



教育部职业教育与成人教育司推荐教材  
中等职业学校汽车运用与维修专业教学用书

汽车运用与维修专业技能型紧缺人才培养培训教材

# 汽车实用英语

(下 册)

主编 马林才    主审 陈 斌 杨维和



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**Qiche Shiyong Yingyu**

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## 内 容 提 要

本书是教育部职业教育与成人教育司推荐教材,也是汽车运用与维修专业技能型紧缺人才培养培训教材。由交通职业教育教学指导委员会汽车运用与维修学科委员会根据教育部颁布的《中等职业院校汽车运用与维修专业领域技能型紧缺人才培养培训指导方案》以及交通行业职业技能规范和技术工人等级标准组织编写而成。

本书总共 21 单元,分别选编了汽车发动机、汽车底盘、汽车电器、汽车检测设备、排放控制装置、自动变速器、汽车防抱死制动系统(ABS)、汽车智能运输系统(ITS)、全球定位系统(GPS)、前轮定位仪、发动机模拟仪、车身电器模拟板、汽车计算机控制系统等汽车专业英语短文。书中有大量清晰精致的插图,便于认识和理解汽车专业英语单词与词汇;每个单元结尾都有对应练习题,便于复习和巩固所学知识;书后附有参考译文,增强了本书的自学性和阅读性。

本书供中等职业院校汽车运用与维修专业教学使用,也适合大专院校相关专业师生和汽车工程技术人员阅读。

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# 前言 QIANYAN

为深入贯彻《国务院关于大力推进职业教育改革与发展的决定》以及教育部等六部委《关于实施职业院校制造业和现代服务业技能型紧缺人才培养培训工程的通知》精神,全面实施《2003—2007年教育振兴行动计划》中提出的“职业教育与培训创新工程”,积极推进课程改革和教材建设,为职业教育教学和培训提供更加丰富、多样和实用的教材,更好地满足职业教育改革与发展的需要。交通职业教育教学指导委员会汽车运用与维修学科委员会组织全国交通职业院校的专业教师,按照教育部颁布的《中等职业学校汽车运用与维修专业领域技能型紧缺人才培养培训指导方案》的要求,编写了教育部职业教育与成人教育司推荐教材,供中等职业学校汽车运用与维修专业教学使用。

本系列教材符合国家对技能型紧缺人才培养培训工作的要求,注重以就业为导向,以能力为本位,面向市场、面向社会,为经济结构调整和科技进步服务的原则,体现了职业教育的特色,满足了高素质的中、初级汽车专业实用人才培养的需要。

本系列教材在组织编写过程中,认真总结了全国交通职业院校多年来的专业教学经验,注意吸收发达国家先进的职教理念和方法,形成了以下特色:

1. 以《汽车电工与电子基础》、《汽车机械基础》、《汽车发动机构造与维修》、《汽车底盘构造与维修》、《汽车电气设备构造与维修》、《汽车维修质量检验》六门课程搭建专业基本能力平台,以若干专门化适应各地各校的实际需求;

2. 打破了教材传统的章节体例,以专项能力培养为单元确定知识目标和能力目标,使培养过程实现“知行合一”;

3. 在内容的选择上,注重汽车市场职业岗位对人才的知识、能力要求,力求与相应的职业资格标准衔接,并较多地反映了新知识、新技术、新工艺、新方法、新材料的内容。

《汽车实用英语》(下册)是汽车运用与维修专业领域技能型紧

缺人才培养培训课程之一。本书在编排中做到每单元前有教学目标,单元后有单词和词汇、句子注释和练习题,便于教师教学和学生自学,突出重点、难点,方便学生复习和巩固汽车专业英语知识。本书有大量的插图,而且全书内容主要取自外文原著,较好地反映专业英语自身特色。其语法、句子结构在尊重原著的情况下作了一些修改,以符合中等职业技术教育的要求。全书既介绍了汽车传统知识,也介绍了汽车新技术新结构,以及国外新设备、新仪器的使用。涉及面广,大大拓宽了汽车专业英语的知识面,增加了学习汽车专业英语的兴趣。对从事外文资料阅读和翻译工作起到抛砖引玉的作用。本书附有参考翻译,既增强了本书的自学性、阅读性,也降低了教学难度,促进了中等职业技术教育的开展。

本书由浙江交通职业技术学院马林才主编,参加编写的有:浙江交通职业技术学院刘颖,陈蕾,吕凤军,吴涛。马林才负责编写单元一、二、四、六、七、八、九、十、二十一以及中文翻译,刘颖负责编写单元三、五、十二以及中文翻译和全书的语法分析,陈蕾负责编写单元十一、十三、十四以及中文翻译,吕凤军负责编写单元十五、十六、二十以及中文翻译,吴涛负责编写单元十七、十八、十九以及中文翻译。全书由四川交通职业技术学院陈斌、云南交通职业技术学院杨维和主审。

限于编者经历和水平,教材内容难以覆盖全国各地的实际情况,希望各教学单位在积极选用和推广本系列教材的同时,注重总结经验,及时提出修改意见和建议,以便再版修订时改正。

交通职业教育教学指导委员会  
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## Unit 1 Introduction to the Four-stroke Engine

### 单元一 四冲程发动机介绍

#### 学习目标

##### 知识目标

1. 掌握与发动机四冲程的工作过程、发动机分类相关的专业术语、词汇。
2. 掌握发动机常见术语的英语表达方法。

##### 能力目标

1. 能对关于发动机四个冲程的资料进行中英互译。
2. 能进行相关内容的简单阅读和翻译。
3. 能对汽车实物上标出的英语单词或词汇进行辨认。

#### Internal Combustion Engine

The engine is a self-contained power unit which converts the heat energy of fuel into mechanical energy for moving the vehicle. [1] Because fuel is burned within the engine, it is known as an internal combustion engine. In the internal combustion engine, air/fuel mixture is introduced into a closed cylinder where it is compressed and then ignited. The burning of the fuel causes a rapid rise in cylinder pressure which is converted to useful mechanical energy by the piston and crankshaft. The most common engine is the four-stroke piston engine. These four strokes are intake stroke, compression stroke, power stroke and exhaust stroke.

##### Intake Stroke

The intake stroke of a four-stroke engine begins with the piston at top dead center (TDC). The starter causes the crankshaft to rotate in a clockwise direction. The crankshaft, through the connecting rod, forces the piston to move downward. This downward movement of the piston creates a vacuum, a difference in pressure, in the space above the piston. The engine manufacturer times the intake valve action so that it opens automatically at or slightly before the piston starts down. Therefore, a mixture of gasoline and air, pushed by the atmospheric pressure outside the engine, rushes through the intake manifold and into the engine cylinder. At the same time, the exhaust valve remains closed during this downward stroke of the piston. This valve closure prevents the entering air/fuel charge from escaping through the exhaust port. Af-

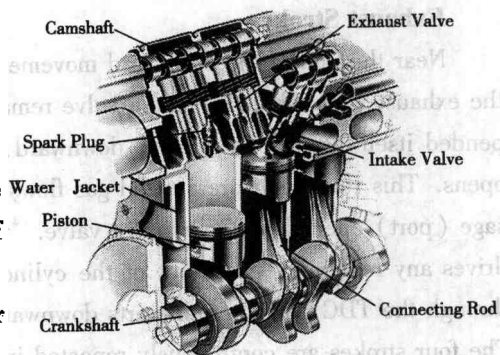


Fig. 1-1 Engine





ter the piston reaches the bottom of its first stroke, the cylinder is practically full of an air/fuel charge. The drawing of an air/fuel charge into the cylinder in this manner, during the downward movement of the piston, constitutes the intake stroke of the piston. [2]

### Compression Stroke

After the piston reaches bottom dead center (BDC), it moves upward again as the starter continues to turn the crankshaft in a clockwise direction. As the piston is beginning to move upward, the intake valve closes, and the exhaust valve remains closed. Since both valves are closed, the piston compresses the air/fuel mixture in the small space between the top of the piston and the cylinder head. As the piston reaches TDC again during its upward travel, the compression stroke of the piston is over. The air/fuel charge is now under compression so that it will produce a great deal of power when the spark plug ignites it.

### Power Stroke

Just as or slightly before the piston reaches TDC on the compression stroke with the air/fuel mixture fully compressed, a timed electrical spark appears at the spark plug. This spark ignites the compressed air/fuel mixture. The burning mixture begins to expand; the pressure in the combustion chamber above the piston immediately increases. This results in a high pressure applied to the top of the piston. Now, both valves remain closed during the power stroke. This assures that the total force of the expanding gas applies itself to the head of the piston. This tremendous force pushes the piston downward on the power stroke, causing the connecting rod to rotate the crankshaft. [3] In other words, the force resulting from the expansion of the burning air/fuel mixture is turning the crankshaft.

### Exhaust Stroke

Near the end of the downward movement of the piston on the power stroke, the camshaft opens the exhaust valve, but the intake valve remains closed. Although much of the gas pressure has expended itself driving the piston downward, some pressure still remains when the exhaust valve opens. This remaining pressurized gas flows comparatively freely from the cylinder through the passage (port) opened by the exhaust valve. [4] Then, as the piston again moves up in the cylinder, it drives any remaining gases out of the cylinder past the open exhaust valve. As the piston travels through the TDC position and starts downward again in the cylinder, a new operating cycle begins. The four strokes are continuously repeated in every cylinder as long as the engine remains running.

### Flywheel

The engine cycle has only one power stroke where the piston is actually driving the crankshaft. During the other three strokes, the rotating crankshaft is moving the piston up or down in its cylinder. Thus, during the power stroke, the crankshaft tends to speed up; during the other three strokes, it tends to slow down. To keep the crankshaft turning smoothly between two power strokes,

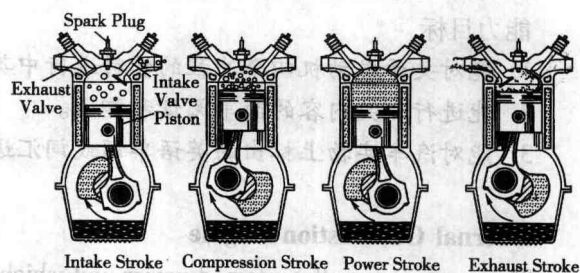


Fig. 1-2 Engine Four-stroke



the flywheel is attached to the end of the crankshaft.<sup>[5]</sup> This wheel resists any effort to change its speed of rotation. When the crankshaft tends to speed up or slow down, flywheel inertia resists it.

### Multiple-Cylinder Engines

The single-cylinder engine just described as above provides only one power stroke during every two crankshaft revolutions or delivers power only one-fourth of the time. To provide a more even and continuous flow of power, automobiles have engines with four, six, or eight cylinders.

### Engine Classification

For identification purposes, manufacturers classify automobile engines by their cylinder arrangement, valve arrangement, and type of system used to cool the engine.<sup>[6]</sup>

Engine manufacturers basically use three distinct ways to arrange the cylinders in an engine: in-line, V-shape, or opposed.

Automobile engines have their valves arranged in one of three ways. In an L-head engine, the valves are in the block, sitting side by side, adjacent to the cylinder. This engine design was at one time very common, but because of its limited compression ratio, the usage now has been confined. The F-type engine has one valve in the cylinder head and one in the engine block. Modern automotive engines utilize the third type of valve arrangement, with both valves in the cylinder head.

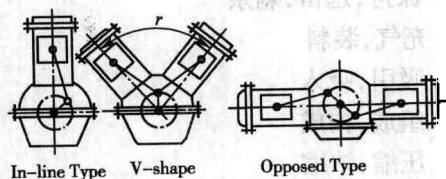


Fig. 1-3 Engine Arrangement

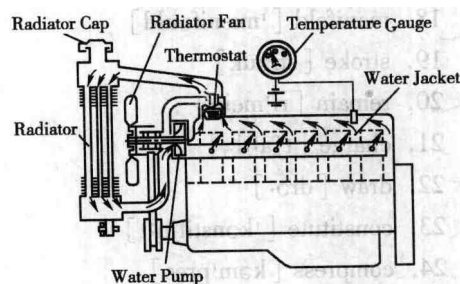


Fig. 1-4 Water-cooled Engine

Manufacturers also classify engines as being either air- or water-cooled. In these air-cooled engines, the cylinders are cooled by the air flowing around. A liquid-cooled engine uses a liquid coolant as the medium to remove heat from the engine. With this system, the engine has the water jackets in the block and head, which surround the cylinders and combustion chambers and through which coolant circulates freely.<sup>[7]</sup> This coolant enters the engine from the bottom of the radiator and circulates throughout the engine, where it absorbs heat. Then it exits from the upper water jackets and pours into the upper portion of the radiator. As the coolant passes through the radiator, it picks up the heat contained in the coolant and passes this heat to the air flowing around the radiator passages or tubes. Thus, the coolant leaving the lower tank is cool ready to flow through the engine again.

### New Words

1. introduction [intrə'dʌkʃ(ə)n]

n. 介绍, 传入, 初步, 导言, 绪论, 入门



2. unit ['ju:nit]
3. vehicle ['vi:ik(ə)l]
4. engine ['endʒin]
5. cylinder ['silində(r)]
6. combustion [kəm'bəstʃ(ə)n]
7. burn [bɜ:n]
8. convert [kən've:t]
9. piston ['pist(ə)n]
10. crankshaft ['kræŋkʃa:ft]
11. ignition [ig'niʃ(ə)n]
12. intake ['inteik]
13. starter ['sta:tə(r)]
14. clockwise ['klokwaiz]
15. movement ['mu:vmənt]
16. vacuum ['vækjuəm]
17. gasoline ['gæsəli:n]
18. manifold ['mænifəʊld]
19. stroke [strəʊk]
20. remain [ri'mein]
21. charge [tʃa:dʒ]
22. draw [drɔ:]
23. constitute ['kɒnstɪtju:t]
24. compress [kəm'pres]
25. travel ['træv(ə)l]
26. power ['paʊə(r)]
27. ignite [ig'nait]
28. spark [spa:k]
29. revolution [revə'lʊ:ʃ(ə)n]
30. expand [ik'spænd]
31. expend [ik'spend]
32. passage ['pæsɪdʒ]
33. port [pɔ:t]
34. continuously [kən'tɪnjuəsli]
35. attach [ə'tætʃ]
36. resist [ri'zɪst]
37. inertia [i'nɜ:ʃə]
38. even [i:v(ə)n]
39. automobile ['ɔ:təməbi:l]
- n. 元件, 部件, 零件, 装置
- n. 交通工具, 车辆
- n. 发动机
- n. 气缸, 圆筒, 圆柱体
- n. 燃烧
- vi., vt. 燃烧
- vt. 使转变, 转换……
- n. 活塞
- n. 曲轴
- n. 点火, 点燃
- n. 入口, 进口
- n. 起动机
- adj. 顺时针方向的; adv. 顺时针方向地
- n. 运动, 动作, 运转
- n. 真空; adj. 真空的
- n. 汽油
- n. 进、排气歧管
- n. 冲程, 行程
- vi. 保持, 逗留, 剩余
- n. 充气, 装料
- vt. 吸引, 吸入
- vt. 组成, 构成
- vt. 压缩, 浓缩
- v. 旅行, 传播, 行进
- n. 能量, 动力
- v. 点火, 点燃
- n. 火花
- n. 旋转, 转数, 旋转一周
- vt. 使膨胀, 详述, 扩张
- vt. 消耗, 花费, 支出
- n. 通道, 通路
- n. 通道, 港口, 端口
- adv. 不断地, 连续地
- vt. 安装上, 系上, 贴上
- vt. 抵抗, 反抗, 抗, 忍得住
- n. 惯性, 惯量
- adj. 平滑的, 偶数的, 平均的
- n. 汽车



- |                                |               |
|--------------------------------|---------------|
| 40. arrange [ə'reindʒ]         | v. 排列, 安排     |
| 41. flywheel ['flaiwi:l]       | n. 飞轮         |
| 42. arrangement [ə'reindʒmənt] | n. 排列, 安排     |
| 43. adjacent [ə'dʒeisənt]      | adj. 邻近的, 接近的 |
| 44. coolant ['ku:lənt]         | n. 冷却液        |
| 45. medium ['mi:diəm]          | n. 媒体, 媒介, 介质 |
| 46. radiator ['reidiəitə(r)]   | n. 散热器        |
| 47. tank [tæŋk]                | n. 水箱         |
| 48. camshaft ['kæmʃa:ft]       | n. 凸轮轴        |

### Phrases and Expressions

- |                               |                |
|-------------------------------|----------------|
| 1. self-contained             | 自备的            |
| 2. internal combustion engine | 内燃机            |
| 3. heat energy                | 热能             |
| 4. mechanical energy          | 机械能            |
| 5. air/fuel mixture           | 空气燃油混合物(可燃混合气) |
| 6. intake stroke              | 进气行程           |
| 7. compression stroke         | 压缩行程           |
| 8. power stroke               | 作功行程           |
| 9. exhaust stroke             | 排气行程           |
| 10. top dead center (TDC)     | 上止点            |
| 11. connecting rod            | 连杆             |
| 12. intake valve              | 进气门            |
| 13. atmospheric pressure      | 大气压力           |
| 14. intake manifold           | 进气歧管           |
| 15. exhaust valve             | 排气门            |
| 16. bottom dead center (BDC)  | 下止点            |
| 17. spark plug                | 火花塞            |
| 18. speed up                  | 加速             |
| 19. slow down                 | (使)慢下来         |
| 20. combustion chamber        | 燃烧室            |
| 21. result in                 | 导致             |
| 22. side by side              | 并排, 并肩         |
| 23. compression ratio         | 压缩比            |
| 24. cylinder head             | 气缸盖            |
| 25. engine block              | 气缸体            |
| 26. water jacket              | 水套             |



## Notes on the Text

1. The engine is a self-contained power unit which converts the heat energy of fuel into mechanical energy for moving the vehicle.

发动机是一种自备动力的装置,它将燃料的热能转换成机械能,用于推动车辆前进。

语法:which converts...引导定语从句。

2. The drawing of an air/fuel charge into the cylinder in this manner, during the downward movement of the piston, constitutes the intake stroke of the piston.

可燃混合气在活塞向下运动时被吸人气缸,这个过程就是进气行程。

语法:during the downward movement of the piston 作时间状语从句。

3. This tremendous force pushes the piston downward on the power stroke, causing the connecting rod to rotate the crankshaft.

在作功行程时,巨大的气体压力推动活塞向下运动,带动连杆转动曲轴。

语法:causing the connecting rod to rotate the crankshaft 是现在分词作结果状语从句。

4. This remaining pressurized gas flows comparatively freely from the cylinder through the passage (port) opened by the exhaust valve.

残余的带压废气相对顺畅地从已被排气门打开的排气道中排出。

5. To keep the crankshaft turning smoothly between two power strokes, the flywheel is attached to the end of the crankshaft.

为了使曲轴在两个相连的作功行程间平稳地转动,我们将飞轮安装在曲轴的后端。

6. For identification purposes, manufacturers classify automobile engines by their cylinder arrangement, valve arrangement, and type of system used to cool the engine.

发动机制造商将汽车发动机按气缸排列、气门布置以及冷却系统的类型进行分类。

语法:for identification purposes 作目的状语。

7. With this system, the engine has the water jackets in the block and head, which surround the cylinders and combustion chambers and through which coolant circulates freely.

在水冷式发动机上,发动机气缸体和气缸盖内均有水套,它围绕着气缸和燃烧室,内部有冷却液自由循环流动。

语法:which 引导的定语从句修饰 the water jackets。

## Exercises

1. Choose the best answer from the following choices according to the text

1) In the internal combustion engine, air/fuel mixture is introduced into a closed \_\_\_\_\_ where it is compressed and then ignited.

A. tank

B. spark

C. cylinder

D. flywheel

2) The air/fuel charge is now under \_\_\_\_\_ so that it will produce a great deal of power when



the spark plug ignites it.

- A. compression      B. inflation      C. vacuum      D. ignition

3) Thus, the coolant leaving the lower tank is \_\_\_\_\_ ready to flow through the engine again.

- A. hot      B. cool      C. cold      D. warm

## 2. Translate the following into Chinese

- |                               |                      |                         |
|-------------------------------|----------------------|-------------------------|
| 1) internal combustion engine | 2) vehicle           | 3) power stroke         |
| 4) exhaust valve              | 5) gasoline          | 6) liquid-cooled engine |
| 7) flywheel                   | 8) air-cooled engine | 9) crankshaft           |

## 3. Translate the following into English

- |           |         |         |
|-----------|---------|---------|
| 1) 四冲程发动机 | 2) 进气行程 | 3) 排气行程 |
| 4) 燃烧室    | 5) 气缸   | 6) 活塞   |
| 7) 可燃混合气  | 8) 火花塞  | 9) 连杆   |

## 4. Translate the following sentences into Chinese

1) In the internal combustion engine, an air-fuel mixture is introduced into a closed cylinder where it is compressed and then ignited.

2) The intake stroke of a four-stroke engine begins with the piston at top dead center (TDC).

3) After the piston reaches bottom dead center (BDC), it moves upward again as the starter continues to turn the crankshaft in a clockwise direction.

## 5. Translate the words or phrases in the following figure into Chinese (Fig. 1-5)

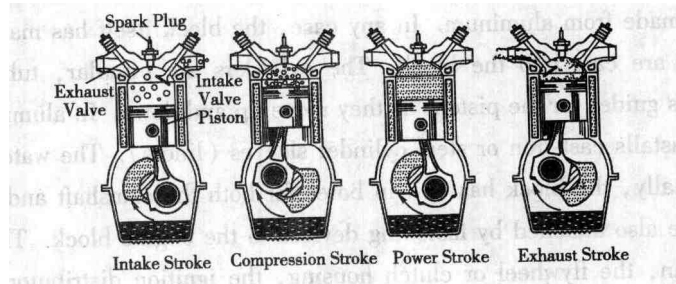


Fig. 1-5



## Unit 2 Engine Construction

### 单元二 发动机构造

#### 学习目标

#### 知识目标

1. 掌握关于发动机构造相关的专业术语、单词和词汇。
2. 掌握发动机中零部件的固定表达方法。

#### 能力目标

1. 能对发动机上各大总成进行中英互译。
2. 能进行与发动机构造相关的英语资料的简单阅读和翻译。
3. 能对汽车实物上标出的英语单词或词汇进行辨认。

#### Engine Block

The engine block forms the main framework, or foundation, of the engine.<sup>[1]</sup> The block is cast mainly from gray iron or iron alloyed with other metals such as nickel or chromium. However, some blocks have been made from aluminum. In any case, the block itself has many components.

The cylinders are cast into the block. The cylinders are circular, tubelike openings in the block, which act as guides for the pistons as they move up and down. In aluminum blocks, the manufacturer usually installs cast-iron or steel cylinder sleeves (liners). The water jackets are also cast into the block. Finally, the block has cast-in bores for both the camshaft and crankshaft.

Many parts are also attached by fastening devices to the engine block. These items include the water pump, oil pan, the flywheel or clutch housing, the ignition distributor, oil and fuel pump, and the cylinder head.

#### Cylinder Head

The cylinder head is bolted to the block. The manufacturer casts the cylinder head in one piece from iron, from iron alloyed with other metals, or from aluminum alloy. Aluminum has the advantage of combining lightness with rather high heat conductivity. Depending on the style of engine, the cylinder head serves many functions.

#### Pistons

The engine manufacturer fits a piston into each cylinder of the engine. The piston is a movable part or plug that receives the pressure from the burning air/fuel mixture and converts this pressure into reciprocating (up-and-down) motion.<sup>[2]</sup> Manufacturers make most engine pistons from aluminum, which is less than half the weight of iron. Iron pistons were common in early automotive engines.



### Piston Clearance

Piston clearance is the distance between the outer circumference of the piston and the cylinder wall itself.<sup>[3]</sup> In operation, oil fills this clearance so that the piston moves on films of lubricating oil. If this clearance is too small, several problems can develop. On the other hand, excessively large clearance can result in piston slap as the piston starts down on the power strokes. The piston itself operates many degrees hotter than the adjacent cylinder wall and therefore expands more. Manufacturers must control this expansion in order to avoid the loss of adequate piston clearance.

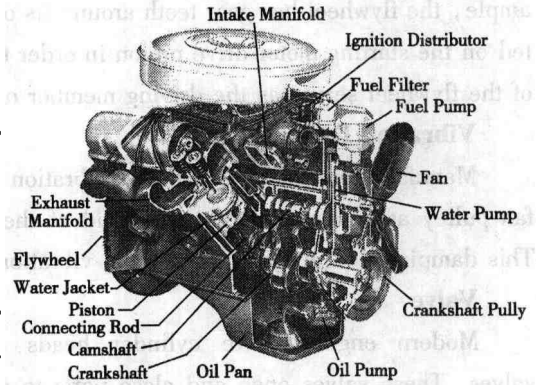


Fig. 2-1 Engine Construction

### Piston Rings

Some operating clearance must exist between the piston and the cylinder wall; however, some form of seal is necessary between the piston and the cylinder wall to prevent blowby. Consequently, piston rings are used to provide the necessary seal to eliminate blowby and to control oil consumption.<sup>[4]</sup> Automotive pistons have two kinds of rings: compression and oil control. The compression rings primarily seal against the loss of air/fuel mixture as the piston compresses it and also the combustion pressure as the mixture burns. While the function of the oil control ring is to prevent excessive amounts of oil from working up into the combustion chamber.

### Connecting Rods

As mentioned earlier, the piston moves up and down in the cylinder, in a reciprocating motion. In order to rotate the drive wheels, a connecting rod and crankshaft must change reciprocating motion to rotary. The connecting rod itself attaches at one end to the piston and on the other end to the crankpin section of the crankshaft.<sup>[5]</sup>

### Crankshaft

The crankshaft is the main rotating member, or shaft, of the engine. Its function, along with the connecting rod, is to change the reciprocating motion of the piston to rotary. In addition, the crankshaft is responsible for driving the camshaft through timing gears, plus operating the accessories via a system of belts and pulleys. Lastly, the crankshaft carries the total torque-turning or twisting effort and delivers it to the flywheel. From the flywheel the torque then passes either to the friction clutch assembly or to the torque converter.

Designed into the one-piece crankshaft are areas for main bearing journals, crankpins, counterweights, flywheel flange, and driving hub.

### Flywheel

The flywheel is a comparatively heavy wheel, bolted to the flange on the rear end of the crankshaft. Its function is to keep the engine running smoothly between power strokes. Its inertia tends to





keep the flywheel rotating at a constant speed. The flywheel also has several other functions. For example, the flywheel has gear teeth around its outer circumference. These teeth mesh with teeth located on the starting motor drive pinion in order to crank the engine over. In addition, the rear surface of the flywheel serves as the driving member of the clutch assembly. <sup>[6]</sup>

### Vibration Damper

Manufacturers usually install a vibration damper and fan pulley assembly onto the drive end of the crankshaft. This damping device controls torsional vibrations.

### Valve

Modern engines have cylinder heads that contain valves. These valves open and close ports to allow or stop the flow of gases into or from the combustion chamber. Each cylinder requires at least two: an intake and exhaust.

### Camshaft

The camshaft is another rotating shaft within the engine; it serves usually three functions. First, the camshaft has a series of cams that can change rotary motion to straight-line motion which cause the intake and exhaust valves to open. The camshaft will have one cam for each valve, or, in most engines, two cams per cylinder. Second, the camshaft has an eccentric, or special cam, designed to operate the fuel pump. Finally, the camshaft has a gear that drives the oil pump and ignition distributor.

### Lifters

A lifter is a cylindrical part within an engine that rests on a cam of the camshaft. As the camshaft rotates, the cam raises the lifter, and the lifter in turn opens a valve. The lifter may be in direct contact with the tip of the valve stem, or it may bear against a push rod that functions along with a rocker-arm assembly to open a valve. <sup>[7]</sup>

### Push Rods and Rocker Arms

Along with the camshaft, valves, valve seats, and valve springs, some valve trains have several other components—the push rods and rocker arms. The push rod is a metal rod that fits between the lifter and the rocker arm. Its function is to transmit cam lobe lift from the camshaft to the rocker arm assembly. The rocker arm is nothing more than a precision-designed lever. Its function is to convert the upward motion of a push rod into downward motion that compresses the spring and opens the valve.

### Valve Timing

Duration is the length of time a valve is open. The measurement of this open period is not in units of time because the actual time a valve remains open varies with engine speed. Therefore, this measurement is in degrees of crankshaft rotation, which does not change with speed. To lengthen the time and to accelerate the air/fuel mixture flow into the cylinders, both the intake and exhaust valves must be open at the same time for a short period. <sup>[8]</sup> The overlap is provided in order to take advan-

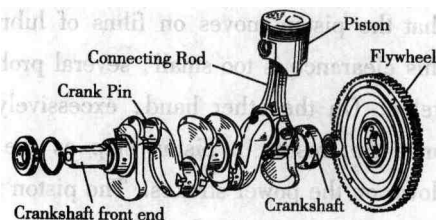


Fig. 2-2 Crankshaft