汽车专业英语

黄汽驰　主编

机械工业出版社

汽车专业英语

主编　黄汽驰
参编　韦超旺　崔淑梅
主审　沈永年

机械工业出版社

本书以汽车构造为主线，介绍了电子喷射、安全气囊、空调等汽车新技术；还介绍了汽车发展史、汽车及零部件检测法规以及中国汽车工业到本世纪末和下世纪初的展望。

本书共12个单元。每单元包括课文、词汇、注释、练习和阅读材料，有的课文和阅读材料配有附图。书后附有常用汽车零件词汇表（Main Constant Automobile Parts）和世界名牌汽车标志，供学生阅读时参考。本书可作为汽车专业的专业英语课程的教材，也可作为汽车专业及相关专业工程技术人员提高本专业英语水平的自学读本。

图书在版编目(CIP)数据

汽车专业英语／黄汽驰主编．—北京：机械工业出版社 1998.6
ISBN 7-111-06107-1

Ⅰ．汽… Ⅱ．黄… Ⅲ．汽车-英语 Ⅳ．H31

中国版本图书馆 CIP 数据核字(98)第 01033 号

机械工业出版社（北京市百万庄大街 22 号　邮政编码 100037）
责任编辑：赵爱宁　版式设计：张世琴　责任校对：黄汽驰
封面设计：姚　毅　责任印制：洪汉军
北京瑞德印刷有限公司印刷
2006 年 1 月第 1 版第 9 次印刷
787mm×1092mm 1/16 · 7.75 印张 · 183 千字
定价：11.00 元

凡购本书，如有缺页、倒页、脱页，由本社发行部调换
本社购书热线电话　（010）68326294
封面无防伪标均为盗版

前　言

本书旨在使学生熟悉本专业的英语词汇及用法，了解汽车领域文章结构及体裁，辅助学生对汽车专业课程的学习，培养学生的英语阅读能力和翻译能力，以便更好地直接从国外资料中获取新的知识和信息。

本书选自国外有关汽车方面的书刊和著作。在个别地方作了适当的改动，基本上保持原文的风格。课文内容主要是以汽车构造为主线，介绍近年来一些新的汽车技术，如电子喷射、安全气囊、空调等，还介绍了汽车发展史、汽车维修技术及汽车零部件检测法规。书中还选编了中国汽车工业到本世纪末和下世纪初的展望，使学生了解汽车领域更广泛的知识。

本书编写了12个单元。每单元包括课文、词汇、注释、练习和阅读材料，有的课文和阅读材料配有附图，长句、难句都有注释和翻译。书后附有常用汽车零件词汇表(Main Constant Automobile Parts)和世界名牌汽车标志，供学生阅读时参考。本书可作为汽车专业的专业英语课程的教材，也可作为汽车专业及相关专业工程技术人员提高本专业英语水平的自学读本。

本书由长春汽车高等专科学校(长春一汽职工大学)黄汽驰副教授任主编(第二单元、第五单元、第十一单元、第十二单元)，参编的有湖北十堰东风汽车公司汽车工业学校崔淑梅(第四单元、第六单元、第七单元、第八单元)、广东省机电学校韦超旺(第一单元、第三单元、第九单元、第十单元)，无锡机械制造学校沈永年任主审。

在编写中参阅了国内、外有关资料，得到了长春一汽大众公司周永江和一汽汽车研究所范存东同志的帮助以及参编学校有关专家和领导的支持，在此一并表示衷心的感谢。

由于编者水平有限，书中不妥及疏漏之处在所难免，恳请读者不吝赐教。

编　者

1997年10月

目　录

Unit One
Engine Operating Principles

Most automobile engines are internal combustion, reciprocating 4-stroke gasoline engines, but other types have been used, including the diesel, the rotary (Wankel), the 2-stroke, and the stratified charge.

Reciprocating means "up and down" or "back and forth". It is the up and down action of a piston in the cylinder that produces power in a reciprocating engine. Almost all engines of this type are built upon a cylinder block, or engine block. The block is an iron or aluminum casting that contains engine cylinders and passages called water jackets for coolant circulation. The top of the block is covered with the cylinder head, which forms the combustion chamber. The bottom of the block is covered with an oil pan or oil sump.

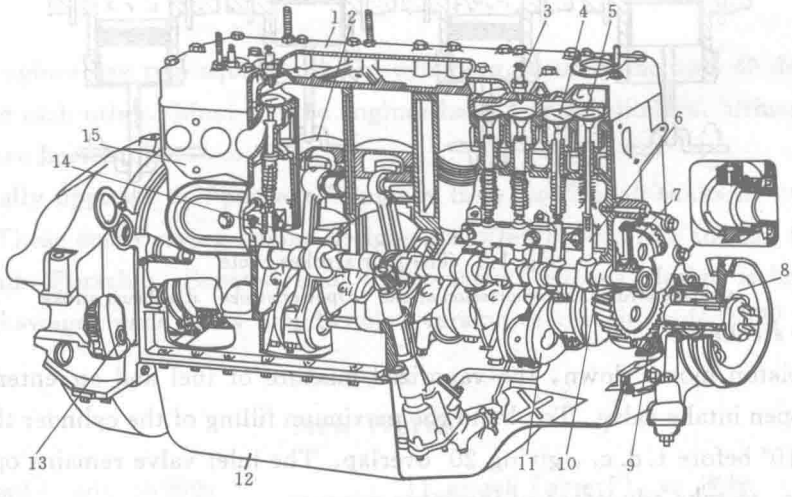

Fig. 1-1 The engine construction.

1—cylinder head 2—piston 3—spark plug 4—intake valve 5—exhaust valve 6—lifter 7—camshaft gear-wheel 8—crankshaft pulley 9—crankshaft timing gear 10—camshaft 11—crankshaft 12—oil pan 13—flywheel 14—connecting rod 15—cylinder block

Power is produced by the linear motion of a piston in a cylinder. However, this linear motion must be changed into rotary motion to turn the wheels of cars of trucks. The piston is attached to the top of a connecting rod by a pin, called a piston pin or wrist pin. The bottom of the connecting rod is attached to the crankshaft. The connecting rod transmits the up-and-down motion of the piston to the crankshaft, which changes it into rotary motion. The connecting rod is mounted on the crankshaft with large bearings called rod bearings. Similar bearings, called main bearings, are used to mount the crankshaft in the block. Shown in Fig. 1-1.

The diameter of the cylinder is called the engine bore. Displacement and compression ratio are two frequently used engine specifications. Displacement indicates engine size, and compression ratio compares the total cylinder volume to compression chamber volume.

The term "stroke" is used to describe the movement of the piston within the cylinder, as well as the distance of piston travel. Depending on the type of engine the operating cycle may require either two or four strokes to complete. The 4-stroke engine is also called Otto cycle engine, in honor of the German engineer, Dr. Nikolaus Otto, who first applied the principle in 1876. In the 4-stroke engine, four strokes of the piston in the cylinder are required to complete one full operating cycle. Each stroke is named after the action it performs intake, compression, power, and exhaust in that order, shown in Fig1-2.

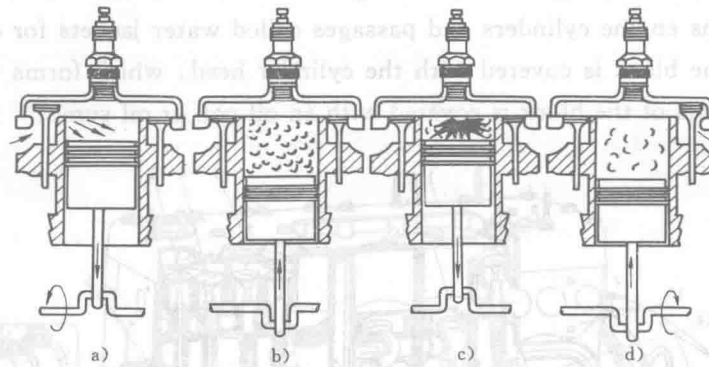

Fig. 1-2 The four strokse cycle

a)intake stroke b)compression stroke c)power stroke d)exhaust stroke

1. Intake stroke

As the piston moves down, the vaporized mixture of fuel and air enters the cylinder through the open intake valve. To obtain the maximum filling of the cylinder the intake valve opens about 10° before t. d. c. , giving 20° overlap. The inlet valve remains open until some 50°after b. d. c. to take advantage of incoming mixture.

2. Compression stroke

The piston turns up, the intake valve closes, the mixture is compressed within the combustion chamber, while the pressure rise to about 1MPa, depending on various factors including the compression ratio, throttle opening and engine speed. Near the top of the stroke the mixture is ignited by a spark which bridges the gap of the spark plug.

3. Power stroke

The expanding gases of combustion produces a rise in pressure of the gas to some 3. 5 MPa, and the piston is forced down in the cylinder. The exhaust valve opens near the bottom of the stroke.

4. Exhaust stroke

The piston moves back up with the exhaust valve open some 50° before b. d. c. , allowing the pressure within the cylinder to fall and to reduce 'back' pressure on the piston during the

exhaust stroke, and the burned gases are pushed out to prepare for the next intake stroke. The intake valve usually opens just before the exhaust stroke.

This 4-stroke cycle is continuously repeated in every cylinder as long as the engine remains running.

A "2-stroke" engine also goes through four actions to complete one operating cycle. However, the intake and the compression actions are combined in one stroke, and the power and exhaust actions are combined in the other stroke. The term 2-stroke cycle or 2-stroke is preferred to the term 2-cycle, which is really not accurate.

In automobile engines, all pistons are attached to a single crankshaft. The more cylinders an engine has, the more power strokes produced for each revolution. This means that an 8-cylinder engine runs more smoothly because the power strokes are closer together in time and in degrees of engine rotation.

The cylinders of multi-cylinder automotive engines are arranged in one of three ways.

1) Inline engines use a single block of cylinder. Most 4-cylinder and any 6-cylinder engines are of this design. The cylinders do not have to be vertical. They can be inclined to either side.

2) V-type engines use two equal banks of cylinders, usually inclined 60 degrees or 90 degrees from the each other. Most V-type engines have 6 or 8 cylinders, although V-4 and V-12 engines have been built.

3) Horizontally opposed or "pancake" engines have two equal banks of cylinders 180 degrees apart. These space saving engine designs are often air-cooled, and are found in the Chevrolet Carvair, Porsches, Subaus, and Volkswagens. Subaus' design is liquid cooled. Late-model Volkswagen vans use a liquid-cooled version of the air cooled VW horizontally opposed engine.

New Words

1. internal [in'tənl] adj. 内部的
2. combustion [kəmbʌstʃən] n. 燃烧，焚烧
3. reciprocating [ri'siprəkeitiŋ] n. 往复移动
4. stratified ['strætifaid] adj. 复叠式的
5. cylinder ['silində] n. 气缸，液压缸
6. iron ['aiən] n. 铁，铁制品
7. aluminum [ə'lju:minəm] n. 铝，铝制品
8. casting ['kɑ:stiŋ] n. 铸造
9. passage ['pæseidʒ] n. 通(水，气)道
10. inline ['inlain] adj. 直线的，一列的，排成列的
11. attach [ə'tætʃ] v. 连接
12. pin [pin] n. 轴销
13. wristpin ['ristpin] n. 轴颈
14. transmit [trænz'mit] v. 转换成，传动，传输
15. mount [maunt] v. 安装，固定，装配
16. bearing ['bɛəriŋ] n. 轴承，支承面
17. crankshaft ['kræŋkʃɑ:ft] n. 曲轴
18. diameter [dai'æmitə] n. 直径
19. bore [bɔ:] n. 内径
20. displacement [dis'pleismənt] n. 排气量，气缸工作容量
21. specification [ˌspesifi'keiʃən] n. 参数

22. stroke [strəuk] n. 行程,冲程
23. intake ['inteik] v. 进气
24. compression [kəm'preʃən] n. 压缩
25. power [pauə] v. 作功
26. exhaust [ig'zɔ:st] v. 排气
27. valve [vælv] n. 阀门,气门
28. overlap [ˌəuvə'læp] n. 进气门和排气门同时打开的时间
29. inlet ['inlet] v. 进气,进气口,引入
30. t. d. c. 上止点
b. d. t. 下止点
31. throttle ['θrɔtl] n. 节气门(俗称风门)
32. ignite [ig'nait] v. 点火,燃烧
33. spark [spɑ:k] n. 火花,电火花,闪光
34. gap [gæp]n. 间隙,空隙,火花塞间隙
35. combine [kəm'bain] v. 混合,联合
36. incline [in'klain] v. 倾斜,下降
37. apart [ə'pɑ:t] adv. 相隔,分开
38. version ['və:ʃən] n. 形式,方案,版本
39. horizontally [ˌhɔri'zɔntli] adv. 水平地,平卧地
40. oppose [ə'pəuz] v. 相对

Phrases and Expressions

1. build upon 把……寄托于……,依赖于……
2. water jacket 水套
3. cylinder block 气缸体
4. combustion chamber 燃烧室
5. oil pan(oil sump) 油底壳,油盆
6. rotation motion 旋转运动
7. connecting rod 连杆
8. spark plug 火花塞
9. push out 排出
10. up and down 上下
11. depend on 取决于,依赖
12. in honor of 向……表示敬意
13. compression ratio 压缩比
14. be forced down 被压下
15. either…or… 既……又……
16. the more…the more… 越……越……

Notes to the Text

1. The block is an iron or aluminum casting that contains engine cylinders and passages called water jackets for coolant circulation.

气缸体是由铁或铝铸出来的,在缸体内有气缸和水套,冷却水在水套内循环。

2. In the 4-stroke engine, four strokes of the piston in the cylinder are required to complete one full operating cycle.

在四冲程发动机中,需要四个行程来完成一个工作循环。

3. To obtain the maximum filling of the cylinder the intake valve opens about 10° before t. d. c., giving 20° overlap.

为了使进气充分,进气门在活塞到达上止点之前约 10°打开,使进气门和排气门有 20°的打开重合角。

4. The more cylinders an engine has, the more power strokes produced for each revolution.

发动机的气缸越多,每转的作功行程就越长。

Exercises

1. Answer the following questions

1)How many types of engines have been used? What are they?

2)How does the combustion chamber form?

3)How does the linear motion of the piston change into rotation motion?

4)What is the displacement?

5)What is the compression ratio?

6)What does the "stroke" mean?

7)What factors does the pressure rising in the cylinder depend on?

8)Describe the four strokes.

9)How does the two-stroke engine work?

10)How the cylinders of multi-cylinder automotive engines are arranged?

2. Translate the following into Chinese

1)internal combustion　　2)build upon

3)mount on　　4)as well as

5)either two or four　　6)one full operation cycle

7)bridge the gap of the spark plug　　8)be forced down

9)push out　　10)be attached to

3. Translate the following into English

1)汽油发动机　　2)进气门和排气门

3)用火花塞点火　　4)压缩比

5)压缩行程　　6)可燃混合气

7)燃烧室　　8)进气歧管

9)多缸汽车发动机　　10)排气歧管

4. Translate the following passages into Chinese

1)Power is produced by the linear motion of a piston in a cylinder. However, this linear motion must be changed into rotation motion to turn the wheels of cars or trucks.

2)Displacement and compression ratio are two frequently used engine specifications. Displacement indicate engine size, and compression ratio compares the total cylinder volume to compression chamber volume.

3)This 4-stroke cycle is continuously repeated in every cylinder as long as the engine running.

4)A "2-stroke" engine also goes through four actions to complete one operating cycle. However, the intake and the compression actions are combined in one stroke, and the power and exhaust actions are combined in the other stroke.

5)The more cylinders an engine has, the more power strokes produced for each revolution. This means that 8-cylinder engine runs more smoothly because the power strokes are closer together in time and in degrees of engine rotation.

5. Translate the following into Chinese

Modern Combustion Chamber Design

Engineers have worked with combustion chamber designs since the automobile was first invented. In the years before exhaust emission controls, much of the experimentation and design work was done with racing engines in an effort to make them go ever faster. The need to reduce exhaust emission, however, refocused attention on the combustion chamber. Efforts were made to promote rapid, uniform burning of the air-fuel charge to control emissions and improve fuel economy.

Combustion of the air-fuel charge in a cylinder is not an instantaneous explosion, but rather, a controlled burning of the charge by the spark from the spark plug. When the spark ignites the air-fuel mixture, a flame front spreads out across the combustion chamber to consume the mixture. Movement of the flame front is called burn time and requires about 3 milliseconds.

However, combustion chamber design, temperature, pressure ,and gasoline quality can combine to cause an unwanted explosion or detonation of the air-fuel charge before the flame front reaches it. In the ideal combustion chamber design, the entire air-fuel charge would burn completely, leaving no unburned areas to be exhausted and eliminating the possibility of detonation. In actual practice, however, there is always some part of the mixture that does not completely burn.

Current combustion chamber design favors the fast-burn or high swirl combustion chamber in which the combustion process is completed in a shorter period of time.

Reading Material

The History and Major Development of Automobile

As early as 1600, the Dutch, no strangers to wind power, had built a wind-powered, sail-mounted carriage. These cariages were reported to hold several passengers and move at speeds as high as twenty mph. However, they were probably the first read land vehicles to move under power, other than that of animals or human muscle.

In 1700s, a French man, Jacques de Vacanson, built a vehicle which was powered by an engine based on the working of a clock. What he neglected to calculate was that any clock which was capable of moving a vehicle with passengers would have to outweigh the load it was carrying, even winding such a clock motor would take great time and greater effort than it was worth.

Inventors in England, France, Germany and other countries worked on the idea of a compressed-air engine, but they were unable to find the solution to self-propulsion in this means. However, in their efforts, they contributed significant individual elements to the picture; elements like valves, pistons, cylinders, and connecting rods, and an emerging idea

of these elements related to each other. The first invention that can truly and logically be called an "automobile" was heavy, three-wheeled, steam driven, clumsy vehicle built in 1769 by Captain Nicolus-Jesph Cugnat, a French Army Engineer. It can still be seen in the Paris Museum, where it is displayed with proper national pride.

Thomas Savery, an English engineer, had given the world the first steam engine in 1698. This engine was crude, inefficient, and blew up at intervals. Thomas Newcomen, an English black smith in 1711, turned out a better, less dangerous version of the engine. Then in 1769, James Watt, a Scottish instrument maker, had patented a truly improved steam engine that become widely used in British mills, mines and factories.

In 1864, in Austria, Siegfried Marcus built one-cylinder engine that used a primitive carburetor and magnet arrangement to create small explosions that applied alternating pressure against the piston with the cylinder. In 1875, he built his second gasoline powered vehicle, which is preserved in the Technical Museum in Vein.

In 1876, in Germany, Langen and Nikolaus August Otto, improved Marcus's engine and introduced the first workable-4-stroke internal combustion gas engine after many years of experimental work. But Wilhem Daimler produced a more efficient 4-stroke gasoline engine in 1883, and successfully mounted the engine on a sturdy bicycle.

In the 1920-1940 period, the main components of the cars were well designed and efficient, and a variety of accessoried were introduced, such as reverse lights, radios, automatic chokes, windshield wipers and chrome-plated trims. Since world war II, most vehicles are fitted with the magnetic speedometer. Tires, until the 1920s, were of narrow cross section and ran at relatively high air pressures, the tires alone would not provide much comfort, however, between the wheel and the body of the car it is necessary to have springs, and the semi-elliptic multi-leaf spring was an early development. Leaf springs are still widely used on cars, especially on the rear axles.

Power breaks were gradually introduced on road vehicles from the 1940s on. Shock absorbers become hydraulic and telescopic consisting of a piston inside a sealed cylinder, one attached to the chassis and the other to the axle.

A great development of transistors during the 1950s led to the introduction on semiconductor ignition systems, which use electronic switching systems to control the ignition coil.

Disc brakes, less prone to failure from over-heating than drum brakes, at last become widely accepted, over half a century after Lan Chester's original designed was patented.

Mechanical improvements brought higher speeds, better road holding, braking and acceleration, but many countries began to introduce laws which restricted the maximum speed of vehicles in 1960s. Cars had to be built to comply with the strict new safety and anti-pollution laws of the United States, which were gradually adopted by many other countries.

Automatic transmission, power breaks and power steering gained wide spread acceptance. The electric systems, which had more and more heavy load to handle, was improved by the introduction of the alternator to replace the dynamo, and the use of circuit breakers

instead of fuses.

One important development in engine design was the invention of the Wankel engine, which has a single three-lobe rotor instead of the conventional pistons and crankshaft. The first one was made in 1957, by Felix Wankel of Germany and in 1964, the NSU company brought out the Wankel-engine "Spider", and a few years later, the R80, the prototype Mercedes CIII and several Japanese Mazda cars also have Wankel engines, that are light, compact, powerful, and smooth running.

Computer, play an important role in car construction now, as in everything else. The purchasing department is in charge of making sure that the glass, rubber, steel and everything else is on hand in the required amounts, and computers keep track of it all. It is only natural for automobile manufacturers to installed on-board computers into cars, it is after all, the only practical method of monitoring all the engine variables at once. The on-board computer receives its information from the various sensors located near or on the engine and processes the signals to adjust the fuel mixture, timing and the other elements. The process is continuous as long as the engine is running.

New Words

1. wind-powered ['windpauəd] n. 风力驱动
2. sail-mounted ['seilmauntid] adj. 装备有螺旋桨
3. carriage ['kæridʒ] n. 车厢
4. vehicle ['vi:ikl] n. 车辆
5. calculate ['kælkjuleit] v. 计算,确定
6. outweigh [aut'wei] v. 重量超过,比……重
7. solution [sə'lu:ʃən] n. 解决办法,分解
8. self propulsion ['selfprə'pʌlʃən] n. 自行驱动
9. contribute [kən'tribju:t] v. 对……有贡献,起作用
10. clumsy ['klʌmzi] adj. 笨拙的,不灵活
11. crude [kru:d] adj. 粗糙的,原始的
12. inefficient [ini'fiʃənt] adj. 低效率的
13. carburetor ['kɑ:bjuretə] n. 化油器
14. magnet ['mægnit] n. 磁铁
15. alternating ['ɔ:tə:neit] adj. 交替变化的
16. accessory [æk'sesəri] n. 附件,辅助设备
17. reverse [ri'vəs] adj. 背面的
18. choke [tʃəuk] n. 阻风门,节气门
19. tire [taiə] n. 轮胎
20. semielliptic [ˌsemii'liptik] adj. 半椭圆的
21. hydraulic [hai'drɔ:lik] adj. 液力的
22. telescopic [ˌtelis'kɔpik] adj. 伸缩套筒式的
23. chassis ['ʃæsi] n. 底盘,车架
24. semiconductor ['semikən'dʌktə] n. 半导体,晶体管
25. patent ['peitənt] v. 取得……专利权
26. restrict [ris'trikt] v. 限制
27. anti-pollution ['æntipə'lu:ʃən] n. 防污染
28. adopt [ə'dɔpt] v. 采用,采纳
29. alternator ['ɔ:ltəneitə] n. 交流发电机
30. dynamo ['dainəməu] n. 直流发电机
31. compact [kəm'pækt] v. 结构紧凑

Phrases and Expressions

1. based on 以……为依据，以……为基础……
2. blow up 爆炸
3. turn out 生产出，推出
4. windshield wiper 刮水器
5. chrome-plated trims 镀铬修饰
6. magnetic speedometer 磁感应车速表
7. multi-leaf spring 钢板弹簧
8. rear axle 后桥
9. shock absorber 减振器
10. comply with 根据
11. Wankel engine 旋转式发动机
12. take great time and greater effort 花更多的时间和精力
13. an emerging idea of 首次提出……解决办法
14. make sure 确认
15. keep track of 跟踪
16. three lobe 三凸角
17. bring out 生产出
18. on hand 在掌握之中

Notes to the Reading Material

1. What he neglected to calculate was that any clock which was capable of moving a vehicle with passengers would have to outweigh the load it was carrying, even winding such a clock motor would take great time and greater effort than it was worth.

   他唯独忽略了估计每个载客的时钟发动机所能承受的负载，甚至给这样的时钟发动机上链花费更多的时间和精力，很不值得。

2. However, in their efforts, they contributed significant individual elements to the picture; elements like valves, pistons, cylinders, and connecting rods, and an emerging idea of these elements related to each other.

   然而，在他们的努力下，对发动机的各种部件，如气门、活塞、气缸和连杆等作出了显著的贡献，并首次解决了各部分之间的联系问题。

3. It is only natural for automobile manufacturers to installed on-board computers into cars, it is after all, the only practical method of monitoring all the engine variables at once.

   车载计算机被制造厂家装备到汽车上是很自然的事，这绝对是对发动机各种参数同时进行监控的唯一有效的办法。

4. In the 1920-1940 period, the main components of the cars were well designed and efficient, and a variety of accessories were introduced, such as reversed lights, radios, automatic chokes, windshield wipers and chrome-plated trims.

   在1920年到1940年间，汽车主要部件的设计日趋完善而高效，同时，各种辅助装置逐步增加，如倒车指示灯、收音机、自动阻风门、刮水器和镀铬装饰等。

Unit Two
Engine Construction

Cylinder Block

The cylinder block is cast in one piece. Usually, this is the largest and the most complicated single piece of metal in the automobile.

The cylinder block is a complicated casting made of gray iron (cast iron) or aluminum. It contains the cylinders and the water jackets that surround them. To make the cylinder block, a sand formcalled a moldis made. Then molten metal is poured into the mold. When the metal has cooled the sand mold is broken up and removed. This leaves the rough cylinder-block casting. The casting is then cleaned and machined to make the finished block. Fig. 2-1 shows the a finished cylinder block.

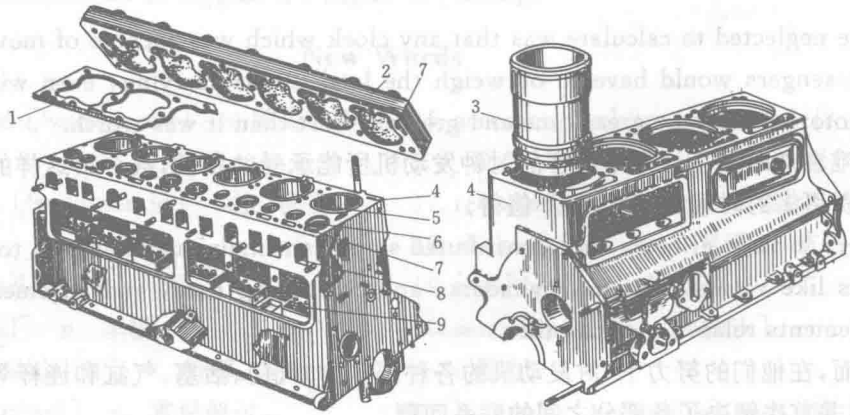

Fig. 2-1 A cylinder block

1—cylinder head gasket 2—piston head 3—cylinder liner 4—cylinder block 5—cylinder 6—valve seat 7—water cooling line 8—intake and exhaust valves 9—valve chamber

Cylinder blocks for diesel engines are very similar to those for spark-ignition engines. The basic difference is that the diesel-engine cylinder block is heavier and stronger. This is because of the higher pressures developed in the diesel-engine cylinders.

Several engines have aluminum cylinder blocks. Aluminum is a relatively light metal, weighing much less than cast iron. Also, aluminum conducts heat more rapidly than cast iron. This means there is less chance for hot spots to develop. However, aluminum is too soft to use as cylinder-wall material. It wears too rapidly. Therefore, aluminum cylinder blocks must have cast-iron cylinder liners or be cast from an aluminum alloy that has silicon particles in it.

Some manufactures make an aluminum cylinder block that does not have cylinder liners, or sleeves. Instead, the aluminum is loaded with silicon particles. Silicon is a very hard

material. After the cylinder block is cast, the cylinders are honed. Then they are treated with a chemical that etches eats away the surface aluminum. This leaves only the silicon particles exposed. The piston and rings slide on the silicon with minimum wear.

Piston

The piston converts the potential energy of the fuel into the kinetic energy that turns the crankshaft. The piston is a cylindrical shaped hollow part that moves up and down inside the engine's cylinder. It has grooves around its perimeter near the top where the rings are placed. The piston fits snugly in the cylinder. The pistons are used to ensure a snug "air tight" fit. See Fig. 2-2.

The piston in your engine's cylinder are similar to your legs when you ride a bicycle. Think of your legs as pistons; they go up and down on the pedals, providing power. Pedals are like the connecting rods; they are "attached" to your legs. The pedals are attached to the bicycle crank which is like the crank shaft, because it turns the wheels.

To reverse this, the pistons (legs) are attached to the connecting rods (pedals) which are attached to the crankshaft (the bicycle rank). The power from the combustion in the cylinders powers the piston to push the connecting rods to turn the crankshaft.

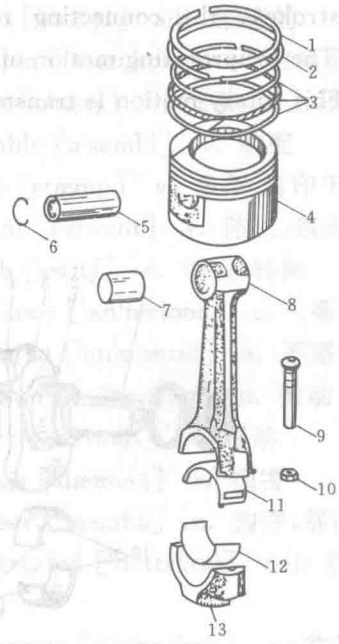

Fig. 2-2 A Piston and a Connecting-rod
1,2—compression rings 3—oil rings 4—piston 5—piston pin 6—piston-pin ring 7—connecting rod bushing 8—connecting rod 9—connecting rod bolt 10—connecting rod nut 11,12—crank bearing half shells 13—connecting rod cap

Connecting-rod

The connecting rod shown in Fig. 2-2 is made of forged high-strength steel. It transmits force and motion from the piston to the crank-pin on the crankshaft. A steel piston pin, or "wrist pin", connects the rod to the piston. The pin usually is pressed into the small end of the connecting-rod. Some rods have a lock bolt in the small end. As the piston moves up and down in the cylinder, the pin rocks back and forth in the hole, or bore, in the piston. The big end of the connecting rod is attached to a crank-pin by a rod bearing cap.

Connecting rod and rod-bearing caps are assembled during manufacture. Then the hole for the bearing is bored with the cap in place. This is called line-boring. It makes each rod and its cap a matched set. Usually, the same number is stamped on the rod and cap. This prevents the caps setting mixed during engine service. If the caps are mixed, the bearing bore will not be round. An engine assembled with the rod-bearing caps switched will

probably lock the crankshaft. If the crankshaft turns, the bearing will probably have improper clearance and early bearing failure will result.

Another reason for keeping the cap and rod matched is to prevent engine unbalance and unwanted vibration. All connecting rods in an engine must be as light as possible. But they must all weigh the same. If one rod is heavier than the others, the engine will vibrate. This could damage the engine.

Crankshaft

The crankshaft shown in Fig. 2-3 is the main rotating member, or shaft, in the engine. It has crank-pins, to which the connecting rods from the pistons are attached. During the power strokes, the connecting rods force the crank-pins and therefore the crankshaft to rotate. The reciprocating motion of the pistons is changed to rotary motion as the crankshaft spins. This rotary motion is transmitted through the power train to the car wheels.

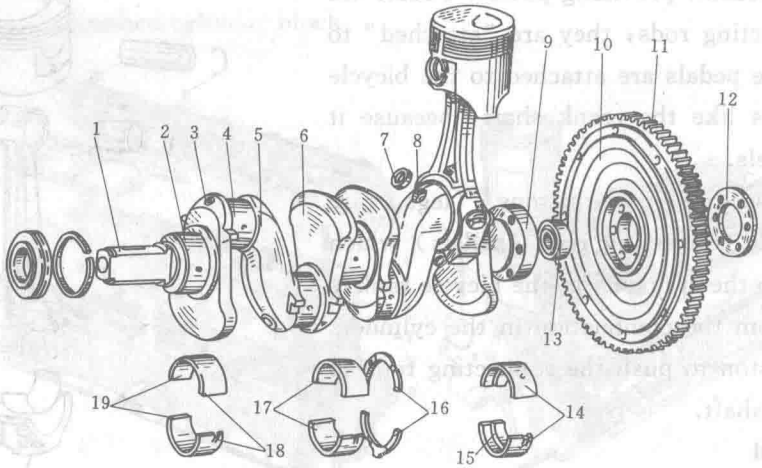

Fig. 2-3 The crankshaft

1—crankshaft front end 2—front main journal 3—oil passage hole 4—crank pin 5—crank web 6—counter weight 7—oil passage plug 8—oil passage 9—crankshaft collar 10—flywheel 11—flywheel gear ring 12—flywheel lock plate 13—clutch shaft bearing 14—rear main bearing half shell 15—oil groove 16—crankshaft thrust 17—central main bearing half shell 18—bearing half shell 19—front main bearing half shell

The crankshaft is a strong, one-piece casting, or forging, of heat-treated alloy steel. It must be strong to take the downward force of the power strokes without excessive bending. It must be balanced so the engine will run without excessive vibration.

New Words

1. engine ['eidʒin] n. 发动机
2. contain [kən'tein] v. 包含,容纳
3. surround [sə'raund] v. 围绕,包围
4. mold [məuld] n. 模子,模具
5. complicated ['kɔmpikeitid] adj. 复杂的
6. aluminum [ə'lju:minəm] n. 铝
7. pour [pɔ:] v. 浇注,浇铸
8. cool [ku:l] v. 冷却