21世纪全国高职高专汽车系列技能型规划教材



汽车专业英语图解教程

主编 侯锁军 王旭东

北京大学出版社
PEKING UNIVERSITY PRESS

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主　编　侯锁军　王旭东
副主编　赵向阳　陈海燕

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内 容 简 介

本书以汽车构造知识为基础，主要包括汽车构造、发动机构造、曲柄连杆机构、气门、汽油机燃油供给系统、汽油机点火系统、汽油发动机计算机辅助系统、柴油机燃料供给系统、汽车冷却系统、发动机润滑系统、发动机起动系统、汽车传动系统、汽车行驶系统、汽车转向系统、汽车制动系统、汽车电气系统、汽车空调系统以及汽车维修工具和设备等内容。全书分为18个单元，每个单元包括结构图或原理图的中英文对照、阅读材料及译文，内容翔实新颖、图文并茂、深入浅出、通俗易懂。

本书可以作为高等工程专科学校、高等职业技术学校汽车检测与维修专业、汽车制造与装配专业、汽车电子技术专业以及汽车技术服务与营销专业等汽车类相关专业学生的教材，又可供汽车维修和汽车销售等相关专业人员自学和参考。

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前　言

随着我国经济的快速发展，汽车保有量逐年增加，汽车市场对专业人才的需求也在逐年增大。随着我国加入 WTO 以及改革开放的深入，社会需要越来越多既懂汽车专业知识，又有一定汽车专业英语基础的人才，为更好地满足高职高专英语教学的需求，我们特编写了本书。

本书改变传统的汽车专业英语编写方法，通过图解的方式对汽车各系统结构进行专业英文解释，使汽车各系统的结构名称与专业词汇一一对应，目的是帮助学生更快、更好地掌握英语专业词汇。本书还提供了阅读材料，以提高学生阅读汽车专业英文资料的能力。

本书由侯锁军和王旭东任主编，赵向阳和陈海燕任副主编，具体编写分工如下：河南机电高等专科学校赵向阳编写第 1、2、3、4、5、6 单元，河南机电高等专科学校王旭东编写第 7、8、9、10 单元以及附录部分，河南职业技术学院陈海燕编写第 11、12、13 单元，河南机电高等专科学校侯锁军编写第 14、15、16、17、18 单元。全书由侯锁军统稿。

本书建议安排 30～40 学时进行学习，各院校教师可根据不同的专业设置灵活安排。

由于时间仓促，编写水平有限，书中难免存在不足之处，恳请读者批评指正。

编　者

2010 年 6 月

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Unit 1　STRUCTURE OF AUTOMOBILE

汽 车 构 造

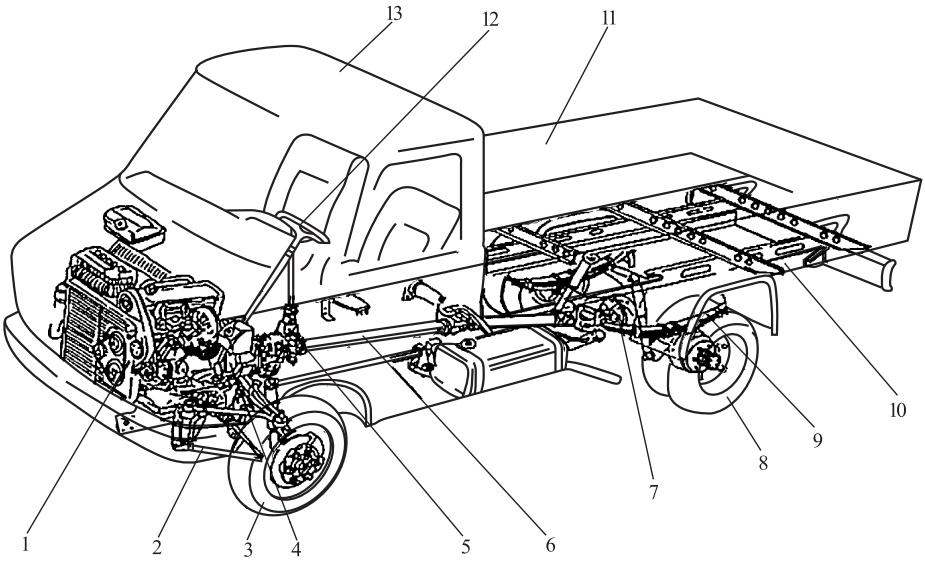


图 1.1　General structure of automobile　汽车的总体构造

1—engine **发动机**；2—front suspension **前悬架**；3—steering vehicle wheel **转向车轮**；
4—clutch **离合器**；5—transmission **变速器**；6—universal transmission device
万向传动装置；7—drive-axle **驱动桥**；8—driving wheel **驱动车轮**；
9—rear suspension **后悬架**；10—frame **车架**；
11—carriage **车厢**；12—steering wheel
转向盘；13—cab **驾驶室**

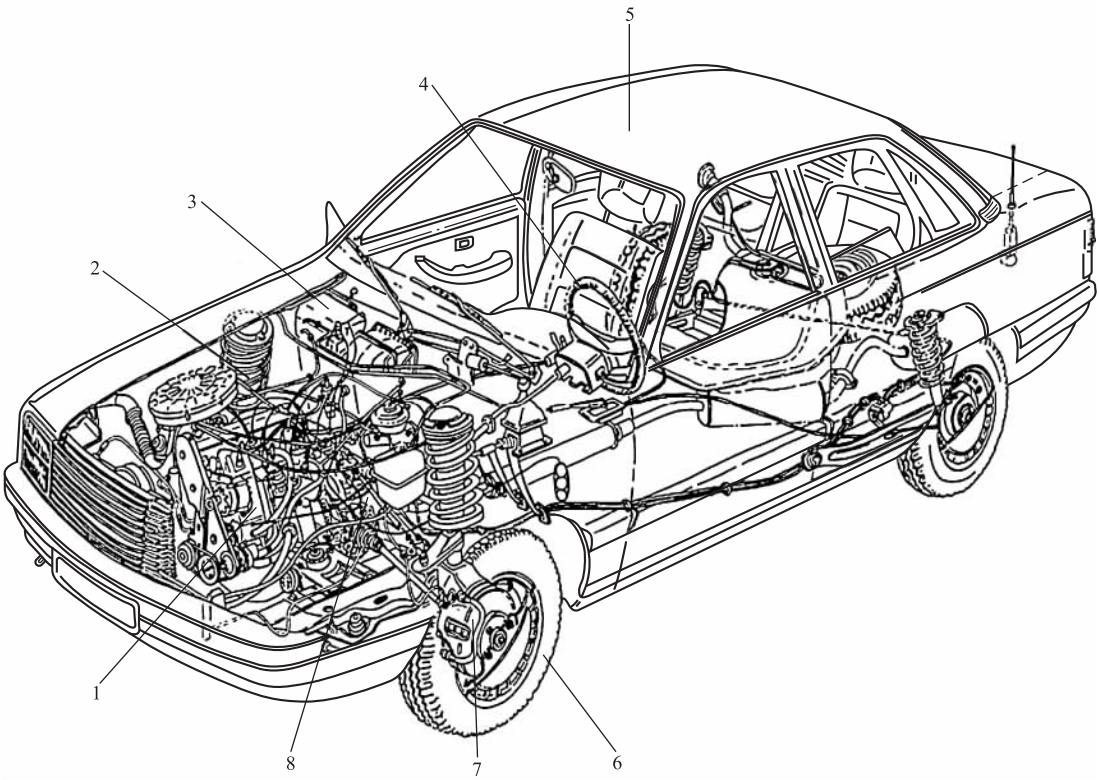


图 1.2　Structure of passenger car　普通轿车的总体构造

1—engine **发动机**；2—suspension system **悬架**；3—air conditioner **空调**；4—steering wheel **转向盘**；5—body **车身**；6—driving wheel **驱动车轮**；7—brake **制动器**；8—transmission **变速器**

Reading Materials

Passage 1

Structure of Automobile

Today's average car contains more than 15,000 separate, individual parts that must work together. These parts can be grouped into four major categories: engine, chassis, body and electrical system.

Engine

Today, the four stroke cycle internal combustion engines are commonly used in cars, trucks, motorcycles and many others other transport vehicles. The four strokes refer to intake, compression, combustion and exhaust strokes that occur during two crankshaft rotations per working cycle of Otto Cycle.

The engine provides power to move the automobile. The most common type of automotive engine is the gasoline-burning engine. It is found in most automobiles. Diesel-fuel burning engines are also used in modern passenger cars, as well as in large trucks. All en-

gines have fuel, exhaust, cooling, and lubrication systems. Gasoline engines also have an ignition system.

Chassis

A chassis which is considered as a support frame for an auto body is used to assemble all auto spare parts on it. In fact, when power from engine continues to be transmitted to chassis, it begins with power train, and goes on to steering, wheel suspension, brakes and tires. These individual components interact with each other closely.

Body

The automobile body which is regarded as the framework is seated on the chassis. Its function is obvious for occupants to provide comfort, protection and shelter. The automobile body is generally divided into five sections: the front, the upper and and top, rear and the underbody. Theses sections are further divided into small units, such as the hood, the fender, the roof panels, the door, the instrument panel, the bumpers and the luggage compartment.

The Electrical System

The electrical system is considered an auto electric power source supplying lighting power for the automobile. The electrical system contains battery, lights, generator, engine ignition, lighting circuit, and various switches that control their use.

阅读材料

材料 1

汽 车 构 造

如今，每辆汽车平均包含 15,000 多个各自独立而又必须共同作用的零件。这些零件可分为四大类：发动机、底盘、车身和电气系统。

发动机

目前，汽车、货车、摩托车和其他车辆采用的内燃机通常是四行程内燃机。四个行程是指在一个奥托循环周期内，曲轴转两圈活塞完成进气行程、压缩行程、做功行程和排气行程。

发动机提供动力使汽车行驶。汽车发动机最常见的类型是汽油发动机，被大多数汽车采用。柴油发动机也用在现代客车以及大型载货车上。所有的发动机均包括燃油系统、排气系统、冷却系统和润滑系统，汽油发动机还包括点火系统。

底盘

对车身来说，底盘被认为是一个支撑框架，用来组装汽车上的所有零部件。事实上，当从发动机产生的动力连续不断地传送到底盘时，它从传动系开始，接着传递到转向系统、车轮悬架、制动系统和轮胎。这些单个组件相互密切合作，完成汽车行驶。

车身

车身被认为是一个框架，固定在底盘上。它的功能显而易见是为乘员提供舒适的环境，保护和庇护。汽车车身一般分为五个部分：前部、上部、顶部、后部和底部。这些部分又被进一步分为更小的单元，如发动机盖、挡泥板、车顶板、车门、仪表板、保险杠和行李箱等。

电气系统

电气系统被认为是汽车的电源供应装置，用于向汽车照明系统提供电能。电气系统包括蓄电池、指示灯、发电机、发动机点火系统、照明电路和控制其使用的各种开关。

Passage 2

Automotive Industry

The global automotive industry is a highly diversified sector that comprises of manufacturers, suppliers, dealers, retailers, original equipment manufacturers, aftermarket parts manufacturers, automotive engineers, motor mechanics, auto electricians, spray painters or body repairers, fuel producers, environmental and transport safety groups, and trade unions.

The automobile and automotive parts & components manufacturers constitute a major chunk of automotive industry throughout the world. The automotive manufacturing sector consists of automobile and light truck manufacturers, motor vehicle body manufacturers, and motor vehicle parts and supplies manufacturers. This sector is engaged in manufacturing of automotive and light duty motor vehicles, motor vehicle bodies, chassis, cabs, trucks, automobile and utility trailers, buses, military vehicles, and motor vehicle gasoline engines.

The Top Automaking Nations

United States, Japan, China, Germany and South Korea are the top five automobile manufacturing nations throughout the world. The United States of America is the world's largest producer and consumer of motor vehicles and automobiles accounting for 6.6 million direct and spin-off jobs and represents nearly 10% of the $10 trillion US economy. Automobile is one of the important industries in the world, which provides employment to 25 million people in the world.

In the recent past, the auto parts manufacturing industry of Midwest lost 12.7% of its employment. The various factors behind this decline are unemployment recession, domestic relocation and foreign competition. This loss in employment has badly affected this industry.

Major Manufacturing Regions

Northeastern United States and Southern Great Lakes Region, Northwestern Europe,

Western Russia and the Ukraine, and Japan are the major manufacturing regions of automotive in the world. In North America, the prominent automotive manufacturing regions are New England, New York and the Mid-Atlantic, Central New York, Pittsburgh/Cleveland, Western Great Lakes, St. Lawrence Valley, Ohio and Eastern Indiana, Kanawha and middle Ohio Valley, St. Louis, the Southeastern region, Gulf Coast, Central Florida, and the West Coast. The European Union has the largest automotive production regions in the World. The key automobile manufacturing regions are United Kingdom, Rhine-Ruhr River Valley, Upper Rhine – Alsace – Lorraine region, and the Po Valley in Italy.

In the Western Russian and Ukraine Region, the leading industrial regions are Moscow, the Ukraine region, the Volga region, the Urals regions.

Major Industry Players

The worldwide automobile industry is largely dominated by five leading automobile manufacturing corporations namely Toyota, General Motors, Ford Motor Company, Volkswagen AG, and Daimler Chrysler. These corporations have their presence in almost every country and they continue to invest into production facilities in emerging markets namely Latin America, Middle East, Eastern Europe, China, Malaysia and other markets in Southeast Asia with the main aim of reducing their production costs.

材料 2

汽 车 产 业

全球汽车业是一个高度多样化的行业，包括制造商、供应商、经销商、零售商、原始设备制造商、售后服务零部件制造商、汽车工程师、汽车维修师、汽车电工、喷绘师和车身修复师、燃料生产商、环境和安全运输集团、贸易联盟。

汽车和汽车零部件生产商是整个汽车行业的主要组成部分。汽车制造业由汽车制造商、汽车车身制造商和汽车零部件供应商构成。该行业涉及轻型汽车、汽车车身、底盘、驾驶室、卡车、轿车和公共拖车、公共汽车、军用车辆以及汽车汽油发动机的生产制造。

顶级汽车制造国

在世界各地，美国、日本、中国、德国和韩国是五大汽车生产国。美国是世界上最大的汽车制造和汽车消费国家，汽车业提供 660 万个直接和间接的工作岗位，并占美国经济收入 10 万亿美元的近 10%份额。汽车是世界上重要的产业之一，它为世界上 2500 万人提供了就业岗位。

在过去的几年中，中西部地区的汽车零部件制造行业失去整个就业岗位的 12.7%的岗位。这种下降背后的各种失业因素是经济的衰退、国内迁移和国外的竞争。这种就业损失已严重影响了这个行业。

主要生产地区

美国的东北部和南部大湖地区、西北欧、俄罗斯的西部地区和乌克兰和日本是世界上主要的汽车制造地区。在北美，优势突出的汽车制造地区是新英格兰、纽约和大西洋中

部、纽约中部、匹兹堡/克利夫兰、西部大湖区、圣劳伦斯河谷、俄亥俄州和印第安纳州东部、俄亥俄河谷和中卡纳瓦、圣.路易斯、东南地区、墨西哥湾、佛罗里达州中部和西部海岸。欧洲联盟在世界拥有最大的汽车生产地区，其主要的汽车制造业地区是英国、莱茵河流域、鲁尔河流域、莱茵河上游—阿尔萨斯—洛林地区和意大利波河流域。

在俄罗斯的西部和乌克兰地区，主要工业地区是莫斯科、乌克兰地区、伏尔加地区、乌拉尔地区。

主要行业制造者

全球汽车业在很大程度上被五大汽车制造公司所主导，即丰田汽车公司、通用汽车公司、福特汽车公司、大众汽车公司和戴姆勒·克莱斯勒汽车公司。这些公司几乎在每个国家都存在，他们不遗余力地在新兴市场投入生产设施，即拉丁美洲、中东、东欧、中国、马来西亚和其他东南亚市场，主要目的是降低制造成本。

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Unit 2　STRUCTURE OF ENGINE

发动机构造

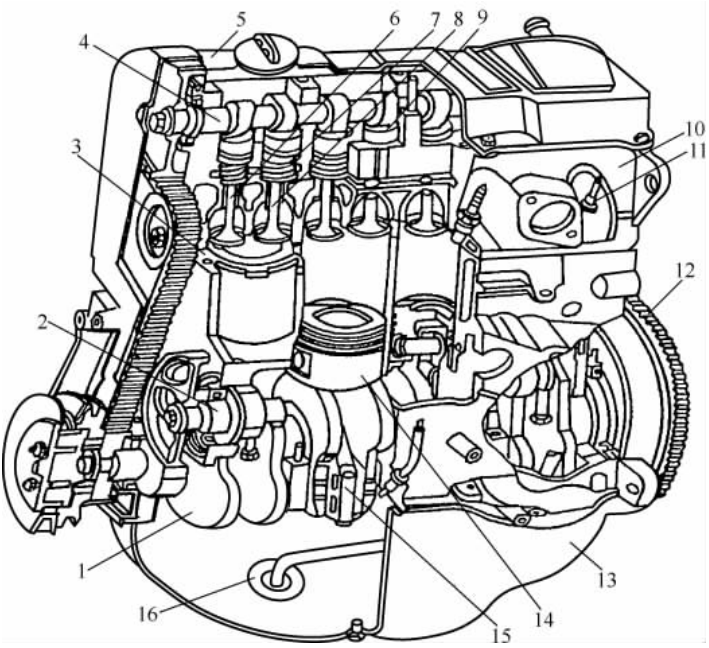


图 2.1　Gasoline engine　汽油机

1—crankshaft **曲轴**；2—intermediate shaft **中间轴**；3—cylinder block **气缸体**；4—camshaft **凸轮轴**；5—camshaft cover **凸轮轴罩盖**；6—exhaust valve **排气门**；7—valve spring **气门弹簧**；8—intake valve **进气门**；9—tappet **气门挺杆**；10—cylinder **气缸**；11—spark plug **火花塞**；12—flywheel **飞轮**；13—oil pan **油底壳**；14—piston **活塞**；15—connecting rod assembly **连杆总成**；16—oil strainer **集滤器**

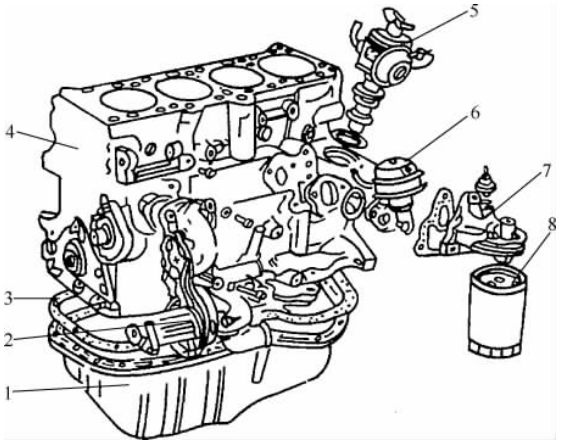


图 2.2　Main accessories of gasoline engine　汽油机的主要附件

1—oil pan **油底壳**；2—pump **水泵**；3—sealing gasket **密封垫**；4—cylinder block **气缸体**；5—distributor **分电器**；6—gas filter **汽油滤清器**；7—gas filter installation seat **机油滤清器安装座**；8—oil filter **机油滤清器**

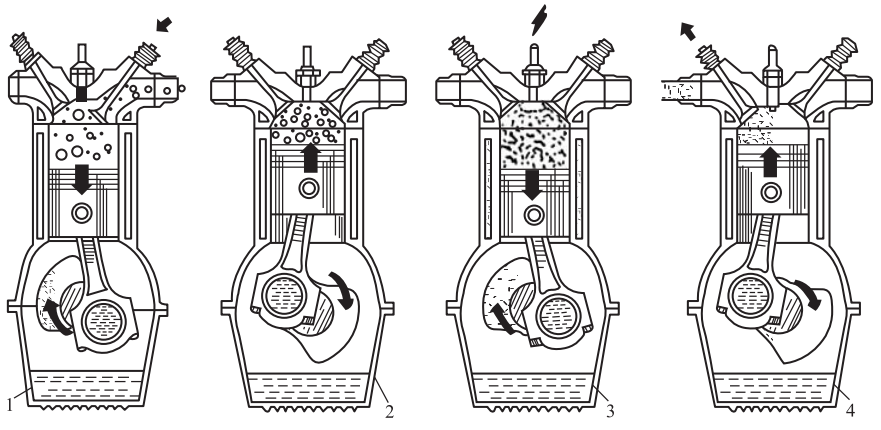


图 2.3　Operational schematic of single cylinder four-stroke engine　单缸四行程汽油机工作原理

1—intake stroke **进气行程**；2—compression stroke **压缩行程**；3—power stroke **做功行程**；4—exhaust stroke **排气行程**

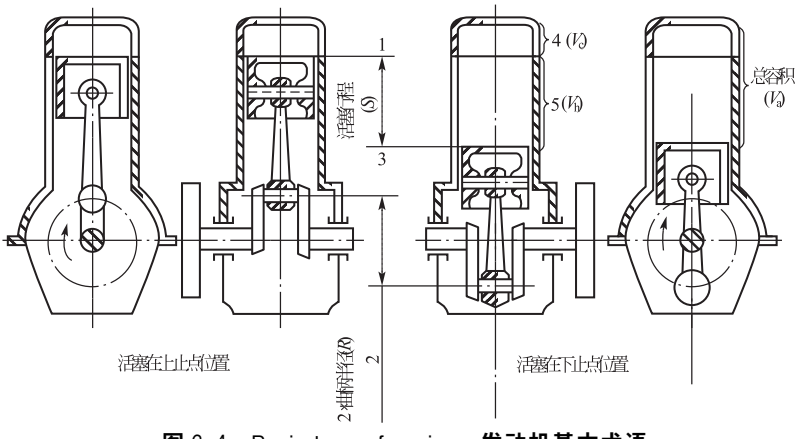


图 2.4　Basic term of engine　发动机基本术语

1—top dead center **上止点**；2—long stroke **活塞行程**；3—bottom dead center **下止点**；4—volume of combustion chamber **燃烧室容积**；5—working volume **工作容积**

Reading Materials

Passage 1

Kinds of Engines

The engine is the heart of an automobile. The purpose of an automotive engine is to convert fuel into the energy that moves the automobile. Currently the easiest way to create motion from fuel is to burn the fuel inside an engine. Therefore, an automotive engine is an internal combustion engine, which burns fuel within the cylinders and converts the expanding force of the combustion into rotary force used to drive the automobile.

There are several types of internal combustion engines classified as reciprocating or rotary engine; spark ignition or compression ignition engine; and alternative-fuel engine or hybrid-electric engine.

Reciprocating Engine

A reciprocating engine consists of(1)compression of air or pre-compressed air(or air-fuel mixture in the case of certain types of engines)within the cylinder of the engine by the action of a piston, (2)addition of heat energy into the compressed air by directly combusting the fuel in the compressed air, followed by(3)expansion of the hot pressurized combustion products in the cylinder against the piston connected to the load to produce useful work. The auto engine and the diesel engine are examples of a reciprocating engine. The compression ratio of an auto engine is lower and the combustion process is initiated by a spark plug while in a diesel engine, the compression ratio is significantly higher and the fuel is ignited by the heat of compression.

Spark Ignition Engines

Next, there are two types of spark ignition engines: the four-stroke cycle and the two-stroke cycle. In the four-stroke engine, four strokes of the piston are required to complete a cycle: (1)intake stroke where the piston moves with the intake valve open and the exhaust valve closed such that a mixture of air with atomized and vaporized fuel is taken into the cylinder, (2)compression stroke, in which the air/fuel mixture is compressed with both valves closed followed by ignition of the air/fuel charge by a timed spark, (3)power or expansion stroke with both valves closed, and finally(4)the exhaust stroke in which the pistons moves with the exhaust valve open and thus completing the cycle. The cylinder walls are cooled by circulating a cooling medium through the cylinder jackets.

In the two-stroke engine, the intake and exhaust strokes are eliminated by using pre-compressed intake charge to displace the exhaust gases. The two-stroke engine has the advantage of a high power to weight ratio because the engine has a power stroke each revolution. This advantage, however, is offset by the loss of a portion of the intake charge with the exhaust gases, resulting in lower efficiencies. The two-stroke engine has thus limited

applications such as in small boat engines, lawnmower engines where low cost and weight are more important than efficiency.

Compression Ignition Engines

With a sufficiently high compression ratio and a suitable fuel, auto ignition occurs in a reciprocating engine. The engine is similar to the spark ignited engines described above except that during the compression stroke, only air is taken into the piston and compressed to ignition conditions and then, the fuel is atomized directly into the combustion chamber at a controlled rate.

The core of the engine is the cylinder, with the piston moving up and down inside the cylinder. Most cars have more than one cylinder(four, six and eight cylinders are common). In a multi-cylinder engine, the cylinders usually are arranged in one of three ways: inline, V or flat. Different configurations have different advantages and disadvantages in terms of smoothness, manufacturing cost and shape characteristics. These advantages and disadvantages make them more suitable for certain vehicles.

Let's look at some key engine parts in more detail:

Spark plug

The spark plug supplies the spark that ignites the air/fuel mixture so that combustion can occur. The spark must happen at just the right moment for things to work properly.

Valves

The intake and exhaust valves open at the proper time to let in air and fuel and to let out exhaust. Note that both valves are closed during compression and combustion so that the combustion chamber is sealed.

Piston

A piston is a cylindrical piece of metal that moves up and down inside the cylinder.

Piston Rings

Piston rings provide a sliding seal between the outer edge of the piston and the inner edge of the cylinder. The rings serve two purposes: They prevent the fuel/air mixture and exhaust in the combustion chamber from leaking into the sump during compression and combustion.

They keep oil in the sump from leaking into the combustion area, where it would be burned and lost. Most cars that "burn oil" and have to have a quart added every 1,000 miles are burning it because the engine is old and the rings no longer seal things properly.

阅读材料

材料 1

发动机的分类

发动机是汽车的心脏，其功用是将燃料转换成能量使汽车行驶。目前，能量转换的最

简单方法是让燃料在发动机内部燃烧。因此，汽车发动机是内燃机，即燃料在气缸内燃烧，并将燃烧的膨胀力转换成旋转力用来驱动汽车。

内部燃烧发动机可分为往复式或旋转式发动机、火花点火式或压燃点火式发动机和替代燃料发动机或混合动力发动机三大类。

往复式发动机

往复式发动机的工作过程包括：(1)通过活塞的运动来压缩或者预压缩发动机气缸内的空气(或对于某些类型的发动机来说，为空气燃料混合物)；(2)通过直接燃烧压缩空气中的燃料来增加压缩空气的热能；(3)气缸中热的高压燃烧产物膨胀推动连接在负载上的活塞做有用功。汽车发动机和柴油发动机就是往复式发动机的一个例子。汽油发动机压缩比低，燃烧过程是由火花塞点燃的；而柴油发动机，压缩比明显较高，燃料是由压缩产生热量点燃的。

火花点火式发动机

有两种类型的火花点火式发动机：四冲程和二冲程。在四冲程发动机中，活塞完成一个周期须经过四个行程：(1)在进气行程中，活塞运动，进气门打开，排气门关闭，这样雾化和蒸发的空气/燃料混合气被吸进气缸；(2)在压缩行程中，进/排气门均关闭，其中空气/燃料混合气被压缩，随后被正时火花点燃；(3)做功或膨胀行程，进/排气门均关闭；(4)排气行程，在此行程中，活塞向下运动，排气门打开，从而完成一个周期。气缸壁通过缸套被循环流动的冷却介质冷却。

在二冲程发动机中，进气和排气行程被取消，通过使用预压缩进气交换取代排气行程，二冲程发动机具有比功率高的优点，因为发动机的每个循环就有一次做功行程。但是这一优势被进气和排气交换时产生的部分能量损失抵消，结果导致效率较低 。二冲程发动机的这些特点，使它的应用被限制在一定领域，如小船的发动机、割草机发动机，其较低的成本和较小的质量比其效率更占优势。

压燃式发动机

有了足够高的压缩比和合适的燃料，自动点火发生在往复式发动机上。该发动机如上面所述，只是在压缩行程，仅有空气被带到活塞附近并被压缩满足点火条件，然后，燃油被雾化以一定的速度直接进入燃烧室。

发动机的核心是气缸，活塞在气缸内做向上和向下运动。大多数汽车有多个气缸(四缸、六缸、八缸是常见的类型)。在多缸发动机上，气缸通常以下面三种方式之一排列：直列、V 形或平行。不同的布置方式在工作平稳程度、制造成本和形状特征方面具有不同的优点和缺点。这些优点和缺点使其更适合某些车辆。

下面详细介绍发动机的一些关键部件。

火花塞

火花塞提供火花，用来点燃空气/燃油混合气，使其进行燃烧。火花必须在正确的时刻产生才能正常工作。

气门

进气门和排气门在适当的时刻打开，让空气和燃料进入气缸，并让废气排出。应注意

在压缩和燃烧过程中，这两个气门均被关闭，以保证燃烧室密封。

活塞

活塞是一个可以在气缸内向上和向下运动的圆柱形金属块。

活塞环

活塞环在活塞外缘与气缸内缘之间形成一个滑动的密封。活塞环有两个目的：在压缩和做功行程中，它们防止燃烧室内的燃料/空气混合气泄漏到油底壳。

它们阻止润滑油进入燃烧区域，从而避免润滑油在燃烧区域燃烧，造成损耗。由于发动机老化和活塞环的密封性能下降，大多数汽车会出现“烧机油”现象，每行驶 1000 英里被燃烧的机油将增加 1quart(夸脱)(美制，1quart＝0.946L；英制，1quart＝1.136L)。

Passage 2

How an Engine Works

Since the same process occurs in each cylinder, we will take a look at one cylinder to see how the four-stroke process works. The four strokes are intake, compression, power and exhaust. The piston travels down on the intake stroke, up on the compression stroke, down on the power stroke and up on the exhaust stroke.

Intake

As the piston starts down on the Intake stroke, the intake valve opens and the fuel-air mixture is drawn into the cylinder when the piston reaches the bottom of the intake stroke, the intake valve closes, trapping the air-fuel mixture in the cylinder.

Compression

The piston moves up and compresses the trapped air fuel mixture that was brought in by the intake stroke. The amount that the mixture is compressed is determined by the compression ratio of the engine. The compression ratio on the average engine is in the range of 8∶1 to 10∶1.

This means that when the piston reaches the top of the cylinder, the air-fuel mixture is squeezed to about one tenth of its original volume.

Power

The spark plug fires, igniting the compressed air-fuel mixture which produces a powerful expansion of the vapor. The combustion process pushes the piston down the cylinder with great force turning the crankshaft to provide the power to propel the vehicle. Each piston fires at a different time, determined by the engine firing order. By the time the crankshaft completes two revolutions, each cylinder in the engine will have gone through one power stroke.

Exhaust

With the piston at the bottom of the cylinder, the exhaust valve opens to allow the burned exhaust gas to be expelled to the exhaust system. Since the cylinder contains so

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