高等职业教育工程机械类专业规划教材

# 工程机械专业英语

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Professional English of Engineering and Machinery

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## 内 容 提 要

本书介绍了柴油发动机、柴油机燃油供给系统、发动机冷却系统和润滑系统、传动系统、发动机起动系统、液压系统、筑路机械、路面养护机械、设备维护、动态仿真技术在工程机械设计上的应用等内容。通过学习，学生可将两到三个学期所涉及的专业基础课和专业核心贯穿起来，并且可以了解专业知识、掌握大量相关的专业英语词汇，为进一步深造打下坚实的基础。

本书可供高等职业院校工程机械类专业师生教学使用。

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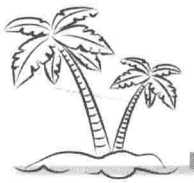


# 总 序

中国高等职业教育在教育部的积极推动下，经过10年的“示范”建设，现已进入“标准化”建设阶段。

2012年，教育部正式颁布了《高等职业学校专业教学标准》，解决了我国高等职业教育教什么、怎么教、教到什么程度的问题，为培养目标和规格、组织实施教学、规范教学管理、加强专业建设、开发教材和学习资源提供了依据。

目前，国内开设工程机械类专业的高等职业学校，大部分是原交通运输行业的院校，现为交通职业学院，而且这些院校大都是教育部“示范”建设学校。人民交通出版社审时度势，利用行业优势，集合院校10年示范建设的成果，组织国内近20所开设工程机械类专业高等职业教育院校专业负责人和骨干教师，于2012年4月在北京举行“示范院校工程机械专业教学教材改革研讨会”。本次会议的主要议题是交流示范院校工程机械专业人才培养工学结合成果、研讨工程机械专业课改教材开发。会议宣布成立教材编审委员会，张铁教授为首届主任委员。会议确定了8种专业平台课程、5种专业核心课程及6种专业拓展课程的主编、副主编。

2012年7月，高等职业教育工程机械类专业教材大纲审定会在山东交通学院顺利召开。各位主编分别就教材编写思路、编写模式、大纲内容、样章内容和课时安排进行了说明。会议确定了14门课程大纲，并就20门课程的编写进度与出版时间进行商定。此外，会议代表商议，教材定稿审稿会将按照专业平台课程、专业核心课程、专业拓展课程择时召开。

本教材的编写，以教育部《高等职业学校专业教学标准》为依据，以培养职业能力为主线，任务驱动、项目引领、问题启智，教、学、做一体化，既突出岗位实际，又不失工程机械技术前沿，同时将国内外一流工程机械的代表产品及工法、绿色节能技术等融入其中，使本套教材更加贴近市场，更加适应“用得上，下得去，干得好”的高素质技能人才的培养。

本套教材适用于教育部《高等职业学校专业教育标准》中规定的“工程机械控制技术(520109)”、“工程机械运用与维护(520110)”、“公路机械化施工技术(520112)”、“高等级公路维护与管理(520102)”、“道路桥梁工程技术(520108)”等专业。

本套教材也可作为工程机械制造企业、工程施工企业、公路桥梁施工及养护企业等职工培训教材。

本套教材也是广大工程机械技术人员难得的技术读本。

本套教材是工程机械类专业广大高等职业示范院校教师、专家智慧和辛勤劳动的结晶。在此向所有参编者表示敬意和感谢。

高等职业教育工程机械类专业规划教材编审委员会

2013 年 1 月

# 前言

我国经济的高速发展、基础设施的建设规模逐步扩大的同时，也带动了我国工程机械行业的迅猛发展。许多国外知名的工程机械产品制造商纷纷加入我国市场，每年都有大量的信息和技术引入我国，这些都离不开英语，英语是信息沟通和交流的媒介和基础。为了适应形势的发展，作者编写了本书。

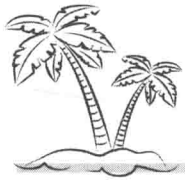
本教材为示范院校工程机械专业教学教材，全书分为10个项目，主要内容有：柴油发动机、柴油机燃油供给系统、发动机冷却系统和润滑系统、传动系统、发动机起动系统、液压系统、筑路机械、路面养护机械、设备维护、动态仿真技术在工程机械设计上的应用等内容。教材内容力求深入浅出，体现新知识、新技术和新方法，并适当留有供自学和拓宽专业的知识内容。教学内容图文并茂，直观生动，能增强教学的直观性与生动性，提高学生学习积极性。

本书由吴明华、陈晓娟任主编，杨川、李活任副主编，其中项目一～项目五由安徽交通职业技术学院吴明华编写，项目六由成都铁路学校杨川编写、项目七由江苏省交通技师学院李鹏飞编写，项目八～项目十由湖南交通职业技术学院陈晓娟、李活编写。全书由吴明华统稿，由安徽农业大学郁玉叶、北京建筑大学连香姣共同审定。

本书涉及知识面较广，编写过程中也力求准确无误，但由于水平所限，不妥之处在所难免，敬请读者批评指正。

编者

2014年4月



# 目 录

# 项目1

# 柴油发动机的认识

## 学习目标

完成本项目学习任务后，你应当能：

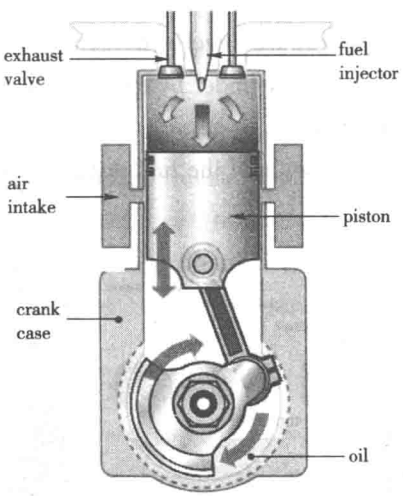
1. 认识关于柴油机的专业术语，熟悉柴油机的工作过程及发展状况；
2. 基于所学专业知识，借助专业词典能无障碍地查阅与柴油机相关的英语资料；
3. 正确完成课后练习。

## 任务描述

通过柴油机与汽油机的简单对比，完成相关单词、词汇、特殊语句的学习。对柴油机的工作特点、自身不足及其新技术有一定的认识。强化相关专业英文资料的阅读能力。

## 引导问题

说说柴油机与汽油机的区别。




## 学　时

2 学时

本学习任务沿着以下脉络进行学习：

复习相关专业知识 → 学习单词和语法 → 通读全文 → 完成课后练习 → 课后阅读

# Project 1　Acquaintance with Diesel Engine

Diesel engines are mechanical devices that use controlled explosions (combustions) of diesel and air to rotate wheels. The reciprocating (back and forth) engine explodes the mixture (of diesel fuel + air) in a cylinder that forces the contained piston to move. This movement of the piston is transmitted (via the connecting rod) to a rotating device (crankshaft shown as a simple red disc) which is ultimately connected to the wheels (via gears, usually). The diesel engine is similar to the 4-stroke petrol engine. In theory, diesel engines and gasoline engines are quite similar. They are both internal combustion engines designed to convert the chemical energy available in fuel into mechanical energy. This mechanical energy moves pistons up and down inside cylinders. The pistons are connected to a crankshaft, and the up-and-down motion of the pistons, known as linear motion, creates the rotary motion needed to turn the wheels of a car forward.

Both diesel engines and gasoline engines covert fuel into energy through a series of small explosions or combustions. The major difference between diesel and gasoline is the way these explosions happen. In a gasoline engine, fuel is mixed with air, compressed by pistons and ignited by sparks from spark plugs. In a diesel engine, however, the air is compressed first, and then the fuel is injected. Because air heats up when it's compressed, the fuel ignites. The diesel engine therefore does not require a sparking plug. The diesel fuel (which is heavier and contains longer chain hydrocarbons) is injected directly into the cylinder when the air has been greatly heated by the compression stroke.

The diesel cycle goes like this:

1. When the piston is at the top of its travel, the cylinder contains a charge of highly compressed air. Diesel fuel is sprayed into the cylinder by the injector and immediately ignites because of the heat and pressure inside the cylinder.

The pressure created by the combustion of the fuel drives the piston downward. This is the power stroke (shown as Figure 1-1).

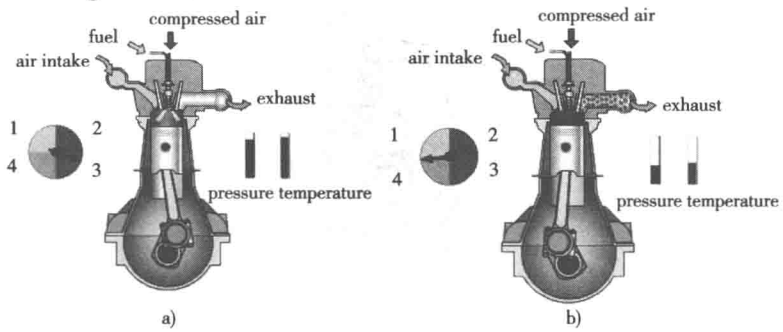



Figure 1-1　Power and Exhaust Stroke

a) fuel injection and combustion; b) exhaust

2. As the piston nears the bottom of its stroke, all of the exhaust valves open. Exhaust gases rush out of the cylinder, relieving the pressure (shown as Figure 1-1).

3. As the piston bottoms out, it uncovers the air intake ports. Pressurized air fills the cylinder, forcing out the remainder of the exhaust gases (shown as Figure 1-2).

4. The exhaust valves close and the piston starts traveling back upward, re-covering the intake ports and compressing the fresh charge of air. This is the compression stroke (shown as Figure 1-2).

5. As the piston nears the top of the cylinder, the cycle repeats with step 1.

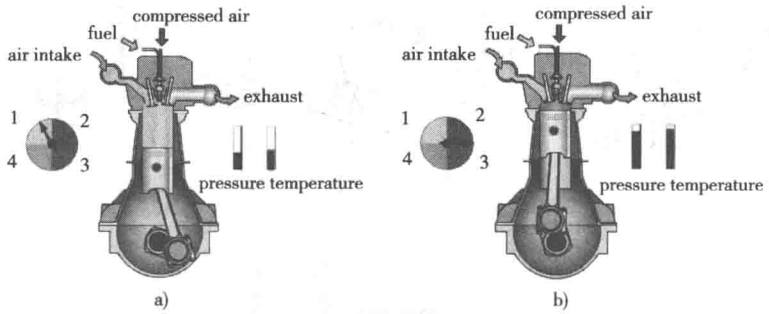



Figure 1-2 Intake and Compression Stroke

a) air intake; b) press

Diesel's story actually begins with the invention of the gasoline engine. Nikolaus August Otto had invented and patented the gasoline engine by 1876. This invention used the four-stroke combustion principle, also known as the "Otto Cycle", and it's the basic premise for most car engines today. In its early stage, the gasoline engine wasn't very efficient, and other major methods of transportation such as the steam engine fared poorly as well. Only about 10 percent of the fuel used in these types of engines actually moved a vehicle. The rest of the fuel simply produced useless heat.

In 1878, Rudolf Diesel was attending the Polytechnic High School of Germany (the equivalent of an engine ring college) when he learned about the low efficiency of gasoline and steam engines. This disturbing information inspired him to create an engine with a higher efficiency, and he devoted much of his time to developing a "Combustion Power Engine". By 1892 Diesel had obtained a patent for what we now call the diesel engine.

If diesel engines are so efficient, why don't we use them more often? You might see the words "diesel engine" and think of big, hefty cargo trucks spewing out black, sooty smoke and creating a loud clattering noise. This negative image of diesel trucks and engines has made diesel less attractive to casual drivers in theUnited States—although diesel is great for hauling large shipments over long distances, it hasn't been the best choice for everyday commuters. ① This is starting to change, however, as people are improving the diesel engine to make it cleaner and less noisy.

**Today's Improved Diesel Engine Technology**

If you haven't driven a diesel powered car lately, you would be surprised at how much they have improved. Gone are clanking engines, smelly exhaust, and anemic performance. ②

Diesel rattle is eliminated by a combination of direct injection (DI), common rail (CR) fuel distribution, unit fuel injectors, and pilot injection. With DI, fuel is injected directly into the cylinder rather than into a small side chamber as with older indirect injection (IDI). This helps provide

the fine, high-pressure mist of fuel needed to eliminate knocks and rattles. High pressure also means better fuel atomization, resulting in increased engine efficiency for more power and better fuel economy (shown as Figure 1-3).

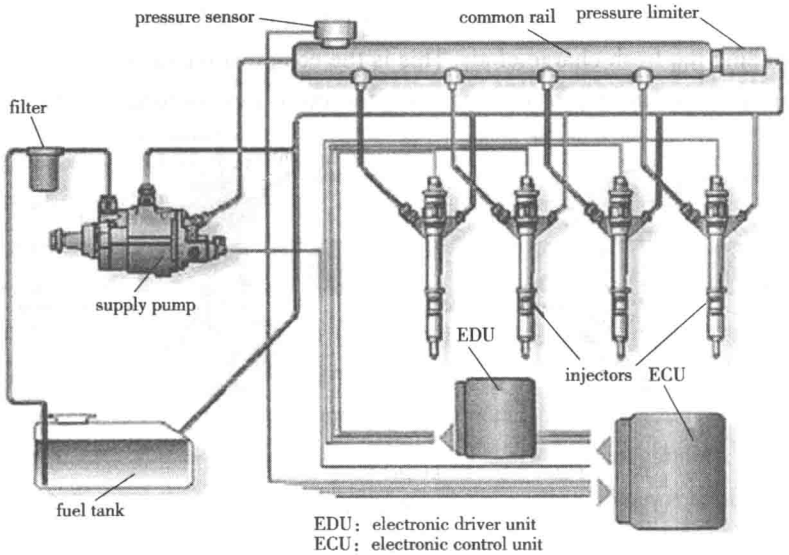



Figure 1-3 Direct Injection and Common Rail

The common rail system uses an engine-driven pump that produces extremely high pressure fuel delivered to the electrically-operated injector at each cylinder, via a single thick-walled tube—— the "common rail." Besides reducing characteristic diesel noise, the CR system can greatly increase injection pressure over the older distributor pump type of injection systems, thus injecting a far finer mist of fuel to enhance DI engine efficiency.

Diesel fuel has to be injected at very high pressures to counter the huge compression pressure in the diesel engine. The higher the pressure, the more power is produced and the cleaner the exhaust emissions. Another advancement is pilot injection, which injects a small amount of fuel prior to the main injection, resulting in a more gradual increase in combustion chamber temperature. This eliminates the diesel knocking and rattling caused by a sudden increase in temperature. All this is made possible by sophisticated electronic injection control systems.

Today's diesel engines are usually turbocharged and most are intercooled. Turbochargers compress the air supplied to the engine, or in automotive terms, improve engine "breathing." More air means more fuel can be combusted, leading to increased power output. Exhaust gases spin the turbocharger's turbine at speeds of up to 150,000 rpm, which rotates an air pump that provides a "boost" of air higher than atmospheric pressure for more powerful combustion. Because the turbocharger is driven by engine exhaust, temperatures are very high. Countering this is an intercooler, either an air-to-air or water-to-air heat exchanger, that's used to cool down the hot compressed air exiting the turbocharger. Cooler air takes up less volume, so more air can be delivered to the cylinders to produce more power.

Recognizing American's demand for vehicles offering good fuel economy without compromising

utility, cargo capacity, and performance, Mercedes-Benz is one of those leading the way by offering several diesel models. The E320 CDI, which has been offered for several years, has been replaced by the E320 BLUETEC luxury sedan. The E320 BLUETEC is the only diesel-powered luxury sedan available in the U. S. that can deliver an estimated 780 miles on a tank of fuel. In addition, there is the new ML320 CDI, R320 CDI, and GL320 CDI-all SUVs. As of now, these four diesel models are not available in California, Maine, Maryland, New York, and Vermont because they do not pass the more stringent emission requirements in these five states.

The Department of Energy estimates that a 30 percent market penetration of light-duty diesel vehicles by 2020 would reduce U. S. net crude oil imports by 350,000 barrels per day. In California alone, gradually increasing the use of currently-available clean diesel technology in cars, pickups, and SUVs to levels seen today in Europe could save the state 110 million gallons of gasoline per year by 2010, and up to 840 million gallons per year by 2030.

Diesel is on the rise in America: The forces holding it back-namely long-held stigmas and emissions concerns – are quickly being overcome by technology and now, of course, cleaner diesel fuel.

A new generation of clean diesel vehicles selling in large numbers opens the door for biodiesel to play a bigger role as well. This clean-burning fuel is derived from domestically produced agricultural products and runs in a diesel engine with little or no modifications, reducing both emissions and energy dependence.

Plus, diesels could factor favorably into the future of the popular hybrid as well. Just imagine the fuel economy that could be achieved by combining the fuel-saving benefits of hybrid-electric technology with an inherently efficient diesel engine. For example, Daimler Chrysler has developed a "mild hybrid" that combines the 3-liter BLUETEC V-6 diesel with a high-torque electric motor. With all this potential, we expect to be hearing a lot more about diesel in the years ahead.

## Word List

1. mechanical[mi'kænikəl] *n.* 机械的,机械学的
2. explosion[iks'pləuʒən] *n.* 爆炸
3. combustion[kəm'bʌstʃən] *n.* 燃烧
4. reciprocating[ri'siprəkeitiŋ] *n.* (机器的部件)直线往复运动
5. cylinder['silində] *n.* 汽缸
6. piston['pistən] *n.* 活塞
7. generate['dʒenəreit] *vt.* 产生
8. sparking['spɑ:kiŋ] *n.* 发火花,打火花
9. ignite[ig'nait] *vt.* 点燃,使燃烧
10. theory['θiəri] *n.* 理论,原理
11. convert[kən'və:t, 'kɔnvə:t] *v.* (使)转变(化)
    *n.* 轮轴,车轴,车桥
12. available[ə'veiləbəl] *a.* 可利用的;可得到的
13. mechanical[mi'kænikəl] *a.* 机械(制造)的
14. crankshaft['kræŋkʃɑ:ft] *n.* (内燃机的)曲轴

15. linear[ 'liniə ] *adj.* 直线的,线形的
16. rotary[ 'rəutəri ] *adj.* 旋转的
17. wheel[ wi:l ] *n.* 轮子
18. plug[ plʌg ] *n.* (内燃机的)火花塞
19. inject[ in'dʒekt ] *vt.* (给…)注射
20. travel[ 'trævəl ] *n.* 旅行,进行
21. charge[ tʃɑ:dʒ ] *n.* (带电物质的)电荷,充电量
22. spray *vt.* &*vi.* 喷,喷射
*n.* 喷雾
23. stroke[ strəuk ] *n.* (成功的)举动
24. invention[ in'venʃən ] *n.* 发明
25. patent[ 'pætənt ] *vt.* 获得…专利
26. premise[ 'premis ] *n.* 前提
27. fare[ fɛə ] *vi.* 进展,遭遇
28. polytechnic[ ˌpɔli:'teknik ] *n.* 工艺学校,综合性工艺学校,理工专科学校
29. equivalent[ i'kwivələnt ] *adj.* 相等的, 相当的,等效的
30. engineering[ ˌendʒi'niəriŋ ] *n.* 工程
31. disturbing[ di'stə:biŋ, di'stɜrbiŋ ] *adj.* 烦扰的,令人不安的
32. inspire[ in'spaiə ] *vt.* 鼓舞,激励,赋予灵感
33. hefty[ 'hefti: ] *adj.* 重的,健壮的,异常大的
*n.* 健壮的人
34. cargo[ 'kɑ:gəu ] *n.* (船或飞机装载的)货物,负荷,荷重
35. spew[ spju: ] *vt.* & *vi.* (使某事物)喷出
36. clank[ klæŋk ] *n.* 低沉的金属声,叮当声
37. anemic[ ə'ni:mik ] *adj.* 没有活力的,无精打采的
38. rattle[ 'rætl ] *n.* 嘎嘎声,发出嘎嘎声的儿童玩具
39. atomization[ ˌætəmai'zeiʃən ] *n.* 雾化

## Proper Names

1. 4-stroke petrol engine 四冲程汽油机
2. sparking plug 火花塞
3. Otto Cycle 奥托循环
4. power stroke 做功行程
5. compression stroke 压缩行程

## Notes

①This negative image of diesel trucks and engines has made diesel less attractive to casual drivers in the United States—although diesel is great for hauling large shipments over long distances, it hasn't been the best choice for everyday commuters.

柴油机和柴油车的这个负面印象使得美国的驾驶者对其不怎么感兴趣。虽然柴油车在长

途大宗货物运输中很有用,但它还不是日常通勤者的最佳选择。

②Gone are clanking engines, smelly exhaust, and anemic performance.

当啷当啷的发动机、难闻的废气、动力不够强劲,在柴油机上已不复存在。

## Exercises

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

_____: piston moves down, air + diesel fuel mixture drawn in. _____: piston moves up, air + fuel mixture compressed until it explodes. _____: piston pushed down by exploding air + fuel mixture. _____: piston moves up, spent gases pushed out through exhaust.

A. INTAKE B. COMPRESSION C. EXHAUST D. POWER

**2. Translate the following into Chinese.**

1) diesel engine 2) direct injection 3) fuel injectors

**3. Translate the following into English.**

1)燃烧 2)行程 3)转换

# Practical Reading

## Internal Combustion Engine

## 内燃机认识

A car engine is an internal combustion engine—combustion takes place internally. There are different kinds of internal combustion engines. Diesel engines are one form and gas turbine engines are another. See also the articles on HEMI engines, rotary engines and two-stroke engines. ① Each has its own advantages and disadvantages.

There is such a thing as an external combustion engine. A steam engine in old-fashioned trains and steam boats is the best example of an external combustion engine. The fuel (coal, wood, oil, whatever) in a steam engine burns outside the engine to create steam, and the steam creates motion inside the engine. Internal combustion is a lot more efficient (takes less fuel per mile) than external combustion, plus an internal combustion engine is a lot smaller than an equivalent external combustion engine. This explains why we don't see any cars from Ford and GM using steam engines.

The principle behind any reciprocating internal combustion engine: If you put a tiny amount of high-energy fuel (like gasoline) in a small, enclosed space and ignite it, an incredible amount of energy is released in the form of expanding gas. Almost all cars currently use what is called a four-stroke combustion cycle to convert gasoline into motion. The four-stroke approach is also known as the Otto cycle, in honor of Nikolaus Otto, who invented it in 1867. The four strokes are intake stroke, compression stroke, combustion stroke and exhaust stroke.

Notice that the motion that comes out of an internal combustion engine is rotational. In an engine the linear motion of the pistons is converted into rotational motion by the crankshaft. The rotational motion is nice because we plan to turn (rotate) the car's wheels with it anyway.

**Basic Engine Parts** (shown as Figure 1-4)

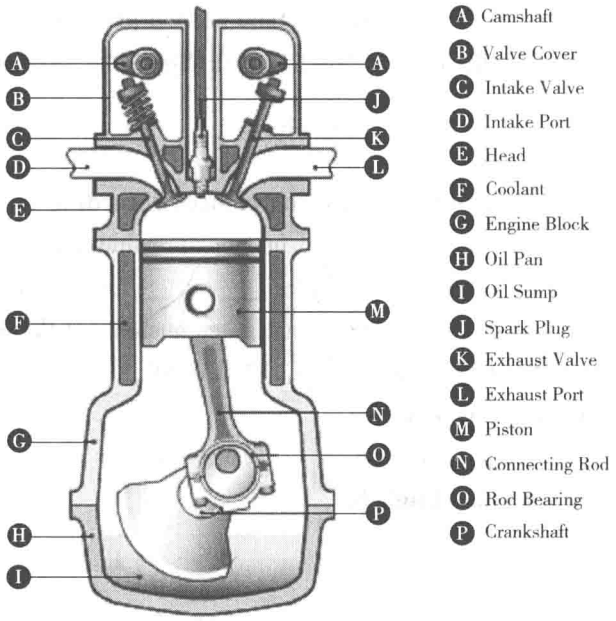



Figure 1-4 The Structure of the Internal Combustion Engine

The core of the engine is the cylinder, with the piston moving up and down inside the cylinder. The engine described above has one cylinder. That is typical of most lawn mowers, but 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 (also known as horizontally opposed or boxer)[②] (shown as Figure 1-5).

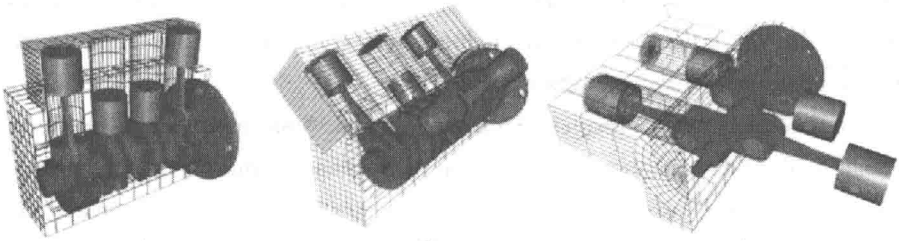



Figure 1-5 The Arrangement of Cylinders

a) inline; b) type; c) 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 ex-

haust. 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.

**Connecting Rod**

The connecting rod connects the piston to the crankshaft. It can rotate at both ends so that its angle can change as the piston moves and the crankshaft rotates.

**Crankshaft**

The crankshaft turns the piston's up and down motion into circular motion just like a crank on a jack-in-the-box does.

**Sump**

The sump surrounds the crankshaft. It contains some amount of oil, which collects in the bottom of the sump (the oil pan).

## Word List

1. advantage[ əd'vɑ:ntidʒ ] — *n.* 有利条件,益处,优越(性)
2. external[ eks'tə:nl ] — *adj.* 外面的,外部的
3. plus[ plʌs ] — *prep.* (表示运算)加;(表示包容)外加
4. incredible[ in'kredəbl ] — *adj.* 不可思议的;惊人的;难以置信的
5. crankshaft[ 'kræŋkʃɑ:ft ] — *n.* (内燃机的)曲轴,曲柄轴

## Proper Names

1. HEMI engine — 半球形燃烧室的发动机
2. in honor of — 为了向…表示敬意
3. lawn mowers — 草坪割草机

## Notes

①See also the articles on HEMI engines, rotary engines and two-stroke engines.

hemispherical combustion chamber engine 可缩写为 HEMI engine。可关闭一半汽缸保留另一半汽缸工作是当今 HEMI 发动机的一个显著特征,然而,HEMI 发动机最基本的特征应该是拥有半球形燃烧室汽缸结构。

②In a multi-cylinder engine, the cylinders usually are arranged in one of three ways: inline, V or flat (also known as horizontally opposed or boxer).