МИНИСТЕРСТВО ОБРАЗОВАНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ

УЧРЕЖДЕНИЕ ОБРАЗОВАНИЯ
«БРЕСТСКИЙ ГОСУДАРСТВЕННЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ»

КАФЕДРА ИНОСТРАННЫХ ЯЗЫКОВ

«Технический перевод (английский язык)» сборник текстов

для самостоятельной аудиторной работы студентов специальностей
1-37 01 06 Техническая эксплуатация автомобилей
1-37 01 07 Автосервис

Брест 2021

УДК 811.111(075.4)

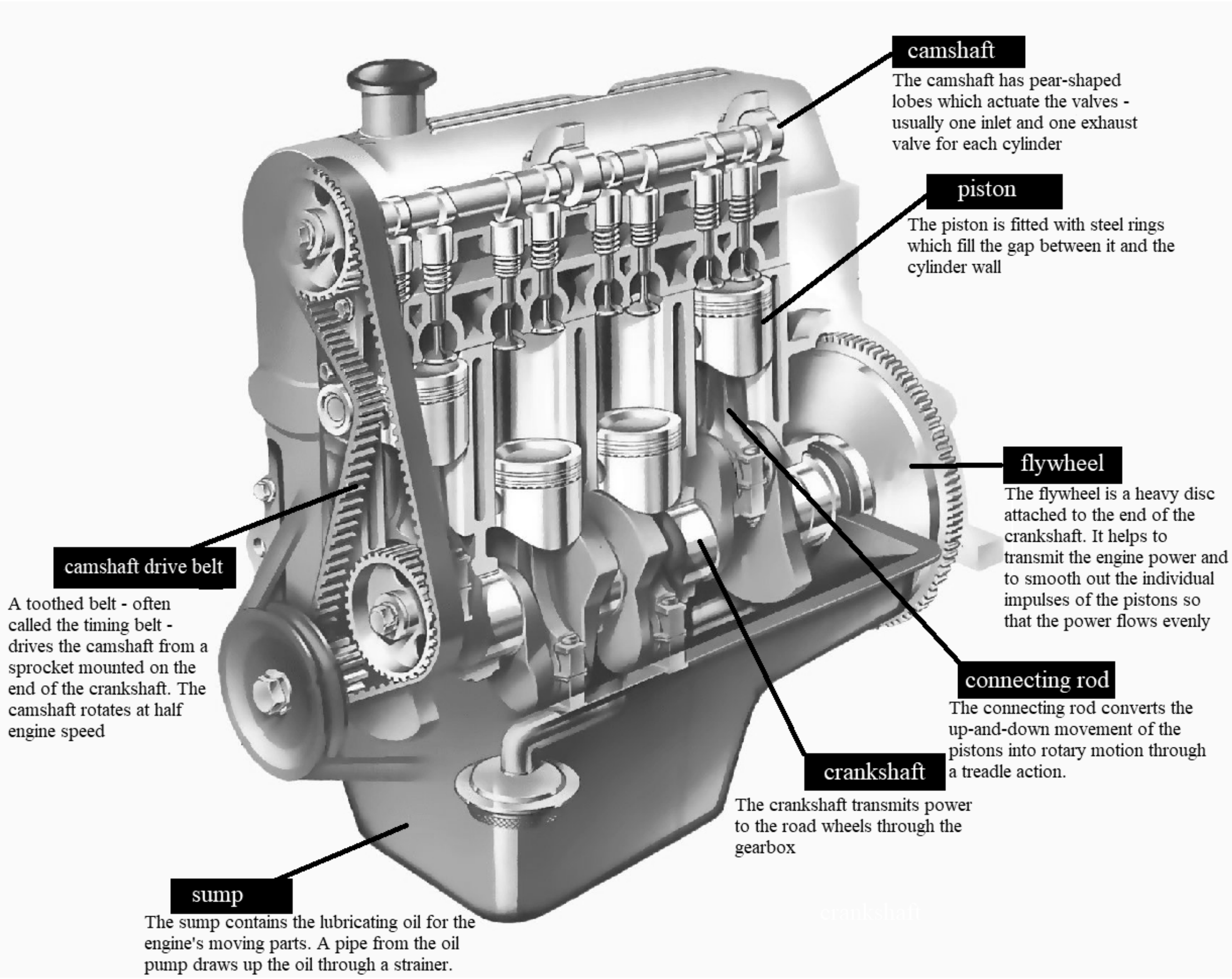
Целью сборника является совершенствование умений чтения, понимания и перевода англоязычных текстов для указанных специальностей. Текстовый материал заимствован из зарубежных источников, его тематика определена программой подготовки специалистов технического профиля.

Составитель: Прокопюк О.В., ст. преподаватель

Рецензент: Зозуля О.Л., заведующий кафедрой немецкой филологии и лингводидактики УО «Брестский государственный университет им. А. С. Пушкина», кандидат филологических наук, доцент

CONTENTS

Unit 1. INTERNAL COMBUSTION ENGINE



Text 1A. CHECKS TO KEEP YOUR ENGINE FIT AND FUNCTIONAL

An engine is like the heart of a car. It needs to run smooth in order to keep your car moving. Here are some engine maintenance tips that'll help your engine run forever:

#1. The engine oil keeps all moving parts well lubricated so that wear and tear is minimal. Also, it traps all the dust, dirt, and sediments, keeping them out of places they shouldn't be. Check oil levels every month and top up if the level is low. Oil grade and change intervals are subject to the manufacturer's recommendations. The oil filter is equally important as it filters all the junk from the oil and stops regulation back into the engine. This will ensure that you engine runs smooth and cool.

#2. Your car's engine needs oxygen as much as you do. A constricted air flow can cause the fuel not to burn completely, increasing emissions and reducing mileage. Check the air filter and get it cleaned/ changed whenever you feel there is too much dirt and debris stuck to it.

#3. Petrol contains sediments which settle at the bottom of your tank. Years of running and there will be definitely a layer of crap which shouldn't reach the engine. Running on low fuel pulls this junk into the fuel pump which could cause a lot of wear. Top up your tank and save yourself repair/ replacement cost of the fuel filter and pump.

#4. Rubber belts are essential links to keep everything in tune when an engine runs. If you hear a squeal coming from under the hood, it is time to replace them.

You should check your belts for cracks and signs of wear even though they last a long time. But if they break while the engine is running, it can cause serious damage to engine components.

#5. The oil filter removes junk from the fuel, preventing it from entering the combustion chamber. A new filter means free flow of clean fuel to the fuel pump and engine. This ensures there is less build-up inside the engine and its thirst for fuel is quenched.

#6. Engines are engineered to run at constant speed. City driving, where you constantly move and come to a stop is really hard on the engine. Try not to rev too hard and don't over-accelerate when you know you have to stop again. Try sticking to the highway whenever possible. This will give you better mileage (now you know why driving on the highway results in less fuel consumption) and keep that engine running for longer.

Text 1B. COMMON ENGINE PROBLEMS

1. Engine has cut out when driving. The engine should not just cut out without any warning – normally you would have a warning light or lights appear. If the engine has cut out without any warning, there are a few simple checks that you can perform to dismiss or confirm the most likely problems. First check that you have not run out of fuel. Make sure you are confident that the car actually has fuel. A faulty fuel gauge could wrongly indicate that your car has fuel. Check that the battery terminals are securely in place. Loss of vehicle power can be caused by a battery terminal vibrating loose or not being refitted correctly.

Another consideration is that your car may have a blocked fuel filter or a failed fuel pump. In this instance, when attempting to start the car the engine will turn over, but will not start.

2. Car has limited power when driving. If you are driving along and the car seems to have very little power when you accelerate, it may be that the ECU (electronic control unit) has switched itself into what is commonly referred to as 'limp home mode.' This will usually be accompanied by the illumination of an engine warning light. The purpose of the limp home mode is to reduce engine power and protect the engine in the event that the ECU has identified a fault that could be damaging. It is very common to experience this problem when the engine would normally begin to deliver the most power – for example, a turbo diesel accelerating quickly from low engine speed, and at the point where the turbo would normally be working fully (say between 2000-2500rpm). Here, the ECU reduces the engine output and you feel a substantial reduction in engine power.

3. Engine overheating. If the engine is overheating, stop and turn it off as soon as possible to investigate the cause. Failing to act promptly can cause catastrophic damage to the engine. The first thing to check is whether there is an engine coolant leak, and that there is enough coolant in the cooling system. Do this by checking around and under the car for any signs of liquid. Check that the coolant level is between the 'min' and 'max' marks on the expansion tank. If there are signs of a liquid leak or a large loss of engine coolant, investigate this further, as this is the most likely cause of the engine overheating. Topping up the coolant and repairing any leaks with an emergency hose repair or stop-leak product may solve the problem, and allow you to drive the car again.

If there is no loss of liquid and no obvious leak, the radiator fan may not be operating and thus not assisting with cooling the engine. This will be particularly evident in hotter weather. Check whether the radiator fan fuse has blown, and that the wiring to the radiator fan is still intact.

4. Hissing noise/steam coming from under bonnet. This will most likely be water escaping from the engine's cooling system due to a leak. Stop the car immediately and turn off the engine. A loss of engine coolant can cause it to overheat, which can cause catastrophic and very costly damage. Hissing Check around and under the car for any signs of water, and check the coolant level, top it up if necessary. On occasion, it has been known for water pipes to come loose, and refitting them can solve the problem. You may need a screwdriver to refit the pipe clamp. More commonly, the leak will be coming from either a hole in a water pipe or from the radiator. It is possible to fix this by refilling the coolant and repairing the leak with an emergency hose repair or stopleak product.

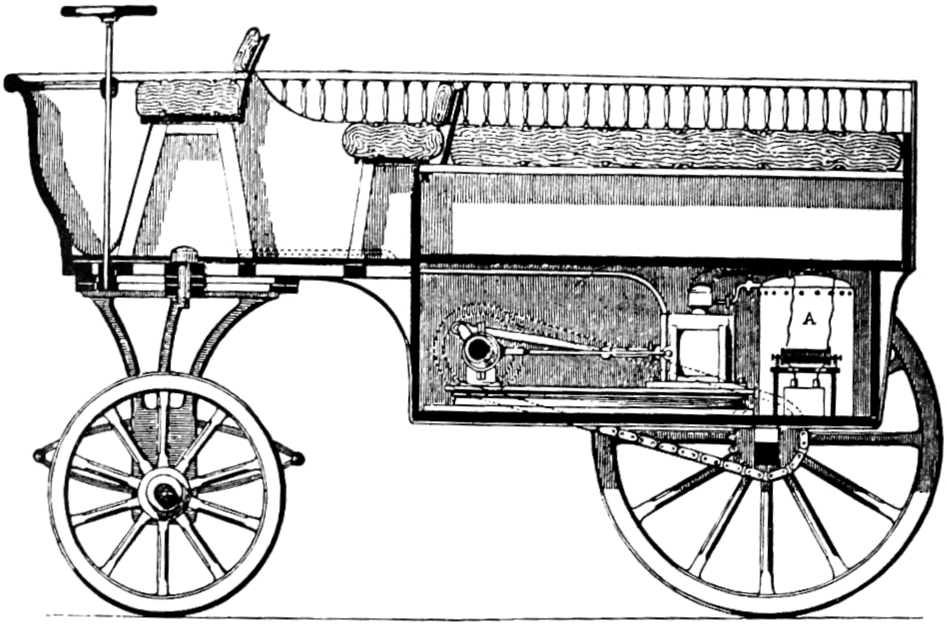
Text 1C. ETIENNE LENOIR AND THE INTERNAL COMBUSTION ENGINE

Etienne Lenoir was born in 1822 in the small town of Mussy-la Ville, part of the Wallonia region of Belgium since 1830, and was granted French citizenship in 1870.

One of the overriding influences on the young Lenoir was the way animal and muscle power was being replaced by hydropower, machines and steam engines, and by the age of 12 he already had a clear idea and desire for his future. Lenoir stated: "When I grow up, I'll make machinery, new machinery, machinery walking all alone".

Lenoir eventually left his village in 1838 and went to Paris with the dream of becoming an inventor, and the hope of making his fortune. While working for a living, he started self-learning and attended free sessions at the Conservatoire des Arts et Métiers (where professors worked with Sadi Carnot a few decades earlier). Lenoir invented chemical processes that included his first patent – a way to set white enamel on tin without oxidization. Achieving greater efficiency by sparking and pre-compression. During the 1850s, Lenoir also became owner of a large number of patents within the fields of electrochemistry and electromechanics. This allowed him more freedom to concentrate on his main interest: the engine. At the same time, Lenoir read about the story of Nicolas-Joseph Cugnot and his steam artillery carriage of the 18th century (this very first 'automotive' was powered by a steam Newcomen type 2-cylinder engine in 1769). Lenoir explained: "Surely there is a better way, let's see about this goblin." At the 'Conservatoire des Arts et Métiers', Lenoir made an important contact with Alfonse Beau de Rochas, who had already worked on air engines and who was then going to provide him with very valuable help and support in his research around engines. Beau de Rochas was especially helpful when Lenoir came to develop his first practical internal combustion engine, and his friend Hippolyte Marinoni allowed him to build it in his mechanical workshop, in the center of Paris. This first engine was created in 1858-60, and was a 2-stroke without compression (although sometimes identified as 1-stroke) spark-ignited gas engine, with double-effect piston – a system already proposed in 1801 by Philippe LeBon, the man better known for using gas lamps to light Paris. Lenoir was able to put together ideas that already existed, such as Robert Street's piston, spark ignition pioneered by Isaac de Rivaz and powered by a coil recently invented by Heinrich Daniel Rühmkorff within the frame of a steam machine, but Lenoir's genius was in arranging the combustion system to get an already accomplished engine to regularly deliver power. And for the first time in the world, Lenoir also built numerous working copies. Lenoir's engine had a displacement of 18 liters, a maximum power output of 2hp at 130rpm, and an efficiency of between 4.5 and 5%. This engine impressed a lot and was immediately seen as a possible substitute for steam engines. In 1859, Lenoir invented and elaborated upon the spark plug, which he would patent a few years later. In 1860, Lenoir received a patent for “an air motor expanded by gas combustion” from Conservatoire National Des Arts Et Métiers, no. N.43624, and 380 of these engines were produced within a year by the Lenoir-Gautier company.

As with the steam engines that went before, Lenoir also turned his hand towards transportation, equipping a boat with his engine in 1861, before creating the ‘Hippomobile’ automobile in 1863.



Prior to other gases, the Hippomobile engine was supplied with hydrogen, generated via the electrolysis of water. Along with being a genius, it’s clear that Etienne Lenoir was more than a century ahead of his time.

Lenoir continued his research to get more performance and efficiency from his engine, pushing the boundaries in different directions, and he went on to take further measures including the extension of the expansion stroke, the increase of the gas-air ratio (richness) and in the end, the switch to a 4-stroke cycle with compression, as advocated by his associate Alfonse Beau de Rochas.

Beau de Rochas patented his 4-stroke cycle in 1862. It involved the pre-compression of the air-gas mixture before ignition, in a way to increase the thermodynamic efficiency, as recommended by Sadi Carnot in his ‘Reflections on the Motive Power of Fire’ in 1824.

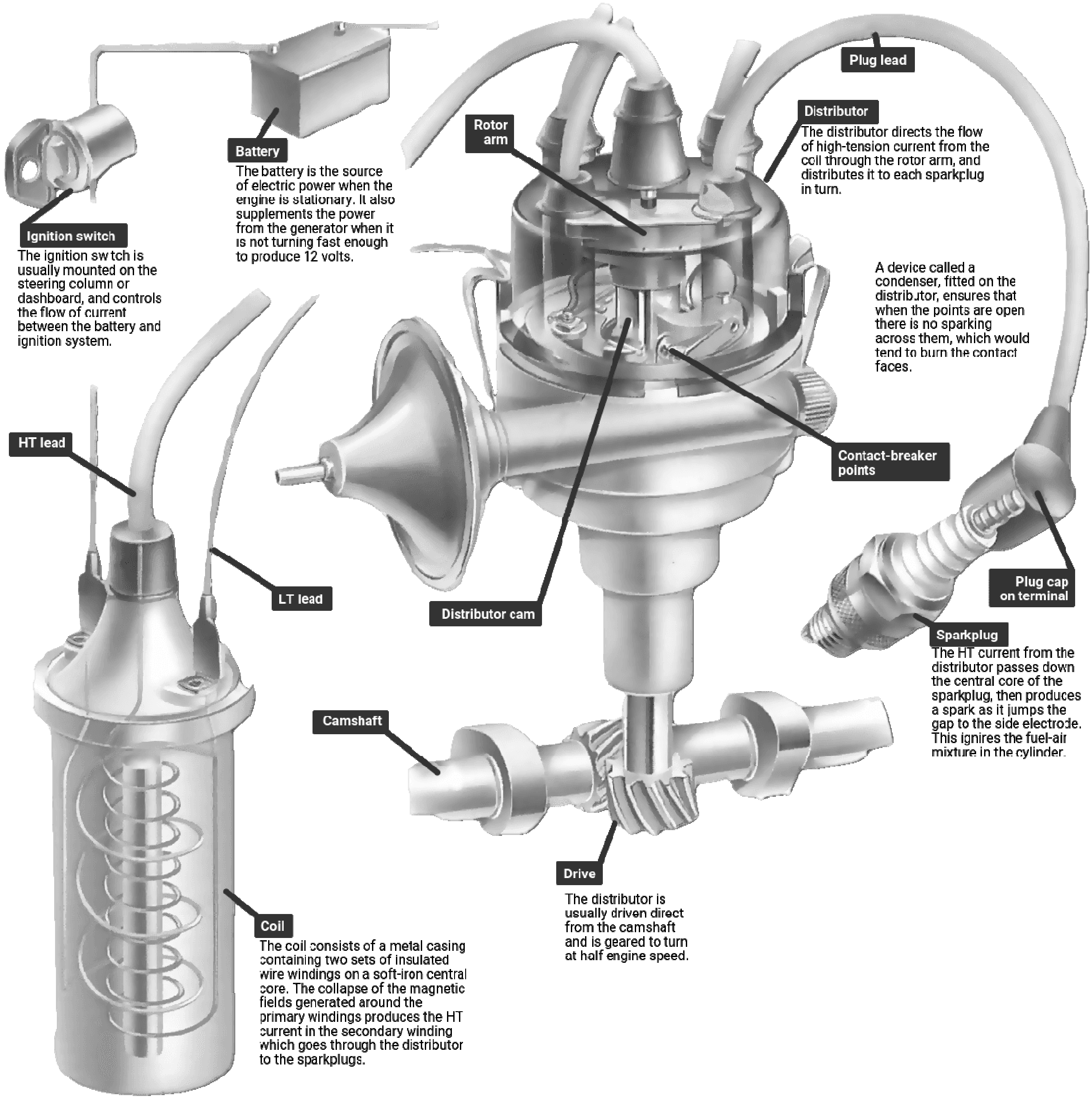
Here is the 4-stroke cycle, as Beau de Rochas described it:

1. suction during an entire piston stroke (intake);
2. compression during the next stroke (compression);
3. ignition at the top dead center and expansion during the third stroke (combustion – expansion);
4. forcing out the burned gases from the cylinder on the fourth and last, or return, stroke (exhaust).

The crankshaft makes 2 revolutions per cycle.

Note that the Austrian watchmaker Christian Reithmann is also credited as having patented a 4-stroke engine during the early 1860s. Those creations heavily influenced the next innovator – Nikolaus August Otto – who concretized an engine cycle still used today.

Unit 2. IGNITION SYSTEM



Text 2A. INSPECTING THE IGNITION SYSTEM

Inspect the ignition system whenever you make a general under-bonnet check. It takes only a couple of minutes, and guards against a frequent cause of breakdown.

Check that the low-tension connections are tight and free from corrosion, and that all LT (Low Tension) wires have sound insulation and no cracks, kinks or breaks.

Follow with the plug leads and plugs. The leads should be clean, dry and free from cracks. Clean the leads with a soft cloth. Replace them if they are damaged. High-tension leads should be replaced every two or three years, to maintain peak performance.

Check that the plug caps are firmly fixed to the leads, and that the leads are properly connected to the distributor. Leads may be screwed into the distributor vertically with threaded collars; pushed in vertically and held by crimped terminals; or inserted from the side and held by small screws.

Check the distributor and plug caps for cracks. Pull off the plug caps one at a time and wipe the porcelain plug tops. Take off the distributor cap. It may have a pair of spring clips which you lever off outwards, or two small screws – avoid dropping these.

Check the inside of the cap for cracks. Look closely at the contacts. If there is a sprung carbon brush at the top, it should be free to slide up and down; or there may be a spring contact on top of the rotor arm, which bears against a fixed carbon brush in the cap. The rotor-arm spring contact should be free from wear or damage. The rotor-arm tip and the contacts around the inside of the cap should not be more than slightly pitted, and the gap between tip and contacts must not vary. If the rotor-arm tip is dirty, lift off the arm (a few types have screws) and clean it by removing the pitting marks by gentle filing or scraping.

Remove any corrosion from the contacts inside the cap by gentle scraping.

The narrow pipe or pipes of the vacuum advance mechanism run from the distributor to the inlet manifold. Check that the pipe is undamaged and that the connections are sound. A plastic pipe must be routed away from heat.

Look at the coil. The most usual type has a thick HT (High Tension) lead coming out of the end flanked by two smaller LT leads. Check that the HT lead is firmly fixed to both coil and distributor, and that any rubber seals over the ends fit properly. The LT leads have spade connectors, or screws on older cars. Make sure these are firmly fastened, and that the leads are connected the right way round: a coil connected backwards still works, but could cause a misfire.

Make sure that the coil is fixed firmly in its mountings. There are two leads from the switch to the coil; one for normal running going through the resistor; the other for starting, which bypasses the resistor to provide extra ignition strength. The resistor is often clamped to one of the coil mounting bolts. Make sure it is not cracked, and that the connectors are tight.

Text 2B. SYMPTOMS OF A BAD IGNITION COIL

If a vehicle is behaving intermittently and is giving its driver some trouble in a smooth driving, then it could indicate that the ignition coil of that vehicle has gone bad.

The failed or weak ignition coil symptoms may vary depending on the severity of the ignition coil failure. Here are some of the most common signs of bad ignition coil.

#1 Backfiring caused by your vehicle can indicate the symptoms of the ignition coil failure in its early stages. Car backfiring occurs when the unused fuel in the combustion cylinders of the engine leaves through the exhaust pipe.

If this problem is left unchecked, then it can result in costly repairs. The backfiring problem can usually be detected by the emission of a black smoke through the exhaust pipe. The smell of gasoline in that smoke may also give away the ignition coil failure.

#2 Another sign of a faulty ignition coil is poor fuel economy. If your vehicle is getting noticeably less mileage than it was before, then it could mean that an ignition coil failure has occurred.

#3 Engine misfiring will be seen in a vehicle whose ignition coils have failed. Trying to start the engine of such a vehicle will result in engine misfiring that sounds like a coughing, sputtering noise. When driving at high speeds, jerking and spitting will be seen in the behavior of the vehicle. A vehicle with a failed ignition coil will also result in vibration when it is idling at a stop sign or light.

#4 Ignition coil failure may also result in the stalling of that vehicle. This can occur because of the irregular sparks sent to the spark plugs by the faulty coil. Your car may shut off completely when brought to a stop leaving you with the trouble of it hopefully restarting.

#5 Another symptom is rough idling of the engine, jerking, and hesitating while accelerating. It will feel like your vehicle is missing some power when driving.

#6 Often, the check engine light will turn on in your dash. Most commonly, engine code P0351 (Ignition Coil – Primary/Secondary Circuit Malfunction) is what shows up when scanned using a car diagnostic tool. Scanning for the error code is probably the easiest way to troubleshoot a coil issue, so if you see that check engine light, grab your scan tool or have a repair shop confirm.

#7 A hard to start engine is a symptom that will occur especially if your car uses a single coil. If the coil has a malfunction, it means the engine will be cranking without sparks inside the cylinders.

Text 2C. INVENTORS OF THE SPARK PLUG

Internal combustion engines need three things to run: spark, fuel, and compression. The spark comes from the spark plug. Spark plugs consist of a metal threaded shell, a porcelain insulator, and a central electrode, which may contain a resistor.

According to Britannica a spark plug or sparking plug is, "a device that fits into the cylinder head of an internal-combustion engine and carries two electrodes separated by an air gap, across which current from a high-tension ignition system discharges, to form a spark for igniting the fuel."

Some historians have reported that Edmond Berger invented an early spark plug on February 2, 1839. However, Edmond Berger did not patent his invention. Spark plugs are used in internal combustion engines and in 1839 these engines were in the early days of experimentation. Therefore, Edmund Berger's spark plug, if it did exist, would have had to have been very experimental in nature as well or perhaps the date was a mistake.

Jean Joseph Étienne Lenoir developed the first commercially successful internal combustion engine in 1858. He is credited for developing the spark ignition system, which is described in US Patent #345596.

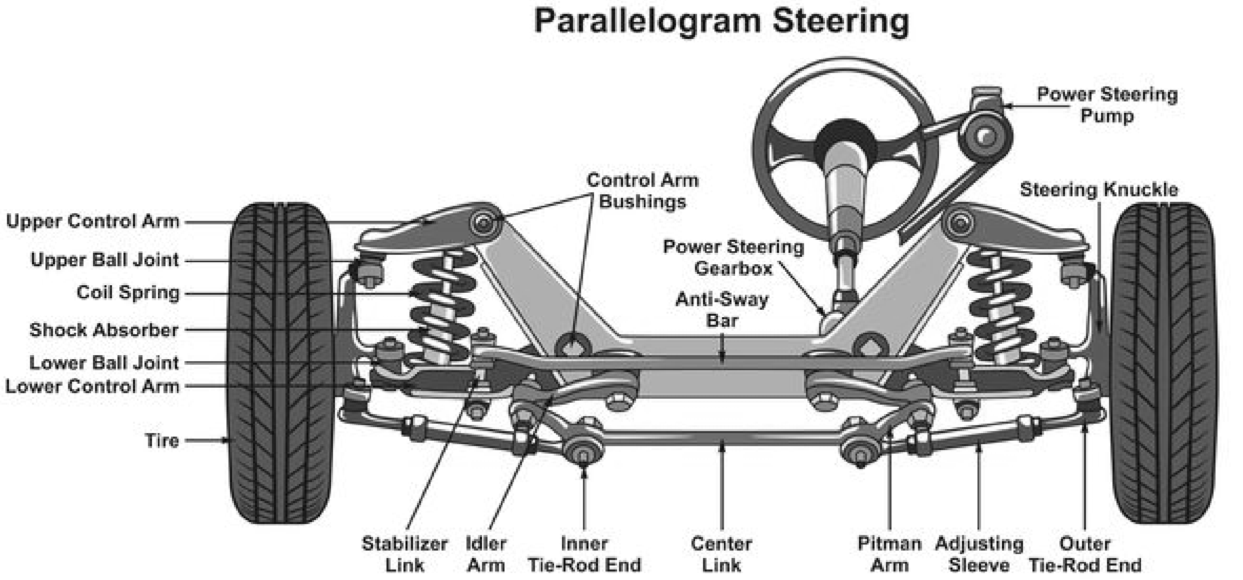
Oliver Lodge invented the electric spark ignition (the Lodge Igniter) for the internal combustion engine. Two of his sons developed his ideas and founded the Lodge Plug Company. Oliver Lodge is better known for his pioneering work in radio and was the first man to transmit a message by wireless.

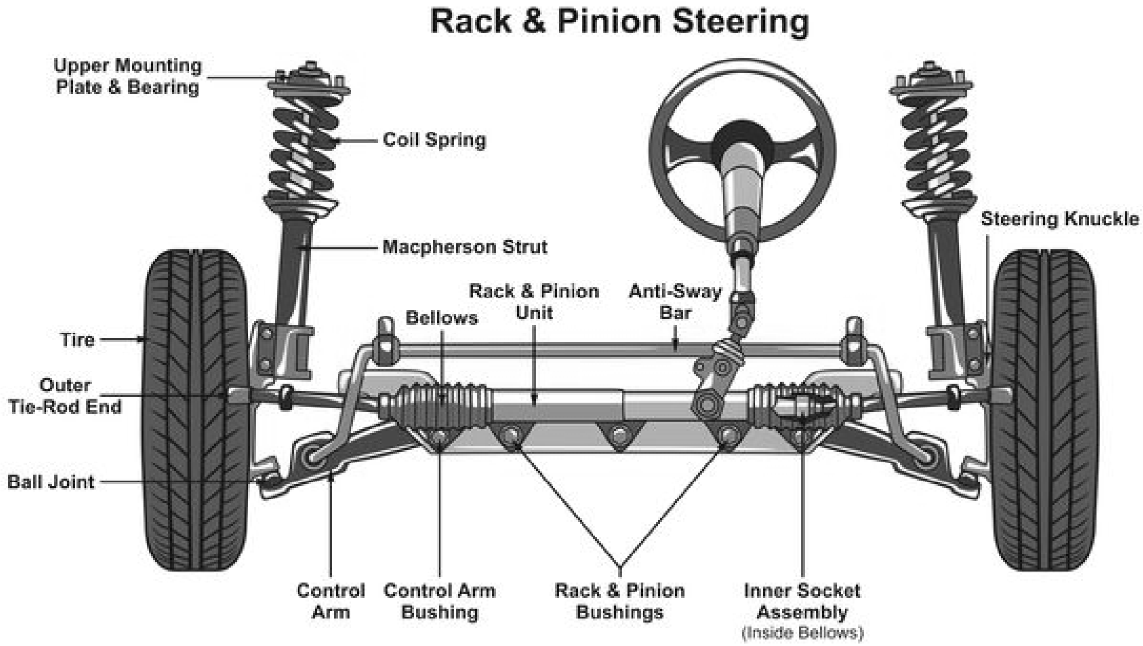
During the early 1900s, France was the dominant manufacturer of spark plugs. The frenchman, Albert Champion, was a bicycle and motorcycle racer who immigrated to the United States in 1889 to race. As a sideline, Champion manufactured and sold spark plugs to support himself. In 1904, Champion moved to Flint, Michigan where he started the Champion Ignition Company for the manufacturing of spark plugs. He later lost control of his company and in 1908 started the AC Spark Plug Company with backing from Buick Motor Co. AC presumably stood for Albert Champion. His AC spark plugs were used in aviation, notably for the trans-Atlantic flights of Charles Lindbergh and Amelia Earhart. They also were used in the Apollo rocket stages.

You may think the current-day Champion company that produces spark plugs was named after Albert Champion, but it was not. It was a completely different company that produced decorative tile in the 1920s. Spark plugs use ceramics as insulators, and Champion started producing spark plugs in their ceramic kilns. Demand grew so they switched completely to producing spark plugs in 1933. By this time, the AC Spark Plug Company had been bought by GM Corp. GM Corp was not allowed to continue using the Champion name as the original investors in Champion Ignition Company set up Champion Spark Plug Company as competition.

Years later, United Delco and the AC Spark Plug Division of General Motors combined to become AC-Delco. In this way, the Champion name lives on in two different spark plug brands.

Unit 3. STEERING SYSTEM





Text 3A. FIVE EASY STEPS TO MAINTAIN THE POWER STEERING SYSTEM

If you follow these 5 easy steps, your steering system will always be ready to assist your steering.

#1 Power steering fluid is essential to the operation of the entire system. The pump creates pressure so that the fluid can apply that pressure to the piston. Most power steering problems arise because a leak has developed and the fluid is low. You may start to feel that the steering wheel is harder to turn and hear a squealing noise when you turn the wheel. It’s never fun to be caught on the road with no power steering. It’s always suggested that you check the fluid level before you go on a long trip and after you return. Otherwise, checking the power steering fluid when you get an oil change is a good practice to follow.

#2 The power steering fluid is transported through two hoses. One supplies the fluid with high-pressure and the other returns it back to the fluid tank with low-pressure. It's common for leaks to develop in these hoses. They should be checked periodically to make sure they aren't rubbing against each other and protective coverings are intact.

#3 Some driver's aren't even aware there's a power steering fluid filter. This filter should be changed every year or when your owner's manual dictates. It's always important to keep the fluid clean and free flowing to reduce wear-and-tear on your pump. You would be amazed at all the contaminants that find their way into the fluid.

#4 Changing the filter and keeping your fluid contaminant free also protects the quality of the fluid and how well it works. You can try to determine the quality of the fluid at home by taking a sample, inspecting the color and checking for pieces of metal and other dirt and grime. The darker the fluid, the worse off it is. If the fluid is dark and has particles floating around in it, the fluid should be flushed and replaced.

#5 Low fluid levels and dirty fluid can impact your power steering pump in a negative way. If you start to hear a whirring or whining sound as you drive, it could be a sign that your pump is about to fail. It's always smart to have it checked. There are much more expensive power steering repairs that could follow a bad pump if not repaired.

Text 3B. WARNING SIGNS OF STEERING SYSTEM PROBLEMS

Unlike some mechanical problems, steering problems generally give you plenty of warning that something is wrong, and the warning signs persist until the problem is fixed or the system fails. Ignoring these warnings could result in an accident that may not be covered by your car insurance, so if your steering is exhibiting any of the following symptoms, take it to a mechanic for inspection and repair:

Difficulty in turning the wheel. If you have power steering, as most cars do these days, then this could indicate the system has a problem. Firstly, check to see if the fluid reservoir is full. If it isn't, fill it up. If the next time you check, it has gone down again, then check under the vehicle for signs of any fluid leakage. Leaks can be in the steering pump, hoses or the steering rack itself.

Steering wheel vibration. While this is often an indication of wheel alignment problems, steering wheel vibration can also indicate a problem with the power steering. A build-up of contaminants in the system can cause the steering wheel to vibrate or 'pulsate' when the wheel is turned fully in one direction or another. A power steering flush would normally fix this problem.

Steering wheel slips when you attempt to turn it or hold it in a turned position. This is another sign that the power steering is failing. Other causes of power steering failure apart from leakage include faulty pumps, worn steering rack mounts and loose or worn steering belts.

Looseness in steering wheel. This is usually caused by worn steering racks and tie rods.

Excessive steering wheel vibration when you accelerate or turn a corner. This is usually caused by faulty or worn tie rods. If allowed to continue, it will cause the whole car to vibrate and eventually lead to loss of steering, so it should be rectified as soon as the problem is discovered.

Vehicle wanders or pulls to one side. This often indicates a problem with a worn steering gear. Premature steering gear wear can be caused by lack of lubrication from power steering fluid, so you should also check for any power steering leaks when replacing a worn steering gear.

Excessive play in the steering wheel can also point to a worn or faulty steering gear. If you have to turn the steering wheel more than an inch before the wheels begin to turn, then you can be fairly certain there is a problem with the steering gear.

Grinding noise when turning the steering wheel. This is yet another indication of a steering gear problem.

Screeching noise when you turn the wheel. This is often caused by a loose or worn power steering belt. This is the belt that connects the power steering pump to the engine. The screeching noise could also be a symptom of low power steering fluid levels, as mentioned before.

Foaming or discoloured power steering fluid. This indicates that air or water has gotten into the system and the fluid is not lubricating the components properly.

By having your vehicle regularly serviced and free from general wear and tear and staying alert for any of the warning signs mentioned above, you will have a much better chance of finding and fixing a steering problem before it becomes costly and dangerous.

Text 3C. BRIEF HISTORY OF STEERING WHEELS

Believe it or not, the very first cars weren't even directed with a steering wheel, but rather with a tiller. In fact, the history of steering wheels as a whole is probably more interesting than you might imagine.

The earliest known use of a steering wheel can be traced back to 1894, when Alfred Vacheron used one on his custom four-horsepower Panhard to participate in the Paris-Rouen race.

It wasn't until 1898 that steering wheels were introduced as a standard feature in some cars, but once they were introduced, it was clear they were there to stay. By 1904, all Rambler models (one of the few mass-produced cars at the time) came with a steering wheel, and within a decade the tiller had been eradicated.

For about two generations thereafter, steering wheels were as simple as they got: wooden circles directly connected to the wheel axis. They served no other task and could be extremely hard to turn, especially at low speeds or when stationary.

Though power steering patents were circulating as early as the steering wheel itself, it was many years before these systems were actually used. In the 1920s, an engineer named Francis W. Davis wanted to make truck-driving a little easier and invented the first power steering system to be fitted into a vehicle, inspired by earlier work on power steering systems used in ships.

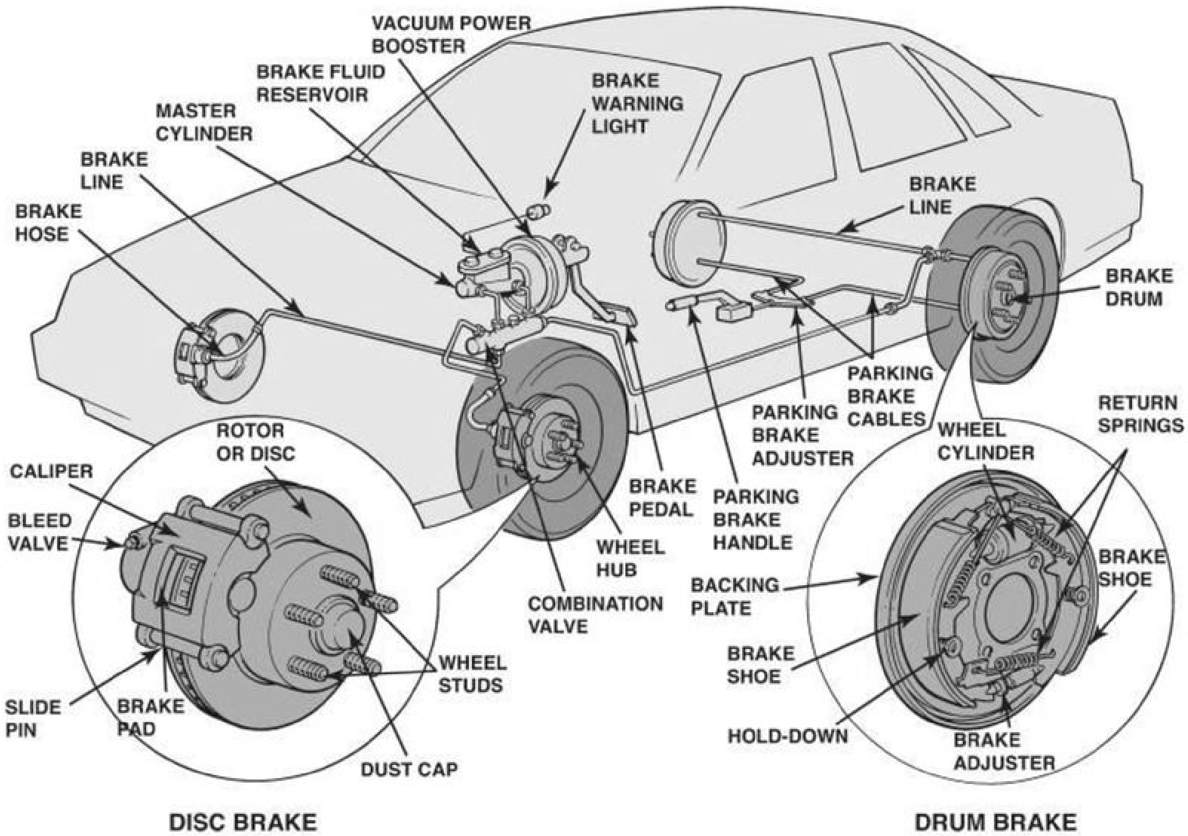
In 1926, Davis signed a contract that would have seen his technology applied to future Cadillac models, but the economic crisis brought about by the Great Depression led to the contract being scrapped in 1934.

What finally brought power steering into explosive existence was the second World War. The military wanted easily-controllable war machines and in 1940 started fitting power steering systems in Chevrolets armored for the British Army. 10,000 vehicles would go on to receive similar treatment by the end of the war, and auto manufacturers began to develop their own power steering technologies after that. Some were hydraulic, others electric, and others still a mix of the two.

For about sixty years, the steering wheel had no other purpose than turning the car and providing a surface upon which to slam the horn. In 1960, some carmakers began fitting the cruise control operating switches onto the wheel, but it wasn't until 1990 that steering wheel gadgets and innovation really began to take off.

As car technology progressed, so too did the need for buttons and switches. Some of these were moved over to the steering wheel, like controls for the audio system, the car's computer, and other features like voice command — and that's essentially where we are today.

Unit 4. BRAKING SYSTEM



Text 4A. BRAKING SYSTEM MAINTENANCE

The braking system of your vehicle is complex but surprisingly simple to maintain. It is important you inspect and make necessary repairs to every component to ensure all parts are in working order. These parts include the master cylinder and brake line, brake pads, calipers, and rotors.

Here are five keys to brake maintenance that will help you stay safe on the roads:

#1 Check Brake Pads and Rotors

The brake pads and rotors are the point of contact between your braking system and your tires. These elements deteriorate more easily than other components and require more frequent maintenance. Friction between the tires and the brake pads cause heat, and this heat wears down the brake pad. It is important to inspect the quality and depth of the pads to make sure there is sufficient resistance.

#2 Flush Your Brake Fluid

Brake fluid is extremely important because it is the messenger between you and your car’s braking system. Unfortunately, brake fluid attracts moisture, which can be highly damaging to your braking system. Moisture in the brake fluid causes corrosion of the metal components of the brakes and reduces the boiling point of the fluid and affects the effectiveness of the brakes. Brake fluid should be checked and changed every 25,000 miles. A cloudy or milky quality indicates the fluid must be changed.

#3 Bleed the Brake Lines

In addition to flushing the brake lines to change the brake fluid, it is also a good idea to bleed the brake line to remove excess air. When small amounts of air become trapped inside the brake line, it can reduce the efficacy of the braking system.

#4 Replace or Upgrade Brake Parts Sometimes it may be necessary to replace some elements in your braking system, and this can be a good opportunity to upgrade to higher performance or specialized components. Parts such as slotted disc brakes which are more heat resistant or switching to ceramic pads, which are quieter and produce less brake dust, are popular upgrades.

#5 Braking System Care

One of the most effective ways to ensure the performance of your brakes is to look after them. There are many external factors that contribute to brake deterioration, such as: carrying too much weight; unnecessary, late, or heavy braking; wet weather.

Avoiding these, and other situations that can affect your braking performance where possible, will keep your brakes performing better for longer and reduce the likelihood of brake failure related incidents.

Your brakes are your safety on the road, and ensuring your brakes are in perfect working order is essential to protect yourself and your passengers, as well as those around you. Maintain all braking components and avoiding hazardous driving practices will guarantee your brakes function efficiently.

Text 4B. WARNING SIGNS OF DEFECTIVE BRAKES

Brakes are one of the most important components of your car. Keeping your brakes in good condition is essential for safety. In order to do this, you should be able to tell when your brakes need servicing. Braking problems are easy for a qualified mechanic to diagnose and fix. Yet, many people do not pay enough attention to this critical system.

Brakes deteriorate gradually and that makes it harder to detect problems. As the brake performance degrades, you keep getting used to it and it’s easy to overlook the fact that your car is taking longer to slow down and come to a stop. Brake components are designed to last for a long time, but they have a finite life. The life of the components and pace of deterioration depends on the frequency and intensity of use. It is, therefore, important to be alert for any signs of braking problems.

Here are four warning signs that indicate a problem with your brakes:

#1. If an abnormal (squealing) sound occurs whenever you apply the brakes, get your brakes checked immediately. The noise is usually caused due to worn out brake pads, which leads to direct metal to metal contact between the braking surfaces. Worn out brake pads should be immediately replaced.

#2. If your brake rotors have a problem, you will feel a strong vibration in the steering wheel as your car comes to a halt. With age, rotors become warped. This is not visible, but the shudder of the steering wheel is a giveaway. Rotors can be repaired by machining, but it’s better to get a new set of rotors.

#3. If it becomes obvious that the car is taking too long to stop or you have to press harder on the pedals then it’s a bad sign. It is dangerous to continue driving in this condition and you may also get into legal trouble in case of an accident.

#4. If you notice smoke near your wheels after you stop, get the problem checked by a mechanic because it could be a problem with the braking system.

Most garages will check your brakes when you get your car serviced. However, it is important to recognize the symptoms that may indicate a brake problem. If you notice any of the problems mentioned above, get your car checked by a mechanic without delay. This is very important for your safety. Modern vehicles have complex braking mechanisms. Don’t ignore the problem and don’t try to diagnose it yourself or tamper with the braking system. You could be putting your life, the life of your co-passengers and the safety of other road users at risk. Negligence on your part can also get you into serious legal trouble.

Text 4B. BRIEF HISTORY OF BRAKES

Considered as the foundation of the modern braking system, the mechanical **drum brake** was developed in 1902 by Louis Renault, a French manufacturer and a pioneer in the automobile industry. However, the first, or among the first, to think that a cable-wrapped drum anchored to the vehicles’ chassis could be used to stop momentum was Gottlieb Daimler. He created this first concept of the drum brake in 1899.

In 1901, Wilhelm Maybach designed the first Mercedes with a simple mechanical drum brake, wherein steel cables were wrapped around the drums of the rear wheels and is operated by a hand lever. But it was Louis Renault who was credited with inventing the drum brake that has become the standard for cars

In 1918, Malcolm Loughead (who later changed his name to Lockheed in 1926) proposed a concept of a four-wheel brake system using hydraulics. Using cylinders and tubes, Lockheed used fluids to transfer force to the brake shoe when a pedal was pressed. It required much less effort for the driver to apply brakes.

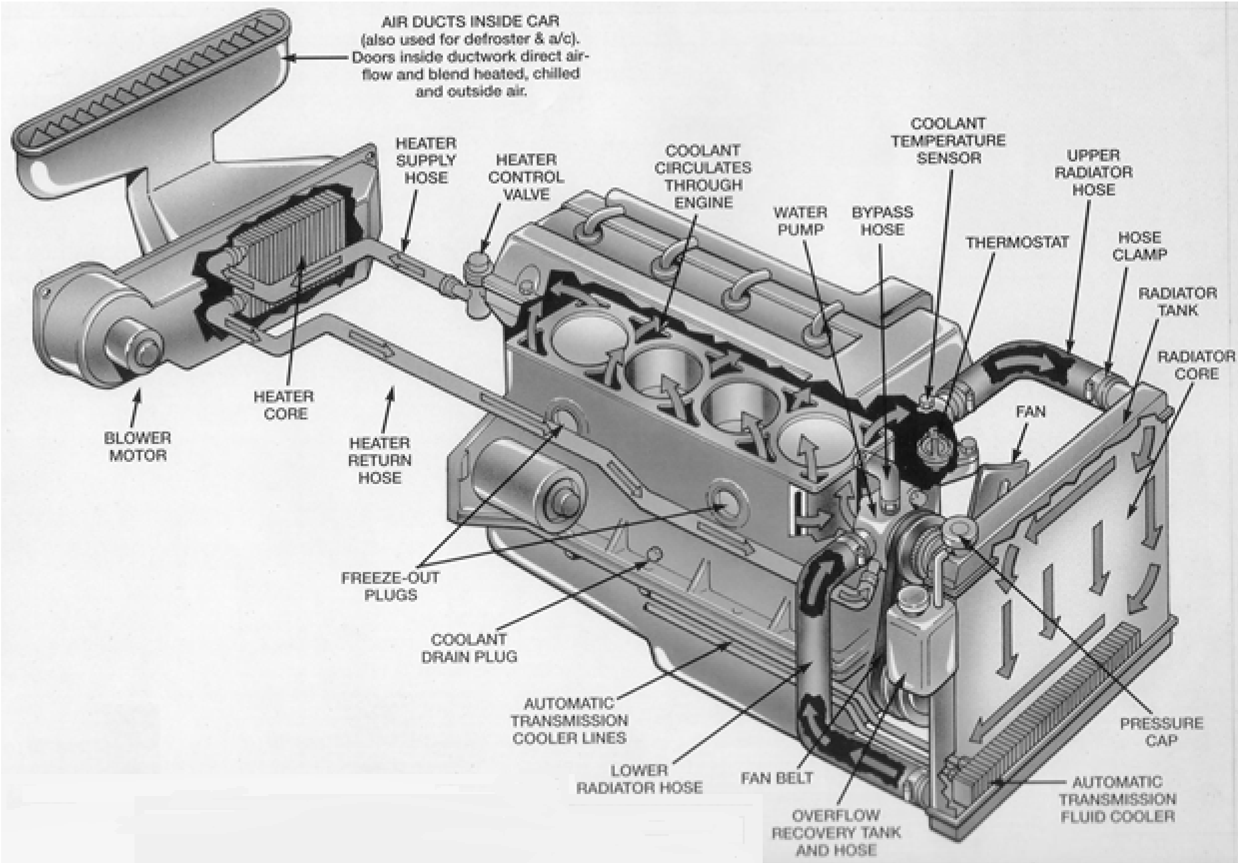
The **hydraulic brake system** was first fitted into all four wheels of a Model A Duesenberg car in 1921. However, it was beset with fluid leakage problems, but engineers from the Maxwell Motor Corporation produced rubber cup seals to help solve it. In 1923, the improved Lougheed brakes were offered as an optional upgrade on the Maxwell-Chalmers car for $75. This new brake design was also used in Chrysler cars from 1924 to 1962.

The **disc brake** was invented decades before it became popular. In 1898, Elmer Ambrose Sperry designed an electric car with front-wheel disc brakes built by the Cleveland Machine Screw Co. Disc brakes work like bicycle brakes, wherein a caliper with brake pads pinches a disc or rotor. However, it was William Lanchester, an English engineer, who patented the idea in 1902. The biggest downside to his invention though was the horrible screeching noise it produced, which were caused by copper brake linings moving against a metal disc. After five years, another British named Herbert Frood solved the noise problem by lining the pads with long-lasting asbestos, which continued to be used in car brakes until the 1980s.

The disc brakes were first integrated in the Chrysler Imperial since 1949 and 1953 and were first used with hydraulic functions.

In the US, Crosley Motors became the first American manufacturer to fit disc brakes. In 1949, it was fitted to Crosley’s Hotshot model but discontinued in 1950. These brakes, built by Auto Specialists Manufacturing Company (Ausco), used twin discs that spread apart and rub against the interior of a cast-iron drum. Less pedal pressure than caliper discs was required, and more friction surface than the drum brakes were provided.

Unit 5. COOLING SYSTEM



Text 5A. COOLING SYSTEM MAINTENANCE

Maintaining your car’s cooling system will maximize efficiency and prolong the life of your cooling system and vehicle. It isn’t that hard, here are some tips.

1. Replace coolant at the intervals recommended by the manufacturer, regardless of the condition of the coolant. You cannot gauge the effectiveness of coolant based on appearance.

2. Use only products recommended by the manufacturer of your car. If this is not possible use one which meets Australian Standard AS/NZ 2108.1.1997 (Type A or Type B) at the very least. Don’t forget that coolant is also diverted to the heating system of a car and turn on the heater when draining, flushing or filling a system to ensure all coolant is affected/drained. If possible when replacing old coolant, try to flush the cooling system with a quality (alkaline based) flushing product, especially if changing brands.

3. Never mix inhibitor or coolant products. Always drain the cooling system and flush completely if switching brands, the coolant appears contaminated or where scale build-up is suspected.

4. Ensure the correct mixture ratios are maintained when topping up to avoid under treatment, which promotes corrosion. Under treatment can raise the corrosive rate to higher levels than found in water.

5. Regularly check radiator hoses for signs of obvious expansion, excessive softness, or a crunchy feel on squeezing. Have them replaced if any of these are apparent. Ensure the radiator cap fits tightly and securely.

6. Radiator fins and core tubes are prone to corrosion from external factors, reducing heat transfer efficiency and increasing the potential for leaks. Inspect the external fins of the core regularly and have them replaced where necessary.

7. If you are having problems with an overheating engine, do not be tempted to disable or remove the thermostat. Running a car in an overheated condition can have very serious consequences on your cooling system, you might break a head gasket, inflict pre-ignition/detonation damage to the engine or in extreme cases cause complete seizing of the engine.

8. The fastest killer of radiators electrolysis. Coolant is conductive and any stray current can increase the corrosion of the core at an incredible rate, new radiators can be completely destroyed in under three months. Check to ensure all earthing points are properly connected and making clean contact, especially where aluminium radiator cores are concerned. If you are unsure if your radiator is properly earthed, consult your mechanic or auto electrician.

Text 5B. COMMON SIGNS OF COOLING SYSTEM PROBLEMS

Car engines run very hot. They are burning up fuel to provide power for the vehicle. That's why your cooling system is so important. Most cars will use a traditional fluid-cooled system that requires an ideal mix of water and radiator coolant (antifreeze) in the radiator. It is then circulated throughout the engine through the water pump. This process keeps the engine from overheating and causing major damage within the vehicle.

The point is, you need your cooling system working properly at all times or it can lead to very costly engine repairs. Simard Automotive has put together this list of common signs that you may have a cooling system problem:

#1. If your vehicle is overheating—and especially if it happens more than once—then there is definitely something wrong within your cooling system. Your water pump may be failing, the head gasket may be worn out or there could be a coolant leak somewhere along the way. You'll want to get it looked at by a professional mechanic.

#2. Often when a car is overheating or about to overheat, you'll see white steam coming from under your hood. This is a sign to pull over and let the engine cool down before driving again. If the problem persists, make sure to get your cooling system inspected as soon as possible before any major engine damage is done.

#3. You can check the coolant level in your radiator. However, you'll want to do it when the engine is cold. Heat and pressure will build up in the radiator, so it is very dangerous to remove the cap when everything is still hot.

#4. Radiator coolant is easy to identify because it is usually bright yellow/green in color. If you notice a coolant leak underneath your vehicle, then that's a problem worth getting looked at.

#5. If your coolant is not bright yellow/green and translucent in appearance, that's a problem. If it is dark, dirty or has a distinctive burnt, sweet smell, it's time to replace the fluid and make sure the old fluid hasn't caused any damage within the cooling system or engine itself.

#6. A noticeable decrease in fuel economy can be a sign of many different things, including the fuel system, the engine, the exhaust system, etc. It can also be a sign of a failing cooling system.

These are some of the most common signs of cooling system problems. If you notice any of these symptom, if any dashboard warning lights are illuminated or your vehicle is acting odd in any way, you must bring it to an experienced auto shop.

Text 5C. BRIEF HISTORY OF THE RADIATOR

The first water radiator was invented by Karl Benz. In addition to the radiator, Benz also patented components like spark plugs, carburetors, and clutches in the period between 1871 and 1882.

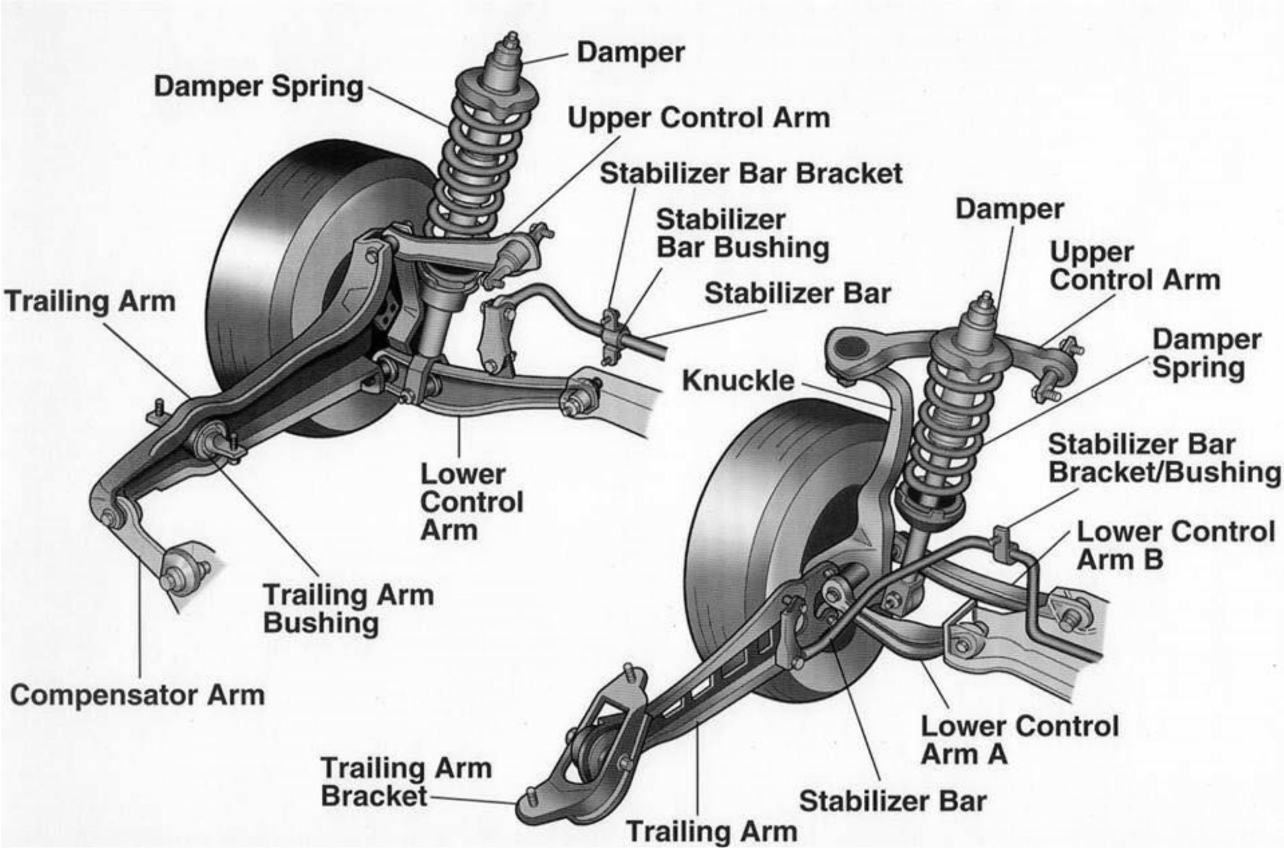
Wilhelm Maybach was another innovator in the early history of the radiator. He solved a large number of technical problems, and many of his patents have retained their basic validity to this day. On December 24, 1897, for instance, the tubular radiator developed by Maybach was registered as a utility model (no. 107418) in Germany. This radiator significantly improved engine cooling and was used for the first time in the so-called Phoenix car (1897), the first passenger car of Daimler-Motoren-Gesellschaft with an engine installed at the front. He also received a patent for a "honeycomb" radiator (Fig. 1) design that would prove popular for decades. This honeycomb design first appeared in Maybach's Mercedes 35hp, which he unveiled in March of 1900.

Fig.1 Maybach's honeycomb radiator

Early radiators used water as a coolant, which suffered from inherent problems with "boiling over" during the course of normal operation. These radiators were also operated at normal atmospheric pressure. Due to the problem of boiling over, air cooling was popular until post-World War II.

The next major radiator developments were borrowed from airplane engineering. Since water cooling systems work less efficiently at high altitudes than at low altitudes due to lower air pressure, engineers came up with the solution of pressurizing the cooling systems. This concept was then applied to automobile engines, where pressurization allowed radiators to operate more efficiently and engines to run at higher temperatures.

Unit 6. SUSPENSION



Text 6A. SUSPENSION MAINTENANCE

The suspension is composed of hundreds of different parts, and vehicles vary tremendously in suspension designs, but every suspension has to do three things: hold the vehicle up, absorb bumps and other road shocks, and turn the vehicle in response to the driver’s input. To accomplish these tasks, the system is composed of the following major parts and subsystems:

- **Wheels and tires.** Many drivers don’t think of tires as part of the suspension, but they’re arguably the most important part. Tires provide traction for acceleration, braking, and cornering, as well as absorbing smaller bumps.
- **Springs.** Every car and truck today has some sort of springs, which support the vehicle and absorb large bumps.
- **Shock absorbers.** While springs absorb the bumps, shock absorbers (or, in cars that have them, struts) dampen the motion of the springs after a bump, keeping them from bouncing up and down excessively.
- **Linkages.** A complete compilation of suspension linkages would fill a book, but every suspension includes various arms, rods, and other connecting pieces that collectively keep the wheels where they’re supposed to be relative to the rest of the vehicle. Most of these linkages are solid metal parts.
- **Bushings, bearings, and joints.** Because most parts of the suspension have to be able to move, the various linkages are connected by flexible connections.

Each of the major part types listed above requires attention, but some require much more than others. If you’re interested in making everything last as long as possible, you’ll want to do the following:

#1 Check your tires air. This is probably the easiest maintenance to perform, and may be the most important. Properly inflated tires (check your manual for the correct pressure) help protect the rest of the suspension from damage; under-inflation costs you money in extra fuel while hurting handling and braking performance; if the tires are seriously low on air, the car won't even be safe to drive. Check inflation at least every couple thousand miles.

#2 Check your tires tread. When you check the tires air pressure, check the tread too. The minimum legal tread depth is 1/16 of an inch (check it by placing a penny in one of the grooves; if you can't cover up any of Lincoln's head, you don't have 1/16 depth). However, many experts recommend at least 1/8 inch for safe driving (use a nickel instead of a penny; the top of Jefferson's head is 1/8 of an inch from the edge of the coin), and even more is best for driving in snowy conditions. Regardless, watch for uneven wear, which means there's another problem (usually misalignment).

#3 Get your wheels aligned. Proper alignment improves handling, reduces tire wear, and is necessary for safety. An alignment every two years or 30,000 miles is a minimum for most vehicles; if you drive on rough roads (including those with potholes) a lot, you'll want an alignment about every year.

#4 Inspect the bushings and joints. At every oil change, your mechanic should (and probably will) check every suspension and steering system bushing and joint for wear or damage. Also, older vehicles' tie rod ends and ball joints may need to be lubricated periodically. (Most modern cars and trucks have sealed joints.) Such checks and, if necessary, joint lubrication are a standard part of a wheel alignment and full-service oil changes.

#5 Inspect the shocks. Shock absorbers and struts should be checked for leakage, as a leaking shock will soon need replacement and may contribute to damage to other suspension components. As with bushings and joints, this inspection is a normal part of wheel alignment and usually of a full-service oil change.

The best approach to keeping your suspension working well for as long as possible is to check for wear on a regular basis, and fix any problem as soon as you find it rather than letting the damage — and the eventual cost — build up.

Text 6B. PROBLEMS WITH SUSPESION COMPONENTS

Loud banging noise from front on rough ground. This kind of noise will be related to a worn or broken suspension component that will need to be replaced. The most likely cause is worn anti-roll bar drop links. These are the bars that connect the anti-roll bar to the suspension arm to reduce body roll. When the bushes at each end wear out, they will make a banging sound, especially when you are travelling over speed bumps or hit a pothole. These bushes are relatively cheap and easy to change and should be available from your local car parts shop. Change these parts first, and also have the rest of the suspension components inspected for wear. If you are going to let a garage do the work, then perhaps you could have the mechanic confirm exactly what the fault is first.

Steering pulling to the left or right (not under braking). If, when driving, you notice that the car is pulling to one side instead of straight ahead, there are a number of possible causes:

• Poorly matched tyre pressures. Even a small amount of difference between tyre pressures of the front two wheels can cause the car to pull to one side. Check that all of the tyres have the correct amount of pressure in them as per the manufacturer's recommendations.

• Poor wheel alignment. If the wheels are not correctly aligned in relation to each other and the car, pulling and excessive tyre wear can result. Possible causes are hitting a kerb resulting in suspension damage, a badly repaired vehicle or worn out suspension/steering components. Take the car to a wheel alignment specialist (usually found in tyre and exhaust centres) which will check and adjust alignment of the wheels. You may also receive advice about any worn parts that are causing the misalignment.

• Brake binding. A brake caliper that is not releasing correctly will cause the brake pads on one side to always be in contact with the brake disc. This will result in slight pulling to the side of the binding brake. A quick check for this, after a drive, is to compare the temperature of each wheel to see if the one you feel is dragging is getting hotter than its opposite number. Have this problem investigated before it gets worse and causes a warped brake disc. The mechanic may repair or replace the faulty caliper.

Nail/debris stuck in tyre. If you know that you have a nail or something else relatively small stuck in a tyre, you will need to get the puncture fixed or the tyre replaced. If you do have to drive the vehicle to a garage with that tyre on it, do not take the object out of the tyre as it will probably be plugging the puncture or at least slowing down the leak. You can use emergency puncture repair foam as a temporary fix to inflate the tyre until you can get the puncture repaired or the tyre replaced. These products are readily available from most car parts shops and many fuel filling stations: a useful item to carry in the car in case of a puncture. Note that these products work best where a straightforward puncture has occurred, eg a nail in the tread. If you have driven on the flat tyre for any distance or there is damage to the sidewalls, the product cannot be used.

Uneven tyre wear. The tyre treads should wear at an even rate across their width, so if you notice more wear in different places, look into this further. The first thing to check is that the tyre is inflated sufficiently. An overinflated tyre will experience more tread wear in the centre of its tread. An under-inflated tyre will experience more tread at the outside edges. If you see high tread wear on one edge, this is an indication that there is a wheel alignment problem, and, possibly, worn suspension components. You will need to take the car to a wheel alignment specialist (at tyre and exhaust centres) which will check and adjust the alignment of the wheels. You will also receive advice about any worn parts that are causing the misalignment. A tyre that does not make correct contact with the ground cannot provide its full level of grip. It is important to have the necessary alignment adjustments made and to change any worn suspension/steering parts.

Text 6C. INNOVATIONS: SHOCK ABSORBERS

Driving around today, you may take for granted that you don't feel the impact of every small bump or rock in the road, but these little impacts caused passengers in early cars quite a bit of discomfort. All vehicles available on the market today are equipped with shock absorbers. This little tool was invented by vehicle manufactures in order to improve driving stability and increase passenger comfort. Designed to absorb shock impulses, it converts the kinetic energy of an impact into a different type of energy. This energy is most typically turned into heat and then dissipated.

Early Prototypes. Car manufacturers worked to dampen shock for passengers as soon as vehicles were available to the public. The first shock dampening tools widely used on cars were called leaf springs. The tool used a spring between mechanical leaves that dampened shock impact. A review of them in 1912 pointed out that they were largely unreliable as a shock dampening mechanism and did not operate well when wet.

The Telesco Shock Absorber was the first hydraulic dampener to go into mass production. First unveiled to the public at the 1912 Olympia Motor Show, it was constructed of a telescopic unit with a spring inside. It also contained oil and an internal valve, allowing oil to absorb shock in the rebounding direction. The Telesco Shock Absorber was made to fit at the rear end of a leaf spring so that it could be easily applied to existing vehicles. The concern that rose from this was that the damping was not applied to the main leaf spring, but only to the spring inside the telescopic unit.

The Birth of Modern Shock Absorbers. Maurice Houdaille patented an original concept in 1908 that addressed the main leaf spring movement. The first production hydraulic dampers were likely based on these designs by Houdaille. They utilized a lever arm that controlled hydraulically damped vanes inside the unit. The biggest advantage that this new concept provided was that it had the ability to resist sudden movement while simultaneously allowing for slow movement. The problem facing rotary friction dampers was that they often became stuck and then offered the same resistance across all speeds of movement.

Although this idea was the birth of today's shock absorber, it was not widely commercialized until the end of World War I. These lever arm shock absorbers were most notably implemented as standard equipment on the 1927 Ford Model A.

Types of Shock Absorbers. Today, vehicles are equipped with either a twin-tube or mono-tube shock absorber, although there are some variations on these models.

Twin-tube shock absorbers are equipped with two cylindrical tubes. There is a compression valve at the base of the device. When a piston is forced up or down on the road, hydraulic fluid pumps between chambers in the piston and the valves, absorbing the energy of impact and converting it into heat.

Mono-tube shock absorbers have only one of the cylindrical tubes, yet they do have two pistons. Due to only having one tube, this design lacks directionality and can be mounted on a vehicle either way. Because of this, the mono-tube shock was considered to be a breakthrough advancement when it was first invented in the 1950s.

References

1. Collins, C. First Aid for Your Car: Your expert guide to common problems & how to fix them / C.Collins. – Dorchester : Veloce Publishing, 2013. – 128 p.
2. Crolla, D. Encyclopedia of Automotive Engineering / D. Crolla. – Chichester : Wiley, 2015. – 4101 p.
3. Bellis, M. Inventors of the Spark Plug [Электронный ресурс] / M. Bellis // ThoughtCo. –2020. – Режим доступа: thoughtco.com/inventors-of-the-spark-plug-4074529. – Дата доступа: 05.11.2021.
4. https://bmorsenterprise.com/tips/
5. https://www.howacarworks.com
6. https://charge-magazine.abb.com/birth-of-an-idea-etienne-lenoir-and-the-internal-combustion-engine/
7. https://cartreatments.com/bad-ignition-coil-symptoms/
8. https://www.youi.com.au/youi-news/the-warning-signs-of-steering-problems
9. https://www.cbac.com/yukon/media-center/blog/2015/october/5-easy-steps-to-maintain-the-power-steering-syst/
10. https://thenewswheel.com/history-of-steering-wheels/
11. https://simardautomotive.com/blog/6-common-signs-of-a-cooling-system-problem
12. http://www.crankshift.com/radiator/
13. https://www.popsci.com/cars/article/2012-09/innovations-driving-shock-absorbers/
14. http://advantagecollisioncenter.com/history-of-shock-absorbers/

Учебное издание

Составитель:
Прокопюк Ольга Васильевна

«Технический перевод (английский язык)» сборник текстов

для самостоятельной аудиторной работы студентов специальностей
1-37 01 06 Техническая эксплуатация автомобилей
1-37 01 07 Автосервис

Текст печатается в авторской редакции, орфографии и пунктуации

Ответственный за выпуск: Прокопюк О. В.
Редактор: Митлошук М. А.
Компьютерная вёрстка: Соколюк А. П.

Подписано в печать 03.12.2021 г. Формат 60х84 $^{1}/_{16}$. Бумага «Performer».
Гарнитура «Arial». Усл. печ. л. 1,4. Уч. изд. л. 1,5. Заказ № 1315. Тираж 18 экз.
Отпечатано на ризографе учреждения образования «Брестский государственный технический университет». 224017, г. Брест, ул. Московская, 267.
Свидетельство о государственной регистрации издателя, изготовителя, распространителя печатных изданий № 1/235 от 24.03.2014 г.