POWER ENGINEERING

动力工程

大学英语专业阅读精选系列教材

FOCUS READING SERIES

上海外语教育出版社

前　言

大学英语教学大纲规定大学本科(包括理工科和文理科)的英语教学分为基础阶段和专业阅读阶段。专业阅读阶段的任务是：指导学生阅读有关专业的英语书刊和文选，使其进一步提高阅读英语科技资料的能力，并能以英语为工具，获取专业所需要的信息。我们感到基础阶段学生所接触的语言材料在文体和词汇方面与专业阅读阶段有着较大的差别，而且一般说来学生第五学期刚开始接触专业基础课，他们还缺乏专业知识，直接进行专业阅读尚有一定困难。另外学生在基础阶段学习中所掌握的读、听、写、说四种技能在专业阅读阶段还需要进一步巩固和提高。

Focus Reading Series 是为解决大学英语从基础阶段过渡到专业阅读阶段的衔接问题而编写的一套系列教材。本系列教材按专业大类分成六个分册：Mechanical Engineering; Electrical and Electronic Engineering; Chemistry and Chemical Engineering; Computer Engineering; Materials Science 和 Power Engineering。教师可按学生所学专业选用对口的分册。在编写过程中编者力求打破同类教材的老框框，使学生通过大量专业基础方面有关材料的阅读不仅能学到英语，而且还能学到一定的专业基础知识，熟悉和了解专业题材文章的特色并掌握一定量的专业词汇，从而为他们顺利进入专业阅读阶段学习打下良好的基础。本教材练习形式力求新颖多样，学生可以通过各种练习在语言运用上得到锻炼，使他们在大学英语基础阶段所掌握的读、听、写、说技能得到进一步巩固和提高，并进而提高交际能力。本系列教材在编写过程中还着重强调专业文章的特色及与之有关的功能意念和语言技能训练。

全套教材由机械工业部大学英语协作组责成华东工业大学、湖南大学、吉林工业大学和沈阳工业大学负责编写，并特邀上海大学合作编写。华东工业大学程月芳副教授担任总主编，卢思源教授担任总主审。本教材在编写过程中得到了机械工业部教育司的领导和上海外语教育出版社编辑同志的大力支持和帮助。

编著者

1994 年 2 月

本书使用说明

本书为 Power Engineering 分册，供有关专业的大学本科学生用作专业阅读阶段之前的过渡性教材。一般在第五学期使用，约需 34 学时。

本书由 15 个单元组成，各单元均按专业内容划分，既考虑到专业知识的连贯性又照顾到英语学习的循序渐进。每个单元由 Reading and Comprehension; Reading and Practice 和 Reading and Translation 三个部分组成。Reading and Comprehension 部分有一篇阅读文章，其后是检查学生对文章理解的练习，旨在训练提高学生对科技体裁文章的阅读技能。文章后面附有生词表，将大学英语 1～4 级中未出现过的词汇或虽已出现过但在专业方面有特殊词义的词汇列入表内，生词后注有国际音标、词性和词义。Reading and Practice 部分也有一篇文章，其内容基本与 Reading and Comprehension 部分一致，但文字较浅近易懂。要求学生在理解文章内容的基础上做好练习。该部分练习由 Use of English 和 Guided Writing 两个部分组成，是为训练学生运用语言的能力而设计的。Use of English 练习中，有的是 Use of Language 有的是 Information Transfer，旨在为学生提供运用语言的实践机会。教师在引导学生做这一练习时应注意语言的流畅程度和准确性并重，并要尽力鼓励学生将已掌握的语言知识较流利地运用到实践中去。Guided Writing 旨在指导并训练学生的书面表达能力，练习的设计从连句成段开始，最后到指导学生写出简单的实验报告以及某一零部件或图表的定义、分类和描述。在这一练习的教学过程中教师可向学生推荐一些简单的实验报告格式，也可让学生对某些实物进行定义、分类和描述。Reading and Translation 部分要求学生把英语短文中的斜体部分翻译成汉语。在做这部分练习时教师可作一些翻译指导，并要求学生不仅注意单句的译法，还要注意上下文意思对译文的影响，该部分选材以有利于指导翻译教学为主，但在内容上力求不脱离本分册的专业范围。

本书阅读总量约为 60000 词，每一阅读文章（不包括翻译部分）篇幅一般为 1000 词左右。总生词量为 400～500 个，并按字母顺序列于书后。在讲课中教师应注重阅读理解、翻译和语言实践的指导及交际能力的培养。学生宜在课前做好预习工作。本书的阅读和练习量较大，教师可根据学生的实际情况安排教学内容，对教材进行有选择的使用。

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Unit One

I. Reading and Comprehension

SEVERAL KINDS OF ENERGY

Several kinds of energy are connected with electricity. When an electric current flows through electrical machines, work has to be done to keep the current moving. The energy to do this work may come from a battery or from the machines called generators in the power stations which make the current flow.

Not only is energy used in keeping a current flowing. Every electric current has a magnetic field around it. If an electric current passes through wire *coiled* round a bar of iron, a strong magnetic field is *produced*, turning the iron bar into a magnet. This is an *electromagnet*, and they are widely used in industry for lifting and transporting heavy pieces of metal. When an electromagnet is switched on above a metal object, the object flies up and is held to the magnet. Work is done by the magnet in lifting this weight against the force of *gravity*. And the energy that is used in doing this work comes from the power station that generates the current.

Another form of energy is chemical energy. Chemical *compounds* are built up of atoms. The atoms are held in place by attractions between them. The atoms are made of parts that are held together by electrical forces. In the outer parts of the atom are tiny particles called electrons (Moving electrons make up ordinary electric currents). When the atoms join to form new compounds, some electrons are *rearranged*. Energy may be given out as this happens, or it may have to be taken in from outside. When large amounts of energy are given out very quickly, there is an explosion. Energy given out in chemical reactions comes from chemical energy.

Chemical energy is very important in everyday life. For example, the burning of petrol in a car engine is a chemical change. As oxygen from the air combines with the petrol, energy is released and used to drive the wheels. Chemical compounds in an electric battery react with each other to produce an electric current. Human beings must eat food to live. The food is broken down in the body in complicated chemical reactions. The chemical energy released is used by the body.

Heat is a form of energy, too. In any hot object, atoms and molecules are vibrating fast. The hotter the object is, the faster they vibrate. So heat is a form of kinetic energy of atoms and molecules.

Whenever two things strike each other—water hitting the rocks at the bottom of water fall, a high speed jet hitting molecules of air as it travels faster than sound, or the atoms on the surface of a *drill-tip* boring through rock—the molecules of the two objects are set vibrating. Kinetic energy of the moving object is turned into kinetic energy of the molecules. Motion is turned into heat.

In a car's *brakes* , rough pads press against a metal disc or *cylinder* attached to the wheels. The brakes grow very hot as the car slows down. Kinetic energy of the car's forward motion is being turned into the heat energy of the atoms in the brakes.

At the centre of every atom is a tiny particle called the nucleus of the atom. The nucleus is itself made up of even tinier particles. The forces that hold the nucleus together are even stronger than the electrical forces which hold the electrons in place. Tremendous amounts of energy are stored in the nucleus. They are released when a nuclear bomb is exploded. This energy is called nuclear energy.

Yet another form of energy appears in light waves, radio waves and *X-rays* . All these forms of energy are basically the same, except for their wavelength. Huge amounts of energy are constantly falling on the Earth in the form of sunlight. When an electric light glows, it is sending out energy in the form of light.

Sound waves carry energy too. They are vibrations of the molecules in the air, and so these molecules have kinetic energy. When any thing is making sound, energy is being *carried away* from it in the sound waves.

New Words

coil /kɔil/ *v.*	卷绕
produce /prəˈdjuːs/ *v.*	产生
electromagnet /iˈlektrouˈmægnit/ *n.*	电磁铁
gravity /ˈgrævəti/ *n.*	地球引力
compound /ˈkɔmpaund/ *n.*	化合物
rearrange /ˈriəˈreindʒ/ *n.*	重新排列
drill-tip /ˈdriltip/ *n.*	钻尖
brake /breik/ *n.*	刹车
cylinder /ˈsilində/ *n.*	汽缸
X-ray /ˈeksˈrei/ *n.*	X 射线
carry away *v.*	带走

Reading Comprehension

Choose the best answer for each of the following.

1. The energy to do the work to keep the current moving comes from ______.
   a. the electricity
   b. the power station
   c. the machine
   d. the generator
2. The electromagnet is used in industry for ______.
   a. generating the electric current
   b. making the electric current pass through wire coil
   c. lifting the weight against the pull of gravity
   d. being switched on the metal object
3. Which of the following may have to be taken in when the atoms join to form new compounds?
   a. Tiny particles.
   b. Energy.
   c. Electrical forces.
   d. Attractions.
4. The molecules of the hot object vibrate ______ those of the cold object.
   a. faster than
   b. as fast as
   c. slower than
   d. much faster than
5. When two things strike each other, their molecules must ______.
   a. be turned into heat
   b. be changed into kinetic energy of the two objects
   c. travel faster than sound
   d. vibrate
6. Which of the following does not happen when the car slows down with its brakes?
   a. The pads of the brakes press against a cylinder attached to the wheels.
   b. Kinetic energy of the car's forward motion is turned into the heat.
   c. The pads stop the car wheels directly.
   d. There is energy change.
7. The energy called nuclear energy is ______.
   a. the electrical forces which hold the electrons in place
   b. the forces that hold the tinier particles together in the nucleus
   c. all the forces in the atom
   d. the energy are released from the nuclear bomb
8. The word "light" in the fourth line of the ninth paragraph can be replaced by ______.
   a. not being heavy
   b. firing

c. wave

d. lamp

9. The energy is carried away from ______ when any thing makes sound.

a. sound

b. sound waves

c. molecules

d. any thing

10. How many kinds of energy are mentioned in the essay?

a. five.

b. six.

c. seven.

d. eight.

II. Reading and Practice

ENERGY CHANGE

One of the most important things to know about energy is that any form of energy can be changed into any other form. For example, chemical energy is changed into heat energy when *combustion* (burning) of gasoline takes place in an automobile engine. Some of this heat energy is then turned into the energy of the car's movement. Electrical energy is changed into energy in the form of heat and light when an electric current passes through a wire. The kinetic energy of a spinning turbine is changed into electrical energy in a generator.

Imagine an explosive expert in a *quarry*. The explosives he uses are really stored chemical energy. His job is to release that energy safely and make it work for him by loosening the rock in the quarry.

He *detonates* (sets off) the explosive and the chemical energy is released. Some of it is changed into heat energy and light energy. We can see the light energy as the flash of the explosion. Some energy is released as sound energy, and we can hear the sound of the explosion. If the explosive expert has placed his explosive in the right place, most of the energy will be absorbed (taken in) by the rock. This will cause the rock to vibrate, split, and loosen. This energy finally spreads out among the molecules of the rock as heat, flowing away from the point of explosion.

In this example, one form of energy — chemical energy — has changed into a number of other forms of energy. But if we could measure all the energy released in these different forms, we would find that the total amount was equal to the amount of chemical energy we started with.

This is another very important idea concerning energy. Energy can be changed from one form to another, but it is never created and never destroyed. This idea is known as the law of conservation of energy.

Sometimes it might seem that energy has been destroyed. For example, if you boil a kettle of water, then turn out the flames under it, the water will slowly cool down to room temperature. The heat energy seems to have been destroyed or to have disappeared. But it hasn't. It has just spread out through the air. A bouncing ball also seems to lose energy as it rolls to a *standstill*. Its kinetic energy has been changed to heat energy. This happens as the ball pushes the air aside as it moves, and as it strikes the ground. The energy is still there — spreading out in the form of heat energy.

So we can say that energy never disappears. It changes from one form to another and always ends up as heat energy.

New Words

combustion /kəm'bʌstʃən/ *n.* 燃烧
quarry /'kwɔri/ *n.* 采石场
detonate /'detouneit/ *v.* 起爆
standstill /'stænd'stil/ *n.* 静止

1. Use of Language

Exercise A

Complete the following paragraph selected from the reading passage with right words.

Sometimes ___(1)___ might seem that energy has been destroyed. For example, if you boil a kettle of water, then turn out the flames ___(2)___ it, ___(3)___ water will slowly cool down to room ___(4)___. The heat energy seems to have been destroyed ___(5)___ to have disappeared. But it hasn't. It has just spread ___(6)___ through the air. A bouncing ball ___(7)___ seems to lose energy as it rolls to a standstill. Its ___(8)___ energy has been changed to heat energy. This happens as the ball pushes the air ___(9)___ as it moves, and as it strikes the ground. The energy is still there — spreading out ___(10)___ the form of heat energy.

Exercise B

Fill in the following blanks with proper prepositions or adverbs.

1) One of the most important things to know about energy is that any form ______ energy can be changed into any other form.
2) Some of this heat energy is then turned ______ the energy of the car's movement.
3) Electrical energy is changed into energy ______ the form of heat and light when an electric current passes through a wire.

4) His job is to release that energy safely and make it work for him ______ loosening the rock in the quarry.
5) Some energy is released ______ sound energy, and we can hear the sound of the explosion.
6) We would find that the total amount was equal ______ the amount of chemical energy we started with.
7) ______ this example, one form of energy — chemical energy — has changed into a number of other forms of energy.
8) This is another very important idea ______ energy.
9) Energy can be changed ______ one form to another, but it is never created and never destroyed.
10) It changes from one form to another and always ends ______ as heat energy.

Exercise C

Fill in the blanks with the words or expressions given below. Change the forms where necessary.

change... into	take place	in the form of	take in ...
spead out	equal to	be known as	turn out
push aside	end up		

1) The smoke from the automobiles ______ among the air and pollutes it.
2) The water on the desk can ______ with paper.
3) We may ______ electrical energy ______ heat energy with this device.
4) The heat energy in the equipment is turned into energy ______ light in this way.
5) What ______ during this chemical change?
6) The amount of chemical energy ______ that of kinetic energy and heat energy in our last experiment.
7) Energy changed into heat energy when combustion of gasoline takes place in a car engine ______ chemical energy.
8) When you left the room, you should ______ the light.
9) The chemical reaction ______ as was expected.
10) The force of the dynamite will ______ everything in its way.

2. Guided Writing

Definition (I)

Definitions are a very important writing skill for science students to know. They are frequently used by scientists, engineers and technicians to define ideas, concepts, laws, substances or objects in scientific writings.

A definition usually has two parts. The first part is the class or category consisting of items which can be grouped together because of their likenesses or traits. The second part is the characteristic of the defined item which differentiates it from other members of the same class. Take for example the definition of the word "pulsar": "A pulsar is a star that emits radio waves in uniform pulses." Here the first part is "a star" that tells you to which class the pulsar belongs. The fact that "it emits radio waves in uniform pulses" differentiates the pulsar from any other stars. It is the second part.

Stage 1

Fill in the blanks with the given words so as to complete each statement as a definition.

energy an electromagnet gravity a cylinder X-ray

1) ______ is the piece of soft iron that becomes magnetic when an electric current is passed through wire coiled round it.
2) ______ is a kind of short-wave ray that penetrates solids and makes it possible to see into or through them.
3) ______ is a force of attraction between any two objects, especially that force which attracts objects towards the center of the earth.
4) ______ is force, vigour or capacity to do things and get things done.
5) ______ is a cylinder-shaped chamber (in an engine) in which gas or steam works a piston.

Stage 2

Write the definitions of the following things.

1) an atom
2) petrol
3) an engine
4) a generator
5) a brake

III. Reading and Translation

Read either of the following passages and translate the italicised parts into Chinese.

(1) ENERGY (I)

Picture your community if a sudden and complete power failure has occurred one cold winter evening at about 6 PM. Electric and electrically controlled gas and oil furnaces have gone off. *You go to light the gas stove in the kitchen to warm at least one room, only to discover that it will not light because the pumps that maintain pressure in the gas line into the city are powered with electricity.* Only those people who had the "foresight" to equip their homes with coal-fired furnace are keeping cozy and warm tonight. The next day when you attempt to drive out to the country to cut some dead trees for firewood, you discover that the car has only a few gallons of gasoline in the tank. It is impossible to obtain gasoline because service station pumps are operated by electric motors.

The telephone company, hospitals, municipal water system, and a few radio stations are operating on an emergency basis with standby generators. But you do not have a battery powered radio so you have a problem trying to find out what is happening. You are eating cold soup from cans you opened with a hammer and screwdriver because the electric can opener does not operate. The community is almost completely paralyzed. Electric typewriters do not type, automatic doors do not open, supermarket cash registers do not ring, escalators and elevators are motionless, traffic signals do not function, and crime accelerates in the darkened city. *The evening of the second powerless night finds you and your family, wrapped in blankets, huddled in the living room, watching the last candle burn down. There isn't anything else to do.* No newspapers were printed today. There is no TV and the theaters are all closed. Today you located a neighbor with a battery radio. The powerout extends over a wide area and was triggered by a malfunction in one of the system's nuclear power plants.

Perhaps the power will be back on tomorrow. *But there are rumors of fuel shortages for the other power plants and the utility company is warning that the same thing can happen again within a very short time.* Already there had been some power brownouts in your community the past summer, at least the lights and stoves kept working.

This gloomy picture is presented to emphasize the degree to which we have come to depend upon convenient electrical energy andwhat happens when we are suddenly deprived of our servants. Power brownouts and blackouts have occurred and will become more frequent as our accelerating energy demands continue to outrun our resources for supplying the energy. Americans now use more than six times as much electrical power per capita as the world average, and our demand for more energy is doubling every 15 years. Within the next 15 years we will need twice as many power generating plants as we have now plus the necessary distribution system to take care of the increase.

But simply building more power producers is not enough; there must be fuel to produce heat energy that can then be converted to electrical energy and we just do not have it. Already this country consumes 30% of the world production of coal and oil and 50% of the natural gas. *We presently are importing one-third of the oil we consume and our production of natural gas lags our requirements by about 10%. Only in the areas of coal and nuclear fuel do we have an ample supply — at the moment. But these two energy sources are principal polluters of the environment and their indiscriminate use is of major concern and is being contested* *at every turn.* It is something to be concerned about.

From *Physical Science for Today* by Ernest E. Snyder

(2)ENERGY (II)

Energy, the word means the capacity for doing work. *When we say that a ton of coal, a lake of water high above a generating station, an electric battery, or a red-hot iron 'contains' a certain amount of energy, we are not referring to anything that we can take out of the water, or coal, or whatever it is, we are saying something about the state that it is in.* The coal possesses potential energy because the chemicals in it are in a condition to combine with oxygen, releasing heat energy. The water possesses potential energy because it is in a condition to fall. The amount of potential energy it possesses depends on how far it can fall. It could fall to the centre of the earth, in theory; but in practice we always measure potential energy relative to a given fall. When it does fall, its energy is changed into kinetic energy, or energy due to its movement. It can then be made to do work. In other words energy is a state of affairs, and not a 'thing' at all.

Energy in the form in which it is directly available for doing work is known as mechanical energy. *Only two sources of mechanical energy are naturally available — wind power and water power — and, since the energy requirements today are far greater than can be conveniently and economically supplied by winds, waterfalls, and tides, we are very much concerned with the conversion of other forms of energy into the mechanical form.*

At present, by far the greatest and most important source of natural energy available is in the form of chemical energy from natural fuels. Another natural source of energy is radiation from the sun. There is also electrical energy from lightning, though this is in far too unmanageable a form to be put to practical use. *In recent years, a new source of energy has been successfully exploited — a source which in future times promises to be of far the greatest importance and that is matter itself.* Energy derived from the actual destruction of matter (as opposed to chemical energy, which springs merely from the rearrangement of matter) is popularly termed 'atomic', though the correct term is nuclear energy. Finally, there is a rather special form of energy — heat. Heat is not a source but a form of energy — and the distinction is an important one. *Just as several thousand tons of water in a lake are a source of energy only if the lake is high up a mountain, so several thousand therms of heat are a source of energy only if the heat is available at a high temperature.* Moreover, heat is the lowest form of energy. The other forms — chemical, electrical, mechanical, nuclear — are, in the natural course of events, constantly being converted to heat, but the heat can be converted into one of the other forms of energy only with considerable waste. *Heat at a high temperature is in its nature constantly being converted to heat at a low temperature, but the reverse is not possible without the expenditure of mechanical energy.*

From *Oxford Junior Encyclopaedia* Vol. 8, Engineering

Unit Two

I. Reading and Comprehension

ELECTRICITY SUPPLY

Most of the electric power required for industrial and domestic purposes is generated in power stations, which are either conventional thermal, *hydro-electric*, or nuclear. In conventional thermal stations the electric generators are driven by engines — generally turbines — fuelled by coal, oil, or gas. In hydro-electric plants the water stored up behind the dams or falling through *penstocks* rotates the *turbo-generators*. In nuclear power stations the energy is gnerally transferred to turbines by means of steam or another gas which is heated in an atomic reactor, and cooled after passing through the turbines.

The current produced by the generators of a power station is collected by copper bars called "*bus bars*". Very often, all the power stations of the same country or region are *interconnected* by High Voltage transmission lines, so as to form integrated networks such as the National *Grid* System in Britain. Control centres *co-ordinate* the operation of the network according to the variations of the consumption.

Examples taken from the British National Grid System show the various parts of a power network (fig. 2—1 and Fig. 2—2). First, there are 275 KV and 400 KV systems, which consist of power stations and *substations* containing transformers linked together by *pylon*-supported "*feeders*"; electric current can thus be transferred over great distances at comparatively low cost, in wires that are far out of reach of the human hand. Near the areas where the current is to be distributed 132 KV transmission lines are connected to the 275 KV system through *step-down* transformers, and at other points the 132 KV grid is tapped, through switching stations, to feed 33 KV lines supplying area substations, from which 6600 V systems are fed. To these substations are connected large industrial consumers and the small *kiosk* transformers from which the network is supplied through Low-Voltage "*distributors.*" This 3 - phase network has necessarily a fourth - wire — the *neutral lead* , which is *earthed* (U. S. : *grounded*) at the transformer end — since the ordinary one-phase circuits used in houses for lighting, heating, etc. , are distributed among the three phases and cannot have balanced loads whose sums would be equal to zero.

In some cases the a. c. of the supply system has to be converted into d. c. , for instance in order to drive d. c. motors used for *traction*, to carry out *electrolytic* processes, to charge batteries, or to feed radio and television equipment. This conversion can be achieved by means of rotating machines or static *rectifiers*. The former are now *obsolescent*; the best known among them is the rotary *converter*, which makes use of a *commutator* of the d. c. -generator type driven by a *synchronous* motor. Static rectifiers — by far the most common type of converting devices — make use of electronic components. Among them the *diode*, *mercury-arc*, and semiconductor rectifiers must be mentioned.

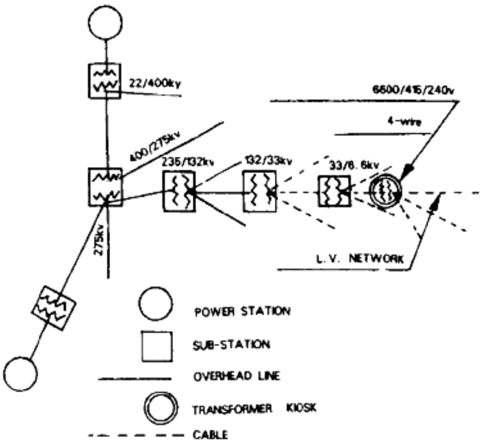

Fig. 2—1 A large supply system

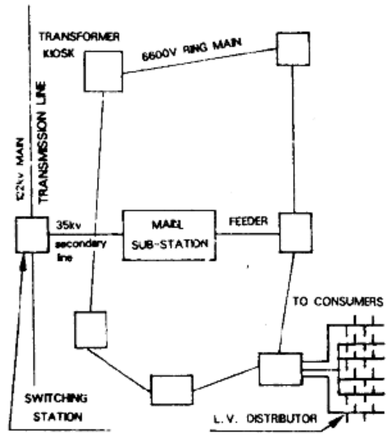

Fig. 2—2 A distribution system

From *Technical English* by P. Larreya and J. Piraud

New words

hydro-electric/ˈhaidrouiˈlektrik/ *a.*	水力发电的
penstock/ˈpenstɔk/ *n.*	闸门
turbo-generator/ˈtəːbouˈdʒenəreitə/ *n.*	涡轮发电机
bus bars *n.*	汇流母线
interconnect/ˈintəkəˈnekt/ *v.*	互连
grid/grid/ *n.*	电网
co-ordinate/kouˈɔːdineit/ *v.*	调整
substation/ˈsʌbsteiʃən/ *n.*	变电所
pylon/ˈpailən/ *n.*	铁塔
feeder/ˈfiːdə/ *n.*	电源线
step-down *a.*	降压的
kiosk/kiˈɔsk/ *n.*	小配电亭
distributor/disˈtribjuːtə/ *n.*	配电盘
neutral lead	不带电导线