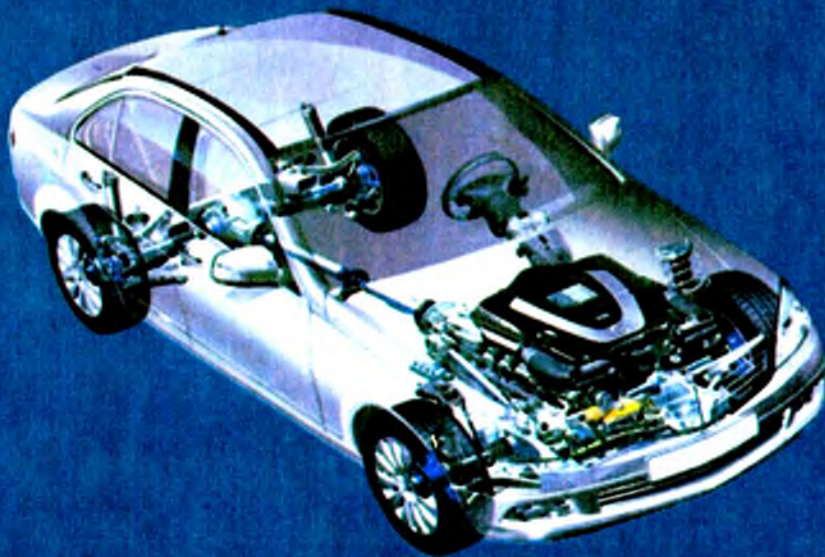


A.Muhitdinov, B.Sattivaldiev,
Sh.Xakimov

TRANSPORT VOSITALARINING TUZILISHI **DESIGN OF VEHICLES**



O'ZBEKISTON RESPUBLIKASI OLIY VA O'RTA
MAXSUS TA'LIM VAZIRLIGI

A.Muhitdinov, B.Sattivaldiev, Sh.Xakimov

TRANSPORT VOSITALARINING TUZILISHI

DESIGN OF VEHICLES

Professor **O.Salimov** tahriri ostida

*O'zbekiston Respublikasi Oliy va O'rta maxsus ta'lim vazirligi
tomonidan oliy o'quv yurtlarining „Yer usti transport tizimlari
va ularning ekspluatatsiyasi“ ta'lim yo'nalishi talabalari uchun
o'quv qo'llanma sifatida tavsiya etilgan*

Ushbu o'quv qo'llanma O'zbekiston Respublikasi Prezidentining 2012-yil 10-dekabrda „Chet tillarni o'rganish tizimini yanada takomillashtirish chora-tadbirlari to'g'risida“ Qarorini bajarishga qaratilgan tadbir maqsadida yaratildi.

O'quv qo'llanmada O'zbekistonda ishlab chiqarilayotgan va transport xizmatlarida keng tarqalgan avtomobillar va ixtisoslashtirilgan transport vositalarining agregat va tizimlarining vazifasi, tuzilishi vaishlash prinsipi ikki tildauzviy keltirilgan. Ma'lumotlar, mohiyatlar va materiallarning yozilishi bakalavr uchun mutaxassislik fani va ingliz tilini oson qabul bo'ladigan tarzda bo'lishiga alohida e'tibor qaratildi.

O'quv qo'llanma „5310600 — Yer usti transport tizimlari va ularning ekspluatatsiyasi“ ta'lim yo'nalishining Davlat ta'lim standarti asosida yozilgan hamda avtomobil tuzilishi fani bo'lgan barcha ta'lim yo'nalishiari uchun ham tavsiya qilinadi.

O'quv qo'llanmadan kasb-hunar kolleji o'quvchilari, pedagoglari hamda avtomobilsozlik va avtomobil transporti korxonalari muhandislari, texnik xodimlari foydalanishiari mumkin.

This manual is devoted to the implementation of the President's Decree "On Measures for Further Improvement of Foreign Languages Learning System" promulgated in December 10, 2012.

The main purpose of this manual is to describe in Uzbek and English the designs, operation principles, structures of the vehicles that are produced in our Country. When developing this manual the authors tried to a certain extent to simplify the language of description of the equipment to make it easy to understand by undergraduate students of technical Universities.

The manual is written according to the requirements "5310600 - The system of ground transportation and their exploitation" of the State Education Standard. It may be used by all the educational Institutions where automobile structure is taught as a special subject.

The manual may also be recommended to professional college students, to the teaching staff of such colleges as well as to the engineers and workers of transportation enterprises.

O'zbekiston iqtisodiyotining barqaror o'sishi va sur'atlarini ta'minlashda xomashyo ishlab chiqarishdan raqobatbardosh tayyor sanoat mollarini ishlab chiqarish hajmini oshirish siyosati oqilona yo'l ekanligini isbotladi.

Jamiyatimizning rivojlanish jadalligini ta'minlashda yuqori malakali kadrlar alohida o'ringa ega. O'zbekistonda ta'lim islohotlarining ilg'orligi zamon talab kadrlarga oshayotgan talablarga mos bo'lishi zarur. Kadrlarimizning xalqaro maydonga chiqishi va nufuzining e'tiborga sazovor bo'lishiga yo'naltirilgan O'zbekiston Respublikasi Prezidentining 2012-yil 10-dekabrda „Chet tillarni o'rganish tizimini yanada takomillashtirish chora-tadbirlari to'g'risida“ Qarorini ta'limdagi yangi islohot deb tushunish kerak. Ushbu qo'llanma mazkur Qaror talablarini bajarishga qaratilgan tadbir maqsadida yaratildi.

Iqtisodiyot rivojlanishida avtotransportning va yo'l kommunikatsiyalarining ahamiyati katta. Shuning uchun ichki bozorimizni ta'minlab chet elga eksport-bop avtomobil ishlab chiqarish sanoati ustuvor tarmoqlar qatoriga kiritilgan. Ustuvor tarmoq kadrlarining mutaxassislik bilimlari bilan bir qatorda chet tilini yuqori saviyada egallashlari alohida talab etiladi.

Shuning uchun avtosanoat korxonalariga zamonaviy konstruksiya va texnologiya yaratuvchi, transport xizmatini tashkil etuvchi va undan samarali foydalanuvchi mutaxassislarni tayyorlashda

The stable growth of Uzbekistan industry has proved that the politics of increasing the volume of ready-made competitive industrial goods is much better and wise than production of raw materials.

The role of qualified specialists is of great importance in intensifying the progress of the society. The reforms in the educational system of a country should be in accordance with the requirements in well-qualified specialists. The Decree of the President of the Republic of Uzbekistan from December 10, 2012 "On Measures for Further Improvement of Foreign Languages Learning System" is considered to be a very important document for further developing the system of education in our country.

This manual is one of the ways of the implementation of the mentioned Decree. The growth of vehicles and road communication is of great importance in the development of country's economics. To provide inner market with transportation and exportation of automobiles to foreign countries is one of the acute tasks of our automobile industry. Our specialists in all the fields along with their specialty should know foreign languages. Therefore we'll have to take care of effective teaching of foreign languages to our specialists who are going to automobile industry of the country and will be dealing with modern technology in designing and producing vehicles, organizing transport service and their effective exploitation.

ta'lim muassasalarining mas'uliyati yuqori.

Zamonaviy bozorda xilma-xil vazifalari, texnik tavsiflari, narxlari va hokazo bilan katta farq qiladigan avtomobil modellarini uchratish mumkin. Bunday holatning asosiy sabablari — bozordagi kuchli raqobat.

O'quv qo'llanmada O'zbekistonda ishlab chiqarilayotgan va transport xizmatlarida keng tarqalgan avtomobillar va ixtisoslashtirilgan transport vositalarining agregat va tizimlarining vazifasi, tuzilishi vaishlash prinsipi ikki tildauzviy keltirilgan. Ma'lumotlar, mohiyatlar va materiallarning yozilishi bakalavr uchun mutaxassislik fani va ingliz tilini oson qabul bo'ladigan tarzda bo'lishiga alohida e'tibor qaratildi.

O'quv qo'llanma mualliflarning uzoq yillar mobaynida Toshkent avtomobil-yo'llar instituti „Avtomobillar va ixtisoslashtirilgan transport vositalari“ kafedrasida uslubiy va ilmiy faoliyatlari natijalari va zamonaviy avtomobillardagi konstruktiv yangiliklarni hisobga olgan holda yozildi. Mualliflar o'quv qo'llanmaning ingliz tilidagi matnini tahrir qilishda ko'rsatgan yordamlari uchun O'zbekiston Davlat jahon tillari universiteti professori A. T. Iriskulovga o'zlarining katta minnatdorchiliklarini izhor etadilar.

O'quv qo'llanma 5310600 - „Yer usti transport tizimlari va ularning ekspluatatsiyasi“ ta'lim yo'nalishida o'qiladigan „Transport vositalari tuzilishi va nazariyasi“ fanining o'quv-uslubiy majmuasi tarkibiga kiradi.

There are many types of vehicles in the market from the point of view of their technical characteristics, tasks, specifications, prices and so on. This may be easily explained by the ever existing competition in the world market.

The manual is written in two languages. It describes the construction of the automobiles produced in the enterprises of Uzbekistan from the point of view of the purpose, construction, operation principles, their spare parts and so on. The authors tried to make the text of the book as simple as possible for students to understand it easily.

The course - book is written by the teaching staff of "The Automobiles and the Means of Specialized Vehicles" department of Tashkent Automobile and Roads Institute.

This book is first of all the conviction of the authors and the result of their many years of scientific research and practical activity in which they tried to take into account the latest ideas in the field of automobile designing and production.

Authors express their deepest gratitude to the professor of Uzbekistan State University of World Languages A.Iriskulov for the assistance rendered by him in improving the English translation of the book.

The material developed in this manual is considered to be an inseparable part of the major topic of "Construction and Theory of Vehicles" included into the educational direction 5310600- "The Ground Transportation System and Their Exploitation".

*Asl farzandlar har doim Vatanga iqbol tilaydi, uning kelajagi yo'lida
butun kuch-g'ayratini, hayotini baxsh etishga tayyor bo'ladi.*

I. Karimov

1. INTRODUCTION

1.1. TRANSPORT VOSITALARINING TASNIFI

1.1. CLASSIFICATION OF TRANSPORT

Turli xildagi avtomobillar, tirkamalar va yarim tirkamalar transport vositalarini tashkil etadi.

Avtomobil — o'zi harakatlanuvchi (autos — grekcha *o'zi*, **mobilis** — lotincha *harakatlanuvchi*) degan ma'noni bildiradi.

Avtomobil — mustaqil energiya manbayiga ega bo'lgan, quruqlikda, relssiz yo'larda yuk va odamlarni tashishga yoki unga o'rnatilgan qurilmalar yordamida maxsus ishlarni bajarishga mo'ljallangan kamfortabellik va xavfsizlikka ega bo'lgan g'ildirakli mashinadir.

Vazifasiga ko'ra avtomobillar **transport**, **maxsus** va **poyga** avtomobillariga bo'linadi.

Transport avtomobillariga **passajir**, **yuk** va **yuk-passajir** avtomobillari kiradi

Maxsus avtomobillar ma'lum ishlarni bajarishga mo'ljallangan mexanizm, asbob va uskunalar bilan jihozlangan bo'ladi. Bularga sanitariya, o't o'chirish, ko'cha supurish, yuk ortish avtomobillari kiradi.

Poyga avtomobillari sport avtomobillari

Different automobiles, trailers and semi trailers form the vehicles.

Automobile - means self-mover (autos in Greek - self, mobilis in Latin - mover).

Automobile is the wheeled machine, which has individual energy source, intended to carry the cargo and passengers on the land and roads or to do special operations with the help of devices mounted on it and has the comfort and safety.

Depending on the purpose automobiles are divided into transport, special automobiles and race cars.

Transport automobiles consist of passenger automobiles, trucks and cargo-passenger automobiles.

Special automobiles are equipped with mechanisms, devices intended to do some specific operations. The ambulance, fire tender, street sweeper, automobile-loader belong to this category.

Race cars are sport cars that are in-

bo'lib, avtomobil-sport poygasida qatnashishga mo'ljallangan.

Yuk avtomobillari yuk tashish uchun xizmat qiladi.

Passajir avtomobillari yo'lovchilarni tashish uchun mo'ljallangan bo'lib, ular ikkiga bo'linadi: **yengil avtomobillar** va **avtobuslar**. O'rindiqlar soni haydovchi o'rindig'idan tashqari 8 tagacha bo'lsa **engil avtomobil**, 8 tadan ortiq bo'lsa **avtobus** deb ataladi.

Bortlari ochiladigan universal kuzovli avtomobillarda xilma-xil yuklar tashiladi. Sochiluvchan yuklar o'zi ag'daradigan (samosval) avtomobillarda, suyuqliklar sisternali avtomobillarda, oziq-ovqatlar refrejerator-furgonlarda tashiladi. Bu avtomobillar **ixtisoslashtirilgan** avtomobillar deyiladi.

Har xil yo'llardan harakatlanish imkoniyatlariga qarab **oddiy** va **o'tag'on** avtomobillar bo'ladi:

1. Avtomobil qatnovga moslashtirilgan qattiq qoplamali yo'llarda harakatlanuvchi yetakchi g'ildiraklar bitta o'qda bo'lgan avtomobillar **oddiy** avtomobillar deyiladi.

2. Yomon va moslashtirilmagan yo'llarda harakatlanuvchi ikkita va undan ko'p o'qi yetakchi bo'lgan avtomobillar **o'tag'on** avtomobillar deyiladi.

Avtomobilga ikki va undan ortiq harakat vositalarini (tirkama va yarim tirkamalar, 1.1-rasm) ulanishidan tashkil etilgan avtoullov **avtopoyezd** deb ataladi.

Avtopoyezdlarning qo'llanilishi ish unumdorligini oshiradi va yuk tashish narxini kamaytiradi.

tended to participate in racing.

Trucks serve to carry the cargo.

Passenger automobiles are intended to carry passengers and divided into two categories: cars and buses. If the number of seats is less than 9 without the driver seat, the vehicle is called a car, if it is more than 8 the vehicle is called a bus.

Automobiles with all-purpose flap platform carry different cargoes. Quick-sand cargoes are carried by dumper, liquids are carried by cistern, foods are carried by van-refrigerator. These automobiles are called specialized automobiles.

Depending on moving possibility on different roads there are conventional and off-road trucks:

1. Automobiles moving on hard surfaced public roads and with single drive axle are called conventional automobiles.

2. Automobiles moving on poor and unsurfaced roads and with two and more drive axles are called off-road automobiles.

The transport formed by jointing to the truck two or more road vehicles (trailer, semi trailer, fig. 1.1) is called train.

Applying the trains increases the efficiency and reduces the cartage.



a)



b)



d)



e)

1.1-rasm. Tirkamalar turlari:

a—bir o'qli tirkama; b—ikki o'qli tirkama; d—yoyma-tirkama; e—yarim tirkama.

Avtomobil zavodida bir xil agregat va mexanizmlardan turli avtomobillar ishlab chiqarilsa, ulardan biri, odatda, eng ko'p chiqarilayotgan avtomobil modeli **asosiy** deb qabul qilinadi.

Asosiy model konstruksiyasidan qisman farq qiluvchi avtomobil **modifikatsiya** deb ataladi.

Avtomobillarni klassifikatsiyalash va belgilash uslublari milliy, mintaqaviy, xalqaro bo'ladi.

Yevropada yengil avtomobillar gabarit o'lchamlariga qarab klassifikatsiyalanadi.

Figure 1.1. Types of trams:

a—one-axle trailer; b—two-axle trailer; d—log trailer; e—semi-trailer.

In automobile plant, different automobiles are produced from the same assemblies and mechanisms and the model of automobile that is produced much is taken for base.

The automobile that differs a little from base model is called modification.

There are national, continental, international methods of classification and marking of automobiles.

In Europe, automobiles are classified depending on dimensions.

Klassi Class		A	V	S	D	E	F	Minivan
Gabarit o'lchami, sm Dimension, sm	Uzunligi Length	365 gacha	360-380	380-440	430-470	430-470	470-510	450-480
	Baza Wheel base	215-245	235-250	240-270	250-270	250-270	270-300	270-300
	Eni Width	145-160	155-165	167-174	167-177	167-177	180-190	175-190
	Balandligi Height	135-148	135-148	133-144	136-143	136-143	140-150	165-180

Birlashgan millatlar tashkilotining Yevropa iqtisodiy qo'mitasi ishlab chiqqan Qoidalarga muvofiq yo'l transport vositalarining barcha turlarini qamrab olgan quyidagi klassifikatsiyalash tizimi joriy qilingan:

According to Rules of European Economical Committee of United Nations Organization the following classification system is applied, which comprises all types of transport:

Turi Type	Xillari Kinds of type	Transport vositasi Vehicle	To'liq massasi, t Gross weight, t	Dvigatel ish hajmi, sm ³ Displacement of the engine, sm ³	Izoh Comment
L	L1, L2	Ikki va uch g'ildirakli With two or three wheels	Me'yorlanmaydi Not regulated	50 sm ³ va undan kichik 50 sm ³ and less than that	Mototsikl, motoroller Motorcycle, Scooter
	L3-L5			Chegaralanmagan Unlimited	
	M1	4 g'ildirakdan kam bo'lmagan va 8 ta yo'lovchi tashishga mo'ljallangan Not less than 4 wheels and intended for 8 passengers	Me'yorlanmaydi Not regulated		Yengil avtomobillar Cars

M	M2	Yuqoridagidek, 8 o'rindiqdan ko'p bo'lgan As above seats more than 8	5,0 gacha Till	Chegaralanmagan Unlimited	Avtobuslar Buses
	M3	Yuqoridagidek, 8 o'rindiqdan ko'p bo'lgan As above seats more than 8	5,0 dan katta (more than)		Avtobuslar, shu jumladan, qo'shaloqlilari Buses, also articulated buses
N	N1	4 g'ildirakdan kam bo'lmagan va yuk tashishga mo'ljallangan Not less 4 wheels and intended for carrying the cargo	3,5 gacha (till)	Chegaralanmagan Unlimited	Yuk va maxsus avtomobillar Trucks and special automobiles
	N2		3,5 ... 12,0		Yuk va maxsus avtomobillar hamda tyagachlar Trucks, special automobiles and truck-tractors
	N3		12,0 katta (more than)		
O	O1	Dvigatell bo'lmagan transport vositasi Without engine	0,75 gacha (till)	Chegaralanmagan Unlimited	Tirkama va yarim tirkamalar Trailer and semi trailer
	O2		0,75 ... 3,5		
	O3		3,5 ... 10,0		
	O4		10,0 katta (more than)		

„GM Uzbekistan“ QK avtomobil-larining turli yurtlarda klassifikatsiyalani-shi.

Classification of automobiles pro-duced at JV "GM Uzbekistan" in for-eign countries.

Modellar Models	Matiz	Spark	Damas	Nexia	Cobalt	Lacetti	Epica	Malibu	Captiva
Yevropada In Europe	A		M	C			E		J
Shimoliy Amerikada In North America	Mini compacter		—	Sub- compact cars			Midsize cars intermediates		Midsize SUV
Xitoyda In China	Small cars		Multi- Purpose Vehicles (MPV)	Category A			Category B		Sport Utility Vehicles (SUVs)

Mustaqil davlatlar hamdo'stligi (MDH)da ishlab chiqarilayotgan avtomobillar tarmoq me'yori (ON-

Automobiles, made in Common Wealth of Independent States are marked by figures and letters according to the

025270-66) bo'yicha harf va raqamlar bilan belgilanadi. Dastlabki harf belgisi avtomobil ishlab chiqargan zavodni, undan keyingi 5 ta raqamlardan dastlabki ikki raqam avtomobil klassini va turini, keyingi ikki raqam avtomobil modelini, so'nggi beshinchi raqam avtomobil modifikatsiyasining tartib raqamini bildiradi.

MDH hududida ishlab chiqilgan avtomobillar klassi quyidagicha raqamlanadi:

branch norm (ON-025270-66). The first letter mark means the factory, the first two figures of the next five figures mean the class and type of automobile, the next two figures mean the model of automobile and the last fifth figure means the number of automobile modification.

The class of automobiles made in the area of Common Wealth of Independent States are numbered as following:

Yengil avtomobillar Cars

Klassi Class	Mikro litrajli Minicar	Kichik litrajli Small displacement	O'rta litrajli Middle displacement	Katta litrajli Large displacement
Dvigatelning ish hajmi, [l] Displacement of the engine, [l]	1,2 gacha (till)	1,2-1,8	1,8-3,5	3,5 dan yuqori (more than)
Raqamlanishi Numeration	11	21	31	41

Avtobuslar Buses

Klassi Class	Juda kichik Minibus	Kichik Small	O'rtacha Middle	Katta Large	Juda katta Articulated
Uzunligi, [m] Length, [m]	5 gacha (till)	5-7,5	8-9,5	10,5-12	16,5 dan uzun (more than)
Raqamlanishi Numeration	22	32	42	52	62

Yuk avtomobillar Trucks

To'liq vazni, [t] Gross weight, [t]		1,2 gacha (till)	1,2–2,0	2,0–8	8–14	14–20	20–40	40 dan yuqori (more than)
Raqamlanishi Numeration	Bortli platforma Flap platform	13	23	33	43	53	63	73
	O'rindiqli tortqich Truck-tractor	14	24	34	44	54	64	74
	O'zi ag'daruvchi Dumper	15	25	35	45	55	65	75
	Sisternalar Cisterns	16	26	36	46	56	66	76
	Furgon Van	17	27	37	47	57	67	77
	Maxsus Special	19	29	39	49	59	69	79

Nazorat uchun savollar

Self-control questions

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Vazifasiga ko'ra avtomobillarning turlarini ayting. 2. Qanday passajir avtomobili avtobus deb ataladi? 3. Qanday avtomobillar ixtisoslashtirilgan avtomobillar deb ataladi? 4. Avtomobilning qanday modeli zavodda bazaviy hisoblanadi? | <ol style="list-style-type: none"> 1. Mention types of automobile depending on the function. 2. What passenger automobile is called a bus? 3. What kind of automobile is called specialized automobile? 4. Which model of automobile is taken for base at the factory? |
|---|--|

Ishbilarmon, mardlik va shijoat sohibi, azmi qat'iy, tadbirkor va hushyor bir kishi ming-minglab tadbirsiz, loqayd kishilardan yaxshidir.

A. Temur

1.2. AVTOMOBILNING UMUMIY TUZILISHI

1.2. GENERAL STRUCTURE OF AUTOMOBILE

Avtomobil — mustaqil energiya man-bayi bor, harakatlanadigan mashina. Avtomobil, asosan, yo'lovchi yoki yuk tashishga mo'ljallangan bo'ladi. Bu vazifalarni yengil, yuk avtomobillari va avtobuslar bajaradi. Bunday avtomobillar umumiy foydalaniladigan avtomobillar deb yuritiladi. Aniq vazifani bajarishga mo'ljallangan avtomobillar maxsus avtomobillar deb ataladi. Ularga tibbiy tez yordam, o't o'chiruvchi, sport va boshqa maxsus vazifali avtomobillar kiradi.

Avtomobil tuzilishi usluban uch qismga — dvigatel, shassi va kuzovga bo'linib o'rganiladi.

Avtomobilni harakatlantiruvchi mexanik energiyani dvigatel sodir qiladi. Dvigatel issiqlik, elektr, shamol, quyosh yoki yana boshqa turdagi energiyalarni mexanik energiyaga aylantirish uchun xizmat qiladi.

Kuzov haydovchimi va tashiladigan yo'lovchilarni, yukni joylashtirish uchun xizmat qiladi. Avtobus va yengil avtomobillarda kuzovni salon deb ham yuritiladi. Salonda haydovchi va yo'lovchilar uchun sharoit yaratilgan. Yuk avtomobillarining kuzovi, odatda, haydovchi uchun kabina va yuk uchun alohida kuzovdan tashkil topgan bo'ladi.

Automobile is moving machine that has the individual energy source. It is the main purpose of automobile to carry passengers or cargo. Cars, trucks and buses do these functions. These automobiles are called all-purpose automobiles. Automobiles intended to do exact purpose are called special automobiles. Ambulance car, fire tender, sport car and special purpose automobiles belong to those types of automobiles.

Structure of automobile is methodically described by dividing into three parts - engine, chassis and body.

The engine creates the mechanical energy that moves the automobile. The engine serves to convert the heat energy, electrical energy, wind energy, sun energy and other types of energy into mechanical energy.

Body serves to place the driver, passengers and cargo. The bus body and car body is called saloon too. Comfortable condition is created for driver and passengers in the saloon. Truck body usually consists of cabin for driver and flap platform for cargo.

Chassis sum of parts, which provides the movement of automobile by energy of the engine. Chassis comprises the

Shassi — dvigatel energiyasidan avtomobilning harakatlanishini ta'minlaydigan qismlar majmuasidir. Shassi tarkibiga transmissiya, harakat boshqarmalari va yurish qismi kiradi.

Transmissiya dvigatel (1) (1.2-rasm) momentini yetakchi g'ildiraklarga uzatadi. Transmissiya tarkibiga ilashish muftasi (6), uzatmalar qutisi (7), kardanli uzatma (8), asosiy uzatma (9) va ichidagi differensial (10) va yarim o'qlar (11) kiradi.

Boshqarmalar avtomobil harakat yo'nalishini va tormozlanishini boshqarish uchun xizmat qiladi. Boshqarmalarga rul boshqarmasi va tormoz boshqarmasi kiradi.

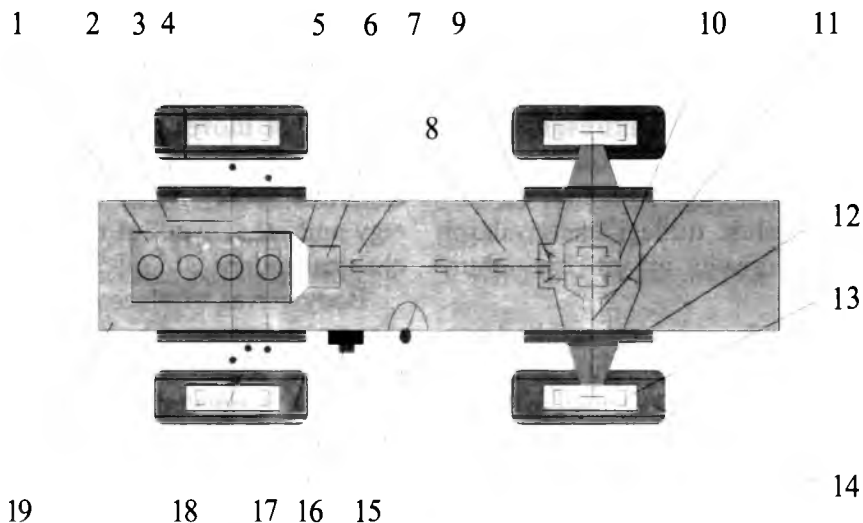
Rul boshqarmasi avtomobil harakat yo'nalishini boshqarishga xizmat qiladi. U rul mexanizmi va rul yuritmasiga bo'linadi. Rul mexanizmi qismlari: rul chambaragi (15), rul mexanizmi (16). Rul yuritmasi qismlari: bo'ylama va ko'ndalang tortqi (17), rul trapesiyasi (18).

transmission, movement controls and running gear.

Transmission passes the torque of the engine (1) (fig. 1.2) to drive wheels. Transmission consists of the clutch (6), gearbox (7), cardan drive (8), final drive (9), differential (10) and axle shafts (11).

Controls serve to manage the moving direction and braking of automobile. Controls comprise the steering and brakes.

The steering serves to control the moving direction of automobile. The steering divided into steering mechanism and steering gear. The parts of steering mechanism: steering wheel 15, steering mechanism 16. The parts of steering gear: longitudinal and transverse control arm 17, steering trapezium 18.



1.2-rasm. Avtomobilning umumiy tuzilishi.

Figure 1.2. General structure of automobile.

1—dvigatel; 2—old ko'prik; 3—osma;
4—old tormoz mexanizmi; 5—old
g'ildirak; 6—ilashish muftasi; 7—
uzatmalar qutisi; 8—kardan uzatma; 9—
asosiy uzatma; 10—differensial; 11—
yarim o'q; 12—orqa ko'prik; 13—orqa
tormoz mexanizmi; 14—orqa g'ildirak;
15—rul chambaragi; 16—rul mexanizmi;
17—bo'ylama tortqi; 18—rul trapesiyasi;
19—rama.

Yurish qismi og'irlik kuchlarini qabul qilish va harakatlanishda er bilan g'ildirak orasidagi kuchlarni avtomobil ramasiga uzatish uchun xizmat qiladi. Yurish qismiga (1.2-rasm) osmalar (3), ko'priklar (2 va 12), g'ildiraklar (5 va 14), rama (19) kiradi.

1—engine; 2—front axle; 3—suspension; 4—front brakes; 5—front wheel; 6—clutch; 7—gearbox; 8—cardan drive; 9—final drive; 10—differential; 11—axle shaft; 12—rear axle; 13—rear brakes; 14—rear wheel; 15—steering wheel; 16—steering mechanism; 17—longitudinal control arm; 18—steering trapezium; 19—frame.

Running gear serves to perceive the gravity force and passes forces created between the road and the wheel at the time of movement, to the automobile frame. Running gear (Fig. 1.2) consists of suspensions 3, axles 2 and 12, wheels 5 and 14 and the frame 19.

Nazorat uchun savollar

Self-control questions

1. Avtomobilni izohlab bering.
2. Avtomobilning asosiy qismlari.
3. Dvigatelning vazifasi nima?
4. Transmissiyaning vazifasi nima?
5. Yurish qismi qanday detallarni o'z ichiga oladi?

1. Describe the automobile.
2. Basic parts of automobile.
3. What is the function of the engine?
4. What is the function of transmission?
5. What details does running gear comprise?

1.3. IXTISOSLASHTIRILGAN TRANSPORT VOSITALARI

1.3. SPECIALIZED VEHICLES

Yuk avtomobillarining umumvazifali va ixtisoslashtirilgan turlari bo'ladi. Bort platformalari umum vazifali yuk avtomobili deb yuritiladi. Ular turli turdagi yuklarni tashishi mumkin. Ixtisoslashtirilgan avtomobillar ma'lum turdagi yuklarni tashishga mo'ljallangan — ixtisoslashtirilgan. Ixtisoslashtirilgan avtomobillar vazifasiga ko'ra quyidagi turlarga bo'lmadi:

There are all-purpose and specialized types of trucks. Trucks with flap platform are called all-purpose truck. They may carry different types of cargoes. Specialized automobiles are intended to carry the individual cargo. There are following types of specialized automobiles depending on the purpose:



Furgon
Van



O'zi yuklovchilar
Self-loaders



Sisterna
Cistern



Uzun o'lchamli yuklarni tashuvchilar
Long goods carrier



Samosval
Dumper



Og'ir vaznli yuklarni tashuvchilar
Heavy-weight goods carrier



Konteyner tashuvchi
Container carrier



Qurilish konstruksiyalarini tashuvchi
Building construction carrier

Ixtisoslashtirilgan avtomobillar tushirish-yuklashni ta'minlovchi qurilmalar bilan ham jihozlanishi mumkin.

Avtomobil-samosval o'zi tushiruvchi platforma (kuzov) bilan jihozlangan.

Avtomobil-furgon yuklarni tashqi ta'sirdan himoya qiladi. Bikir yopiq kuzov bilan jihozlangan.

Avtomobil-sisterna suyuq, gazsimon va sochiluvchan yuklarni tashiydi. Rezervuar va turli to'ldirish-to'kish qurilmalari bilan jihozlangan.

Specialized automobiles can be equipped with unloading-loading devices.

Automobile — dumper is equipped with self-loading platform (body).

Automobile — van protects the cargo from external influence. It is equipped with closed stiff body.

Automobile — cistern carries liquid, gaseous and quicksand cargoes. It is equipped with the tank and different devices for filling and pour off.

O'zi yuklovchi avtomobillar yuklarni yuklash-tushirishga mo'ljallangan mustaqil moslamalar bilan jihozlangan.

Uzun o'lchamli yuklarni tashuvchilar yog'och-materiallari (lesa), quvur (truba) va sortli metallarni (metalli prokat) tashishga moslashtirilgan.

Qurilish konstruksiyalarini tashuvchilar bir xil nomli temirbeton qurilish konstruksiyalarini (panel, ferma, plita, balka, blok, santexkabina) tashishga moslashtirilgan.

Og'ir vaznli yuklarni tashuvchilar bo'linmaydigan (ajratilmaydigan) yirik gabaritli, gabaritli emas va og'ir vaznli yuklarni tashishga moslashtirilgan. Ularga transformatorlar, atom reaktorlari, turbinalar, turli qurilish va yo'l yer qazuvchi mashinalar va hokazolar kiradi.

Konteyner tashuvchilar avtomobil, temir yo'l va dengiz floti, universal konteynerlarni tashishga moslashtirilgan.

Ixtisoslashtirilgan avtomobillar umum vazifall avtomobillarga taqqosiy ravishda quyidagi afzalliklarga ega:

1. Tashishda yuklarning sifatini hamda miqdorini yuqori darajada saqlanishligi.
2. Tushirish-yuklash jarayonini mexanizatsiyalashtirish imkoniyati.
3. Spetsifik yuklarni tashish imkoniyati.
4. Idishga (tara) bo'lgan harajatning kamaytirilishi.

Self-loaders are equipped with individual devices intended for loading and unloading.

Long goods carriers intended for carriage wood materials (wood), the pipe and rolled stocks.

Building construction carriers intended for carriage one-named iron-concrete building constructions (panel, girder, plate, beam, block, santech cabin)

Heavy weight goods carriers intended for carriage indivisible big dimension, not overall and heavy weight cargoes. Transformers, atom reactors, turbines, different building and road machines, bulldozers belong to those types of automobiles.

Container carriers intended for carriage the automobile, railway and sea fleet, universal containers.

Specialized automobiles have the following advantages relatively all-purpose automobiles:

1. Quantity and quality of cargoes is kept at high level in carriage.
2. Mechanization possibility of loading and unloading processes.
3. Carriage possibility of specific cargoes.
4. Decreasing of consumption for package.
5. Expulsion of additional operations

5. Yuklarni tashishda qo'shimcha operatsiyalarni istisno qilishligi.

6. Ba'zi bir yuklarni tashishda xavfsizlikni oshirish va sanitariya-gigiyena sharoitini yaxshilash (kimyoviy moddalar va chang tarqatuvchi yuklar).

Hozirgi paytda yuklarni qariyb 75—80 foizi ixtisoslashtirilgan avtomobillarda tashilmoqda.

in carriage.

6. Increasing of safety and improving of sanitary-hygienic condition in carrying some cargoes (chemical matters and dust spreading cargoes).

Now, approximately 75-80 percent of cargoes have been carrying by specialized automobiles.

Nazorat uchun savollar

Self-control questions

1. Vazifasiga ko'ra ixtisoslashtirilgan avtomobillarning turlari qanday?
2. Qanday ITV o'zi ag'daruvchi deyiladi?
3. Sisternada qanday yuklar tashiladi?
4. Furgonda qanday yuklar tashiladi?
5. Ixtisoslashtirilgan avtomobillar oddiy avtomobillarga nisbatan qanday afzalliklarga ega?

1. What kind of specialized automobiles do you know?
2. Which specialized automobile is called dumper?
3. What kind of goods does the cistern carry?
4. What kind of goods does the van carry?
5. What advantages do specialized automobiles compared with all-purpose automobiles have?

2. DVGATEL

2. ENGINE

2.1. AVTOMOBIL DVGATELLARINING TASNIFI. UMUMIY TUSHUNCHALAR VA ASOSIY PARAMETRLAR.

2.1. CLASSIFICATION OF THE VEHICLE ENGINES. COMMON NOTIONS AND MAIN PARAMETERS.

Yonilg'i yonishidan hosil bo'ladigan energiyani mexanik energiyaga aylantiradigan dvigatellar ikki xil bo'ladi: ichki yonuv va tashqi yonuv dvigatellari. Avtomobillarda ichki yonuv dvigatellari (IYD) keng tarqalgan.

Avtomobil IYDlari quyidagi belgilari bilan tasniflanadi:

1. Ishlatiladigan yonilg'ining turiga ko'ra:

a) yengil suyuq yonilg'i (benzin, gazokondensat) bilan ishlaydigan;

b) og'ir suyuq yonilg'i (gazoyl, solyarka) bilan ishlaydigan;

d) gazsimon yonilg'i (tabiiy, sanoat va sintetik gazlar) bilan ishlaydigan.

2. Yonuvchi aralashma hosil qilish usuliga ko'ra:

a) silindrdan tashqarida yonuvchi aralashma hosil qiluvchi (karbyuratorli, gazda ishlaydigan va purkash tizimli);

b) silindr ichkarisida aralashma hosil qiluvchi (dizel, purkash tizimli).

3. Ish aralashmasining alangalanishi bo'yicha:

a) majburan alangalanuvchi (elektr uchqunidan);

b) siqish natijasida alangalanuvchi (dizel, purkash tizimli).

The engines that convert the heat energy of the fuel into mechanical energy are divided into two types: internal combustion and external combustion engines. Automobiles are equipped with internal combustion engines.

Internal combustion engines (ICE) are classified:

1. Depending on the fuel to be used:

a) light fuel (petrol, gasoline, condensate of gas) engines;

b) heavy fuel (diesel, oil gas) engines;

v) gaseous fuel (natural, industrial and synthetic gases) engines.

2. Depending on fuel and air mixing process:

a) the fuel is mixed with air outside the cylinder (carburetor, gas, injection system);

b) the fuel is mixed with air inside the cylinder (diesel, injection system).

3. Depending on ignition of the fuel-air mixture:

a) the fuel-air mixture is burned by the electric spark;

b) the fuel-air mixture is burned by pressing (diesel, injection system).

4. Ish siklini amalga oshirish bo'yicha:

a) to'rt taktli; b) ikki taktli.

5. Silindrlarning soni va joylashuviga ko'ra:

a) bir va ko'p silindrli;

b) bir qatorli (vertikal, burchak ostida, gorizontal joylashgan);

d) ikki qatorli („V“ simon yoki bir-biriga qarama-qarshi (oppozitli) joylashgan).

6. Sovitish usuli bo'yicha: suyuqlik yoki havo bilan sovitiladigan.

2.1-rasmda to'rt taktli benzinli dvigatelning soddalashgan sxemasi keltirilgan. Kallak (1) bilan yopilgan silindrga (5) porshen (6) o'rnatilgan. Porshen barmoq (7) va shatun (8) yordamida tirsakli val (9) bilan ulangan. Val uchiga og'ir g'ildirak — maxovik (10) birlashtirilgan.

Porshen silindrda ilgarilama-qaytma xarakat qiladi. Porshen yo'lining chekkalari yuqori chekka nuqta (YCHN) va pastki chekka nuqta (PCHN) deb nomlanadi. Bu nuqtalarda porshen harakat yo'nalishini o'zgartiradi.

Porshen yo'li S tirsakli valning yarim aylanishiga (180°) mos. Tirsakli val o'qidan shatun bo'ynining o'qigacha bo'lgan masofa **krivoship radiusi** R deb ataladi. Demak, $S = 2 \cdot R$.

Porshen yo'li S va silindrning diametri D dvigatelning asosiy ko'rsatkichlaridan biri. Agar $S/D < 1,0$ bo'lsa — **qisqa yo'lli**, $S/D = 1,0$ bo'lsa — **kvadratli**, $S/D > 1,0$ bo'lsa — **uzun yo'lli** dvigatel deyiladi.

4. Depending on the working cycle:

a) four stroke engine; b) two stroke engine.

5. Depending on the number and arrangement of the cylinders:

a) with one and multiple cylinders;

b) line (vertical, tilted, horizontal);

v) two lines (V-type, opposite).

6. Depending on cooling system:

Air and liquid cooling system.

The principal scheme of the four stroke gasoline engine is given in Figure 2.1. The piston 6 is mounted inside the cylinder 5 closed by head 1. The piston is connected to the crankshaft 9 by the piston pin 7 and the connecting rod 8. The flywheel 10 is located on the rear end of the crankshaft.

The piston makes reciprocating motion in the cylinder. The highest position of the piston in the cylinder is called "top dead centre" (TDC) and the lowest "bottom dead centre" (BDC). At these points piston changes its direction of movement.

The path, covered between these two positions is called "piston stroke". Each stroke of the piston is accompanied by one half of a crankshaft revolution (by angle 180°). The distance R between axes of the main journal and the rod journal of the crankshaft is called "crank radius". In that case, $S = 2 \cdot R$.

The piston stroke S and cylinder bore D are main parameters of the engine. The engine is called short stroke if ratio $S/D < 1,0$, square if $S/D = 1,0$ and long stroke if $S/D > 1,0$.

Porshen YCHN holatida turganda uning yuqorisida hosil bo'lgan bo'shliq **yonish kamerasining hajmi** V_c deyiladi. Porshen PCHN holatida turganda uning yuqorisida hosil bo'lgan bo'shliq **silindrning to'la hajmi** V_a deyiladi. Porshen yo'lidagi hajm **silindrning ish hajmi** V_h deyiladi. $V_a = V_c + V_h$.

Silindr to'la hajmining yonish kamerasi xajmiga nisbati **siqish darajasi** deyiladi $\varepsilon = V_a / V_c$.

Silindrlar ish hajmlari yig'indisi **dvigatel litraji** deyiladi.

The volume between the piston in the top dead centre and the cylinder head is called "combustion chamber" V_c . The space between the piston in the bottom dead centre and the cylinder head is called "full cylinder volume" V_a . The volume covered during the travel of the piston between dead centers is called "piston displacement". $V_a = V_c + V_h$.

The ratio of full cylinder volume to combustion space is called "compression ratio" $\varepsilon = V_a / V_c$.

The sum of the stroke capacities of cylinders is called "engine displacement".

2.2. TO'RT TAKTLI DVIGATEL

2.2. FOUR STROKE ENGINE

Tirsakli val aylanishida porshen YuChN dan uzoqlashadi va ustki qismida bosim pasayadi. Kiritish klapani (2) ochiq. Silindrga yonuvchi aralashma kiradi. Porshen PCHN ga yetganda kiritish kanali yopiladi. Tirsakli valning keyingi aylanishida porshen YCHNga harakatlanadi. Porshen YCHNga yetganda ishchi aralashma yonish kamerasiga siqiladi. Siqish natijasida ish aralashma harorati ko'tariladi. Yondirish shami (svecha) (3) bilan uchqun hosil qilinadi. Ish aralashmasi portlab alanganadi. Porshen yuqorisida harorat va bosim keskin oshadi. Bosim kuchi porshenni PCHNga harakatlantiradi va tirsakli valni aylantiradi. Issiqlik energiyasi mexanik energiyaga aylanadi.

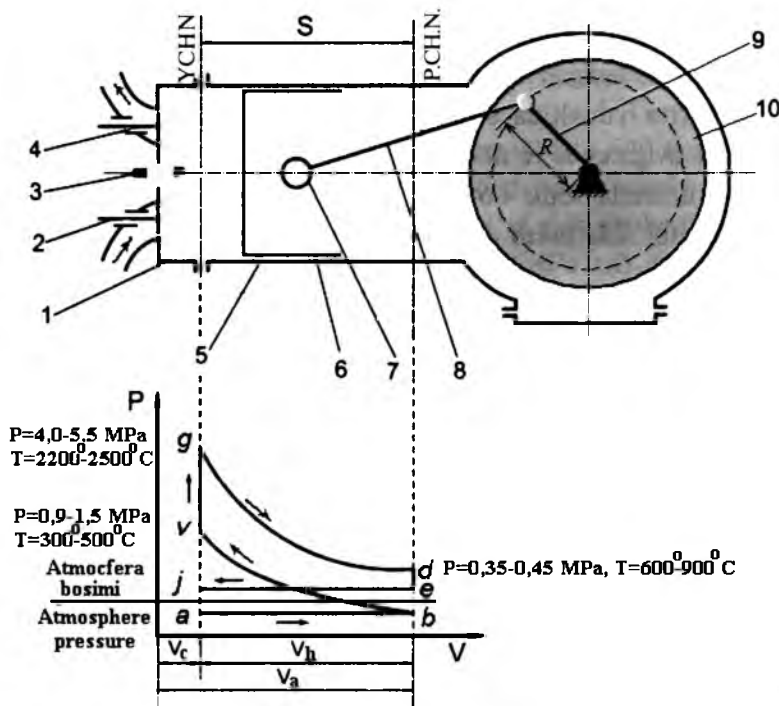
The crankshaft rotates and the piston moves from TDC and pressure above the piston decreases. The intake valve 2 opens. The fuel-air mixture enters into the cylinder. When the piston has reached the BDC the intake valve closes. In the next half of a crankshaft revolution the piston moves to the TDC. After the piston has reached the TDC the fuel-air mixture is compressed. The temperature of the fuel-air mixture increases due to compressing the fuel-air mixture. The fuel-air mixture is ignited and burned by the spark plug 3. The temperature and the pressure above the piston increase quickly. The piston moves to the BDC under the pressure of the expanding gas and the crankshaft rotates. The heat energy is converted into mechanical energy.

Porshen PCHNga yetganda chiqarish klapani ochiladi. Val bilan aylangan maxovik inersiyasi porshenni YCHNga harakatlantiradi. Porshen silindrdan ishlatilgan gazlarni haydaydi.

To'rtta takt amalga oshirildi. Tirsakli valning aylanishida silindrdagi avvalgi barcha jarayonlar takrorlanadi.

When the piston has reached the BDC the exhaust valve is opened. The piston moves to the TDC by steadying effect of the flywheel. The piston pushes the exhaust gases out of the cylinder.

Four stroke cycle is completed. The next cycle begins by the crankshaft revolution, repeating all above mentioned cycles.



2.1-rasm. To'rt taktli benzinli dvigatelning sxemasi.

1—blok kallagi; 2—kiritish klapani; 3—sham (svecha); 4—chiqarish klapani; 5—silindr bloki; 6—porshen; 7—barmoq; 8—shatun; 9—tirsakli val; 10—maxovik.

Figure 2.1. Four stroke gasoline engine.

1—cylinder head; 2—intake valve; 3—spark plug; 4—exhaust valve. 5—cylinder block; 6—piston; 7—piston pin; 8—connecting rod; 9—crankshaft; 10—flywheel.

Demak, silindrda yonuvchi aralashmani **kiritish**, uni **siqish**, gazlarning alangalanishi va bosimidan **kengayish**, ishlatilgan gazlarni **chiqarish** kabi jarayonlar sodir bo'ladi. To'rtta jarayondan faqat bittasida -kengayishda foydali ish bajariladi. Ushbu jarayon **ish yo'li** deb ataladi. Qolganlari yordamchi hisoblanadi. Ular maxovikda to'plangan inersiya energiyasi evaziga bajariladi. Bu jarayonlar majmui dvigatelning **ish sikli** deyiladi.

Takt — porshenning bir chekka nuqtadan ikkinchi chekka nuqtaga harakatlanganda sodir bo'ladigan jarayon.

Porshenning to'rtta yurishida sodir bo'ladigan ish sikli dvigatel **to'rt taktli**, porshenning ikki yurishida sodir bo'ladigan ish sikli dvigatel **ikki taktli** deyiladi.

Dvigatel ish jarayonini ko'rib chiqishda indikator diagrammasidan (2.1- rasm) foydalaniladi. Indikator diagrammasi deb, silindrdagi bosimni porshenning ustidagi hajmga bog'liq grafigiga aytiladi.

To'rt taktli benzinli dvigatelning ish sikli quyidagicha amalga oshiriladi. Kiritish taktida (**a—b**) kiritish klapani ochiq bo'ladi. Silindrga **yonuvchi aralashma** kiradi. Silindrda yonuvchi aralashma va avalgi sikldan qolgan qoldiq gazlar birga **ish aralashmasiga** aylanadi. Porshen PChN ga etganda (**b**) kiritish klapani yopiladi. Kiritish taktida silindrdagi bosim 0,08 MPa bo'ladi (**a—b**). Tirsakli val birinchi yarim aylanadi (0°dan 180°gacha). Kiritish

It can be noted that the processes like **intake** of the fuel-air mixture, **compression** of the working mixture, **power** and **exhaust** of the gases are done in the cylinder. The efficiency is attained by only process. This process is called "**power stroke**". Other processes are called ancillary. These processes are completed by the help of the flywheel. Totality of these processes is called **working cycle** of the engine.

The motion of the piston from one dead centre to another is called "**stroke**".

In **four stroke** engines the cycle is completed by four strokes of the piston, in **two stroke** engines the cycle is completed by two strokes of the piston.

The engine cycle is analyzed by the help of the indicator diagram (Fig. 2.1.). The graph, which displays the influence between the volume above the piston and the pressure inside the cylinder is called indicator diagram.

The working cycle of the gasoline engine is completed as following. In intake stroke (**a—b**) the intake valve opens. The **fuel-air mixture** enters into the cylinder and it is mixed with exhaust gases from previous cycle inside the cylinder and this mixture is called **working mixture**. After the piston has reached the BDC (**b**) the intake valve closes. The pressure is 0,08 MPa in the cylinder in intake stroke (**a—b**). The crankshaft has turned half revolution (from 00 to 1800). At the end of intake stroke the temperature increases to 80°—120° C.

oxirida aralashma harorati 80—120° C gacha ko'tariladi.

Porshenning ikkinchi yurishida klapanlar yopiq bo'ladi. Ikkinchi takt — **aralashmani siqish takti** ($b-v$). Bunda tirsakli val ikkinchi yarim aylanadi (180°dan 360°gacha). Siqish taktining oxirida aralashma hajmi 6...8 martaga qisqaradi, bosim 0,8...1,5 MPa, harorat 300°...500° C gacha ko'tariladi.

Porshen YCHNga yetganda sham elektrodleri orasida uchqun paydo bo'ladi. Siqilgan aralashma alangaladi. Gazlar bosimi 4,0...5,5 MPa (g), harorati 2200°—2500° C gacha oshadi.

Porshenning uchinchi yurishida gazlar kengayishi sodir bo'ladi. Tirsakli val 360°dan 540°gacha buriladi. Bu jarayon **kengayish takti** yoki **ish yo'li** deyiladi. Uning tugallanishida bosim 0,35—0,45 MPa (d) va harorat 600°—950° C bo'ladi. Kengayish taktining oxirida chiqarish klapani ochiladi.

Porshenning to'rtinchi yurishida (**chiqarish takti**) ($e-f$) chiqarish klapani ochiq, kiritish klapani yopiq bo'ladi. Silindr ishiatilgan gazlardan tozalanadi. Bunda tirsakli val 540°dan 720°gacha buriladi. Bosim 0,11 ... 0,12 MPa, harorat 700° ... 800° C ni tashkil qiladi.

Dvigatel krivoship-shatunli va gaz taqsimlash mexanizmlari hamda sovitish, moylash, ta'minlash va o't oldirish (benzinli dvigatellarda) tizimlaridan iborat.

The second stroke of the piston with the valves closed. The second stroke is **compression stroke** ($b-v$). The crankshaft has finished the second half of a revolution (from 180° to 360°). At the end of compression stroke the capacity is decreased for 6...8 times, the pressure is 0,8...1,5 MPa, the temperature increases till 300°—500° C.

After the piston has reached the TDC the spark plug is ignited. The compressed fuel-air mixture burns. The pressure of gases is 4,0...5,5 MPa (g), the temperature increases till 2200°—2500° C.

At the third stroke of the piston the gases expand. The crankshaft has turned from 360 to 540 degree. This process is called **power stroke** (**expansion**). At the end of this stroke the pressure is 0,35 - 0,45 MPa (d) and the temperature is 600°—950° C. At the end of the power stroke the exhaust valve is opened.

At the fourth stroke of the piston ($e-f$) (**exhaust stroke**) the exhaust valve is opened and the intake valve is closed. The cylinder is cleaned from the exhaust gases. The crankshaft turns from 540 to 720 degree. The pressure is 0,11 ... 0,12 MPa and the temperature is 700°...800° C.

The engine consists of crank mechanism, valve control mechanism and also consists of cooling, lubricating, fuel system and ignition systems.

2.3. IKKI TAKTLI BENZINLI DVIGATEL

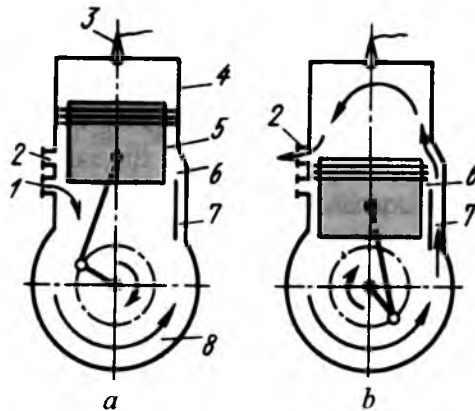
2.3. TWO STROKE GASOLINE ENGINE

Odatda, ikki taktli dvigatellarda klapanlar bo'lmaydi (2.2-rasm). Silindrning ma'lum joylarida shamollatish (puflash) darchasi bo'ladi. Darchalarning biridan yonuvchi aralashma kiritiladi, ikkinchisidan ishlatilgan gazlar chiqariladi. Silindrlar kallagiga o't oldirish shami o'rnatiladi.

Odatda, bunday dvigatellarning porshenlari maxsus shaklga ega. Silindr ichida harakatlanayotgan porshen ma'lum ketma-ketlikda darchalarni ochadi va yopadi, ya'ni klapanlar vazifasini bajaradi. Ikki taktli dvigatelning ish sikli porshenning ikki yurishida yoki tirsakli valning bir marta aylanishida sodir bo'ladi.

Usually, two stroke engines have no valves (Fig. 2.2). The cylinder has holes. The fuel air mixture enters into the cylinder through a hole and the exhaust gases are pushed out of the cylinder through another hole. A spark plug is mounted at the cylinders head.

In most cases, the piston of engines has a special form. The piston sliding in the cylinder opens and closes the holes with predefined sequence, i.e., functions as valves. The complete cycle of the two-stroke engine is done by two strokes of the piston or by one revolution of the crankshaft.



2.2-rasm. Ikki taktli benzinli dvigatelning ishlash sxemasi:

a—ish aralashmasini siqish va karterga yonuvchi aralashmani kiritish; b—ish yo'li: ishlatilgan gazlarni chiqarish va karterdagi gazlarni silindrga o'tkazish; 1—kiritish darchasi; 2—chiqarish darchasi; 3—o't oldirish shami; 4—silindr; 5—porshen; 6—o'tkazish darchasi; 7—kanal; 8—zichlangan karter.

Figure 2.2. Two-stroke gasoline engine: a—compression of the working mixture and inlet of the fuel-air mixture into the crankcase; b—power stroke, exhaust of the burned gases and bypassing the gases from crankcase into the cylinder; 1—inlet hole; 2—exhaust hole; 3—spark plug; 4—cylinder; 5—piston; 6—bypassing hole; 7—duct; 8—sealed crankcase.

*Harakat zaif bo'lgan joyda, kuchli bilim foydasizdir.
Harakatsiz bilim — ipsiz kamon o'qidir.*

Az - Zamaxshariy

Birinchi takt. Porshen (5) pastdan yuqoriga harakatlanib, yon yuzasi bilan avval o'tkazish darchasini (6), so'ngra chiqarish darchasini (2) berkitadi. Silindrda siqish jarayoni boshlanadi. Porshen osti bo'shlig'ida bosim pasayadi. Karterga kiritish darchasi (1) orqali yonuvchi aralashma kiradi. Porshen yuqori chekka nuqtaga yetganda shamda (3) elektr uchquni paydo bo'ladi. Siqilgan ish aralashmasi portlab alanganadi.

Ikkinchi takt. Hosil bo'lgan bosim porshenni pastga harakatlantiradi va ish yo'li boshlanadi. Ish yo'li nihoyasida avval chiqarish darchasi (2) ochiladi. Ishiagan gazlar atmosferaga chiqib boshlaydi. Porshenning pastga harakati davomida o'tkazish darchasi (6) ochiladi. Ish aralashma kanal (7) orqali karterdan (8) silindrga o'tadi va silindrdan ishlagan gazlardan siqib chiqarib o'rni to'ldiradi.

Bunday dvigatellarni moylash uchun yonilg'iga moy ma'lum proporsiyada 1:20 qo'shiladi. Demak, yonuvchi aralashma tarkibi yomilg'i, moy va havodan iborat.

The first stroke. The piston (5) moving upward at first closes the inlet hole (6), then closes exhaust hole (2) with its side surface. The compression process has started in the cylinder. The pressure of the space below the piston is decreased. The fuel-air mixture enters into the crankcase through inlet hole. After the piston has reached the TDC a spark plug (3) ignites. The compressed working mixture burns.

The second stroke. The piston moves downward under the impulse of expanding gas and power stroke starts. At the end of power stroke the exhaust hole (2) opens. Exhaust gases flow out of the cylinder. The piston continues moving downward and opens the hole (6). The working mixture bypasses from the crankcase (8) into the cylinder through duct (7) and pushes exhaust gases out of the cylinder.

In engines of this type the lubricant is mixed with fuel with proportion 1:20 for lubrication. Hence, burning mixture consists of fuel, lubricant and an air.

Nazorat uchun savollar

Self-control questions

1. Dvigatelning tasnifini tushuntiring.
2. „Yuqori chekka nuqta“ nima?
3. „Pastki chekka nuqta“ nima?
4. „Porshen yo'li“ nima?
5. „Dvigatel ish hajmi“ nima?
6. To'rt taktli dvigatelning ishlashini tushuntiring.
7. Ikki taktli dvigatelning ishlashini tushuntiring.

1. What types of engines do you know?
2. What is "top dead centre"?
3. What is "bottom dead centre"?
4. What is the "piston stroke"?
5. What is "engine displacement"?
6. Describe working principle of four stroke engine.
7. Describe working principle of two stroke engine.

2.4. TURLI DVIGATELLARNING ISHLASH PRINSIPLARI

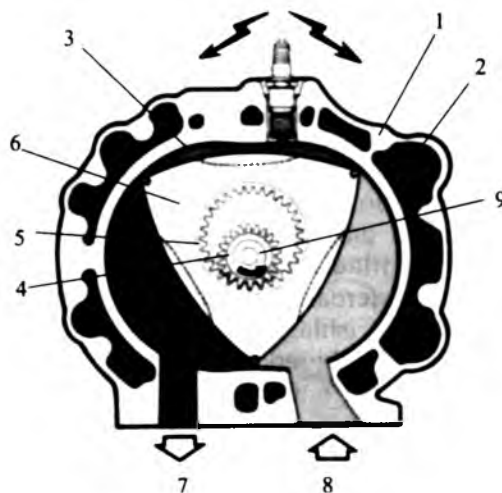
2.4. OPERATING PRINCIPLES OF DIFFERENT ENGINES

2.4.1. ROTOR-PORSHENLI DVIGATELLAR

2.4.1. ROTARY ENGINES

Rotor-porshenli dvigatel (RPD) odatdagi porshenli dvigatel kabi to'rt taktli siklda ishlaydi. RPD porshen vazifasini maxsus shaklli rotor (6) bajaradi (2.3-rasm).

The working process of the rotary engine is based on the four-stroke cycle in internal combustion engines. Particularly, in the rotary engines specially formed rotor functions as piston (Fig. 2.3).



2.3-rasm. Rotor-porshenli dvigatel sxemasi.

Korpus (1) sovitish g'ilofidan (2) iborat. Korpusning ichki devorlari (3) maxsus shaklli. Korpusning yonbosh devorlarida o'rnatilgan podshipniklarda eksentirksimon ishchi val (9) aylanadi.

Rotor aylanganda uchchala cho'qqisi devorlar bilan uzluksiz tutashadi. Natijada, bir-biridan ajratilgan o'zgaruvchan hajmli siljuvchi o'roqsimon (yarimoy-simon) kameralar hosil bo'ladi. Korpusda

Figure 2.3. The scheme of the rotary engine.

The housing (1) consists of cooling jacket (2). The internal walls (3) of the housing have a special form. The eccentric shaft (9) rotates on the bearings mounted in the sidewalls of the housing.

While the rotor rotates, it seals to walls with its three peaks constantly. As a result, the separated from each other, with variable capacity and movable chambers with semi-moon volumes are

kiritish (8) va chiqarish (7) teshiklari mavjud. Ularning ochilishi va yopqlishini rotor cho'qqilari bajaradi. Rotor ichki ilashuvchi shesternya (5) bilan bikir bog'langan. Dvigatelning ishlashida shesternya (5) markaziy joylashgan shesternya (4) atrofida g'ildirab aylanadi. Ish aralashmasining alanganishini o't oldirish shami bajaradi.

Rotorning aylanishida kameralarning har birida ketma-ket to'la ish sikli sodir bo'ladi.

RPD konstruksiyasi ixcham, o'lchami va massasi kichik. Lekin rotor qirralarini zichlash muammosi mavjud.

formed. There are intake (8) and exhaust (7) holes in the housing. They are opened and closed by peaks of the rotor. The rotor is firmly connected with internal coupling gear (5). When the engine is running gear (5) rotates rolling around the central gear (4). The working mixture is ignited by a spark plug.

During the rotor's rotation, the working cycle is completed in each chamber according to firing order.

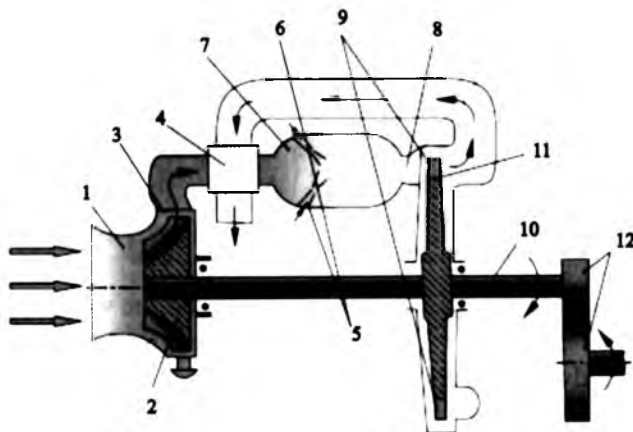
The rotary engine is compact, has a small dimensions and mass. However, it has a problem of accurate sealing of the rotor peaks.

2.4.2. GAZTURBINALI DVIGATELLAR

2.4.2. GAS-TURBINE ENGINES

Gaz turbinali dvigatellarda (GTD) ish jarayoni uzluksiz sodir bo'ladi. GTD turbina g'ildiraklari parraklariga ta'sir qiluvchi gazlar oqimi kinetik energiyasidan foydalaniladi.

The working process of the gas-turbine engines goes continuously. In gas-turbine engines the kinetic energy of the gas flow acting on blades of turbine wheels is used.



2.4-rasm. Gaz turbinali dvigatel sxemasi.

Figure 2.4. The scheme of gas-turbine engine.

Kompressor (2) yonish kamerasiga (7) diffuzor (3) orqali siqilgan havo haydaydi. Forsunka (5) yonilg'ini uzluksiz purkaydi.

Yonilg'i havo bilan aralashib svecha (sham) (6) yordamida yonadi (kavsharlash lampasidagiga o'xshash).

Hosil bo'lgan gaz yo'naltiruvchi parraklar (8) orqali g'ildirak (11) parraklarini (9) aylantiradi.

Kuch turbinasi g'ildiragi (11) valga (10) o'rnatilgan. Kuch turbinasi avtomobil transmissiyasi reduktori (12) bilan ulangan. Turbinadan chiqayotgan ishlatilgan gazlar issiqlik almashtirgichga yuboriladi. Issiqlik almashtirgich (4) yonish kamerasiga uzatilayotgan havoni isitish uchun xizmat qiladi.

GTD ilgarilama-qaytma harakatlantiruvchi qismlarning yo'qligi bir tekis ishlashini ta'minlaydi. Konstruksiyasi sodda, ishonchlilik yuqori. Yonilg'i tejamkorligining pastligi, katta shovqin chiqarishi va ishlab chiqarish narxi yuqoriligi kamchiliklaridir.

Compressor (2) feeds the pressed air to combustion chamber (7) through diffuser (3). The injector (5) injects the fuel continuously.

The fuel is mixed with air and ignited by a spark plug (6) (as blow lamp).

Formed gas rotates blades (9) of the wheel (11) through the guide blades (8).

The wheel (11) of the power turbine is fixed on the shaft (10). The power turbine is connected to the reducer (12) of the automobile transmission. Exhaust burned gases flow from the turbine to the heat exchanger. The heat exchanger (4) serves to heat an air, which flows to combustion chamber.

Gas-turbine engine does not have parts, with reciprocating motion. Because of this the gas-turbine engine works smooth. It has compact design and higher reliability. The disadvantages of the engine are: poor fuel economy; the high level of noise and high production costs.

Nazorat uchun savollar

Questions for control

1. Rotor porshenli dvigatelning ishlash prinsipini tushuntiring.
2. Gaz-turbinali dvigatelning ishlash prinsipini tushuntiring.
3. Rotor - porshenli dvigatelning qanday afzalliklari mavjud?
4. Gaz-turbinali dvigatelning qanday afzalliklari mavjud?

1. Describe the working principle of rotary engine.
2. Describe the working principle of gas-turbine engine.
3. What advantages does the rotary engine have?
4. What advantages does the gas-turbine engine have?

2.5. KRIVOSHIP-SHATUNLI MEXANIZM

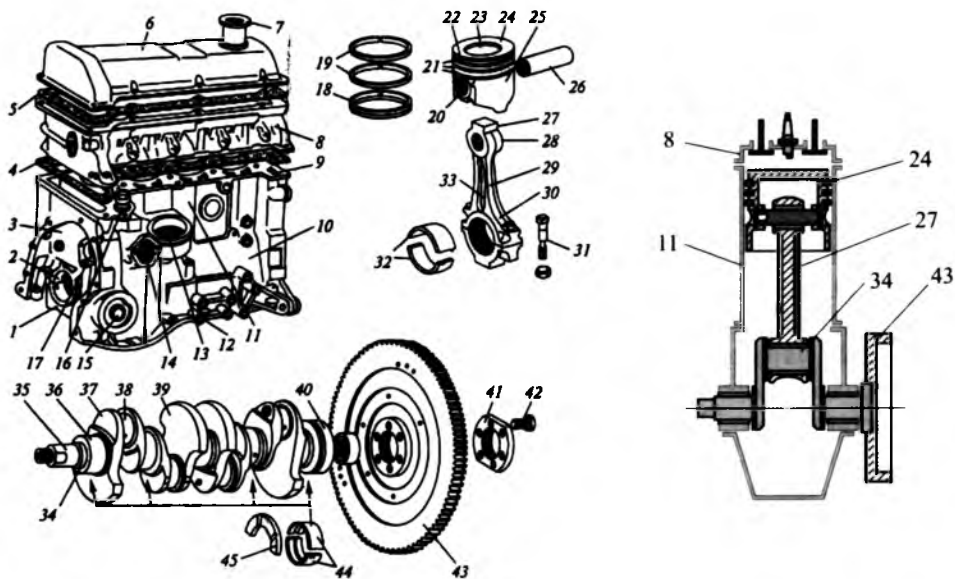
2.5. CRANK-DRIVE MECHANISM

Mexanizm-harakat turini o'zgartiradigan qurilma: aylanma harakatni chiziqlikka, chiziqlikni aylanmaga.

Krivoship-shatunli mexanizm (KSHM) porshenning ilgari lama-qaytma harakatini tirsakli valning aylanma harakatiga aylantirib beradi.

Mechanism principle is to convert rotating motion into the linear motion and linear motion into the rotating motion.

Crank-drive mechanism (CDM) converts the reciprocating motion of the piston into the rotating motion of the crankshaft.



2.5-rasm. Yengil avtomobil dvigateling krivoship-shatunli mexanizmi:

8—silindrlar kallagi; 11—silindrlar bloki; 24—porshen; 27—shatun; 34—tirsakli val; 43—maxovik.

Figure 2.5. Crank-drive mechanism of the vehicle:

8—cylinder head; 11—cylinder block; 24—piston; 27—connecting rod; 34—crankshaft; 43—flywheel.

Krivoshlp-shatunli mexanizmni tashkil qiluvchi qismlar harakatlanuvchi va harakatlanmaydigan guruhlarga bo'linadi.

Harakatlanuvchi qismlarga tirsakli val (34), maxovik (43), porshenlar (24), porshen halqalari (18, 19), porshen barmoqlari (26) va shatunlar (27) kiradi (2.5-rasm).

Harakatlanmaydigan qismlarga silindrlar bloki (11) karteri (10) bilan, silindrlar kallagi (8) qistirmalar (4, 5) va qopqoqlar (1, 6) kiradi.

Silindrlar bloki dvigatelning korpus qismi bo'lib, unda silindrlar joylashgan.

Silindrlar blokida (11) maxsus cho'yangdan tayyorlangan silindrlar o'rnatilgan. Silindrda dvigatelning ish sikli amalga oshiriladi. Blok ichida silindrlar devori va uning tashqi devori orasida sovitish g'ilofi (9) bor. Unda sovitish tizimining suyuqligi aylanib turadi.

Aluminiy blokka quyilgan yoki o'rnatilgan cho'yan gilzalar silindrlarni hosil qiladi. Agar silindr gilzalari tashqi sirtiga sovitish suyuqligi tegib tursa, „ho'l“ gilza, agar tegib turmasa, „quruq“ gilzalar deb ataladi.

Blokning ichida moylash kanallari bor. Ular orqali dvigatelni ishqalanuvchi qismlariga moy uzatiladi. Silindrlar blokining quyi qismida tirsakli valning o'zak bo'yinlari uchun tayanchlar (2) ishlangan. Tayanchlarda tirsakli val o'zak bo'yinlarini boltlar bilan mahkamlaydigan qopqoq (1) bor.

Blokda bir qator osma uzellar o'rnatiladigan maxsus bo'rtmalar va teshiklar bor.

Silindrlar blokining kallagi (8) silindrlar ustini yopadi. Ostki yuzasi hamda porshen kallagi bilan yonish kamerasini tashkil etadi. Kallak ichida

Parts of the crank-drive mechanism are composed of mobile and fixed groups.

Mobile parts consist of: crankshaft (34), flywheel (43), pistons (24), piston rings (18, 19), piston pins (26) and connecting rods (27) (Fig. 2.5).

Fixed parts consist of: cylinder block (11), the crankcase (10), the cylinder head (8), gaskets (4, 5) and caps (1, 6).

Cylinder block is the body of the engine and cylinders are mounted in it.

Cylinders are made of special cast iron and mounted in the cylinder block (11). Operation cycle of the engine runs in cylinder. There is a cooling jacket (9) between cylinder outer wall and outer wall of the block. The cooling liquid circulates in it.

Cast-iron liners cast or mounted in the aluminum block form cylinders. If the cylinder liners are surrounded by cooling water, they are called "wet", if the cylinder liners are not surrounded by cooling water, they are called "dry".

There are oil lines in the block. The oil is fed to the rubbing parts of the engine. The supports (2) are made for main journals of the crankshaft in the bottom of the cylinder block. There is a cap (1) for attaching the main journal of the crankshaft by bolts at supports.

There are special attachment points and holes on block for mounting of hanging assemblies.

The cylinder head (8) covers the top of the cylinders. There is a combustion chamber between the bottom surface of the cylinder head and the top of the piston. Intake and exhaust ducts, water

kiritish va chiqarish kanallari, sovitish suyuqligining o'tishi uchun suv g'ilofi kanallari va moylash tizimi kanallari ishlangan. Kallakda klapanlar, forsunkalar, o't oldirish svechasi joylashtiriladi.

Porshen (24) — silindrda harakatlantiruvchi, o'z usti va osti bo'shliqlarini hermetik ajratuvchi detal.

Porshenlar asosiy ikki qismdan: zichlovchi (22) va yo'naltiruvchi (25) qismlardan iborat. Yo'naltiruvchi qismi yubka deb ataladi. Porshenda ichki bo'rtna — bobishka (20) bor. Bobishkada porshen barmog'ini o'rnatish uchun teshik ochilgan. Teshikda porshen barmog'ining siljini qulfovchi halqa uchun ariqcha yo'milgan. Porshenning bobishka qismi devori chuqurroq qilib ishlangan. Bu zona devorlari silindr devorlariga tegmaydi.

Porshen golovkasi devorlarida porshen halqalari uchun ariqchalar (21) o'yilgan. Pastki ariqchada moy sizdirish (drenaj) teshikchalar ishlangan.

Porshen halqalari vazifalariga ko'ra kompression (19) va moy sidirgich (18) bo'ladi. Kompression halqalar silindr va porshen oraliqlarini zichlashtiradi. Ular porshen golovkasidan issiqlikni silindr devorlariga tarqatish uchun ham xizmat qiladi.

Halqalar ochiq kesikli bo'ladi. Kesik qulf deb ataladi. Qulf halqaga porshen va silindr orasini zichlash xususiyatini beradi.

Moy sidirgich halqa silindr devoridagi ortiqcha moyni sidiradi va karterga yo'naltiradi.

Porshen barmog'i (26) shatun bilan porshenni sharnirli ulaydigan o'q vazifasini bajaradi.

Shatun (27) porshen bilan tirsakli valmi bog'lovchi zveno bo'lib, ish takti

jackets for cooling liquid circulation and lines of lubricating system are made in the cylinder head. Valves, injectors and a spark plug are mounted in the head.

Piston (24) is a part that moves and separates pressure-tight the spaces above and below it.

The piston consists of two parts: sealing part (22) and guide part (25). Guide part is called "shirt". The piston has inner bump - boss (20). The boss has a bore for mounting the piston pin. The bore has a groove for check ring, which locks the pin float. The wall of the boss area of the piston is made deeper. The walls of these areas do not contact with cylinder walls.

Piston head has grooves (21) for mounting the piston rings. Lower groove has the oil-weeping hole.

There are compression (19) and oil wiper (18) **piston rings** depending on the purpose. Compression rings seal the clearance between the piston and the cylinder. They transfer the heat from the piston head to the cylinder wall.

Rings have a slot. The slot is called "lock". The lock provides the ring property to seal the clearance between the piston and the cylinder.

The oil wiper ring wipes off excessive oil on the cylinder wall and directs it to the oil pan.

The piston pin (26) connects the piston to the connecting rod jointly.

Connecting rod (27) is a link that connects the piston to the crankshaft. It transfers the motion from the piston to the crankshaft at power stroke and from the

paytida porshendan valga, yordamchi taktlarda esa valdan porshenga harakat uzatadi. Shatun uchta konstruktiv elementlardan iborat: o'zak (sterjen) (29), yuqori kallak (28) va pastki kallak (30).

Tirsakli val krivoshipi yordamida shatunning murakkab harakatini aylanma harakatga o'zgartiradi. Tirsakli val (34) o'zak (36) va shatun (38) bo'yinlar, jag'lar (37), posongilar (39), oldingi (35) va ketingi (40) uchiardan tashkil topgan. Tirsakli val o'zak bo'yinlari bilan podshipniklarda (44) dvigatel karterining tayanchlariga o'rnatiladi. Shatun bo'yinlariga (38) shatunning pastki kallagi birlashtiriladi. O'zak bo'yin shatun bo'yin bilan jag' (37) orqali birlashib krivoshipni tashkil qiladi. Posangilar (39) markazdan qochma kuchlarning o'zak bo'yinlariga ta'sirini kamaytiradi.

Maxovik (43) inersion disk. Tirsakli val ortiga biriktiriladi. Tirsakli val harakatidan olgan kinetik energiyasini porshenning chekka nuqtalaridan o'tishiga, tirsakli valning yordamchi taktlarda aylanishiga sarflaydi. Maxovik gardishiga presslab o'rnatilgan tishli chambarak dvigatelni starter bilan ishga tushirish uchun xizmat qiladi.

crankshaft to the piston at auxiliary strokes. Connecting rod comprises three constructive elements: stem (29), small end (28) and big end (30).

The crankshaft converts complicated motion of connecting rod into rotating motion with the help of its crank. The crankshaft (34) comprises main (36) and rod (38) journals, webs (37), counterweights (39), front (35) and rear (40) ends. The crankshaft supported by bearings (44) at the crankcase of the engine. Big end of the connecting rod is connected to the rod journals (38). Main journal is united with rod journal through web (37) and forms the crank. Counterweights (39) decrease the influence of centrifugal forces to the main journals.

The flywheel (43) is an inertial plate. It is located on the rear end of the crankshaft. Kinetic energy of the flywheel is consumed to take out the piston from dead centers and to rotate the crankshaft at auxiliary strokes. Toothed wheel mounted on the rim of the flywheel by press meshes with the starter pinion to start the engine.

Nazorat uchun savollar

Self-control questions

1. Krivoship-shatunli mexanizmning vazifasi nima?
2. Krivoship-shatunli mexanizm qanday detallardan tashkil topgan?
3. Porshen halqalarining turlari va vazifalari.
4. Maxovikning vazifasi nima?
5. Qanday gilzalar „xo'l gilza“ deyiladi?
6. Qanday gilzalar „quruq gilza“ deyiladi?
1. What is the function of crank-drive mechanism?
2. What details does the crank-drive mechanism consist of?
3. Types and functions of piston rings.
4. What is the function of the flywheel?
5. What cylinder is called "wet"?
6. What cylinder is called "dry"?

2.6. GAZ TAQSIMLASH MEXANIZMI (GTM)

2.6. VALVE CONTROL MECHANISM (VCM)

Gaz taqsimlash mexanizmi (GTM) silindrlarga taktga mos ravishda yonuvchi aralashma yoki havo kiritish va ishlatilgan gazlarni chiqarish uchun xizmat qiladi.

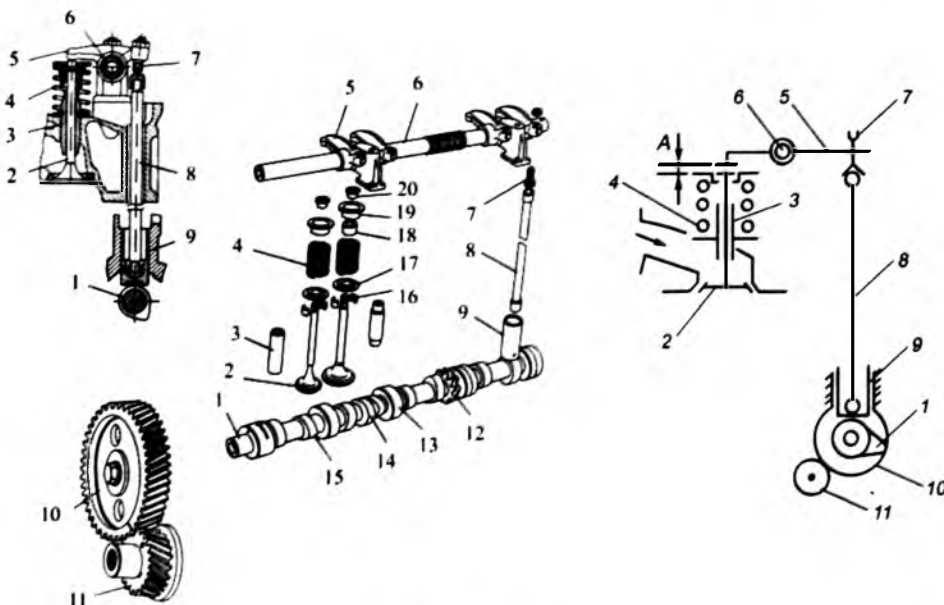
Klapanlarning joylashuviga ko'ra klapanlari pastda va yuqorida joylashgan GTM mavjud. Birinchi holatda klapanlar silindrlar blokiga, ikkinchi holatda klapanlar silindrlar kallagiga joylashtirilgan bo'ladi.

GTM 2.6-rasmda gaz taqsimlash vali pastda joylashgan bir silindrda ikkita klapan o'rnatilgan dvigatelning gaz taqsimlash mexanizmi ko'rsatilgan.

Valve control mechanism serves to inlet the fuel-air mixture or an air into the cylinders according to current stroke of the engine and to outlet the exhaust gases out of the cylinders.

There are two types of VCM depending on arrangement of the valves. In the first case, the valves are mounted at the cylinder block, in the second case the valves are mounted at the cylinders head.

The VCM with the camshaft mounted at the cylinder block and with two valves for one cylinder, is given in Figure 2.6.



2.6 -rasm. Gaz taqsimlash mexanizmi:

Figure 2.6. Valve control mechanism:

1—gaz taqsimlash vali; 2—klapan;
3—yo'naltiruvchi vtulkalar; 4—prujina;
5—koromislo; 8—shtanga; 9—turtkich;
10—11—shesternyalar.

Klapanlar (2) silindrlar bloki kallagi-dagi kiritish yoki chiqarish kanallarini yopish va ochish uchun xizmat qiladi. Vazifasiga ko'ra kiritish va chiqarish klapanlari mavjud. Klapan kallak va sterjendan iborat. Kallak zichlovchi faska va silindrik belbog'dan tashkil topgan. Klapan prujmalarini ushlab turish uchun klapan sterjenining uchida ariqcha qilinadi.

Klapan prujinalari (4) klapani o'rindiqqa zich o'tirishini ta'minlaydi va uni yopiq holatda ushlab turish uchun xizmat qiladi.

Klapan yo'naltiruvchi vtulka ichida harakatlanadi. **Yo'naltiruvchi vtulka** (3) klanning o'rindiqqa aniq o'tirishini ta'minlaydi. Vtulkalar silindrlar kallagiga yoki silindrlar blokiga presslab o'rnatiladi.

Taqsimlash vali (1) klapanlarning o'z vaqtida ochilish va yopilishini ta'minlaydi. Taqsimlash vali, asosan, sterjen, kiritish va chiqarish mushtchalari, tayanch bo'yinlar, moy nasosini yurituvchi shesternyadan iborat.

Mushtchalar (15) soni klapanlar soniga mos va holati dvigatelning ishlash tartibi bilan belgilanadi. Mushtchalar klapani harakatlantiradi.

Turtkich (9) taqsimlash vali mushtchasidan klapan sterjeniga yoki shtanga (koromislo)ga o'q bo'ylab kuch uzatish uchun xizmat qiladi.

1—camshaft; 2—valve; 3—guide bush; 4—spring; 5—rocker arm; 8—rod; 9—tappet; 10—11—control gears.

The valves (2) serve to open or close the intake and exhaust ducts in the cylinder head. Depending on the purpose, there are intake and exhaust valves. The valve consists of head and stem. The head of the valve has a chamfer and the cylinder belt. The valve stem has a groove to hold the valve spring.

The valve springs (4) hold the valve at its saddle tight and serve to hold it closed. The valve moves in guide bush.

The guide bush (3) provides the correct valve sit at its saddle. The guide bushes are mounted at the cylinder head or at the cylinder block by press.

The camshaft (1) controls the work of the intake and exhaust valves. The camshaft comprises the drive gear, stem, cams, support journals and the driving pinion of the oil pump.

The number of **cams** (15) is equal to the number of valves and their position is fixed corresponding to firing order. The valves are actuated by cams.

The tappet (9) serves to pass the axial force from the cam of camshaft to the valve stem or to the rod (rocker arm).

Hydraulic tappet — one of the parts that actuates the intake and exhaust

Gidravlik turtkich hozirgi vaqtda yengil avtomobillarning dvigatellarida kiritish va chiqarish klapanlarini harakatlantirish detallariga kiradi. Hidravlik turtkich klapan sterjeni uchida mushtcha yoki koromislo bilan tirqishsiz kontaktni avtomatik ta'minlaydi. Klapan uchida issiqlik tirqishi bo'lishiga zaruriyat bo'lmaydi.

Shtanga (8) turtkichdan koromisloga kuch uzatish uchun xizmat qiladi

Koromislo (5) (obkash) ikki yelkali richag bo'lib, turtkich harakat yo'nalishini klapaning ochilish yo'nalishiga o'zgartirish uchun xizmat qiladi.

Taqsimlash vali yuritmasi tirsakli valdan, harakat uzatuvchi detallardan iborat bo'ladi. Yuritmaning shesternyali, egiluvchan zanjirli yoki tishli tasmali turlari bor.

Taqsimlash valining harakati (2.6-rasm) tirsakli valga o'rnatilgan yetakchi shesternya (11) bilan ilashgan yetaklanuvchi shesternya (10) orqali amalga oshiriladi. U shesternyalar shovqinni kamaytirish maqsadida qiya tishli qilib ishlangan.

Kiritish klapani kiritish taktida ochiq, chiqarish klapani chiqarish taktida ochiq bo'lishi kerak. GTM shunday tartibni ta'minlaydi.

Klapanlarning ochiq holati tirsakli valning yarim aylanishiga mos. Klapanlarning ochiq holatini tirsakli valning burilish burchagi bilan ifodalanishi **gaz taqsimlash fazasi diagrammasi** deyiladi (2.7-rasm).

valves of the engines of modern vehicles. Hydraulic tappet automatically provides the gapless contact between the valve and the cam or rocker arm. In this case the valve clearance is not necessary.

The rod (8) serves to pass the force from the tappet to the rocker arm.

The rocker arm (5) lever with two arms transmits the tappet movement direction into opening movement of the valve.

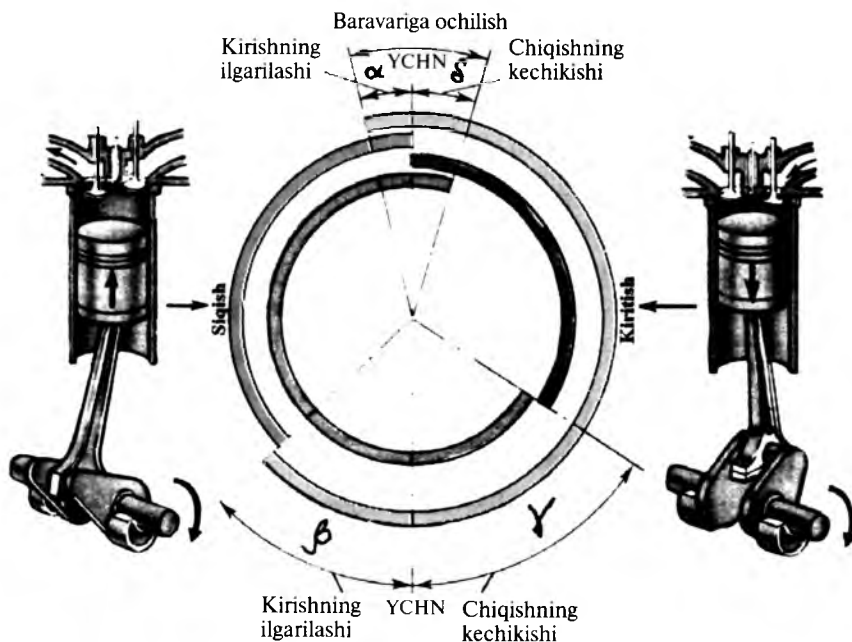
The drive of the camshaft comprises the parts, which pass the action from crankshaft. The drive is provided by the help of gears, flexible chain and toothed belt.

The camshaft is driven (Fig. 2.6) by gears (10 and 11). In order to decrease a gear noise the gears have grade teeth.

The intake valve is opened at intake stroke and the exhaust valve is opened at exhaust stroke. This is provided by the valve control mechanism.

The opened position of the valve corresponds to one half of a crankshaft revolution.

Expression of the opened positions of the valves by turning angle of the crankshaft is called **valve timing diagram** (Fig. 2.7).



2.7-rasm. Gaz taqsimlash fazasining diagrammasi.

Figure 2.7. Valve timing diagram.

Silindrlarni yonuvchi yangi zaryad bilan ko'proq to'ldirish uchun kiritish klapani ilgarilab ochiladi (α). Silindrni to'ldirish porshenni so'rish va kiritish quvuridagi potok inersion bosimi ta'sirida bajariladi. Takt yakunida kiritish klapani kechikib yopiladi (β). Kiritish quvurida oqimning inersiyasi hisobiga silindrga yangi zaryad ko'proq kiradi. Demak, kiritish jarayonining davomiyligi $\alpha + 180^\circ + \beta$ ga teng bo'ladi. Silindrni yangi zaryad bilan to'ldirish yaxshilanadi.

Chiqarish klapani ham ilgarilab ochiladi (γ). Ish takti tugallanishiga qadar bosim ostidagi gazlar silindrdan tashqariga

In order to provide the best admission of the cylinders with new charge the intake valve is opened with advance (α). The admission is done by suction of the piston and under the action of inertial pressure of flow in the intake duct. At the end of stroke the intake valve is closed with delay (β). The new charge takes in because of the flow inertia in the intake duct. So, duration of the suction process is equal to $\alpha + 180^\circ + \beta$. The admission of the cylinders with new charge is improved.

The exhaust valve is opened with advance too (γ). Before the piston has reached the BDC at the power stroke

chiqara boshlanadi. Porshenning ishlatilgan gazlarni chiqarishiga minimal kuch sarflanadi. Chiqarish klapanining kechikib (δ) yopilishi yonish kamerasini gazlardan yaxshi tozalash uchun kerak. Chiqarish jarayonining davomiyligi $\gamma + 180^\circ + \delta$ ga teng bo'lib, silindrni ishlatilgan gazlardan tozalanishini yaxshilaydi.

Kiritish va chiqarish klapanlarining ayni bir vaqtda ochiq holatda bo'lishi ($\alpha + \delta$) klapanlarning baravariga ochilik burchagi deyiladi.

the exhaust gases begin to take out of the cylinder by pressure. The force expense is minimal to push exhaust gas out of the cylinder by piston. The closing of the exhaust valve with delay (δ) is necessary for good cleaning the combustion chamber from exhaust gases. Duration of the exhaust process is equal to $\gamma + 180^\circ + \delta$, it improves cleaning the cylinder from exhaust gases.

The opened position of the intake and exhaust valves at the same time ($\alpha + \delta$) is called valve lap.

Nazorat uchun savollar

Self-control questions

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. GTMning vazifasi nima? 2. GTMning qanday turlari keng tarqalgan? 3. GTMning detallari. 4. GTMning ishlash prinsipini tushuntiring? 5. Kiritish va chiqarish klapanlarinig o'zaro qanday farqi bor? 6. SOHC va DOHC ga izoh bering? 7. Gaz taqsimlash fazalarini tushuntiring. | <ol style="list-style-type: none"> 1. What is the function of VCM? 2. What types of VCM are widespread? 3. Details of VCM. 4. Describe the operation principle of VCM? 5. What is the difference between intake and exhaust valves? 6. Describe SOHC and DOHC? 7. Describe the valve timing diagram. |
|--|---|

2.7. SOVITISH TIZIMI

2.7. COOLING SYSTEM

Dvigatelning sovitish tizimi uning harorat rejimini boshqarishga xizmat qiladi. Sovitish tizimining havoli va suyuqlikli turlari bor.

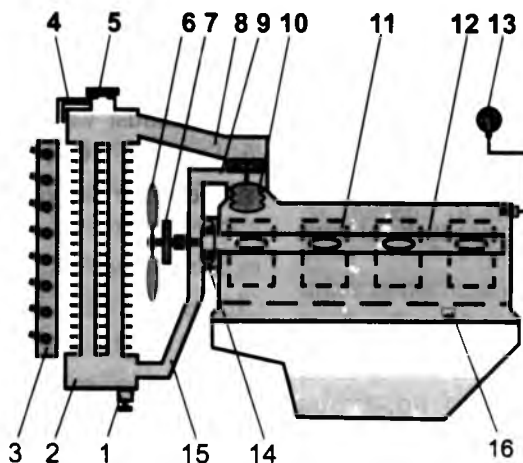
Suyuqlik bilan sovitish tizimining sxemasi 2.8-rasmda keltirilgan.

Silindrlar blokidagi suyuqlik g'ilofi shlang va patrubkalar (8, 15) orqali radiator bilan ulangan. Radiator (2) ortida ventilyator (6) va suyuqlik nasosi (14) joylashgan. Nasos shkivi (7) tasma orqali tirsakli val shkividan yuritma oladi. Tizim radiatorning qopqoqli bo'g'zi orqali to'ldiriladi. Suv radiator va blokda joylashgan jo'mraklar (1, 16) orqali to'kiladi.

It is the purpose of the cooling system to control the temperature regime of the engine. The air and liquid cooling systems are used.

The scheme of the liquid cooling system is shown in Fig.2.8.

The water jacket in the cylinder block is connected to the radiator through the hose and pipes (8, 15). The fan (6) and water pump (14) are arranged behind the radiator. The pump pulley (7) is driven by the crankshaft via the belt. The system is filled in through the neck of radiator that has a cap. The water is discharged from the system by faucets (1, 16) at the radiator and cylinder block.



2.8-rasm. Suyuqlikli sovitish tizimining sxemasi.

Figure 2.8. Scheme of the liquid cooling system.

1, 16—jo'mraklar; 2—radiator; 3—jalyuzi; 5—radiator qopqog'i; 6—ventilyator; 8 va 15—birlashtiruvchi patrulkalar; 10—termostat; 11—silindr atrofi; 12—suv taqsimlovchi quvur; 14—suyuqlik nasosi.

Suyuqlikni kam bug'lantirish va qaynash haroratini oshirish maqsadida sovitish tizimi qopqoq bilan yopiladi. Tizimdagi bosim atmosfera bosimiga nisbatan katta yoki kichik bo'lishiga qarab maxsus bug'-havo klapani (5) shlang (4) orqali bachokka bug'm chiqaradi yoki tizimga suyuqlikni kirg'izadi.

Suyuqlik nasosi (14) radiatorda sovitilgan suyuqlikni taqsimlovchi quvur (12) yordamida g'ilofga bir tekisda haydaydi. G'ilofda tekis taqsimlangan suyuqlik qizigan silindrlar haroratini pasaytiradi va birlashtiruvchi patrulka (8) orqali radiatorga o'tadi. Radiatordan o'tadigan suyuqlik miqdorini termostat (10) avtomatik tarzda boshqaradi.

Radiator (2) issiqlik almashtirgich vazifasini bajaradi. Sovitish tizimidagi haroratni atmosferaga tarqatadi. Radiatorda suyuqlik oqadigan naychalar ikkita bachokni ulaydi. Issiqlik harorati shu naychalar orqali atmosferaga tarqatiladi.

Jalyuzi (3) sovuq ob-havo sharoitida radiatordan o'tayotgan havo oqimi miqdorini kamaytiradi. Dvigatel haroratining oshiqcha tushib ketmasligini ta'minlaydi.

Suyuqlik nasosi (14) tizimdagi suyuqlikni tinimsiz aylantiradi. Sovitish tizimi-

1, 16—faucets; 2—radiator; 3—blind; 5—cap of radiator; 6—fan; 8 and 15—connecting pipes; 10—thermostat; 11—water jacket; 12—water distributing duct; 14—water pump.

In order to prevent the intensive vaporizing and to increase the boiling temperature of the water the cooling system is closed by a cap. Depending on the pressure in the system, the steam is discharged to expansion tank or the liquid is entered to the system from expansion tank through the pipe (4) and pressure air valve (5).

The water pump (14) feeds equally the water cooled in the radiator to the water jacket by the help of distributing duct (12). The equally distributed water in the jacket decreases the temperature of the heated cylinders and flows to the radiator via the connecting pipe (8). The quantity of the fluid that flows through the radiator is automatically controlled by the thermostat (10).

Radiator (2) is a heat changer that distributes the heat of the cooling system to atmosphere. Pipes, through which flows the liquid, connect two tanks of radiator. The heat temperature is distributed to atmosphere through these pipes.

Blind (3) limits the quantity of an air that flows through the radiator when the weather is cold. It prevents over reducing of the engine temperature.

Water pump (14) circulates the water in the system constantly. The centrifugal pumps are widespread in the cooling system.

da markazdan qochma nasoslar keng qo'llaniladi.

Ventilator (6) radiatordan o'tayotgan havo miqdorini va tezligini oshirish uchun xizmat qiladi.

Thermostat (10) suyuqlik harorati ta'sirida radiatorni ulaydigan yoki ajratadigan klapan. Suyuqlik harorat pastligida dvigatel g'ilofida aylanadi. Harorat me'yordan ko'tarilganda termostat suyuqlikni radiator orqali o'tish kanalini ochadi.

Fan (6) increases the quantity and speed of an air that flows through the radiator.

Thermostat (10) is the valve that connects or disconnects the radiator under the influence of liquid temperature. The liquid is circulated in the water jacket while the water temperature is low. After the temperature has become higher, the thermostat opens and passes the liquid to the radiator.

Nazorat uchun savollar

Self-control questions

1. Sovitish tizimining vazifasi nima?
2. Sovitish tizimining qanday turlari keng tarqalgan?
3. Sovitish tizimining detallari.
4. Sovitish suyuqligining turlari.
5. Bug'-havo klapanlarinig vazifasi nima?

1. What is the function of cooling system?
2. What types of cooling system are widespread?
3. Details of cooling system.
4. Types of cooling liquids.
5. What is the function of pressure-air valve?

2.8. MOYLASH TIZIMI

2.8. LUBRICATING SYSTEM

Moylash tizimi ishqalanuvchi yuzalarga moyni yetkazib berish uchun xizmat qiladi. Maqsad yuzalarda ishqalanish kuchini kamaytirish. Shu bilan birga, moy yuzani qirindilardan tozalaydi, korroziyadan himoyalaydi, sovitadi.

Lubricating system serves to feed the oil to rubbing surfaces of details. The purpose is to reduce a friction force between surfaces. Additionally, the oil cleans the surface from abrasive particles, protects from corrosion and cools details.

Moy ishqalanuvchi yuzalarga bosim ostida, sachratish va oqizish usullarida yetkaziladi.

Silindr ichiga moy sachratish usulida yetkaziladi. Porshen bilan bog'liq detallar moylanadi.

Dvigateldagi tirsakli val, gaz taqsimlash vali, koromislo o'qlari bo'yinlari bosim ostida moylanadi.

Moylangan yuzadan chiqayotgan moy karterga tushadi.

Ishqalanuvchi yuzalarda moy qiziydi. Moy nasosi karterdagi moyni qisman moy radiatori orqali haydaydi, moy sovitiladi. Moylash tizimining sxemasi 2.9-rasmda ko'rsatilgan.

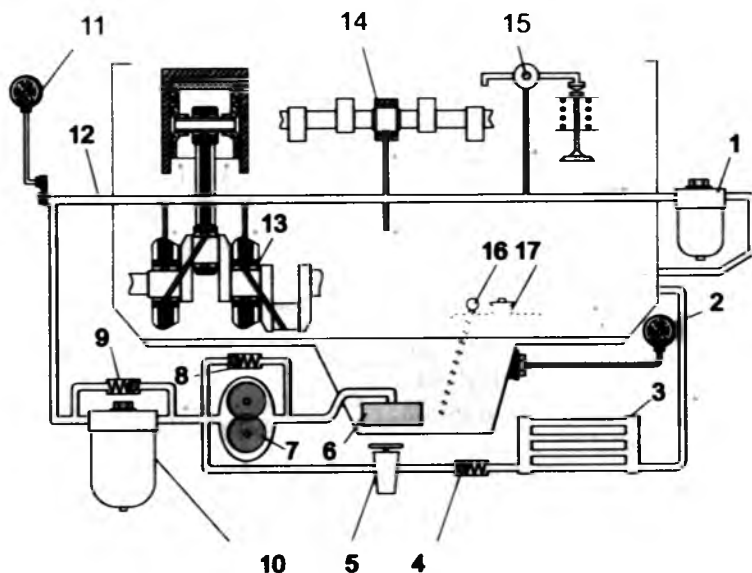
The oil is passed to rubbing surfaces by pressure, by splash and gravity.

The oil is fed by splash to inner surface of the cylinder. Details connected to the piston are lubricated.

Journals of the crankshaft, camshaft and axis of the rocker arm of the engine are lubricated under the pressure.

The oil from lubricated surfaces gets the oil pan.

The oil is heated on the rubbing surfaces of details. Oil pump partially feeds the oil amassed in the oil pan through the oil cooler and oil is cooled. Figure 2.9 shows the scheme of the lubricating system.



2.9-rasm. Moylash tizimining sxemasi:

1—mayin filtr; 3—moy radiatori; 6—setkali moy qabul qilgich; 7—moy nasosi; 10—dag'al filtr; 12—asosiy moy magistrali; 16—moy sathini o'lchagich (shchup).

Figure 2.9. Scheme of the lubricating system.

1—fine filter; 3—oil cooler; 6—grided oil receiver; 7—oil pump; 10—particle filter; 12—main oil line; 16—measuring probe.

Moy karter-poddomiga (osttog'orasi) moy quyish patruboki (17) orqali quyiladi. Karter poddonidagi moy sathi o'lcagich shchup (16) yordamida nazorat qilinadi. Ishlatilgan moyni to'kish tiqinni (18) ochib amalga oshiriladi.

Moy nasosi (7) moy qabul qilgich (6) orqali moyni so'radi va bosim ostida dag'al filtrga (10) haydaydi. Moy bosimimig me'yoridan oshib ketmasligi uchun reduksion klapan (8) o'rnatilgan.

Dag'al filtrdan moy blok-karterdagi bosh magistral kanaliga (12) yuboriladi. Dag'al filtrning (10) chiqindilar bilan tiqilishi holati uchun filtrga papallel o'tkazuvchi klapani (9) o'rnatilgan.

Moylash ehtiyojidan oshiqcha moy mayin filtr (1) orqali poddonga qaytadi.

Moy bosh moy magistralidan (12) blok-karterdagi kanalchalar orqali tirsakli valning o'zak bo'yinlarga (13), taqsimlash valining podshipniklariga (14) va koromislolar o'qiga (15) yuboriladi.

Koromislo tanasidagi kanaldan kelgan moy shtanga va klapan uchlarini moylaydi. Tirsakli val kanali orqali moy bosim ostida shatun bo'yimini va shatun sterjenidagi kanal orqali porshen barmog'ini moylash uchun yuboriladi.

Ba'zi dvigatellarda shatunning pastki kallagida teshikcha ishlangan bo'lib, u shatun bo'ynidagi radial kanal teshigi bilan ustma-ust kelganida moy silindr devorining yuzasiga bosim ostida sachraladi. Taqsimlash va tirsakli val podshipniklaridan oqib tushayotgan moy harakatlantiruvchi qismlar bilan sachratiladi va mayda tomchi ko'rinishida silindrlar devori,

The oil is poured into the oil pan through the oil pipe (17). The level of the oil in the oil pan is controlled by measuring probe (16). Waste oil is drained through the hole closed by drain plug (18).

The oil pump (7) sucks the oil through the oil receiver (6) and blows it to the particle filter (10) under pressure. A pressure-reducing valve (8) is installed to prevent an excessive increase of the oil pressure in the system.

Lubricant moves from the particle filter to the main oil line (12) in the crankcase block. The bypass valve (9) is actuated after the particle filter (10) has become dirty.

The excessive oil in the main oil line passes through fine filter (1) and is back to the oil pan.

Lubricant is transferred from the main oil line (12) to main journals (13) of the crankshaft, to bearings (14) of the camshaft and to the axis (15) of the rocker arms through channels in the crankcase.

The oil received from the channel on the body of rocker arm greases the push rod and the tips of the valves. The oil is fed under pressure through the channel of the crankshaft to grease the crankpin and through the channel in the connecting rod to grease the piston pin.

Some connecting rods have a hole on the big end and lubricant sprays to the inner surface of the cylinder in case of coincidence of the hole with the radial channel of the crankpin. Dripping oil from the bearings of the crankshaft and

taqsimlash vali mushtchalari, turtkichlar, porshen halqalari va hokazo qismlarni moylaydi.

Tizimdagi moyning harorati 95°C dan oshmasligini moy radiatori (3) ta'minlaydi. Moy radiatori jo'mrak (5) yordamida ishga tushiriladi va moy radiator orqali sovutilib karter poddoniga oqib tushadi. Saqlagich klapan (4) tizimdagi moy bosimining me'yoridan kamayib ketmasligini ta'minlaydi.

Bosh magistralda (12) o'rnatilgan datchik (11) orqali moylash tizimining ishlashi nazorat qilinadi.

Moy nasosi vazifasi — moylash tizimida moyni harakatga keltirib, kerakli bosim hosil etish. Moylash tizimida ichki va tashqi ilashgan shesterniyali va rotorli moy nasoslari qo'llaniladi.

Moy filtri vazifasi — moyni dvigatel qismlarining eyilishi oqibatida hosil bo'lgan qattiq zarrachalardan, qurum va hokazo qirindilardan tozalash.

Karterni shamollatish porshen halqalari bilan silindr oralig'idagi tirqishlardan karterga o'tadigan „karter“ gazlarini chetlashtirish uchun xizmat qiladi.

camshaft is sprayed with the help of moving parts and lubricates the inner surface of the cylinder, cams of the camshaft, the tappets, the piston rings etc. in drops form.

Increasing of the oil temperature in the system not more than 95°C is provided by oil cooler (3). Oil cooler is actuated with the help of the crane (5) and chilled oil flows back to the oil pan. Safety valve (4) prevents the reduction of the pressure in the system lower than the norm.

Operation of the lubricating system is controlled by a sensor (11) mounted in the main oil line (12).

The oil pump serves to feed the oil in the system and to create the necessary pressure. There are gear pumps with external and internal mesh and rotor oil pumps in the lubricating system.

The oil filter serves to clean the lubricant from abrasive particles of the wear product, soot etc.

The crankcase ventilation serves to issue the crankcase gases, appearing because of seepage of the burned gases through the clearance between the surface of the cylinder and piston rings.

Nazorat uchun savollar

Self-control questions

1. Moylash tizimining vazifasi nima?
2. Moylash tizimining qanday turi keng tarqalgan?
3. Motlash tizimining detallari.
4. Moy nasosining turlari.
5. Dvigatel detallari qanday moylanadi?

1. What is the function of lubricating system?
2. What types of lubricating system are widespread?
3. Details of lubricating system.
4. Types of the oil pumps.
5. How details of the engine are lubricated?

2.9. KARBYURATORLI DVIGATELLARNING TA'MINLASH TIZIMI

2.9. FUEL SYSTEM OF CARBURETTOR ENGINES

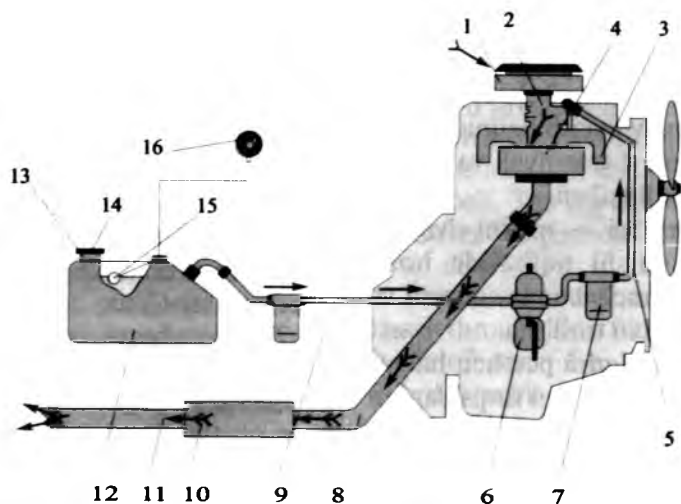
Ichki yonuv dvigatelining ta'minlash tizimi yonuvchi aralashma tayyorlash, uni silindrlarga uzatish va ishiatilgan gazlarni chiqarish uchun xizmat qiladi.

Karbyuratorli dvigatellarda yonuvchi aralashma karbyuratorda tayyorlanadi. Karbyuratorli dvigatellar ta'minlash tizimining sxemasi 2.10- rasmda keltirilgan.

The fuel system of internal combustion engines serves to produce the fuel-air mixture, feed it to cylinders and to exhaust burned gases.

The fuel-air mixture is produced in carburetor in the engines of this type.

The scheme of the fuel system of carburetor engine is shown in Fig. 2.10.



2.10-rasm. Karbyuratorli dvigatel ta'minlash tizimining sxemasi.

→ yonilg'i; >→ havo; ishlatilgan gazlar >>→

1—havo filtri; 2—karbyurator; 6—yonilg'i nasosi; 10—shovqin so'ndirgichi; 12—yonilg'i baki.

Yonilg'i zahirasi bakda (12) saqlanadi. Bakdan yonilg'ini nasos (6) so'radi. Yonilg'i tarkibida suv yoki boshqa quyqa bo'lsa, tindirgichda (7) tozalanadi. Nasos yonilg'ini karbyuratorga (2) haydaydi. Karbyurator — aralashtirgich moslamasi.

Figure 2.10. The scheme of the fuel system of carburettor engine.

→ Fuel; >→ air; >>→ exhaust gases.

1—air filter, 2—carburettor, 6—fuel-feed pump, 10—damper, 12—fuel tank.

The fuel margin is stored in the fuel tank (12). The pump (6) draws the fuel from the tank. The water or dirt in the fuel composition is cleaned by sediment filter (7). The pump feeds the fuel to the carburetor (2). Carburettor is a mixing device.

Porshen so'rish taktida silindrda vakuum hosil qiladi. Havo silindrga so'rilishida filtrdan (1) tozalanib o'tadi. Havo va yonilg'i karbyurator (2) aralashadi, yonilg'i aralashmasi tayyorlanadi. Kiritish quvuri (3) yonilg'i aralashmasini silindrlarga yo'naltiradi.

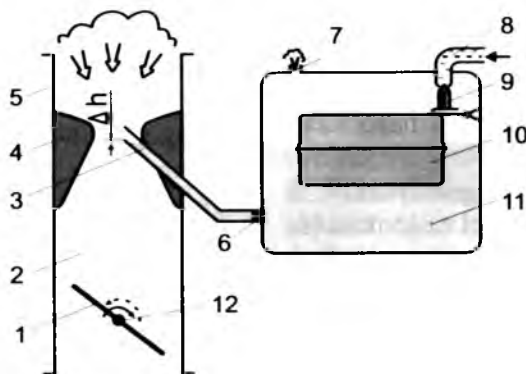
Silindrlarda yonuvchi aralashma yondirilib mexanik energiya olinadi. Yonish natijasida hosil bo'lgan gazlar chiqarish quvuri (4) bo'ylab shovqin so'ndirgichi (10) orqali atmosferaga chiqarib yuboriladi.

Yonuvchi aralashmani tayyorlash jarayonini oddiy karbyurator misolida ko'rib chiqamiz (2.11-rasm).

The piston creates vacuum at the suction stroke. The air is cleaned in the air filter (1) before drawing to the cylinder. The fuel is mixed with air in the carburetor (2) and fuel-air mixture has been produced. The intake manifold directs the fuel-air mixture to the cylinder.

The fuel-air mixture burns in the cylinder and mechanical energy is produced. Exhaust gases formed after burning are pushed to the atmosphere through exhaust manifold (4) and damper.

The producing process of the fuel-air mixture is described in example of simple carburettor (Fig. 2.11).



2.11-rasm. Oddiy karbyuratorning sxemasi.

Figure 2.11. The scheme of simple carburettor.

1—drossel zaslonkasi; 2—aralashtirish kamerasi; 3—purkagich; 4—diffuzor; 5—havo yo'li; 6—jikler; 7—teshik; 8—enzin keluvchi kanal; 9—ignasimon klapan; 10—qalqovich; 11—qalqovichli kamera; 12—drossel zaslonkasimi o'qi.

Qalqovichli kamerada (11) benzin sathi me'yorlangan. Sath me'yorda bo'lishi uchun kanal (8) uchi qalqovichning (10) ignasimon klapani (9) bilan yopiladi.

1—throttle; 2—mixing chamber; 3—nozzle; 4—diffuser; 5—air intake pipe; 6—jet; 7—hole; 8—fuel channel; 9—shut-off needle; 10—float; 11—float chamber; 12—throttle axle.

The fuel level in the float chamber (11) is rated. The fuel channel (8) is closed by the shut-off needle (9) of the float (10) to provide the fuel level norm.

Kishida sabr qanoatli xususiyat mavjud bo'lsa, u kishidan albatta dono etishib chiqadi.

Abu Nasr Forobiy

Benzin sathi me'yordan pasaya boshlaganda ignasimon klapan benzin tushish yo'lini ochadi.

Karbyuratorning havo yo'li (5) diffuzor (4) bilan toraytirilgan. Diffuzor o'tayotgan havo tezligini oshiradi va tor qismda bosim pasayadi.

Kamerada (11) atmosfera bosimini teshik (7) ta'minlaydi. Bosimlar farqi hisobiga benzin purkagich (3) kanali orqali so'riladi. Jikler (6) o'tayotgan benzin miqdorini me'yorlaydi. Purkagichdan oqib chiqayotgan benzin katta tezlik bilan harakatlanayotgan havo zarbasidan mayda tomchilarga parchalanadi va havo bilan aralashadi.

Silindrga yuboriladigan yonuvchi aralashma miqdori drossel zaslonkasi (1) bilan boshqariladi. Drossel zaslonkasi haydovchi gaz pedali bilan ulangan.

Dvigatel salt, o'rtacha, yuqori yuklanish va boshqa rejimlarda ishlaydi. Dvigatel rejimiga mos turli tarkibdagi yonilg'i aralashmasi kerak bo'ladi.

Rejimlarga mos ravishda yonilg'i aralashmasi tayyorlash uchun karbyurator quyidagi qurilmalarga ega: ishiga tushirish qurilmasi, salt ishlash tizimi, bosh dozalovchi qurilma, ekonomayzer va tezlatish nasosi.

Ishga tushirish qurilmasi sovuq dvigatelni ishonchli o't olish rejimiga mos yonilg'i aralashmasi tayyorlaydi.

Salt ishlash tizimi tirsakli valning minimal aylanish chastotasida turg'un ishlashi uchun aralashma tayyorlaydi.

When the fuel-level has decreased down than required norm, the shut-off needle opens the fuel channel

Diffuser 4 narrows the air intake pipe (5) of carburettor. The speed of the induction air will be increased in diffuser and the air pressure will be decreased in narrowed place.

The atmosphere pressure in the chamber (11) is provided by the hole (7). By means of pressure differences, the fuel is sucked through channel (3). The jet (6) rates the level of feeding fuel. The leaking gasoline from the nozzle is broken up into small drops by action of high-speed airflow and mixed with air.

The quantity of the sucked fuel-air mixture into cylinder is controlled by throttle (1). Throttle is connected to the driver's pedal.

The engine runs at an idle mode; partial load; full load and other speed ranges. The fuel-air mixture with different consistence is required for all engine speed ranges.

The carburettor has the following devices to prepare the fuel-air mixture for all engine speed ranges: starting device; idle mode system; main metering device; economizer and acceleration pump.

Starting device makes the fuel-air mixture to start the cool engine.

Idle mode system makes fuel-air mix-

Bosh dozalovchi qurilma oʻrtacha yuklanish diapazonida tejamkor tarkibli yonuvchi aralashmasini tayyorlaydi.

Ekonomayzer toʻla quvvat olish uchun boyitilgan aralashma tayyorlashga xizmat qiladi.

Tezlatish nasosi avtomobilning keskin dinamik harakatini taʼminlash uchun aralashmani tezkor boyitib berishga xizmat qiladi.

ture for constant minimal speed range of the engine.

Main metering device makes the saving fuel-air mixture for middle speed range.

Economizer serves to make enriched mixture for full load speed range.

Acceleration pump serves to enrich the mixture quickly to provide the high-speed movement of the vehicle.

Nazorat uchun savollar

Self-control questions

1. Karbyuratorli dvigatel taʼminlash tizimining vazifasi?
2. Tizimning ishlashini sxema yordamida tamishtiring.
3. Karbyuratorli dvigatel taʼminlash tizimining detallari.
4. Karbyuratorning qanday qurilmalari mavjud?
5. Yonuvchi aralashmani tushuntirib bering.

1. What is the function of the fuel system of carburettor engine?
2. Describe the operation principle of the system by scheme.
3. Details of the fuel system of carburettor engine.
4. What devices does the carburettor have?
5. Tell about the fuel-air mixture.

2.10. GAZDA ISHLAYDIGAN DVIGATELNING TAʼMINLASH TIZIMI

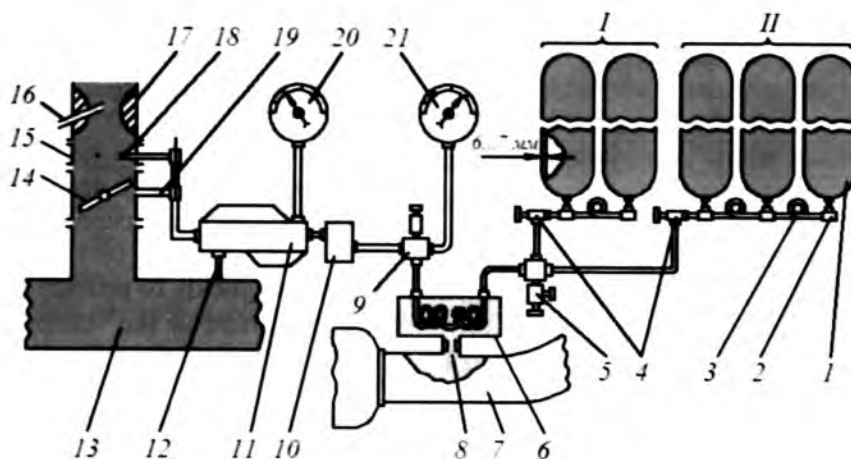
2.10. FEED CIRCUIT OF THE GAS ENGINE

Ichki yonuv dvigatellarida siqilgan yoki suyultirilgan tabiiy gaz yonilgʻi sifatida ishlatiladi. Metan gazi 1,5...1,8 MPa bosimgacha siqiladi. Butan, propan gazlari siqilganda suyuq holatga oʻtadi.

Siqilgan gaz bilan ishlaydigan gaz ballonli qurilmaning prinsipial sxemasi 2.12-rasmda keltirilgan.

Compressed and liquefied natural gas is used as a fuel in the internal combustion engines. Methan gas is compressed until pressure 1,5...1,8 MPa. Butan, propan is converted into liquid by pressing.

The scheme of the gas tank device operated with liquefied gas is shown in Fig. 2.12.



2.12-rasm. Gaz ballonli qurilmaning prinsipial sxemasi.

1—ballonlar; 3—naychalar; 4, 9—ventillar; 5—jo'mrak; 6—isitgich; 7—dvigateldan chiqadigan gaz quvuri; 10—filtr; 11—ikki pog'onali reduktor; 13—yonuvchi gaz kirish quvuri; 14—drossel; 17—karbyurator-aralashtirgich; 18—gaz forsunkasi; 19—dvigatel salt rejimi gaz naychasi.

Siqilgan gaz po'lat ballonlarda (1) saqlanadi. Ballonlar bir-biri bilan o'zaro ulovchi naychalar (3) bilan tutashtirilgan. Gaz ballonlardan (1) sarflash ventili (4), isitgich (6), filtr (10) orqali reduktorga (11) o'tadi. Reduktor (11) gazning bosimi atmosfera bosimigacha pasaytiradi.

Yuqori bosimdan past bosimga o'tishda gaz harorati keskin tushadi. Isitgich (6) gaz haroratini ko'taradi. Dvigatelda ishlatilgan chiqindi gazlarning issiqligi yonilg'1 gazni isitadi.

Dvigatel ishlaymay turganda reduktor (11) gaz magistralini berkitib qo'yadi. Ishlayotgan dvigatelda gaz forsunka (18) orqali karbyurator-aralashtirgichga o'tadi va havo bilan aralashadi. Salt ishlash

Figure 2.12. Scheme of the gas tank device.

1—tanks; 3—pipes; 4, 9—valves; 5—faucet; 6—heater; 7—exhaust pipe; 10—filter; 11—two step reducer; 13—intake pipe; 14—throttle; 17—carburetor-mixer; 18—gas nozzle; 19—gas pipe of the idle mode.

Compressed gas is stored in the steel tank (1). Each tank is connected to other by connecting pipes (3). Gas passes from the tank (1) to the reducer (11) through the valve (4), the heater (6) and the filter (10). The reducer (11) reduces the pressure of gas to atmosphere.

In reducing the pressure from high to low the temperature of gas is decreased quickly. The heater 6 increases the temperature of gas. Gas is heated by heat of exhaust gases flowing from the engine.

When the engine is cut off reducer (11) closes the gas pipe. When the engine is running gas passes to the carburettor-mixer through the nozzle (18) and mixes with an air. At the idle mode,

rejimida gaz naycha (19) orqali drossel (14) ostki qismiga kiritiladi.

Yuqori bosim manometri (21) yordamida ballonlardagi gaz bosimi nazorat qilinadi. Past bosim manometri (20) yordamida esa reduktorning ishlash nazorat qilinadi.

Ballonlar gaz bilan jo'mrak (5) orqali to'ldiriladi.

Suyultirilgan gazlar gaz holatga maxsus issiqlik almashtirgichda o'tkaziladi.

the gas enters into the space under the throttle (14) via the pipe (19).

The pressure of gas in the tanks is controlled by high-pressure manometer (21). Reducer is controlled by low-pressure manometer (20).

Tanks are filled up by gas through the faucet (5).

Liquefied gases are converted into gas in special heat changer.

Nazorat uchun savollar

Self-control questions

1. Gazda ishlaydigan dvigatel ta'minlash tizimining vazifasi nima?
2. Tizimning ishlashini sxema yordamida tashitirni.
3. Ta'minlash tizimining detallari.
4. Siqilgan va suyultirilgan gazlarni tushuntirni?

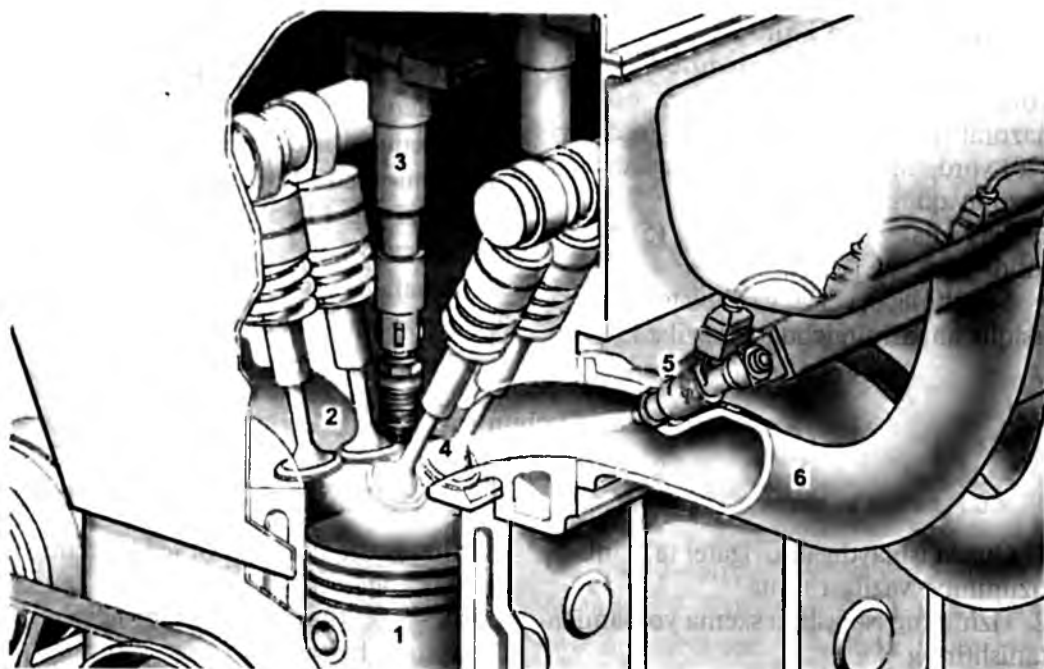
1. What is the function of feed circuit of the gas engine?
2. Describe the operation principle of the system by scheme.
3. Details of feed circuit system.
4. Tell about compressed and liquefied gases?

2.11. BENZINLI YONILG'INI KIRITISH QUVURIGA PURKASH TIZIMI

2.11. INJECTION SYSTEM OF THE GASOLINE INSIDE THE INTAKE MANIFOLD

Yonilg'ini kiritish quvuriga purkash tizimida yonilg'i aralashmasi dvigatel lindridan tashqarida tayyorlanadi. bunday tizimlarda, karbyuratorlilardan ko'ra, yonilg'i aralashmasi optimal tarkibli tayyorlanadi. Shuning uchun ular karbyuratorli tizimlarni ortda qoldirdi.

The fuel-air mixture is made outside of the cylinder of the engine in the injection system of the gasoline in intake manifold. The fuel-air mixture is made with optimum composition in such systems than systems equipped with acarburetor. That is why these systems outperform a lot more than systems equipped with acarburetor.



2.13-rasm. Kiritish quvuriga yonilg'ini purkash jarayoni.

1—porshen; 2—gazlarni chiqish quvuri; 3—o't oldirish g'altagi svecha bilan; 4—kiritish klapanlari; 5—injektor; 6—havo kiritish quvuri.

Figure 2.13. Injecting process of the gasoline in intake manifold.

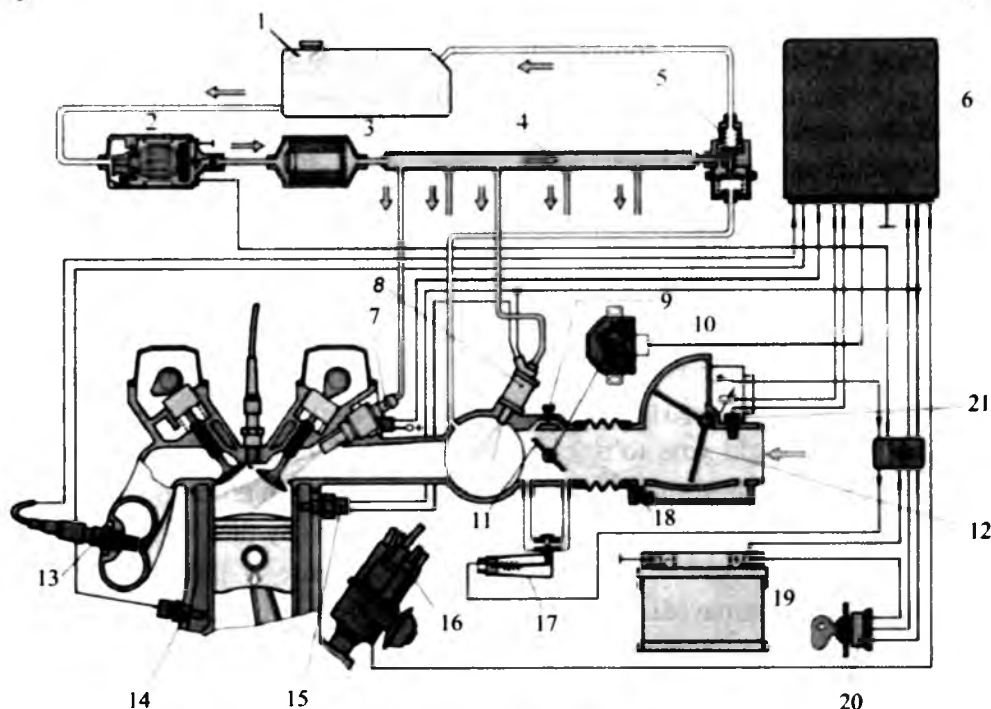
1—piston; 2—exhaust manifold; 3—ignition coil with spark plug; 4—intake valves; 5—injektor; 6—air intake duct.

Injektor (5) yonilg'ini bevosita kiritish klapanlari (4) yaqinida purkaydi. Yonilg'i shu yerda quvurdan (6) kelayotgan havo bilan aralashadi. Yonilg'i aralashmasi tayyorlanadi. Kiritish klapanlari (4) ochilganda tayyorlangan yonilg'i aralashmasi silindrga kiradi. Silindrda bitta, ikkita, xattoki, uchta kiritishi klapani bo'lishi mumkin.

Yonilg'ini kiritish quvuriga purkash tizimini sxematik ko'rinishi quyidagicha:

Fuel is injected near the intake valves (4) by the injector (5). The fuel is mixed with air inflowing from the duct (6). The fuel-air mixture is prepared. Intake valves (4) open and fuel-air mixture enters into the cylinder. One, two, even three intake valves can be mounted in a cylinder.

The scheme of an injection system of gasoline in the intake duct is given below.



2.14-rasm. Yonilg'i purkash ta'minlash tizmining sxemasi:

1—yonilg'i baki; 2—nasos; 3—filtr; 4—yonilg'i trubkalari; 5—bosim sozlagich klapani; 6— elektron boshqaruv bloki; 7, 8—injektor; 9—salt rejim sozlash vinti; 10—drossel xolati datchigi; 11—drossel zaslonkasi; 12—havo zaslonkasi; 13—kislorod va chiqindi gazlar xarorat datchigi; 14, 15—sovitish suyuqligi xarorati datchigi; 16—tok taqsimlagich; 17—salt rejimda havo miqdori klapani; 18—o't oldirishda xavo kanali; 19—akkumulyator batareyasi; 20—kalit; 21—kiruvchi havo xarorat datchigi.

Figure 2.14. Scheme of the fuel-injection circuit.

1—fuel tank; 2—pump; 3—filter; 4—fuel-pipes; 5—pressure adjusting valve; 6—electronic control module; 7, 8—injectors; 9—idle adjusting screw; 10—throttle sensor; 11—throttle gate; 12—air throttle; 13—oxygen and exhaust gases temperature sensor; 14, 15—cooling liquid temperature sensor; 16—current distributor; 17—air quantity piston for an idle mode; 18—airflow duct; 19—storage battery; 20—key; 21—inflow air temperature sensor.

Yonilg'i bakdan (1) elektr nasosi (2) yordamida filtr (3) orqali yonilg'i trubkasiga (4) haydaladi. Trubka (4) yuqori bosimli yonilg'i zahirasi va injektorlarni (7) mahkamlash uchun xizmat qiladi. Injektorlar (7) soni silindrlar soniga teng bo'ladi.

Markaziy injektor (8) dvigatelni o't oldirish rejimida ishlaydi. Yonilg'i bosimini sozlagich klapan (5) yonilg'i trubkasida (4) bosimni me'yorda saqlaydi.

Bunday tizimlarda dvigatel ish rejimiga muvofiq yonilg'i bosimi 0,3...0,5 MPa (3...5 atm) bo'ladi. Bosim yonilg'i miqdoriga va purkash mayinligiga ta'sir qiladi. Har siklda yonilg'i ikki yoki to'rt karra porsiyalab purkaladi. Bu yonilg'i aralashmasining to'liq yonishini yaxshilaydi. Yonilg'i tejamkorligi oshadi, chiqindi gazlarning zararliligi kamayadi.

Yonilg'ini kiritish quvuriga purkash tizimi elektronik boshqaruvli bo'ladi (2.14-rasm). Elektron boshqaruv bloki (6) (2.14-rasm) suyuqlik harorati (14, 15), kislorod miqdori (13), havo harorati (21), zaslonkalar holati (12) va (10) datchiklari signallari asosida injektorlardan (7, 8) sepiadigan yonilg'i miqdorini aniqlaydi. Yonilg'i miqdorini havo hajmiga mos tezkor boshqarish imkoni bor. Yonilg'i tejamkorligi yuqori, chiqindi gazlarning zarari kam bo'ladi. Bunday talablar borgan sari oshib boryapti.

The fuel is fed from the tank 1 to the pipe 4 through the filter (3) by the help of the electric pump (2). The pipe (4) serves to hold high-pressure fuel storage and the injectors (7). The number of injectors (7) is equal to the number of cylinders.

The central injector (8) is actuated with a start of the engine. The fuel pressure-adjusting valve (5) keeps the pressure at the norm in the fuel pipe (4).

The fuel pressure changes within 0,3...0,5 MPa according to engine speed in the engines of this type. The pressure influences on the fuel quantity and smooth fuel injection. Two or four times of fuel injection in portions are performed in each cycle. By this full ignition of the fuel-air mixture is improved. The fuel economy improves and harm of exhaust gases decreases.

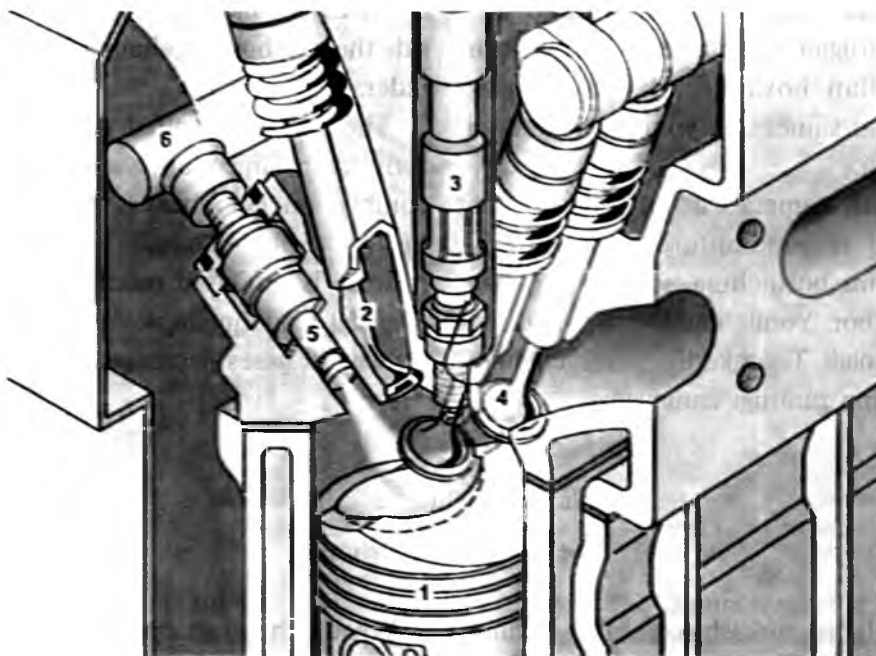
The injection system of the gasoline inside the intake manifold has an electronic control (Fig. 2.14). The electronic control module (6) (Fig. 2.14) defines a quantity of injecting fuel from the nozzles (7, 8) by the help of signals from liquid temperature (14, 15), oxygen (13), air temperature (21), throttle position sensors (12, 10). It is possible to manage fast control of proper quantity of the fuel according to air quantity. High fuel economy and low harm effects of exhaust gases are provided. Such requirements have been increasing.

2.12. BENZINLI YONILG'INI YONISH KAMERASIGA PURKASH TIZIMI

2.12. THE INJECTION SYSTEM OF THE GASOLINE INTO COMBUSTION CHAMBER

Benzinli yonilg'ini yonish kamerasiga purkash tizimida yonilg'i aralashmasi silindr ichida tayyorlanadi. Kirishi taktida ochiq kiritish klapani (2) (2.15-rasm) orqali silindrga faqat havo kiritiladi. Silindr yonish kamerasiga yonilg'i maxsus injektorlar (5) bilan purkaladi (2.15-rasm).

The fuel-air mixture is made inside the cylinder in the injection system of the gasoline into combustion chamber. Only air enters into the cylinder through the open intake valve (2) (Fig. 2.15) at the intake stroke. The fuel is injected into the combustion chamber of the cylinder by special injectors (5) (Fig. 2.15).



2.15-rasm. Benzinli yonilg'ini yonish kamerasiga purkash sxemasi.

1—porshen; 2—kiritish klapani; 3—o't oldirish g'altagi svecha bilan; 4—chiqarish klapanlari; 5—yuqori bosimli yonilg'i purkovchi injektor; 6—yonilg'i reykasi.

Figure 2.15. The injection system of the gasoline into the combustion chamber.

1—piston; 2—intake valve; 3—ignition coil with spark plug; 4—exhaust valves; 5—high- pressure fuel injector; 6—fuel bar.

Bak ichidagi elektr nasos yonilg'ini boshlang'ich bosim 0,3...0,5 MPa (3...5 atm) bilan yuqori bosim nasosiga haydaydi. Yuqori bosim nasosi dvigatel ish rejimiga mos bosimni ko'taradi. Yuqori bosimli yonilg'i yonilg'i reykasiga (6) (2.15-rasm) zahira uchun yuboriladi. Yonilg'i bosimi 5...12 MPa qiymatida bo'ladi. Yonilg'i reykasida (Common Rail deb ham yuritiladi) yuqori bosimli yonilg'ini yig'ish uchun xizmat qiladi. Reyka hajmi tizimda sodir bo'ladigan yonilg'i silkimishlarini tekislaydi. Yonilg'i reykasida yuqori bosim injektorlari joylashtirilgan. Ularning ishlashi elektron blok bilan boshqariladi. Injektorlar yonilg'ini silindrning yonish kamerasiga purkaydi.

Yonish kamerasiga purkash tizimida yonilg'i tezroq, aniqroq yetkaziladi. Yonilg'ini bosqichma-bosqich purkash imkoni bor. Yonilg'i aralashma sifatliroq tayyorlanadi. Tejamkorlik oshadi, chiqindi gazlarning zararliligi kamayadi.

The electric pump inside the tank feeds the fuel by pressure 0,3...0,5 MPa to the high-pressure pump. The HPFP increases the pressure according to engine speed. The high-pressure fuel is stored in the bar (6) (Fig. 2.15). The fuel pressure is about 5...12 MPa. The fuel bar (Common rail) serves to supply the fuel until high pressure. The capacity of the fuel bar smoothes the fuel shakings of the system. The high-pressure injectors are located on the fuel bar. They are controlled by an electronic control module (ECM). Injectors inject the fuel inside the combustion chamber of the cylinder.

The fuel is supplied faster and exactly in the injection system inside the combustion chamber. It is possible to inject the fuel gradually. The fuel-air mixture is produced more qualitatively. The fuel economy improves and the harm of exhaust gases decreases.

Nazorat uchun savollar

Self-control questions

1. Yonilg'ini purkash tizimining vazifasi nima?
2. Tizimning ishlash prinsipini tushuntiring.
3. Yonilg'ini purkash tizimining detallari.
4. Yonilg'ini purkash tizimining turlari.
5. Yonilg'ini purkash tizimining afzalliklari.

1. What is the function of the fuel injection systems?
2. Describe the operation principle of the system.
3. Details of the fuel injection system.
4. Types of the fuel injection systems.
5. Advantages of the fuel injection systems.

Kelajakda kim bo'lishingizni o'qiganlaringiz, ko'rganlaringiz va siz bilan birga bo'lgan insonlar belgilaydi.

Sa'diy Sheroziy

2.13. DIZEL DVIGATELINING TA'MINLASH TIZIMI

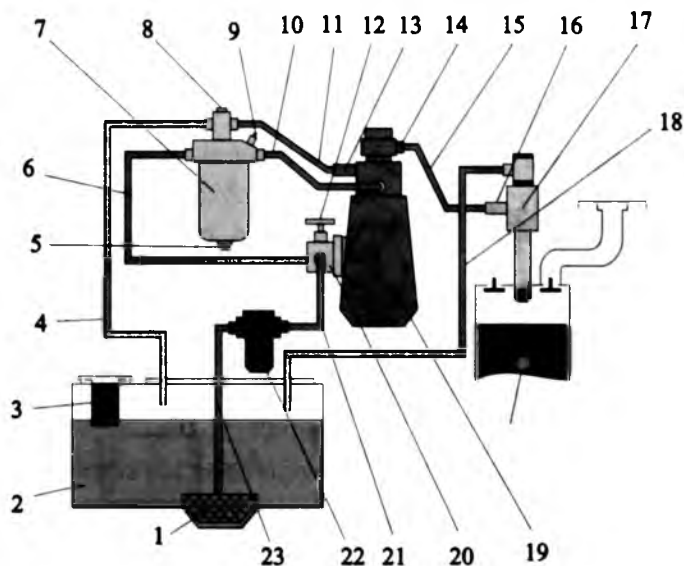
2.13. FUEL SYTEM OF THE DIESEL ENGINE

Dizel dvigateling ta'minlash tizimi yonuvchi aralashmani silindr ichida tayyorlaydi.

Dizel ta'minlash tizimining umumiy sxemasi 2.16-rasmda keltirilgan.

The fuel system of the diesel engine makes the fuel-air mixture in cylinder.

The scheme of the fuel system of the diesel engine is shown in Fig. 2.16.



2.16-rasm. Dizel ta'minlash tizimining umumiy sxemasi.

2—yonilg'i baki; 7—mayin tozalash filtri; 17—forsunka; 19—yuqori bosim yonilg'i nasosi; 20—yonilg'i haydash nasosi.

Figure 2.16. Common scheme of the fuel system of the diesel engine.

2—fuel tank; 7—fine filter; 17—injector; 19—high-pressure fuel pump; 20—fuel feed pump.

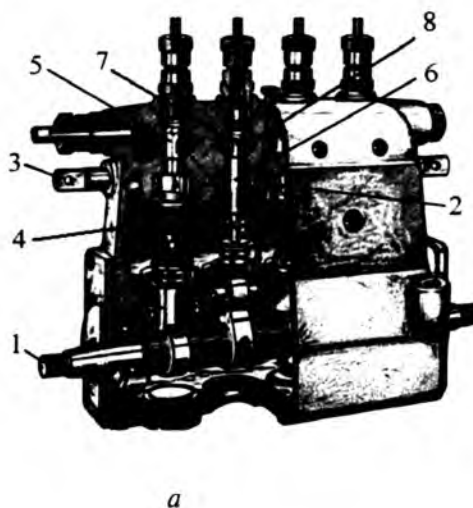
Yonilg'i haydash nasosi (20) harakatni yuqori bosim nasosi (19) validagi eksentrikdan oladi. Nasos yonilg'ini

Fuel feed pump (20) is driven by an eccentric mounted on the shaft of the high-pressure fuel pump (19). Pump

bakdan soʻradi. Soʻrilayotgan yonilgʻi dastlab dagʻal filtrda (22) tozalanadi. Nasosdan (20) oʻtib, mayin filtr (7) orqali yuqori bosim nasosiga haydaladi.

Yuqori bosimli yonilgʻi nasosi (YBYN) (19) yonilgʻini 1,2...1,8 MPa bosimgacha koʻtaradi va dvigatelning yuklanmasiga mos ravishda dozlash uchun xizmat qiladi.

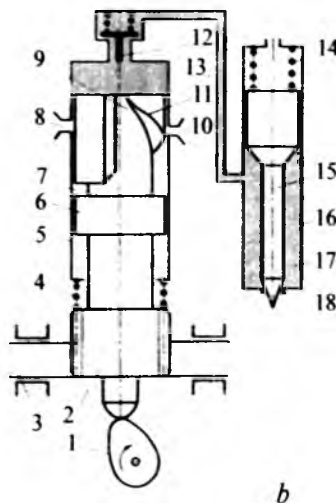
YBYNda yonilgʻi bosimi plunjer juftligi ichida oshadi (2.17-a rasm). Plunjer juftligini plunjer (6) va uning gilzasi (5) tashkil etadi (2.17-b rasm). Ularga oʻzaro juftlikda yuqori aniqlik bilan ishlov beriladi. YBYNda plunjerlar juftligi seksiyalar tarkibiga kiradi. Seksiyalar soni silindrlar soniga teng boʻladi. Har silindrga alohida seksiya.



draws in a fuel from the tank. At first drawing fuel is cleaned at the primary filter. Passes through the pump (20) and through the fine filter (7) goes to high-pressure fuel pump.

High-pressure fuel pump (HPFP) (19) increases the fuel pressure until 1,2...1,8 MPa and doses a fuel according to engine load.

The pressure of the fuel is increased in the plunger pair of the HPFP (Fig. 2.17, a). Plunger pair consists of the plunger (6) and the line (5) (Fig. 2.17, b). They are made by high accuracy in pair. The plunger pair is the part of section of the HPFP. The number of sections is equal to the number of cylinders. One section for one cylinder.



2.17-rasm. YBYNdan silindrga yonilgʻi uzatish sxemasi.

1—kulachokli val; 2—shesternya; 3—reyka; 4—qaytarish prujinasi; 5—gilza; 6—plunjer; 7—aylanma yoʻnma; 8—yonilgʻi kirish teshigi; 9—vertikal paz; 10—yonilgʻi chi-

Figure 2.17. Fuel feed scheme from HPFP to cylinder.

1—camshaft; 2—gear; 3—rack; 4—return spring; 5—line; 6—plunger; 7—circular groove; 8—fuel intake opening; 9—vertical groove; 10—fuel exhaust opening; 11—tilted

qish teshigi; 11—qiya qirra; 12—klapan; 13—yuqori bosim naychasi; 14—qaytarish prujinasi; 15—igna; 16—forsunka; 17—forsunka bo'shlig'i; 18—to'zitgich soplosi.

Shesternya (2) plunjerga qotirilgan va reyka (3) bilan ilashib turadi. Reyka gaz pedali bilan ulangan. Kulachokli val (1) harakatni dvigatel validan oladi. Plunjer (6) gilzada (5) ilgarilama-qaytma harakatlanadi. Reykaning (3) surilishi plunjerni o'qi atrofida aylantiradi.

Gilzaning ustki qismida yuqori bosimli yonilg'ining chiqish klapani (12) o'rnatilgan. Gilzada ikkita teshik bor — yonilg'ining kirish (8) va chiqish (10) teshiklari.

Forsunkada (16) prujina (14) igna (15) bilan to'zitgich soplosini (18) yopadi.

Plunjerning gilzada pastki holatida teshiklar (8) va (10) ochiq bo'ladi. Klapan (12) yopiq bo'ladi.

Yonilg'i gilzaga (5) kiritish teshigidan (8) kiradi. Plunjer (6) qiya oralig'i va ustki bo'shlig'i yonilg'i bilan to'ladi. Plunjer (6) kulachok (1) ta'sirida yuqoriga siljiydi va sirti bilan kiritish teshiklarini yopadi. Plunjer ustki bo'shlig'idagi yonilg'i bosimi oshadi.

Bosim haydash klapanini (12) ochadi. Yonilg'i yonilg'i naychasi (13) orqali forsunkaga (16) uzatiladi.

Bosim forsunka bo'shlig'iga (17) keladi. Yonilg'ining maksimal bosimi siqish taktining oxiriga to'g'ri keladi. Bosim igna (15) konus yuzasiga ta'sir qiladi. Bosim

edge; 12—valve; 13—pressure pipes; 14—return spring; 15—needle; 16—injector; 17—injector space; 18—nozzle.

Gear (2) is attached to plunger and coupled with the rack (3). The rack is connected to the accelerator pedal. Camshaft (1) is driven by crankshaft. Plunger 6 makes the reciprocating motion in the line (5). Movement of the rack (3) is accompanied by rotation of the plunger around its axis.

The high-pressure fuel feed valve (12) is mounted above the line. The line has two openings — fuel intake (8) and fuel exhaust (10) openings.

The spring (14) closes the nozzle (18) by needle (15) in injector (16).

The openings (8) and (10) are opened when the plunger has reached the bottom. The valve (12) is closed.

Fuel enters into the line (5) through the opening (8). Tilted groove and space above the plunger (6) is filled by fuel. The plunger (6) is actuated by the cam (1), moves upward, and closes the openings by its surface. The fuel pressure above the plunger increases.

The pressure opens the fuel feed valve (12). The fuel is passed to the injector (16) via the pipe (13).

The pressure comes to space (17) of injector. The maximum fuel pressure coincides to end of compression stroke. The pressure acts the cone surface of needle (15). The pressure force overcomes the stiffness force of the spring (14) and the

kuchi prujina (14) kuchini yengadi va ignami ko'taradi. To'zitgich soplosi (18) ochiladi. Yonilg'i silindr ichiga purkaladi. Silindrda 18...20 marta siqilgan havo harorati 800...850°C ko'tarilgan bo'ladi. Purkalgan yonilg'i qizigan havodan portlab alanganadi. Ish takti boshlanadi.

Plunjer (6) siljishi davomida qiya qirra (11) yonilg'i chiqish (10) teshigini ochadi. Yonilg'i bosimi birdaniga pasayadi. Klapan (12) yopiladi. Pujina (14) igna (15) bilan to'zitgich soplosini (18) yopadi. Naychada (13), forsunka bo'shlig'ida (17) ortiqcha bosimli yonilg'i qoladi. Plunjer juftligidan, forsunkadan ortgan yonilg'i qaytish kanallari bilan bakka tushadi.

Haydovchi gaz pedali bilan reyka (3) orqali plunjerni (6) gilzada (5) buradi va purkaladigan yonilg'i miqdorini boshqaradi.

needle has lifted. The nozzle (18) is opened. The fuel is injected inside the cylinder. The temperature of an air that compressed for 18...20 times in the cylinder, increases until 800...850°C. Injected fuel explodes in heated air and ignites. The power stroke has begun.

The tilted edge (11) opens the fuel exhaust opening (10) during the movement of the plunger (6). The fuel pressure is decreased fast. The valve (12) is closed. The spring (14) closes the nozzle (18) by the needle (15). The fuel is remained in pipe (13), in space of injector (17) with surplus pressure. The surplus fuel flows back through the return pipes to the fuel tank from the plunger pair and the injector.

A driver turns the plunger (6) in line (5) by the pedal and through the rack (3) and controls the quantity of the injecting fuel.

Nazorat uchun savollar

Self-control questions

- | | |
|---|---|
| 1. Dizel dvigateli ta'minlash tizimining vazifasi nima? | 1. Tell about function of the fuel system of the diesel engine? |
| 2. Ta'minlash tizimi ishiashini tushuntiring. | 2. Describe the operation principle of the fuel system. |
| 3. YBYN ning ishlashini tushuntiring. | 3. Describe the operation principle of HPFI. |
| 4. Yonilg'i uzatish nasosining vazifasi nima? | 4. What is the function of fuel feed pump? |
| 5. Tizimning detallarini ayting. | 5. Details of the system. |

*Odobli, bilimdon va aqlli mehnatsevar, iymon-e'tiqodli farzand
nafaqat ota-onaning, balki butun jamiyatning eng katta boyligidir.*

I. Karimov

2.14. COMMON RAIL — YONILG'INI PURKASH TIZIMI

2.14. COMMON RAIL — FUEL INJECTION SYSTEM

Zamonaviy dizel dvigatellarida Common Rail yonilg'i ta'minlash tizimi keng tarqalmoqda. Bunday dvigatellar yuk va yengil avtomobillar o'rnatilmoqda, jumladan, MAN rusumli avtomobillarga.

Purkash tizimining afzalliklari:

- dvigatelning turli ish rejimlarida optimal yonilg'i bosimini yaratadi;

- 1800—2000 bar bosimini yaratish imkoniyati yonilg'ini juda mayda purkashni, yonilg'i aralashmarining sifatli tayyorlanishini ta'minlaydi;

- purkashni nozik moslanuvchan boshqarish mumkin, bu yonilg'i tejamkorligini yaxshilaydi, chiquvchi gazlarning zararini kamaytiradi, dvigatel shovqinini pasaytiradi.

Common Rail — yuqori bosimda „akkumulyatorda — rampada“ yig'iladigan yonilg'ini purkash tizimidir. Inglizcha „Common Rail“ so'zma-so'z „umumiy balka/rampa“ bo'ladi.

Bu tizimda yuqori bosim nasosi yonilg'ini akkumulyatorga, rampaga uzatadi. U yerda doimiy yuqori bosim saqlab turiladi. Yonilg'ini forsunkalar orqali silindrlarga purkash davriy amalga oshiriladi.

Mazmunan, forsunkalar (12) yagona yonilg'i yuqori bosim rampasiga (9) ulangan. Bu tizimda yonilg'i bosimini yaratish va purkash jarayonlari o'zaro bog'liq emas.

Common Rail fuel system is widespread in modern diesel engines. Such engines are mounted on cars and lorries, including trucks of model MAN.

Advantages of the fuel injection system:

- creates optimum fuel pressure in different operating modes of the engine;

- possibility of creation the pressure 180—200 MPa provides to make qualitative fuel-air mixture and pulverization of the fuel very small;

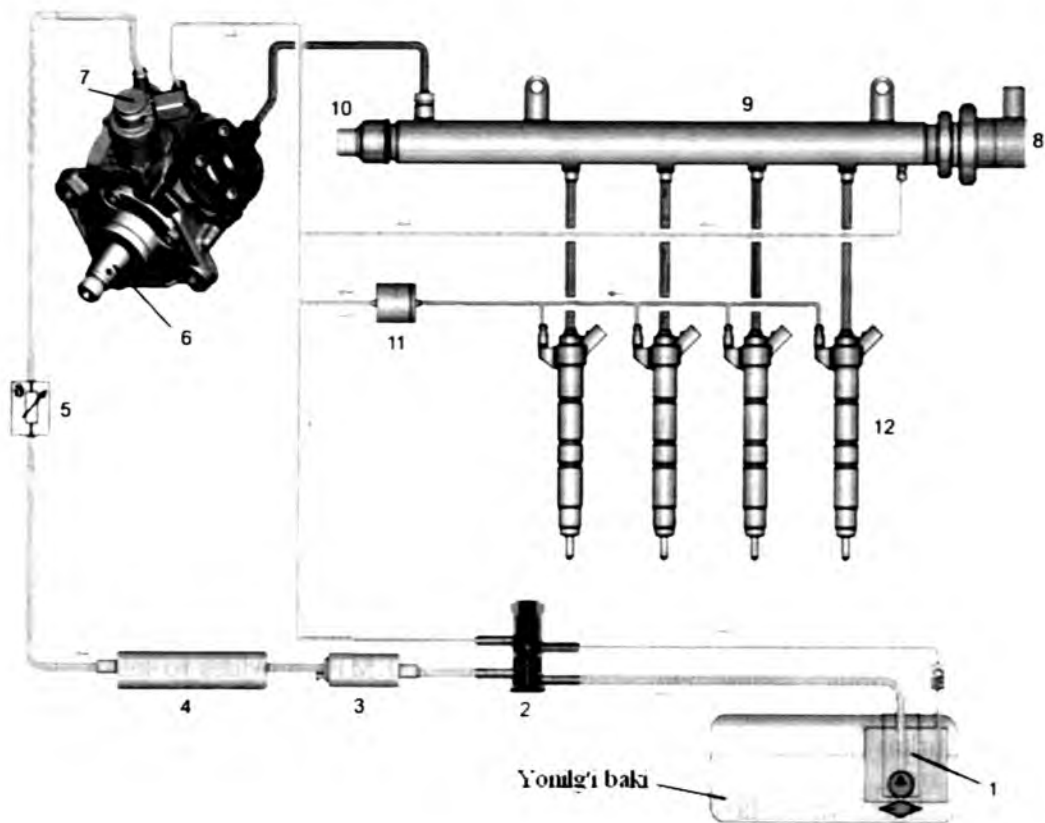
- It is possible to adjust accurate the interval of fuel injection in cylinder.

It improves fuel profitability, reduces harm of exhaust gases and engine noise.

Common Rail — injection system of the fuel by high pressure supplied "in accumulator — in a bar". From English "Common Rail" literally is "general beam/bar".

High-pressure fuel pump feeds the fuel to the accumulator, bar, where supplied constant high pressure and injection of the fuel inside the cylinder through nozzle is made periodical.

In general, nozzles (12) are connected to the fuel bar (9) of high pressure. High-pressure fuel creation and injection process are not interconnected in this system.



2.18-rasm. Common Rail — yonilg'ini purkash tizimi sxemasi.

1—magistralga yonilg'i etkazib berish nasosi;
 2—yonilg'ini dastlabki qizdiruvchi klapan, filtrlarni past xaroratlarda parafin bilan tiqilishidan saqlaydi; 3—past bosim nasosi, yonilg'ini YBYNga xaydaydi; 4—yonilg'i filtri; 5—yonilg'i xarorat datchigi; 6—YBYN, yonilg'i purkash uchun kerakli yuqori bosim yaratadi; 7—yonilg'ini me'yorlash klapani, rampaga yuboriladigan yonilg'i miqdorini boshqaradi; 8—yonilg'i bosimini me'yorda saqlaydigan sozlagich, yuqori bosim magistralida yonilg'i bosimini boshqaradi; 9—rampa, forsunkalarda purkaladigan yuqori bosimdagi yonilg'ini

Figure 2.18. The scheme of Common Rail fuel injection system.

1—fuel feed pump to mainline; 2—preliminary heating valve of the fuel, prevents a lock of the filter by paraffin in low temperatures; 3—low pressure pump, feeds the fuel to HPFP; 4—fuel filter; 5—fuel temperature sensor; 6—HPFP, creates the pressure necessary for fuel injection; 7—fuel rationing valve, manages the quantity of the fuel fed to fuel bar; 8—fuel pressure regulator adjusts the pressure of the fuel in high-pressure line; 9—fuel bar, supplies the fuel by high pressure injected through nozzles; 10—fuel

yig'ish uchun xizmat qiladi; 10—yonilg'i bosimi datchiki, yuqori bosim konturida bosimni o'lchaydi; 11—reduksion klapan, yonilg'ining bakka qaytish magistrahidagi bosimni boshqaradi; 12—forsunkalar.

Yuqori bosimli yonilg'i nasosi (YBYN) (6) 1800—2000 bar yonilg'i bosimini hosil qiladi. YBYN quvvatni dvigatel validan tishli tasma orqali oladi. Yuqori bosimdagi dizel yonilg'isi rampa (9) ichiga yig'iladi. Bosimning me'yordan oshmasligini YBYNdagi saqlagich klapani (7) ta'minlaydi.

Forsunkalar purkash jarayoni elektromagnit klapani bilan boshqariladi. Klapan ochilishida rampadan yonish kamerasiga miqdori me'yorlangan yonilg'i purkaladi. Elektr signali yordamida klapan tezkor ishlaydi, va bir siklda yonilg'ini bir necha bor qism-qism purkash mumkin. Masalan, MAN avtomobiliga o'rnatilgan dvigatellarda bir siqish va ish taktlarida silindrga yonilg'i uch marta purkaladi. Ba'zi yengil avtomobillarda hesh martagacha purkaladi. Bu dvigatelning yonilg'i tejamkorligimi yaxshilaydi.

pressure sensor, measures the pressure in high-pressure contour; 11—reducer valve, controls the pressure in return line of the fuel; 12—injectors.

High-pressure fuel pump (HPFP) 6 creates pressure of the fuel within 180–200 MPa. HPFP takes the power from the engine by means of gear belt. Diesel fuel with high pressure is supplied in bar 9. The safety valve 7 provides to hold the fuel pressure on fixed value.

Injection process of injectors is controlled by the help of electromagnetic valves. After the valve has opened, the fuel with normalized quantity is injected inside the combustion chamber from the fuel bar. By means of electric signal the valve operates quickly and partial injection of the fuel for a few times is possible during a cycle. For instance, in the engines established on MAN truck models at compression and power strokes the fuel is injected for three times inside the cylinder. In some cars, the fuel is injected for five times. It improves the fuel profitability of the engine.

Nazorat uchun savollar

Self-control questions

1. Common rail — yonilg'i purkash tizimining vazifasi nima?
2. Tizimning ishlash prinsipini tushuntiring.
3. „COMMON RAIL“ nima ma'noni anglatadi?
4. Common rail — yonilg'i purkash tizimining afzalliklarini ayting.
5. Tizimning detallari.

1. What is the function of common rail — fuel injection system?
2. Describe the operation principle of the system.
3. What does the "COMMON RAIL" mean?
4. Mention the advantages of common rail — fuel injection system.
5. Details of the system.

3. TRANSMISSIYA

3. TRANSMISSION

3.1. TRANSMISSIYA

3.1. TRANSMISSION

Transmissiya dvigateldan yetakchi g'ildiraklarga burovchi moment uzatadi. Bu jarayonda burovchi moment qiymati o'zgaradi.

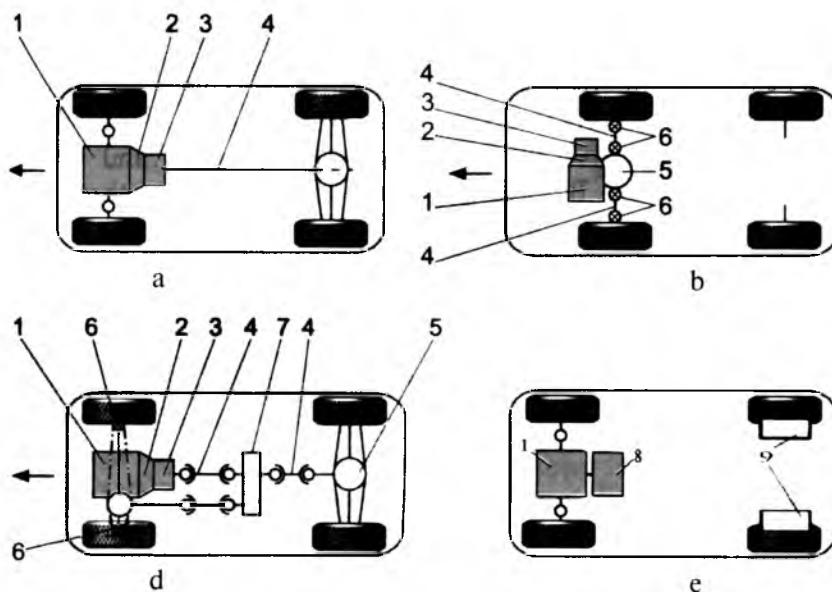
Dvigatel bilan yetakchi g'ildiraklar o'rtasidagi bog'lanishga ko'ra transmissiya mexanik, gidrohajmli, elektrik, kombi-natsiyalashgan (gidromexanik, elektro-mexanik) turlarga bo'linadi.

Zamonaviy avtomobillarda, asosan, mexanik transmissiya qo'llaniladi (3.1-rasm).

Transmission transfers the torque from the engine to the drive wheels. The value of the torque is changed in this process.

There are mechanical, hydraulic, electrical, combined (hydro mechanical, electro mechanical) types of transmission depending on the coupling between the engine and drive wheels.

Mechanical transmission is widespread in modern vehicles (Fig. 3.1).



3.1-rasm. Avtomobillar transmissiyalarining sxemalari.

a—orqayuritmal; b—oldyuritmal;
d—to'layuritmal; e—elektrik (gidrohajmli);
1—dvigatel; 2—ilashish muftasi; 3—uzat-

Figure 3.1. The scheme of the vehicle transmissions.

a—rear wheels drive; b—front wheels drive;
d—all wheel drive; e—electric (hydraulic);
1—engine; 2—clutch; 3—gearbox; 4—car-

malar qutisi; 4—kardanli uzatma; 5—yetakchi ko'prik; 6—burchak tezliklari teng sharnirlar; 7—taqsimlash qutisi; 8—generator (gidronasos); 9—elektrodvigatel (gidromotor).

Orqayuritmalı avtomobillarda (3.1-a rasm) burovchi moment ilashish muftasi (2), uzatmalar qutisi (3), kardanli uzatma (4), yetakchi ko'prik (5) orqali uzatiladi. Yetakchi ko'prikda asosiy uzatma, differensial va yarimo'qlar joylashgan.

Old yuritmalı avtomobillarda dvigatel ko'ndalang joylashtiriladi (3.1-b rasm). Bu holda dvigatel, ilashish muftasi, uzatmalar qutisi, asosiy uzatma va differensial bitta blokda joylashtiriladi. Undan yetakchi g'ildiraklarga burovchi moment kardanli uzatma 4 orqali uzatiladi.

To'la yuritmalı avtomobillarda (3.1-d rasm) taqsimlash qutisi (7) qo'llaniladi.

Elektrik va gidrohajmli transmissiya sxemalari o'xshashdir (3.1-e rasm). Elektrik transmissiyada dvigatel (1) generatorni (8) harakatga keltiradi. Elektr toki etakchi g'ildiraklarning elektrodvigtellariga (9) uzatiladi. Ichiga elektrodvigatel o'rnatilgan g'ildirak „elektromotorg'ildirak“ deb ataladi.

Gidrohajmli transmissiyada (3.1-e rasm) dvigatel (1) gidronasosni (8) harakatlantiradi. Gidronasos trubalar orqali gidromotorlar (9) bilan ulangan. Gidromotor vali yetakchi g'ildirak bilan ulangan. Suyuqlik bosimi yetakchi g'ildirakda mexanik energiyaga aylanadi.

dan drive; 5—drive axle; 6—constant velocity joints; 7—transfer gearbox; 8—generator (hydraulic pump); 9—electric engine (hydraulic motor).

The torque is transmitted through the clutch (2), gearbox (3), cardan drive (4), drive axle (5) in the rear-wheel drive vehicles (Fig. 3.1. a). Final drive, differential and axle shafts are located in drive axle.

Front wheel drive cars have an arrangement with transversally, front-mounted engine (Fig. 3.1, b). In this case, the engine, the clutch, the gearbox, the final drive and the differential are located in one block. The torque is transferred to drive wheels via the cardan drive (4).

The transfer gearbox (7) is used in all-wheel drive automobiles (Fig. 3.1, d).

Schemes of electric and hydraulic transmissions are alike (Fig. 3.1, e). The engine (1) in electric transmission drives the generator (8). Electric current is transferred to electric motors (9) of drive wheels. The wheel equipped with electric motor is called "wheel-electric motor".

The engine 1 in hydraulic transmission drives the hydraulic pump (8) (Fig. 3.1, e). Hydraulic pump is connected to hydraulic motors through pipes. The shaft of hydraulic motor is connected to drive wheel. The liquid pressure is converted into mechanical energy in drive wheel.

- | | |
|--|--|
| 1. Transmissiyaning vazifasi nima? | 1. What is the function of transmission? |
| 2. Transmissiyaning qanday turlari mavjud? | 2. What types of transmission do you know? |
| 3. Mexanik transmissiya nima uchun keng tarqalgan? | 3. Why mechanical transmission is wide-spread? |

3.2. ILASHISH MUFTASI

3.2. CLUTCH

Dvigatel maxovigi transmissiyaga mufta orqali ulanadi. Mufta transmissiyani dvigateldan ajratish va dvigatelga ravon ulash uchun xizmat qiladi.

Avtomobillarda muftalarning (3.2-rasm) gidravlik (a), elektromagnitli (b) va friksion (d) turlari qo'llaniladi.

Muftalar tarkibi yetakchi va yetaklanuvchi qismlarga bo'linadi. Yetaklovchi qismlar maxovik bilan bikir bog'langan bo'ladi. Yetaklanuvchi qismlar transmissiya bilan doimiy bog'langan bo'ladi.

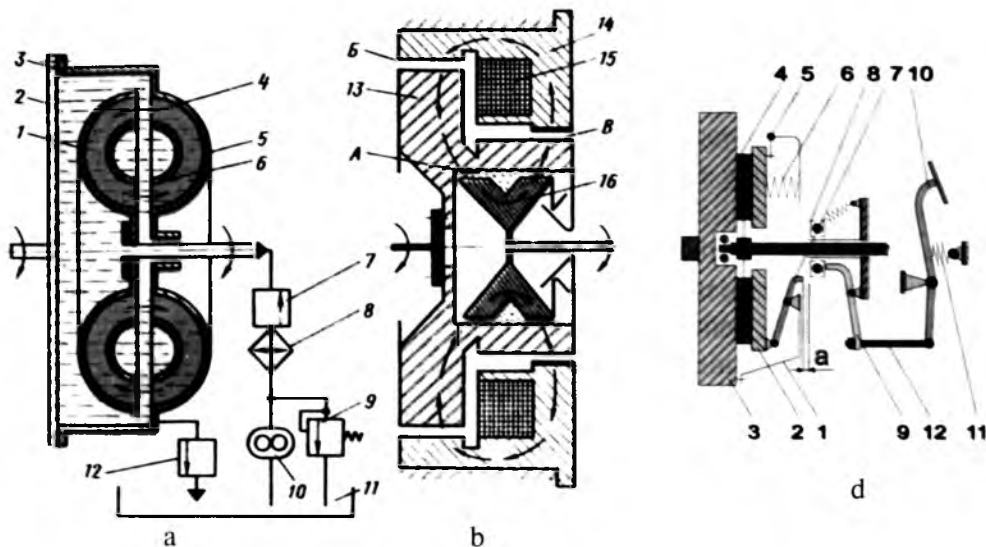
Gidravlik muftalarning yetakchi va yetaklanuvchi qismlari orasida harakat uzatish suyuqlik bilan amalga oshiriladi. Elektromagnit muftalarida magnit maydoni hosil qilinadi. Elektromagnit maydoni ta'siridagi temir kukunlari yetakchi va yetaklanuvchi qismlar orasida harakat uzatadi.

The flywheel of the engine is connected with transmission via the clutch. The purpose of the clutch is to disconnect the transmission from the engine and to connect them smoothly.

The hydraulic (a), electromagnetic (b) and friction (d) types of clutches are used in the vehicles (Fig. 3.2).

The details of clutches are divided into drive and driven parts. The drive parts are connected to the flywheel. The driven parts are connected to the transmission continuously.

The torque between the drive and driven parts of hydraulic clutch is transmitted via the liquid. In the electromagnetic clutches the drive and driven parts are connected by magnet. Under the effect of the magnet the metal powder transmits the torque between the drive and driven parts.



3.2-rasm. Dvigatel va transmissiyani bog'lovchi muftalar turlari
a—gidravlik; b—elektromagnit;
d—friksion.

Figure 3.2. The types of the clutches.
a—hydraulic; b—electromagnetic;
d—friction.

Avtomobillarda keng tarqalgan mufta — friksion mufta. Friksion muftada harakatni yetakchi qismdan yetaklanuvchi qismga uzatish oradagi yuzalarni bir-biriga ilashtirish hisobiga amalga oshiriladi. Shuning uchun friksion mufta — ilashish muftasi deb ham nomlanadi.

Ilashish muftasining (3.2-d rasm) yetakchi qismiga maxovik (3), kojux (1), siquvchi disk (2) hamda kojux va siquvchi diskni bog'lovchi plastina (5) kiradi. Yetaklanuvchi qismiga yetaklanuvchi disk (4) tegishli. Bog'lovchi plastina (5) siquvchi disk (2) va kojuxni (1) elastik bog'laydi. Plastina (5) siquvchi diskning (2) o'q bo'ylab siljishiga imkon beradi, kojuxdan siquvchi diskka (2) aylanma xarakat uzatadi.

The friction clutch is widely implemented in vehicles. Engaging of the drive and driven parts in the friction clutches is performed by friction between the surfaces. That is why the friction clutches are called coupling clutch.

The drive part of the clutch (Fig. 3.2, d) comprises the flywheel (3), the housing (1), the pressure plate (2) and the sheet (5) that connects the housing with pressure plate. The driven part is clutch disk (4). The pressure plate (2) is flexible connected with housing (1) by the sheet (5). The sheet (5) lets the pressure plate (2) the axial move and transmits rotation from the housing to the pressure plate (2).

Kojux (1) maxovikka (3) boltlar bilan gotiriladi. Siquvchi disk (2) kojuxga (1) tiraladigan prujinalar (6) kuchi bilan yetaklanuvchi diskni (4) maxovikka siqadi. Yetaklanuvchi diskning (4) ikki yuzasi maxovik (3) va siquvchi disk (2) orasida ilashadi. Ilashish hisobiga maxovik dvigatel momenti transmissiyaga uzatiladi.

Haydovchi mufta pedalini (10) bosganda tortqi (12) vilkaning (9) ikkinchi uchi bilan ajratish podshipnikini (8) suradi. Podshipnik (8) richaglarni (7) o'z tayanchlarida og'diradi. Ikkinchi uchi bilan siquvchi diskka (2) sharmirli ulangan richaglar (7) prujinalar (6) kuchini yengib yetaklanuvchi diskni (4) bo'shatadi. Yuzalar ilashishdan ajraydi. Muftadan moment uzatilmaydi. Bu jarayon ilashish muftasini ajratish deb ataladi.

Haydovchi pedalni (10) bo'shatganda qaytaruvchi prujinalar (11) pedalni (10) va podshipnikni (8) dastlabki holatga qaytaradi. Siquvchi prujina (6) yetaklanuvchi diskni (4) maxovik (3) va siquvchi disk (2) orasiga ilashtiradi. Bu jarayon ilashish muftasini ulash deb ataladi.

Demak, ilashish muftasi doim ilashgan holatda bo'ladi. Haydovchi uzatmalar qutisi pog'onasini almashtirishida pedalni (10) bosib ilashish muftasini ajratadi. Pog'ona ulangandan so'ng pedalni asta bo'shatib, transmissiyani dvigatel bilan ravon ulaydi.

Ajratish richaglari (7) siquvchi disk (2) va kojux (1) bilan doim birga aylanma harakatda bo'ladi. Richaglarning (7) ajratish podshipnikidan (8) xoli bo'lishi

The housing (1) is bolted to the flywheel (3). The pressure plate (2) presses the driven disk (4) onto the flywheel by force of springs (6) mounted at the housing (1). Both surfaces of clutch disk (4) are engaged between the flywheel (3) and the pressure plate (2). The engine torque is transmitted to the power train by engaging.

When, the pedal (10) is pressed by a driver, the rod (12) pushes the clutch bearing (8) by the second end of the clutch release fork (9). Clutch bearing (8) rotates the levers (7) around their supports. The levers (7) connected to the pressure plate (2) by the second end overcome the stiffness force of springs (6) and release the clutch disk (4). The surfaces are disengaged. The flow of power from the flywheel to the clutch shaft is interrupted. The process is called disengagement of the clutch.

When the pedal (10) is released, the return springs (11) return the pedal (10) and bearing (8) back to their initial position. The clutch disk (4) is coupled between the flywheel (3) and the pressure plate (2) by the spring (6). This process is called engagement of the clutch.

So, the clutch is always engaged. When a driver changes a gear of the gearbox disengages the clutch by pressing the pedal (10). After the gear has shifted a driver releases the pedal slowly and smoothly connects the engine with transmission.

The release levers (7) with the pressure plate (2) and the housing (1) are always in rotating motion. The clearance

uchun tirqish „a“ xizmat qiladi. „a“ tirqishi tortqi (12) bilan sozlanadi.

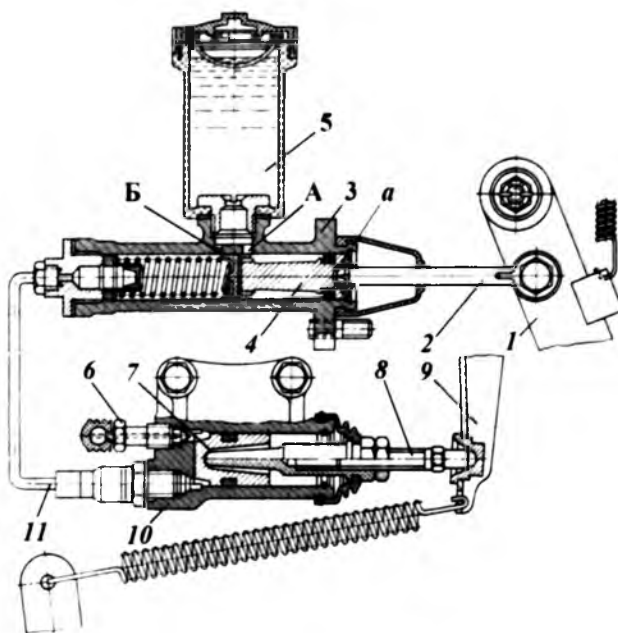
Keltirilgan sxemada (3.2-d rasm) pedal (10), tortqi (12), vilka (9), podshipnik (8), richaglar (7) va prujinalar (11) ilashish muftasining yuritmasi qismlariga kiradi. Sxemada mexanik yuritma keltirilgan.

Yuritmalarning mexanik, gidravlik (3.3-rasm), aralash va boshqa turlari bo'lishi mumkin.

„a“ serves to separate the levers (7) and the bearing (8) from each other. The clearance „a“ is adjusted by the rod (12).

The drive parts pedal (10), rod (12), release fork (9), bearing (8), levers (7) and springs (11) are given in scheme (Fig. 3.2, d). The mechanical drive is shown in the scheme.

The mechanical, hydraulic (Fig. 3.3), combined and other types of the drives are used.



3.3-rasm. Ilashish muftasi gidravlik yuritmasi.

1—pedal; 2—pedal turtkisi; 3—asosiy silindr; 4—porshen; 5—zahira suyuqlik bachogi; 6—tizimdan havomi chiqarish klapani; 7—porshen; 8—turtki; 9—mufta vilkasi; 10—ishchi silindr; 11—silindrlarni ulash trubkasi.

Figure 3.3. The hydraulic drive of the clutch.

1—pedal; 2—push rod; 3—master cylinder; 4—piston; 5—clutch fluid reservoir; 6—air out flow valve; 7—piston; 8—push rod; 9—clutch release fork; 10—secondary (work) cylinder; 11—connecting pipe.

Haydovchi pedalni (1) bosganda porshen (4) asosiy silindrdan (3) suyuqlikni bosim ostida ishchi silindrga (10) haydaydi. Porshen (7) turtki (8) orqali vilkaga (9) ta'sir qiladi. Ilashish muftasi ajraydi. Ajratish podshipniklarini (8) ajratish richaglaridan (7) (3.2-rasm) xoliligini ta'minlaydigan „a“ tirqishi turtki (2) va porshen (4) (3.3-rasm) oralig'ida qoldirilgan.

Pedal qo'yib yuborilganda qaytaruvchi prujinalar ta'sirida detallar boshlang'ich holatga qaytadi.

Pedal (1) (3.3-rasm) bosilmaganda gidravlik yuritmadagi suyuqlik B tirqishi orqali zahira bachoki (5) bilan ulangan bo'ladi. Tizimda qoldiq bosim bo'lmaydi.

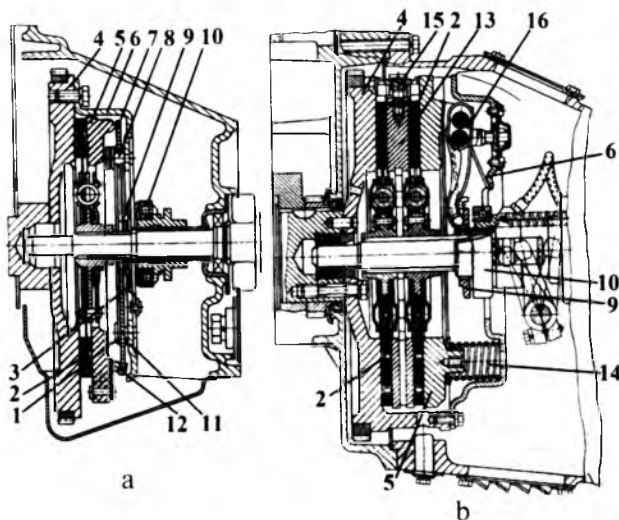
Ilashish muftasidan katta moment uzatilsa, siquvchi prujinalar kuchi ham katta bo'ladi. Haydovchining ishini yengil-latish uchun yuritmalarda kuchaytirgich-lardan foydalaniladi. Siquvchi prujinalar kuchi o'ta kattalashmasligi uchun ikki diskli ilashish muftasidan foydalaniladi (3.4-rasm).

After a driver has pressed the pedal (1), the piston (4) pushes under the pressure the fluid from the master cylinder to the secondary cylinder (10). The piston (7) via the push rod (8) acts the clutch fork (9). The clutch is disengaged. The clearance "a" that separates the bearing (8) and the levers (7) (Fig. 3.2) from each other, is between the push rod (2) and the piston (4) (Fig. 3.3).

After the pedal has released, the parts take their initial position by return springs.

When the pedal (1) (Fig. 3.3) has released, the fluid in the hydraulic drive is connected with the fluid reservoir (5) through the hole B. There is no residual pressure in the system.

If the clutch transmits the high torque, then the stiffness force of the springs is high too. In order to make lighter the driver's work the boosters are installed in drives and in order to prevent increasing the stiffness force of the pressure springs dual disk clutches are used in vehicles (Fig. 3.4).



3.4-rasm. Bir (a) va ikki (b) diskli ilashish muftasi.

Figure 3.4. Single (a) and dual (b) disk clutches.

*Ilm va hikmat halol luqmadan hosil bo'ladi, ishq va marhamat
ham halol rizqdan paydo bo'ladi.*

Jaloliddin Rumi

Ikki diskli muftalarda etaklanuvchi disklar (2) (3.4-b rasm) ikkita bo'ladi. Moment to'rtta yuzadan uzatiladi. Siquvchi prujinalar (14) kuchlarni ikki marta kichik qilish mumkin. Yetaklanuvchi disklar orasida oraliq yetakchi disk (13) bo'ladi. Pedal bosilganda ilashish muftasi to'liq ajralishi kerak. Yetaklanuvchi disklar tomonlarida kafolatlangan tirqish hosil qilish kerak. Maxovik (4), oraliq disk (13) va siquvchi disk (5) oraliqlarini ochishga qurilma (15) xizmat qiladi. Pedal bosilganda qurilma (15) maxovikka tiralib, disklar oralig'ini belgilangan masofaga ochadi.

The dual disk clutches have two clutch disks (2) (Fig. 3.4, b). The torque transmits via the four surfaces. It is possible to decrease the stiffness force of the pressure springs (14) for two times. The intermediate pressure plate (13) is located between the clutch disks. The full engagement of the clutch is required when the pedal is pressed. The guaranteed clearance is required for both sides of the clutch disks. The device (15) provides the clearance between the flywheel (4), intermediate plate (13) and the pressure plate (5). After the pedal has pressed, the device (15) provides required path between the plates stretching against the flywheel.

Nazorat uchun savollar

Self-control questions

1. Ilashish muftasining vazifasi nima?
2. Ilashish muftasining qanday turlari mavjud?
3. Ilashish muftasining detallari.
4. Ilashish muftasining qaysi turi keng tarqalgan?
5. Ilashish muftasining ishlash prinsipini tushuntiring?

1. What is the function of the clutch?
2. What types of the clutch do you know?
3. Details of the clutch.
4. Which type of the clutch is widespread?
5. Describe the operating principle of the clutch?

3.3. UZATMALAR QUTISI

3.3. GEARBOX

Avtomobil harakatlanish sharoitlari turli og'irliklarda bo'ladi. Turli sharoitlarda tezlik, tortish kuchlari keng diapazonda o'zgaradi. Bu sharoit o'zgarishlari uchun zaruriy moment va tezlikni dvigatel ta'minlay olmaydi. Diapazonni yengil avtomobillarda 3...5 marta, yuk avtomobillarida 7...20 marta kattalashtirish talab etiladi. Dvigatel moment va tezlik diapazonini bir necha marta kattalashtirish uchun uzatmalar qutisi xizmat qiladi.

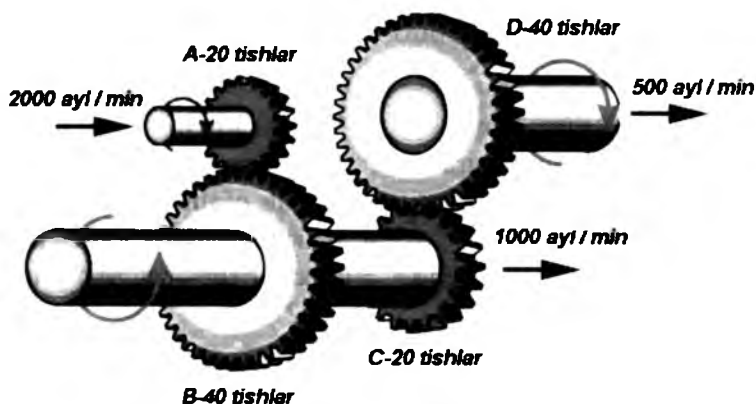
Uzatmalar qutisi uzatishlar sonini keng diapazonda o'zgartiruvchi konstruksiyadir.

Uzatishlar soni qutiga kiruvchi valning aylanish tezligini chiqish valining aylanish tezligiga nisbati bilan aniqlanadi (3.5-rasm). Har juft shesternyanning uzatish soni ikkiga teng. Ikki juft shesternyaning umumiy uzatish soni to'rtga teng bo'ladi. Tezlik necha marta kamaysa, uzatilayotgan moment shuncha marta ortadi.

The vehicle is driven in different loading conditions. The velocity and drive force change wide ranges. For such different conditions its engine cannot provide necessary torque and velocity. Increasing of the range for 3...5 times for motor cars and for 7...20 times for trucks is required. Gearbox serves to increase a range of engine torque and velocity for a few times.

The gearbox is a unit that changes transmission ratio in wide ranges.

The gear ratio is defined by ratio of speeds of input and output shafts of the gearbox (Fig. 3.5). The transmission ratio of each pair of gears is two. Total ratio of two pairs of gears is four. How many times speed is decreased that many times torque will be increased.



3.5-rasm. Ikki juft shesternyadan uzatishda aylanma tezlikning o'zgarishi.

Figure 3.5. Change of rotational speed transmitted via two pairs of gears.

Uzatishlar sonining o'zgarishiga qarab uzatmalar qutisi pog'onali, pog'onasiz turlarga bo'linadi. Pog'onali uzatmalar qutisida harakat shesternyalar juftliklari orqali uzatiladi.

Harakatni uzatish uslubiga binoan mexanik, gidravlik uzatmalar qutisi mavjud.

Boshqarish usuli bo'yicha qo'lda, yarim avtomatik va avtomatik boshqaruvli uzatmalar qutisi bo'ladi.

Pog'onali uzatmalar qutisi oldinga yurishga xizmat qiladigan pog'onalar soni bilan farqlanadi. Zamonaviy yengil avtomobillarda 5...6 pog'onali, yuk avtomobillarida, masalan, MAN rusumli yuk avtomobilida 14...16 pog'onali uzatmalar qutisi o'rnatilyapti. Har pog'onada harakat ma'lum shesternyalar juftliklari orqali uzatiladi. Demak, pog'onani o'zgartirish harakat uzatishdagi shesternyalar juftligini o'zgartirish orqali bo'ladi. Haydovchi harakat sharoitiga mos pog'onani tanlaydi. Pog'onalar soni qancha ko'p bo'lsa, dvigatel quvvatidan samarali foydalanish yuqori bo'ladi.

Pog'onali uzatmalar qutisi harakat uzatishda ishtirok etadigan vallari soniga qarab ikki, uch va ko'p valli turlarga bo'linadi.

Zamonaviy yengil avtomobillarda dvigatel oldinda, ko'ndalang joylashgan, old g'ildiraklari yetakchi kompanovkaligi keng tarqalgan. Bunday konstruksiyalarda ikki valli uzatmalar qutisi o'rnatiladi (3.6-rasm). Konstruksiya joylamishi qulay va samarasi yuqori bo'ladi.

Zamonaviy Lasetti, Neksiya, va Matiz avtomobillarida ikki valli uzatmalar qutisi o'rnatilgan.

Depending on transmission ratios, the gearboxes are divided into speed gear-change transmission and continuously variable transmission types. In speed gear-change transmission the motion is transmitted through the pairs of gears.

Depending on a transmission drive gearboxes are divided into mechanical and hydraulic types.

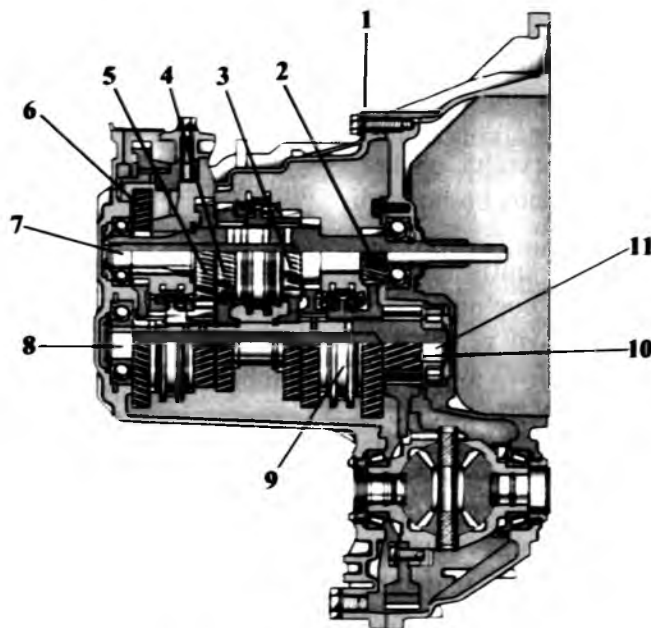
Depending on a control method, gearboxes are divided into semiautomatic and automatic types.

Change-speed gearboxes differ by the number of gears. 5...6 speed gear transmissions in modern cars, and 14...16 speed gear transmission in trucks, for instance MAN truck models are used. On each speed motion is transmitted via a pair of gears. Therefore, the speed is changed by changing a couple of gears, through which motion is transmitted. A driver chooses a speed according to driving conditions. Higher the number of gears is, higher the efficiency of engine output will be.

Depending on the number of gear shafts, gearboxes are divided into two, three and multiple gear shaft gearboxes.

Transversally, front-mounted engine and front wheel drive design is widely implemented in modern cars. This type of designs has a gearbox with two gear shafts (Fig. 3.6). The gearbox with two gear shafts is compact and efficient.

Modern cars such as Lacetti, Nexia and Matiz have a gearbox with two gear shafts.



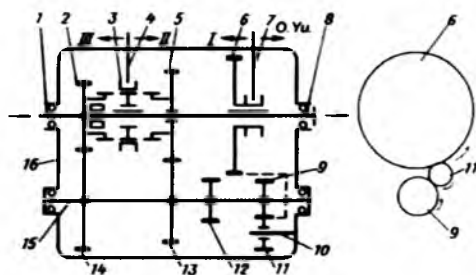
3.6-rasm. To'rt pog'onali, ikki valli uzatmalar qutisi.

Figure 3.6. Four speed gearbox with two gear shafts.

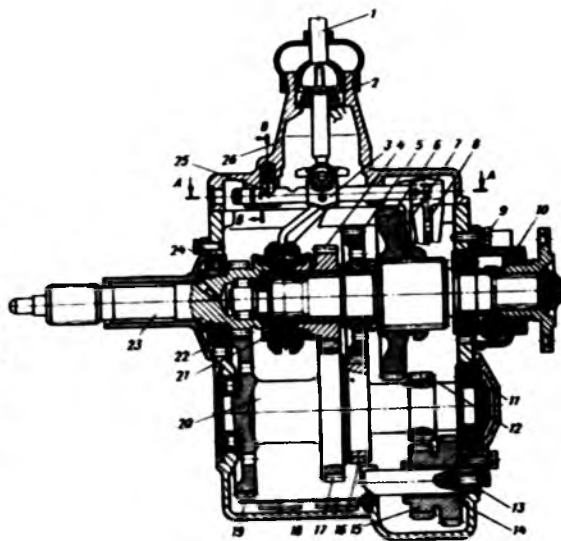
Etakchi val, odatda, birlamchi val deb ataladi. Birlamchi valdagi shesternyalar val bilan yaxlit yasaladi. Birlamchi valdagi shesternyalar (2, 4, 5, 6) (3.6-rasm) o'zlarining juftliklari bilan, mos ravishda, birinchi, ikkinchi, uchinchi va to'rtinchi pog'onalarni beradi. Birinchi — quyi pog'onaning birlamchi valdagi shesternyasi (2) eng kichik bo'ladi. Uzatish soni eng katta bo'ladi. Bu pog'ona avtomobil joyidan qo'zg'alishida, og'ir sharoitlarda ulanadi. Pog'ona yuqorilashgan sari, aksincha, birlamchi valdagi shesternya kattalashadi, ikkilamchi valdagi shesternya

Usually a drive shaft is called a primary shaft. The gears of the primary shaft are made solid with shaft. The gears (2, 4, 5, 6) (Fig. 3.6) of the primary shaft with their couples provide the first, second, third and fourth speeds respectively. The gear (2) of the first speed on the primary shaft is smallest. But its drive ratio is biggest. This gear is connected to put a car in motion or in poor road conditions. The gear of the next speed of the primary shaft is bigger than previous and vice versa, the gear on the secondary (driven) shaft is smaller than previous. The gears on the secondary shaft rotate

kichiklashadi. Ikkilamchi valdagi shesternyalar valdapodshi priklarda aylanadi. Bu shesternyalardan harakat ikkilamchi valga shlotsida o'rnatilgan sinxronizator (9) muftasi orqali uzatiladi. Haydovchi pog'ona o'zgartirishida sinxronizator muftalarini siljitadi va ikkilamchi valdagi ulanayotgan pog'ona shesternyasi bilan tishlatadi. Ikki valli uzatmalar qutisida harakat valdan valga bir juft shesternya orqali uzatiladi.



a



b

3.7-rasm. Uch pog'onali uch valli uzatmalar qutisi.

a—sxemasi; b—chizma ko'rinishi

Sxemada: 1—birlamchi val; 2—birlamchi val shesternyasi; 3—sinxronizator muftasi; 4—ikkinchi va uchinchi pog'onalarini ulash vilkasi; 5—ikkilamchi valdagi ikkinchi pog'ona shesternyasi; 6—ikkilamchi valdagi birinchi pog'ona shesternyasi; 7—birinchi pog'ona va orqaga xarakatlanish pog'onalarini ulash vilkasi; 8—ikkilamchi val; 9—oraliq valdagi orqaga harakatlanish pog'ona shesternyasi; 10—aylanish xarakatini teskarisiga o'zgartiruvchi

by bearings. The engine torque is transmitted from these gears to the secondary shaft via the synchronizing sleeve (9), which is mounted on the secondary shaft by a slit. In order to change speed a driver removes the synchronizing sleeve and connects it with a gear of shifting speed. In gearboxes with two shafts, torque from a shaft to a shaft is transmitted by coupling gears.

Figure 3.7. Three speed gearbox with three shafts.

a—scheme; b—cross sectional view of a gearbox.

In the scheme: 1—primary shaft; 2—primary shaft gear; 3—synchronizing sleeve; 4—the shifting fork of second and third gears; 5—second speed gear mounted on the secondary shaft; 6—first speed gear mounted on the secondary shaft; 7—shifting fork of the first and reverse speed gears; 8—secondary shaft; 9—reverse speed gear on the countershaft; 10—reverse drive gear

shesternya o'qi; 11—aylanish harakatini teskarisiga o'zgartiruvchi shesternya; 12—oraliq valdagi birinchi pog'ona shesternyasi; 13—oraliq valdagi ikkinchi pog'ona shesternyasi; 14—oraliq valga harakatni doimiy uzatuvchi shesternya; 15—oraliq vali; 16—uzatmalar qutisi korpusi.

Vallar (1, 8 va 15), uzatmalar qutisi-ning korpusida (16) podshipniklarda o'rnatilgan. Birlamchi valdagi shesternya (2) oraliq valning (15) shesternyasi (14) bilan doimiy tishlashgan bo'ladi. Shesternyalar (9, 12, 13 va 14) oraliq val bilan yaxlit yasaladi. Ikkilamchi valning (8) shesternyasi (6) valda shlitsali birikmada. Ikkilamchi valdagi (8) sinxronizator muftasi (3) ham shlitsali birikmada. Ular val (8) o'qi bo'ylab surilish imkoni bor. Ikkilamchi valdagi (8) shesternya (5) podshipnikda joylashgan va shesternya (13) bilan doimiy tishiashishda.

Birinchi pog'ona ulash uchun uchun haydovchi vilka (7) yordamida shestenyani (6) surib shesternya (12) bilan tishlatadi. Harakat birlamchi valdan (1) ikkilamchi valga (8) shesternyalar (2, 14, 12, 6) orqali uzatiladi.

Ikkinchi pog'onani ulash uchun shestenyani (6) dastlabki holatga qaytaradi va vilka (4) yordamida sinxronizator muftasini (3) shesternya (5) bilan tishlatadi. Harakat birlamchi valdan (1) ikkilamchi valga (8) shesternyalar (2, 14, 13, 5 va mufta (3) orqali uzatiladi.

Uchinchi pog'onani ulash uchun muftani (3) shesternya (2) bilan tishlatadi.

shaft; 11—gear to change direction of rotation into reverse; 12—first speed gear on the countershaft; 13—second speed gear on the countershaft; 14—gear to constantly transmit motion to the countershaft; 15—countershaft; 16—gearbox housing.

Shafts (1, 8 and 15) are mounted in the gearbox housing (16) by bearings. The primary shaft gear (2) is constantly meshed with gear (14) on the countershaft (15). Gears (9, 12, 13 and 14) are made solid with the countershaft. Gear (6) of the secondary shaft (8) is mounted on the shaft by slit. The synchronizing sleeve (3) on the secondary shaft (8) is connected to the shaft by slit too. They can move on the shaft (8) in the longitudinal direction. Gear (5) on the secondary shaft (8) is mounted by bearings and constantly meshed with the gear (13).

The driver with the help of fork (7) shifts a first gear by meshing the gear (6) with the gear (12). The motion transmits from the primary shaft (1) to the secondary shaft (8) via gears (2, 14, 12, 16).

Gear (6) returns to its initial position and the synchronizing sleeve (3) is meshed with the gear (5) by fork (4) and the second gear is shifted. The motion transmits from the primary shaft to the secondary shaft via gears (2, 14, 13, 5) and the sleeve (3).

Harakat birlamchi valdan (1) ikkilamchi valga (8) shesternyalar (2) va mufta (3) orqali uzatiladi. Birlamchi val (1) va ikkilamchi val (8) to'g'ri ulanadi. Aylanish tezliklari bir xil bo'ladi.

Avtomobil orqaga harakatlanishi uchun haydovchi vilka (7) yordamida shesternyani (6) aylanish harakatini teskarisiga o'zgartiruvchi shesternya (11) bilan tishlatadi. Harakat birlamchi valdan (1) ikkilamchi valga (8) shesternyalar (2, 14, 9, 11 va 6) orqali uzatiladi.

Haydovchi pog'onalarini o'zgartirishni ilashish muftasini ajratib amalga oshiradi.

Uch valli uzatmalar qutisida harakat birlamchi valdan (1) ikkilamchi valga (8) ikki juft shesternya orqali uzatiladi. Ikki juft shesternya katta uzatmalar sonini olishga imkon beradi.

Sinxromizator ulanayotgan shesternya bilan valning aylanish tezliklarini tenglashtirish uchun xizmat qiladi. Bir xil tezlikda aylanayotgan qismlarni ulash zarbasiz, shovqinsiz amalga oshiriladi.

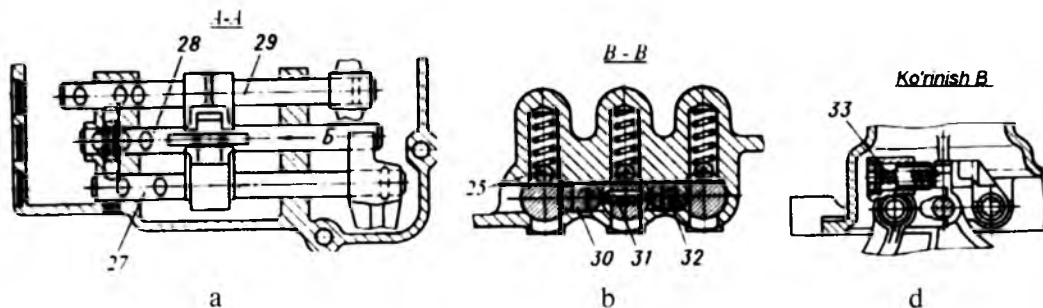
The third speed is shifted by meshing the gear (3) with the gear (2). The primary shaft (1) is connected to the secondary shaft (8) directly. Rotating speeds are same.

Gear (6) is meshed with reverse speed gear (11) by fork (7) and a vehicle moves back. The motion transmits from the primary shaft (1) to the secondary shaft (8) via gears (2, 14, 9, 4 and 6).

A driver with the disengaged clutch changes speed gears.

In the gearbox with three shafts, the motion transmits from the primary shaft (1) to the secondary shaft (8) through two pairs of gears. Two pairs of gears provide the high transmission ratio.

Synchronizer serves to align the rotary speeds of the shifting gear and a shaft. Gears, which are rotating with the same speeds, connect without noise and shock.



3.8-rasm. Uch pog'onali uzatmalar qutisida pog'ona almashtirish mexanizm qismlari. a—qulf; b—fiksator; d—orqaga harakatlanishda pog'onani ulash moslamasi.

Figure 3.8. Speed gear shifting device of the gearbox with three shafts. a—lock; b—gear lock; d—reverse gear shifting device.

Uzatmalar qutisida pog'ona o'zgartirish mexanizmi quyidagi vazifalarni bajaradi: gulf — bir vaqtda ikki pog'onaning ulanishini taqiqlaydi; fiksatorlar — ulangan pog'onani haydovchi ta'sirisiz ajralishini taqiqlaydi; orqaga liarakatlanish pog'onam ulash moslamasi — haydovchi orqaga harakatlanish pog'onasini ulashda e'tiborini oshiradi.

Zamonaviy avtomobillarning aksariyatida avtomatik boshqariladigan uzatmalar qutisi qo'llaniladi. Pog'onali uzatmalar qutisining ham avtomatik boshqarish tizimlari mavjud. Gidravlik uzatmalar qutisini avtomatik boshqarishni yaratish yengilroq. Avtomobillarda gidravlik uzatmalar qutisi sifatida gidrotransformatorlar (3.9-rasm) qo'llanishi keng tarqalgan.

Nasos, turbina va reaktor g'ildiraklari birgalikda tor shaklini tashkil etadi.

G'ildiraklar ichida parraklar bo'ladi. Gidrotransformator ichi moy bilan to'la bo'ladi. Nasos — yetakchi, turbina — yetaklanuvchi, reaktor — momentni oshirish vazifalarini bajaradi.

Nasos (1) g'ildiragi aylanma harakatni dvigatel validan oladi. Nasos parraklari orasidagi moy markazdan qochma kuch ta'sirida kichik radiusdan R_{1n} katta radiusga R_{2n} intiladi. Nasosdan moy kinetik energiya oladi. Moy oqimi turbina parraklariga uriladi. Unga kinetik energiyasini beradi va harakatga keltiradi. Turbinada energiyasini yo'qotgan moy kichik radiusdan R_{1n} reaktorga kiradi. Reaktor moy oqimining yo'nalishini nasos parraklari yo'nalishiga o'zgartiradi. Moy nasosga qarshiliksiz kiradi.

Functions of gear shifting device of the gearbox are followings:

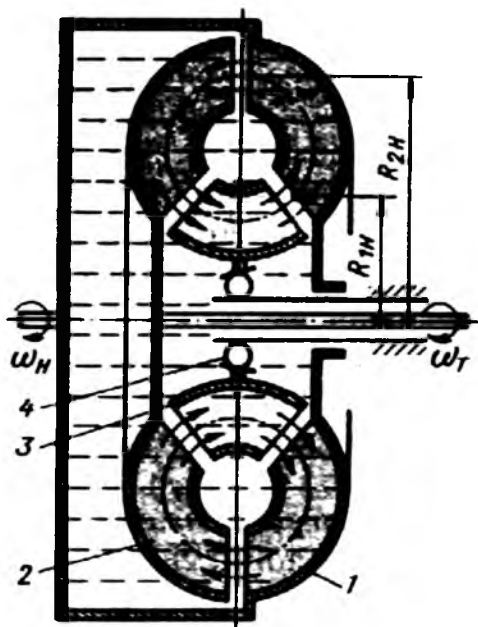
the lock prevents the shifting of two speeds at the same time; the gear locks prevent disconnect of connected gears without driver's action; the reverse gear shifting device concentrates a driver's attention to shift reverse drive gear.

In modern cars, the automatic controlled gearboxes are used. The change-gear gearboxes have automatic control systems too. It is easier to make hydraulic gearboxes with automatic control. The torque converters (Fig. 3.9) are used wide in motorcars as hydraulic gearboxes.

The pump, turbine and the stator make a tore form together.

Wheels have the wings inside. The converter is filled in with oil. The pump is drive, turbine is driven, and a stator increases the torque.

The engine drives the pump wheel (1). The oil between wings flows from small radius R_{1n} to the big radius R_{2n} under the influence of centrifugal force. The oil takes kinetic energy from the pump. The oil flow affects the turbine wings. Gives the kinetic energy and removes it. The oil loses energy in the turbine and enters the stator from the small radius R_{1n} . The stator changes oil flow to the pump wing direction. The oil enters into the pump without resistance.



3.9-rasm. Hidrotransformator sxemasi va ishlash prinsipi.

1—nasos; 2—turbina; 3—reaktor; 4—o'zish muftasi, yoki erkin aylanish mexanizmi.

Reaktor gidrotransformatororda uzatlayotgan momentni 2..4 karra oshirib bera oladi. Reaktorsiz momentni oshirib bo'lmaydi. Turbina aylanish tezligi nasosning aylanish tezligiga yaqinlashganda o'zish muftasi (4) reaktorning erkin aylanishini ta'minlaydi. Moment qiymati oshmaydi. Hidrotransformator gidromufta rejimida ishlaydi.

Gidrotransformatorning momentni oshirish diapazoni 2...4 avtomobil uchun yetarli emas. Shuning uchun gidrotransformatorga qo'shimcha mexanik uzatmalar qutisi qo'llaniladi. Uzatma — gidromexanik uzatmalar qutisi deb ataladi.

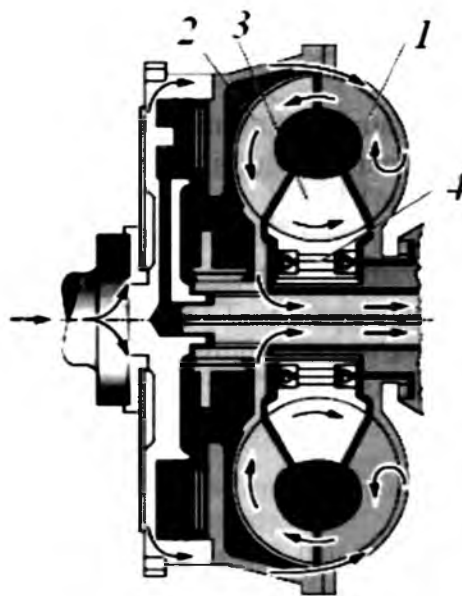


Figure 3.9. Converter scheme and working principle.

1—pump; 2—turbine; 3—stator; 4—disengagement clutch or free rotating mechanism.

The stator increases the transmitting torque in the converter for 2...4 times. Increasing the torque without stator is impossible. When the rotary speed of the turbine has become closer to the rotary speed of the pump the stator has run free by disengagement clutch (4). The torque value has not increased. The torque converter runs in mode of hydraulic coupling.

The torque increasing range 2...4 of the converter is not enough for a car. This is why the torque converter installs together with mechanical transmission. The drive is called hydro mechanical transmission.

Nazorat uchun savollar

Self-control questions

- | | |
|---|---|
| 1. Uzatmalar qutisining vazifasi nima? | 1. What is the function of the gearbox? |
| 2. Uzatmalar qutisining qanday turlari mavjud? | 2. What types of the gearbox do you know? |
| 3. Uzatmalar qutisining detallari. | 3. Details of the gearbox. |
| 4. Uzatmalar qutisining ishlash prinsipini tushuntiring? | 4. Describe the operating principle of the gearbox? |
| 5. Pog'ona almashtirish qurilmasi to'g'risida aytib bering. | 5. Tell about gear shifting device of gearbox. |

3.4. TAQSIMLASH QUTISI

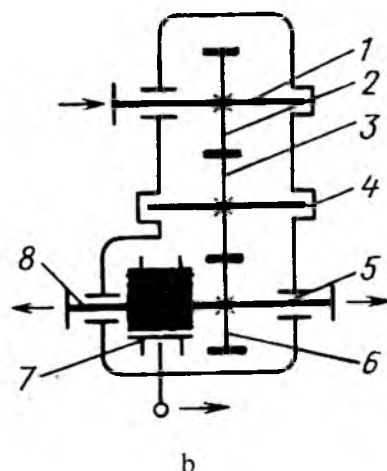
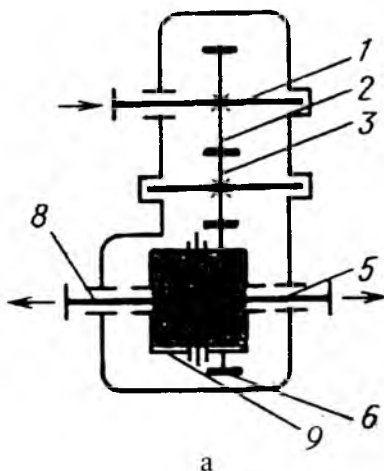
3.4. TRANSFER GEARBOX

Oldi va orqa ko'priklar yetakchi bo'lganda uzatilayotgan harakat tarmoqlanishi kerak. Taqsimlash qutisi uzatadigan harakatni tarmoqlantiradi, taqsimlaydi. Taqsimlash qutisi g'ildirak formulasi 4x4, 6x6 bo'lgan avtomobillarda qo'llaniladi.

Oddiy taqsimlash qutisiga (3.10-rasm) harakat yetakchi valdan (1) kiradi. Shes-terniyalar (2, 3, 6) yordamida old va orqa ko'priklarga harakat uzatish vallari (8, 5) orqali taqsimlanadi.

When the front and rear axles of the vehicle are drive distribution of the transmitting movement is required. The transfer gearbox distributes the transmitting movement. The transfer gearbox is used in vehicles with wheel arrangement 4x4, 6x6.

The motion enters to the simple transfer gearbox from the drive shaft (1) (Fig. 3.10). The motion is distributed to front and rear axles by the help of gears (2, 3, 6) and through shafts (8, 5).



3.10-rasm. Taqsimlash qutisining sxemasi:
a—differensialli taqsimlash qutisi;
b—oldi va orqa ko'prik vallarini ulaydigan
muftali taqsimlash qutisi.

Figure 3.10. The scheme of the transfer gearbox.
a—transfer gearbox with differential; b—
transfer gearbox with coupling the shafts
of axles.

Oldi va orqa yetakchi ko'priklar val-lari (8 va 5) orasida differensial bo'ladi (3.10-a rasm). Differensial ko'priklar g'ildiraklarini turli tezlikda aylamishiga imkon beradi. Differensial transmis-siyaning oshiqcha zo'riqlasligini ta'min-laydi. Nosimmetrik differensial konstruk-siyasi ko'priklararo momentni turlicha taqsimlashga ham imkon beradi.

Old va orqa etakchi ko'prik vallari (8 va 5) mufta (7) bilan ulanishi mumkin (3.10-b rasm). Haydovchi og'ir yo'l sharoitida muftani (7) ulaydi, old va orqa ko'prik yuritmalarini blokirovka qlladi. Avtomobil o'tag'onligi oshadi. Yengil yo'l sharoitida haydovchi mufta (7) bilan vallarni ajratadi. Transmissiyada oshiqcha zo'riqlash bo'lmaydi, yonilg'i sarfi oshmaydi.

Taqsimlash qutilari bir va ikki pog'o-nali bo'lishi mumkin. Ikki pog'onali old va orqa ko'priklarga differensial yuritmal-i taqsimlash qutisi 3.11-rasmda ko'rsatilgan.

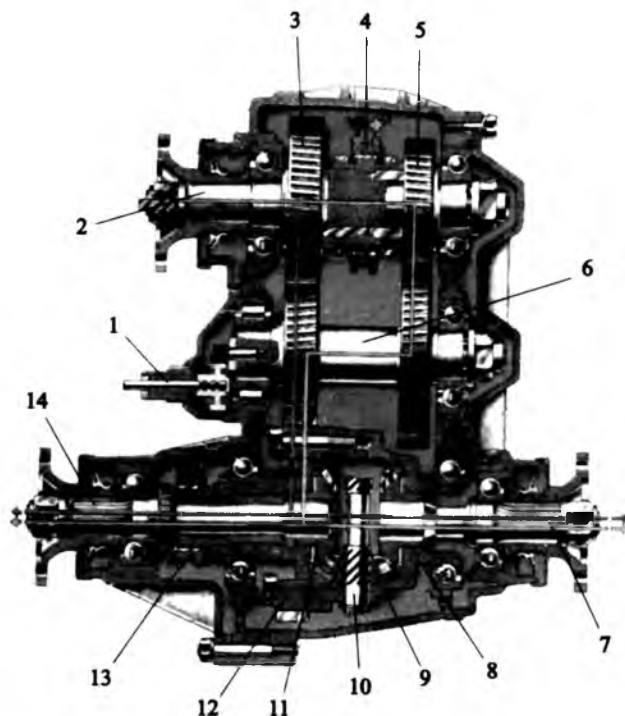
The differential is located between the shafts (8 and 5) of the front and rear axles (Fig. 3.10, a). The differential provides rotation of wheels of axles with different velocity. The differential prevents the overstresses of transmission. Design of non-equalizing differential provides distribution the torque between axles by different value.

Shafts of the front and rear drive axles (8 and 5) are coupled by clutch (7) (Fig. 3.10, b). A driver couples the clutch (7) and locks the drive of front and rear axles in hard road conditions. Passability of the vehicle is increased. A driver disconnects the shafts by clutch (7) in easy road conditions. There is no overstress in transmission and the fuel consumption does not increase.

One and two gear transfer gearboxes are used. The transfer gearbox with two gear and differential drive for front and rear axles is shown in Fig. 3.11.

Yoshlik chog'da ilm olib, keksayganda esa ana shu ilmdan zavqlanib yashamoq eng to'g'ri yo'ldir.

Seneka



3.11-rasm. Yengil avtomobil taqsimlash qutisi.

2—yetkachi val; 3—quyi pog'ona shesternyasi; 4—pog'ona qo'shish muftasi; 5—yuqori pog'ona shesternyasi; 6—oraliq val; 7—orqa ko'prik yuritmasi vali; 12—differensial korpusi tishli g'ildiragi; 13—differensial blokirovkasi muftasi; 14—old ko'prik yuritmasi vali.

Burovchi moment uzatmalar qutisidan yetakchi valga (2) keladi. Yetakchi valda quyi pog'ona shesternyasi (3) va yuqori pog'ona shesternyasi (5) erkin o'rnatilgan. Shesternyalar (3 va 5) oraliq vali shesternyalari bilan doimiy tishlash-

Figure 3.11. Transfer gearbox of a car.

2—drive shaft; 3—reduction gear; 4—gear shifting sleeve; 5—overdrive gear; 6— counter shaft; 7—rear axle driver shaft; 12—oothed wheel of the differential housing; 13—differential locking sleeve; 14—front axle drive shaft.

The torque is transmitted from the gearbox to drive shaft (2). Reduction gear (3) and overdrive gear (5) is mounted on the drive shaft free. Gears (3 and 5) are meshed with gears of the countershaft constantly. At the intermediate position

gan. Pog'ona qo'shish muftasi (4) o'rta holatda taqsimlash qutisidan harakat uzatilmaydi. Mufta (4) yetakchi valni shesternya (3) bilan ulasa, harakat differensial orqali old va orqa ko'priklar yuritmasiga vallariga (7, 14) uzatiladi. Shesternyalar (3 va 5) har xil o'lchamda. Uzatishlar soni ham turlicha bo'ladi. Shuning uchun taqsimlash qutisi ikki pog'onali deb ataladi.

Mufta (13) bilan differensialni blokirovkalash mumkin. Haydovchi o'ta og'ir yo'l sharoitida muftadan (13) foydalanadi. Differensial blokirovkalanganda hamma ko'priklar vallari (7 va 14) bir xil tezlikda aylanadi.

of the shifting sleeve (4) the motion is not transmitted through the transfer gearbox. After the shifting sleeve (4) has connected the drive shaft to the gear (3) the motion is transmitted through differential to drive shafts (7, 14) of front and rear axles. Gears (3 and 5) have different dimensions. They have different ratios too. That is why the transfer gearbox is called "two-speed".

The differential can be locked by sleeve (13). A driver uses the locker (13) in too hard road conditions. When the differential is locked, rotating speeds of drive shafts (7 and 14) of axles are same.

Nazorat uchun savollar

Self-control questions

1. Taqsimlash qutisining vazifasi nima?
2. Taqsimlash qutisining qanday turlari mavjud?
3. Taqsimlash qutisining detallari.

1. What is the function of the transfer gearbox?
2. What types of transfer gearbox?
3. Details of transfer gearbox.

3.5. KARDANLI UZATMA

3.5. CARDAN DRIVE

Yer notekisligi ta'sirini so'ndirish uchun yetakchi ko'priklar kuzovga osmalar yordamida birlashtiriladi. Avtomobilning harakati vaqtida ular kuzovga nisbatan vertikal tebranadi. Uzatmalar qutisidan yetakchi g'ildiraklarga burovchi momentni uzatishda kardanli uzatmadan foydalaniladi.

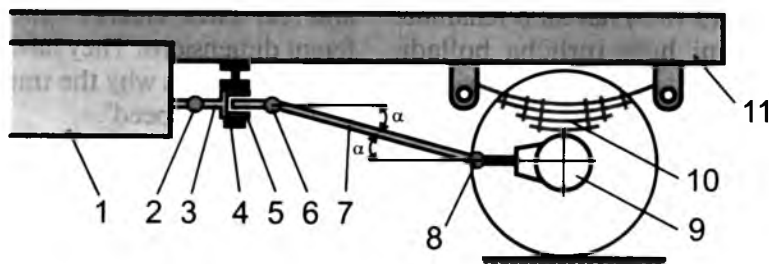
Uzatmalar qutisi (1) (3.12-rasm) ramaga o'rnatilgan, yetakchi ko'priklar esa

In order to absorb the action of the road unevenness drive axles are connected to the body by help of suspensions. Axles oscillate relatively the body in moving automobile. The torque is transmitted from the gearbox to wheels via the cardan drive.

The gearbox (1) (Fig. 3.12) is mounted at the frame and drive axle is

ramaga (11) osmalar (10) yordamida biriktirilgan. Burovchi moment yetakchi ko'priikka o'zgaruvchan α — burchak ostida aylanadigan val (7) orqali uzatiladi.

connected to the frame (11) with the help of suspensions (10). The torque is transmitted to drive axle under the varying angle α via the rotary shaft (7).



3.12-rasm. Kardanli uzatma qismlarining joylashuv sxemasi:
1—uzatmalar qutisi; 2, 6, va 8—kardan sharnirlari; 3—oraliq kardan vali;
4—oraliq tayanch; 5—shlisali birikma;
7—asosiy kardan vali; 9—asosiy uzatma;
10—ressora; 11—rama.

Figure 3.12. Cardan drive parts arrangement scheme:
1—gearbox; 2, 6 and 8—cardan joints;
3—intermediate propeller shaft;
4—center support; 5—splined joint;
7—main propeller shaft; 9—final drive;
10—spring; 11—frame.

Kardanli uzatmaning vazifasi — o'qlari bir chiziqda yotmagan va o'zaro joylashuvi o'zgarib turadigan vallar orasida harakat uzatish.

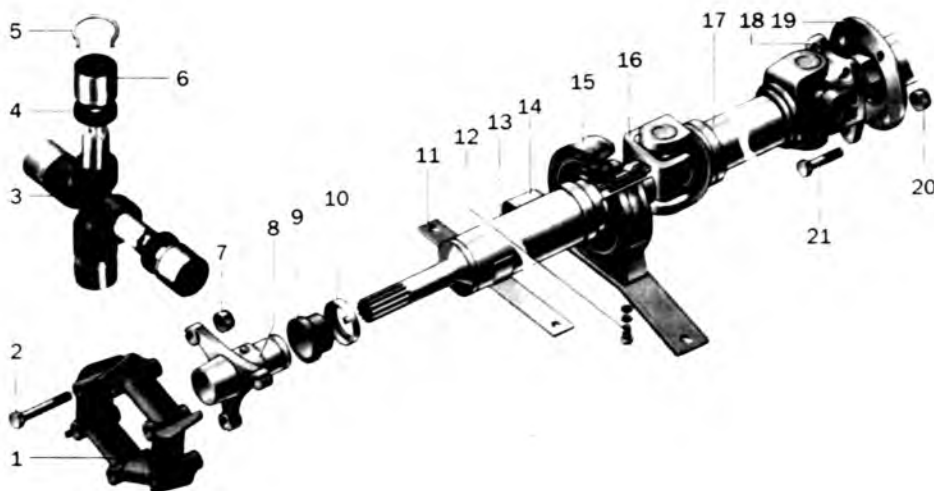
Kardanli uzatmalar mustaqil osmali yetakchi g'ildiraklar bilan asosiy uzatma orasida harakat uzatishda ham foydalaniladi.

Kardanli uzatmaga kardan sharnirlari va kardan vallari kiradi. Kardanli uzatmaning yordamchi qurilmalari: bo'ylama masofa o'zgarishini ta'minlaydigan shlisali birikma (5), ikki va undan ortiq valli kardanli uzatmalarda oraliq tayanch (4) (3.12-rasm).

The **purpose of cardan drive** is to pass the motion between shafts, axes of which are not on one line and change their position.

Cardan drive is used to transfer the motion between wheels with independent suspension and final drive too.

Cardan drive consists of cardan joints and cardan shafts. Additional parts of cardan drive are splined joint 5, which provide changing of longitudinal distance and central support 4 for cardan drives with two or more shafts (Fig. 3.12).



3.13-rasm. Kardanli uzatma: 1—elastik mufta; 3—krestovina; 4—salnik; 5—cheklagich halqa; 6—krestovina podshi pnigi; 8—elastik mufta flanesi; 13—old kardan vali; 15—oraliq tayanch; 16—old kardan vali vilkasi; 17—orqa kardan vali; 18—orqa kardan vali vilkasi; 19—asosiy uzatma yetakchi vallning flanesi.

Figure 3.13. Cardan drive: 1—flexible coupling; 3—cross; 4—gasket; 5—check ring; 6—bearing of cross; 8—flange of flexible coupling; 13—primary propeller shaft; 15—central support; 16—primary propeller shaft fork; 17—secondary propeller shaft; 18—secondary propeller shaft fork; 19—flange of drive shaft of final drive.

Kardan sharniri o'qlari orasidagi burchak o'zgaruvchan bo'lgan vallarni sharnirli biriktirib, harakat uzatishga xizmat qiladi.

Kardan sharniri bikir kardan sharniri va elastik kardan sharniri turlariga bo'linadi (3.13-rasm).

O'qlari orasidagi burchakning o'zgaruvchanligi 4° gacha bo'lgan vallar elastik kardan sharnirlari (1) (3.13-rasm) bilan biriktiriladi.

Elastik kardan sharnirida vallar vilkalari yoki flaneslari elastik materialli elementlar orqali biriktiriladi.

Bikir kardan sharnirlari, biriktirgan vallarning burchak tezliklari nisbatiga

The cardan joint makes articulated joint and passes the motion between shafts, the angle between axes of which is variable.

Cardan joint is divided into stiff and elastic types (Fig. 3.13).

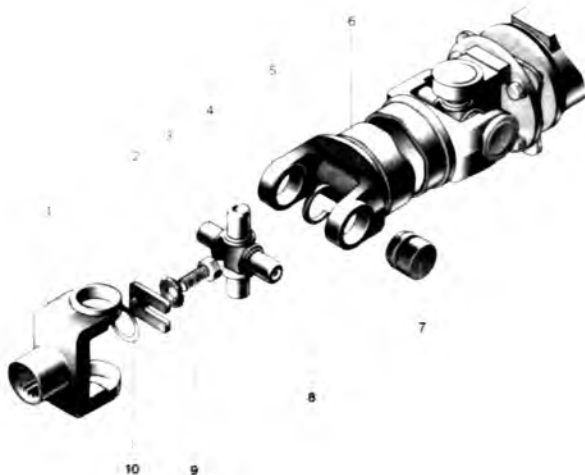
Shafts, which have the varying angle about 4° between axes, are connected through elastic cardan joints 1 (Fig. 3.13).

Forks or flanges of shafts are connected by the help of elements made from elastic materials in **elastic cardan joints**.

There are **constant velocity joint** and **variable velocity joint** types of **stiff cardan**

qarab, **burchak tezliklari teng bo'lgan va teng bo'lmagan** turlariga bo'linadi.

Burchak tezliklari teng bo'lmagan bikir kardan sharnirining tuzilishi va prinsipial sxemasi 3.14-rasmda keltirilgan.



3.14-rasm. Burchak tezliklari teng bo'lmagan bikir kardan sharniri tarkibi:

1—vilka; 2—P-simon plastina;
3—cheklagich shayba; 4—krestovina;
5—orqa vilka; 6—orqa kardan val;
7—ignali podshipnik; 8—cheklagich halqa; 9—bolt; 10—zichlovchi halqa.

Kardan vilkasining birinchi yarmi (1) (3.14-rasm) valga flanes yoki bolt bilan biriktiriladi. Ikkinchi qismi (5) valga (6) payvandlab biriktiriladi. Krestovina (4) vilkalarga ignali podshipniklar (7) orqali sharnirli bog'lanadi. Podshipniklarning krestovina barmoqlarida siljimasligi uchun cheklagich halqalardan (8) foydalaniladi.

Podshipniklar ishqalanuvchi yuzalarini moylash uchun ularning ishchi qismlari moy bilan to'ldiriladi. Tashqi muhitdan g'ilof — salnik bilan yopiladi.

joints depending on rate of turn of shafts connected.

Construction and principle scheme of **stiff variable velocity joint** is illustrated in Fig. 3.14.

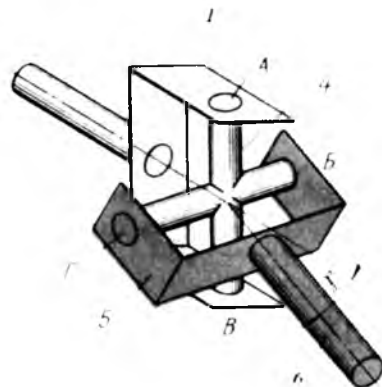


Figure 3.14. Parts of stiff variable velocity joint:

1—fork; 2—P shape plate; 3—safety washer; 4—cross; 5—rear fork; 6—rear propeller shaft; 7—needle bearing; 8—safety ring; 9—bolt; 10—seal ring.

The first half (1) of cardan fork (Fig. 3.14) is connected to shaft by flange or bolt. The second half (5) is connected to shaft (6) by welding. The cross (4) is connected to forks by articulated joint through needle bearings (7). In order to prevent removing of bearings on cross pins safety rings (8) are used.

Work areas of bearings are filled by lubricant to grease its rubbing surfaces. It is protected from environment by cover-seal.

*Biron ishni qilishga qasd qilgan bo'lsam, butun zehnim, vujudim
bilan bog'lanib, bitirmagunimcha undan qo'limni tortmadim.*

Amir Temur

Burchak tezliklari teng bo'lmagan bikir kardan sharnirlaridan vallar o'qlari orasidagi burchak $\gamma = 4^{\circ} \dots 20^{\circ}$ bo'lgan hollarda foydalaniladi. O'qlar orasidagi burchak 4° dan kichik bo'lishi kardan sharnirining xizmat muddatini keskin qisqartiradi.

Kardan vallar har 90° aylanganda krestovina tekisligi kardan vallari o'qlar orasidagi γ burchakka teng qiymatda tebranadi. Bunday jarayon yetakchi kardan vali o'zgaras burchak tezligi bilan aylansa ham, yetaklanuvchi kardan valini har 90° da tezroq va sekinroq aylanishiga sabab bo'ladi.

Yetaklanuvchi kardan vali burchak tezligining notekisligi γ burchakka bog'liq. Burchak kattalashishi bilan notekislik ortadi va aksincha, kamayishi bilan kichiklashadi.

Burchak tezliklari teng bo'lgan kardan sharnirlari (BTTSH) odatda old yetakchi va boshqaruvchi g'ildiraklarga harakat uzatishda qo'llaniladi. Buning asosiy sababi BTTSHlarining 45° burchakgacha harakatni uzatishi mumkin.

BTTSHda yetakchi va yetaklanuvchi vallarning burchak tezliklarining teng saqlanishi, sharnirlarda harakat uzatish hamisha vallar o'qlari orasidagi burchakni bo'luvchi bissektrisa tekisligida amalga oshiriladi.

BTTSHning konstruksiyalari sharchali va mushtchali bo'ladi.

Stiff variable velocity joints are applied when the angle between axes of shafts is about $\gamma = 4^{\circ} \dots 20^{\circ}$. Durability of cardan joints decreases when the angle between axes is small than 4° .

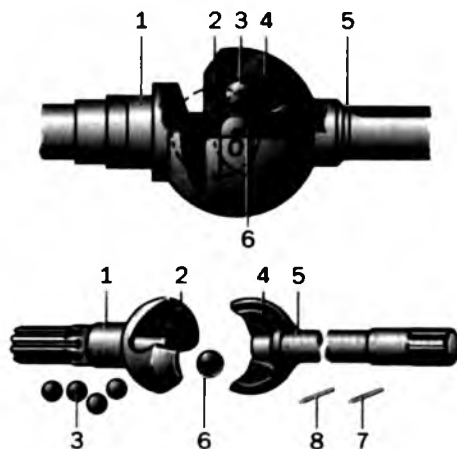
The cross plane oscillates for value which is equal to angle γ between axes of shafts in each revolution of propeller shafts for 90° . Because of it the driven propeller shaft rotates faster or slowly in each revolution of drive propeller shaft for 90° by constant velocity.

Variation of driven propeller shaft velocity depends on angle γ . Variation of velocity increases after the angle has been increased and vice versa, variation decreases after the angle has been decreased.

Constant velocity joints transfer the motion to drive and steered wheels. The main reason of it is transferring the motion under variable angle until 45° by constant velocity joints.

Holding the constant velocities of drive and driven shafts and transferring the motion in constant velocity joints always is made on dividing bisector plane of the angle between axes of shafts.

Constant velocity joints are designed with balls and cams.



3.15-rasm. Burchak tezliklari teng sharchali kardan sharniri: 1 va 5—kardan yarim vallari; 2 va 4—ariqchalar; 3—to'rtta moment uzatuvchi sharchalar; 6—vallarni markazlashtiruvchi sharcha; 7 va 8—shipilkalar.

Figure 3.15. Constant velocity ball joint:
1 and 5—cardan semi axles; 2 and 4—grooves; 4—four torque transferring balls; 6—shafts centering balls; 7 and 8—studs.

Kardan sharnirining vallari (1 va 5) vilkalari bilan yaxlit tayyorlanadi. Vilkalardagi (2 va 4) ariqchalarda to'rtta moment uzatuvchi sharchalar joylashgan bo'ladi. Yetaklovchi val (5) shlitsali uchi bilan harakatni differensialdan oladi. Harakat vilka ariqchalaridagi (4) sharchalardan (3) ikkitasi va vilka ariqchasi (2) orqali yetaklanuvchi valga (1) uzatiladi. Demak, harakat yoki kuch, yo'nalishiga qarab, uzatilishida faqat ikkita sharcha ishtirok etadi. Markazlashtiruvchi sharcha (6) shipilkalar bilan vallar o'qlarining bir nuqtada tutashini ta'minlaydi. Markazlashtiruvchi sharcha (6) va ariqchalarning (2 va 4) shakli sharchalarning vallar o'qlari orasidagi burchakning bissektisa tekisligida joylanishini ta'minlaydi. Shuning uchun vallar bir xil burchak tezlik bilan aylanadi.

Kardan vallari po'latdan tayyorlanadi. Valning ikki uchiga kardan sharnirlarining vilkalari payvandlanadi. Kardan valining

Shafts (1 and 5) of cardan joints are made solid with forks. Four torque transferring balls are located in grooves of forks (2 and 4). Drive shaft (5) takes the motion from differential by its splined end. The motion is transferred via two of balls (3) in grooves of fork (4) and through groove of fork (2) to driven shaft (1). Therefore, depending on direction the motion or force is transferred through only two balls. Centering ball (6) with studs provide the crossing of axes of shafts. Centering ball (6) and form of grooves (2 and 4) provide the location of balls on the plane of bisector of the angle between axes of shafts. Because of it, shafts rotate by the same velocities.

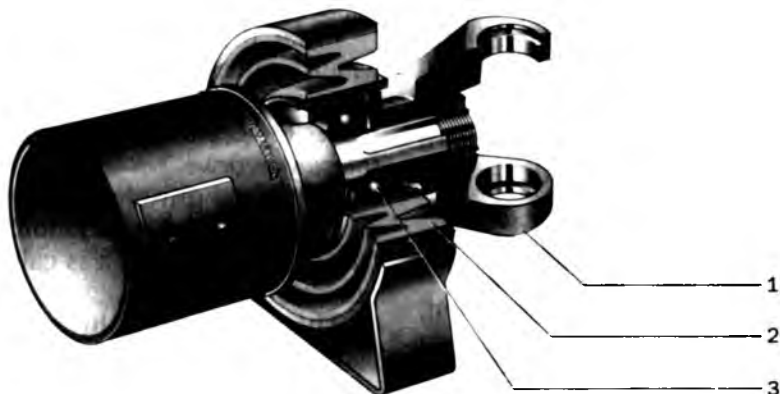
Propeller shafts are made of steel. Forks of cardan joints are welded to the both ends of propeller shaft. In order to

ko'ndalang bikirligini oshirish maqsadida val yupqa devorli trubasimon shaklda bo'ladi.

Ikki va undan ortiq valli kardanli uzatmalarda **oraliq tayanchdan** foydalaniladi (3.16-rasm).

increase the transversal stiffness of propeller shaft it has the shape of thin walled pipe.

Central support is applied in cardan drive with two and more propeller shafts (Fig. 3.16).



3.16-rasm. Kardan uzatmasining oraliq tayanchi: 1—vilka; 2—elastik yostiqcha; 3—sharikli podshipnik.

Figure 3.16. Central support of cardan drive: 1—fork; 2—elastic cushion; 3—ball bearing.

Kardan uzatmasining oraliq tayanchi avtomobil kuzoviga oraliq tayanch kronshteyni orqali bikir biriktiriladi.

Kardan valida sodir bo'ladigan tebraniqlar avtomobil kuzoviga o'tmasligi uchun tayanchning sharikli podshipnigi elastik yostiqchaga (2) (3.16-rasm) joylashtirilgan.

Central support of cardan drive is attached stiffly to body of automobile by the bracket.

In order to absorb the oscillates created in propeller shafts ball bearing of central support is located in elastic cushion (2) (Fig. 3.16).

Nazorat uchun savollar

Self-control questions

1. Kardanli uzatmaning vazifasi nima?
2. Kardanli uzatmaning detallari.
3. Kardan sharnirlarining vazifalari nima?
4. Kardan sharnirlarining qanday turlari mavjud?
5. Oraliq tayanchning vazifasi nima?

1. What is the function of cardan drive?
2. Details of cardan drive.
3. What is the function of cardan joints?
4. What types of cardan joints?
5. What is the function of central support?

3.6. ASOSIY UZATMA

3.6. FINAL DRIVE

Asosiy uzatma — uzatayotgan burovchi momentni doimiy oshiruvchi shesternyali mexanizm. Asosiy uzatma uzatish soni uzatmalar qutisini ixcham, kardan uzatmani kam yuklanishli qiladi.

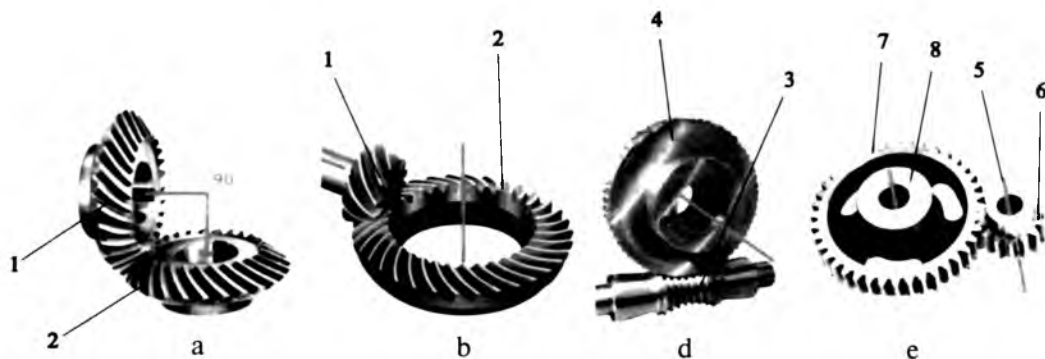
Agar asosiy uzatma bir juft shesternyali bo'lsa — yakka, ikki juft shesternyali bo'lsa — qo'shaloq deyiladi.

Yakka asosiy uzatmalar konussimon, gipoidli, chervyakli va silindrik turlarga bo'linadi (3.17-rasm).

Final drive is a gear mechanism, which increases the transferring torque constantly. The ratio of the final drive makes the gearbox compact and unloads the cardan drive.

If the final drive has a couple of gears it is called "single reduction", if it has two couples of gears it is called "double reduction".

There are conical, hypoid, worm and cylindrical types of single reduction final drive (Fig. 3.17).



3.17-rasm. Yakka asosiy uzatmalar sxemasi:

1—etakchi shesternya; 2—etaklanuvchi shesternya; 3—chervyak; 4—chervyakli shesternya; 5—etakchi val; 6—etakchi shesternya; 7—etaklanuvchi shesternya; 8—differensial.

Yakka asosiy uzatmalar uzatish soni odatda yengil va o'rta yuk avtomobillarida qo'llaniladi. Uzatishlarining soni oltigacha bo'ladi.

Figure 3.17. The scheme of single reduction final drives:

a—conical; b—hypoid; d—worm; e—cylindrical;
1—drive gear; 2—driven gear; 3—worm;
4—worm gear; 5—drive shaft; 6—drive gear; 7—driven gear; 8—differential.

Usually the single reduction final drive ratio is applied in cars and in middle-weight trucks. The gear ratio is up to six.

Konussimon asosiy uzatmaning yetakchi (1) va yetaklanuvchi (2) shesternyalar o'qlari bir tekislikda bo'ladi.

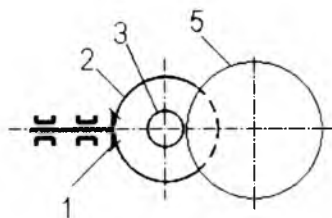
Gipoidli asosiy uzatma yetakchi (1) va yetaklanuvchi (2) shesternyalar o'qlari bir tekislikda yotmaydi. Yetakchi shesternya o'qi yetaklanuvchi shesternya o'qidan e (3.17-b rasm) masofaga siljigan bo'ladi. Gipoidli asosiy uzatma konussimonga nisbatan gabariti kichik, shovqini past bo'ladi.

Chervyakli asosiy uzatmada katta uzatish sonini olish mumkin. Uning foydali ish koeffitsiyenti nisbatan past.

Silindrik asosiy uzatma dvigateli ko'ndalang joylashgan old yuritmalilengil avtomobillarda qo'llaniladi.

Qo'shaloq asosiy uzatmaning uzatish soni ikki juft shesternyalar uzatish sonlari ko'paytmasiga teng. Qo'shaloq asosiy uzatma hisobiga gabarit kichik bo'ladi.

Komponovkasiga ko'ra ular *markaziy* va *ajratilgan* turlarga bo'linadi.



3.18-rasm. Qo'shaloq markaziy asosiy uzatmalar sxemasi:

- 1—yetakchi konussimon shesternya;
- 2—yetaklanuvchi konussimon shesternya;
- 3—yetakchi silindrik shesternya; 4—oralik val;
- 5—yetaklanuvchi silindrik shesternya;
- 6—differensial; 7—yarim o'qlar.

Qo'shaloq markaziy asosiy uzatmada ikki juft shesternyalar bir karterda joylashtiriladi.

Axes of the drive (1) and driven (2) gears of the conical final drive are on the one plane.

Axes of the drive (1) and driven (2) gears of the hypoid final drive are not on the one plane. The axis of the drive gear is removed for path e from the axis of the driven gear (Fig. 3.17, b). Hypoid final drive has a smaller dimension and lower noise than a conical.

The ratio range of the worm final drive is wider. However, it has lower efficiency.

Cylindrical final drive is applied in cars with transversally, front-mounted engine and front wheel drive.

The ratio of the double reduction final drive is equal to multiple of the ratios of two pairs of gears. Dimension is small because of double reduction final drive.

There are *central* and *hub-reduction* types of the double final drive depending on arrangement.

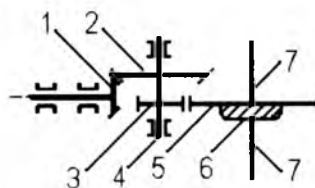


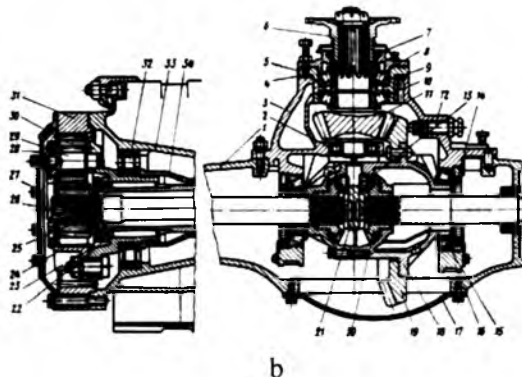
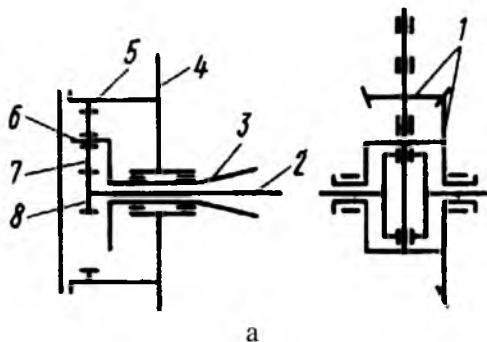
Figure 3.18. The scheme of double reduction final drive:

- 1—drive conical gear; 2—driven conical gear; 3—drive cylindrical gear; 4—counter shaft; 5—driven cylindrical gear; 6—differential;
- 7—semi axles.

Two pairs of gears are located in one housing in double reduction final drive.

Qo'shaloq ajratilgan asosiy uzatmalarda bir juftlik shesternya markazda, ikkinchi juftlik g'ildirakda joylashtiriladi. G'ildirakdagi planetar reduktor shakli keng tarqalgan (3.19-rasm).

Pair of gears is located in center and pair of gears is located inside the hub of the wheel in hub-reduction double final drive. The planet reducer type in a wheel is widespread (Fig. 3.19).



3.19-rasm. Qo'shaloq ajratilgan asosiy uzatmalar sxemasi (a) va chizmasi (b): 1—markaziy konussimon juft; 2—yarim o'q; 3—ko'prik qobig'i; 4—g'ildirak; 5—toj (koronnaya) shesternya; 6—o'q; 7—satellit; 8—quyosh shesternya.

Figure 3.19. The scheme (a) and design (b) of hub-reduction double final drive:

1—central conical pair; 2—semi axle;
3—housing of the axle; 4—wheel;
5—crown gear; 6—axle; 7—satellite;
8—central (sun) gear.

Burovchi moment markaziy konussimon juftdan (1) yarim o'qqa (2) uzatiladi. Uning shesternyasidan (8) burovchi moment ko'prik qobig'iga (3) mahkamlangan o'qda (6) erkin o'rnatilgan satelлитlar (7) orqali toj shesternyaga (5) va g'ildirakka (4) uzatiladi.

The torque is transmitted from central conical pair (1) to the semi axle (2). From the gear (8) of semi axle the torque is transmitted via satellites (7) mounted free on the axle (6) mounted on the housing (3) to crown gear (5) and the wheel (4).

Qo'shaloq ajratilgan asosiy uzatma differensial va yarim o'qlar yuklanishini kamaytiradi, yetakchi ko'prik o'rta qism gabaritini kamaytiradi. Ko'prik bilan yo'l oralig'i kattalashadi.

Hub-reduction double final drive decreases the loading of differential and semi axles, dimension of central part of the axle housing. The clearance between the axle and the road increases.

Nazorat uchun savollar

Self-control questions

1. Asosiy uzatmaning vazifasi nima?
2. Asosiy uzatmaning turlari.
3. Asosiy uzatmaning detallari.

1. What is the function of the final drive?
2. Types of the final drive.
3. Details of the final drive.

4. Gipoid asosiy uzatmaning detallari.
5. Ikkiga ajrarilgan qo'shaloq asosiy uzatmaning afzalliklari.

4. Advantages of hypoid final drive.
5. Advantages of hub-reduction double final drive.

3.7. DIFFERENTIAL

3.7. DIFFERENTIAL

Differential harakatni ikki tomonga tarmoqlantiradi va tomonlarning turli tezlikda aylanishiga imkon beradi.

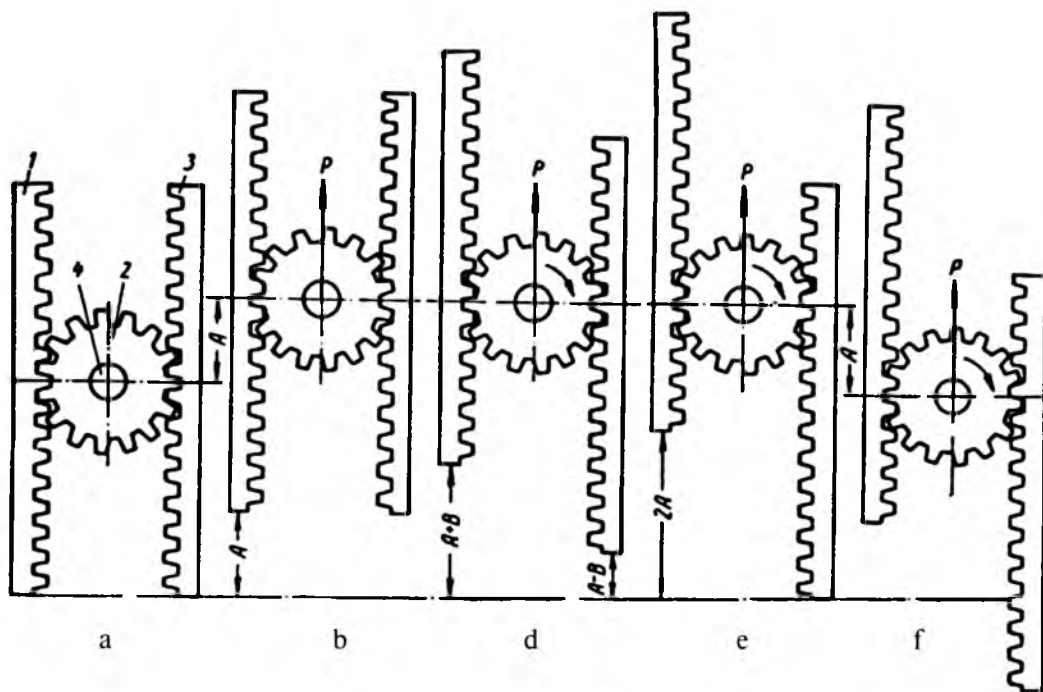
Avtomobil burilishida chap va o'ng g'ildiraklar turli tezlikda aylanadi. Differential g'ildiraklarni sirpanmasdan har xil burchak tezlikda aylanishini ta'minlaydi.

Differentialning ishlashini quyidagi misolda ko'rish mumkin (3.20-rasm).

Differential distributes the motion for two sides and provides rotations of the sides by different speeds.

When automobile is turning left and right wheels rotate in different speeds. Differential provides rotation of the wheels in different speeds without slipping.

Differential operation is demonstrated in the following example (Fig. 3.20).



3.20-rasm. Differentialning ishlash sxemasi.

Figure 3.20. Differential operation scheme.

Ikkita tishli reykarlar (1 va 3) (3.20-a rasm) orasida shesternya (2) o'qqa (4) erkin o'rnatilgan. Agar shesternya o'qiga kuch (R) qo'yilsa, shesternya o'zi bilan ilashgan ikkala reykaning tortadi. Ikkala reyka bir xil masofaga (A) siljiydi (3.20-b rasm). Shesternya (2) o'z o'qi atrofida aylanmaydi.

Reykalardan birining harakatlanishi sekinlatilsa, shesternya (2) o'qida aylanadi (3.20-d rasm). Natijada chap reykaning siljishi ma'lum masofaga (D) oshadi. Xuddi shu masofaga (D) o'ng reykaning siljishi kamayadi.

Agar o'ng reyka siljimasa, shesternya (2) o'ng reykada g'ildiraydi. Shu tufayli chap reykaning siljishi va tezligi shesternya o'qining siljishiga nisbatan (2) martaga oshadi (3.20-e rasm). Bu holda chap reykaning siljishi $2A$ ga tengdir.

Shesternya (2) o'qi siljimasa, reykarlar qarama-qarshi tomonlarga siljiydi (3.20-f rasm).

Yetakchi g'ildiraklar orasiga o'rnatilgan differensial xuddi yuqorida ko'rilgan prinsipial sxema bo'yicha ishlaydi. Differensial tuzilishining soddalashirilgan sxemasi 3.21-rasmda ko'rsatilgan.

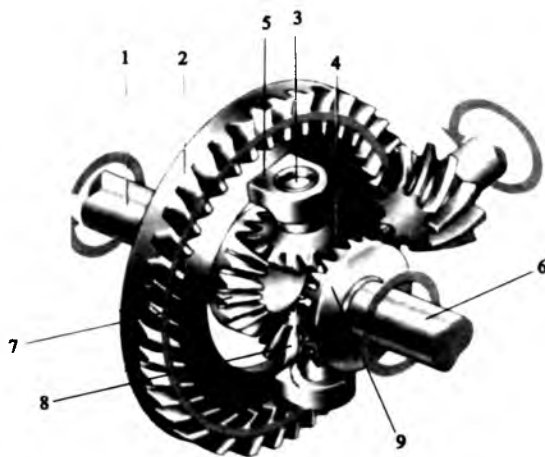
Gear (2) is mounted on the axle (4) free between the toothed racks (1 and 3) (Fig. 3.20, a). If the force (P) has put on gear axle gear pulls the racks coupled to it. Both of racks moves for similar path (A) (Fig. 3.20, b). Gear (2) does not rotate around its axis.

If the motion of one rack slows down gear (2) rotates around its axis (Fig. 3.20, d). Consequently, the travel of the left rack increases for path (D). The travel of the right rack decreases for path (D).

If the right rack is stopped the gear (2) rolls on the right rack. Because of it the motion and speed of the left rack increases for two times than motion of the gear's axis (Fig. 3.20, e). Therefore, the travel of the left rack is equal to $2A$.

If the axis of the gear (2) is stopped racks rotate opposite sides (Fig. 3.20, f).

The differential located between drive wheels operates by principal scheme, considered above. The principal scheme of differential design is shown in figure 3.21.



3.21-rasm. Differensial tuzilishini soddalashtirilgan sxemasi.

Figure 3.21. Principal scheme of differential design.

Asosiy uzatmaning yetaklanuvchi shesternyasi (2) differensial qutisi (5) bilan qotirilgan. Differensial qutisida joylashgan o'qda (3) konussimon satellitlar (4 va 8) erkin aylanadi.

Satellitlar yarim o'q shesternyalari (7 va 9) bilan ilashgan. Yarim o'q shesternyalari yarin o'qlarning (1 va 6) ichki uchlariga shlisli birikma yordamida o'rnatilgan.

Avtomobil to'g'ri chiziqli harakatlanganda ikkala yetakchi g'ildiraklari bir xil yo'l bosadi. Differensial qutisi va ikkala yarim o'q shesternyalari bir xil tezlikda aylanadi. Satellitlar o'z o'qi atrofida aylanmaydi.

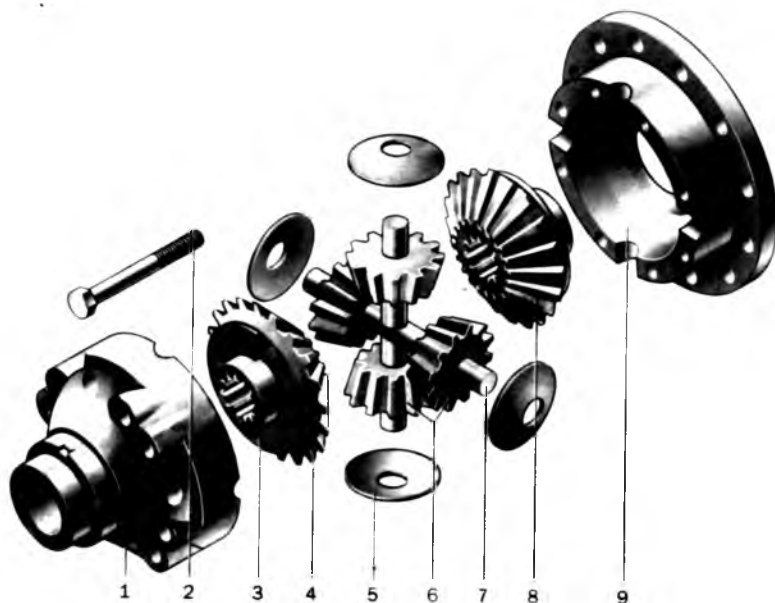
Avtomobil burilishida o'ng va chap g'ildiraklar turli yo'l bosadi. Bir yarim o'q shesternyasining aylanishi sekinlashsa, satellitlar o'z o'qlari atrofida aylanadi. Ikkinchi yarim o'q shesternyasining aylanishini tezlashtiradi. G'ildiraklarning bir vaqtning o'zida har xil masofali yo'l bosib o'tish imkoniyati ta'minlanadi.

The driven gear (2) of the final drive is bolted to the housing (5) of differential. Cone satellites (4 and 8) rotate free on the axis (3) mounted at the housing of differential.

Satellites are meshed with gears (7 and 9) of axle shafts. Gears are mounted on the inner ends of axle shafts (1 and 6) by the slit.

Both drive wheels travel for same path at a time of linear motion of automobile. Differential housing and both gears of axle shafts rotate in similar speed. Satellites do not rotate around their axis.

Right and left wheels travel for different paths when automobile turns. When the rotation of gear of the one axle shaft has decreased, satellites rotate around their axis. Rotation of gear of other axle shaft has become faster. The possibility of the travel of wheels for different paths is attained.



3.22.-rasm. Konussimon simmetrik differensialning qismlari.

- 1, 9—differensial qutisining ikki yarmi,
 2—qutining bolti, 3—shesternya tayanch shaybasi, 4,8—yarim o'q shesternyalari,
 5—satellitlar tayanch shaybasi,
 6—satellitlar, 7—satellitlar o'qi.

To'liq yuritmalı avtomobillarda o'q-lararo differensial qo'llaniladi. Harakat etakchi ko'priklararo taqsimlanadi. O'q-lararo differensial taqsimlash qutisi yoki asosiy uzatma yuritmasida o'rnatiladi.

Figure 3.22. Parts of the bevel gear equaling differential.

- 1, 9—both halves of the differential housing; 2—bolt of housing; 3—thrust washer of gear; 4, 8—gears of axle shafts; 5—thrust washer of satellites; 6—satellites; 7—axle of satellites.

The inter-axle differential is used at all-wheel drive automobiles. The motion is distributed between drive axles. Inter-axle differential is mounted in drive of transfer gearbox or final drive.

Nazorat uchun savollar

Self-control questions

1. Differensialning vazifasi nima?
2. Differensialning turlari.
3. Differensialning detallari.
4. Differensialning ishlash prinsipini tushuntiring.

1. What is the function of differential?
2. Types of the differential.
3. Details of the differential.
4. Describe operation principle of the differential.

3.8. YETAKCHI G'ILDIRAKLAR YURITMALARI

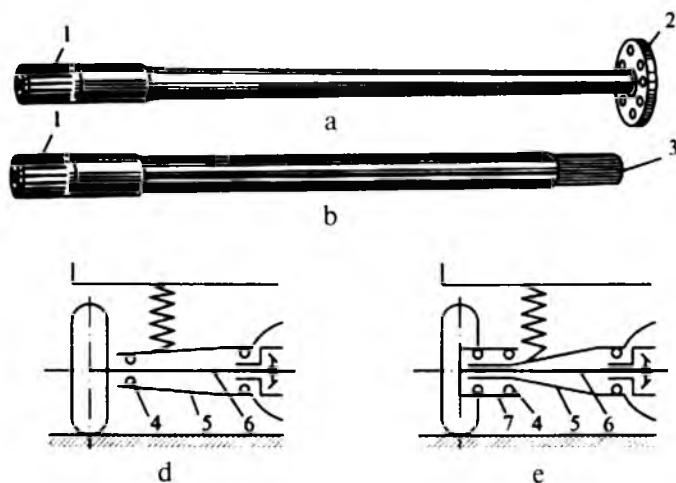
3.8. WHEEL DRIVES

Burovchi moment differensialdan yetakchi g'ildiraklarga yarim o'qlar orqali uzatiladi.

Yarim o'qlar konstruksiyasiga ko'ra flanesli yoki flanesiz, yuklamishiga ko'ra yarim yuksizlantirilgan va to'la yuksizlantirilgan turlarga bo'linadi.

The torque is transmitted from the differential to drive wheels through axle shafts.

There are axle shafts with flange and flangeless depending on design, semi-floating axle and floating axle depending on loading.



3.23-rasm: Yarim o'qlar:
a—flanesli; b—flanesiz; d—yarim yuksizlantirilgan; e—to'la yuksizlantirilgan; 1, 3—shlisli uchlari; 2—flanes; 4—podshipnik; 5—balka; 6—yarim o'q; 7—stupitsa.

Figure 3.23. Axle shafts:
a—with flange; b—flangeless; d—semi-floating; e—floating; 1, 3—splined tips; 2—flange; 4—bearing; 5—beam; 6—axle shaft; 7—hub.

Flanesli yarim o'q (3.23-a rasm) flanesi (2) stupitsani yoki g'ildirak diskini mahkamlash uchun xizmat qiladi. Yarim o'qni ichki uchida yarim o'q shesternyalari bilan birlashtirish uchun shlislar ishlangan. Flanesli yarim o'qlar keng tarqalgan.

Flanesiz yarim o'q (3.23-b rasm) tashqi uchidagi shlislar (3) yarim o'qni

The flange (2) of the axle shaft (Fig. 3.23, a) serves to attach the hub or wheel plate. Inner tip of the axle shaft has a spline to connect it to gears. Axle shafts with flanges are widespread.

Splines (3) on the external tip of the flangeless axle shaft (Fig. 3.23, b)

g'ildirak gupchagi bilan mahkamlovchi flanes o'rnatish uchun xizmat qiladi.

Yarim o'qlar burovchi momentdan tashqari eguvchi momentlar bilan ham yuklanadi. Yarim o'qlarning yuklanishi ularning yetakchi ko'priklari balkalariga o'rnatilish usuliga bog'liq.

Yarim yuksizlantirilgan yarim o'q (6) (3.23-d rasm) tashqi uchi bilan orqa ko'priklari balkasiga (5) o'rnatilgan podshipnikka (4) tayanadi. Yarim o'q burovchi moment, vertikal va gorizontal tekisliklardagi eguvchi momentlarni qabul qiladi.

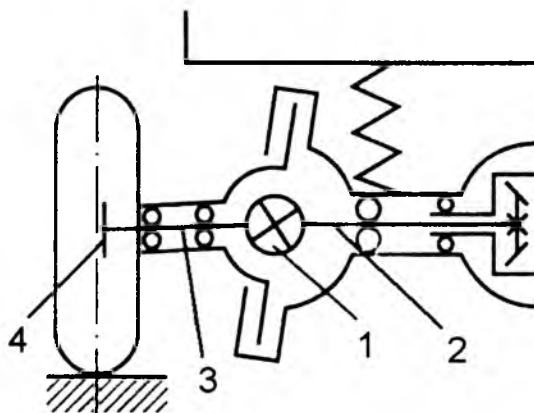
To'la yuksizlantirilgan yarim o'q (6) (3.23-e rasm) ko'priklari balkasiga (5) ikkita podshipniklarda (4) o'rnatilgan g'ildirak gupchagiga (7) ega. Barcha eguvchi momentlarni ko'priklari balkasi qabul qiladi. Yarim o'q faqat burovchi moment uzatadi. To'la yuksizlantirilgan yarim o'qlar avtobus, o'rta va katta yuk avtomobillarining yetakchi ko'priklarida qo'llaniladi.

serve to mount the flange by help of which axle shaft connects to the wheel hub.

Besides the torque, axle shafts are loaded by bending moment. Loading of axle shafts depends on mounting method of them at the drive axle beam.

Semi-floating axle shaft (6) (Fig. 3.23, d) supported by external tip to the bearing (4) mounted on rear axle beam (5). The axle shaft perceives the engine torque, bending moments on vertical and horizontal planes.

Floating axle shaft (6) (Fig. 3.23, e) has a wheel hub (7) mounted on the axle beam (5) by two bearings. Axle beam perceives all bending moments. The axle shaft transfers only the torque. Floating axle shaft is used in drive axles of buses, lorries and trucks.



3.24-rasm. Nomustaqil osmali etakchi kuprik g'ildiraklari yuritmasi sxemasi

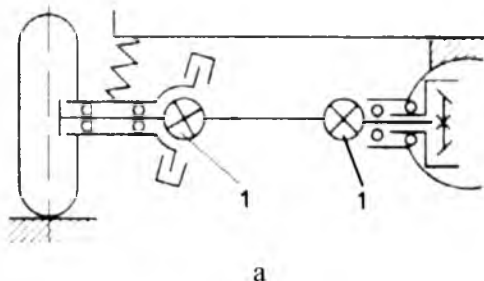
Figure 3.24. Scheme of wheel drive of drive axle with dependent suspension.

*O'zim yigitlikni sog'inaman, uni qo'ldan berganim uchun o'kinaman.
Ammo endigi o'kinchdan naf yo'q.*

Yusuf Xos Hojib

Nomustaqil osmali avtomobillarning yaxlit yetakchi ko'priklarida burovchi moment differensialdan (3.24-rasm) har qaysi etakchi g'ildirakka ichki (2) va tashqi (3) yarim o'qlar va ularni bog'lab turuvchi burchak tezliklari teng bo'lgan kardan sharniri (1) orqali uzatiladi. Burovchi moment differensialdan kardan sharniriga (1) ichki yarim o'qdan o'tkaziladi. Tashqi yarim o'q (3) flanesga (4) ega va undan burovchi moment g'ildirakning burish sapfasida ikkita rolikli podshipnikda o'rnatilgan stupitsasiga o'tkaziladi. Yarim o'qlar (2 va 3) faqat burovchi moment uzatadi.

In drive axles of automobiles with dependent suspension the torque is transmitted from the differential (Fig. 3.24) to each drive wheel through inner (2) and external (3) axle shafts and constant velocity joint (1) that connects axle shafts. The torque is transmitted from the differential to the cardan joint (1) via inner axle shaft. External axle shaft (3) has a flange (4) and the torque is transmitted from it to the hub mounted at the steering knuckle of the wheel by two roller bearings. Axle shafts (2 and 3) transfer only the torque.



3.25-rasm. Mustaqil osmali yetakchi ko'priklar g'ildiraklari yuritmasi sxemasi.
1—burchak tezliklari teng bo'lgan kardan sharniri; 5—burchak tezliklari teng bo'lmagan kardan sharniri.

Mustaqil osmali yengil avtomobillarning (3.25-a rasm) boshqariluvchi yetakchi g'ildiraklari yuritmasida, odatda, burchak tezliklari teng bo'lgan kardan sharnirlaridan (1) foydalaniladi. Bunda,

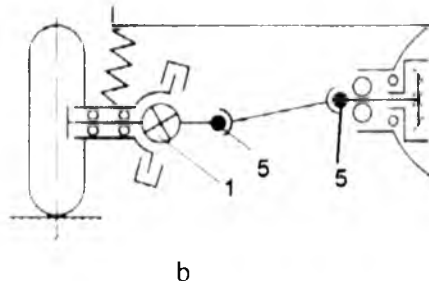


Figure 3.25. Scheme of wheel drive of drive axle with independent suspension.

1—constant velocity cardan joint;
5—variable velocity cardan joint.

Constant velocity cardan joints (1) are applied in drive of steering drive wheels of motorcars with independent suspension (Fig. 3.25, a). In this case,

ichki sharnirlar g'ildiraklarni vertikal siljishini; tashqi sharnirlar esa, ularning burilishini ta'minlaydi. Mustaqil osmali yetakchi g'ildiraklarda, ba'zan, burchak tezliklari teng bo'lmagan ikkita kardan sharnirlari (5) va burchak tezliklari teng bo'lgan bitta kardan sharnirlaridan (1) foydalaniladi (3.25-b rasm).

inner joints provide the vertical replacement of the wheel and external joints provide the steering of them. Sometimes two variable velocity cardan joints (5) and one constant velocity cardan joint (1) are applied in drive wheels with independent suspension (Fig. 3.25, b).

Nazorat uchun savollar

Self-control questions

- | | |
|---|--|
| 1. G'ildirak yuritmalarinig vazifasi nima? | 1. What is the function of wheel drives? |
| 2. Yarim o'qlarning turlari. | 2. Types of axle shafts. |
| 3. G'ildirak yuritmalarining qo'llanilishi. | 3. The application of wheel drives. |

4. YURISH QISMI

4. RUNNING GEAR

4.1. G'ILDIRAKLAR

4.1. WHEELS

G'ildiraklar avtomobilni harakatlanishini ta'minlaydi.

G'ildiraklar yetakchi, yetaklanuvchi va boshqariluvchi turlarga bo'linadi.

Yetakchi g'ildiraklarga transmissiyadan dvigatel burovchi momenti uzatiladi. Yetakchi g'ildirak tayanch yuza bilan ilashganligi uchun, burovchi moment avtomobilni harakatlantiruvchi kuchga aylanadi. Yetaklanuvchi g'ildiraklar rama yoki kuzovdan oladigan kuch hisobiga aylanadi. Boshqariluvchi g'ildiraklar

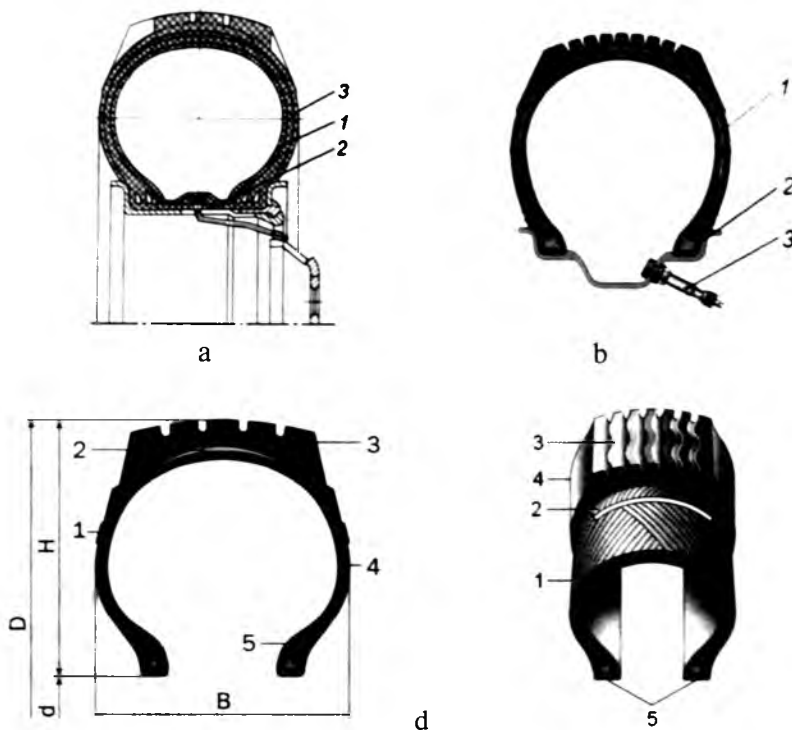
Wheels provide the movement of automobile.

There are drive, driven and steered types of wheels.

The engine torque is transmitted to drive wheels. Drive wheel is coupled with bearing surface area and converts the engine torque to moving force of automobile. Driven wheels rotate by means of force perceived from the frame or body. When the rotating planes of wheels turn,

aylanish tekisliklari burilganda, tayanch yuza bilan ilashganligi uchun, avtomobil harakat yo'nalishini o'zgartiradi. G'ildirak (4.1-a rasm) pnevmatik shina (3), disk (7), obod (6) va gupchakdan iborat bo'ladi.

they change the moving direction of automobile because of wheels coupled with bearing surface area. Wheel (fig. 4.1, a) consists of pneumatic tire (3), the plate (7), rim (6) and the hub.



4.1-rasm. G'ildirak tuzilishi.

Figure 4.1. The wheel design.

Pnevmatik shina g'ildirakni yo'l bilan ilashishini ta'minlaydi. Yo'l notekisliklari tufayli sodir bo'ladigan turtki va zarbalarni yumshatadi. Shinalar kamerali va kamerasiz bo'ladi.

Kamerali shina (4.1-a rasm) pokrishka (3), kamera (1) va obod lentasidan (2) iborat bo'ladi.

Pneumatic tire provides coupling the wheel with the road. It extenuates beats and shocks of the road unevenness. There are tube type and tubeless tires.

Tube type tire (fig. 4.1, a) consists of the cover (3), the tube (1) and the belt (2) of rim.

*Agar inson biror kasbni mukammal egallasa, mehnat unga
huzur bag'ishlaydi, baxt keltiradi.*

Andre Morua

Pokrishka kameradagi havo bosimi kuchini, g'ildirakka ta'sir etadigan tashqi kuchlarni qabul qiladi va kamerani shikastlanishdan saqlaydi hamda g'ildirakni yo'l bilan ilashtiradi.

Pokrishka konstruksiyasi (4.1-d rasm) karkas (1), protektor (3), breker (2), yon tomon (4) va o'zakli bortdan (5) iborat.

Karkas pokrishkaga mustahkamlik beradi. Karkas po'lat simlardan yoki tekstil iplaridan to'qilgan vaoralari rezimabilan to'ldirilgan bir necha qatlamli bo'ladi. Har qatlam kord deb ataladi.

Protektor — pokrishkaning tashqi yuzasidagi qalin rezimali himoya qatlami. Protektor pokrishkaning elastikligini oshiradi va yo'l bilan ilashishiini yaxshilaydi.

Protektor karkas bilan **breker** yordamida tutashtiriladi. Breker turtkilarni yumshatadi. Bort pokrishkani obodga o'rnatishga mo'ljallangan. Rezinalashtirilgan po'lat simli halqa bort puxtaligini ta'minlaydi.

Kamera — tutashtirilgan rezinali quvur-halqa. Unda havo damlash uchun ventil bo'ladi.

Obod lentasi kamera bilan obod orasiga qo'yiladi va kameraning obodga ishqalanib shikastlanishidan saqlaydi.

Kamerasiz shina (4.1-b rasm) faqat pokrishkadan iborat. Pokrishka ichki yuzasi qalinligi 2—3 mm yumshoq rezi-

Cover perceives the air pressure in tube; an external force acted to the wheel, protects the tube from damaging and couples the tire to the road.

Cover design (fig. 4.1, d) comprises the carcass (1), the protector 3, the breaker 2, the sidewall 4 and the bead 5 with the core.

Carcass provides the strength of the cover. The carcass has several layers weaved by steel wires or textile thread and filled with rubber inside. Each layer is called "cord".

Protector is a protecting thick rubber layer on external surface of the cover. Protector increases the flexibility of the cover and improves the tire grip.

Protector is jointed with carcass with the help of **breaker**. Breaker extenuates the beats. The cover is mounted on the rim by means of bead. Rubber-steel wire ring provides the durability of the bead.

Tube is a circled rubber pipe. It has inner tube valve to inflate the air.

The **belt of rim** is arranged between the tube and rim and protects the tube from damaging by friction.

The tubeless tire (fig. 4.1, b) comprises only the cover. The inner surface of the cover has a tender rubber layer 1 for 2-3 mm and sealing bead layer 2.

nali qatlam (1) va obodga zichlovchi bort qatlamli (2) qilib tayyorlangan.

Kamerasiz shina ventili (3) g'ildirak obodiga o'rnatiladi.

Shinalarni o'lchami va markirovkalash (4.1-d rasm). Shinani tashqi diametri D , o'rnatish diametri d , profilini balandligi H va profilini eni B asosiy o'lchamlar hisoblanadi. Diagonal shinalar o'lchami $B-d$ birikmada belgilanadi (masalan, 260—508). Radial shinalar o'lchami uchta son va harf bilan belgilanadi. Masalan, 175/70 R13, bunda 175—profil eni B (mm); 70—profil balandligining H eniga B nisbati (%); R—radial; 13—o'rnatish diametri d (dyuymda).

The inner tube valve 3 of tubeless tire is mounted on the rim of the wheel.

Dimension and the marking of tires (fig. 4.1, v). External diameter of tire D , mounting diameter d , height H and width B of the profile are main parameters. Dimension of diagonal tires is marked with couple $B-d$ (for example 260-508). Dimension of radial tires is marked by three numbers and letter. For example, 175/70 R13, here 175—width of profile B (mm); 70—ratio of profile height H to its width (%); R—radial; 13—mounting diameter d (inch).

Nazorat uchun savollar

Self-control questions

- | | |
|--|--|
| 1. G'ildirakning vazifasi nima? | 1. What is the function of wheels? |
| 2. G'ildirak qanday qismlardan tashkil topgan? | 2. What kind of parts does the wheel consist of? |
| 3. G'ildirakning turlari. | 3. Types of wheels. |
| 4. Shinaning markirovkasini tushuntiring. | 4. Describe the marking of tires. |

4.2. KO'PRIKLAR

4.2. AXLES

Ko'priklar rama bilan g'ildiraklarni bog'lash uchun xizmat qiladi.

Yetakchi ko'priikka yetakchi g'ildiraklar o'rnatiladi.

Boshqariluvchi ko'prik balka (to'sim) ko'rinishida bo'lib, unga avtomobil harakati yo'nalishini o'zgartiruvchi g'ildiraklar o'rnatiladi.

The purpose of axles is to connect the frame and wheels to each other.

Drive axle has drive wheels.

Steering axle has a beam form and it has wheels that change the movement direction of the vehicle.

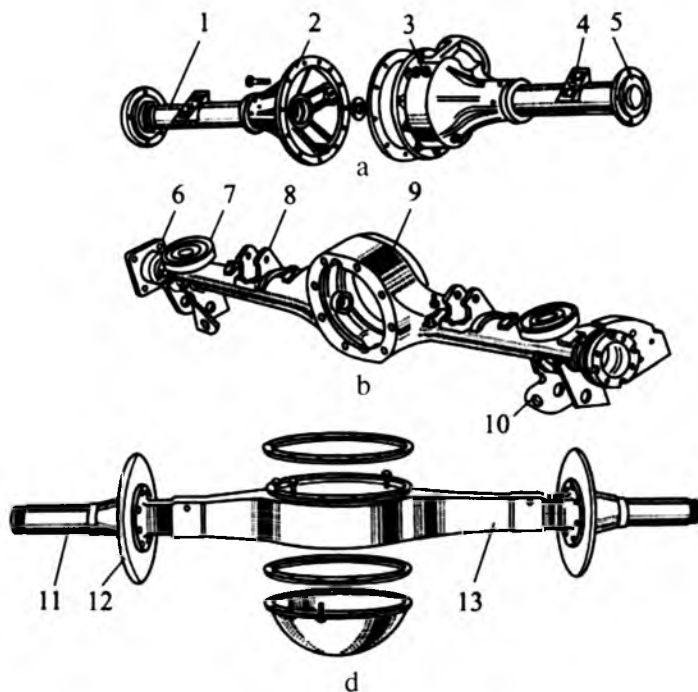
Drive axle is a stiff hollow beam. Final

Yetakchi ko'prik biki g'ovak balkali bo'ladi. Uning ichida asosiy uzatma, differensial va yarim o'qlar joylashtiriladi. Yetakchi g'ildiraklar ko'prikkapodshi p-niklarda o'rnatiladi.

Yetakchi ko'priklar balkasi yaxlit yoki ikki qismli bo'ladi (4.2-rasm).

drive, differential and axle shafts are mounted in it. Drive wheels are mounted at the axle by bearings.

The beam of axles may be solid or may have two parts (fig. 4.2).

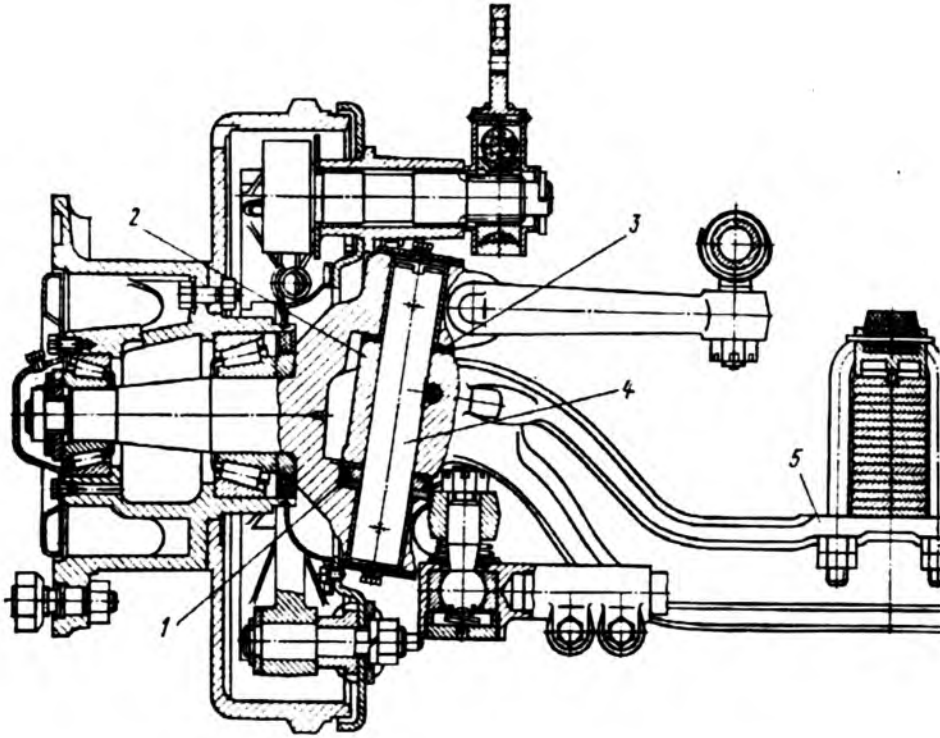


4.2-rasm. Yetakchi ko'priklar:
a—ikki qismli; b, d—yaxlit; 1—kojux (g'ilof); 2,3—karter bo'laklari; 4—tayanchlar; 5,6,12—flaneslar; 7—chashka; 8,10—kronshteynlar; 9,13—balkalar; 11—truba (quvur).

Figure 4.2. Drive axles:
a—axle with two parts; b, d—solid;
1—cover; 2, 3—parts of housing;
4—supports; 5, 6, 12—flanges; 7—cup;
8, 10—brackets; 9, 13—beams;
11—tube.

Boshqariluvchi ko'prikda g'ildiraklarning burilishiga imkon beradigan shkvoren (4) (4.3-rasm) o'rnatiladi.

Steering axle has a kingpin (4) (Fig. 4.3), which allows turning of wheels.



4.3-rasm. Boshqariluvchi ko'prik:
 1—burish kulagining tayanch
 podshipnigi; 2—balkaning bo'rtmasi
 (bobishkasi); 3—rostlovchi qistirmalar;
 4—shkvoren; 5—ressorani mahkamlash
 maydonchasi.

Figure 4.3. Steering wheel:
 1—thrust bearing of steering knuckle;
 2—boss of beam; 3—adjusting gaskets;
 4—kingpin; 5—area for attaching the
 leaf spring.

Ko'priklar ramaga zarba va tebranishni
 so'ndiruvchi osmalar bilan ulanadi.

Axles are connected to the frame
 by means of suspensions that absorb
 shocks and oscillation.

Nazorat uchun savollar

Self-control questions

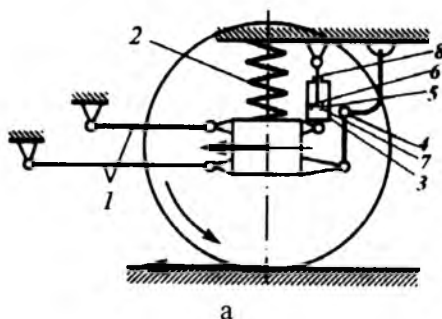
1. Ko'rikning vazifasi nima?
2. Ko'prikning turlari.
3. Ko'prik qanday qismlardan tashkil
 topgan?

1. What is the function of axles?
2. Types of axles.
3. What kind of parts does the axle con-
 sist of?

4.3. OSMALAR

4.3. SUSPENSIONS

Osmalar g'ildirak yoki ko'priklarni rama yoki kuzov bilan elastik bog'laydi. Osmada yo'naltiruvchi, so'ndiruvchi va elastik elementlar bo'ladi (4.4-a rasm).



4.4-rasm. Osmo (a) va ko'ndalang turg'unlik stabilizatorining (b) sxemalari.
 1—yo'naltiruvchi element; 2—elastik element; 3—so'ndiruvchi element;
 4—stabilizator; 5—porshen;
 6,7—klapanlar; 8—shtok; 9—ustun;
 10—rezimli tayanch.

Ba'zi avtomobillarda stabilizator qo'llaniladi (4.4-b rasm).

Yo'naltiruvchi element g'ildirak tayanch yuzasidagi kuchni avtomobil kuzoviga uzatadi.

Elastik element yo'l notekisligi zarbalarini yumshatadi.

So'ndiruvchi element kuzov tebranishini so'ndiradi.

Stabilizator kuzovning yonga og'ishini kamaytiradi.

Osmalar mustaqil va nomustaqil bo'ladi.

O'ng va chap osmalar harakati birbiriga ta'sir ko'rsatsa, osma nomustaqil deb ataladi (4.5-rasm). Aksincha, o'ng va chap osmalar harakati o'zaro ta'sir etmasa, osma mustaqil deb ataladi.

The suspension connects the wheel or axles to the frame or body flexible. The suspension has guide, absorbing and elastic elements (Fig. 4.4, a).

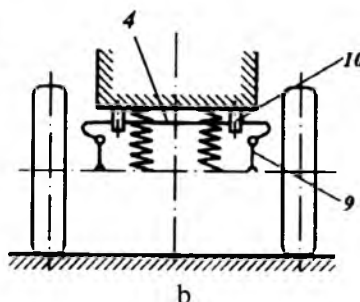


Figure 4.4. The scheme of suspension and antiroll bar.

1—guide element; 2—elastic element;
 3—absorbing element; 4—stabilizer;
 5—piston; 6, 7—valves; 8—rod; 9—pillar;
 10—rubber stop.

Some automobiles have a stabilizer (Fig. 4.4, b).

Guide element transfers the force at the bearing surface area of the wheel to the body of automobile.

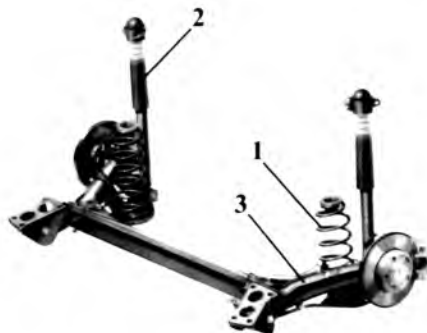
Elastic element attenuates the shocks of the road unevenness.

Absorbing element absorbs the oscillation of the body.

Stabilizer limits the body roll.

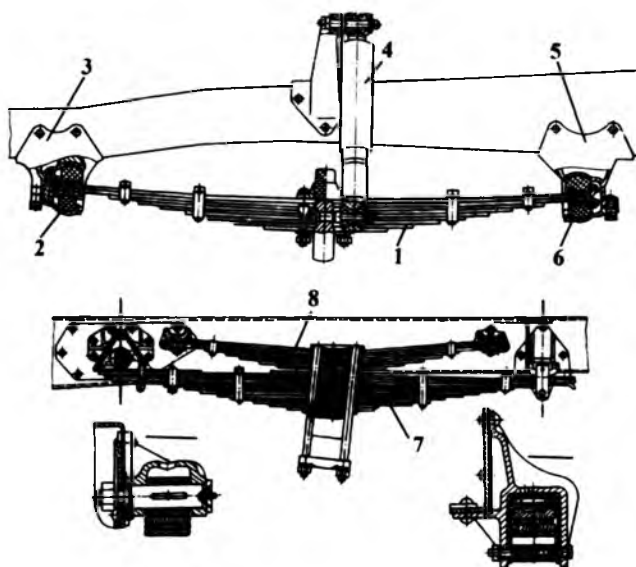
There are independent and dependent suspensions.

If the motion of the right suspension influences to the left suspension the suspension is dependent (Fig. 4.5). In addition, vice versa the motion of the right suspension does not influence to the left suspension the suspension is independent.



4.5-rasm. Prujinali nomustaqlil osma:
1—prujina; 2—amortizator; 3—shtanga.

Figure 4.5. Dependent spring suspension
1—spring; 2—shock-absorber; 3—rod.



4.6-rasm. Ressorali osma:
a—oldingi; b—ketingi; 1—ressora;
2—rezinali tayanch; 3,5—kronshteyn;
6—kronshteyn qopqog'i; 7—asosiy
ressora; 8—qo'shimcha ressoara.

Figure 4.6. Leaf spring suspension:
a—front; b—rear; 1—leaf spring;
2—rubber stop; 3, 5—bracket; 6—cap of
bracket; 7—main leaf spring;
8—additional leaf spring.

Ressorali osmalarda elastik va so'ndirish elementlar vazifasini bir necha qatlamli po'lat listlar bajaradi (4.6-rasm). Listlar to'plamini ressa deb ataladi. Ressa bir listli bo'lsa, u faqat elastik element xisoblanadi.

Pnevmatik osmalarda elastik element vazifasini ballonga siqilgan havo bajaradi. Bunday osmalarda elastiklikni siqilgan havo ta'minlaydi.

Gidravlik amortizatorlar avtomobillarda keng tarqalgan. Avtomobil tebranishi amortizator ichida moyini bir kameradan ikkinchisiga haydaydi. Tebranish suyuqlikni klapanlar va kalibrlangan teshiklar orqali o'tishida qizishi xisobiga so'ndiriladi.

Teleskopik amortizatorlarning ikki trubali va bir trubali turlari bor.

Ikki trubali amortizatorlarda ish silindri va siqilishdan ortadigan moy uchun rezervuar bo'ladi. Bir trubali amortizatorlarda faqat ish silindri bo'ladi.

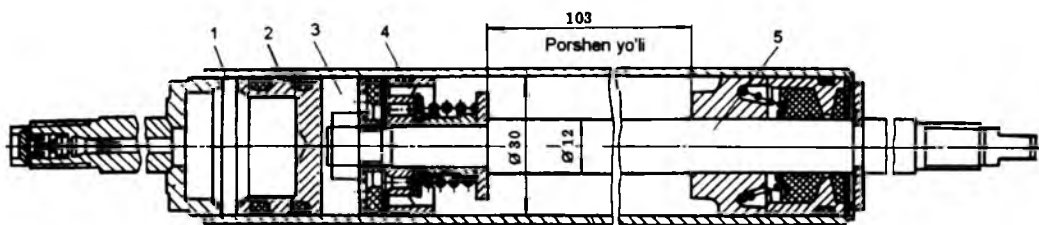
The functions of elastic and absorbing elements in **leaf spring suspensions** are done by steel leaves, which have a few layers (Fig. 4.6). The set of leaves is called "leaf spring". The leaf spring is elastic element if it has only leaf.

The function of elastic element in **pneumatic suspensions** is done by compressed air in tank. The flexibility is provided by compressed air in suspensions of this kind.

Hydraulic shock absorbers are widespread in automobiles. The oscillation of automobile feeds the oil from one chamber to another chamber in shock absorber. The oscillation is absorbed by means of liquid heating at the time of oil flow through valves and calibrated holes.

There are one-pipe and two-pipe types of telescopic shock absorbers.

Two-pipe shock absorbers have a reservoir for work cylinder and oil forced out by compressing. One-pipe shock absorbers have only work cylinder.



4.7-rasm. Bir trubali teleskopik amortizator:

- 1—pnevmoamera; 2—suzib yuruvchi porshen; 3—ish silindri bo'shlig'i; 4—porshen; 5—shtok.

Amortizator (4.7-rasm) ish silindrida shtok (5) porshen (4) bilan harakatlanadi. Silindr suyuqlik bilan to'ldirilgan. Porshenda (4) aylana bo'ylab joylashgan ma'lum o'lchamli teshiklar bor. Teshiklar

Figure 4.7. One-pipe telescopic shock absorber:

- 1-pneumochamber; 2-floating piston; 3-work cylinder space; 4-piston; 5-rod.

The rod 5 moves together with piston 4 in work cylinder of shock absorber (Fig. 4.7). The cylinder is filled in by liquid. The piston has holes with certain dimensions arranged in circle. Valves on both sides of the piston close holes. There

porshen ikki tomonida joylashgan klapanlar bilan yoplgan. Amortizatorida gaz bilan to'ldirilgan pnevmokamera (1) bor.

Gaz va suyuqlik suzib yuruvchi porshen (2) bilan ajratilgan. Suzuvchi porshen shtok yo'lini cheklaydi.

Shtok avtomobil ramasiga, silindr ko'priikka mahkamlanadi. Rama va ko'prik yaqinlashganda porshen moyini ochiladigan teshiklardan porshen usti bo'shlig'iga haydaydi. Rama va ko'prik uzoqlashganda moy teskari yo'nalishda porshen osti bo'shlig'iga o'tadi.

Amortizator siqilishida pnevmokamera shtok hajmiga to'g'ri keladigan moy hajmi miqdorida siqiladi. Pnevmonokamera moy hajmining porshen osti va usti hajmlaridagi farqini kompensatsiyalaydi.

Rezinali tayanch osma harakatini chegaralaydi.

is pneumatic chamber 1 filled in with gas in shock absorber.

The gas and liquid are separated by floating piston (2). Floating piston limits the rod's travel.

The rod is connected to the frame of automobile and the cylinder is connected to the axle. When the frame and axle approach to each other, the piston bypasses the oil to the space above through open holes. When the frame and axle retires from each other, the oil is reversed to the space below the piston.

When the shock absorber has compressed the capacity of pneumatic chamber reduces for value equally to capacity of rod. Pneumatic chamber compensates the oil capacity and difference between capacities of spaces in the above and below the piston.

Rubber stop limits the movement of suspension.

Nazorat uchun savollar

Self-control questions

1. Osmaning vazifasi nima?
2. Osmaning turlari.
3. Osmo qanday qismlardan tashkil topgan?
4. Osmaning uchta asosiy elementini gapirib bering.
5. Avtomobillarda qanday amortizatorlar qo'llaniladi?

1. What is the function of suspensions?
2. Types of suspensions.
3. What kind of parts do the suspensions consist of?
4. Tell about three basic parts of suspensions.
5. What kind of shock absorbers are applied in vehicles?

4.4. RAMA

4.4. FRAME

Rama — avtmobil qismlarini o'zaro joylashtirib mahkamlashga mo'ljallangan tayanch uzal. U harakatlanishda sodir bo'ladigan yuklanma va kuchlarni qabul

Frame is the support assembly, on which automobile parts are arranged and attached. It perceives the load and forces created at the time of automobile move-

Har qanday millatning ravnaqi, umumbashariyat tarixida tutgan o'rni, miqyosi va shuhrati bevosita o'z farzandlarining aqliy va jismoniy etukligiga bog'liqdir.

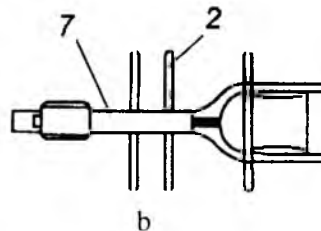
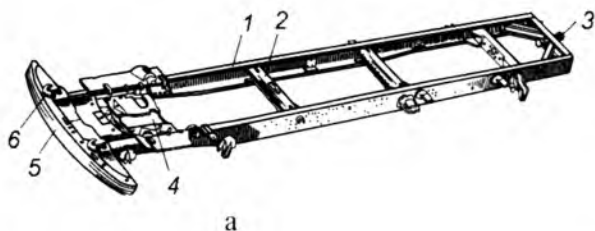
I. Karimov

qiladi. Rama barcha yuk avtomobillarida, oliy klass hamda yuqori o'tag'on yengil avtomobillarda va yuk avtomobili shassisi asosida tayyorlanadigan avtobuslarda mavjud. Rama lonjeronli, umurtqasimon va kombinatsiyalashtirilgan turlarga bo'linadi.

Lonjeron (4.8-a rasm) ramada ikkita bo'ladi. Ular asosiy yukni ko'taradigan detallar hisoblanadi. Lonjeronlar ko'ndalang to'sinchalar (2, 4) bilan o'zaro biriktiriladi. Lonjeron va to'sinchalar parchinlar yoki boltlar, ba'zida payvandlash uslublari bilan o'zaro ulanadi. Lonjeronlar bir-biriga nisbatan parallel yoki burchak ostida o'rnatilishi mumkin. Odatda, lonjeronga turli kronshteynlar o'rnatiladi. Kronshteynlarga kuzov, mexanizm va tizimlar mahkamlanadi. Ramani oldingi qismiga bufer (5) va ilgak (6) o'rnatilgan. Orqa qismiga tortish-ilashtirish qurilmasi (3) o'rnatilgan.

The frame is applied in all trucks, high class and passable cars and in buses constructed on the base of the truck's chassis. The frame is divided into girder, vertebral and combined types.

There are two girders (Fig. 4.8, a) in the frame. They are details, which hold major load. Girders are connected between through transversal beams (2, 4). The girder and beams are connected between by rivets, bolts and sometimes by welding. Girders may be arranged under the angle or parallel relatively each other. Usually, different brackets are mounted on the girder. Body, mechanism and systems are attached to brackets. Bumper (5) and hook (6) are mounted at the front of the frame. Hitching device (3) is mounted at the rear end of the frame.



4.8-rasm. Avtomobil ramasi:

a—lonjeronli; b—umurtqasimon.

1—lonjeron; 2, 4—ko'ndalang to'sincha;
3—tortish-ilashtirish qurilmasi; 5—bufer;
6—ilgak, 7—to'sin.

Figure 4.8. Frame of automobile:

a—girder; b—vertebral.

1—girder; 2, 4—transversal beam;
3—hitching device; 5—bumper; 6—hook,
7—beam.

Umurtqasimon rama (4.8-b rasm) quvursimon to'sinli bitta bo'ylama to'sin (7) va ko'ndalang to'sinchalardan (2) iborat. Ularga turli kronshteynlar o'rnatiladi. Umurtqasimon rama asosan yuqori o'tag'on avtomobillarda qo'llaniladi.

Kombinatsiyalashtirilgan rama, odatda, o'rta qismi umurtqasimon, old va orqa qismlari lonjeronli qilib ishlanadi.

Vertebral frame (Fig. 4.8, b) consists of the one tube type longitudinal beam (7) and transversal beams (2). Different brackets are mounted on them. Mainly, vertebral frame is applied in off-road capability automobiles.

Combined frame is made vertebral and the front and rear parts girder.

Nazorat uchiun savollar

Self-control questions

1. Ramaning vazifasi nima?
2. Ramaning asosiy qismlari.
3. Avtomobillarda qanday osmalar qo'llaniladi?

1. What is the function of the frame?
2. Basic parts of the frame.
3. What kind of frames are applied in vehicles?

4.5. KUZOVLAR

4.5. BODY

Kuzov haydovchi, passajirlarni va yuklarni joylashtirish uchun xizmat qiladi. Bundan tashqari, ko'taruvchi kuzov avtomobil qismlari, passajir va yuk og'irliklarini ko'tarish uchun xizmat qiladi.

Vazifasiga ko'ra kuzovlar yengil, yuk, avtobus va ixtisoslashtirilgan turlarga bo'linadi.

Ajratilmaydigan korpus (4.9-rasm) **yengil avtomobil kuzovi** asosi hisoblanadi. Yengil avtomobil kuzovlari hajmlar soni, eshiklar soni va tomining konstruksiyasiga ko'ra sedan, limuzin, kabriolet va hokazo turlarga bo'linadi.

The purpose of the body is to place the driver, passengers and cargo. Besides, integrated body serves to carry parts of automobile, passengers and load of cargo.

Depending on the purpose, the body is classified as: car, truck, bus and specialized.

Solid case (Fig. 4.9) is the base of **car body**. Car bodies are classified as: sedan, limousine, cabriolet and etc depending on the number of volumes, number of doors and construction of ceiling.



4.9-rasm. Yengil avtomobilning ko'tarib turuvchi kuzov karkasi.

Figure 4.9. Carcass of integrated car body.

Kuzov passajir saloni, dvigatel va yukxona bo'limlari hajmlaridan iborat. Karkasga dvigatel kapoti, yukxona qopqog'i va eshiklar sharnirli biriktiriladi. Qanotlar va dekorativ yechim qismlari biriktiriladi. Kuzov ichiga o'rindiqlar o'rnatiladi. Karkas old qismi qisqa ramadan iborat. Unga kuch agregati va old osma mahkamlanadi.

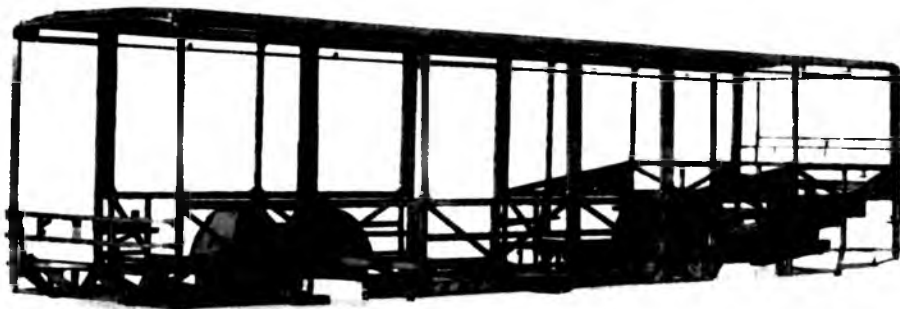
Zamonaviy yengil avtomobil kuzovlariga shovqinga qarshi materiallar bilan ishlov beriladi.

Aksariyat **avtobus kuzovlari** yaxlit metall karkasga ega (4.10-rasm).

The body comprises the passenger saloon, volumes of the engine and trunk sections. Bonnet of the engine, trunk lid and doors are jointly connected to the carcass. In addition, wings and decorative parts are connected to the carcass too. Seats are mounted in the body. The front of carcass consists of short frame. Power plant and front suspension are attached to it.

Modern car bodies are equipped with noise insulation materials.

Common **bus bodies** have all-metal carcass (Fig. 4.10).



4.10-rasm. Avtobus kuzovining ko'tarib turuvchi konstruksiyasi karkasi.

Figure 4.10. The carcass of integrated construction of bus body.

Avtobus kuzovi karkas, tashqi qop-lama, ichki jild, pol, oynalar, eshiklar va hokazolardan iborat. Kuzov ichiga haydovchi va passajirlar uchun o'rindiqlar joylashtiriladi.

Shahar avtobuslarida passajirlarga chiqish va tushish qulayligini ta'minlash uchun avtobus polining balandligi pasaytiriladi. Eshiklar o'rni kengroq qilinadi.

Shaharlarora avtobus kuzovida yuklar uchun katta sig'imli bo'lim bo'lishi lozim. Passajir bo'limi kuzovning yuqori qismida, yukxona uning ostidagi markaziy qismda joylashtiriladi.

Avtobus oynalari har xil shakl va konstruksiyali qilib ishlanadi. Zamonaviy konstruksiyalarda oynalar kuzovdagi **oyna o'rniga** yelimlanadi. Bu bikirlikni oshiradi.

Shahar avtobuslarida rostlanmaydigan, shaharlararo avtobuslarda rostlanuvchi o'rindiqlar qo'llaniladi. Haydovchi o'rindig'i bo'ylama yo'nalishda, balandligi va suyanchiqning qiyalik burchagi bo'yicha rostlanadi. Haydovchi o'rindig'i amortizatsiyalovchi osma bilan ham jihozlangan bo'lishi mumkin.

Yuk avtomobilining kuzovi (4.11-rasm) kabina (a) va yuk kuzovidan iborat. Kabina haydovchi va yukni kuzatuvchi passajirlarni, yuk kuzovi yuklarni joylashtirish uchun xizmat qiladi. Komp-anovka bo'yicha kapotli va kapotsiz kabinalar mavjud. Kabinadagi o'rindiq ikki yoki uch o'rinli bo'lishi mumkin. Uzoq masofaga qatnaydigan avtomobillar kabinasida bitta yoki ikkita yotoq joyi bo'ladi.

The bus body consists of carcass, outer cover, inner trim, floor, windows, doors etc. Seats for driver and passengers are arranged in the body.

City buses have low floor to provide the ease of enter and exit of passengers. The place of doors is wider.

The intercity bus body may have a section with big volume for cargoes. The passenger saloon is located on the top of body and the trunk is located under it at the center of body.

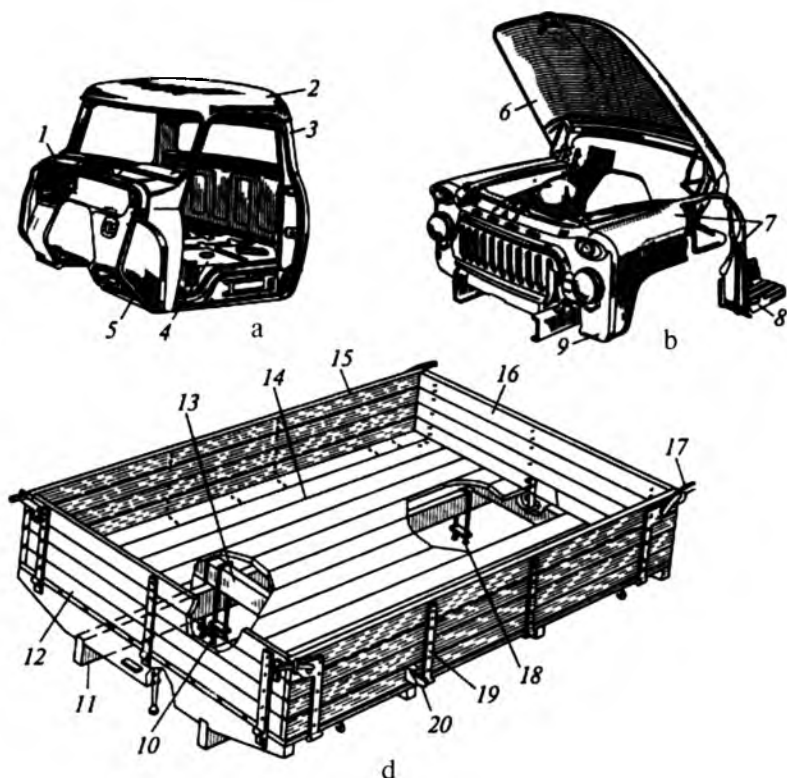
Bus glasses are made with different form and construction. Glasses are glued to the **place of glasses** of body in modern constructions. It increases the stiffness.

The city buses have not adjustable seats while intercity buses have. Driver seat is adjusted in longitudinal direction, its height and backrest angle are adjustable too. Driver seat may be equipped with absorbing suspension too.

Truck body (Fig. 4.11) consists of cabin (a) and cargo body. Cabin serves to place the driver and passengers, who looks after cargo and cargo body serves to place a cargo. There are bonnet and bonnet less cabins depending on arrangement. Seats may be dual-seat or three-seat in the cabin. Far distance automobile cabs have one or two sleeping places.

Yuk kuzovi bort platformali, o'zi ag'daruvchi, furgon, sisterna va hokazo ko'rinishida bo'lishi mumkin.

Cargo body may have flap platform, dumper, van, cistern and other construction.



4.11-rasm. Yuk avtomobilining kabina va bort platformali kuzovi.

a—kabina; b—old qismi; d—bortli platforma; 1, 3, 5—panellar; 6—kapot; 17—qulfovchi qurilma.

Figure 4.11. Truck body with cabin and flap platform.

a—cabin; b—front part; d—flap platform; 1, 3, 5—panels; 6—bonnet; 17—locking device.

Bortli platforma (4.11-d rasm) pol (14) va bortlardan (12, 15, 16) iborat. Pol bo'ylama (11) va ko'ndalang (13), balkalardan tashkil topgan.

Polga qo'zg'almas old bort (12), yonga ochiluvchi (15) va orqaga ochiluvchi (16) bortlar birlashtirilgan. Yig'ilgan bortli platforma avtomobil ramasiga mahkamlanadi.

Flap platform (Fig. 4.11, d) consists of floor (14) and flaps (12, 15, 16). Floor comprises the longitudinal 11 and transversal (13) beams.

Front stationary flap (12), side flap (15) and rear flap (16) are attached to the floor. Assembled flap platform is connected to the frame of automobile.



Ixtisoslashtirilgan kuzovlar xilma-xil (suyuq, gazsimon, sochiluvchan, tez buziluvchan va hokazo) yuklarni joylash-tirish uchun mo'ljallanadi.

Specialized bodies are intended to place different cargoes (liquid, gase-ous, rashi (quicksand), perishable goods etc).

Nazorat uchun savoiilar

Self-control questions

1. Kuzovning vazifasi nima?
2. Yengil avtomobil kuzovlarining turlari.
3. Yuk avtomobil kuzovi va avtobus kuzovi o'rtasida qanday farq bor?
4. Ixtisoslashtirilgan kuzovlarning vazifasi nima?

1. What is the function of the body?
2. Types of vehicle bodies.
3. What is the difference between truck body and bus body?
4. What is the function of specialized bodies?

5. RUL BOSHQARMASI

5. STEERING

5.1. RUL BOSHQARMASINING VAZIFASI

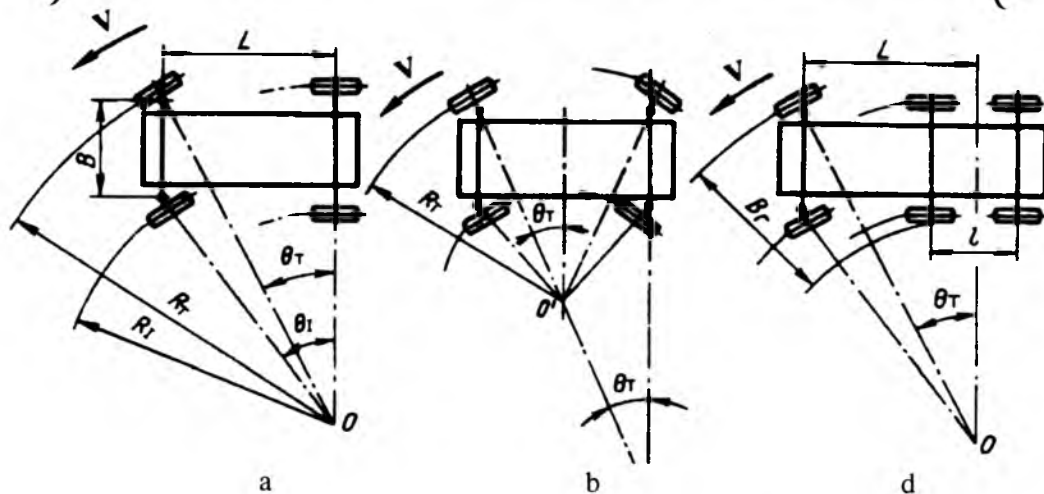
5.1. THE PURPOSE OF THE STEERING

Rul boshqarmasi avtomobilning harakat yo'nalishini boshqarish uchun xizmat qlladi. Avtomobilning harakat yo'nalishini boshqarish turli uslublarda amalga oshirish mumkin. Avtomobilda harakat yo'nalishni boshqarishning keng tarqalgan uslubi bosh-qariluvchi g'ildiraklarning g'ildirash tekis-ligini burish uslubidir (5.1-rasm, a, b, d).

The purpose of the **steering** is to control the moving direction of the automobile. The moving direction of the automobile can be controlled by different ways. Turning of the rolling plane of wheels is the widespread method of moving direction control (Fig. 5.1, a, b, d).

Agar maqsadsiz bo'lsang hech narsa qilolmaysan, maqsading katta bo'lmasa buyuk ish qilolmaysan.

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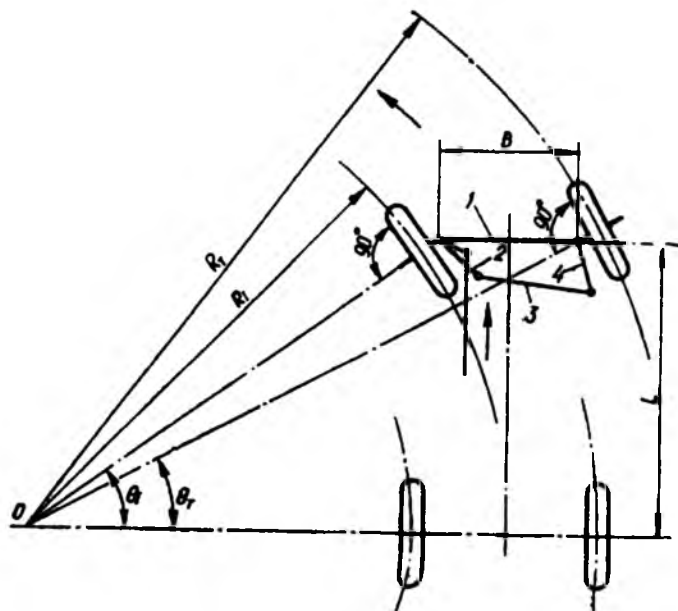


5.1-rasm. Avtomobilning harakat yo'nalishini boshqarish sxemalari.

Figure 5.1. Moving direction control schemes.

Avtomobilning burilish markazi O g'ildiraklarning g'ildirash tekisliklaridan o'tkazilgan ko'ndalang o'q chiziqlarining tutashgan nuqtasida bo'ladi (5.2-rasm). G'ildiraklar yonaki sirpanmasligi uchun ularning geometrik va g'ildirash tekisliklari bir bo'lishi kerak. G'ildiraklar avtomobil burilish markaziga nisbatan joylanishiga qarab ichki yoki tashqi boshqariluvchi g'ildirak deb nomlanadi. Boshqariluvchi va orqa g'ildiraklar o'qlari bir nuqtada tutashishi uchun ichki g'ildirak burilish burchagi θ_i tashqi g'ildirak burilish burchagidan θ_o katta bo'ladi. Bu talabni rul trapetsiyasi ta'minlaydi. Rul trapetsiyasini ko'ndalang rul tortqisi (3), g'ildirak sapfalarining richaglari (2 va 4) hamda g'ildiraklarning o'qi (1) tashkil etadi (5.2-rasm).

The turning center of automobile O is the point, where orthogonal axial lines of wheel planes are crossed (Fig. 5.2). The geometrical and rolling planes of the wheel required to be same to prevent the side wheel slipping. Depending on the position relatively the turning center of automobile wheels are called "inner" and "outer". In order to provide the crossing of axes of steering and rear wheels the turning angle of inner wheel θ_i is bigger than the turning angle θ_o of outer wheel. This requirement is provided by steering trapezium. Steering trapezium comprises the transverse control arm (3), steering knuckle levers (2 and 4) also an axle (1) (Fig. 5.2).



5.2-rasm. Oldi boshqariluvchi g'ildirakli avtomobilning burilish sxemasi.

Figure 5.2. Turning scheme of the vehicle with front steering wheels.

Tashqi va ichki g'ildiraklar burilish burchaklari o'zaro munosabatlari quyidagicha aniqlanadi: $\text{ctg}\theta_r = \text{ctg}\theta_i + B/L$, bu yerda, B — g'ildiraklarning burilish o'qlari orasidagi masofa; L — avtomobil bazasi.

G'ildiraklarning O markazida aylanish radiuslari tashqi radius — R_r va ichki radius — R_i deb ataladi. Tashqi radius — R_{Tmin} ning minimal qiymati avtomobilning mumkin qadar kichik maydonda burila olishini baholaydi: $R_{Tmin} = L / \sin \theta_{Tmax}$.

Boshqariluvchi g'ildiraklarni burish uchun xizmat qiladigan qismlar to'plami **rul boshqarmasi** deb ataladi.

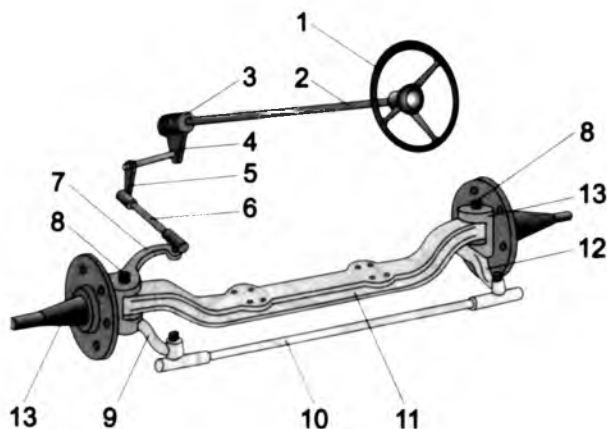
Rul boshqarmasi rul mexanizmi bilan rul yuritmasidan tashkil topgan (5.3, 5.4-rasmlar).

Correlation between outer and inner wheels as following: $\text{ctg}\theta_o = \text{ctg}\theta_i + B/L$, here, B — path between turning axes of wheels; L — wheelbase.

Turning radiuses of wheels around the turning center O are called R_o — "outer radius" and R_i — "inner radius". The minimal value of outer radius — R_{Omin} estimates the turning possibility of automobile in the small area $R_{Omin} = L / \sin \theta_{Omax}$.

Totality of parts that serves to turn the steering wheels is called "**steering**".

Steering consists of steering mechanism and steering drive (Fig. 5.3., 5.4).



5.3-rasm. Nomustaqlil osmali avtomobil rul boshqarmasi sxemasi.

1—rul chambaragi, 2—rul kolonkasi, 3—chervyak, 4—sektor, 5—soshka, 6—bo'ylama tortqi, 7, 9 va 12 —g'ildiraklarni burish sapfalari richaglari, 8—sapfaning burilish o'qi — shkvoren, 10—ko'ndalang tortqi, 11—o'q, 13—sapfa.

Figure 5.3. The scheme of steering of the vehicle with dependent suspension.

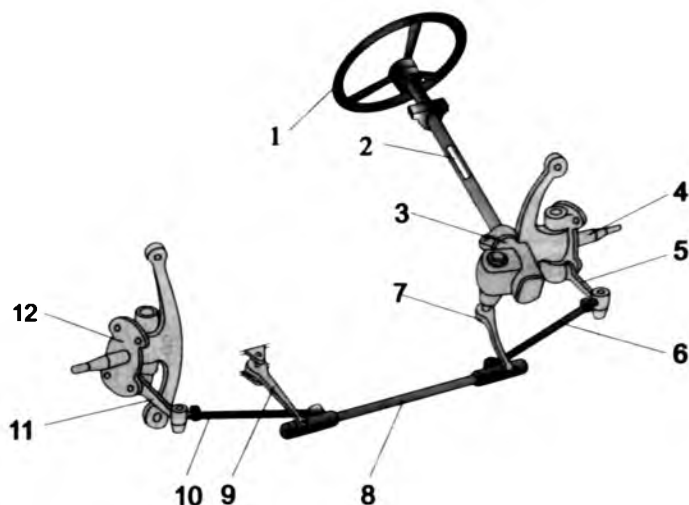
1—steering wheel, 2—steering column, 3—worm, 4—sector, 5—drop, 6—longitudinal control arm, 7, 9 and 12—steering knuckle levers, 8—kingpin, 10—transverse control arm, 11—axis, 13—knuckle.

Boshqariluvchi g'ildiraklar shkvoren (8) o'qida buriladigan sapfaga (13) podshipniklardao'rnatiladi. Shkvoren (8) oldi o'qqa (11) qo'zg'almas o'rnatilgan. Rul chambaragini (1) haydovchi aylantirganda rul kolonkasi (2) chervyakni (3) aylantiradi. Chervyak (3) sektorni (4) buradi. Sektorning o'qiga biriktirilgan soshka (5) bo'ylama tortqini (6) chiziqli harakatga keltiradi. Bo'ylama tortqi (6) richag (7) yordamida sapfani (8) shkvoren o'qida buradi. O'ng g'ildirak burilishiga ostki richak (9), rul ko'ndalang tortqisi (10) va o'ng g'ildirak ostki richagi (12) xizmat qiladi.

Bu sxemada (5.3-rasm) rul trapetsiyasi oldi o'q (11), sapfaning ostki richaglari (9 va 12), ko'ndalang tortqi (10) qismlardan iborat.

Steering wheels are mounted on the knuckle (13), which turns around the kingpin axis (8) by bearings. Kingpin (8) is mounted on front axle (11) stationary. When the steering wheel (1) is turned by a driver, steering column (2) turns the worm (3). Worm (3) turns the sector (4). The drop (5), connected to the axle of sector removes the longitudinal control arm (6) linearly. Longitudinal control arm (6) turns the knuckle on the kingpin (8) with the help of the lever (7). Bottom lever (9), transverse control arm (10) and bottom lever (12) of right wheel serve to turn the right wheel.

Steering trapezium comprises the front axle (11), bottom levers (9 and 12) of the knuckle, transverse control arm (10) in the following scheme (Fig. 5.3).



5.4-rasm. Mustaqil osmali avtomobil rul boshqarmasi sxemasi.

1—rul chambaragi, 2—rul kolonkasi, 3—rul mexanizmi, 4, 12—sapfalar, 5, va 11—richaglar, 6, 8, 10—koʻndalang tortqilar, 7—soshka, 9—mayatnikli richag.

Mustaqil osmali rul boshqarmasida koʻndalang tortqi (6, 8, 10) uch qismdan iborat. Yetakchi koʻndalang tortqiga (8) sapfalar richagini bogʻlovchi tortqilar (6, 10) sharnirli biriktirilgan.

Figure 5.4. The scheme of steering of the vehicle with independent suspension.

1—steering wheel, 2—steering column, 3—steering mechanism, 4, 12—knuckles, 5, 11—levers, 6, 8, 10—transverse control arms, 7—drop, 9—combination lever.

Transverse control arm consists of three parts (6, 8, 10) in the steering with independent suspension. Arms (6, 10), which join the steering knuckle levers, are connected to drive transverse control arm (8) jointly.

Nazorat uchun savollar

Self-control questions

1. Rul boshqarmasining vazifasi nima?
2. Rul trapesiyasining vazifasi nima?
3. Rul boshqarmasining qismlari.
4. Avtomobil burilish markazini tushuntirib bering.

1. What is the function of steering?
2. What is the function of steering trapezium?
3. Parts of the steering.
4. Describe the turning center of automobile.

Kimda-kim manman deb, o'zini baland tutsa, uni na xalq'na tangri sevadi.

Ahmad Yugnakiy

5.2. RUL YURITMASI QURILMALARI

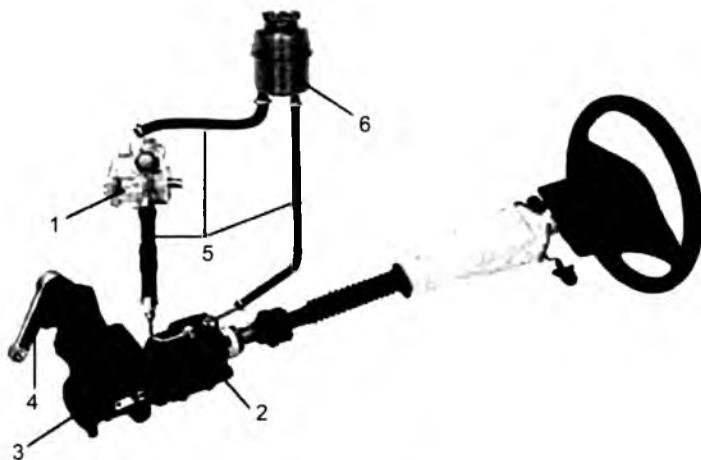
5.2. DEVICES OF STEERING LINKAGE

Boshqariluvchi g'ildiraklarga katta og'irlik kuchi tushsa, ularni boshqarish qiyinlashadi. Shuning uchun rul boshqarmasida rul kuchaytirgichlar qo'llaniladi. Rul kuchaytirgich energiyani dvigateldan oladi.

Gidravlik yuritmalı rul kuchaytirgichlar suyuqlik bosimi hisobiga ishlaydi. Hidravlik rul kuchaytirgichi (5.5-rasm), asosan, nasos, suyuqlik bosimining taqsimlagichi, gidrosilindr, suyuqlik, qismlarni birlashtiruvchi shiang va trubkalar-dan iborat.

If steering wheels are under the influence of a big gravity force, it is difficult to control them. That is why steering boosters are applied in the steering linkage. Steering booster takes energy from the engine.

Steering boosters with hydraulic drive is operated by means of liquid pressure. Mainly, hydraulic steering booster (Fig. 5.5) consists of pump, distributor of liquid pressure, hydraulic cylinder, liquid, hose and pipe, which connect parts.



5.5-rasm. Gidrosilindri rul mexanizmi bilan bir korpusda joylashgan gidrokuchaytirgich: 1—nasos; 2—taqsimlagich korpusi; 3—rul mexanizmi; 4—rul soshkasi; 5—shlanglar; 6—bachok.

Figure 5.5. Hydraulic booster, hydraulic cylinder of which is mounted in one case with steering mechanism: 1—pump; 2—case of distributor; 3—steering mechanism; 4—steering drop; 5—hoses; 6—tank.

Nasos gidravlik tizimda bosim sodir qilish va suyuqlikni sirkulatsiyasi uchun xizmat qiladi. Plastinkali nasos turlari keng qo'llaniladi. Nasos tasmali uzatma bilan harakatni tirsakli valdan oladi.

Taqsimlagich suyuqlik oqimini gidrosilindrning porshen oldi/orqa bo'shliqlariga yoki ulardan bachokka qaytishini boshqaradi. Taqsimlagich zolotnigining harakatiga muvofiq chiziqli tipdagi yoki rotor tipdagi taqsimlagich deb ataladi.

Gidrosilindrdagi suyuqlik bosimi porshen va shtokni chiziqli harakatlantiradi va richag, tortqilar orqali g'ildiraklarni buradi.

Bachok suyuqlikni saqlash uchun idish sifatida xizmat qiladi. Uning ichida filtrlovchi element va moy sathini aniqlash uchun bachok probkasiga biriktirilgan shchup bo'ladi.

5.6-rasmda chiziqli tipdagi zolotnikli gidravlik kuchaytirgichning sxemasi keltirilgan.

Moy nasosi dvigatel validan harakatni olib, moy bachogidan (14) moyni katta bosim kanali (2) orqali taqsimlagichga yuboradi. Taqsimlagich korpusida (1) uchta aylana bo'ylab kanallar, uch gardishli zolotnik (4) va zolotnikni taqsimlagich korpusiga (1) nisbatan markazlashtiruvchi prujinalar (7, 11) bor.

Avtomobil to'g'ri chiziqli harakatlanayotganda (5.6-a rasm) uch gardishli zolotnik (4) taqsimlagich korpusiga nisbatan markaziy holatda turadi. Moy bachokdan nasos, taqsimlagich va kanallar orqali aylanib, salt ishlash rejimida bo'ladi.

Gidrosilindrdagi porshen (8) ning ikki tomoni (A va B) dagi bosimlar teng bo'ladi, chunki ular ham taqsimlagich korpusi (1) ning o'rtasidagi kanal orqali ulangan.

The **pump** serves to make pressure in hydraulic system and to circulate the liquid. A plate type of the pump is widespread. The pump is driven by crankshaft via the belt drive.

The **distributor** controls the fluid flow to the front and behind capacities of the piston of hydraulic cylinder and fluid backflow to the tank. There are linear and rotary types of distributor depending on movement of the valve.

The fluid pressure in **hydraulic cylinder** removes the piston and rod linear and turns the wheels through the lever and links.

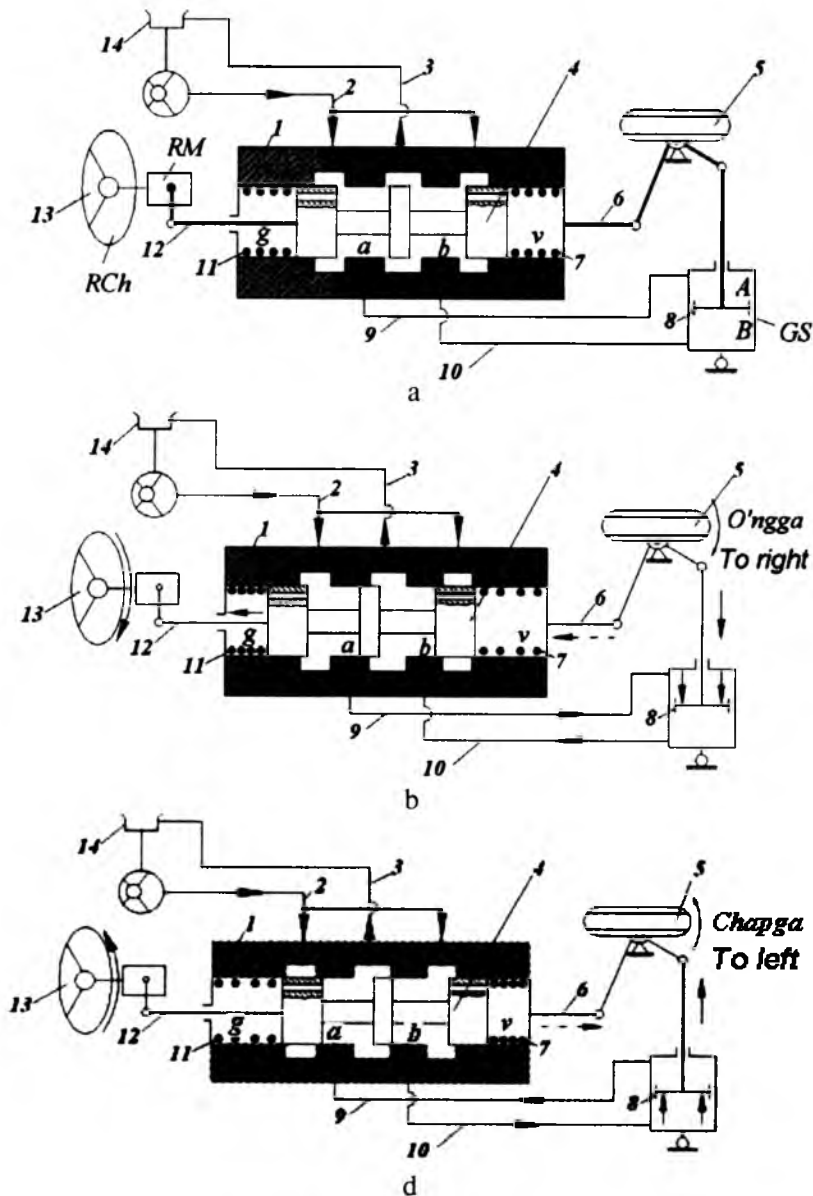
The **tank** serves to keep the fluid as reservoir. There are a cleaner element and fluid level dipstick connected to the cap inside the tank.

Figure 5.6 illustrates the scheme of hydraulic steering booster with linear type valve.

The oil pump is driven by the crankshaft and feeds the oil from the tank (14) through high-pressure line (2) to the distributor. There are three circular grooves, the valve (4) with three rims and centering springs (7, 11) in the case (1) of the distributor.

When the automobile is moving direct (Fig. 5.6, a) three rims valve (4) gets a central position relatively the distributor case. The oil circulates from the tank through the pump, distributor and channels and it has been in idle mode.

Pressures in the both sides (A and B) of the piston (8) in the hydraulic cylinder are equal, because, they are connected through central channel of the distributor (1).



5.6-rasm. Rul kuchaytirgichning ishlash sxemasi.
a—to'g'ri chiziqli harakat holati;
b—o'ngga burilish jarayoni; d—chapga burilish jarayoni. RM—rul mexanizmi; GS—gidrosilindr; RCh—rul chambaragi.

Figure 5.6. The scheme of steering booster
a—position of direct movement;
b—turning process to right;
d—turning process to left
SM—steering mechanism; HC—hydraulic

1—taqsimlagich korpusi, 2—yuqori bosim kanali, 3—past bosim kanali, 4—zolotnik, 5—boshqariluvchi g'ildirak, 6—teskari bog'lanish shtangasi, 7—markazlashtiruvchi prujinalar, 8—porshen, 9, 10—boshqaruv moy kanallari, 12—boshqaruv shtangasi, 13—moy nasosi, 14—moy bachogi.

Haydovchi rul chambaragini o'ngga burayotganida shtanga (12) zolotnikni (4) markaziy xolatdan chap tomonga siljitadi (5.6-b rasm).

Zolotnikning (4) o'rta gard kanali (2) kelayotgan yuqori bosimli moy kanal (9) orqali GSning A hajmiga yo'naladi. A hajmda bosim oshadi. B hajmi taqsimlagich b kamerasi orqali past bosim kanali (3) bilan ulanadi. Moy bachokka yuboriladi. A va B hajmdagi bosimlar farqi ostida porshen (8) pastga siljiydi. G'ildirak (5) o'ngga buriladi. G'ildirak sapfasi tortqilari bilan shtanga (6) taqsimlagich korpusini (1) chapga suradi. G'ildiraklarning burilish jarayoni haydovchining rul chambaragini burish jarayomida davom etadi. Haydovchi rul chambaragini burishni to'xtatsa, shtanga (6) ta'sirida taqsimlagich korpusi (1) zolotnikka (4) nisbatan dastlabki markaziy holatiga qaytadi. A hajmdagi bosim B hajmdagi bosimdan katta bo'ladi. G'ildiraklar burilgan holatda qoladi.

Boshqariluvchi g'ildiraklarni chapga burish jarayoni (5.6-d rasm) shu yo'sinda amalga oshiriladi.

cylinder; SW-steering wheel.

1—distributor case, 2—high-pressure channel, 3—low-pressure channel, 4—valve, 5—steering wheel, 6—feedback rod, 7—centering springs, 8—piston, 9, 10—oil channels of control, 12—control rod, 13—fuel pump, 14—fuel tank.

When the steering wheel is turned to the right by a driver, the rod (12) moves the valve (4) to the left side from central position (Fig. 5.6, b).

Feeding oil with high pressure from channel (2) of the valve (4) goes to the capacity A of hydraulic cylinder. The pressure increases in the capacity A. The capacity B connects to low pressure channel (3) through chamber b of distributor. The oil goes to the tank. Because of the difference between pressures in capacities A and B the piston (8) moves downward. The wheel (5) turns to right. Wheel knuckle with links and rod (6) remove distributor case (1) to left. Turning process of wheels is accompanied by turning process of steering wheel done by driver. After a driver has stopped turning the steering wheel, distributor case (1) returns to the initial central position relatively to the valve (4) under the influence of the rod (6). The pressure in capacity A becomes bigger than the pressure in capacity B. Wheels stay turned.

Turning process of steering wheels to left (Fig. 5.6, d) goes as given above.

Nazorat uchun savollar

Self-control questions

1. Rul kuchaytirgichining vazivasi nima?
 2. Rul yuritmasining qismlari.
 3. Rul kuchaytirgichining ishlash prinsipini tushuntirib bering.
1. What is the function of steering boosters?
 2. Parts of steering linkage.
 3. Describe the operating process of steering boosters.

5.3. RUL YURITMASI SHARNIRLARI

5.3. STEERING LINKAGE JOINTS

Davr talabining konstruksiyalarga oshib borishi yangi ishlanmalarda zamon yutuqlarini keng joriy qilishni taqozo etadi. Hozirgi kunda elektron boshqaruvli gidravlik, elektrik hamda kombinatsiyalashgan rul yuritmalari keng tarqalmoqda.

Rul yuritmasi rul mexanizmi bilan boshqariluvchi g'ildiraklar orasida kuch uzatuvchi vazifasini bajaradi.

Mexanik rul yuritmasining funksional tarkibiga rul trapetsiyasi va boshqariluvchi g'ildiraklarni bog'lovchi richag va tortqilar kiradi. Rul yuritmasidagi tortqi va richaglar o'zaro sharnirli bog'langan, nisbatan tebramish va buralish erkinlik darajalariga ega.

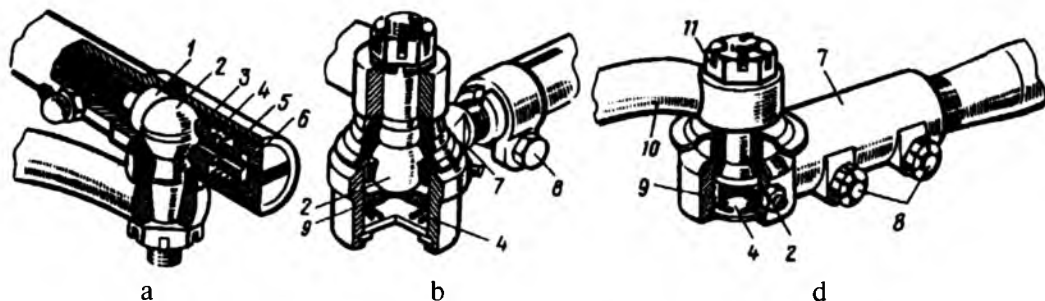
Rul mexanizmi bilan boshqariluvchi g'ildiraklarni bog'laydigan rul yuritmasining tortqi va richaglari o'zaro sharnirli bog'lanishni talab qiladi (5.7-rasm).

Increasing of demand to new and modern constructions requires applying of the latest achievements of science in new designs. At present hydraulic, electric and combined steering linkages with electronically controlled system are widespread.

It is the purpose of steering linkage to transmit the force between mechanism and steering wheels.

Mechanical steering linkage consists of steering trapezium, levers and arms, which connect steering wheels. Levers and arms in steering linkage are connected between jointly and have free grade of oscillation and turning.

Levers and control arms of steering linkage that connects the steering mechanism to steering wheels should be connected by means of joint (Fig. 5.7).



5.7-rasm. Rul yuritmasi tortqilarining sharnirlari:

a—bo'ylama tortqining, b, d—ko'ndalang tortqilarning sharnirlari;

1, 3—suxarik, 2—sferik kallakli barmoq, 4—prujina, 5—cheklagich, 6—rezbali probka, 7—tortqi uchliklari, 8—boltlar, 9—ekssentrik suxariklar, 10—richag.

Figure 5.7. Joints of steering linkage arms:

a—joints of longitudinal control arm, b, d—joints of traverse control arm; 1, 3—ball cup, 2—spherical head pin, 4—spring, 5—limiter, 6—thread plug, 7—arm tips, 8—bolts, 9—eccentric pin, 10—lever

Sharnirning joyiga qarab konstruksiyasidagi erkinlik darajasi farq qiladi. Har bir sharnirning tuzilishida barmoqning (2) (5.7-rasm) sferik kallagini suxariklar (1, 3) lar qamrab turadi. Suxariklarni prujina (4) sferik yuzaga siqib turadi. Rezbalı probka (6) prujina ketida o'rnatilgan cheklagich (5) ning suxarik bilan ma'lum oraliqda bo'lishini ta'minlaydi. Cheklagich (5) prujina (4) ning tasodifan sinishi oqibatida tortqilarning ajralib ketishining oldini olib, xavfsizlikka xizmat qiladi.

Bo'ylama tortqining chekkasi sharnir joylashtirilishi uchun kengaytirilgan bo'ladi (5.3-rasm). Ko'ndalang tortqining ikki chekkasidagi tortqi uchliklarida (7) o'ng va chap rezba ochilgan bo'ladi. Bu rul trapetsiyasini sozlashga kerak.

Depending on replacement, the joint has different free grades. Ball cups (1, 3) keep the spherical head of pin (2) (Fig. 5.7) in each design of the joint. The spring (4) presses cups to spherical area. Thread plug (6) provides the distance between the limiter (5) arranged behind the spring and the cup. Limiter (5) provides safety of the joint preventing disconnection of arms as a result of breaking of the spring (4) suddenly.

The tip of longitudinal arm is enlarged to mount the joint (Fig. 5.3). Left and right threads are made on tips (7) at both ends of traverse control arm. It is necessary to adjust the steering trapezium.

5.4. RUL MEXANIZMI

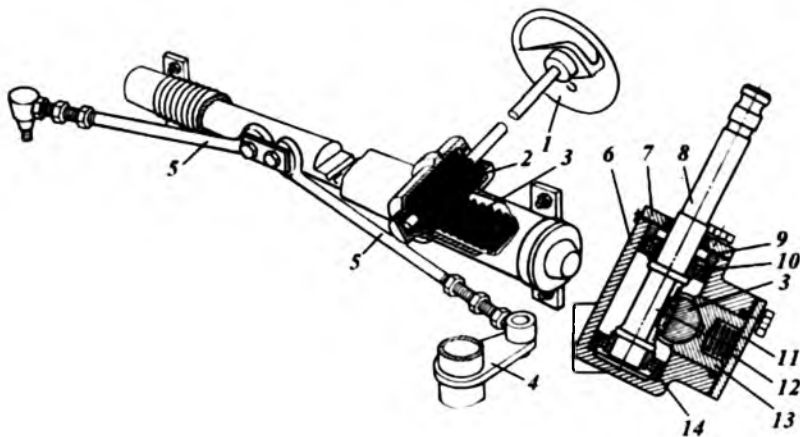
5.4. STEERING MECHANISM

Rul mexanizmining asosiy vazifasi haydovchi uchun g'ildiraklarni burishni yengillatishdir. Bu vazifa rul mexanizmining uzatishlar soni evaziga erishiladi. Avtomobillar rul mexanizmi uzatishlar sonining o'zgarish diapozoni 12...25 bo'ladi.

Shesternya — reyka rul mexanizmi (5.8-rasm), asosan, yengil avtomobillar rul boshqarmasida keng tarqalgan. Bunday mexanizmning uzatish soni 12...15. U ixcham konstruktiv o'lchamli bo'ladi.

The main purpose of the steering mechanism is to ease the wheel turning for driver. This problem is done by steering mechanism drive ratio. Drive ratio of steering mechanism of automobile changes for the range within 12...25.

Gear-rack steering mechanism (Fig. 5.8) is widespread in the steering of cars. Drive ratio of such mechanism is about 12...15. It has compact constructive dimension.



5.8-rasm. Shesternya - reyka rul mexanizmi.

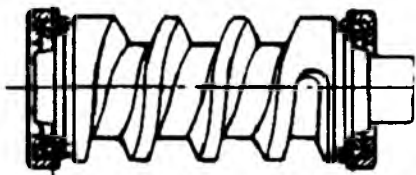
1—rul chambaragi, 2—shesternya, 3—reyka, 5—ko'ndalang tortqilar, 7—korpus qopqog'i, 8—rul vali, 9—shayba, 10, 14—podshipniklar, 11—qopqoq, 12—prujina, 13—suxarik.

Figure 5.8. Gear-rack steering mechanism.

1—steering wheel, 2—gear, 3—rack, 5—transverse control arm, 7—cap of housing, 8—steering axle, 9—washer, 10, 14—bearings, 11—cap, 12—spring, 13—pin.

Haydovchi rul chambaragi (1) (5.8-rasm) yordamida rul valini (8) va unga bikir biriktirilgan shesternyani (2) aylantiradi. Tishli reyka (3) o'qi bo'ylab chiziqli harakat qiladi. Reykaga (3) sharnirli biriktirilgan ko'ndalang tortqilar (5) g'ildirakni burish richaglari (4) orqali boshqariluvchi g'ildiraklarni buradi va avtomobil harakat yo'nalishi boshqariladi.

Silindrik chervyak — sektorli rul mexanizmlarining asosiy detali vintli tishli shesternya — chervyak (5.9-rasm). Vintli tishlarining og'ish burchaklari hisobiga bir juft uzatmada yetarlicha katta uzatishlar sonini olish mumkin.



5.9-rasm. Silindrik chervyak — silindrik vintsimon tishli g'ildirak.

2—silindrik chervyak, 3—tishli sektor, 4—karter.

Globoidli chervyak — rolik mexanizmi. Globoidli chervyakning silindrik chervyakdan farqi uning vintli tishlari tashqi shakli globoida sirti qonuniyatida yasaladi (5.10-rasm).

Globoidli chervyak — rolik mexanizmi silindrik chervyak — sektor mexanizmi kabi ixchamlikda katta uzatishlar sonini ta'minlay oladi. Ilashish yuzalari ishqalan-

A driver turns the steering axle (8) and the gear (2) connected stiff to it by the help of steering wheel (1) (Fig. 5.8). Toothed rack (3) moves linear on its axis. Transverse control arms (5), connected jointly to the rack (3) turn steering wheels through wheel turning levers (4) and moving direction of the vehicle is controlled.

The main detail of **cylinder worm — sector steering mechanism** is spiral tooth gear - worm (Fig. 5.9). Because of spiral teeth inclination enough big ratio is provided in the couple of drive.

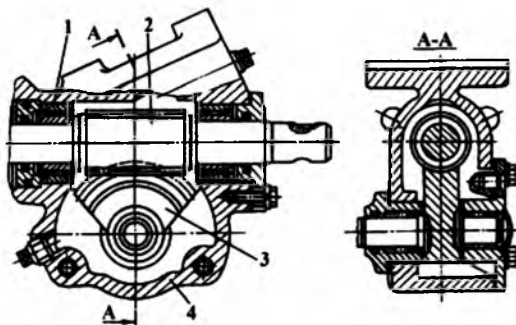


Figure 5.9. Cylinder worm- cylinder spiral toothed wheel.

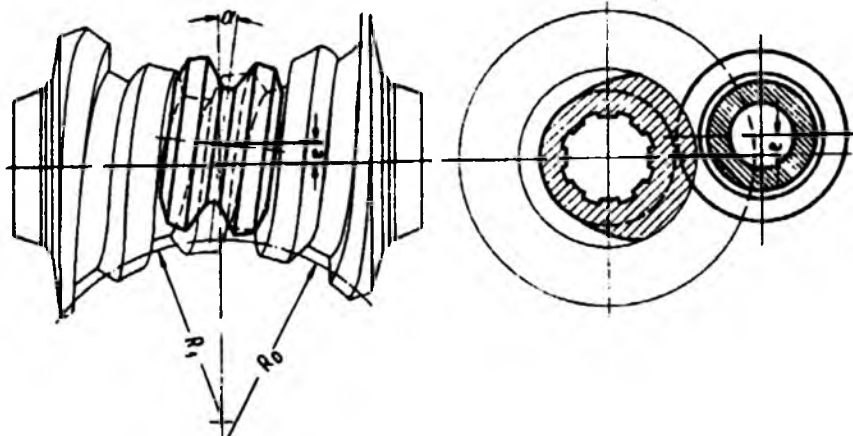
2—cylinder worm, 3—toothed sector, 4—case.

Cone worm-roller mechanism. The outer form of spiral teeth of cone worm made by principal of cone surface makes a difference between cone and cylinder worms (Fig. 5.10).

Cone worm — roller mechanism is compact like the cylinder worm-sector mechanism and provides a big ratio. Cou-

maydi. Globoidli chervyakning vintli tishlari yuzalari bo'ylab rolik g'ildiraydi. Mexanizmning foydali ish koeffitsiyenti keskin ortadi.

pling surfaces do not rub. The roller rolls on the surface of spiral teeth of cone worm. The efficiency increases quickly.

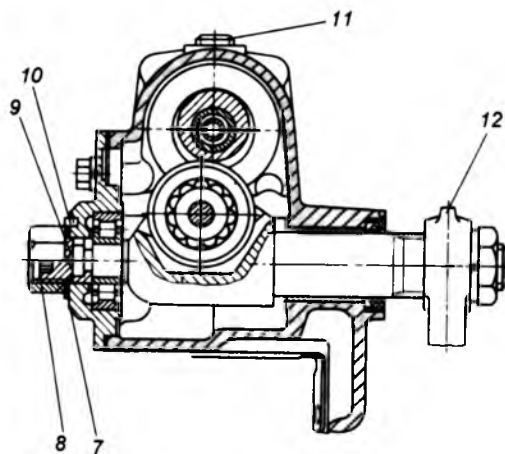


5.10-rasm. Globoidli chervyak va rolik.

Figure 5.10. Cone worm and roller.

Roliklar bir, ikki va uch o'rkachli bo'lishi mumkin (5.11-rasm).

Rollers may be with one, two and three humps (Fig. 5.11).



5.11-rasm. Globoidli chervyak va uch o'rkachli rolik rul mexanizmi.

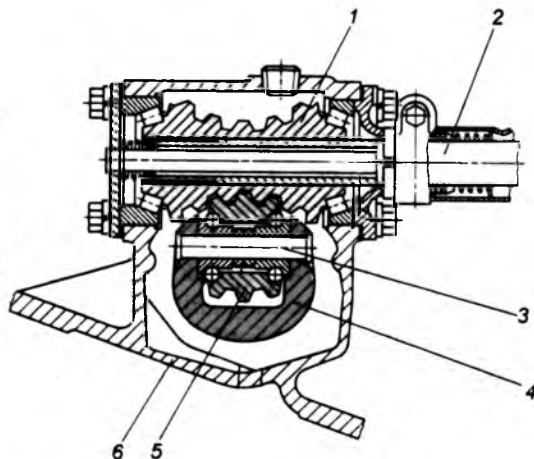


Figure 5.11. Cone worm and roller with three humps steering mechanism.

1—globoidli chervyak, 4—soshka vali kallagi, 5—rolik, 7—qulfovchi shayba, 8—gayka, 9—sozlovchi vint, 10—shtift, 12—soshka.

Globoidli chervyak (1) (5.11-rasm) rul vali 2 uchiga o'rnatilgan. Rul vali karter (6) qopqoqlaridagi konusli rolik podshipniklariga o'rnatiladi. Rolik (5) o'z o'qida (3) ikkita ignapodshipniklarda aylanadi. Rolik o'qi (3) soshka (12) valining kallagi (4) ga presslab biriktiriladi. Rul soshkasi valda shlitsali birikmaga gayka bilan qotirilgan. Rul chambaragini aylantirganda val (2), chervyak (1) va rolik (5) aylanadi. Shu bilan birga rolik (5) globoida yoyi bo'ylab siljiydi va rul soshkasining valini (4) buradi.

"Vint — gayka — reyka — sektor" tipidagi rul mexanizmi. Rul mexanizmlari ichida yuk avtomobillar uchun keng tarqalgan konstruksiyalardan vintli uzatmalar hisoblanadi (5.12-rasm).

Vint (1) ning aylanishi gayka-reyka (2) ning ilgarilama-qaytma chiziqli harakatiga o'zgaradi. Reyka bilan ilashishdagi sektor (4) soshka vali (5) ni o'qi atrofida aylantiradi.

Vint va gayka orasidagi ishqalanishni kamaytirish maqsadida ular yopiq konturda harakatlanadigan shariklar yordamida ilashtirilgan. Vint-gayka oralig'idagi ariqchalardan ortib chiqadigan shariklar gaykaning ikki uchidagi kanallarni biriktiruvchi jeloblar orqali vint-gayka ilashmasining yangidan yaqinlashayotgan narigi uchiga boradi va uzluksiz ilashishda bo'ladi.

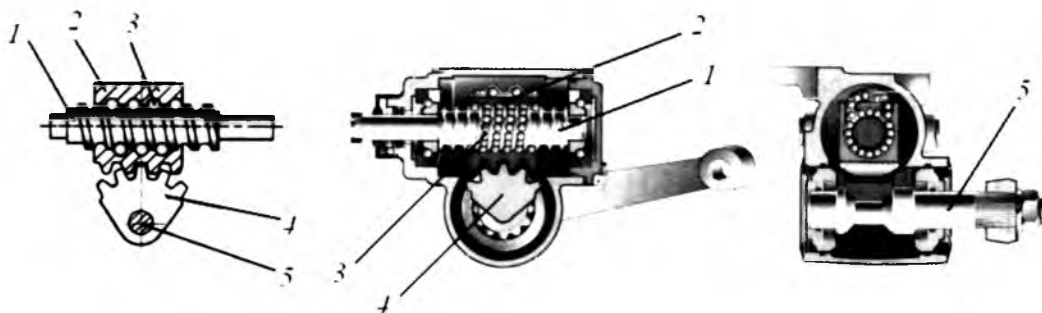
1—cone worm, 4—head of drop axle, 5—roller, 7—lock washer, 8—nut, 9—adjusting screw, 10—pin, 12—drop.

Cone worm (1) (Fig. 5.11) is located at the end of steering axle (2). The steering axle is mounted at the cone roller bearings arranged at caps of the case (6). Roller (5) turns on its axle (3) on two needle bearings. Roller axle (3) is connected to the head (4) of drop's (12) axle by press. Steering drop is attached to splined joint by nut on the axle. After the steering wheel has turned axle (2), worm (1) and roller (5) are turned. In addition, the roller (5) removes on the cone arc and turns the axle (4) of steering drop.

Screw-nut-rack-sector steering mechanism. Screw steering mechanism is widespread in trucks (Fig. 5.12).

Turning of the screw (1) is converted to reciprocating linear motion of the nut-rack (2). The sector (4) coupled with the rack turns the axle (5) of the drop around its axis.

In order to decrease the friction between the screw and nut they are coupled by balls, which rolls inside closed contour. Balls, which go from the groove between screw and nut, go to new approaching other end of screw-nut coupling through flute, which connects grooves at both ends of the nut and make constant couple.



5.12-rasm. „Vint — gayka — reyka — sektor“ tipidagi rul mexanizmi.

1—vint, 2—gayka-reyka, 3—sharik, 4—sektor, 5—soshka vali.

Figure 5.12. Screw-nut-rack-sector steering mechanism.

1—screw, 2—nut-rack, 3—ball, 4—sector, 5—drop axle.

Sektor (4) soshka vali bilan yaxlit ishlangan va karterda igna podshipnik-larda aylanadi. Vint (1) gayka-reyka bilan shariklar (3) orqali rezballi ilashgan mexanizm. Rul chambaragi bilan vint (1) aylantirilganda shariklar bilan ilashgan gayka-reyka (2) chiziqli xarakterga keladi. Gayka-reyka (2) sektor va soshkani o'qida (5) aylantiradi. Soshka rul yuritmasi bilan g'ildiraklarni buradi.

The sector (4) is solid with drop axle and rolls at needle bearings at the case. The screw (1) is mechanism, which is coupled with the nut-rack through balls (3) and by screw thread. When steering wheel and screw (1) turn the nut-rack (2) coupled with balls is moved linear. The nut-rack (2) turns the sector and drop around axle (5). The drop and steering linkage turn wheels together.

Nazorat uchun savollar

Self-control questions

1. Rul yuritmasi sharnirlarini tushuntirib bering.
2. Rul mexanizmining vazifasi nima?
3. Rul mexanizmining turlari.

1. Tell about steering linkage joints.
2. What is the function of steering mechanism?
3. Types of steering mechanisms.

6. TORMOZ

6. BRAKES

6.1. TORMOZ BOSHQARMASI

6.1. BRAKE CONTROL

Tormoz boshqarmasi avtomobilning xavfsizligini ta'minlashda muhim hisoblanadi.

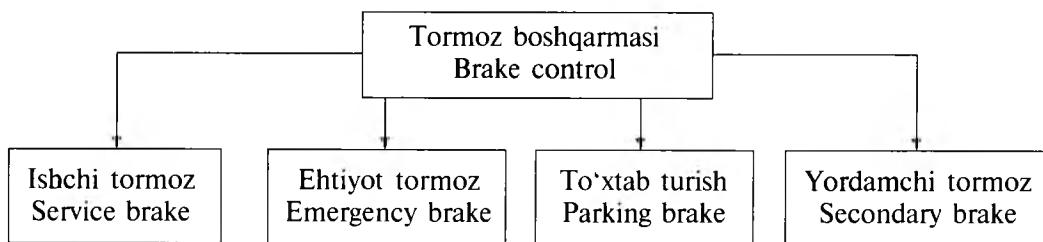
Tormoz boshqarmasi avtomobil harakat tezligini sekinlatish, avtomobilni to'xtatish va yo'l qiyaliklarida uzoq vaqt davomida beixtiyor joyidan qo'zg'alib ketmasligini ta'minlash uchun xizmat qiladi. Avtomobil g'ildiraklari bilan yo'l orasida tormozlovchi kuchni sodir qilish va boshqarish tormoz boshqarmasi bilan amalga oshiriladi.

Tormoz boshqarmasi quyidagi asosiy tormoz tizimlaridan iborat bo'ladi:

Brake control is very important to provide the vehicle safety.

Brake control serves to decelerate automobile speed, to stop automobile and to provide immobility of automobile on the road grade for a long time. Braking force between automobile wheels and road is created by means of brake control.

Brake control comprises the following main brake systems:



6.1-rasm. Tormoz boshqarmasi tizimlari.

Figure 6.1. Systems of brake control.

1. **Ishchi tormoz tizimi** — asosiy tizim hisoblanadi. Avtomobil harakatini sekinlatish, avtomobilni to'xtatish uchun xizmat qiladi.

1. **Service brake system** is the main brake system. This system serves to decelerate automobile speed, to stop automobile.

2. **Ehtiyot tormoz tizimi** tormoz boshqarmasining ishonchliligini oshirish uchun, ishchi tormoz tizimiga zahira tormoz sifatida xizmat qiladi.

3. **To'xtatib turish tormoz tizimi** to'la yuklangan avtomobilni 25% yo'l qiyaligida chegaralanmagan vaqt davomida qo'zg'alib ketmasligini ta'minlash uchun xizmat qiladi.

4. **Yordamchi tormoz tizimi** uzun qiyaliklarda pastlikka harakatlanayotgan avtomobil tezligini tezlashmasdan saqlanishi uchun xizmat qiladi.

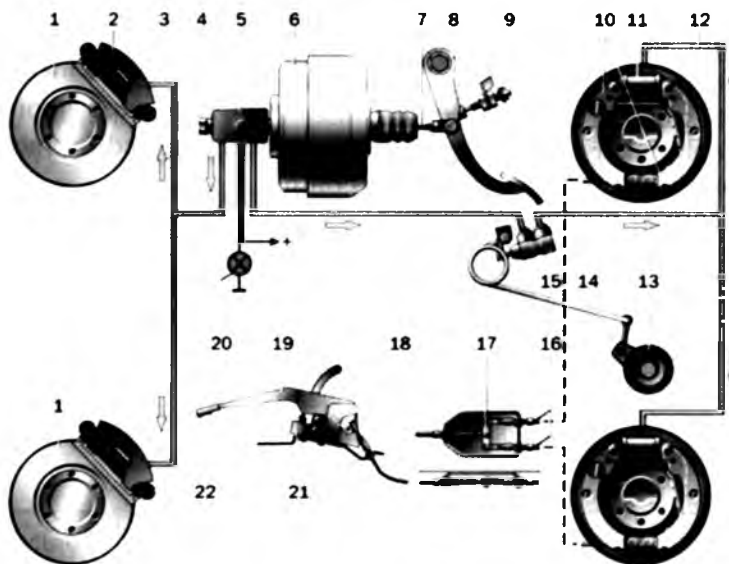
Ishchi tormoz tizimi tormoz mexanizmi va tormoz yuritmasidan tashkil topadi (6.2-rasm).

2. **Emergency brake system** serves to increase the reliability of brake control and it is emergency for service brake system.

3. **Parking brake system** provides immobility of full loaded automobile on the road grade with level 25% for unlimited time.

4. Secondary brake system provides decelerated speed of automobile when it moves from grade to downgrade.

Service brake system consists of brakes and brake drive (Fig. 6.2).



6.2-rasm. Avtomobil ishchi tormoz tizimining prinsipial sxemasi:
1—tormoz diski; 2—oldingi tormoz mexanizmining skobasi; 3—tormoz yuritmasining oldingi konturi;
4—asosiy tormoz silindri; 5—tormoz suyuqligi bachogi; 6—vakuum kuchaytirgichi; 8—tormoz pedali; 10—orqa

Figure 6.2. Principal scheme of service brake system of automobile:

1—brake disk; 2—caliper of front brakes; 3—front circuit of brake drive; 4—master brake cylinder; 5—reservoir of brake fluid; 6—vacuum booster; 8—brake pedal; 10—rear wheel brake

g'ildiraklar tormoz kolodkalari;
 11—orqa g'ildirak tormoz mexanizm
 silindrlari; 12—tormoz yuritmasining orqa
 konturi; 16—to'xtatib turish tormoz
 tizimi trosarlari; 19—to'xtatib turish
 tormoz tizimi richagi; 22—oldingi
 g'ildiraklar tormoz mexanizm
 kolodkalari.

Tormoz pedali (8) bosilganda tormoz yuritmasi konturlarida (3, 12) va g'ildirak tormoz mexanizmi silindrlarida (11, 22) suyuqlik bosimi oshadi. Bosim tormoz silindrlaridagi porshenlarni harakatga keltiradi. Tormoz kolodkalari (10, 22) tormoz diskini 1 va orqa tormoz barabanini siqadi. G'ildiraklar aylanishi sekinlashadi. Shinalar bilan yer orasida tormozlovchi kuch yuzaga keladi.

To'xtatib turish tormoz tizimida tormozlovchi kuch mexanik usulda yaratiladi. Uning yuritmasi, odatda, richagli, trosli bo'ladi.

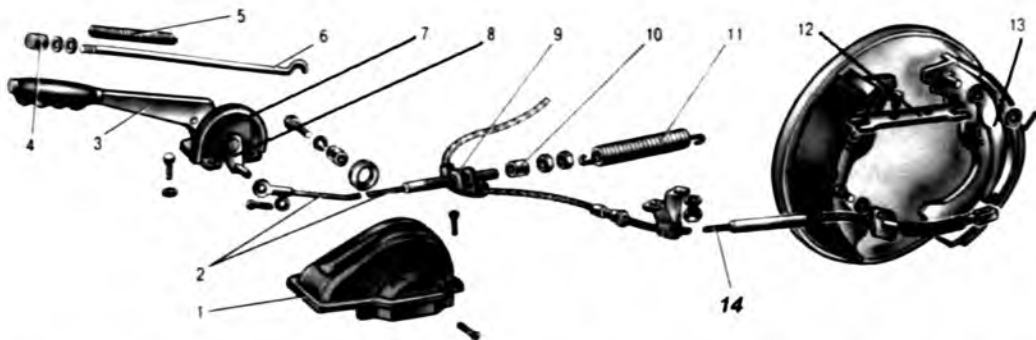
Bu tizimning tormoz mexanizmi yengil avtomobillarda g'ildirakka, yuk avtomobillarida transmissiyaga joylash- tiriladi. To'xtatib turish tormoz tizimi, odatda, qo'l bilan richag orqali ishga tushiriladi.

shoes; 11—rear wheel brake cylinder;
 12—rear circuit of brake drive;
 16—cables of parking brake system;
 19—lever of parking brake system;
 22—front wheel brake shoes.

After the brake pedal (8) has been pressed the fluid pressure in circuits (3, 12) of brake drive and in wheel brake cylinders (11) is increased. The pressure removes pistons in brake cylinders. Brake shoes (10, 22) press the brake disk (1) and rear brake drum. Rotating velocity of wheels decelerates. Braking force is created between the tire and road.

Braking force is created mechanically in the **parking brake system**. It has the drive with cable or lever.

Brakes of this system are mounted at wheels in cars and at the transmission in trucks. Usually parking brake system is operated by hand through the lever.



6.3-rasm. Yengil avtomobilning to'xtatib turish tormoz tizimi sxemasi:

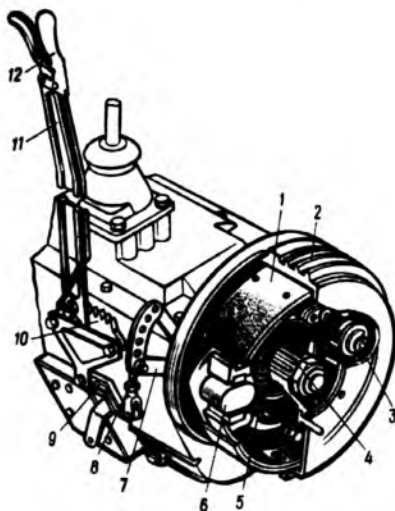
Figure 6.3. The scheme of parking brake system of a car:

1—chexol; 2—markaziy tros; 3, 8, 13—richaglar; 4—knopka; 5, 11—prujinalar; 6—tortqi; 7—kronshteyn; 9—yo'nal-tiruvchi; 10—vtulka; 12—planka; 14—g'ildirak tormoz mexanizmlari bilan bog'lovchi tros.

1—cover; 2—central cable; 3, 8, 13—levers; 4—button; 5, 11—springs; 6—arm; 7—bracket; 9—guid; 10—bush; 12—slat; 14—cable, which connects to wheel brakes.

Haydovchi knopkani (4) bosib, tortqini (6) kronshteydagi (7) tishli sektor-dan ozod qiladi. Richagni (3) o'qi atrofida buradi (6.3-rasm). Richag (3) richag (8) yordamida markaziy trosni (2) va g'ildiraklar tormoz mexanizmlari troslarni (14) tortadi. Richag (13) va planka (12) ikki kolodkalarini barabanga tiraydi. Tormozlovchi kuch sodir qilinadi. Haydovchi knopkani (4) bo'shatadi, tortqi (6) kronshteyndagi (7) sektorning tish oralig'ida qulflanadi. Tormoz kuchi uzoq vaqt saqlanishi ta'minlanadi.

The driver releases the arm (6) from toothed sector on the bracket (7) by pressing the button (4). Turns the lever (3) around axis (Fig. 6.3). The lever (3) pulls central cable (2) and cables (14) of the wheel brakes with the help of the lever (8). The lever (13) and the slat (12) press two brake shoes onto the drum. Breaking force is created. The driver releases the button (4) and the arm (6) is locked in the toothed sector on the bracket (7). Braking force is kept for a long time.



6.4-rasm. Yuk avtomobilining to'xtatib turish tormoz tizimi:

Figure 6.4. The scheme of parking brake system of a truck:

Musibat yetganda sabr qiluvchi, berilgan ne'matlarga shukr qiluvchi, birovlarining qilmishini kechiruvchi o'zi birovga ozor yetkazsa, tavba qiluvchi kishilarga xotirjamlik va hidoyat ato etilur.

Hadis

1—tormoz kolodkalari; 2—tormoz barabani; 3—kolodkalar o'qi; 4—uzatmalar qutisining yetaklanuvchi vali; 5—kolodkalarni qaytaruvchi prujina; 6—kolodkalarni keruvchi mushti; 7, 9—richaglar; 8—sozlanuvchi tortqi; 10—tishli sektor; 11—qo'l richagi; 12—stopor bandi.

1—brake shoes; 2—brake drum; 3—shoe axis; 4—secondary shaft of the drive box; 5—return spring of shoes; 6—shoes expanding cam; 7, 9—levers; 8—adjusting rod; 10—toothed sector; 11—hand lever; 12—stopper handle.

Yuk avtomobillarida to'xtatib turish tormoz tizimi transmissiyaga joylashtiriladi. Mexanizmida sodir qilingan tormoz kuchi g'ildiraklarga ortib boradi (6.4-rasm).

Haydovchi keruvchi mushtni 6 o'qi atrofida buradi. Tormoz kolodkalari barabanga yopishib tormoz momentini yaratadi.

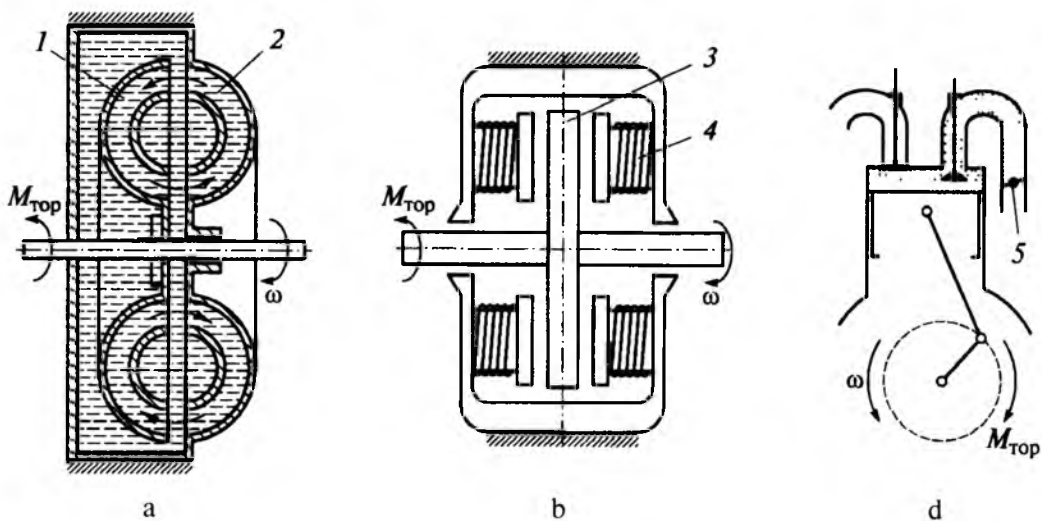
Ehtiyot tormoz tizimining samaradorligi ishchi tormoz tizimidan me'yorlangan miqdorga kam bo'ladi. Ehtiyot tormoz tizimi vazifasini ikki va undan ortiq konturli tormoz yuritmasi yoki to'xtatib turish tormoz tizimi bajarishi mumkin.

Yordamchi tormoz tizimi uzun qiyaliklarda pastlikka harakatlanayotgan avtomobil tezligini tezlashmasdan saqlanishi uchun xizmat qiladi. Maxsus yordamchi tormoz tizimi to'la massasi (12) tonna va undan ziyod bo'lgan transport vositalarida qo'llaniladi. Yordamchi tormoz tizimini tormoz-sekinlatgich deb ham yuritiladi. Tormoz-sekinlatgichlar gidravlik, elektrli, kompressorli (6.5-rasm) bo'lishi mumkin.

Parking brake system of trucks is mounted at the transmission. Braking force created at brakes is increased at wheels (Fig. 6.4). The driver turns the expanding cam 6 around axis. Brake shoes press onto the drum and create brake torque.

The efficiency of **emergency brake system** is smaller than service brake system for fixed value. The function of emergency brake system can be done by brake drive with two or more circuits or by parking brake system.

Secondary brake system provides decelerated speed of automobile when it moves from grade to downgrade. Special secondary brake system is used in a vehicle that has gross weight 12 t and more. Secondary brake system is called "brake-retarder". There are hydraulic, electric, compressor brake-retarder (Fig. 6.5).



6.5-rasm. Tormoz-sekinlatgichlar sxemasi: a—gidravlik; b—elektrli; d—kompressorli; 1—aylanuvchan parrakli g'ildirak; 2—harakatlanmaydigan parrakli g'ildirak; 3—aylanuvchan disk; 4—xharakatlanmaydigan korpusdagi elektromagnit; 5—gaz chiqish yo'lim to'suvchi zaslonka.

Figure 6.5. The scheme of brake-retarders: a—hydraulic; b—electric; d—compressor; 1—rotating blade wheel; 2—stationary blade wheel; 3—rotating disk; 4—electromagnet in stationary housing; 5—exhaust duct throttle.

Aylanuvchan parrakli g'ildirak (1) harakatdagi avtomobil g'ildiragi bilan bog'langan. Harakatlanmaydigan parrakli g'ildirak (2) odatda dvigatel blokiga qotiriladi. Tormoz-sekinlatgich ishga tushirish uchun korpus ichiga suyuqlik kiritiladi. Harakatlanayotgan g'ildirak suyuqlikka oqim — kinetik energiya beradi (6.5-a rasm). Suyuqlikning kinetik energiyasini harakatlanmaydigan parrakli g'ildirak oladi. Suyuqlikning harakatiga yaratilgan qarshilik avtomobil g'ildiraklariga tormozlovchi moment bo'lib uzatiladi. Avtomobil pastlikka harakatlanayotganida tezlashib ketmaydi.

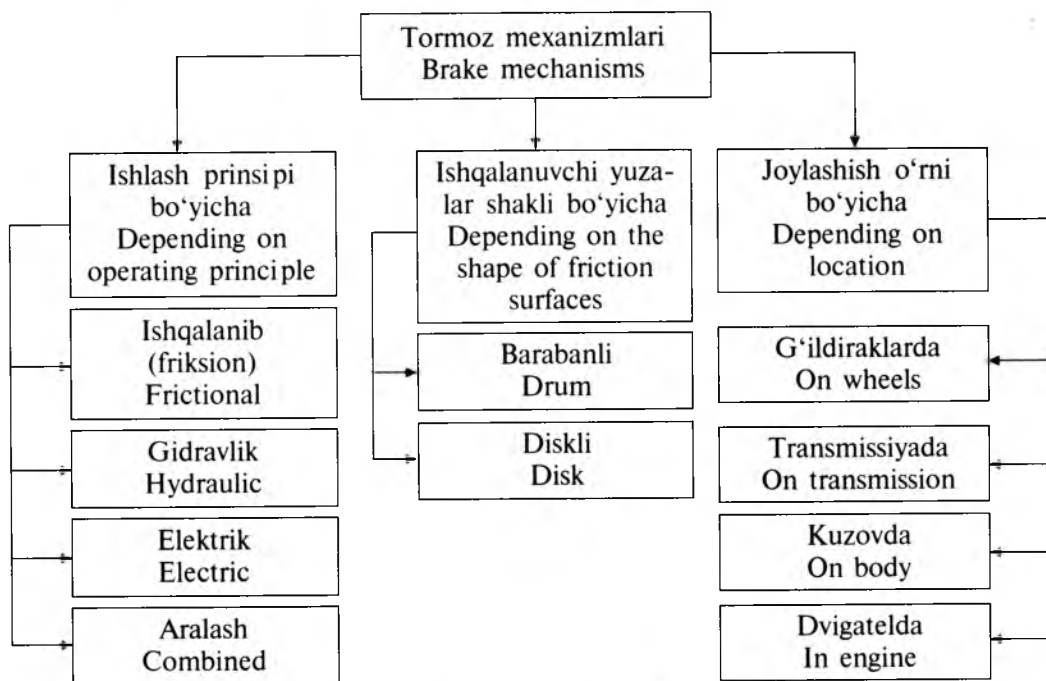
Rotating blade wheel (1) is connected to the wheel of moving vehicle. Stationary blade wheel (2) is usually attached to the block of the engine. The body is filled by fluid to operate the brake-retarder. Moving wheel gives flow-kinetic energy to fluid (Fig. 6.5, a). Stationary blade wheel takes fluid kinetic energy. The resistance created against the fluid motion is transmitted to automobile wheels as braking torque. Automobile does not accelerate when it has been moving to downgrade.

6.2. TORMOZ MEXANIZMLARI

6.2. BRAKE MECHANISMS

Tormoz mexanizmlarining vazifasi avtomobilning harakat tezligiga tormozlovchi kuch yaratishdir. Zamonaviy avtomobillarda foydalaniladigan tormoz mexanizmi turlari 6.6-rasmda keltirilgan.

The main function of brakes is to create braking force to stop the moving vehicle. Brake designs of modern automobiles are shown in Fig. 6.6.



6.6-rasm. Tormoz mexanizmi turlari.

Figure 6.6. Types of brakes .

Tormozlovchi kuchni mexanizmlarda turlicha usullarda sodir qilish mumkin: ishqalanuvchi yuzalardagi kuch bilan, gidravlik qarshilik bilan, elektr-induksion kuchlar bilan va avtomobildan tashqarida, masalan, havo qarshiligini oshirish bilan.

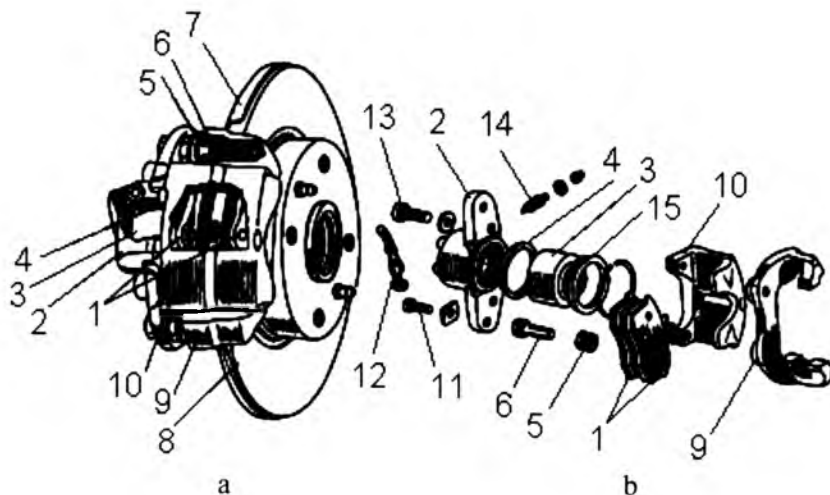
Avtomobillarda friksion (ishqalanish yuzali) tormoz mexanizmlari keng tarqalgan bo'lib, ular ishqalanuvchi yuzalari shakliga qarab diskli va barabanli bo'ladi.

Braking force in brakes can be created by different ways: by force at friction surfaces, by hydraulic resistance, by electric-induction forces and outside of a vehicle, for example, by increasing air drag.

Friction (rubbing surfaces) brakes are widespread in automobiles and there are disk and drum brakes depending on the shape of friction surfaces.

Diskli tormoz mexanizmi ishlashining turg'unlik-doimiylik xususiyatlariga asosan tezkor harakatlanadigan avtomobillarda, ayniqsa, yengil avtomobillarda keng tarqalgan. Hozirgi davrda yengil avtomobillarning orqa tormozlarida, hattoki, kichik avtobus va yengil yuk tashiydigan avtomobillarda ham qo'llanishi oshib boryapti. Yengil avtomobilning diskli tormoz mexanizmining umumiy tuzilishi 6.7- rasmda keltirilgan.

Based on constant-stable operating performance disk brake mechanism is widespread in high speed vehicles, especially in cars. At present, application of disk brakes is increasing in rear brakes of automobiles, even, in buses and in lightweight trucks. Construction of disk brake of a car is shown in Fig. 6.7.



6.7-rasm. Yengil avtomobilning old tormozi.

a—chizma ko'rinishi; —mexanizm detallari; 1—kolodkalar; 2—silindr; 3—porshen; 5, 15—changdan himoya qopqoqchalar; 6—barmoq; 7—shit; 8—tormoz diski; 9—yo'naltiruvchi; 10—support; 11, 13—boltlar; 12, 14—shtutserlar.

Figure 6.7. Front disk brake of a car:

a—design view; b—parts of mechanism; 1—shoes; 4—cylinder; 3—piston; 5, 15—protection caps; 6—pin; 7—backplate; 8—brake disk; 9—guide; 10—support; 11, 13—bolts; 12, 14—adapters.

G'ildirak tormoz diskiga (8) biriktiriladi va demak, disk g'ildirak bilan birga aylanadi. Diskning g'ildirakka teskari tomonidan, qo'zg'almas shitga (7) boitlar (11, 13) bilan silindr qotirilgan. Haydovchi pedalni bosganda silindrga (2) tormoz suyuqligi bosim ostida shtutser (12) orqali kiradi. Bosim porshenni (3) surib kolodkalarni diskka siqadi. Porshen (3) tomonidagi kolodkalardan biri diskka taqalganda, erkin siljishdagi support (10) tashqi tarafdagi kolodkani diskka (8) tomon surib siqadi. Tormoz yuritmasida paydo bo'lishi mumkin bo'lgan havoni yuritmadan chiqarish uchun shtutserdan (14) foydalaniladi.

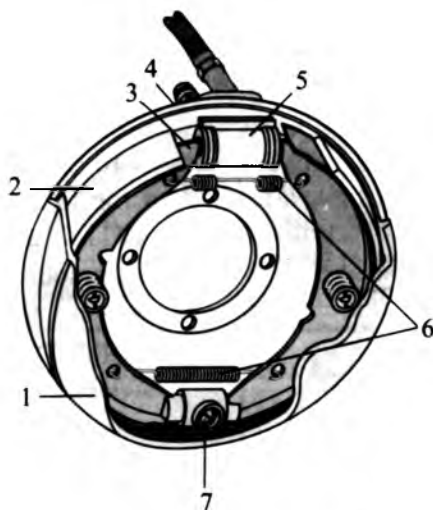
Barabanli tormoz mexanizmi yengil avtomobillarning orqa tormoz mexanizmlarida, avtobus va yuk avtomobilarida ishlatilib kelmoqda.

Gidravlik yuritmalı tormoz tizimining barabanli tormoz mexanizmi 6.8-rasmda keltirilgan.

The wheel is attached to the brake disk (8) and consequently, disk rotates together with the wheel. At the reverse side of the disk, the cylinder is attached to the stationary backplate (7) by bolts (11, 13). After the driver has pressed the pedal, the brake fluid enters the cylinder (2) under the pressure through adapter (12). The pressure moves the piston (3) and presses shoes onto the disk. After one of shoes on the side of piston (3) has stretched to disk, free moving support (10) presses outer the shoe to disk (8). The adapter (14) is used to remove possible air in brake drives.

The drum brake is applied in rear brakes of cars, in buses and trucks.

Figure 6.8 illustrates a drum brake with hydraulic drive.

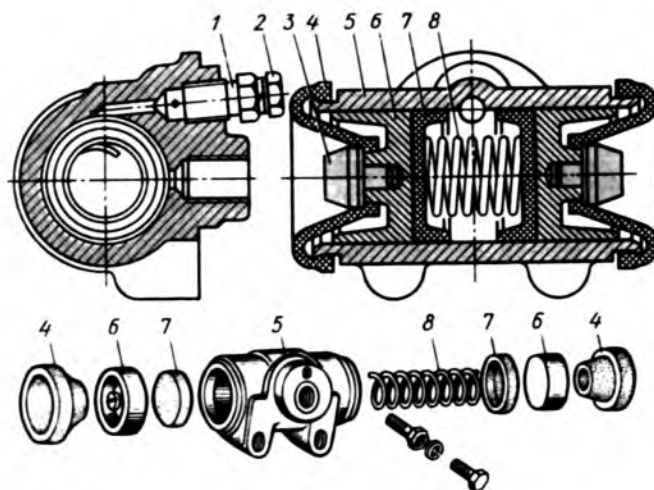


6.8-rasm. Barabanli tormoz mexanizmi:

- 1—baraban; 2 —nakladka; 3—kolodka;
- 4—shit; 5—ishchi tormoz silindri;
- 6—qaytaruvchi prujinalar; 7—ekssentrik.

Figure 6.8. Drum brake:

- 1—drum; 2—lining; 3—shoe;
- 4—backplate; 5—wheel brake cylinder;
- 6—return spring; 7—eccentric.



6.9-rasm. Ishchi tormoz silindri.

Figure 6.9. Wheel brake cylinder:

Ishchi tormoz silindri suyuqlik bosimidan kolodkalarining barabanga siquvchi kuchni hosil qilishni amalga oshiradi (6.9-rasm). Ishchi tormoz silindriga (5) bosim ostida kirgan tormoz suyuqligi porshenlarga ta'sir qilib, ularni tashqariga suradi. Natijada kolodkalarni bir-biriga yaqinlashtirib, tortib turgan prujinalar (6) (6.8-rasm) kuchini yengib, ularni barabanga siqadi. Nakladkalar (2) barabanga (1) (6.8-rasm) ishqalanib, uning aylanishiga qarshilik ko'rsatadi va avtomobil sekinlashadi, to'xtaydi. Silindr (5) bilan porshen (6) orasidagi zichlikni manjet (7) ta'minlaydi (6.9-rasm).

Haydovchi tormoz pedaliga ta'sirini olganda, qaytaruvchi prujinalar (6) kolodkalarni orqaga qaytaradi, ishchi silindrdagi (5) suyuqlikni tormoz yuritmasiga siqib chiqaradi. Kolodka baraban yuzidan ajraladi.

Prujma (8) porshenlarning erkinligini chegaralab turadi. Tormoz yuritmasiga kirib qolgan havoni chiqarish uchun

Wheel brake cylinder creates the force, which presses shoes onto the drum by means of fluid pressure (Fig. 6.9). The brake fluid, which entered inside the wheel brake cylinder (5) under the pressure, acts pistons and moves them outward. Therefore, it overcomes stiffness force of springs (6) (Fig. 6.8), pulling shoes to each other, and presses them onto the drum. Linings (2) rub on the drum (1) (Fig. 6.8), resist to its rotation and automobile decelerates, stops. Packing between the cylinder (5) and piston (6) is provided by the cup (7) (Fig. 6.9).

After a driver has released his action onto the pedal, springs (6) return shoes back, force out fluid in the brake cylinder (5) back to the break drive. The shoe disengages from the drum surface.

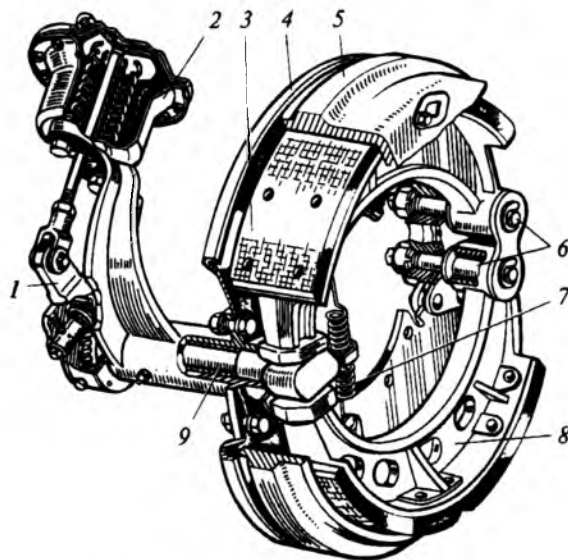
The spring (8) limits pistons from free floating. The valve (1) is used to remove air from brake drive. Rubber caps (4 and

klapandan (1) foydalaniladi. Tashqi atmosfera changlaridan saqlanish uchun rezinali qalpoqchalar (4 va 2) qo'llanilgan.

Pnevmatik tormoz yuritmalarda kolodkalarini barabanga siquvchi kuch keruvchi mushtcha yordamida amalga oshiriladi (6.10-rasm).

2) are used to protect a brake cylinder from dust particles coming from outside.

In pneumatic brake drives the force, pressing shoes onto the drum, is created with the help of an expansion cam (Fig. 6.10).



6.10-rasm. Yuk avtomobilining g'ildirak tormoz mexanizmi:

- 1—richag; 2—tormoz kamerasi;
- 3—nakladka; 4—shit; 5—baraban;
- 6—tayanch barmoqlari; 7—prujina;
- 8—kolodka; 9—mushtcha.

Tormoz kamerasiga (2) yuqori bosimdagi havo kiradi. Havo kameradagi diafragma bilan birikkan shtok orqali richagmi (1) suradi va mushtchani (9) o'qi atrofida buradi.

Figure 6.10. Wheel brake mechanism of the truck:

- 1—lever; 2—brake chamber; 3—lining;
- 4—backplate; 5—drum; 6—anchor pins;
- 7—spring; 8—shoe; 9—cam.

High-pressure air enters the brake chamber (2). The air moves the lever (1) via the pushrod connected to the diaphragm in the chamber and turns the cam (9) on its axis.

Mushtchaning burilishi kolodkalarini (8) barmoqlar (6) o'qida burib, barabanga (5) siqadi. Barabanming aylamishiga qarshilik kuchi — ishqalanuvchi kuch sodir qiladi. Avtomobil sekinlashadi, to'xtaydi. Tormoz kamerasidagi havo bosimi ta'siri olinsa, prujina (7) kuchi bilan kolodkalar (8) dastlabki holatiga qaytadi. Baraban erkin aylanishi ta'minlanadi.

Shoes (8) are turned around the axis of pins (6) and pressed to the drum (5) by turning of the cam. The resist force to drum turning creates the force of friction. Automobile decelerates and stops. After the air pressure action has been released in brake chamber shoes (8) return to initial position by force of the spring (7). Free rotation of the drum is provided.

6.3. TORMOZ YURITMASI

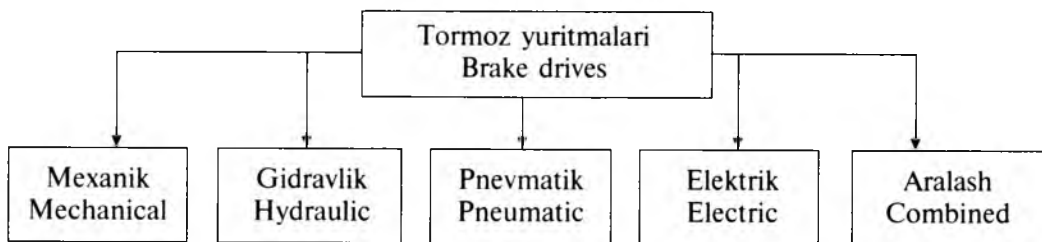
6.3. BRAKE DRIVE

Haydovchining pedalga yoki richakka bergan boshqaruv ta'sirini tormoz mexanizmlariga yetkazadigan qurilmalar tormoz yuritmasini tashkil etadi.

Avtomobil konstruksiyasining vazifasi va turiga ko'ra turli tormoz yuritmalari qo'llaniladi (6.11-rasm).

Brake drive is formed by devices that pass the control action of driver given onto the pedal or lever to brakes.

Different brake drives are applied depending on the purpose of the vehicle construction and their type (Fig. 6.11).



6.11-rasm. Tormoz yuritmasining turlari.

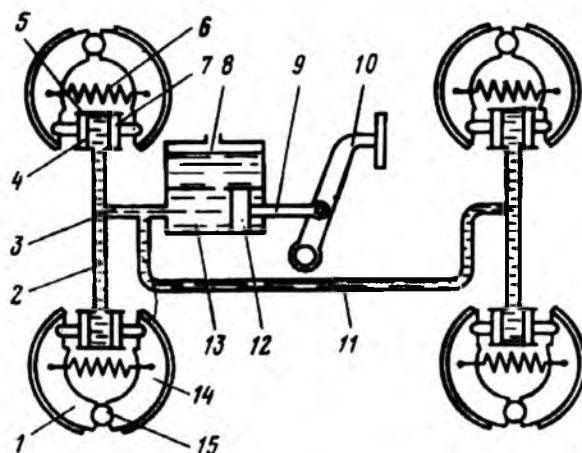
Figure 6.11. Types of brake drives.

Mexanik tormoz yuritmasi haydovchining pedalga yoki richakka ta'sir kuchini tortqilar, richaglar va trosalar orqali tormoz mexanizmiga uzatadi. Avtomobillarda, aksariyat holda, mexanik yuritma to'xtatib turish tormoz tizimida foydalaniladi.

Gidravlik tormoz yuritmasida boshqaruv energiyasi yuritmadagi tormoz suyuqligining bosimi hisobiga uzatiladi (6.12-rasm).

Mechanical brake drive passes the action of driver given onto the pedal or lever to brakes through rods, levers and cables. Mechanical brake drive is mostly applied in parking brake system of automobile.

In hydraulic brake drive, control energy is passed by means of brake fluid pressure in drive (Fig. 6.12).



6.12-rasm. Gidravlik tormoz yuritmasining soddalashtirilgan sxemasi: 2, 3, 11—trubkalar; 8—asosiy tormoz silindri; 9—tortqi; 10—pedal; 12—asosiy tormoz silindri porsheni; 13—asosiy tormoz silindridagi suyuqlik.

Figure 6.12. Principle scheme of hydraulic brake drive:

2, 3, 11—pipes; 8—master brake cylinder; 9—rod; 10—pedal; 12—piston of master cylinder; 13—fluid in master cylinder.

Haydovchi tormoz pedalini (10) (6.12-rasm) bosganda tormoz suyuqligi (13) bosimi old trubkalar (2, 3) va orqa trubkalardan (11) ishchi tormoz silindrlariga (5) boradi. Suyuqlik bosimi porshenlarni (4, 7) siljitib, kolodkalarni (1, 14) tayanchlari (15) o'qida buradi va kolodkalarni barabanga siqadi. Barabarlarning aylanishiga qarshilik ko'rsatuvchi ishqalanish kuchi sodir qilinadi. Tormoz pedali qo'yib yuborilishi bilan suyuqlik bosimi pasayadi. Prujinalar (6) kolodkalarni avvalgi holatiga qaytaradi. Tormozlanish jarayoni yakunlanadi.

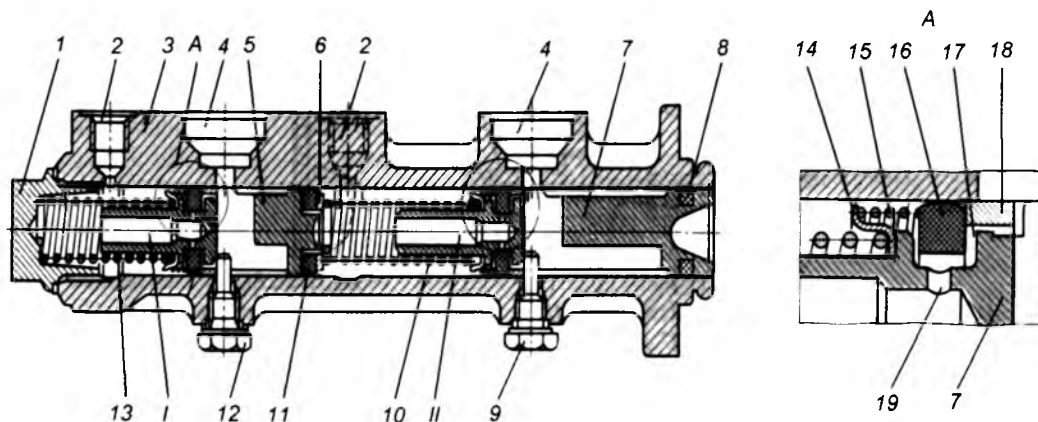
Tormoz boshqarmasining ishonchliligini oshirish uchun gidravlik tormoz

After brake pedal (10) (Fig. 6.12) is pressed by a driver brake fluid (13) pressure is passed to wheel brake cylinders (5) through front pipes (2, 3) and rear pipes (11). Fluid pressure removing pistons (4, 7) turns shoes (1, 14) on axis of support (15) and presses them onto the drum. Friction force is created, which makes resistance to the wheel turning. Fluid pressure is decreased by releasing the pedal. Springs (6) return shoes to initial position. Braking process is completed.

In order to increase the reliability of brake control hydraulic brake drive is

yuritmasi ikki konturli qilib qo'llaniladi. Odatda, ikki konturli gidravllk yuritmani ikki kamerali asosiy tormoz silindri bilan amalga oshirish keng tarqalgan (6.13-rasm).

used with two circuits. Usually, hydraulic brake drive with two circuits is applied with master brake cylinder, which has two chambers (Fig. 6.13).



6.13-rasm. Yengil avtomobilning ikki seksiyali asosiy tormoz silindri:

1—probka; 2, 4, 19 —teshiklar;
3—korpus; 5, 7—porshenlar; 6—shayba;
8, 16—zichlovchi halqalar; 18—chegara-
lovchi halqa; 9, 12 —cheklagichlar;
10, 13, 15—prujinalar; 11—manjet;
14—tarelka; 17—tirqish; I, II—kameralalar.

Figure 6.13. Master cylinder with two chambers of a car:

1—cap; 2, 4, 19—holes; 3—body;
5, 7—pistons; 6—washer; 8, 16—seal
rings; 18—stopper ring; 9, 12—limiters;
10, 13, 15—springs; 11—cup;
14—plate; 17—clearance;
I, II—chambers.

Ikki kamerali asosiy tormoz silindri (6.13-rasm) bir vaqtda ikkala konturni ishga tushiradi. Korpusda (3) ikkita porshen (5, 7) alohida konturlarda bosim oshiradi. Porshenlar (5, 7) silindrda (I va II) kameralarni hosil qiladi. Kameralar teshiklar (2) orqali ikki kontur trubkalariga xoli ulangan. Tormoz silindri teshik (4) orqali tormoz bachogi bilan bog'liq. Tormoz pedali bosilmaganda porshen (5) dastlabki (o'ng) xolatida prujina (13) ta'sirida bo'ladi. Porshen (5) cheklagichga (12), porshen (7) cheklagichga (9) tiralib

Master cylinder with two chambers (Fig. 6.13) operates two circuits at the same time. Two pistons (5, 7) increase the pressure in individual chambers in the body (3). Pistons (5, 7) form chambers (I and II) in the cylinder. Chambers are connected to pipes of two circuits separately through holes (2). Master cylinder is connected to the reservoir through the hole (4). When brake pedal is released the piston (5) is in the (right) initial position under the influ-

turadi. Kameralar bir-biridan manjet (11) bilan ajralib turadi. Dastlabki holatda prujina (15) zichlovchi halqa (16), chegaralovchi halqa (18) va porshen oraliqlarida tirqish (17) qoldiradi. Bu tirqish va teshik (19) orqali kameralar tormoz bachogi bilan o'zaro ochiq bo'ladi. Tormoz yuritmasining ikkala konturida suyuqlikning oshiqcha bosimi bo'lmaydi.

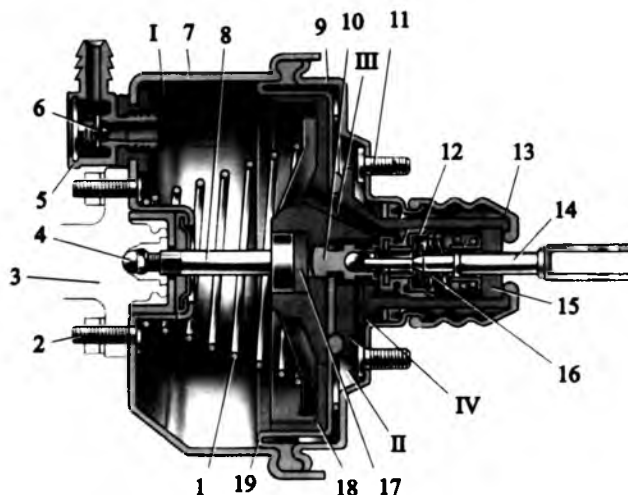
Tormozlanish jarayonida porshen (7) siljiydi, tirqish (17) bekiladi. Porshenning borti zichlovchi halqaga (16) siqiladi. Asosiy tormoz silindridagi suyuqlik porshen (7) siljishi hisobiga oldingi konturga siqib chiqara boshlanadi. Porshen (7) bilan bir vaqtda porshen (5) ham siljib, ikkinchi konturda bosim hosil qiladi. *II* kamerada yuzaga kelayotgan bosim, porshen (5) orqali *I* kameraga uzatiladi. Konturlar soz bo'lganda suyuqlik bosimi ikkala konturda bir xil bo'ladi. Oldingi kontur shikastlanib, bosim pasayib ketgan holda porshen (7) porshenga (5) tiralib uni suradi. *I* kamerada yaratilgan bosim orqa tormoz mexanizmini ishga tushirib, avtomobil harakatini sekinlatadi, to'xtatadi. Orqa kontur ishlamaganda, porshen (5) probkaga (1) tiralib qoladi va *II* kameradagi bosim bilan oldingi tormoz mexanizmining ish faoliyati ta'minlanadi.

Tormoz yuritmalarida haydovchining kuch sarflashini kamaytirish uchun kuchaytirgichlar qo'llaniladi (6.14-rasm).

ence of the spring (13). The piston (5) is stretched to limiter (12), the piston (7) is stretched to limiter (9). Chambers are separated between by means of the cup (11). In initial position the spring (15) leaves the clearance (17) between seal ring (16), stopper ring (18) and the piston. Chambers are united with reservoir through the clearance and the hole (19). There is no excess pressure of fluid in two circuits of brake drive.

The piston (7) removes in braking process and the hole (17) is closed. Piston side is pressed to seal ring (16). By means of moving of the piston (7) the fluid in the master cylinder is forced out to front circuit. Piston (5) moves at the same time with the piston (7) and creates the pressure in the second circuit. The pressure created in chamber *II* is passed to the chamber *I* through the piston (5). If circuits are in good condition, pressures in both circuits are the same. In case of damaging of front circuit and decreasing of the pressure, the piston (7) stretches to the piston 5 and removes it. The pressure created in the chamber *I* operates rear brake, decelerates automobile moving and stops it. In case of damaging of rear circuit, the piston (5) stretches to the cap (1) and provides the action of front brake.

In order to decrease the force consumption by driver, boosters are applied in brake drives (Fig. 6.14).



6.14-rasm. Yengil avtomobilning vakuum kuchaytirgichi:

1, 16—prujinalar; 3—silindr;
6, 12—klapanlar; 7, 18—korpuslar;
8—shtok; 9—qopqoq; 10—porshen;
13—g'ilof; 14—turtkich; 15—filtr;
17—bufer (qaytargich); 19—diafragma;
I, II—bo'shliqlar; III, IV—kanallar.

Figure 6.14. Vacuum booster of a car:

1, 16—springs; 3—cylinder;
6, 12—valves; 7, 18—bodies;
8—pushrod; 9—cap; 10—piston;
13—cover; 14—tappet; 15—filter;
17—bumper (return); 19—diaphragm;
I, II—capacities; III, IV—channels.

Vakuum kuchaytirgich dvigatelning kiritish kollektoridagi xavo siyraklanishi effektidan foydalanishga asoslangan.

Diafragma (19) korpus (7) va qopqoq (9) orasini vakuum (I) va atmosfera (II) bo'shliqlariga bo'ladi. Vakuum bo'shlig'i dvigatelning kiritish kollektoriga shlang bilan ulanadi. Dvigatel ishlayotganda va pedal bosilmaganda ikkala bo'shliqdagi bosimlar bir xil siyrak bo'ladi. Bo'shliqlar kanallar (III va IV), klapan (12) va uning korpusidagi (18) o'rindig'i orqali ulangan. Tormozlanishda bo'shliqlar bir-biridan uziladi, ular ulaydigan kanallar yopiladi. Bo'shliqda (I) dvigatelning kollektoridagi vakuum ta'sirida bosim siyraklashadi. Atmosfera bosimi (II) bo'shliqqa kiradi.

Vacuum booster is based on using of depression effect of air in the intake manifold of the engine.

The diaphragm (19) separates the space between the body (7) and the cap (9) into vacuum (I) and atmosphere (II) capacities. Vacuum capacity is connected with the intake manifold of the engine by hose. When the engine is running and the pedal is released the pressures in the both capacities are the same. Capacities are connected through cannels (III and IV), valve (12) and its saddle in the body (18). In braking capacities are disconnected and channels, that connect them, are closed. Under the act of the vacuum

Ikki bo'shiqdagi bosimlar farqi haydovchining pedalga ta'sir kuchini 5—7 barobar yengillatadi.

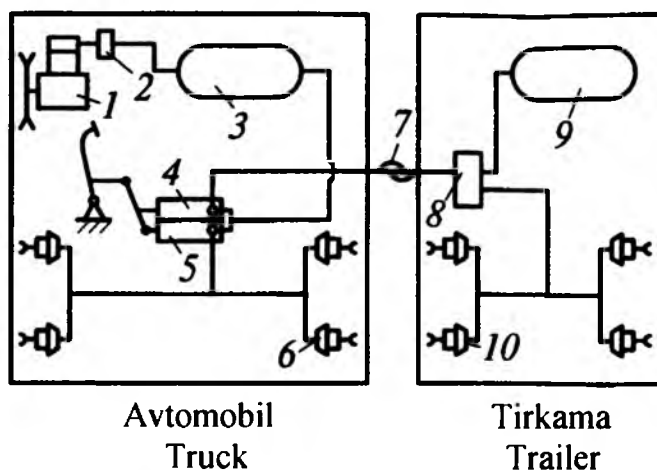
Pnevmatik tormoz yuritmasi o'rta va og'ir yuk avtomobillarida, avtopoyezdlarda, avtobuslarda qo'llaniladi. Avtomobilda siqilgan havo g'ildiraklarga dam urish, g'ildiraklarda bosimni ushiab turish, avtobuslarda eshiklarni ochish-yopish, tirkamalar tormozini tashkil etishda qulaylik bo'lishi va hokazo ishlarga qo'llanishi tormoz yuritmasi pnevmatik turidan foydalanishning afzalligini ko'rsatadi.

6.15-rasmda pnevmatik yuritmalı tormoz tizimining avtopoyezdlarning soddalashtirilgan bir uzatmalı pnevmatik tormoz yuritmasi keltirilgan.

in the intake manifold of the engine the pressure in the capacity (I) is depressed. Atmosphere pressure enters the capacity I. A difference between pressures in both capacities eases the action force of driver onto the pedal for 5—7 times.

Pneumatic brake drives are applied in lorries and trucks, trains and buses. Using pressed air to inflate the tire, to keep the pressure in tire, to open and close the doors of buses, to form the brake of trailer and using it in other devices shows the advantage of using pneumatic brake drives.

Figure 6.15 illustrates a simplified single circuit pneumatic brake drive of brake system of trains.



6.15-rasm. Avtopoyezdlarning bir uzatmalı pnevmatik tormoz yuritmasi sxemasi:

1—kompressor; 2—bosim rostlagich;
3, 9—ballonlar; 4, 5—tormoz kranining
seksiyalari; 6, 10—tormoz kameralari;
7—avtomobil va tirkama tormoz yuritma-
sini ulovchi kallaklar; 8—havo taqsimlagich.

Figure 6.15. The scheme of one circuit pneumatic brake drive of trains:

1—compressor; 2—pressure adjuster;
3, 9—tanks; 4, 5—sections of brake
valve; 6, 10—brake chambers; 7—trailer
coupling; 8—air distributor.

Bir uzatmali pnevmatik tormoz yuritmasida (6.15-rasm) avtomobil va tirkama yuritmalarni ulovchi golovka (7) bitta bo'ladi. Bu ulanish orqali tirkama yuritmasi siqilgan havo bilan ta'minlanadi va boshqariladi. Avtopoyezd harakatlantirish jarayonida kompressor (1) rostlagich (2) orqali avtomobil va tirkamaning ballonlariga (3 va 9) siqilgan havo haydaydi. Tormozlanish jarayonida tormoz kranning seksiyasi (5) tormoz kameralarini (6) ballon (3) bilan ulaydi. Kranning seksiyasi (4) tirkamaning truboprovodini atmosfera bilan ulaydi. Havo taqsimlagich (8) tirkama tormoz kameralarini (10) tirkamadagi siqilgan havoli ballon (9) bilan ulaydi. Bunday konstruksiya, favqulodda avtomobil va tirkama ulanishida uzilish yuz bersa, tirkamaning tormozlanish ishonchligini ta'minlaydi. Shu bilan birga bunday sxema tirkamaning tormozlanish vaqtini kamaytirishga sabab bo'ladi.

Pnevmatik tormoz yuritmasida haydovchining pedalga ta'sir kuchini oshirib berishga yuritmada sodir qilingan 0,8—0,9 MPa havo bosimi xizmat qiladi. Havo bosimini dvigatel validan harakatga keltiriladigan **kompressor** hosil qiladi.

Pnevmatik tormoz yuritmasida bosim o'rnatilgan me'yordan oshib ketmasligi uchun **bosim rostlagich** va bosimni me'yordan oshirmaydigan saqlagich klapanlari o'rnatiladi.

Tormoz krani ishchi tormoz tizimining tarkibiga kiradi va avtomobil hamda tirkama

There is only one trailer coupling (7) in one circuit brake drive (Fig. 6.15). Brake drive of trailer is provided with compressed air and controlled by means of trailer coupling. When the train is moving, the compressor 1 flows compressed air into tanks (3 and 9) of the truck and trailer through adjuster (2). In braking process, the section (5) of brake valve connects brake chambers 6 to tank (3). The section (4) of the valve connects the piping of trailer to atmosphere. The air distributor (8) connects brake chambers of the trailer to compressed-air tank (9). Such construction provides braking reliability of the trailer in case of disconnection of trailer coupling. In addition, such scheme is reason of decreasing the braking time of the trailer.

The air pressure 0,8—0,9 MPa created in the drive serves to increase the action force of driver onto the pedal in pneumatic brake drive. The **compressor** driven by the crankshaft of the engine creates the air pressure.

In order to prevent increasing the pressure over fixed value, pneumatic brake drive is equipped with **pressure adjuster** and safety valves.

The **brake valve** is the part of service brake system and it controls creating the braking force in wheel brakes of the truck and the trailer.

g'ildiraklari tormoz mexanizmlarida tormozlovchi kuch hosil qilishni boshqaradi.

Qo'l tormoz krani to'xtatib turish yuritmasidagi prujinali energoakkumulyatorlar va zahira tormoz tizimini boshqarish uchun xizmat qiladi.

Energoakkumulyatorli tormoz kameralari to'xtatib turish tormoz tizimlarida xizmat qiladi. Energoakkumulyatorli tormoz kamerasi tormoz kamerasidan va prujinali energoakkumulyatordan iborat (6.16-rasm).

Avtomobil dvigateli o'chirilib, to'xtatib turish tizimi ishga tushirilganda silindr (7) bo'shlig'idan havo kanal (I) orqali atmosferaga chiqariladi. Energoakkumulyator prujinasi (9) porshenni (8) pastga suradi. Turtkich (12) tayanchi (6) orqali diafragma ta'sir ko'rsatadi. Disk (4) shtokni (1) suradi. Tormoz mexanizmi mushtchasi buralib, kolodkalarni barabanlarga siqadi.

Dvigatel o't oldirilganda kompressor va ballonlarda yig'ilgan siqilgan havo kanal (I) orqali silindr (7) bo'shlig'iga yuboriladi. Siqilgan havo bosimi prujinani (9) siqib, porshenni (8) yuqori chekki nuqtaga ko'taradi. Porshenning yuqorisidagi kamera trubka (11), kamera korpusi (2) va undagi teshik orqali tashqariga ulangan. Shtok (1) prujina (13) bilan siljiriladi, kolodkalar barabanlardan ajraydi, g'ildirak harakatlana oladi.

Yuritmada siqilgan havo bo'lmaganda to'xtatib turish tormoz tizimidan tormozlangan g'ildiraklarni bo'shatish uchun vintdan (10) foydalaniladi.

Hand brake valve serves to control the spring brake in parking brake drive and emergency brake system.

Spring brake chambers serve in parking brake system. Spring brake chamber consists of brake chamber and spring brake (Fig. 6.16).

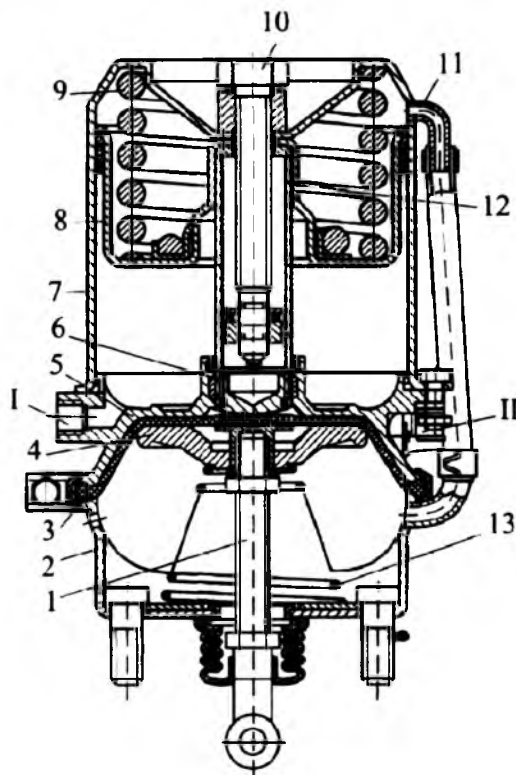
When the engine is switched off and parking brake system is operated the air is pushed out to atmosphere from cylinder capacity (7) through channel (I). The spring (9) of the brake removes the piston (8) downward. The tappet (12) acts the diaphragm via the support (6). The disk (4) moves the pushrod (1). The cam of brake mechanism turns and presses shoes onto drums.

When the engine is switched on, stored and compressed air in the compressor and tanks is flowed to the cylinder capacity (7) through channel (I). The pressure of compressed air presses the spring (9) and moves the piston (8) upward to the top point. The chamber above the piston is connected to outside through the pipe (11), chamber body (2) and the hole on it. Pushrod (1) is moved by spring (13), shoes are depressed from drums, the wheel can move.

In order to release braked wheels by parking brake system the screw (10) is used if compressed air is absent in drive.

Ko'pchilik insonlar vaqtida ikki ne'matning qadriga etmaydilar: salomatlik va bo'sh vaqt.

Hadis



6.16-rasm. Energoakkumulyatorli tormoz kamerasi.

1—shtok; 2—kamera korpusi;
3—diafragma; 4—disk; 5—flanes;
6—turtgich tayanchig'i; 7—silindr;
8—porshen; 9, 13—prujinalar; 10—vint;
11—trubka; 12—turtgich; I, II—kanallar.

Ishchi tormoz tizimi ishga tushirilganda, orqa g'ildirak tormoz mexanizmlari pnevmatik tormoz kameralari orqali ishga tushiriladi. Siqilgan havo bosimi kanal

Figure 6.16. Spring brake chamber.

1—pushrod; 2—chamber body;
3—diaphragm; 4—disk; 5—flange;
6—tappet support; 7—cylinder;
8—piston; 9, 13—springs; 10—screw;
11—pipe; 12—tappet; I, II—channels.

When service brake system is operated rear wheel brakes are operated by means of pneumatic brake chambers. The pressure of compressed air gets above

(II) orqali diafragma (3) ustiga keltiriladi va u o'z navbatida disk (4) orqali shtokka (1) ta'sir ko'rsatib, tormozlanishni ta'minlaydi. Tormoz pedali qo'yib yuborilganda siqilgan havo tashqariga chiqadi, diafragma va shtok dastlabki holatga qaytadi.

the diaphragm (3), acts the pushrod (1) via the disk (4) and provides braking. When the pedal is released, compressed air is pushed out, the diaphragm and the pushrod resets.

Nazorat uchun savollar

Self-control questions

1. Tormoz boshqarmasining vazifasi nima?
2. Tormoz tizimlarining turlari.
3. Barcha tromoz tizimlarining vazifasini tushuntiring.
4. Tormoz mexanizmlarinign vazifasi nima?
5. Tormoz mexanizmining turlari qanday?
6. Tormoz yuritmalarining vazifasi nima?
7. Tormoz yuritmalarining turlari.
8. Gidravlik tormoz yuritmasining ishlashini tushuntiring.
9. Pnevmtic tormoz yuritmasining ishlashini tushuntiring.
10. Tormoz yuritmalarinig qo'llanilishini gapirib bering.

1. What is the function of brake control?
2. Types of brake systems.
3. Tell about functions of all the brake systems.
4. What is the function of brakes?
5. Types of brakes?
6. What is the function of brake drives?
7. Types of brake drives.
8. Describe the operating process of hydraulic brake drive.
9. Describe the operating process of pneumatic brake drive.
10. Tell about application of brake drives.

UZBEK-ENGLISH DICTIONARY

dimension
gas
gas analyzer
gasifier
nut
generator
hydraulic

gidravlik tizim	hydraulic system
gidralik bosim	hydraulic pressure
gidromufta	fluid (hydraulic) coupling
gidronasos	hydraulic pump
gidrotransformator	torque(fluid) converter, hydromantic converter
gidrosilindr	jack, hydraulic ram
gidroyuritma	hydraulic actuator, hydraulic drive
g'ildiraklar	car wheels
g'ildirakli transport vositasi	wheeled vehicle
gilza	liner, sleeve, muff, shell
globoid	globoid

D

datchik	pickoff, pickup, sensor, transducer
dvigateldan olinadigan quvvat	engine output
dvigatel	engine, motor
dvigatel V-simon	V-type engine
dvigatel quvvati	engine capacity
delitel, pog'ana oralig'ini bo'lish, tezlatgich pog'anasini hosil qilish	divider, splitter
demultiplikator, yuqori pohana qiymatini oshirish va pog'analar orallg'ini bo'lish	demultiplier, splitter
detal	part, element, member, piece, unit, detail
diametr	diameter
diafragma	diaphragm
diafragmatidagi prujina	diaphragm spring
dizel	diesel
diskli tormoz	disc brakes
differensial	differential
diffuzor	diffuser, air funnel, choke tube, venture
drossel	throttle

Y

yonilg'i baki qopqog'i	gas cap
yonilg'i berish pedali, drossel zaslonkasini boshqarish pedali	accelerator pedal
yonilg'i parlari	fuel vapors
yonilg'i sarfi	fuel consumption
yonilg'i ta'minlash tizimi	fuel system
yordam	aid
yordamchi uskunalar	accessories
yetaklanuvchi disk	driven plate
yetakchi val	inner (drive) shaft
yetakchi tormoz kolodkasi	leading shoes
yetishganlik, erishganlik	achievement
yetishmoq	achieve

J

jalyuzi	blind, louvers, screen, shutters, gill
jikler	jet, nozzle, bleed

Z

zavod	factory, mill, plant, works
zaglushka	choke, gag, (core) plug
zamonaviy talablarga moslik	meet up-to-date requirements
zapas g'ilirak	spare wheel
zarba, turtki	kick, down
zaryad	charge
zaslonka	choke, flap, gate, shutter
zveno	link, member
zolotmk	valve

I, Y

yig'ma, agregat, komplekt	assembly
yig'moq	assemble
ilashish muftasi	clutch
ilashish muftasi pedali	clutch pedal

imkon bermoq	permit	konus shesterniyali dif-	spiral bevel differential
inersiya bo'yicha xarakatlanish	coasting	ferensial	
yo'lda xarakatlanmoq	road travel	kord, shina karkasi	cord
ichki yonuv dvigateli	internal combustion engine	krivoship	crank, toggle
		kronshteyn	bracket, carrier, out-rigger
ichki qism	inner portion	kuzov, korpus	body, case, shell, housing
ishlab chiqarish	manufacturing		
ishlab chiqarish jara-yoni	manufacturing processes	kulachok	cam, tappet
ishlab chiqarmoq	manufacture	ko'p diskli qurilma	multi-disc device
ishonchii tormoz	dependable brakes	uzatmalar qutisi ko'p	multiple-speed gearbox
ishchi silindrlar	operating cylinders	pog'anahi	
		kuch agregati	power plant
		kuch uzatma, transmissiya	power train

K

kabina	cab
kallak	head, end
kamera	cell, chamber, compartment, room
kamerasiz g'ildirak	tubeless
kanal	channel, duct, passage, port
kapot	bonnet, cowl(ing), hood
karbyurator	carburetor
kardan	cardan
kardan vali	propeller shaft
karkas	carcass, frame, basic structure
karter	case, casing, housing
katalitik o'zgartirgich	catalytic converter
kattalashtirmoq, ko'tarmoq	increase
kislota	acid
klapan	valve
klemma	post, terminal
knopka	knob
kollektor	manifold
kolodka	block, shoe
kolonka	column
kompensator, moslagich	compensator
kompressor	compressor, blower
konveyer, transport	conveyor
kondensator	capacitor, condenser
konsruksiya	construction
kontakt	contact

Q

qanotlar	fenders
qoplama	adjustment
qurilma	device
quti	box
quyush bo'yni	throat, waist, neck

L

listli ressa	leaf spring
litraj	displacement
loyihalamoq	design
lonjeron	girder, frame rail
lyuft	looseness, play, slack

M

manjet	collar, cuff, cup
manometr	pressure, indicator, manometer
markazdan qochma	centrifugal forces
kuch	
massa	bulk, mass
masshtab	measure, scale
material	cloth, material
maxovik	flywheel
membrana	diaphragm
metanol	methyl alcohol, methanol
mexamizm	device, gear, mechanism

spidometr	speedometer
stabilizator	stabilizer
starter	starter
sath	level
stend sinovii	laboratory test
stopor halqa	retaining ring
so'ndirgich	extinguisher, damper, muffler, silencer
so'ndirgich	damper, muffler, silencer
support	carriage

T

takomilashtirmoq	improve
takomillashtirish	improvement
takt	stroke, cycle
taqsimlash vali	camshaft, distribution shaft
taqsimlash vali yuqorida joylashgan	overhead camshaft
taqsimlash qutisi	splitter, transfer gearbox
talabga mos bo'lmoq	suit requirements
talablar	demands
tarelka	plate, dish
tarkibga ega bo'lmoq	consist of
ta'minlamoq	provide
tayanch nuqta, sharnir	fulcrum
o'qi	
tezlanish	acceleration
tezlatmoq, tezlanmoq	accelerate
termostat	thermostat
tirsakli val	crankshaft
tirsakli val	crankshaft
tok	current
tormoz	brake
— ishonchli tormoz	— dependable brakes
— diskli tormoz	— disc brakes
— barabanli tormoz	— drum brakes
tormoz kuchi, tormozlanish kuchi	braking force
tormoz pedali	brake pedal
tormoz ta'siri, samarasi	braking effect
torsion	torsion bar
tortuvchi kuch, harakatlantiruvchi kuch	tractive effort
transport	transport

transport vositasi	vehisle
trassa, shosse	highway
tros	cable, rope
to'la yuritmal	all-wheel drive
turbokompressor	turbo-charger
to'rt g'ildiragi yetakchi	four-wheel drive
to'xtatib turish tormozi	park brake

O', U

o'z ichiga olish,	comprise
tarkibiga kirish	
uzatish soni	ratio
uzatmalar qutisi	change gear(box)
uzatmoq, yetkazmoq	deliver
uzel, blok, qism,	component
o'zi ag'daruvchi	dumper, tipper, dump track
o'q, ko'prik	axle
— orqa ko'prik	— back axle
o'qqa, ko'prikka yuklama	axial thrust
ulamoq	link
ulamoq, biriktirmoq	connect
ulangan holatda	engaged position
ulash	engage
o'rnatmoq, montaj	installation
qilmoq, yig'moq	
o't oldirish tizimi	ignition system
o'chirish, ajratish	disengagement
uchqun o'chirgich	spark arrester, spark trap
uya	socket, nest, pocket, rabbet, rebate

F

fara	lamp, headlight
fiksator	catch, clamp
filtr	cleaner, filter
flanes	flange
fonar	lamp, light
forkamera	antechamber
forsunka	atomizer, injector, jet, nozzle
frikcion disk	friction disc

frikсион qoplama	friction pad
frikсион material	friction material
frikсион ilashish muf-tasi	friction clutch
furgon	van

X

xavfsiz xaydamoq (xarakatlanmoq)	driving safety
xisoblamoq, tasavvur qilmoq, ko'rib chiqmoq	consider
xisoblamoq, tasavvur qilmoq, ko'rib chiqmoq	consider
xrapovik	ratchet (wheel), click

H

havo oqimi	flow of air
havo filtri	air cleaner, air filter
havo haydagich	turbo-charger

CH

chervyak	screw, worm
chiqarish	bleeding, discharge
chiqarish quvuri	tailpipe
chiqish (ikkilamchi) val	outer shaft
chiquvchi quvvat	power output

SH

shayba	disk, washer
shamollatish	ventilation, aeration
sharnir	hinge, joint, pivot
sharnir, shkvoren, aylanish o'qi	pivot
shassi	chassis, running gear
shatun	link, pitman, connecting rod
sheyka, bo'yincha	journal, neck, pin
shesternya	gear (wheel) pinion, toothed wheel
shina	tire
shkvoren	pin

shlang	hose, flexible, line
shovqinsiz kuch uzat-masi	quiet-running power unit
shpilka	bolt, fld, stud
shplint	cotter, pin
shponka	key, tongue
shtanga	link, rod
shtok	guide, bar, shaft, stem
shu xisobiga	due to

E

ega bo'lmoq	possess
egiluvchan	flexible
ekonomayzer	economizer
ekscentrik	eccentric
elektr motor	electric motor
elektr tizimi	electric system
elektrod	electrode
elektrolit	electrolyte
elektromobil	electro mobile
erkin xarakatlanish muftasi	one-way free-wheel
etanol	ethyl alcohol, ethanol
eshik	door

Y

yubka	skirt
yuk avtomobili	truck
yuk ko'tarish mexa-nizmi, pod'emnik	hoist
yuqori fik	high efficiency
yuritma	drive
yakunlamoq	complete
yaratish	development
yaratmoq, ishlab chiqmoq	work out
yarim o'q	axle shafts

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