工业和信息化高职高专
“十二五”规划教材立项项目

高等职业院校
机电类“十二五”规划教材

数控技术专业英语

（第3版）

Numerical Control Technology English (3rd Edition)

精选专业英文文章
全面覆盖数控领域
每篇皆有中文翻译

◎ 闫帅经 卢艳 邢希英 主编
◎ 李云松 孙庆 刘青云 副主编

人民邮电出版社
POSTS & TELECOM PRESS

精品系列

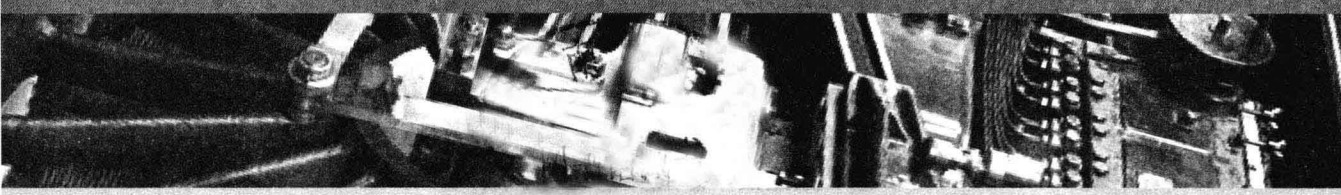
工业和信息化高职高专
“十二五”规划教材立项项目

高等职业院校
机电类“十二五”

数控技术专业英语

（第3版）

Numerical Control Technology English (3rd Edition)



◎ 闫帅经 卢艳 邢希英 主编
◎ 李云松 孙庆 刘青云 副主编

人 民 邮 电 出 版 社
北 京

精品系列

图书在版编目（CIP）数据

数控技术专业英语 / 闫帅经，卢艳，邢希英主编
-- 3版. -- 北京 : 人民邮电出版社，2012.3
高等职业院校机电类“十二五”规划教材
ISBN 978-7-115-27414-4

Ⅰ. ①数… Ⅱ. ①闫… ②卢… ③邢… Ⅲ. ①数控技术－英语－高等职业教育－教材 Ⅳ. ①H31

中国版本图书馆CIP数据核字(2012)第010439号

内 容 提 要

本书选择了数控领域的十余篇难度较小的典型英文文章，每篇文章后面都配有词汇、语法分析和讲解，课后习题，课文译文，补充阅读材料及其中文译文。通过本书的学习，读者可以在短时间内读懂一般的数控类英文文献。本书可作为高职高专院校数控技术专业的英语教材，也可以作为工程技术人员的自学参考书。

高等职业院校机电类“十二五”规划教材

数控技术专业英语（第3版）

◆ 主　　编　闫帅经　卢艳　邢希英
副 主 编　李云松　孙庆　刘青云
责任编辑　潘新文

◆ 人民邮电出版社出版发行　　北京市崇文区夕照寺街14号
邮编　100061　　电子邮件　315@ptpress.com.cn
网址　http://www.ptpress.com.cn
北京隆昌伟业印刷有限公司印刷

◆ 开本：787×1092　1/16
印张：10　　2012年3月第3版
字数：248千字　　2012年3月北京第1次印刷

ISBN 978-7-115-27414-4

定价：25.00元

读者服务热线：(010)67170985　印装质量热线：(010)67129223
反盗版热线：(010)67171154

前言

本书第2版自2008年9月出版以来，得到了广大师生的普遍认可。为了使本书更加符合当前高职高专教学改革的需要，我们结合当前高职高专教学改革的形势以及学校任课教师的反馈意见，对书中存在的一些不足和缺陷进行了纠正弥补，降低了整体内容的难度，考虑到高职高专学生的学时有限，为了使他们在短时间内快速提高阅读翻译水平，我们对补充阅读材料进行了精简，删除了一些庸长的文章，并对各章补充阅读材料都附加了中文翻译。同时本版还进行了以下修订。

1. 对课文做了适当的调整，在保留重要语法和关键词汇的同时，将上一版教材中篇幅较大的课文进行了缩减并列出了更多的生词和注释。

2. 在每篇课文的课后练习中增加了“Words Study”和“Language Study”两部分，以帮助学生掌握简单的构词法以及用法含义较灵活的单词，理解常见语法。

3. 每篇课文和每篇补充阅读材料都给出了完整的译文，以帮助学生正确理解课文内容，也便于教师教学。

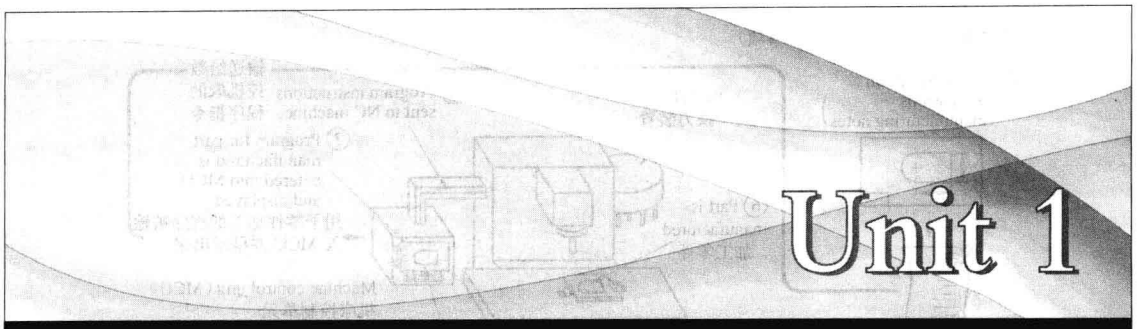
本书每课的参考课时为2～4课时。学生在课堂上除了课文的学习，还可以在教师的安排下完成部分课后练习，以巩固所学知识，提高课堂学习效果；每篇课文后面的补充材料可供学有余力的学生阅读，教师也可选择其中的部分内容作为课后作业进行布置。

本书由闫帅经，卢艳，邢希英主编。李云松，孙庆，刘青云任副主编。由于编写时间仓促，书中错误和不足之处在所难免，敬请广大读者批评指正。

编　者

2011年12月

目 录



Unit 1

Introduction to Computer Numerical Control Manufacturing

Reading Target

After reading this unit, you should be able to explain what Computer Numerical Control (CNC) is and what basic components comprise CNC systems.

Text

1.1 Definition of Computer Numerical Control and its components

A Computer Numerical Control (CNC) machine is an NC machine with the added feature of an on-board computer. The on-board computer is often referred to as the machine control unit or MCU. Control units for NC machines are usually hard wired. This means that a machine functions are controlled by the physical electronic elements that are built into the controller.① Simply put, numerical control is a method of automatically operating a manufacturing machine based on a code of letters, numbers, and special characters. A complete set of coded instructions for executing an operation is called a program. Such programs are stored in RAM or the random-access memory portion of the computer. They can be played back, edited, and processed by the control. Thus, the machine functions are encoded into the computer at the time of manufacture.

The components found in many CNC systems are shown in Fig.1-1.②

Machine control unit: generates, stores and processes CNC programs. The machine control unit also contains the machine motion controller in the form of an executive software program.③

NC machine: responds to programmed signals from the machine control unit and manufactures the part.④

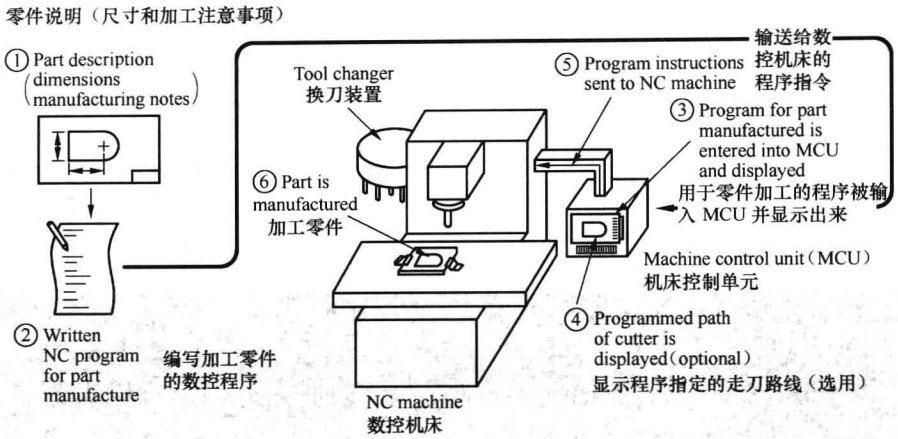


Fig. 1-1 components of modern CNC system
（现代 CNC 系统的组成）

1.2 Types of CNC Equipment

Machining centers are the latest development in CNC technology. These systems come equipped with automatic tool changers with the capability of changing up to 90 or more tools.⑤ Many are also fitted with the movable rectangular worktables called pallets. The pallets are used to automatically load and unload work pieces. At a single setup machining centers can perform such operations as milling, drilling, tapping, boring, and so on. Additionally by utilizing indexing heads, some centers are capable of executing these tasks on many different faces of a part and at specified angles. Machining centers save production time and cost by reducing the need for moving a part from one machine to another.

Turning centers with increased capacity tool changers are also making strong appearance in modern production shops.⑥ These CNC machines are capable of executing many different types of lathe cutting operations simultaneously on rotating part.

In addition to machining centers and turning centers, CNC technology has also been applied to many other types of manufacturing equipment. Among these are wire electrical discharge machines (wire EDM) and laser cutting machines.

Wire EDM machines utilize a very thin wire as an electrode. The wire is stretched between two rollers and cuts the part like a band-saw.⑦ Material is removed by the erosion caused by a spark that moves horizontally with the wire.⑧ CNC is used to control horizontal table movements.

Laser cutting CNC machines utilize an intense beam of focused laser light to cut the part. Material under the laser beam undergoes a rapid rise in temperature and is vaporized. If the beam power is high enough, it will penetrate through the material. Because no mechanical cutting forces are involved, lasers cut parts with a minimum of distortion, they have been very effective in machining slots and drilling holes.⑨

Key Terms

Computer Numerical Control 计算机数字控制
MCU （Machine Control Unit） 机床控制单元
electronic element 电子元件
controller 控制器
RAM （Random-Access Memory）随机存储器
machining center 加工中心
pallet 托盘
ATC（Automatic Tool Changer）自动换刀装置
work piece\workpiece 工件
milling 铣削
drilling 钻孔
tapping 攻丝
boring 镗孔
indexing head 分度头
turning center 车削中心
lathe 车床
electrical discharge machine 电火花加工机床
wire EDM（wire Electrical Discharge Machine）线切割电火花加工机床
laser cutting machine 激光切割机床
machining 机械加工
slot 窄槽

New Words

feature ['fi:tʃə] *n.* 特色，功能
on-board 在船（飞机，车）上，文中指内嵌在机床上
be referred to as 被称为
wire ['waiə] *vt.* 用金属线捆扎、联结或加固 *n.*金属丝，电线，电报，电信，铁丝网
portion ['pɔ:ʃən] *n.*一部分，一份
encode [in'kəud] *vt.* 编码，把（电文、情报等）译成电码（或密码）
generate ['dʒenə,reit] *vt.* 产生，发生
equip [i'kwip] *vt.* 装备，配备，训练，准备行装
capability [,keipə'biliti] *n.* 能力，性能，容量，接受力
rectangular [rek'tæŋgjulə] *adj.* 长方形的
pallet ['pælit] *n.* 托盘
load [ləud] *vt.*加载

unload ['ʌn'ləud] *vi.* 卸载
counter ['kauntə] *adv.* 相反地；反对地
specify ['spesifai] *vt.* 指定，详细说明，列入清单
shop [ʃɔp] *n.* 商店；工厂；职业；修理厂
simultaneously [siməl'teiniəsly] *adv.* 同时发生地；同步地
electrode [i'lektrəud] *n.* 电极；电焊条
discharge [dis'tʃɑ:dʒ] *v.* 放电，排出；发射 *n.* 发射；放电量
stretch [stretʃ] *v.* 伸出；拉紧
roller ['rəulə] *n.* 滚筒，辊子，导轮（用在线切割机床上）
band-saw *n.* 带锯
erosion [i'rəuʒən] *n.* 腐蚀
spark [spɑ:k] *n.* 火花，火星，电火花
remove [ri'mu:v] *v.* 拿走，去掉
intense [in'tens] *adj.* 强烈的，剧烈的
focused ['fəukəst] 聚焦的
undergo [ˌʌndə'gəu] *vt.* 经历，承受；遭受
vaporize ['veipəraiz] *v.* 蒸发，汽化
penetrate ['penitreit] *v.* 穿过；了解；进入
distortion [dis'tɔ:ʃən] *n.* 变形；扭曲
slot [slɔt] *n.* 狭缝；窄槽

Notes

① Control units for NC machines are usually hard wired. This means that a machine functions are controlled by the physical electronic elements that are built into the controller.

NC 机床的控制单元通常由硬件构成，也就是说机床的功能是由控制器内置的物理电子元件控制的。

注：该句的难点在于 wire 这个词，wire 做名词是电线、金属丝的意思，这个大家都很熟悉，做动词则表示用金属线捆扎、联结或加固。在本句中直译应该是：NC 机床的控制单元通常是硬连接的。

② The components found in many CNC systems are shown in Fig.1-1

CNC 系统中常见的组成部分如图 1-1 所示。

其中：found in many CNC systems 作为定语修饰 components。found 这个词在科技英语中经常用到，一般来讲，不能直接翻译为“找到”，而要根据句子的具体情况翻译为“常见”、“具备”等。

③ The machine control unit also contains the machine motion controller in the form of an executive software program.

机床控制单元还包括机床运动控制器，该控制器是一个可执行的软件程序。

注：in the form of 意为以……的形式。

④ NC machine: responds to programmed signals from the machine control unit and manufactures the part.

NC 机床：响应来自机床控制单元的程序信号并对零件进行加工。

⑤ These systems come equipped with automatic tool changers with the capability of changing up to 90 or more tools.

这些系统装有自动换刀装置，可换刀具数高达 90 把甚至更多。

⑥ Turning centers with increased capacity tool changers are also making strong appearance in modern production shops.

具有大容量刀库的车削中心在现代制造厂中占据着显著位置。

⑦ The wire is stretched between two rollers and cuts the part like a band-saw.

切割丝在两个导轮之间拉紧，像带锯一样切割工件。

⑧ Material is removed by the erosion caused by a spark that moves horizontally with the wire.

切割丝水平移动所产生的电火花会将材料腐蚀掉。

⑨ Because no mechanical cutting forces are involved, lasers cut parts with a minimum of distortion, they have been very effective in machining slots and drilling holes.

由于没有机械切削力，所以激光加工的工件变形非常小，激光切割机对加工窄槽和钻孔非常有效。

Words Study

1．……被称做（或叫做）……

In technical English, the following expressions are very common. Everybody has to master them.

A is { called / known as / referred to as } B

Exercise Ⅰ Try to fill in the blanks with above phrases.

（1）The point of intersection（交点）_____ (know) the origin.

（2）When you are specifying coordinates from the program zero point (origin), it _____(call) the absolute mode of programming.

（3）A CNC machine is a NC machine with the added feature（功能） of an on-board（内嵌的） computer. The on-board computer _____(refer) the machine control unit or MCU.

（4）If a computer is used to create a program, the process _____(know) computer-aided programming.

（5）A complete set of coded instructions（被编码的指令） for executing（执行） an operation _____ (call) a program.

2．fit 的词性和用法非常丰富，下面来学习常见的用法。

（1）fit 做及物动词，表示适合、胜任、安装、为……提供场所或时间，与……相配合等，请看下面例句。

This coat doesn't fit me.
这件大衣我穿不合身。

Some training will fit them for the job.
经过一些训练他们就会胜任工作。

Fit a handle on a door.
给门安上一个把手。

You can't fit any more toys in the box.
那箱子里已装不下更多的玩具了。

The doctor can fit you in today.
今天医生能跟你定个时间。

The observations fit the theory nicely.
观测与理论完全相符。

That sort of music fits your mood.
那种音乐适合你的心情。

The tailor fitted the trousers by shortening them.
裁缝把这条裤子裁短了一些使之合身。

（2）fit 做不及物动词表示适合、吻合、相配以及和谐等意思，请看下面例句。

Try the new key and see if it fits.
试试新配的钥匙看看是否合适。

The shoes doesn't fit well.
这鞋不合脚。

She doesn't fit in with these people.
她与这些人格格不入。

His good mood fits in with the joyful occasion.
他良好的情绪与那欢快的场合很和谐。

（3）fit 也可以用做形容词。和系动词连用，表示“适合，恰当”等。和 feel 或 keep 等连用，表示精神极好，保持健康等。

He isn't fit for his work.
他不适合做这项工作。

The food isn't fit to eat.
这食物不好吃。

It's fit that he should say so.
他那样说是恰当的。

Though he is over 70 years old, he feels fit.
尽管他 70 多岁，但精神极好。

I hope you are keeping fit.
我希望你能保持健康。

（4）fit 也可以做名词，表示合身，合身的衣服。

Fit is even more important than color.

合身比颜色更重要。

The coat is a good fit.

这件大衣很合身。

Exercise Ⅱ Everybody knows the word "fit". But can you translate the word in these sentences?

(1) Many are also *fitted* with the movable rectangular worktables called pallets.

(2) There are some machines *fitted* with specially designed AC motors that also provide for variable spindle speeds.

(3) The program is too long to *fit* into the control's memory.

Language Study

现在完成时。

Numerical control has been used in industry for over 50 years.

数控在业界的应用已经超过 50 年。

这个句子属于现在完成时态，表示已经发生的事情，这件事情往往与现在的情况有联系。这包含两方面的含义，一方面它指的是现在，包含某个动作的一段时间，从过去的某个时间开始一直到现在，所以这段时间仍属于现在。另一方面，这个动作在不同程度上已经完成了，所持续的时间可以到说话时结束，也可以延续下去，这可以由句子中的时间状语来显现。

请看下面几个例子。

1. He has got a letter from his father.
2. She has rung me up four times this evening already.
3. I've seen little of my teacher in the past few years.
4. She has worked in the company since she graduated in 2000.
5. I have got a bad headache.
6. She has been here several times, but she's gone to live abroad.

Exercise Ⅲ Fill in the blanks.

(1) _____ you had your supper yet?

(2) She _____ never broken her word.

(3) She's _____ to do some shopping.

(4) I have _____ terribly busy since I have been back.

(5) Have you _____ to leave so soon?

Translation

第 1 单元　计算机数控加工简介

1.1　CNC 的定义及其系统组成

计算机数控机床就是在 NC 机床的基础上附加一个内置式计算机，这种内置式计算机通常

称为机床控制单元或 MCU。NC 机床的控制单元通常由硬件构成，也就是说机床的功能是由控制器内置的物理电子元件控制的。简单地说，数字控制是基于代码自动操作制造类机床的一种方法，这些代码由字母、数字和特殊字符组成。所谓的程序就是用于执行某一操作的一整套代码表示的指令，而这些程序是存放在计算机的随机存储器中的，控制器可以对它们进行重新调用、编写以及处理等操作。因此，可以通过对计算机进行编码从而在加工时实现机床操作的各种功能。

CNC 系统中常见的组成部分如图 1-1 所示。

机床控制单元：生成、存储和处理 CNC 程序。机床控制单元还包括机床运动控制器，该控制器是一个可执行的软件程序。

NC 机床：响应来自机床控制单元的程序信号并对零件进行加工。

1.2 CNC 设备的类型

加工中心在 CNC 技术中属于最前沿的。它们装有自动换刀装置，可换刀具数高达 90 把甚至更多。许多加工中心还装有可移动的长方形工作台，即托盘系统。这种托盘系统用来自动装卸工件。加工中心只需一次装卡就可以完成铣、钻、攻丝、镗等多种加工操作。此外，一些加工中心利用分度头可以对零件不同的面和特定的角度进行加工。通过减少零件在机床间转移，加工中心能够节省生产时间与成本。

具有大容量刀库的车削中心在现代制造厂中占据着显著位置。这些 CNC 机床能对旋转的工件同时进行多种车削加工。

除加工中心和车削中心之外，CNC 技术还被广泛用于其他许多类型的设备，其中包括线切割机床和激光切割机。

线切割机是用一根很细的切割丝做电极。切割丝在两个导轮之间拉紧，像带锯一样切割工件。切割丝水平移动所产生的电火花会将材料腐蚀掉，而 CNC 就用来控制水平工作台的移动。

激光切割 CNC 机床能利用一束强烈的聚焦光线来切割工件。材料在光线的照射下温度会骤然上升并汽化。若光束能量足够高就会将材料穿透。由于没有机械切削力，所以激光加工的工件变形非常小，激光切割机对加工窄槽和钻孔非常有效。

Supplementary Reading

The History of Numerical Control

In 1945, at the end of World War Ⅱ, several events led to an experiment that changed metal manufacturing.①

1945

In the early 1940s, the need to produce military products, such as airplanes, accelerated technical research. As a result, the products being produced at the end of the war were too complex in shape or too closely toleranced for practical manufacturing.②

To assist in engineering calculations, a computer was developed at the University of Pennsylvania. The ENIAC (Electrical Numerical Integrator And Calculator) as it was called, was a

huge mass of tubes and wires. It was difficult to program and very slow by today's standards, but it was a computer.

Later, numerical control machines and computers were used to develop today's Computer Numerical Control (CNC) machines. The Parsons Corporation, the United States Air Force, and the Massachusetts Institute of Technology each played a role in this development.

1946

In 1946, the Parsons Corporation tried to find accurate ways to make complicated aircraft parts. In an effort to generate an accurate rotor blade for a helicopter, they experimented with complicated tables of coordinates and manual machines.③ To generate the compound curves, they placed one human operator per axis handle, and called each move out in turn. This was slow and prone to errors. The Parsons Corporation then turned its attention to automatically generating these shapes. It seemed that an automatic method was possible.

1949

John Parsons then set up a demonstration of his ideas for the Air Force. With a demonstration, Parsons convinced the Air Force to award a research contract.

1952

Shortly thereafter, Parsons set up a subcontract with the Servomechanisms Laboratory of the Massachusetts Institute of Technology (MIT). After three years, MIT built the first NC milling machine. In 1952, a vertical spindle milling machine ran the first true NC-produced parts. Refer to Fig. 1-2. The electrical cabinet took up more floor space than the machine, this was, however, the beginning that would change machining forever.

The prototype numerical control machine developed by MIT used a punched tape to generate movements of three axes. This machine was capable of making curved shapes, quickly, accurately, and reliably.

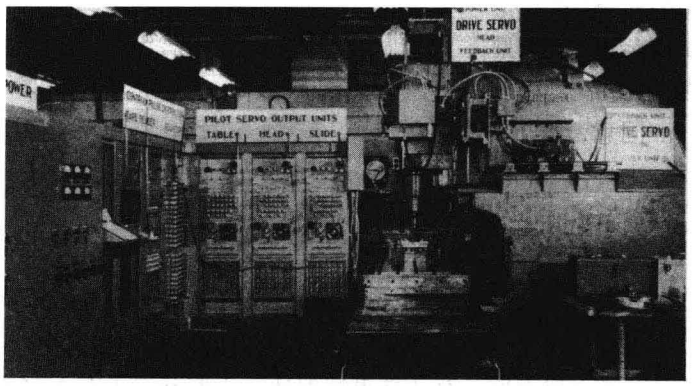


Fig .1-2 the first true NC machine
（第一台真正的 NC 机床）

1955

In 1955, the Air Force of USA granted 35 million dollars to produce 100 NC machines. These were used to make military aircraft.

1960

In 1960, machine manufacturers began to make NC equipment that many companies could afford. In 1960, equipment was on the market at a price that allowed many shops to purchase their first NC machine.

New Words

military ['militəri] *adj.* 军事的，军用的
accelerate [æk'seləreit] *v.* 加速，促进
closely ['kləuzli] *adv.* 精密地， 严密地
tolerance ['tɔlərəns] *n.* 公差，宽容，容许量；*vt.* 给（机器部件等）规定公差
Pennsylvania [pensil'veinjə] *n.* 宾夕法尼亚州（美国州名）
tube ['tju:b] *n.* 管，管子，[英] 地铁，<美> 电子管，显像管
play a role in 在……中起重要作用
Massachusetts [ˌmæsə'tʃu:sits] *n.* 马萨诸塞州
rotor ['rəutə(r)] *n.* （电机的）转子，（直升机的）水平旋翼
blade [bleid] *n.* 刀刃，刀片
rotor blades 动叶片
compound ['kɔmpaund] *adj.* 复合的
demonstration [ˌdemən'treiʃən] *n.* 示范，实证
convince [kən'vins] *vt.* 使确信，使信服
thereafter [ðɛər'ɑ:ftə] *adv.* 其后，从那时以后
subcontract [sʌb'kɔntrækt] *n.* 转包合同
servomechanism *n.* 伺服系统
cabinet ['kæbinit] *n.* 柜子
prototype ['prəutətaip] *n.* 原型
punched tape 穿孔纸带
grant [grɑ:nt] *vt.* 同意，准予，承认

Notes

① In 1945, at the end of World War Ⅱ, several events led to an experiment that changed metal manufacturing

1945年，第二次世界大战末期，有几件事情促使（人们开始了在）改变金属加工（方面）的尝试。

其中：

that changed metal manufacturing 是宾语从句，用来修饰 experiment。

用括号括起来的部分在原文中并未出现，之所以添加它们，是为了让句子更符合汉语的语言习惯。这种状况在本书的注释、翻译中会经常出现。