The Analysis of Gas Balloon Supply Systems

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ABSTRACT

Gas engines are widely used in modern urban vehicles. It uses compressed or liquefied natural, industrial and synthetic gases. The basic scheme of the gas supply system, the order of operation and requirements to them, and the advantages and disadvantages of the system are discussed.

Keywords: Gas Cylinder Engines, Gaseous Fuel, Gas Cylinders, Reducer.

Introduction

Gas engines are widely used in modern urban vehicles. It uses compressed or liquefied natural, industrial and synthetic gases. Compressed and liquefied gases are stored in special cylinders, which is why vehicles are called gas cylinders. It is usually created based on gas-powered engines produced in series (mass) on liquid fuels. When a series (mass-produced) engine is converted to gaseous fuel, its main parts and components remain unchanged. The main differences between the gas-fired modifications are the fuel transmission system, the ignition and the regulation of the combustible mixture [1-4].

Materials and methods

There are two ways to convert carburettor engines to gaseous fuel. The first method is to equip a regular carburettor engine with gas-cylinder devices and create its gas modification. In this case, the engine can run on both gasoline and gas. At the same time, when the engine reaches full power in gasoline, the power in the gas decreases slightly. The second method is to create a special gas engine from a carburettor engine that reaches full power on gaseous fuel [5-9]. The efficiency of these engines is significantly improved due to the increased compression ratio and the installation of a gas mixer. There are two ways to convert diesel engines to gaseous fuel. The first method is to re-equip (turn) the diesel into a spark-ignited gas engine. Therefore, the compression ratio in the cylinders will be reduced to 8-9, and an ignition system and gas cylinder devices will be installed. The second method (gas diesel) involves running the engine on diesel and gas at the same time. The engine is equipped with a gas cylinder for the transmission of small amounts of fuel. The gas is passed through a mixer to the inlet pipe and absorbed into the cylinders by mixing with air. At the end of the compression stroke, the cylinders are sprayed with diesel fuel, which acts as a spark. Its amount is 20 per cent of the amount consumed in a typical diesel process. This method does not require any major changes to the engine design. The gas diesel method is widely used for car engines. Both methods are used for most stationary engines. The operating cycle of a gas engine is almost no different from the operating cycle of a gasoline engine. A set of tools (equipment) installed in a car to run an engine on gaseous fuel is called a gas cylinder device.

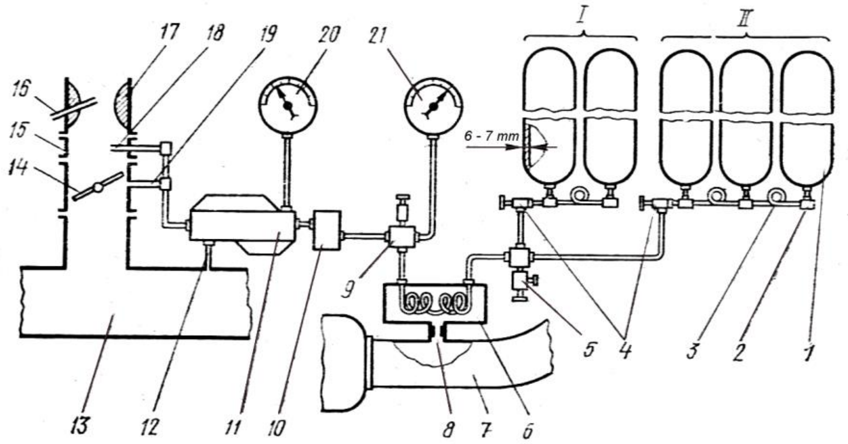

Figure 1. Schematic diagram of gas cylinder equipment

1 cylinder; 2 connecting fittings; 3 steel tubes; Consumption tap 4; Filling tap 5; Heater 6; 7 exhaust gas pipeline; 8 dosing washers; 9th main tap; 10-filter; 11-reducer; 12 connecting pipe with pipe; 13 inlet pipe; 14- throttle valve; Base 15; 16-sprayer; 17 carburetor-mixer; 18-nozzle; 19-salt processing tube; 20 low-pressure manometer; 21 high pressure manometer.

Gas cylinder devices are mainly divided into two types: compressed and liquefied gases. The peculiarity of the gas cylinder device is that the gas flows in the cylinders under high pressure in any case. Therefore, a reducer is installed in the system, which allows reducing the gas pressure. The schematic (basic) scheme of liquefied gas cylinder equipment is shown in Figure 1 below, and the schemes of its location in cars are shown in Figure 2. Compressed gas up to a pressure of 20 MPa is stored in five steel cylinders (1) installed under the platform with a capacity of 50 *l* each, divided into two groups (I and II) [10-17]. The cylinders are connected by connecting fittings (2) and tubes (3). They are equipped with compensators to prevent the tubes (3) from breaking due to the differentiation of the car frame. The discharge valve (4) from the gas cylinders passes through the heater (6) to the main valve (9), then through the filter (10) and passes to the reducer (11). In the gearbox, the gas pressure is reduced to atmospheric pressure.

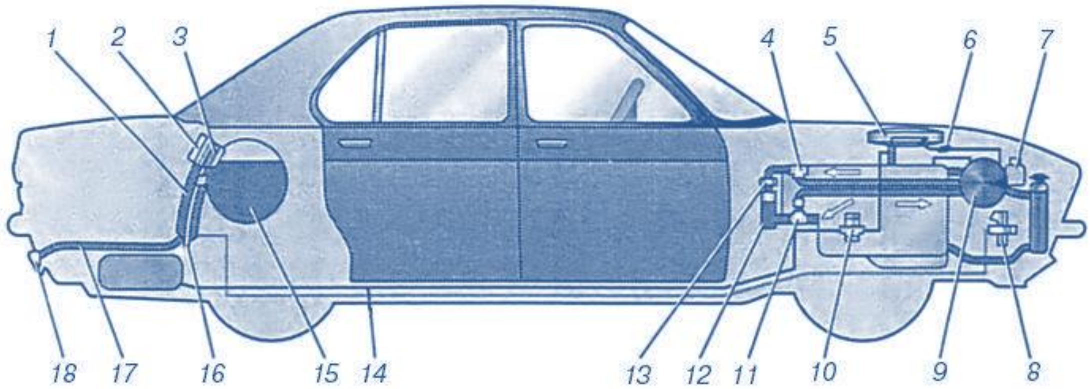

Figure 2. Scheme of placement of gas equipment in the car.

1 - ventilation duct; 2 - airtight box; 3 - armature; 4, 11 - tees; 5 - mixer; 6 - dispenser; 7 - control unit; 8 - solenoid gas valve with filter; 9 - reducer evaporator; 10 - solenoid petrol valves; 12 - salon heater; 13 - heater coil; 14– high pressure pipeline; 15 - duralumin cylinder; 16 - ejectors; 17 - transition pipe; 18 - Filling device.

Due to the sudden drop (expansion) of the gas pressure, if it is wet, freezing can cause the system to malfunction. Therefore, the gas is passed through the heater (6). The heat of the gases used to heat the gas is used (7, 8). When the engine is not running, the reducer closes the gas line. In a running engine, the gas passes through a nozzle (18) to the carburettor-mixer (17) and mixes with air to form a gas-air mixture. In salt operation, the gas is introduced directly into the bottom of the throttle through a tube (19). Using a high-pressure manometer (21), the gas pressure in the cylinders and the amount proportional to it are monitored. Using a low-pressure manometer (20), the operation of the reducer is monitored. Both manometers are also mounted on the instrument panel in the cab. The cylinders are filled with gas through the valve (5). The device shown in the picture is universal, thanks to the fuel system in reserve, which allows you to work normally on gasoline, as a precaution. In liquefied gas appliances, the vaporization of the gas takes place in a special heat exchanger, ie an evaporator. The specificity of a liquefied gas device is that the operating pressure does not depend on the amount of gas in the cylinder, but on the component composition of the mixture and the ambient temperature to determine the amount of liquefied gas in the cylinder, unlike a compressed gas device. A liquefied gas appliance requires a special level indicator. The liquefied gas is stored under a platform and is stored in a 225-litre cylinder 20, which is attached to the left side of the frame. Ventilation valves are installed on the front wall of the cylinder, through which the gas passes from the cylinder tip (flange) to the 19-speed valve 18. The gas is drawn from the liquid phase through the overflow valve installed above [18-26].

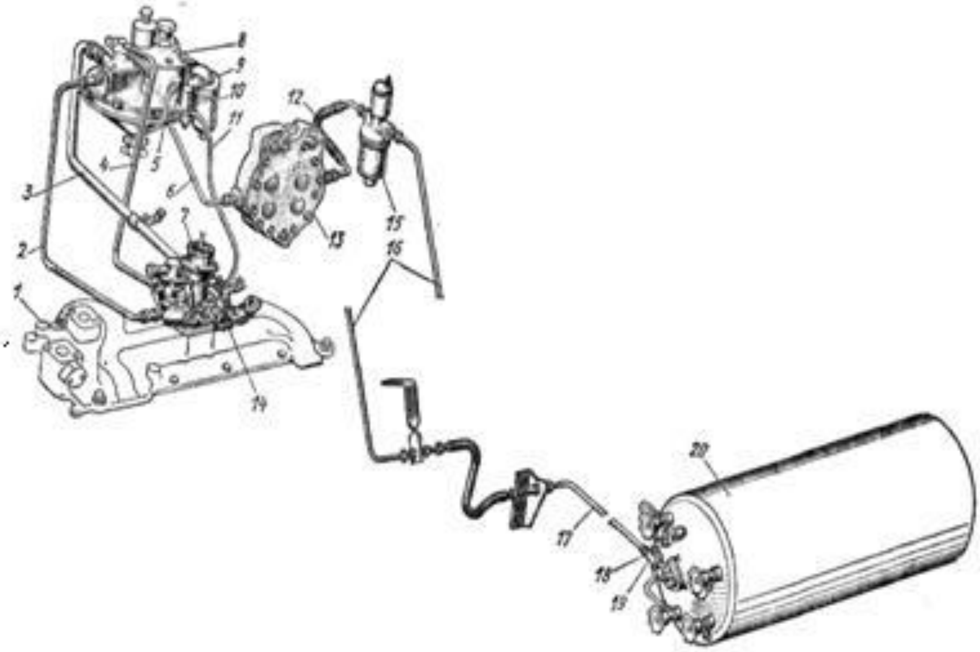

Figure 3. Scheme of the liquefied gas supply system of the car
1 - ventilation duct; 2 - airtight box; 3 - armature; 4, 11 - tees; 5 - mixer; 6 - dispenser; 7 - control unit; 8 - solenoid gas valve with filter; 9 - reducer evaporator; 10 - solenoid petrol valves; 12 - salon heater; 13 - heater coil; 14– high pressure pipeline; 15 - duralumin cylinder; 16 - ejectors; 17 - transition pipe; 18 - Filling device.

From the flange (flange) (19) the gas passes through the tubes (16, 17) to the solenoid valve (15). When the ignition is switched on, the gas is routed through a high-pressure hose (12) to the evaporator (13) mounted on the engine inlet manifold (1). The gas from the evaporator (13) enters the two-stage reducer (8) and reduces the pressure. A filter (9) is installed before the first stage of the gearbox. From the second stage of the gearbox, the gas passes to the dosing-economizer device and from there is sent the required amount of gas to the mixer (7) in accordance with the operating mode of the engine. The engine starting system includes a solenoid actuating valve (10) with hoses, hoses and valve shut-off valves. When the cold engine ignition start valve is connected, the gas passes from the first stage of the reducer through the pressurized tube (2) to the mixing system. The operation of the supply system is monitored by a manometer mounted on the driver's cab. After the first stage of the gearbox, the gas pressure should be 0.12-0.15 MPa [29-36]. The function of the gas reducer is to reduce the pressure of the gas entering (passing) from the cylinder to the engine, automatically adjusting (changing) the amount of gas supplied to the mixer in accordance with the operating modes of the engine and instantly disconnecting the gas line when the engine stops. From a design point of view, automotive gas reducers are two-stage automatic pressure regulators of various sizes, consisting of a dosing device, reducing devices and a pneumatic-driven economizer.

Results

The high-pressure reducer is designed to reduce the pressure of the compressed gas from 20 to 0.9-1.15 MPa. The decrease in gas pressure in the gearbox is caused by its expansion during the transition from the gap between the valve and the seat to the low-pressure chamber. The compressed gas enters the high-pressure cavity through a nozzle. The flap opens under the influence of the pressing spring force. This force is transmitted to the valve through the diaphragm and the impeller until it is balanced by the gas pressure under the diaphragm. Once the forces are balanced, the valve closes under the action of a spring. The reducer automatically maintains the working pressure. If the pressure is less than

0.45 MPa, the reducer valve will open continuously and the control light in the driver's cab will illuminate. If for some reason, the working pressure exceeds 1.7 MPa, the safety valve is activated. A gas heater is necessary to preheat the gas, especially in winter. Without a heater, the carbon dioxide and moisture in the gas can freeze in a high-pressure reducer. The heater's short inlet pipe is connected to the receiving pipe on the left side of the noise suppressor by means of a flexible metal branch. the liquefied gases are released into the atmosphere through a short exhaust pipe from the heater. The gas enters the solenoid valve filter from the reducer at a pressure of 0.9-1.15 MPa. The filter housing consists of a solenoid valve, a damp filter element, a cap, and inlet and outlet nozzles. When the ignition system is disconnected, the solenoid valve is closed under the action of the spring and does not transfer the gas to the low-pressure reducer. When the ignition system is connected, the valve opens and the gas cleared of mechanical impurities enters the low-pressure reducer and then the mixer and carburettor. When the filter cap is mounted on the housing, it is sealed with a rubber ring. A low-pressure gas reducer is a diaphragm-type unit that transmits power from the diaphragm to the valve by means of levers, automatically adjusting the pressure in two stages. The main function of the reducer is to reduce the pressure of the gases entering the mixer. In addition to adjusting the pressure in the gearbox, the amount of fuel required for different operating modes of the engine is automatically adjusted using a dosing-economizer device. At the outlet of the gearbox when the engine is not running, there is a membrane-spring-type discharge device connected to the inlet pipe of the engine to ensure overpressure of the gas and more reliable closing of the gas main. The gearbox has two stages, each of which has an adjustment valve, a flat membrane made of rubber tissue, a spring and a lever connecting the diaphragm to the valve. The supply gasoline system is different from the carburettor and mechanical sprayers. As an example, consider a multi-point mixture spraying system. A schematic diagram of the structure and principle of operation of the system is shown in Figure 4. The preparation of the mixture and its transfer to the injector system is controlled by an onboard computer system. The amount of fuel sprayed by the injector (injector) (21) enters the onboard computer called the electronic block controller (EBC) 7. The fuel comes from the fuel tank (5) to the inlet pipe through the filter (4) using a gas pump (3). The voltage at the gas pump is taken from the ignition switch via switch (1) and relay (2).

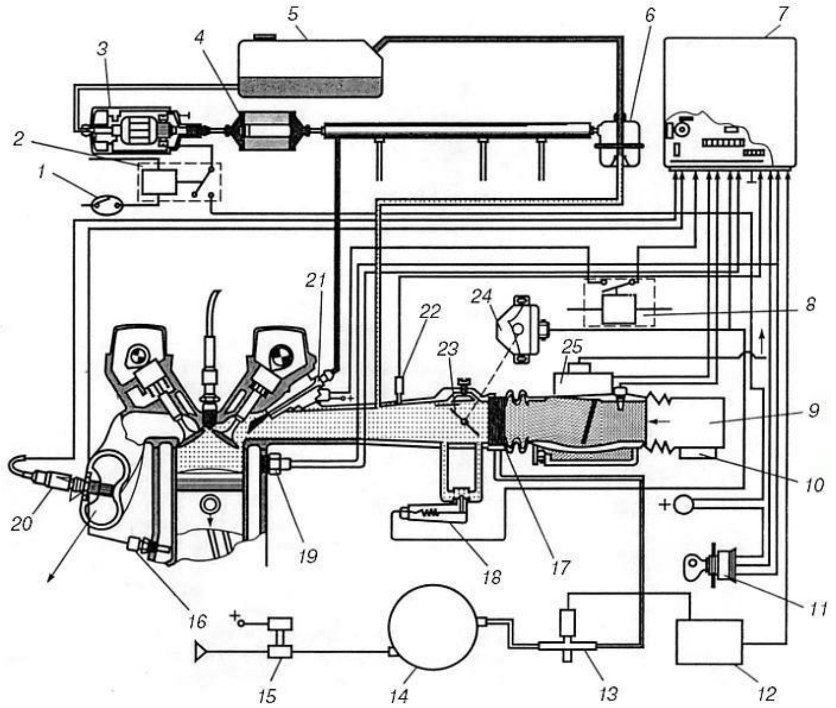

Figure 4. Schematic of a multi-point spray system

1 - "Gasoline-Gas" connector; 2 - fuel pump relay; 3 - gasoline pump; 4 - fuel filter; 5 - gas tank; 6 - pressure regulator; 7 - EBC; 8 - injector relay; 9 - air filter housing; 10 - valves; 11 - power lock; 12 - electronic block; 13 - dispenser; 14 - low pressure reducer; 15 - solenoid valve-filter; 16 - temperature sensor; 17 - gas mixer; 18 - valves; 19 - sensor; 20 - lambda-probe; 21 - gasoline injectors; 22 - sensor; 23 - throttle valve; 24 - electric motor; 25 - air flow meter.

The fuel is injected into the inlet pipes using its injectors 21, with the electrical circuit connected to the EBC. The signal from the EBC changes the amount of fuel in the engine combustion chamber. The driver controls the engine operation by changing the position of the throttle valve 23 installed in front of the inlet manifold. The air transfer control is served by a salt walk valve 18. The valve operates on the EBC signal. Information on the amount of air entering the engine and the condition of the crankshaft and distribution shafts, engine temperature, detonation, etc. are obtained through sensors installed in the EBB. The main components of the catalytic neutralizer harmful emissions installed in the exhaust tract are the ratios of the amount of CO, CH, NOx between fuel and air (1: 14.7 for gasoline and air; 1: 16.1 for propane-butane and gas). 1: 17.2 ratios) quickly normalizes. The oxygen sensor used is also called a lambda probe. The amount of unburned oxygen in the continuous combustion chamber is indirectly expressed by indicator 1. The nozzle injects the required amount of mixture into the combustion chamber, with a coefficient of 1 or slightly lower. Thus the efficient operation of the catalytic neutralizer is ensured. Currently, there are many principles and design schemes of the injection system, which are selected based on the design, structure and other technical and economic characteristics of car engines.

References

1. Багдасаров И. ., Савельев Г. ., Бакиров Ю. ., Брагин А. (1999). Газовый двигатель с искровым зажиганием. *Газовая промышленность*. №10, с. 32.
2. Григорьев Е., Колубаев Б., Ерохов В., Зубарев А. (1989). Газобаллонные автомобили. М.: «*Машиностроение*». 217-277.
3. Горбунов, В. В., & Патрахальцев, Н. Н. (1998). Токсичность двигателей

внутреннего сгорания. *Изд-во РУДН*. 214 с.

4. Ismadiyorov, A. A., & Sotvoldiyev, O. U. (2021). Model of assessment of fuel consumption in car operation in city conditions. *Academic research in educational sciences*, *2*(11), 1013-1019.
5. Абдурахмонов, А. Г., Одилов, О. З., & Сотволдиев, У. У. (2021). Альтернативные пути использования сжиженного нефтяного газа с добавкой деметилового эфира в качестве топлива легкового автомобиля с двигателем искрового зажигания. *Academic research in educational sciences*, *2*(12), 393-400.
6. Abduraxmonov, A., Oʻ. Sotvoldiyev & Tojiboyev, F. (2021). Korxonada shinalar va harakatlanuvchi tarkibni tahlil qilish va tekshirilayotgan harakat tarkibining xususiyatlari. *Academic research in educational sciences*, *2*(11), 1357-1363.
7. Сотволдиев, У., Абдубаннопов, А., & Жалилова, Г. (2021). Теоретические основы системы регулирования акселерационного скольжения. *Scientific progress*, *2*(1), 1461-1466
8. Abdukhalilovich, I. I., & Obloyorovich, M. H. (2020). Support for vehicle maintenance. *Asian Journal of Multidimensional Research (AJMR)*, *9*(6), 165-171.
9. Ikromov, I. A., Abduraximov, A. A., & Fayzullayev, H. (2021). Experience and Prospects for the Development of Car Service in the Field of Car Maintenance. *ISJ Theoretical & Applied Science, 11 (103),* 344-346.
10. Muxammadjonovich, K. N. M., & Abduxalilovich, I. I. (2021). Substantiation of Deep Softener Parameters that Cut the Vine Roots and Apply Fertilizer in a Wide-Band Manner. *Central asian journal of theoretical & applied sciences*, *2*(12), 56-59.
11. Gʻolibjon Ulugʻbek oʻgʻli Jaloldinov (2021). Texnik xizmat koʻrsatish va ta'mirlashning texnologik jarayonlarini tashkil etish. Academic research in educational sciences, 2 (11), 1006-1012.
12. Qobulov, M. A. O., & Abdurakhimov, A. A. (2021). Analysis of acceleration slip regulation system used in modern cars. *ACADEMICIA: An International Multidisciplinary Research Journal*, *11*(9), 526-531.
13. Tursunaliyev, I. E., Ergashev, I. E., Tursunov, D. M., & Abdurahimov, A. A. (2021). Simulation of wear of the piston ring of the internal combustion engine. *Asian Journal of Multidimensional Research*, *10*(9), 353-362.
14. Эшметов, И. Д., Салиханова, Д. С., Абдикамалова, А. Б., Абдурахимов, А. А., & Усманов, Р. М. (2020). Разработка технологической схемы получения гранулированных композиционных адсорбентов на основе древесного угля и дефеката. *Science and Education*, *1*(6), 42-49.
15. Abdukhalilovich, I. I., & Abdujalilovich, J. A. (2020). Description Of Vehicle Operating Conditions And Their Impact On The Technical Condition Of Vehicles. *The American Journal of Applied sciences*, *2*(10), 37-40.
16. Fayziyev, P. L. R., OʻG, G. O. U. B., & Jaloldinov, L. (2021). Avtomobil texnikalariga servis xizmat ko ʻrsatishning bosqichlari. *Academic research in educational sciences*, *2*(11), 1114-1120.
17. Абдурахмонов, А. Г., Одилов, О. З., & Сотволдиев, У. У. (2021). Альтернативные пути использования сжиженного нефтяного газа с добавкой деметилового эфира в качестве топлива легкового автомобиля с двигателем искрового зажигания. *Academic research in educational sciences*, *2*(12), 393-400.
18. Файзиев, П. Р., Исмадиёров, А., Жалолдинов, Г., & Ганиев, Л. (2021). Солнечный инновационный бытовой водонагреватель. *Science and Education*, *2*(6), 320-324.
19. Abduraxmonov, A., & Tursunov, D. (2021). Gaz dizelda ishlovchi dvigatellarini sovitish tizimi. *Science and Education*, *2*(7), 226-232.
20. Qobulov, M., Jaloldinov, G., & Masodiqov, Q. (2021). Existing systems of exploitation of motor vehicles. *Экономика и социум*, (4-1), 303-308.
21. Babaev, B., Ziyaev, A., Ziyavitdinov, J., Rakhmonova, G., Bozorov, S., & Jaloliddinov,

F. Synthesis, structure and toxicity of 2, 5-bis-(izopropyl-oxycarbonylmethylenthio)-1, 3, 4-Thiadiazole. In *XIII International Symposium on the Chemistry of Natural Compounds (ISCNC 2019)* (p. 69).

22. Khusanjonov, A., Makhammadjon, Q., & Gholibjon, J. (2020). Opportunities to improve efficiency and other engine performance at low loads.
23. Solomatov, V. I., Mamajonov, A. U., Yunusaliev, E. M., & Qosimov, L. M. (2022). The formation of concrete macrostructure. *ISJ Theoretical & Applied Science*, *2*(106), 170-178.
24. Обидов, Н., Рузибаев, А., Асадова, М., & Ашуров, Ш. (2019). Выбор зубьев ковшей одноковшовых экскаваторов зависимости от условий эксплуатации. In *World Science: Problems And Innovations* (pp. 89-92).
25. Tojiev, R. R., & Mirzakulov, K. C. (2020). Treatment of dried and mixed salts of Karaumbet in magnesium hydroxide following sodium sulfate and chloride production. *Test Engineering and Management*, *83*(5-6), 7101-7108.
26. Рузибаев, А. Н., Обидов, Н. Г., Отабоев, Н. И., & Тожибаев, Ф. О. (2020). Объемное упрочнение зубьев ковшей экскаваторов. *Universum: технические науки*, (7-1 (76)).
27. Обидов, Н. Г. (2019). Фрезерные дорожные машины в условиях эксплуатации в жарком климате узбекистана. In *Подъемно-транспортные, строительные, дорожные, путевые машины и робототехнические комплексы* (pp. 377-379).
28. Ismadiyorov, A. A., & Sotvoldiyev, O. U. (2021). Model of assessment of fuel consumption in car operation in city conditions. *Academic research in educational sciences*, *2*(11), 1013-1019.
29. Абдурахмонов, А. Г., Одилов, О. З., & Сотволдиев, У. У. (2021). Альтернативные пути использования сжиженного нефтяного газа с добавкой деметилового эфира в качестве топлива легкового автомобиля с двигателем искрового зажигания. *Academic research in educational sciences*, *2*(12), 393-400.
30. Сотволдиев, У., Абдубаннопов, А., & Жалилова, Г. (2021). Теоретические основы системы регулирования акселерационного скольжения. *Scientific progress*, *2*(1), 1461-1466.
31. Тилляходжаев Р.Р., Журабоев А.З. (2019). Расчет электродвигателя для серийного автомобиля с ДВС. In Сборник научных трудов. Ташкент, ТашГТУ, 165-167.
32. Leitman, S., & Brant, B. (2013). *Build your own electric vehicle*. McGraw Hill Professional.
33. Abdukhalilovich, I. I., & Obloyorovich, M. H. (2020). Support for vehicle maintenance. *Asian Journal of Multidimensional Research (AJMR)*, *9*(6), 165-171.
34. Эшметов, И. Д., Салиханова, Д. С., Абдикамалова, А. Б., Абдурахимов, А. А., & Усманов, Р. М. (2020). Разработка технологической схемы получения гранулированных композиционных адсорбентов на основе древесного угля и дефеката. *Science and Education*, *1*(6), 42-49.
35. Абдурахмонов, А. Г., Одилов, О. З., & Сотволдиев, У. У. (2021). Альтернативные пути использования сжиженного нефтяного газа с добавкой деметилового эфира в качестве топлива легкового автомобиля с двигателем искрового зажигания. *Academic research in educational sciences*, *2*(12), 393-400.
36. Babaev, B., Ziyaev, A., Ziyavitdinov, J., Rakhmonova, G., Bozorov, S., & Jaloliddinov, F. Synthesis, structure and toxicity of 2, 5-bis-(izopropyl-oxycarbonylmethylenthio)-1, 3, 4-Thiadiazole. In *XIII International Symposium on the Chemistry of Natural Compounds (ISCNC 2019)* (p. 69)