



Unit 1

Text A

Internal Combustion Engine Mechanical

Engine is used to produce power. The chemical energy in fuel is converted to heat by the burning of the fuel at a controlled rate. This process is called combustion. If engine combustion occurs within the power chamber, the engine is called internal combustion engine. If combustion takes place outside the cylinder, the engine is called an external combustion engine.

Engine used in automobiles are internal combustion heat engines. Heat energy released in the combustion chamber raises the temperature of the combustion gases with the chamber. The increase in gas temperature causes the pressure of the gases to increase. The pressure developed within the combustion chamber is applied to the head of a piston to produce a usable mechanical force, which is then converted into useful mechanical power.

Linking the piston by a connecting rod to a crankshaft causes the gas to rotate the shaft through half a turn. The power stroke “uses up” the gas, so means must be provided to expel the burnt gas and recharge the cylinder with a fresh petrol-air mixture; this control of gas movement is the duty of the valves; an inlet valve allows the new mixture to enter at the right time and an exhaust valve lets out the burnt gas after the gas has done its job. Engine terms are:

TDC (Top Dead Center): the position of the crank and piston when the piston is farther away from the crankshaft. (Fig. 1-1-1)

BDC (Bottom Dead Center): the position of the crank and piston when the piston is nearest to the crankshaft.

Stroke: the distance between BDC and TDC; stroke is controlled by the crankshaft.

Bore: the internal diameter of the cylinder.

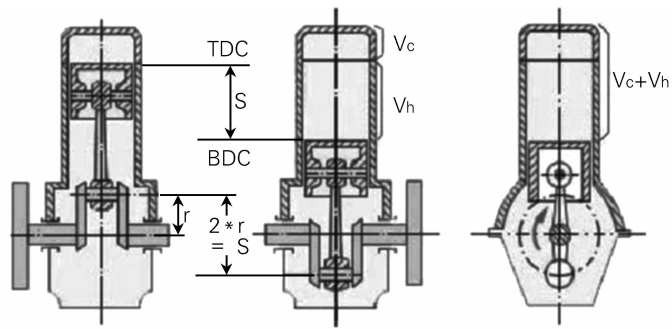


Fig. 1-1-1 TDC and BDC

Swept volume: the volume between TDC and BDC.

Engine capacity: this is the swept volume of all the cylinder e. g. a four-stroke having a capacity of two liters(2000cm) has a cylinder swept volume of 50cm.

Clearance volume: the volume of the space above the piston when it is at TDC.

Compression ratio = (swept vol + clearance vol)\(clearance vol).

Two-stroke: a power stroke every revolution of the crank. (Fig. 1-1-2)

Four-stroke: a power stroke every other revolution of the crank. (Fig. 1-1-2)

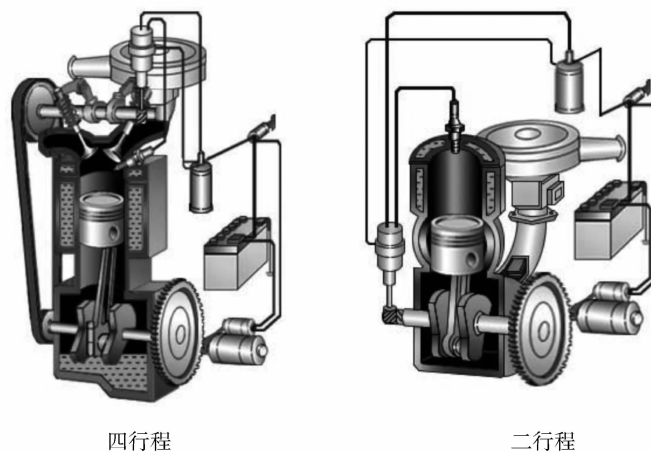


Fig. 1-1-2 Four-stroke and Two-stroke

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.)

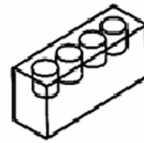
One part of gas that is completely vaporized into 14.7 parts of air can produce tremendous power when ignited inside an engine.

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

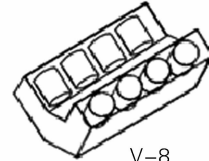


There are several engine types which are identified by the number of cylinders and the way the cylinders are laid out. Motor vehicles will have from 3 to 12 cylinders which are arranged in the engine block in several configurations. The most popular of them are shown below. (Fig. 1-1-3) In-line engines 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 V-6, V-8, V-10 and V-12 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.

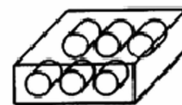
TYPICAL CYLINDER ARRANGEMENTS



IN-LINE 4 CYLINDER



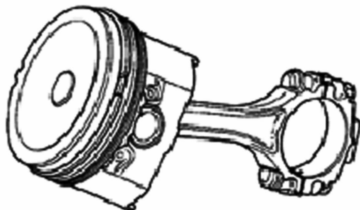
V-8



FLAT 6

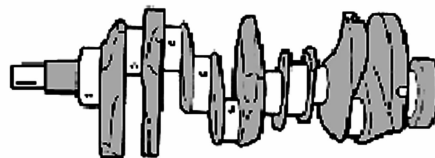
Most engine blocks are made of cast iron or cast aluminum. Each cylinder contains a piston that travels up and down inside the cylinder bore. (Fig. 1-1-4) All the pistons in the engine are connected through individual connecting rods to a common crankshaft.

Fig. 1-1-3 Engine Types



A TYPICAL PISTON AND CONNECTING ROD

Fig. 1-1-4 Connecting Rod



CRANKSHAFT

Fig. 1-1-5 Crankshaft

The crankshaft 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. (Fig. 1-1-5) As the pistons move up and down, they turn the crankshaft just like your legs pump up and down to turn the crank that is connected to the pedals of a bicycle.

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 (Fig. 1-1-6). This allows the air-fuel mixture to enter the cylinder and the burned exhaust gas to exit the cylinder. Engines have at least two valves per cylinder, one intake valve and one exhaust valve. 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 V-6 engine with four valves per cylinder. Modern engine designs can use anywhere from 2 to 5 valves per cylinder.

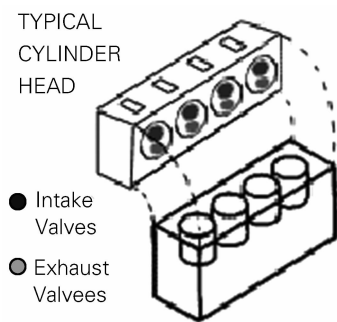


Fig. 1-1-6 Cylinder Head

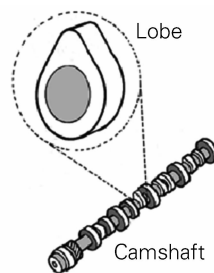


Fig. 1-1-7 Camshaft

The valves are opened and closed by means of a camshaft. A camshaft is a rotating shaft that has individual lobes for each valve. (Fig. 1-1-7) The lobe is a “bump” on one side of the shaft that pushes against a valve lifter moving it up and down. 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. The camshaft must be synchronized with the crankshaft so that the camshaft makes one revolution for every two revolutions of the crankshaft. In most engines, this is done by a “Timing Chain” (similar to a bicycle chain) that connects the camshaft with the crankshaft. Newer engines have the camshaft located in the cylinder head directly over the valves. This design is more efficient but it is more costly to manufacture and requires multiple camshafts on Flat and V-type engines. It also requires much longer timing chains or timing belts which are prone to wear. 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 (D. O. H. C.) Engines while the other type is called Single Overhead Camshaft (S. O. H. C.)



Engines. Engines with the camshaft in the block are called Overhead Valve (O. H. V) Engines.

New Words

chamber/ˈtʃeɪmbə/	<i>n.</i>	室,箱
rod/rɒd/	<i>n.</i>	连杆
crankshaft/ˈkræŋkʃɑ:ft/	<i>n.</i>	机轴,曲柄轴
rotate/rəʊteɪt/	<i>v.</i>	旋转,扭转
expel/ɪksˈpel/	<i>v.</i>	驱逐,排除
inlet/ˈɪnlet/	<i>n.</i>	入口,进口
vaporize/ˈveɪpəraɪz/	<i>v.</i>	(使)蒸发
beetle/ˈbi:tl/	<i>n.</i>	(德国)大众牌小汽车,大众甲壳虫
aluminum/əˈlju:mɪnəm/	<i>n.</i>	铝
camshaft/ˈkæmʃɑ:ft/	<i>n.</i>	凸轮轴
lobe/ləʊb/	<i>n.</i>	凸轮叶
synchronize/ˈsɪŋkrənaɪz/	<i>vt.</i>	使同步,使同时发生

Phrases and Expressions

internal combustion engine	内燃发动机
external combustion engine	外燃发动机
convert into	转变为……
petrol-air mixture	汽油空气混合气
inlet valve	进气门
TDC(Top Dead Center)	上止点
BDC(Bottom Dead Center)	下止点
two-stroke	二冲程
four-stroke	四冲程
timing chain	正时链条



Exercises

1. Answer the following questions.

- (1) What is the internal combustion engine according to this passage?
- (2) What is the external combustion engine according to this passage?
- (3) How can we understand the important role of engine of the automobiles?
- (4) What are the meanings of these terms: TDC, BDC, Stroke, Bore?
- (5) What is the meaning of “Engine capacity”?
- (6) What are the main types of the majority of engines in motor vehicles?

2. Translate the following into Chinese.

- | | |
|--------------------------------|--------------------------------|
| (1) internal combustion engine | (2) external combustion engine |
| (3) TDC(top dead center) | (4) BDC(bottom dead center) |
| (5) swept volume | (6) clearance volume |
| (7) compression ratio | (8) two-stroke engine |

3. Translate the following into English.

- | | |
|------------|------------|
| (1) 燃烧室 | (2) 活塞 |
| (3) 做功冲程 | (4) 气缸 |
| (5) 油气混合气体 | (6) 直列式发动机 |
| (7) V型发动机 | (8) 卧式发动机 |

4. Translate the following sentences into Chinese.

- (1) Engine is used to produce power. The chemical energy in fuel is converted to heat by the burning of the fuel at a controlled rate. This process is called combustion. If engine combustion occurs within the power chamber, the engine is called internal combustion engine.
- (2) Engine used in automobiles are internal combustion heat engines. Heat energy released in the combustion chamber raises the temperature of the combustion gases with the chamber. The increase in gas temperature causes the pressure of the gases to increase.
- (3) There are several engine types which are identified by the number of cylinders and the way the cylinders are laid out. Motor vehicles will have from 3 to 12 cylinders which are arranged in the engine block in several configurations.
- (4) Most engine blocks are made of cast iron or cast aluminum. 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.

(5) The valves are opened and closed by means of a camshaft. A camshaft is a rotating shaft that has individual lobes for each valve. The lobe is a “bump” on one side of the shaft that pushes against a valve lifter moving it up and down.

5. Fill in the blanks with the information given in the text.

(1) The pressure developed within the combustion chamber is applied to the head of a piston to _____, which is then converted into useful mechanical power.

(2) Internal combustion gasoline engines run on a mixture of _____. The ideal mixture is _____.

(3) Flat engines _____ 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.

(4) The majority of engines in motor vehicles today are _____, _____ internal combustion engines.

(5) _____ 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.



Grammar(1)

主谓一致 (Concord)

一、概述

主谓一致是指：

1. 语法形式上要一致，即单复数形式与谓语要一致。

2. 意义上要一致，即主语意义上的单复数要与谓语的单复数形式一致。

3. 就近原则，即谓语动词的单复形式取决于最靠近它的词语，一般来说，不可数名词用动词单数，可数名词复数用动词复数。例如：

There is much water in the thermos.

但当不可数名词前有表示数量的复数名词时，谓语动词用复数形式。例如：

Ten thousand tons of coal were produced last year.



二、主谓一致的原则

1. 意义一致的原则

主语后跟有以下引起的短语：谓语动词仍与短语前的主语的形式保持一致。

(1) (together) with, 例如：

Alice (together) with her parents often goes to the park on Sundays.

(2) except/but, 例如：

Every picture except/but these two has been sold.

Nobody but Mary and I was in the classroom at that time.

(3) no less than, 例如：

His sister, no less than you, is wrong.

(4) rather than, 例如：

The father, rather than the brothers, is responsible for the accident.

(5) perhaps, 例如：

Peter, perhaps John, is playing with the little dog.

(6) like, 例如：

He, like you and Xiao Liu is very diligent.

(7) including/besides/as well as, 例如：

The book, as well as the pencil, is on the desk.

2. 就近原则

(1) 主语由以下连词连接：谓语动词与后一个主语一致：

(Either)... or..., Neither... nor..., Whether... or..., Not only... but (also)..., Not... but... 例如：

Either you or I am going to the movies.

(2) there be 句型：be 动词与后面第一个名词一致。例如：

There is an apple, two bananas and some oranges on the plates.

(3) 副词 here, there, now, then, up, down, in, out, away, such 连接的全部倒装结构中：谓语动词由动词后面的主语决定。例如：

On the wall hang two maps. 墙上挂着两张地图。

On the wall hangs a world of map. 墙上挂着一张世界地图。

Such is the result. 结果就是这样。

Such are the results. 这就是结果。



3. 整体原则

(1) 并列主语如果指的是同一个人、同一事物或同一概念时, 谓语动词用单数, and 后面的名词没有冠词。例如:

The writer and worker is coming to our school tomorrow. (一个人)

这位作家, 也是一名工人, 明天要来我们学校。

The writer and the worker are coming to our school tomorrow. (两个人)

这位作家和这名工人明天要来我们学校。

Bread and butter is their daily food.

面包加黄油是他们每天的食物。

(2) 表示时间、距离、价格、度量衡等的复数名词或短语作为一个整体看待时, 谓语动词常用单数形式。例如:

Three years is not a long time. 三年时间并不长。

Ten dollars is what he needs. 10 美元正是他所需要的。

Five hundred miles is a long distance. 500 英里是一段很长的路。

(3) 复数形式的专有名词作为整体看待(人名、地点、国家、组织、书籍、报刊等), 动词用单数形式。例如:

The United Nations has passed a resolution(决议)。

联合国已经通过了一项决议。

The Arabian Nights is an interesting book.

《天方夜谭》是一本很有趣味的书。

(4) 集合名词 people, police, cattle 作主语, 谓语动词用复数形式。例如:

The police are searching for him. 警察正在追捕他。

The cattle are grassing. 牛在吃草。

4. 谓单原则

(1) 用 and 连接的并列单数名词前如有 each, every, no 修饰时, 谓语动词要用单数形式。例如:

Every boy and girl has been invited to the party.

每位男孩及女孩都被邀请参加聚会。

No teacher and no student is absent today.

今天没有一位老师, 也没有一位学生到场。

Many a student is busy with their lessons.

许多同学都在忙自己的功课。



(2)用 many a, more than one 修饰名词时,谓语动词要用单数形式。例如:

More than one person has made the suggestion.

不止一人提出这样的建议。

Many a rough man has been civilized by his wife.

许多粗野的男人已经被他的妻子所教化。

(3)用 each, either, one, another, the other, neither 作主语时,谓语动词用单数形式。例如:

Each takes a cup of tea. 每人喝一杯茶。

Either is correct. 任何一个都是正确的。

(4)由 every, some, any, no 构成的合成代词作主语时,谓语动词用单数形式。例如:

Nothing is to be done. 无事可干。

(5)用 means, politics, physics, plastics 作主语时,谓语动词用单数形式。例如:

Politics has always interested me. 我一直对政治感兴趣。

5. 具体情况原则

(1)all, few, more, most, some, any, none, half, the rest 等作主语时,既可表示复数意义,也可表示单数意义,谓语动词要根据实际情况而定。例如:

All of the apple is rotten. 整个苹果都烂了。(不可数,谓单)

All of the apples are rotten. 所有的苹果都烂了。(可数,谓复)

Most of the wood was used to make furniture. (不可数,谓单)

大部分木材都被用来做了家具。

Most of the people are from England. (可数,谓复)

大多数人从英国来。

(2)the + 形容词(或分词)作主语时,常指一类人,谓语动词用复数形式。如指的是抽象概念,谓语动词则用单数形式。例如:

The wounded are being taken good care of here now.

受伤人员在这里受到很好的照顾。

(3)population 当“人口”讲时,谓语动词用单数形式;当“人们”讲时,谓语动词用复数。例如:

The population of China is larger than that of Japan.

中国人口比日本庞大。

(4)the number of + 名词复数,是表示“……的数字”,作主语时,谓语动词用单数形式;
a (large/great) number of + 名词复数,表示许多,作主语时,谓语动词用复数。例如:

The number of the students in our school is increasing year after year.

我们学校的学生人数在逐年增加。



A number of students have gone for an outing.

很多学生去郊游。

(5)有些集体名词如 family, team, group, class, audience, government 等作主语时,如看做是一个整体,谓动词则用单数形式;如强调各个成员时,谓动词要用复数形式。例如:

My family is going to have a long journey. 我们家准备一次长途旅游。

My family are fond of music. 我的家人都喜欢音乐。

The class has won the honour. 这个班集体赢得了荣誉。

The class were jumping for joy. 班上的同学高兴得跳了起来。

6. 先行词原则

关系代词 who, that, which 等在定语从句中作主语时,其谓动词的数应与句中先行词的数一致。例如:

He is one of my friends who are working hard.

他是我的朋友中努力工作的其中之一。

He is the only one of my friends who is working hard.

他是我的朋友中唯一一位努力工作的。

参考译文 内燃机机械原理

发动机用来产生动力。燃料中的化学能在一定比率控制下燃烧转换为热能。这个过程被称做燃烧。如果发动机燃烧过程发生在能量室内,就称为内燃发动机。若燃烧发生在气缸体外,称做外燃发动机。

在汽车中使用的发动机一般为内燃发动机。在燃烧室内释放的热能使得燃烧气体和燃烧室升温。燃烧气体的升温促使气压的增加。燃烧室内形成的压力作用在活塞上来产生可用的机械力,这种机械力被转换成有用的机械能。

通过连杆连接活塞与曲轴,并引发曲轴转动半圈。做功冲程“用尽”气体,这意味着必须提供一种方法排出燃烧后的废气,同时向气缸内冲入新的油气混合气体;这种对气体运动的控制是气门要完成的任务;进气门使得新的油气混合气体在恰当的时间进入,同时排气门排出完成燃烧使命后的废气。有关的发动机术语如下:

上止点(TDC):当活塞最远离曲轴时,曲柄与活塞的位置 (Fig. 1-1-1)。

下止点(BDC):当活塞最靠近曲轴时,曲柄与活塞的位置。

冲程:上止点与下止点之间的距离、冲程由曲轴决定。

缸径:气缸的内径。

工作容积:位于上止点与下止点之间,气缸的容积。

发动机排量:所有气缸的工作容积。比如,一个四冲程排量为2升(2000cm)的发动机,单个气缸工作容积为50cm。

余隙容积:当活塞到达上止点时,位活塞之上的空间容积。

压缩比率=(工作容积+余隙容积)\(余隙容积)



二冲程:曲轴每转动一圈完成一次做功冲程(Fig. 1-1-2)。

四冲程:曲轴每转动二圈完成一次做功冲程(Fig. 1-1-2)。

内燃汽油发动机工作于汽油与空气的混合气体之上。理想的空气与汽油的混合比大约是14.7:1(重量比)。1份完全汽化的汽油混合与14.7份的空气混合后,在发动机内点燃时可以产生巨大的能量。

当今,大部分汽车的发动机都是四冲程、火花点火内燃机。以气缸数目以及气缸排列方式为依据,汽车发动机可分为以下几类。汽车发动机一般可拥有3至12个气缸,它们以不同的排列方式构成发动机机组。常见的发动机如下图所示(Fig. 1-1-3)。所谓直列式发动机,是指所有发动机气缸排成一列,常见的有3缸、4缸、5缸、6缸配置直列发动机。而V型发动机是指并排安置两列气缸使它们成一定角度,就像字母V一样,常见的配置有V-6、V-8、V-10、V-12。卧式发动机则是相对的水平放置两列气缸,相对于前面两种类型,这种类型并不常见。这种排列方式被用在4缸或6缸的斯巴鲁(Subaru)、保时捷及较早的4缸大众甲壳虫发动机上,卧式发动机也被应用于一些法拉利12缸发动机车上。

大部分的发动机机组都是由铸铁或铸铝制造而成。每个气缸内部包括一个在缸径内能上下运动的活塞(Fig. 1-1-4)。每一个活塞通过独立的连杆与公共曲轴相连接。

在直列式发动机中,曲轴位于气缸下方;在V型发动机中,它在两列气缸组V的公共底部;而对于卧式发动机而言,曲轴位于相对的两列气缸之间(Fig. 1-1-5)。当活塞上下运动时,它们转动曲轴,就像你用腿使自行车的脚踏板转动曲柄一样。

气缸盖通过螺栓固定在每个独立的气缸之上,来密封完成气缸内燃烧过程。大部分的气缸盖是由铸铁或铸铝制造而成,每个气缸盖上至少有一个进气门和一个排气门(Fig. 1-1-6),这使得油气混合物能够进入气缸,燃烧后的废气排出气缸。发动机中每个气缸至少具有两个气门,一个进气门,一个排气门。许多新型的发动机使用多进气门与排气门来增大发动机功率和效率。这些发动机通常通过气门数来命名,例如,“24门V6”发动机就是指V-6发动机,并且每个气缸上有4个气门。现代发动机设计中,每个气缸已经可以使用3至5个气门。

气门通过凸轮轴的转动来实现开闭。凸轮轴是一种转动轴,它为每个气门分配一个凸轮叶(Fig. 1-1-7)。凸轮叶是一种在轴上一侧的凸块,它推动气门升降器上下移动。当凸轮叶推动气门升降器,升降器提升打开气门,当凸轮叶转动离开升降器,气门在气门弹簧作用下关闭。通常的做法是通过一系列的联动装置,将凸轮轴安置在发动机组上并通过升降器连接气门。凸轮轴必须与曲轴同步,即凸轮轴旋转一周时曲轴旋转两周。在大多数发动机中,通过将正时链条(与自行车链条相似)与凸轮轴、曲轴同时相连来实现。一些新的发动机中将凸轮轴直接安装在气门之上的气缸顶部。这种设计更加高效,但是增加制造成本,对于V型和卧式发动机则需要多个凸轮轴,也需要更长的正时链条或同步带。有一些发动机具有两个凸轮轴,一个用于控制进气门,另外一个用于控制排气门,这种发动机通常被称为双顶置凸轮轴发动机(D. O. H. C),而另外一种则被称做单顶置凸轮轴发动机(S. O. H. C)。发动机与凸轮轴在一起的发动机组被称做顶置气门发动机(O. H. V)。