of delivering comparatively constant voltage under varying electrical loads. The series-wound generator is used principally to supply a constant current at variable voltage. A magneto is a small DC generator with a permanent-magnet field.

**AC MOTORS**

Two basic types of motors are designed to operate on alternating current: synchronous motors and induction motors. The synchronous motor is essentially a three-phase alternator operated in reverse. The field magnets are mounted on the rotor and are excited by direct current, and the armature winding is divided into three parts and fed with three-phase alternating current. The variation of the three waves of current in the armature causes a varying magnetic reaction with the poles of the field magnets, and makes the field rotate at a constant speed that is determined by the frequency of the current in the AC power line.

The constant speed of a synchronous motor is advantageous in certain devices. However, in applications where the mechanical load on the motor becomes very great, synchronous motors cannot be used, because if the motor slows down under load it will «fall out of step» with the frequency of the current and come to a stop. Synchronous motors can be made to operate from a single-phase power source by the inclusion of suitable circuit elements that cause a rotating magnetic field.

The simplest of all electric motors is the squirrel-cage type of induction motor used with a three-phase supply. The armature of the squirrel-cage motor consists of three fixed coils similar to the armature of the synchronous motor. The rotating member consists of a core in which are imbedded a series of heavy conductors arranged in a circle around the shaft and parallel to it. With the core removed, the rotor conductors resemble in form the cylindrical cages once used to exercise pet squirrels. The three-phase current flowing in the stationary armature windings generates a rotating magnetic field, and this field induces a current in the conductors of the cage. The magnetic reaction between the rotating field and the current-carrying conductors of the rotor makes the rotor turn. If the rotor is revolving at exactly the same speed as the magnetic field no currents will be induced in it, and hence the rotor should not turn at a synchronous speed. In operation the speeds of rotation of the rotor and the field differ by about 2 to 5 per cent. This speed difference is known as slip.

Motors with squirrel-cage rotors can be used on single-phase alternating current by means of various arrangements of inductance and capacitance that alter the characteristics of the single-phase voltage and make it resemble a two-phase voltage. Such motors are called split-phase motors or condenser motors (or capacitor motors), depending on the arrangement used. Single-phase squirrel-cage motors do not have a large starting torque, and for applications where such torque is required, repulsion-induction motors are used. A repulsion-induction motor may be of the split-phase or condenser type, but has a manual or automatic switch that allows current to flow between brushes on the commutator when the motor is starting, and short-circuits all commutator segments after the motor reaches a critical speed. Repulsion-induction motors are so named because their starting torque depends on the repulsion between the rotor and the stator, and their torque while running depends on induction. Series-wound motors with commutators, which will operate on direct or alternating current, are called universal motors. They are usually made only in small sizes and are commonly used in household appliances.

**VOCABULARY**

**accident/ crash**авария

**accident report** протокол дорожного происшествия

**air conditioning** кондиционер

**auto mechanic** автомеханик

**auto mechanic shop**станция техобслуживания

**back door**задняя дверь

**be licensed to drive**иметь водительские права

**bearing** подшипник

**bend** крутой поворот

**block/ hold-up in the traffic**задержка в движении

**bottle-neck in the traffic** сужение дороги

**brake** тормоз

**brake fluid**тормозная жидкость

**break down** сломаться

**break in the traffic**перерыв в движении

**car accident** дорожное происшествие

**chain lock** цепочка на двери

**checkbook** чековая книжка

**car registration**регистрация автомобиля

**change gears** переключать передачу скоростей

**check the oil** проверить масло

**collide (with)** столкнуться

**comply with the traffic rules**соблюдать правила дорожного движения

**cost of repair** стоимость ремонта

**crossroad** перекрёсток

**damage a car** повредить автомобиль

**dashboard** приборная доска

**direct the traffic**направить движение

**driver’s license**водительские права

**driving regulations**правила вождения автомашины

**driving violation** нарушение правил вождения

**engine** двигатель

**enter (merge into) highway** въезжать на шоссе

**exceed the speed limit** превышать скорость

**exit the highway** съезжать с шоссе

**fender** бампер

**fill out an accident report**заполнять протокол дорожного происшествия

**flat tire** спущенное колесо

**foot brake** ножной тормоз

**fork** разветвление

**freeway, expressway** автострада

**front door** передняя дверь

**gain on** нагонять, догонять

**garage** гараж

**gear** передача скоростей

**gearshift**рычаг передачи скоростей

**get a flat tire**проколоть шину

**get stuck** застрять

**hand brake**ручной тормоз

**have the car repaired**ремонтировать автомобиль

**headlights** передний свет

**heavy traffic**большое движение

**highway** шоссе

**hold up traffic**задерживать движение

**hood** капот

**horn** гудок

**identification papers, I.D**. удостоверение личности

**ignition system** зажигание

**insurance company**страховая компания

**international Driver’s License** международное водительское удостоверение

**intersection** т-образный перекрёсток

**jam in the traffic**транспортная пробка

**key** ключ

**keep to the right**держаться правой стороны

**knock down** сбить

**left-sided traffic**левостороннее движение

**level of alcohol in blood**уровень алкоголя в крови

**license plate**номерной знак

**lights** фары

**light traffic**мало транспорта

**lock** замок

**lock the door** запирать дверь на замок

**Lost and Found**бюро находок

**main road** главная дорога

**make a U-turn**развернуться

**mileage** километраж

**offense**правонарушение

**oil** масло

**one-way traffic**одностороннее движение

**overtake, pass** обгонять; обгон

**overtake / to overhaul/ to outstrip a car**обгонять машину

**park a car** ставить машину на стоянку

**parking** стоянка

**parking lights**габаритные огни

**parking ticket** извещение об уплате штрафа

**peephole** глазок в двери

**police officer**полицейский

**police station**полицейский участок

**purse, handbag, pocketbook** кошелёк

**put air in the tire** накачать шины

**rearview mirror** зеркало заднего вида

**repair**ремонт

**report an accident** сообщать о дорожном происшествии

**rest stop, emergency parking** стоянка на обочине

**road** дорога

**road accident**дорожное происшествие

**roadside** обочина дороги

**run into/over** наехать

**seat belt** ремень безопасности

**secondary road** второстепенная дорога

**service road** дорога-“дублёр”

**service station**авторемонтная мастерская

**side road** второстепенная дорога

**slow down** замедлить движение

**shoulder, side of the road** асфальтовая обочина дороги

**spark plugs** свечи

**speed** скорость

**speed limit**предельная скорость

**steering** рулевое управление

**steering wheel**руль

**step on the brake** затормозить

**tail lights**задний свет

**take a driving test**держать экзамен на права

**tire**шина

**traffic circle**круговое движение

**traffic is blocked up/ jammed** движение заблокировано

**traffic is heavy/ congested** движение интенсивное

**traffic jam, hold-up, tie-up** дорожная пробка

**traffic lights**светофор

**traffic safety** дорожная безопасность

**traffic signs, road signs**дорожные знаки

**turn off the engine** выключить двигатель

**turn on headlights** включить передние фары

**turn signal, “blinkers”**сигнал поворота

**turning** поворот

**two-way traffic**двустороннее движение

**violate the traffic rules**нарушать правила

**wheel**колесо

**windshield** ветровое стекло

**wipers** «дворники