

高等院校“十一五”规划教材·汽车类

汽车专业英语

English for Automobile Engineering

陈 勇 边明远 主编

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内 容 简 介

本书内容涉及汽车工程专业领域的主要内容,包括汽车结构与原理、汽车维修装备、汽车商务、汽车修理与保险以及汽车新技术等内容。全书共分五章,每章均包括课文和采用英英、英汉注释的词汇两部分。本书可作为大中专院校汽车相关专业的英语教材或双语教材,也可以作为相近专业学生的课外参考书以及从事汽车相关领域相关工作人员了解专业技术的参考资料。

Introduction

This book involves the major contents in automobile engineering, which includes automotive structure & fundamentals, automobile servicing equipments, automobile business, automobile repair & insurance and advanced automotive technologies. The book is divided into five chapters, each of which contains a text and vocabulary explanation in English-English and English-Chinese. It is intended to provide specialized English textbook for students majoring in Automobile Engineering. At the same time, it is hoped that the book provides reference to students in the related subjects and to engineers working in Automobile Engineering.

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出版说明·

近几年，我国的汽车生产量和销售量迅速增大，全国汽车保有量大幅度上升，世界各知名汽车企业纷纷进入国内汽车市场，促进了国内汽车技术的发展。汽车保有量的急剧增加和汽车技术的不断更新，使得汽车运用与维修行业的车源、车种、服务对象以及维修作业形式都已发生了新的变化，以致技能型、运用型人才非常紧缺。

本套教材针对汽车专业学生教学特点的变化和新形势下教材的编写要求，面向高等院校（应用型），以服务市场为基础，以提高能力为本位，注重培养学生的综合能力，同时合理控制理论知识，丰富实例，力求突出应用型学科教材的实用性、操作性特色。

本套教材可供开设有汽车运用工程、汽车服务工程、汽车交通与运输、汽车维修等汽车相关专业的高等院校使用，也可作为成人高等教育、汽车技术培训等相关课程的培训教材。

本套教材经编委会相关老师评审，做了适当的修改，内容更具体、更实用，特推荐出版。但限于水平和经验，本套图书难免存在不足之处，敬请广大同行和读者批评指正。

丛书编委会

前言

本书是根据“高等院校‘十一五’规划教材（汽车类）编写研讨会”确定的教材编写规划进行编写的。

随着汽车技术的不断进步、汽车保有量的不断增加，汽车已经逐步进入家庭，成为人们工作和生活的重要组成部分，提供汽车的相关知识以及后市场服务已非常必要。

本书涉及汽车工程相关专业领域的主要内容，包括汽车结构与原理、汽车维修装备、汽车商务、汽车修理与保险以及汽车新技术等内容。全书共分五章，每章均包括课文以及重点或难点词汇的注释，注释采用了英英、英汉两种方式。

本书可作为大专院校汽车工程专业的专业英语教材或双语教材，也可以作为相近专业学生的课外参考书以及从事汽车相关领域相关工作人员了解专业技术的参考资料。

本书主编为辽宁工业大学陈勇、清华大学边明远，副主编为中国农业大学李真芳、李淑艳和天津工程师范学院张蕾。编写的分工如下：陈勇（第1章第1节，第5章），边明远（第1章第2、3、4、5、6节），李真芳（第2章），张蕾（第3章），李淑艳（第4章）。

由于编写时间仓促，编者水平有限，书中难免有错漏之处，敬请读者批评指正。

编者

PREFACE.

This book is edited according to composing requirements of the Teaching Direction Committee on Automobile Engineering.

As automotive technology improvements and increase in the registered number of automobiles, automobiles have played an important role in people's work and life. It is essential to provide related knowledges and after-market services to the buyers and owners of automobiles.

This book involves the major contents in Automobile Engineering, which includes automotive structure & fundamentals, automobile servicing equipments, automobile business, automobile repair & insurance and advanced automotive technologies. The book is divided into five chapters, each of which contains texts and vocabulary explanation in English-English and English-Chinese.

It is intended to provide specialized English textbook for students majoring in Automobile Engineering. AT the same time, it is hoped that the book provides reference to students in the related subjects and to engineers working in Automobile Engineering.

As editors in chief, Dr. Prof. Chen Yong in Liaoning University of Technology and Dr. Associate professor Bian Mingyuan in Tsinghua University are responsible for edition of this book. Associate professor Li Zhenfang and Li Shuyan in China Agricultural University and Zhang Lei in Tianjin University of Technology and Education take part in the edition.

We are very grateful to a number of readers for their comments. Reader's comments on the book will be welcomed so that their annotations will be of great value when the book is revised.

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Chapter 1

Automotive Fundamentals

1.1 The Automobile

The modern automobile, as you know, evolved from the horse-drawn carriage which was gradually replaced in the early part of last century. Early automobiles even looked like carriages. As the automobile made a place for itself in our daily lives, it also became more and more expensive to purchase, use, and maintain. Automobile expenses now account for a substantial portion of most family budgets. In fact, one out of every four retail sales dollars goes for an automotive-related purchase.

To make the best buy, a consumer must understand how cars work and what kinds of attention they need to stay in good shape. Knowledge of the automobile is equally important for anyone considering employment in the automotive industry. This chapter will begin the study of the automobile with an examination of its major components- frame, body, engine, drivetrain, and chassis (Fig. 1 – 1).

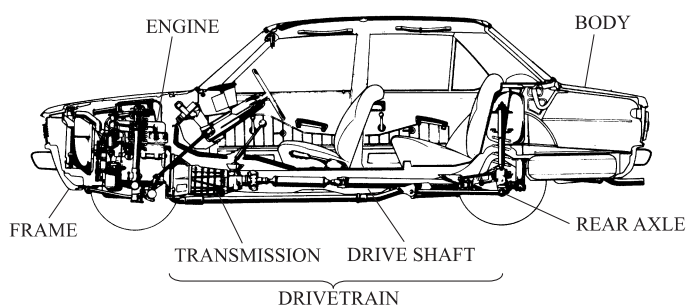


Fig. 1 – 1 Major parts of a car

1.1.1 Frame

The frame is the foundation of the automobile, a platform to which the rest of the automobile components are attached. Each frame member, or separate part of the frame, is constructed of heavy steel bars welded into a square or box shape. These tough frame members, well-suited to supporting the car's tremendous weight, are fastened together in different framework designs.

One popular frame design uses two large side rails running beneath the sides of the car and a

number of cross pieces, called cross members. This design is often called a ladder frame (Fig. 1 - 2) because it resembles a stepladder. The ladder frame has one serious disadvantage. During a collision, the impact on one or another corner of the frame could push the frame out of square, resulting in the need for an expensive frame straightening.

In attempting to strengthen the ladder frame, car designers came up with the x-member frame, as shown in Fig. 1 - 3. The x-member frame uses two large members that cross under the center of the car. These members are welded to the frame's side rails and cross members.

Some automobiles are constructed without a regular frame. In these vehicles a very thick sheet of metal, called the floor pan, is used to support the car. The body of the car is welded directly to the floor pan. The other components are attached to the body-floor pan assembly. This design, a unitized body (shown in Fig. 1 - 4) or monocoque design, lends some advantages in terms of weight savings, and lower floor and production costs.

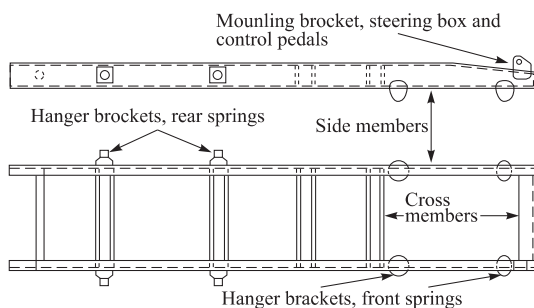


Fig. 1 - 2 Ladder frame

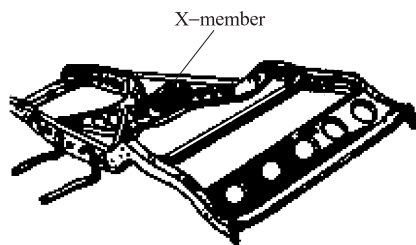
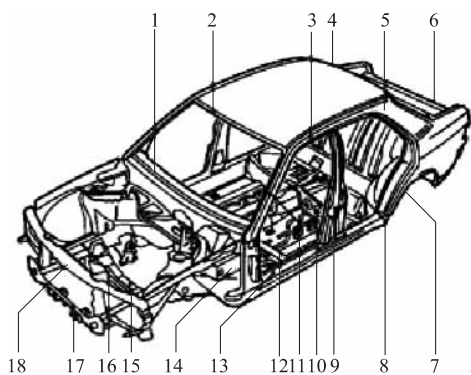


Fig. 1 - 3 X-member frame



- 1—Cross member under windshield; 2—Roof frame, front;
- 3—Roof frame, side; 4—Roof frame, rear; 5—C-pillar;
- 6—Rear-facing panel; 7—Rear floor and spare-wheel pan;
- 8—Side member, rear; 9—B-pillar; 10—Cross member under rear seat;
- 11—A-pillar; 12—Cross member under driver's seat; 13—Side member;
- 14—Wheel well; 15—Engine-support cross member; 16—Side member, front;
- 17—Cross member, front;
- 18—Radiator cross member.

Fig. 1 - 4 Unitized body

The relative merits of frame construction versus the unitized body, in terms of ability to withstand a crash, have not been fully determined. There is a growing conviction, however, that the sheet metal in the unitized construction may absorb the energy of impact more effectively than the rigid members of a frame.

Unitized construction suffers from one clear disadvantage: road noise. When a car has a

frame, the passenger compartment can be insulated from road noise by the insertion of rubber biscuits between the frame and body. With unitized construction, the noise telegraphs from the road directly into the passenger compartment.

1.1.2 Body

The automobile body encloses the chassis, making the car comfortable to drive. It also makes the car more useful and nicer to look at. The body comprises fenders, hood, doors, roof, trunk lid, floor, seats, windows, dashboard, lights, windshield wipers, grille, and bumpers.

Today, body design is influenced not only by a desire to protect people from the elements and offer an esthetically pleasing vehicle, but also by the need to protect passengers in a crash. Crash testing now plays a major role in body design.

The modern automobile body is constructed from sheets of steel formed to the required shape in giant punch presses. Most of the body components are welded together to form a tight, rattle – free unit.

Automobiles of today have developed into many different body styles befitting their varied uses. Although bodies are manufactured in an almost infinite variety, it is possible to categorize all body styles by size and type. The five body sizes are:

Mini-compact — which is less than 85 cubic feet of passenger and luggage volume.

Subcompact — which is between 85 to 100 cubic feet of passenger and luggage volume and has the lowest original cost and delivers the best fuel economy.

Compact — which is between 100 to 110 cubic feet of passenger and luggage volume and a largely North American term denoting an automobile smaller than a mid-size car, but larger than a subcompact car, and gives additional room in the front and rear seats as well as added crash-protection for passengers.

Midsize — frequently referred to as an intermediate, which is between 110 to 120 cubic feet of passenger and luggage volume and the North American term for an automobile with a size between that of a compact and a full-size car and provides what many consider to be the best trade-off between economy and comfort.

Large — a full-size car the equivalent class in Australian terms, which is more than 120 cubic feet of passenger and luggage volume. A full-size car is a term used in North America for an automobile larger than a mid-size car.

All of these sizes can apply to the eight body types, shown in Fig. 1 – 5.

Two-door sedan — which is similar to the 2 Door Coupe, but a sedan has at least 33 cubic feet of rear interior volume, where as a coupe has less than 33 cubic feet.

Four-door sedan — which is a 4 door, with a B pillar that extends from the floor to the roof. This style generally hold 6 passengers, and is used in many years.

Convertible — whose body style with a removable or retractable roof and rear window.

Hardtop — originally referred to a removable solid roof on a convertible; later, also a fixed-roof car whose doors have no fixed window frames, which is designed to resemble such a

convertible.

Hatchback — identified by a rear door including the back window that opens vertically to access a storage area and is not separated from the rest of the passenger compartment.

Station wagon — which is a car with a full-height body all the way to the rear; the load-carrying space created is accessed via a rear door or doors.

Pickup truck — which is small or medium sized truck.

Van — in North America van refers to a truck-based commercial vehicle of the wagon style, whether used for passenger or commercial purpose.

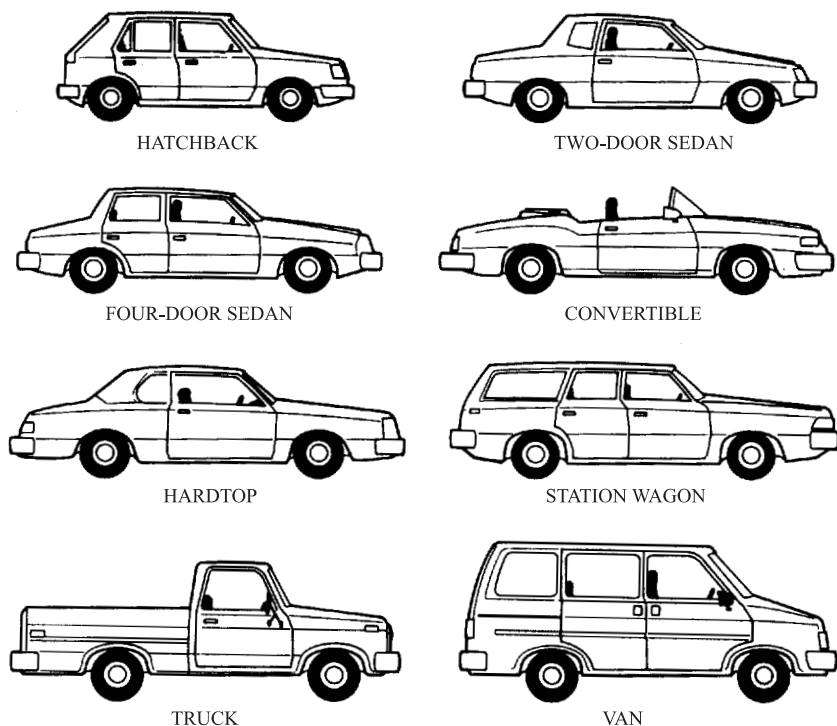


Fig. 1 - 5 Automobile body styles

1.1.3 Engine

An engine (Fig. 1 - 6) is a machine that turns heat energy into mechanical motion. In so doing it consumes fuel. The engine, sometimes called the powerplant, makes the car go by using the explosive power of a mixture of gasoline and air or diesel fuel and air to push the pistons. The pistons are connected to a crankshaft and force it to turn. The rotating force of the crankshaft is used to make the car's wheels turn. In developing this power, the engine utilizes six different systems, described below.

(1) Fuel System pumps gasoline from the gas tank and mixes it with air so that the proper air/fuel mixture can flow into the cylinders.



Fig. 1 – 6 Automobile engine

(2) The ignition System produces an electric charge and carries it to the spark plugs through ignition wires.

(3) The lubrication system supplies oil to the engine parts so they can move easily to prevent wear.

(4) The cooling system removes destructive heat from the engine components. The radiator and the water pump are used to circulate water around the cylinders. The water then travels through the radiator to cool it off.

(5) The electrical system provides electrical energy for starting, charging, ignition, lights, and accessories. The battery powers the electrical parts of a car (ignition system, radio, headlights, windshield wipers, power windows, power seats, and computers). The alternator generates electricity to recharge the battery and is connected to the engine by a belt.

(6) The emission control system or systems reduces or prevents the escape of pollutants into the atmosphere. The exhaust pipe directs smoke from the combustions out of the system and the muffler quiets the sound.

The most common American practice is to install the engine in the front of the car, because a front-mounted engine is readily accessible and can be cooled easily. European designers have often used rear-engine placement, which means the front of the car can be made more streamlined for better fuel economy. Also, the hood can be lower, driver visibility can be increased, and the engine's weight over the rear wheels can serve to increase traction in a rear-drive car.

Although front- or rear-engine placement is most common, the engine can also be placed in the middle of the car. The earliest cars, in fact, used mid-engine placement. When something went wrong with the engine, the driver had to get out and lift up the seat to work on it.

Mid-engine installation is now enjoying a resurgence in some cars. A mid-engine car handles very well because the heavy engine in the middle of the car provides the best possible weight distribution. Like the early vehicles, however, today's mid-engine car still suffers from inaccessibility. And instead of having the engine under the seat, a modern mid-engine sports car has the engine behind the driver, which eliminates the rear seat.

1.1.4 Drivetrain

The power developed by the engine must be transferred to the drive wheels. Delivering engine power to the driving wheels is the job of the drivetrain. It comprises the clutch (on manual-transmission car), transmission, (sometimes) drive shaft with universal joints, differential gearing, and drive axles and wheels. The main component of the drivetrain is the transmission, which contains a system of gears used to multiply the engine's turning effort to get the car going forward or, when necessarily, backward. A drive shaft is used to transfer power from the transmission to the drive axle assembly. The drive axle assembly contains another system of gears that transfers the engine's power to each of the drive wheels.

The engine is mounted on the frame or underbody of the automobile. The position of the engine and the drive axle vary the layout of the automotive drivetrain. Four kinds of drivetrain arrangements (Fig. 1 - 7) are common in today's cars: front engine rear-drive, front engine front-drive, rear engine rear-drive, and mid-engine rear-drive.

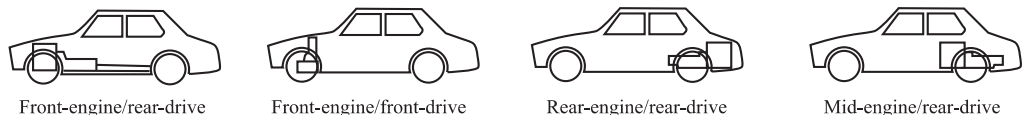


Fig. 1 - 7 Driver train arrangements

The typical drivetrain arrangement with a front-mounted engine is Rear-Wheel Drive (RWD). This means the engine's power is sent to the rear wheels, which push the car along. With the exception of light commercial vehicles, all lorries have the engines at the front or centrally between the front and rear axles together with RWD vehicles.

An alternative drivetrain arrangement with a front-mounted engine, however, is Front-Wheel Drive (FWD), which applies the driving force to the front wheels rather than the rear wheels. With this arrangement, the transmission and drive axle assembly are all combined in a single unit called the transaxle and mounted in the front of the vehicle.

FWD has some advantages. The car may hold the road better on curves, since the drive is through the front wheels, which carry a heavier load. There is no hump in the passenger compartment caused by routing the drive shaft under the vehicle, which maximizes passenger space or enhances cargo area. The vehicle has less weight because there is no long drive shaft and separate rear differential housing. Lower weight results in higher fuel economy.

There are two basic arrangements of FWD. The lengthwise mounting has the engine mounted in the standard front-to-back position. The engine may be mounted ahead, behind, or on top of

the driveline components.

In the transverse configuration, the engine is mounted sideways, perpendicular to the length of the car. The transverse layout is popular because it requires the least amount of engine compartment space and allows more space for the passengers.

When the engine is placed in the rear of the car, the transmission and drive axle assembly are usually also in the rear. This eliminates the long drive shaft.

Another type of drivetrain arrangement is Four-Wheel Drive (4WD), with the engine's power directed to driving axles located at both the front and rear of the vehicle. When 4WD is engaged, all of the wheels are driven by the engine, and maximum traction can be achieved. The vehicle is able to climb steep hills and drive through deep sand or snow. The extra components required for 4WD make it an expensive addition, mostly appropriate for off-the-road vehicles such as jeeps and trucks. But 4WD is also used in some late model passenger cars. Often confused with 4WD, All-Wheel Drive (AWD) automatically splits engine torque between the front and rear wheels as needed, improving on-road traction in unfavorable road conditions. Unlike 4WD, AWD is an on-road system and is not designed for off-road use. AWD does not require the driver to actively engage the system. It is operational at all times, and requires no switches, lights or visor instructions for system operation.

1.1.5 Chassis

The term chassis describes all the parts of the automobile under the body. The chassis forms the main structure of the modern automobile. A large number of designs in pressed-steel frame form a skeleton on which the engine, wheels, axle assemblies, transmission, steering mechanism, brakes, and suspension members are mounted. During the manufacturing process the body is flexibly bolted to the chassis. The major components of the basic chassis are the frame, engine, drivetrain, wheels, tires, steering, brakes, suspension and steering-everything needed to drive the car (Fig. 1 – 8). In addition, several other systems are mounted to the chassis assembly. The wheels of the automobile are connected to the frame by a system of springs, shock absorbers, and linkages that make up the car's suspension system. The suspension system absorbs road shocks as the vehicle travels over rough roads and holds the tire and wheel in correct alignment with the car and the road. It also allows the tires and wheels to move up and down relative to the body over bumps and chuckholes.

Another important chassis component is the steering system, which allows the driver to control the direction the car travels. The steering wheel, which the driver controls, is connected to a gearbox that multiplies the driver's effort. The gearbox is linked to the front wheels of the vehicle.

The last major chassis component is the braking system, the function of which is to either reduce the vehicle's speed, bring the vehicle to a halt, or keep it stationary if already halted. When the driver pushes on the brake pedal, hydraulic fluid is forced out of a master cylinder to each of the four wheels. The resulting hydraulic pressure operates a drum or disk brake assembly to slow or stop the car's wheels.

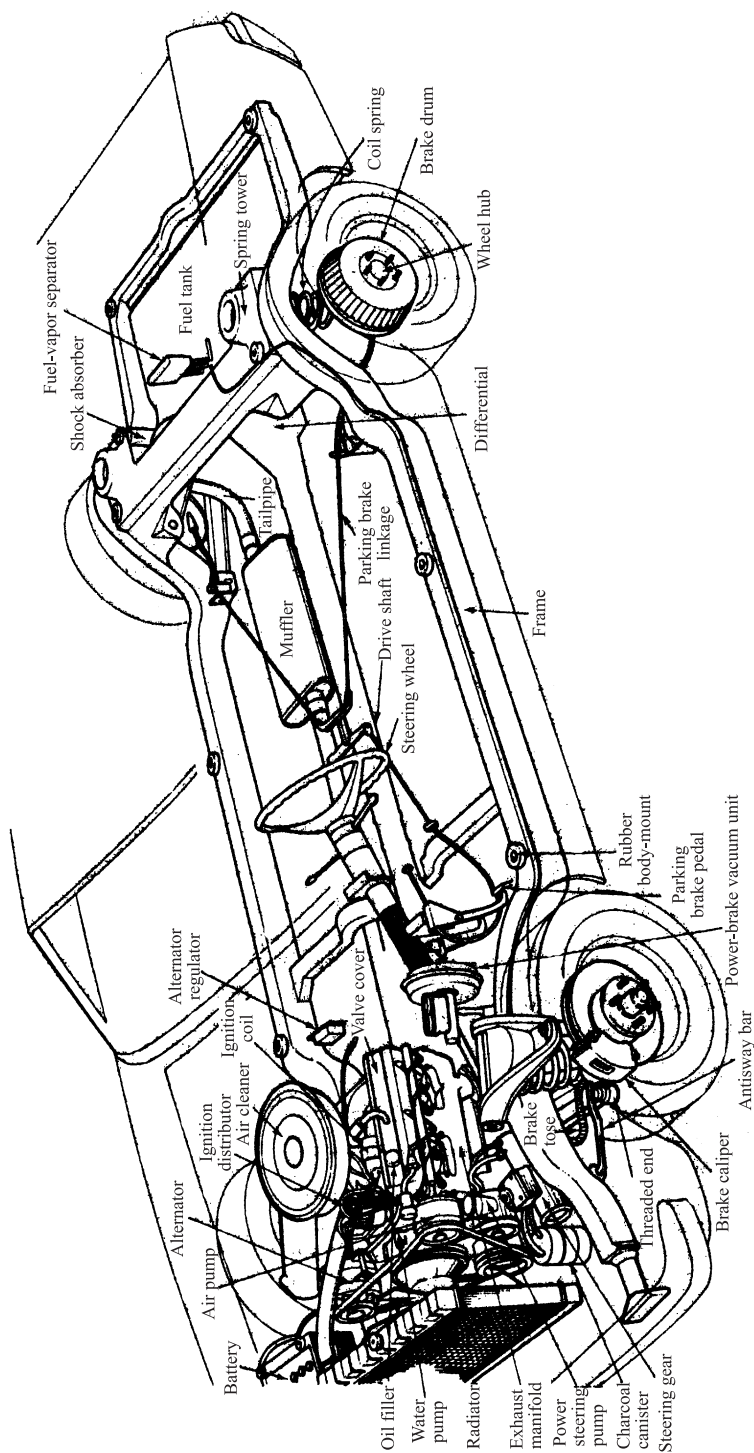


Fig. 1-8 Automobile chassis

Key Words and Expressions

- Frame — The platform or foundation of the automobile to which the body, engine and running gear are attached. 车架
- Cross member — The frame members that run between the side rails. 横梁
- Body — The structure of the car that encloses the driver, passengers, engine compartment, and trunk. 车身
- Fender — Any fixed side-panel of a vehicle that partially shrouds a road wheel. 翼子板
- Hood — Hinged or removable body panel by which access is gained to the engine compartment of a vehicle. 发动机罩
- Trunk lid — The entire back of the vehicle lifts up (using a liftgate or hatch). 后厢盖
- Floor — The base panel of a passenger car. 地板
- Dashboard — Interior panel beneath the windscreen or windshield, on which instruments are mounted. 仪表板
- Windshield wiper — Oscillating blade, with flexible rubber blade, for cleaning and removing water from a windshield or windscreen. 刮水器
- Grille — Decorative and protective grid at front of vehicle. 格栅
- Bumper — Horizontal bar mounted at front and rear of vehicle to prevent or reduce damage in low-speed impacts, and to absorb impact energy. 保险杠
- Engine — The main power unit of a vehicle, converting the energy of a liquid or gas fuel into mechanical energy. 发动机
- Drivetrain — The path through which power flows from the engine to the drive wheels. 传动系
- Transmission — A gearbox used to multiply torque and allow various vehicle speeds while keeping the engine speed within its designed rpm range. 变速器
- Chassis — Structural lower part of a vehicle to which the running gears and body is attached. The true chassis is now evident only in heavy goods vehicles, some public service vehicles, and some specialist cars. 底盘
- Floor pan — The base panel of a passenger car. 地板
- Unitized body — A body type construction that there is no frame and all assembly units are attached to the body. All the functions of the frame are carried out by the body and frame are a single unit welded together. The construction makes the body sheets relieve the metal frame work of part of the stress and results in some weight saving over the conventional separate frame and body construction. 整体式车身
- Piston — Component, usually in the form of a cylinder closed at one end, that converts fluid pressure into mechanical movement and force, or vice versa, within a smooth walled cylinder, in which it is a sliding fit. 活塞
- Crankshaft — The main power shaft of a reciprocating engine, comprising the cranks that impart reciprocating motion to the pistons by way of their crank throw or offset from the

shaft axis, and the journals whereby it is located and supported by the crankcase main bearings. 曲轴

Front-wheel drive — Transmission system in which the engine power is delivered to the front wheels of a vehicle. 前轮驱动

Transaxle — Combined gearbox and differential unit attached to the engine in some front-wheel drive vehicles. Contraction of transmission-axle. 驱动桥(与变速箱连成一体,用于前轮驱动的汽车)

Differential — System of gears capable of driving the input torque of one shaft between two output shafts where rotation at different speeds is likely to occur. 差速器

Driving axle — Axle capable of transmitting power by way of a differential or other transmission arrangement. 驱动桥

Drive shaft — Hollow steel shaft that connects the transmission to the rear axle in a front-engine, rear-drive car. 传动轴

Four-wheel drive — Transmission system in which engine power is delivered to front and rear wheels of a vehicle. 四轮驱动

Shock absorber — Mechanism for damping vibration in a sprung system. 减振器

Suspension system — The system of springs that supports the body and frame on the wheels. 悬架系统

Steering system — A mechanism by which a motor vehicle is steered. 转向系

Braking system — Hydraulic system of levers, cylinders, surfaces and fluid used to stop or slow down a vehicle. 制动系

Brake pedal — Foot-operated control by which the service brake is applied. 制动踏板

Master cylinder — Primary source of pressure in a brake system, containing the piston by which pressure is applied and connected to a source of hydraulic fluid. 制动主缸

Drum brake — Brake in which friction blocks called brake shoes lined with friction material are brought to bear on the periphery of a drum or cylinder. 鼓式制动器

Disk brake — Brake in which external friction pads are brought to bear on the faces of a disk, usually by the clamping action of a caliper. 盘式制动器

1.2 The Engine's System

The engine is an important part of the automobile; it acts as the heart of a person, which provides the power that the cars need to run on the road. All the automotive engines today are the Internal Combustion Engines (ICEs) because the fuel is burnt inside their cylinders and the energy is provided.

ICEs are those heat engines that burn their fuel inside the engine cylinder. In ICEs, the chemical energy stored in their fuel is converted into heat energy during the burning part of their operation. The heat energy is converted into mechanical energy by the expansion of gases against the piston attached to crankshaft that can rotate. The engines that burn petrol are known as petrol