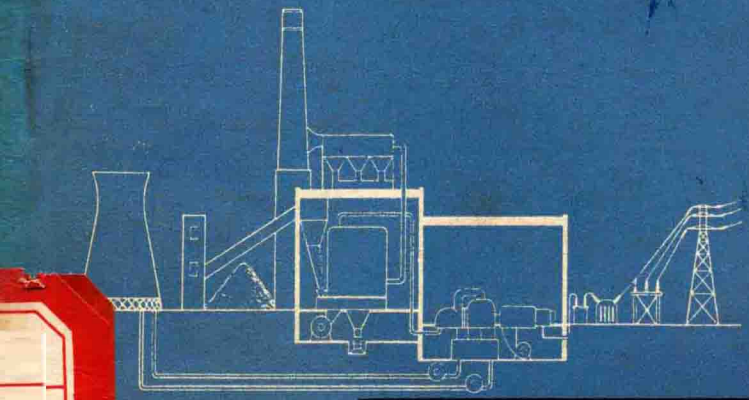
科技英语注释读物



ELECTRIC POWER

电　力

〔英〕F. J. M. Laver 著

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清华大学外语教研组
课外读物注释小组　注　释

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F. J. M. Laver

ELECTRIC POWER

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内 容 提 要

本书系供具备一定英语基础的理工科学生及科技工作者阅读的英语科技读物，文字平易，内容通俗，有助于读者提高英语阅读水平并增加科技基础知识。我们对原书的个别段落作了删节，希望读者批判使用。

本书内容介绍电及磁的基本概念及其应用。全书共分十六章：1.电；2.静止的电；3 流动的电；4 电是什么；5 磁性；6 磁性与电流；7 电学与化学；8 安培、伏特和欧姆；9.电力；10 电流的测量；11 电流是怎样产生的；12.交流电；13.发电站；14 电力如何分配；15 电动机；16.电照明及电供热。每章都附有必要的插图。对一些较难的英语习惯用法、词组、特殊句型等均加汉语注释，书末附有词汇表，以期有助于读者正确理解原文。

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CONTENTS

1. ELECTRICITY

Almost everyone today uses electricity in one way or another,[1] and it is hard to imagine what life in our large towns would be like without it.[2] Electricity lights the streets and buildings, warms the houses, heats food in cookers or cools it in refrigerators, works trains and trolley buses, traffic lights and lifts, and drives the machines in factories making all kinds of goods. And the everyday wonders of radio and television use electricity to bring entertainment and news to millions of families.

In villages and farms electrical machines milk the cows[3] and chop their food, cool the milk, and churn the butter. Indeed, electricity finds as much work to do in the country as it does in the towns.[4]

These uses for electricity have all developed in this century, but electricity itself was discovered a very long time ago. At least[5] 2,500 years ago the Greeks knew that if they rubbed a piece of amber it would attract small pieces of thread and dust. This happens because the amber becomes electrified. Amber is a natural substance which ancient peoples used for making ornaments, and we can imagine one of them polishing an amber bead with a woollen cloth and noticing[6] that the hairs from the

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1. in one way or another: 以这种或那种方式. **2. it is hard to imagine ... without it:** 很难想像如果没有电，我们大城市的生活会像什么样子. 这里 it 代替后面的不定式 to imagine.... **3. milk the cows:** 挤牛奶. **4. electricity finds as much work ... in the towns:** 电在乡村中的用途和它在城市中的用途一样多. 这里 does 代替 finds work. **5. at least:** 至少. **6. imagine one of them polishing ... and noticing:** 想像他们中的一人在擦亮...并注意到.... 此处 polishing 和 noticing 是分词，作 one of them 的补足语.

wool clung to the bead. The Greek name for amber[1] is 'elektron', and this gave us our word electricity. Rubbing amber is not a very good way of generating large amounts of electricity, and we use different methods today.

The ancient peoples also knew that in a place called Magnesia[2] there were curious stones which would pick up[3] small pieces of iron. They called them Magnes-stones, and so we have our word magnet. It was many hundreds of years later, in 1819, that[4] the Danish scientist Oersted[5] discovered that an electric current, that is a stream of electricity, acted like a magnet. A few years later, in 1832, the British scientist Faraday[6] discovered how to produce an electric current by moving a magnet near a coil of wire. These two important discoveries made it easy[7] to produce very large currents of electricity and to use their magnetic forces to drive powerful electric motors.

Nowadays, great quantities of electric power are generated in large power stations, and this power is carried over long distances through thick copper wires to the places where it is used to give light, heat, and driving power. Electric light, electric heat, and electric driving power can be provided without dirt or noise just where they are needed,[8] and can be quickly and easily controlled. This makes electricity a very convenient

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1. The Greek name for amber: 琥珀的希腊名称. **2. Magnesia** [mæg'ni:ʃə]: 麦克尼西亚. 地名, 在希腊东北爱琴海的海滨. **3. pick up:** 拾起. **4. It was many hundreds of years later, in 1819, that:** 那是经过几百年以后, 即在一八一九年, ... 这里 it was ... that 是强调句型, 强调时间状语 many hundreds of years later, in 1819. **5. Danish scientist Oersted** ['ə:stid]: 丹麦科学家奥斯忒 (1777-1851). **6. British scientist Faraday** ['fæ-rədi]: 英国科学家法拉第 (Michael Farady, 1791-1867). **7. made it easy:** 使...容易. it 代替后面的不定式 to produce 和 to use. **8. just where they are needed:** 就在需要它们的地方.

source of light, heat, and power. Electricity is working everywhere, so everyone should know something about how it is generated and how it behaves. Electrical devices[1] are much more interesting to use[2] when you know just how they work.

2. ELECTRICITY AT REST

If a rubber toy balloon is rubbed with a piece of woollen cloth the balloon collects electricity all over its surface,[3] and then it will pick up small pieces of paper and thread, for example. If the electrified balloon is hung up[4] by a long piece of cotton tied to its neck and the woollen cloth is held near, the balloon will be attracted by the cloth and move towards it. If another balloon is electrified and held near, the suspended balloon will move away, showing that the two electrified balloons repel each other.

We now know that there are two different kinds of electricity, which we call positive electricity and negative electricity. Ordinary things contain equal amounts of positive and negative electricity, and as these have equal and opposite effects we do not usually notice that any electricity is present at all.[5] When a balloon is rubbed a small amount of negative electricity passes from the woollen cloth to the balloon. The balloon then has a surplus of negative electricity, and we call this its 'negative electric charge'. The cloth has lost some of its negative electricity, and so it is left with a surplus of positive electricity,[6]

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1. electrical devices: 电气设备. **2. much more interesting to use:** 用起来更有趣得多. **3. all over its surface:** 在它全部表面上. **4. is hung up:** 挂起来. **5. not ... at all:** 全不; 毫不. **6. and so it is left with a surplus of positive electricity:** 因此它就留有多余的正电.

that is, it has a positive electric charge. Two negative charges repel each other, and so do two positive charges;[1] but positive and negative charges attract each other: that is, like charges repel, unlike charges attract,[2] as shown in Fig. 1. The strength of the attraction, or repulsion, between two electric charges is doubled if the amount of electricity in one of the charges is doubled. It increases by $2 \times 2 = 4$ times[3] if the distance between the original charges is halved.

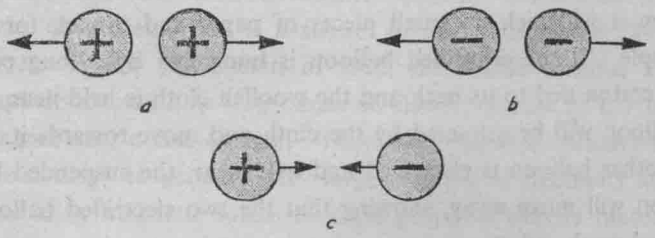

FIG. 1. (*a*) Two positive charges repel each other. (*b*) Two negative charges repel each other. (*c*) Positive and negative charges attract each other

The attraction between positive and negative electric charges pulls them towards each other, and unless they are prevented from[4] moving they come together again and cancel out.[5] The electric charges on a body can move quite easily when the body is made of carbon or of a metal, such as copper or aluminium. These materials are called conductors of electricity because they can be used to conduct, or lead, electricity from place to

---

1. so do two positive charges: 两个正电荷也是这样. so do 代前面的 repel each other. 本句是倒装句型. **2. like charges repel, unlike charges attract:** 同性电荷相排斥，异性电荷相吸引. **3. increases by $2 \times 2 = 4$ times:** 增加到(原来的)四倍. **4. they are prevented from:** 不让他们.... **5. cancel out:** 抵消.

place.[1] Many materials are rather poor conductors,[2] and electricity can move through them only with difficulty. Ordinary water is a poor conductor of electricity, damp earth is another, and so is the human body.[3] Some materials, such as amber, silk, paper, rubber, glass, porcelain, and some plastics, do not normally allow electricity to move through them at all: these materials are called non-conductors or insulators.

When a rubber balloon is rubbed with wool, the negative electric charge which it collects cannot move, because rubber is an insulator, and so the balloon holds on to its charge.[4] But when a piece of metal is rubbed, the electricity produced[5] moves freely through the metal, passes through the hand and body of the person holding it, and flows away into the earth. The metal loses its surplus negative electricity as fast as it comes[6] and does not collect an electric charge. But if the piece of metal is held by a handle made of an insulating material such as[7] glass, this stops the electricity flowing away,[8] and so the metal soon becomes electrified when it is rubbed.

The electricity that collects on insulators is called a static charge because the electricity is static, that is, at rest.[9] When two nearby bodies have very large static charges of opposite kinds, the strong attraction between the positive and negative charges may cause a stream of electricity to rush suddenly through

---

1. from place to place: 到处；从一个地方到另一地方。 **2. rather poor conductors:** 很不良的导体。 **3. so is the human body:** 人的身体也是如此。本句是倒装句型。 **4. holds on to its charge:** 保持住它的电荷。 **5. produced:** 这是过去分词，作定语。 **6. The metal ... as fast as it comes:** （金属上的）多余的负电荷一经产生，就很快消失。as fast as，和...一样快。 **7. such as:** 例如。 **8. this stops the electricity flowing away:** 这就阻止电流流出。 **9. at rest:** 处于静止状态。

the air with the hot, bright flash and the bang which we call an electric spark. Sparks can start fires; and therefore in certain places — for instance, in a paper mill, where the rubbing of the paper through the paper-making machine builds up[1] a static charge — special care has to be taken[2] to prevent static charges from collecting. Lightning is an enormous electric spark produced by the static charge on a thunder-cloud: the thunder is the noise of the spark. Buses and other vehicles that are insulated from the earth by their rubber tyres may collect a static charge during a thunderstorm. When, therefore, anyone standing on the ground touches the vehicle, he may feel its electric charge flow through his body and away into the earth[3] — an unpleasant sensation that we call an electric shock. To prevent this, the vehicle is connected to the ground all the time[4] either by a dangling steel chain or by tyres in which some conducting material such as carbon dust has been mixed with the non-conducting rubber.

Over the whole world there are about 100 flashes of lightning every second. Lightning rushes towards the ground at about 250,000 m.p.h.,[5] and its intense heat damages whatever it strikes.[6] Tall buildings, such as church towers, therefore, are often protected from this danger by a lightning conductor;[7] this consists of a thick copper strip which is run up the outside of the building,[8] the bottom end of the strip being buried in the

---

1. builds up: 造成；构成. **2. special care has to be taken:** 必须特别小心. to take care, 小心. **3. and away into the earth:** 然后离开(他的身体)到地下去. **4. all the time:** 一直；始终. **5. m.p.h.** = miles per hour 每小时哩数. **6. whatever it strikes:** 它所碰到的无论什么东西. **7. lightning conductor:** 避雷针. **8. run up the outside of the building:** 沿着建筑物的外部向上伸延.

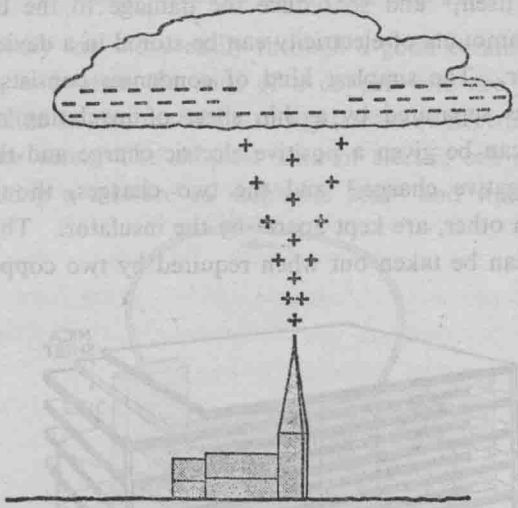

FIG. 2. Lightning conductor reducing the negative charge on a thunder-cloud

earth and the top end joined to a sharp-pointed copper rod that stands up above the building. The rod is sharp pointed because electricity leaks away quite quickly from sharp points. The large negative electric charge of the thunder-cloud attracts positive electricity from the earth up through the point of the lightning conductor, as in Fig. 2, and the stream of positive electricity cancels the static charge on the cloud quickly and safely, before it can produce lightning. A 'lightning preventer'[1] would be a more accurate name than a lightning conductor; although, if the thunder-storm is very severe and lightning does strike[2] the building, the lightning conductor will usually take

---

1. **'lightning preventer':** '防雷器.' 2. **does strike:** 真的击中.... does 起加强动词 (strike) 语气的作用.

the stroke itself,[1] and so reduce the damage to the building.

Small amounts of electricity can be stored in a device called a condenser. The simplest kind of condenser consists of two metal plates separated by a thin sheet of insulating material. One plate can be given a positive electric charge and the other plate a negative charge,[2] and the two charges, though they attract each other, are kept apart[3] by the insulator. The stored electricity can be taken out when required by two copper wires

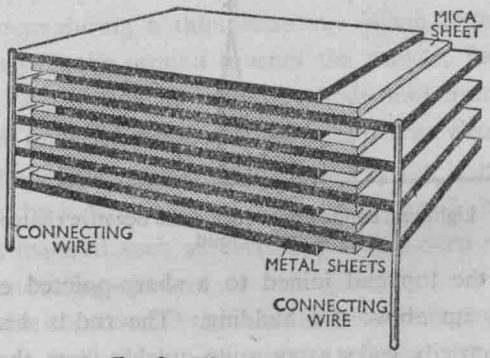

FIG. 3. Electric condenser

connected to the plates.[4] If the condenser has several plates arranged in two sets, as in Fig. 3, more electricity can be stored. The plates are sandwiched together with thin sheets of the insulating mineral substance mica in between.[5]

---

1. take the stroke itself: 它(避雷针)本身承受着雷击. **2. and the other plate a negative charge** = and the other plate can be given a negative charge. **3. are kept apart:** 分开. **4. The stored electricity can be taken out... connected to the plates:** 需要时,可以利用连接极板的两根铜丝来去掉储存的电. **5. The plates are sandwiched together with ... in between.** 这些金属板之间逐一夹有绝缘云母薄片并叠合在一起.

3. ELECTRICITY ON THE MOVE

Electricity can move easily through a good conductor such as copper, and when the ends of a copper wire are joined to a device called an electric cell[1] a steady stream of electricity flows through the wire. The simplest kind of electric cell is a glass jar containing a mixture of sulphuric acid[2] and water and a

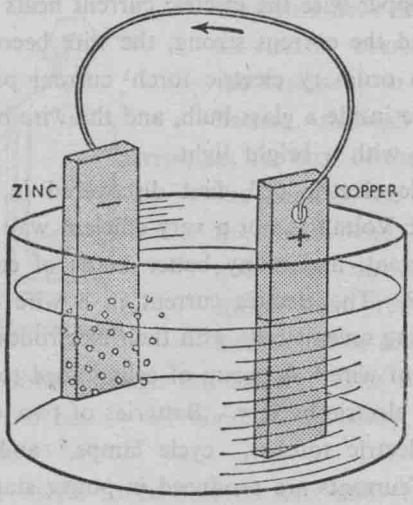

FIG. 4. Simple electric cell

piece of zinc and a piece of copper dipped into the liquid but not touching each other. When the zinc and the copper, which are called electrodes, are joined by a piece of copper wire as in Fig. 4, the zinc begins to dissolve in the acid. This chemical reaction results in the zinc soon being covered with bubbles of hydrogen gas.[3] At the same time a continuous stream, or

1. electric cell: 电池. **2. sulphuric** [sʌl'fjuərik] **acid:** 硫酸. **3. This chemical reaction results in ... of hydrogen gas.** 化学反应的结果是锌很快地为氢气泡所盖满. being covered 是动名词.

current, of electricity flows through the wire from the copper to the zinc. If the wire is broken the current stops, for electricity cannot flow through air, which is an insulator, and the acid stops dissolving the zinc. The zinc is called the negative electrode of the cell, because it has a surplus of negative electricity, and the copper is the positive electrode. In flowing through the copper wire the electric current heats it, and if the wire is thin and the current strong, the wire becomes very hot indeed. In an ordinary electric torch[1] current passes through a very thin wire inside a glass bulb, and the wire becomes white hot and glows with a bright light.

The simple electric cell, first discovered in 1800 by the Italian scientist Volta,[2] is not a very efficient way of producing an electric current, and many better kinds of cell have since been invented.[3] The electric current in a wire can be made stronger by using several cells with their electrodes joined together by pieces of wire.[4] A group of cells joined together in this way makes an electric battery. Batteries of two or three cells are used in electric torches, cycle lamps,[5] and bells. Very strong electric currents are produced in power stations by large machines called generators, which are usually driven by powerful steam turbines. The electric current from the generators is taken through thick copper wires from the power station to wherever it is needed.[6] A steady electric current flows only when

---

1. electric torch: 手电筒. **2. Italian scientist Volta** ['vɔltə]: 意大利科学家伏打 (1745—1827). **3. have since been invented:** 自从那时以来已被发明了. **4. with their electrodes ... of wire:** 它们的电极用一些金属线连接起来. **5. cycle lamps:** 自行车灯. **6. to wherever it is needed:** 到任何需要它的地方.

there is a complete ring of conductors for it to flow around.[1] Such a ring of conductors is called an electric circuit. If the circuit is broken at any point the current immediately stops, but it will start again as soon as the break is mended.[2]

The bulb in an electric torch is joined to its battery as shown in Fig. 5. When the spring switch[3] is pushed forward to touch the brass neck of the bulb at *A*, an electric current flows from the brass cap at the top of the battery, through the metal tip at the base of the bulb, through the filament, the screw-neck[4] of the bulb, the spring switch, and back through the spiral spring[5] that presses against the metal base of the battery. The current then flows through the battery. The bulb, the metal springs, and the battery all conduct electricity, and form an electric circuit.

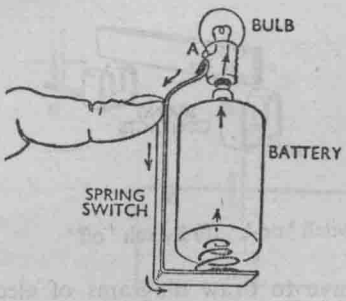

FIG. 5. Electric torch

It is very useful to be able to start and stop the current in an electric circuit, for instance, to turn a torch bulb on and off,[6] and the devices used to do this are called switches. In the torch shown in Fig. 5 the electric circuit can be made and broken by moving the spring switch so that it either touches or does not touch the neck of the bulb. Electric switches are made in a great many different shapes and sizes, but they all

---

1. only when ... to flow around: 只有当有一个它能通过的闭合导体环路时. **2. as soon as the break is mended:** 在断处一连接起来时. **3. spring switch:** 弹簧开关. **4. screw-neck:** 螺旋颈. **5. spiral spring:** 蜷簧. **6. to turn a torch bulb on and off:** 将手电筒灯泡(的电流)接通和断开.

work in the same way. In all of them there are two fixed springy metal parts called contacts and a movable metal link. When the link is pressed firmly between the spring contacts, as in Fig. 6 (*a*), an electric current can flow through the switch, but when the link is removed, as in Fig. 6 (*b*), the circuit is broken and the current stops.

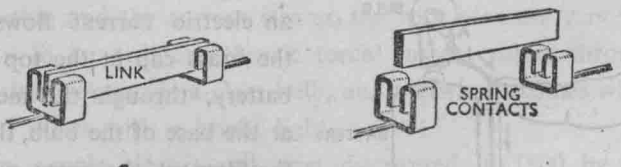

FIG. 6. Simple switch. (*a*) Switch 'on'. (*b*) Switch 'off'

Electrical engineers often have to draw diagrams of electric circuits. It takes too long to draw[1] batteries, bulbs, switches, and so on as they really are,[2] and so they use symbols and join these by straight lines to represent the copper wires. The symbols for the parts of the electric circuit of Fig 5 and a complete 'circuit diagram' of this circuit are shown in Fig. 7. The arrow-head shows which way the electric current flows.

Suppose that in the electric circuit of Fig. 7 the two wires joined to the battery were accidentally to touch each other,[3] a very strong electric current would immediately rush from the one wire to the other where they touched.[4] That is, the current

---

1. It takes too long to draw: 画...等图要用很长时间. it 代替不定式 to draw. **2. as they really are:** 如它们真正的那样; 逼真地. 此句说明前面的 to draw. **3. were accidentally to touch each other:** 偶然互相接触. **4. rush from the one wire ... touched:** 在它们接触的地方从一条导线涌入另一条导线.

would flow through the 'short circuit' between the wires, rather than flowing all the way round the long circuit through the switch and the bulb.[1] The bulb, therefore, would not light, and as the switch could not be used to turn the current off, the short-circuit current would soon run the battery down.[2] To prevent

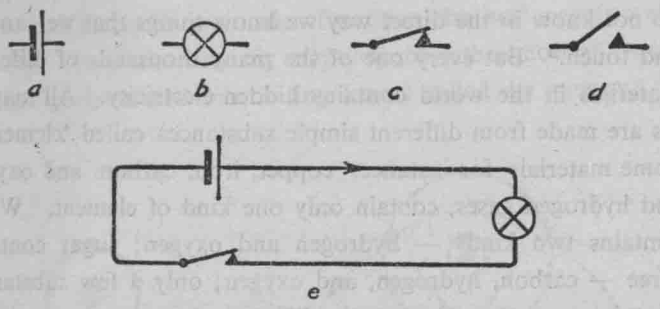

FIG. 7. Symbols for an electric circuit. (*a*) Battery. (*b*) Bulb or lamp. (*c*) Switch ' on '. (*d*) Switch ' off '. (*e*) Circuit of an electric torch

short circuits, the wires are kept from[3] touching one another by being covered with an insulator such as rubber or one of the plastic materials. This also reduces the risk that someone may get an electric shock by touching a wire and so causing the electric current to flow through his body. Electric shocks feel very unpleasant,[4] and a strong current can be very dangerous. It is safest, therefore, to cover all the bare metal parts of an electric circuit with insulating material.

---

1. rather than ... and the bulb: 而不是绕经开关与灯泡之间这条长电路流动. rather than, 而不. **2. run the battery down:** 把电池(的电能)消耗掉. **3. are kept from:** (被)避免. **4. feel very unpleasant:** 令人有极不舒服的感觉.