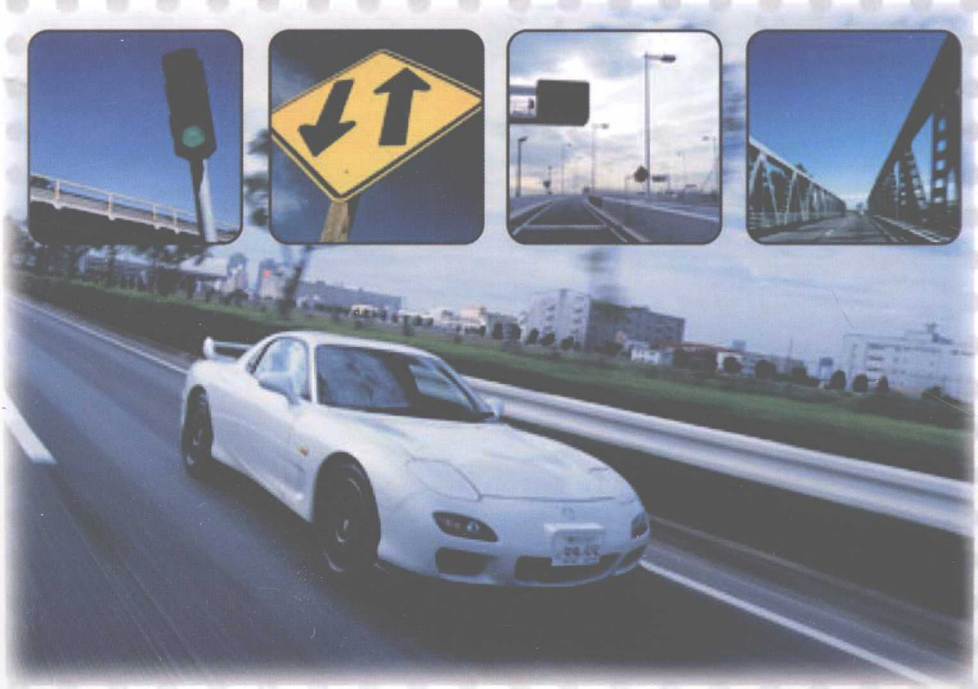
全国高等职业教育专业英语系列规划教材

汽车专业英语

蒋芳　吴喜骊　主编



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本书以汽车专业知识和公共英语知识为基础，着重培养和提高读者阅读、翻译汽车英文书籍和文献的能力，以适应行业发展的需要。全书共分为14个单元，内容涉及汽车发动机、传动系统、行驶系统、转向系统、制动系统、车架与车身、车身控制系统及车辆维护，侧重新技术、新结构的介绍。遴选的文章内容丰富、图文并茂、专业性强。

本书可作为高等职业院校汽车相关专业教学用书，亦可作为其他汽车技术学校、汽车修理技术培训的参考书。

为方便教学，本书配备电子课件等教学资源。凡选用本书作为教材的教师均可登录机械工业出版社教材服务网 www. cmpedu. com 免费下载。如有问题请致信 cmpgaozhi@ sina. com 或致电 010-88379375 联系营销人员。

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前　言

随着我国汽车产业的蓬勃发展，汽车新车型、新技术不断涌现，进口车辆不断增加，英文原版汽车使用手册、维修资料、检测设备随处可见，汽车仪表、熔丝、继电器、传感器等零部件也大多采用英文来标记。汽车维修行业的变化对从业人员提出了新的挑战和更高的要求。本书的编写目的就是为了提高汽车专业学生和汽车维修人员的英文阅读水平，适应行业发展需要。

本书以汽车专业知识和公共英语知识为基础，以训练汽车英文文献的阅读、翻译能力为目标，内容涉及汽车发动机、传动系统、行驶系统、转向系统、制动系统、车架与车身、车身控制系统及车辆维护，侧重新技术、新结构的介绍。遴选的文章内容丰富、图文并茂、专业性强。

全书分为 14 个单元，每个单元包括 Text A、Text B、Exercises 三部分。Text A 为该单元的主要讲解部分；Text B 类似于阅读材料，属于扩展、延伸部分。这两部分内容均以现代汽车的典型结构和原理讲解为主，文章后有单词、词组和难句注释。Exercises 包括课堂小问题、词组互译和短文翻译，内容与本单元相关联，短文翻译参考英文原版汽车使用说明书和维修手册，涉及拆装、维修、检测、故障诊断等方面的知识，以帮助读者进一步提高专业英语运用能力。

本书由包头职业技术学院蒋芳（第 1、2、3、13 单元，附录 A）、吴喜骊（第 4、5、6、14 单元，附录 B）担任主编，参编的有天津中德职业技术学院赵嫱（第 7、11、12 单元）、承德石油高等专科学校许海东（第 8、9、10 单元）。全书由内蒙古北方重型汽车股份有限公司杨芙蓉高级工程师审阅。

本书在编写过程中得到了多位教师同仁、企业专家的帮助，他们提出了许多宝贵意见和建议，在此一并深表谢意。

由于编者水平有限，书中不妥及疏漏之处在所难免，敬请广大读者批评指正。

编　者

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Unit 1 Engine Operating Principle

Text A Four-stroke Engine

Internal combustion gasoline engines run on a mixture of gasoline and air. The ideal mixture is 14.7 parts of air to one part of gasoline (by weight). One part of gas that is completely vaporized into 14.7 parts of air can produce tremendous power when ignited inside an engine[1].

Engine Types

There are several engine types that are identified by the number of cylinders and the way the cylinders are laid out. Motor vehicles will have from 3 to 12 cylinders that are arranged in the engine block in several configurations. The most popular of them are shown in Fig. 1-1. In-line engines have their cylinders arranged in a row. 3, 4, 5 and 6 cylinder engines commonly use this arrangement. The "V" arrangement uses two banks of cylinders side-by-side and is commonly used in V6, V8, V10 and V12 configurations. Flat engines use two opposing banks of cylinders and are less common than the other two designs. They are used in engines from Subaru and Porsche in 4 and 6 cylinder arrangements as well as in the old VW beetles with 4 cylinders. Flat engines are also used in some Ferraris with 12 cylinders.

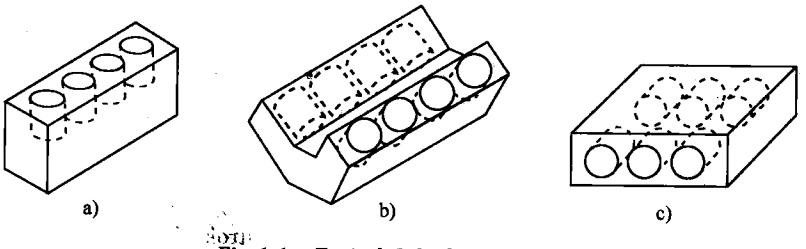

Fig. 1-1 Typical Cylinder Arrangement
a) In-line4 b) V8 c) Flat6

Each cylinder contains a piston that travels up and down inside the cylinder bore. All the pistons in the engine are connected through individual connecting rods to a common crankshaft. See Fig. 1-2.

The crankshaft shown in Fig. 1-3 is located below the cylinders on an in-line engine, at the base of the V on a V-type engine and between the cylinder banks on a flat engine. As the pistons move up and down, they turn the

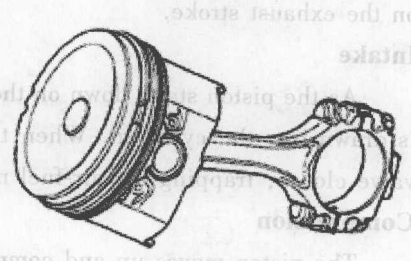

Fig. 1-2 Piston and Connecting Rod

crankshaft just like your legs pump up and down to turn the crank that is connected to the pedals of a bicycle.

Fig. 1-3 Crankshaft

A cylinder head is bolted to the top of each bank of cylinders to seal the individual cylinders and contain the combustion process that takes place inside the cylinder. Most cylinder heads are made of cast aluminum or cast iron. The cylinder head contains at least one intake valve and one exhaust valve for each cylinder. This allows the air-fuel mixture to enter the cylinder and the burned exhaust gas to exit the cylinder. Many newer engines are using multiple intake and exhaust valves per cylinder for increased engine power and efficiency. These engines are sometimes named for the number of valves that they have such as "24 Valve V6" which indicates a V6 engine with four valves per cylinder[2]. Modern engine designs can use anywhere from 2 to 5 valves per cylinder.

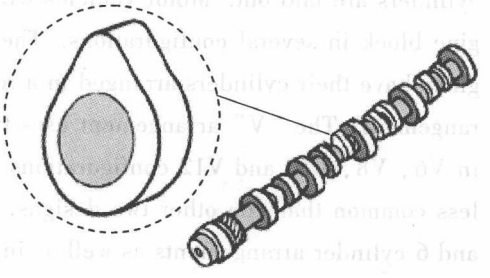

Fig. 1-4 Camshaft

The valves are opened and closed by means of a camshaft. A camshaft is a rotating shaft that has individual lobes for each valve, seeing Fig. 1-4. When the lobe pushes against the lifter, the lifter in turn pushes the valve open. When the lobe rotates away from the lifter, the valve is closed by a spring that is attached to the valve. A common configuration is to have one camshaft located in the engine block with the lifters connecting to the valves through a series of linkages[3]. Some engines have two camshafts on each head, one for the intake valves and one for the exhaust valves. These engines are called double overhead camshaft (DOHC) engines while the other type is called single overhead camshaft (SOHC) engines.

How an Engine Works

The majority of engines in motor vehicles today are four-stroke, internal combustion engines.

The four strokes are intake, compression, power and exhaust, seeing Fig. 1-5. 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 air-fuel 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

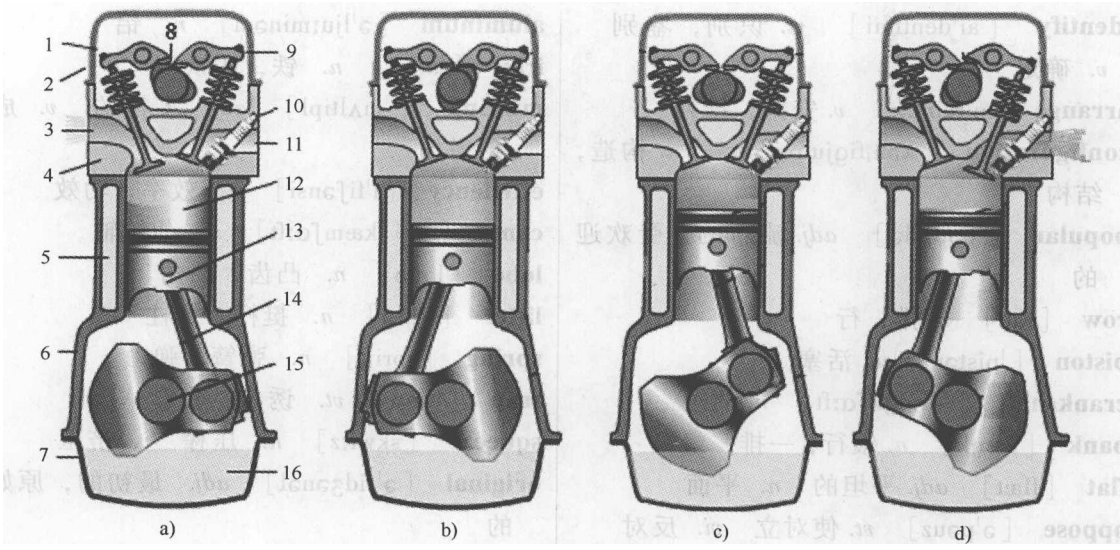

Fig. 1-5 Engine Strokes

a) Intake b) Compression c) Power d) Exhaust

1—Intake Valve 2—Valve Cover 3—Intake Port 4—Head 5—Coolant 6—Engine Block 7—Oil Pan 8—Camshaft 9—Exhaust Valve 10—Spark Plug 11—Exhaust Port 12—Cylinder 13—Piston 14—Connecting Rod 15—Crankshaft 16—Oil

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[4]. 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 much pressure, when the valve opens, the gas is expelled with a violent force. The piston travels up to the top of the cylinder pushing all the exhaust out before closing the exhaust valve in preparation for starting the four stroke process over again[5].

New Words

principle [ˈprinsəpl] *n.* 原则，原理
stroke [strəuk] *n.* 行程，冲程
gasoline [ˈgæsəliːn] *n.* 汽油
cylinder [ˈsilində] *n.* 圆筒，圆柱体，气缸，柱面
combustion [kəmˈbʌstʃən] *n.* 燃烧
ideal [aiˈdiəl] *n.* 理想
vaporize [ˈveipəraiz] *v.* （使）蒸发
tremendous [triˈmendəs] *adj.* 极大的，巨大的

identify [ai'dentifai] *vt.* 识别，鉴别 *v.* 确定
arrange [ə'reindʒ] *v.* 安排，排列
configuration [kən,figju'reiʃən] *n.* 构造，结构
popular ['pɔpjulə] *adj.* 流行的，受欢迎的
row [rau] *n.* 排，行
piston ['pistən] *n.* 活塞
crankshaft ['kræŋkʃɑ:ft] *n.* 曲轴
bank [bæŋk] *n.* 银行；一排，组
flat [flæt] *adj.* 平坦的 *n.* 平面
oppose [ə'pəuz] *vt.* 使对立 *vi.* 反对
bore [bɔ:] *n.* 孔 *v.* 钻孔
individual [,indi'vidjuəl] *n.* 个体 *adj.* 个别的，单独的
pump [pʌmp] *n.* 泵 *vt.* 抽吸
pedal ['pedl] *n.* 踏板 *v.* 踩……的踏板
bolt [bəult] *n.* 螺栓 *v.* 用螺栓紧固
seal [si:l] *n.* 密封 *vt.* 封，密封
cast [kɑ:st] *n.* 铸件 *v.* 浇铸
aluminum [ə'lju:minəm] *n.* 铝
iron ['aiən] *n.* 铁，铸铁
multiple ['mʌltipl] *adj.* 多样的 *v.* 成倍增加
efficiency [i'fiʃənsi] *n.* 效率，功效
camshaft ['kæmʃɑ:ft] *n.* 凸轮轴
lobe [ləub] *n.* 凸齿，凸角
lifter ['liftə] *n.* 挺杆，挺柱
spring [spriŋ] *n.* 弹簧，弹力
trap [træp] *vt.* 诱入；收集
squeeze [skwi:z] *n.* 压榨 *v.* 挤压
original [ə'ridʒənəl] *adj.* 最初的，原始的
volume ['vɔlju:m] *n.* 体积，容积
expansion [iks'pænʃən] *n.* 扩充，膨胀
propel [prə'pel] *vt.* 推进，驱使
expel [iks'pel] *v.* 驱逐，开除；排出，发射
revolution [,revə'lu:ʃən] *n.* 旋转，转数；革命
violent ['vaiələnt] *adj.* 猛烈的，强烈的

Phrases and Expressions

internal combustion engine 内燃机
connecting rod 连杆
intake valve 进气门
exhaust valve 排气门
by means of 利用，依靠
spark plug 火花塞
cylinder head 气缸盖
cast aluminum 铸铝
valve lifter 气门挺柱
double overhead camshaft（DOHC） 双顶置式凸轮轴
single overhead camshaft（SOHC） 单顶置式凸轮轴
intake stroke 进气行程
compression stroke 压缩行程
power stroke 作功行程
exhaust stroke 排气行程
compression ratio 压缩比
air-fuel mixture 可燃混合气

Notes to the Text

[1] One part of gas that is completely vaporized into 14.7 parts of air can produce tremendous power when ignited inside an engine.

1 份燃油在 14.7 份空气中完全蒸发，在发动机内点燃它，会产生强大的爆发力。

[2] These engines are sometimes named for the number of valves that they have such as "24

Valve V6" which indicates a V6 engine with four valves per cylinder.

这些发动机有时采用气门数量来命名，比如“24 Valve V6”表示 V6 发动机，每缸四气门。

[3] A common configuration is to have one camshaft located in the engine block with the lifters connecting to the valves through a series of linkages.

通常发动机缸体内有一根凸轮轴，凸轮经过一套连接装置使挺柱与气门联动。

[4] The combustion process pushes the piston down the cylinder with great force turning the crankshaft to provide the power to propel the vehicle.

燃烧过程中产生的巨大推力使活塞沿着气缸下行，转动曲轴，为汽车行驶提供动力。

[5] The piston travels up to the top of the cylinder pushing all the exhaust out before closing the exhaust valve in preparation for starting the four stroke process over again.

活塞上行到气缸顶部，在排气门关闭之前将废气推出，准备开始下一个四冲程循环。

Text B Two-stroke Engine

Both gasoline and diesel automotive engines are found in nearly every car and truck on the road today. The two types of engines are classified as four-stroke reciprocating internal combustion engines. There is a third type of engine, known as a two-stroke engine that is commonly found in motorcycle.

Two-stroke Basic

Two-stroke engines have two important advantages over four-stroke engines:

(1) Two-stroke engines do not have valves, which simplifies their construction and lowers their weight.

(2) Two-stroke engines fire once every revolution, while four-stroke engines fire once every other revolution. This gives two-stroke engines a significant power boost.

These advantages make two-stroke engines lighter, simpler and less expensive to manufacture.

Two-stroke Cycle

Two-stroke engines operated with only a compression stroke and a combustion stroke, seeing Fig. 1-6. Intake of fuel and air mixture and expulsion of exhaust gases takes place between the combustion and compression strokes while the piston is near the bottom of its travel. Ports in the cylinder walls replace the cylinder head valves of the four-stroke engine. The crankcase is kept dry of oil, and the entire engine is lubricated by mixing the oil with the fuel, so that a fine mist of oil covers all moving parts.

Combustion Stroke

Combustion stroke starts with the point where the spark plug fires. Fuel and air in the cylinder have been compressed, and when the spark plug fires the mixture ignites. The resulting explo-

sion drives the piston downward. As the piston moves downward, it is compressing the air-fuel mixture in the crankcase. As the piston approaches the bottom of its stroke, the exhaust port is uncovered. The pressure in the cylinder drives most of the exhaust gases out of cylinder.

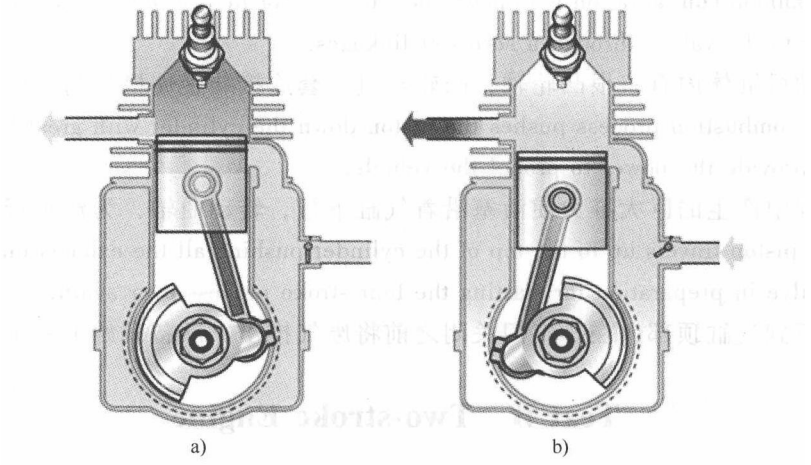

Fig. 1-6 Two-stroke Cycle
a) Combustion Stroke b) Compression Stroke

As the piston finally bottoms out, the intake port is uncovered. The piston's movement has pressurized the mixture in the crankcase, so it rushes into the cylinder, displacing the remaining exhaust gases and filling the cylinder with a fresh charge of fuel[1].

In many two-stroke engines, the piston is shaped so that the incoming fuel mixture doesn't simply flow right over the top of the piston and out the exhaust port[2].

Compression Stroke

Now the momentum in the crankshaft starts driving the piston back toward the spark plug for the compression stroke. As the air-fuel mixture in the cylinder is compressed, a vacuum is created in the crankcase. This vacuum opens the reed valve and sucks air-fuel-oil in from the carburetor.

Once the piston makes it to the end of the compression stroke, the spark plug fires again to repeat the cycle. It's called a two-stoke engine because there is a compression stroke and then a combustion stroke. In a four-stroke engine, there are separate intake, compression, combustion and exhaust strokes.

The piston is really doing three different things in a two-stroke engine:

(1) On one side of the piston is the combustion chamber, where the piston is compressing the air-fuel mixture and capturing the energy released by the ignition of the fuel.

(2) On the other side of the piston is the crankcase, where the piston is creating a vacuum to suck in air-fuel from the carburetor through the reed valve and then pressurizing the crankcase so that air-fuel is forced into the combustion chamber[3].

(3) Meanwhile, the sides of the piston are acting like valves, covering and uncovering the intake and exhaust ports drilled into the side of the cylinder wall.

In a four-stroke engine, the crankcase is completely separated from the combustion chamber;

thick oil in the crankcase can lubricate the crankshaft bearings, the bearings on either end of the piston's connecting rod and the cylinder wall. In a two-stroke engine, on the other hand, the crankcase is serving as a pressurization chamber to force air-fuel into the cylinder, so it can't hold thick oil. Instead, oil has to be mixed with the gas to lubricate the crankshaft, connecting rod and cylinder walls.

Disadvantages of the Two-stroke

Cars and trucks commonly use four-stroke engines because two-stroke engines have a couple of significant disadvantages. There are four main reasons:

(1) Two-stroke engines don't last nearly as long as four-stroke engines. The lack of a dedicated lubrication system means that the parts of a two-stroke engine wear a lot faster[4].

(2) Two-stroke oil is expensive, and per gallon of gas need about 4 ounces of oil. You would burn about a gallon of oil every 1,000 miles if you used a two-stroke engine in a car.

(3) Two-stroke engines do not use fuel efficiently.

(4) Two-stroke engines produce a lot of pollution. The pollution comes from two sources. The first is the combustion of the oil. The oil makes all two-stroke engines smoky to some extent, and a badly worn two-stroke engine can emit huge clouds of oily smoke. The second reason is the leaking hydrocarbons. Each time a new charge of air-fuel is loaded into the combustion chamber, part of it leaks out through the exhaust port.

New Words

diesel [ˈdiːzəl] *n.* 柴油机
motorcycle [ˈməutəsaikl] *n.* 摩托车，机车
significant [sigˈnifikənt] *adj.* 有意义的，重要的
boost [buːst] *v.* 推进
expulsion [iksˈpʌlʃən] *n.* 逐出，开除
entire [inˈtaiə] *adj.* 全部的，整个
explosion [iksˈpləuʒən] *n.* 爆发，爆炸
crankcase [ˈkræŋkkeis] *n.* 曲柄轴箱
approach [əˈprəutʃ] *n.* 接近，方法 *vt.* 接近
pressurize [ˈpreʃəraiz] *vt.* 增压，使……加压
momentum [məuˈmentəm] *n.* 动力，力量
reed [riːd] *n.* 簧片
carburetor [ˈkɑːbjuretə(r)] *n.* 化油器
capture [ˈkæptʃə] *n.* 捕获 *vt.* 夺取
release [riˈliːs] *n.* 释放 *vt.* 释放，放弃
thick [θik] *adj.* 厚的，粗的，浓的
pressurization [ˌpreʃəraiˈzeiʃən] *n.* 增压，加压；耐压
chamber [ˈtʃeimbə] *n.* 室，房间
extent [iksˈtent] *n.* 范围，程度
emit [iˈmit] *vt.* 放射，散发
hydrocarbon [ˈhaidrəuˈkɑːbən] *n.* 碳氢化合物

Phrases and Expressions

two-stroke engine 两冲程发动机
cylinder wall 气缸壁
exhaust port 排气口
intake port 进气口
on the other hand 另一方面

Notes to the Text

[1] The piston's movement has pressurized the mixture in the crankcase, so it rushes into the cylinder, displacing the remaining exhaust gases and filling the cylinder with a fresh charge of fuel.

活塞的运动将混合气压缩，并使之冲入气缸，扫除残留的废气，使气缸充满新鲜混合气。

[2] In many two-stroke engines, the piston is shaped so that the incoming fuel mixture doesn't simply flow right over the top of the piston and out the exhaust port.

在两冲程发动机中，活塞的造型会避免新鲜混合气扫过活塞顶而冲出排气口。

[3] On the other side of the piston is the crankcase, where the piston is creating a vacuum to suck in air-fuel from the carburetor through the reed valve and then pressurizing the crankcase so that air-fuel is forced into the combustion chamber.

活塞的另一侧是曲轴箱，在那里，活塞运动产生真空，可燃混合气从化油器经过节气门进入曲轴箱，然后活塞下行将曲轴箱加压，迫使混合气进入燃烧室。

[4] The lack of a dedicated lubrication system means that the parts of a two-stroke engine wear a lot faster.

润滑系统的缺陷意味着两冲程发动机零部件磨损更快。

Exercises

1. Answer the following questions according to the text.

(1) What is the ideal mixture?

(2) How does the engine types identify?

(3) What is the cylinder head made up of?

(4) What does the cylinder head contain at least?

(5) Can you list the four engine strokes?

(6) There are three types of engine. What are they?

(7) What are the advantages of a two-stroke engine?

(8) What are the two strokes in a two-stroke engine?

(9) Why do the cars and trucks commonly use four-stroke engines?

(10) The pollution of two-stroke engine comes from two sources. What are they?

2. Translate the following into Chinese.

(1) internal combustion engine

(2) in-line engine

(3) V-type engine

(4) flat engine

(5) air-fuel mixture

(6) double overhead camshaft (DOHC)

(7) single overhead camshaft (SOHC)

(8) cylinder wall

(9) oil pan

(10) fresh charge

3. Translate the following into English.

(1) 发动机缸体

(2) 气缸盖

(3) 铸铁

(4) 进气口

(5) 排气门

(6) 压缩比

(7) 作功行程

(8) 气门挺柱

(9) 燃烧室

(10) 润滑系统

4. Translate the following passages into Chinese.

Checking Engine Oil

(1) Position vehicle on a flat level.

(2) Warm up the engine and stop the engine.

Note: In the case of a vehicle that has been out of service for a prolonged period, run the engine for several minutes and stop for some time before attempting to check oil level.

(3) Check to ensure that the engine oil level is within the level range indicated on the oil dipstick. If oil level is found to have fallen to the lower limit by the MIN mark, replenish the engine oil.

Caution: For replenishment, use the same type of engine oil as one currently used.

(4) Check to be sure that the oil is not noticeably dirty or mixed with coolant or gasoline, and that it has the proper viscosity.

Checking Engine Compression Pressure

(1) Check to be sure that the engine oil, starting motor and battery are in the normal condition.

(2) Start the engine and allow it to warm up until the temperature of the coolant reaches 80℃ to 90℃ (176 ℉ to 194 ℉).

(3) Loosen the nuts at the nozzle side of the injection pipes, and disconnect the pipes from the nozzle holders.

Caution: Caps must be used to prevent entry of foreign materials into the nozzles.

(4) Remove the glow plug plate and all 4 glow plugs.

(5) Set an engine tachometer in place.

(6) Place a compression gauge adaptor and compression gauge in the glow plug hole.

(7) Crank the engine with the throttle valve fully open, and measure the compression at the place where the compression gauge indicator shows a stabilized reading.

Standard value (at engine speed of 250r/min): 2700kPa (27kg/cm^2, 384psi); limit (at engine speed of 250r/min): 2400kPa (24kg/cm^2, 341psi); difference between each cylinder: 300kPa (3.0kg/cm^2, 43psi) or less.

(8) If, after the measurement, the compression is below the limit, put the small amount of engine oil through the glow plug hole into the cylinder, then measure the compression once again and determine the cause of the malfunction.

(9) If, after oil is added, the compression rises, the cause of the malfunction is a worn or damaged piston ring or cylinder inner surface. If, however, the compression does not rise, the cause is a bad valve or a bad gasket.

Unit 2 Engine Technology

Text A Piston Connecting Rods and Crankshaft

Piston Assembly

The piston is an important part of a four-stroke cycle engine. Most pistons are made from cast aluminum. The piston, through the connecting rod, transfers to the crankshaft. The force creates by the burning fuel mixture and turns the crankshaft. Some piston rings fit into grooves around the piston to seal the bottom of the combustion chamber. A piston pin fits into a round hole in the piston. The piston pin joints the piston to the connecting rod. The thick part of the piston that holds the piston is the pin boss.

The piston itself, its rings and the piston pin are together called the piston assembly.

Piston

As Fig. 2-1 shows, to withstand the heat of the combustion chamber, the piston must be strong. It also must be light, since it travels at high speeds as it moves up and down inside the cylinder. The piston is hollow. It is thick at the top where it takes the brunt of the heat and the expansion force. It is thin at the bottom, where there is less heat. The top part of the piston is the head, or crown. The thin part is the skirt. The sections between the ring grooves are called ring lands.

The piston crown may be flat, concave, domed or recessed. In diesel engine, the combustion chamber may be formed totally or in part in the piston crown, depending on the method of injection. So they use pistons with different shapes.

Piston Rings

As Fig. 2-2 shows, piston rings fit into ring grooves. In simplest terms, piston rings are thin, circular pieces of metal that fit into grooves in the tops of the pistons.

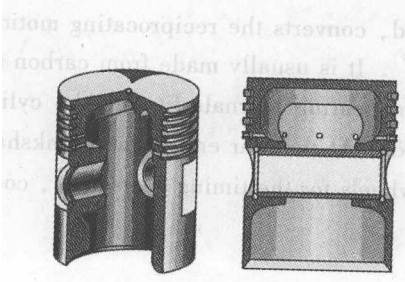

Fig. 2-1 Piston

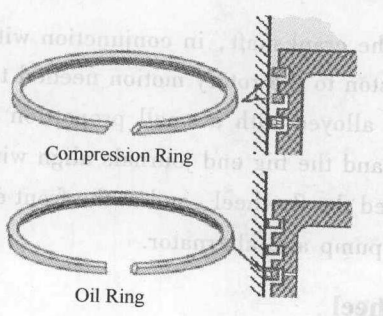

Fig. 2-2 Piston Rings