中等职业教育数控专业规划教材

# 数控技术专业英语

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# 数控技术专业英语

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本书是中等职业教育数控专业规划教材，是根据教育部数控技能型紧缺人才培养培训方案的指导思想和最新的数控专业教学计划编写的，本书结合专业课程，围绕数控应用技术，主要介绍了一般机械常识（机械零部件、常用工具、量具、机床），电工、电子常识（电流、电路、元器件及电气设备），自动控制的原理及主要元器件。在此基础上还着重介绍了数控应用技术（数控原理、数控机床结构、设备操作）专业知识。为适应当前中等职业教育的特点，本书突出实用性，注重针对性。此外，在课文和阅读材料中除了专业技术知识外，还选编了一定数量的科普内容，体现了趣味性、知识性。

本书可作为中等职业学校数控应用技术专业及近机类教材用书，也可作为培养专业技术人员参考用书。

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# 前　言

本书是中等职业教育数控专业规划教材，是根据教育部数控技能型紧缺人才培养培训方案的指导思想和最新的数控专业教学计划编写的。

数控技术是机电一体化技术高度发展的体现，是计算机控制技术的最新表现，它给制造业的发展带来了一个飞跃，使之进入了一个全新的发展阶段。随着数控技术的普及和发展，数控设备在现代企业得到越来越广泛的应用，同时也造成数控技术实用型人才的极其紧缺。为此，机械工业出版社主持召开了全国中职中专“数控技术应用专业”技能型紧缺人才培养教学研讨和教材建设工作会议。通过讨论，确定了中职中专“数控技术应用”专业的主干课程13门，作为指导培养中职中专数控实用型人才的主要教材。

《数控技术专业英语》是中职中专数控技术应用专业的一门主干课程之一，其主要任务是培养学生的科技英语阅读能力，具备运用数控技术、操作机电类设备和继续学习所必需的专业英语知识，能借助于专业词典阅读机电设备，特别是数控设备的说明书及技术资料。

本书的编写，立足于社会需求和学生实际，体现了以下特色：

1. 突出实用性，以能力为本位，为实践教学服务，增强实用技能。如对话部分表现实训教学活动；课文介绍实训设备的原理、结构和操作以及数控操作指令的应用。

2. 遵循循序渐进原则，从介绍机械知识开始，再介绍电工电子知识、自动控制技术，最后介绍数控应用技术。

3. 贴近专业知识，接近实际。与专业课和实训课比较起来，虽然学习不同的语言，但接触相同的内容。

4. 体现资料性、知识性和趣味性。操作技能介绍和专业技术用语可供学生在工作中查阅利用；专业技术课文和科普类读物穿插，尽量减小英语学习的难度，提高学生学习兴趣，取得较好的学习效果。

5. 内容反映较新的科技发展水平。如数控操作技能介绍反映了西门子和发那科的最新技术手册内容。

6. 图文并茂，配合多种形式的插图、表格，便于理解课文内容。

本书适用于中等职业教育三年制数控技术应用专业的学生专业英语学习。总学时为48学时，安排在完成基础英语教学后的1～2个学期内进行。

本书由12个单元和附录组成。每单元计划学时定为4学时。

1. 单元结构

本书由对话、课文、生词、课文注释、语法讲解、练习、阅读材料等部分组成。根据科技英语的特点，语法学习重点在以下几方面：

1）动词不定式；2）动名词；3）分词；4）定语从句；5）It的非人称代词用法。

2. 附录

附录部分包括：1）总词汇表；2）常用机电数控专业技术词语。

第1和第2单元主要介绍机械基础知识，由贵州省机械工业学校刘灵老师编写；第3、

4、5单元主要介绍基本电工电子知识，由沈阳市装备制造工程学校张玉鑫老师编写；第6、7、8单元主要介绍自动控制基础知识，其中对话部分由沈阳市装备制造工程学校伯九令老师编写，其中第6单元主要介绍传感器，由沈阳市装备制造工程学校张玉鑫老师编写，第7、8单元主要介绍可编程序控制器和自动控制技术基础，由浙江科技工程学校钱雄伟老师编写；第9至12单元主要介绍数控技术原理及应用，由沈阳市装备制造工程学校伯九令老师编写。

全书由贵州省机械工业学校冯晓峰老师任主编，沈阳市装备制造工程学校伯九令老师任副主编，贵州大学谭丽华副教授担任主审。

本书的编写得到机械工业出版社职教分社的精心指导，得到了各参编学校领导的关心和大力支持，在此谨表示衷心感谢。

由于时间仓促，编者水平有限，错误遗漏之处难免，恳请使用者批评指正。

编　者

2006年2月

# Contents

# Unit 1

## Dialogue

Li Hua: What's in your hand?

Zhang Ming: It's a spanner.

Li Hua: Where did you get it?

Zhang Ming: I found it lying on the playground. It seemed that somebody had left it there. I think the spanner must be from the machine shop. I'll take it back and give it to the teacher there.

Li Hua: That's great. By the way, what else are there in the machine shop?

Zhang Ming: What I know are the spanner, double-ended spanner, adjustable spanner, scraper, hacksaw, punch and so on. The teacher told us that those tools are very useful for operating, repairing and mounting machines.

Li Hua: Why didn't I find them? I was really too careless.

## Text

### Machine Elements, Measuring Tools and Hydraulic Systems

Pre-reading tasks

1. What machine elements do you know? Tell some of them.
2. Can you use the measuring tools? Give an example.
3. What is the vernier caliper?
4. What are the advantages of the hydraulic systems?

**1. Machine Elements**

A machine consists of a number of machine elements. Here are some examples.

• **Gear** The most useful machine element in power transmission is the gear. [1] The gear is virtually a wheel with a number of teeth. Gears must work in pairs. A pair of gears with different number of teeth will increase or decrease the speed of rotation.

• **Pulleys and belts** They are very common in power transmission. They can also change the speed of a machine tool.

• **Shaft** Gears or pulleys rotate on shafts. The shaft must be rest in bearings. [2] Sometimes there may be couplings between shafts. We may use clutches to start or stop shaft motion.

• **Screw** It has been used as fastener for a long time. A screw consists of a circular cylinder with a helical groove in it.

• **Spring** It is a load-sensitive, energy-storing device, the chief characteristic of which is an ability to tolerate large deflections without failure and to recover its initial size and shape when loads are removed.

• **Ball bearing** They are used in almost every kind of machine and device with rotating parts. The bearing must be provided with adequate mounting, lubrication, and sealing. A ball bearing usually consists of four parts—an inner ring, an outer ring, the balls and the cage, or the separator.

• **Cam** A cam is a machine member that drives a follower through a specified motion. By the proper design of a cam, any desired motion of a machine member can be obtained. As such, cams are widely used in machinery.

Some machine elements may be very large. Others may be very small. However, each of them plays an important part in the construction of a machine.

## 2. Measuring Tools

In a machine shop, if the parts are machined accord with the designs, they will be measured with the measuring tools. There are several types of measuring tools below.

• **Vernier caliper** It is a precise measure used for internal, external, wide and deep measurement on a workpiece. (Fig. 1-1)

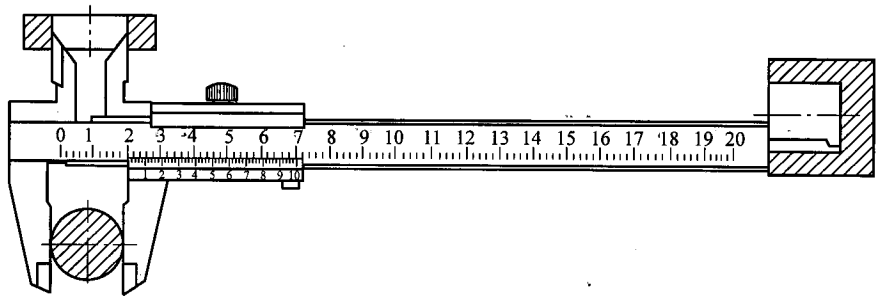


Fig. 1-1 Vernier caliper

• **Steel rule** Steel rules of a large variety of types and lengths are used in machine shops. Good-quality steel rules are made of hardened and tempered alloy steel or stainless steel. (Fig. 1-2)

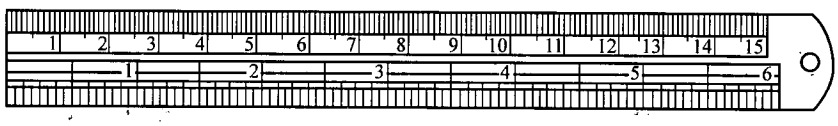


Fig. 1-2 Steel rule

• **Dial indicator** It is a kind of accurate measure tool. It only measures the relative value, not absolute value. The measuring tool is used to check the errors of the shape or position about a workpiece.

- **Caliper** It is used to have a measurement of the thickness about the shafts.
- **Plug gauge** It is used to measure the diameter of holes or the width of notches.

**3. Hydraulic System**

Hydraulic machine tool drive offers a great many advantages. One of them is that it can give infinitely-variable speed control over wide range.[3] In addition, they can change the direction of drive as easily as they can vary the speed. As in many other types of machines,[4] many complex mechanical linkages can be simplified or even wholly eliminated by the use of hydraulics.[5]

The flexibility and resilience of hydraulic power is another great virtue of this form of drive. Apart from the smoothness of operation thus obtained, a great improvement is usually found in the surface finish on the work and the tool can make heavier cuts without detriment and will last considerably longer without regrinding.

By far the greater proportion of machine tool hydraulic drive is confined to the linear motion, a rotary pump being used to actuate one or more linear hydraulic motors in the form of double-acting hydraulic rams, usually of the piston type. In some cases, as in certain hydraulic lathes both the linear motion of the cutting tool and the rotary motion of the work may be hydraulically driven and/or controlled. Such rotary motion is produced by the use of a rotary hydraulic motor.

Three types of pumps are used in hydraulic system—rotary, reciprocating, and centrifugal pump.

Simple hydraulic system may use but one type of pump. The trend is to use pumps with the most satisfactory characteristics for the specific tasks. In matching the characteristics of the pump to the requirements of the hydraulic systems,[6] it is not unusual to find two types of pumps in series. For example, a centrifugal pump may be used to supercharge a reciprocating pump, or a rotary pump may be used to supply pressurized oil for the controls associated with a reversing variable-displacement reciprocating pump.

Rotary pumps are built in many different designs and are extremely popular in modern hydraulic systems. The most common rotary-pump designs used today are spurgear, internal-gear, generated-rotor, sliding-vane, and screw pumps. Each type has advantages that make it most suitable for a given application.

## New words

element ['eliмənt] *n.* 零件，元件
transmission [trænz'miʃən] *n.* 传送，传动
gear[giə] *n.* 齿轮；传动装置
virtually['vəːtjuəli] *adv.* 实际上
pulley['puli] *n.* 滑轮；带轮
belt[belt] *n.* 皮带，传动带
rest[rest] *n.* 台，架；支柱 *v.* 安放
bearing['bɛəriŋ] *n.* 轴承
coupling['kʌpliŋ] *n.* 联轴器
clutch[klʌtʃ] *n.* 离合器
hydraulics[hai'drɔːliks] *n.* 液压系统
infinitely['infinitli] *adv.* 无限地
variable['vɛəriəbl] *adj.* 易变的 *n.* 变量
range[reindʒ] *n.* 范围
vary['vɛəri] *v.* 改变，(使)变化
centrifugal[sen'trifjuːgəl] *a.* 离心的
linkage['liŋkidʒ] *n.* 联锁；联动装置
simplify['simplifai] *v.* 简化

eliminate[i'limineit] *v*. 消除
flexibility[fleksə'biləti] *n*. 适应性；机动性
resilience[ri'ziliəns] *n*. 恢复力
virtue['və:tju:] *n*. 长处；效能
finish['finiʃ] *n*. 表面粗糙度；精加工
detriment['detrimənt] *n*. 损害
regrind[ri'graind] (reground, reground) *v*. 将……再磨
confine[kən'fain] *v*. 限制
linear['liniə] *a*. 直线的
ram[ræm] *n*. 滑枕
piston['pistən] *n*. 活塞
spurgear['spə:giə] *n*. 直齿轮

## Useful expressions

variable-displacement fluid motor 变量液压马达
in pairs = in a pair 成双的，成对的
by far 显然，无疑地
confine... to... 把……限于……
match... to... 使……适合……

## Notes

[1] The most useful machine element in power transmission is the gear.
在动力传递中最有用的机械零件是齿轮。

[2] The shaft must be rest in bearings.
轴必须安装在轴承内。

[3] One of them is that it can give infinitely-variable speed control over wide range.
（液压传动的）优点之一就是它能在很大范围内进行无级变速。
them 代表前句中的“a great many advantages”。infinitely-variable speed 无级变速

[4] As in many other types of machines...
像在其他各类型的机床上一样…

[5] ... by the use of hydraulics.
通过使用液压传动。
这个介词短语为方式状语，修饰 simplified or even wholly eliminated.

[6] In matching the characteristics of the pump to the requirements of the hydraulic systems,...
使泵的特性与液压系统的要求相适应。

# Grammar

## 动词不定式 Infinitive (1)

**1. 基本概念及构成**

动词不定式是一种非限定动词（不能单独作谓语动词，没有人称和数的变化）。由 to 加动词原形构成，具有动词的特征，也有名词、形容词和副词的特征。

**2. 语法功能**

(1) 作主语。常放在谓语动词之后，用 it 作形式主语。)

To machine the part with the lathe is cheap.

(It is cheap to machine the part with the lathe.)

(2) 作表语

My wish is to design a new milling machine.

## Exercises

**1. Tell the following statements true(T) or false(F) according to the text.**

( ) (1) A pair of gears with same number of teeth will increase or decrease the speed of rotation.

( ) (2) Screws have been was used as fastener for a long time.

( ) (3) A ball bearing often consists of three parts—an inner ring, an outer ring, and the ball.

( ) (4) Cams are widely used in almost all buildings.

( ) (5) The vernier caliper is used to take a measurement of the thickness about the shafts.

( ) (6) Hydraulic machine tool drive can change the direction of rotary as easily as they can vary the speed.

( ) (7) Simple hydraulic system may use but two types of pumps.

( ) (8) We may use clutches to start or stop shaft motion.

**2. Translate the following technical terms.**

(1) power transmission (2) alloy steel (3) the speed of rotation (4) lubrication (5) infinitely-variable speed

(6) 球轴承 (7) 游标卡尺 (8) 精密量具 (9) 驱动方向 (10) 离心泵

**3. Choose the correct answer to complete each of the following sentences.**

(1) A machine consists _____ a number of machine elements.

A. through B. into C. of

(2) Screws have been used _____ fastener for a long time.

A. as B. in C. to

(3) In the machine shop, if the parts machined accord _____ the designs, they will be measured with the measuring tools.

A. to B. with C. on

(4) As in many other types of machines, many complex mechanical linkages can _____ simplified or even wholly eliminated by the use of hydraulics.

A. were B. is C. be

(5) The plug gauge is used _____ measure the diameter of holes or the width of notches.

A. during B. to C. about

**4. Translate the following sentences into Chinese.**

(1) Turning and boring are the basic operations of a lathe.

(2) Gears are very useful in power transmission, and gears must work in pairs.

(3) In milling, the cutter rotates and the workpiece feeds.

(4) There are three kinds of chips that are resulted from metal cutting.

(5) Dial indicator is the most accurate measure tool, it only measures the relative value, not

absolute value. The measuring tool is used to check the errors of the shape or position about a workpiece.

(6) In matching the characteristics of the pump to the requirements of the hydraulic systems, it is not unusual to find two types of pumps in series.

## Reading material

### Machine Tool Drive

A machine tool is equipped with a drive,having sufficient power to supply the required energy.

Driver for machine tools is designed so that cutting speeds and feeds may be varied to suit the material being cut, the material of which the cutting tool is made, and other operating conditions.

The source of power for a modern machine tool consists of one or more electric motors. Speeds of the machines may be varied to suit operating conditions in four ways. First, the motor may drive the machine through a pair of step-cone pulleys or through an infinitely variable-speed pulley arrangement. Speeds are changed by shifting the position of a belt on the pulleys. Second, a motor may be applied to a geared-head machine(全齿轮机床) whose speeds are changed by shifting the positions of gears in a transmission. Third, a variable-voltage drive may be employed; that is, a motor-generator set or a rectifier supplies direct current to a variable-speed DC motor that drives the machine. And the fourth, the electric motor being employed operates a hydraulic pump or a variable-displacement fluid motor, which, in turn, drives the machine.

## Exercises

Tell the following statements true(T) or false(F) according to the passage.

( ) (1) A machine tool is equipped with a drive having sufficient power to supply the required power.

( ) (2) The source of power for a modern machine tool consists of only one electric motor.

( ) (3) Speeds of the machines may be varied to suit operating conditions in four manners.

( ) (4) Speeds of the machines are changed by shifting the position of a spindle.

( ) (5) The electric motor being used operates a hydraulic pump or a variable-displacement fluid motor, which, in turn, drives the machine.

# Unit 2

## Dialogue

A: Where were you yesterday afternoon?

B: I was in the machine shop of our school.

A: What did you do there?

B: The teacher showed us around the machine shop. I saw many kinds of machining tools — the lathes, milling machines, drilling machines, planers, shapers, and grinding machines.

A: Would you like to tell me what they are used for?

B: The lathe is used to turn the cylindrical shapes. The drilling machine makes holes. The planer and shaper produce flat surfaces.

A: It's very interesting. We are going to visit the machine shop next week, too. I hope to learn a lot then.

## Text

### Machine Tools

Pre-reading tasks

1. How many main parts does the lathe have?
2. What is the lathe used for?
3. How many milling methods are used in machining?
4. What are open-side planers designed for?

**1. The Lathe**

The lathe is one of the most important machines in a machine shop. Various types of lathes are designed and produced for machining different workpieces. The main types of them are engine lathes, bench lathes, vertical lathes, turret lathes, and so on.

The engine lathe is mostly used in machine shops. It can perform various turning operations and, in addition, drilling, threading, boring, and other operations.

The bench lathe is mounted on a work bench. It is smaller in size. It is used to machine small parts.

The vertical lathe is characterized by its vertical spindle. It is suitable for turning heavy and short workpieces.

The turret lathe is equipped with a turret for mounting a number of different cutting tools which are used in sequence.

The lathe has five important parts: bed, headstock, carriage, tailstock and feed box. The bed is the foundation member of the lathe. It is rigid in construction. The headstock, the tailstock and the carriage are all on the lathe bed. The feed box is below the headstock. (Fig. 2-1)

The lathe is a machine that removes material by rotating the work against a cutter. Workpieces to be machined can be held between centers, attached to a face plate, supported in a jaw chuck, or held in a draw-in chuck or collet. [1]

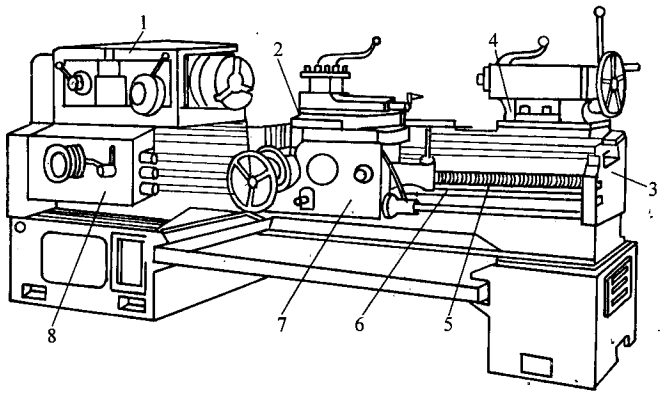


Fig. 2-1 Lathe
1—headstock (主轴箱) 2—tool post (刀架)
3—tailstock (尾座) 4—rail(导轨)
5—feed rod(光杠) 6—lead screw(丝杠)
7—slide(溜板) 8—feed box(进给箱)

A long workpiece that will sag in the center of its own weight is supported near the middle with a steady rest that is mounted on the inner ways of the lathe between the headstock and carriage. And long workpieces that will be deflected away from the tool by cutting forces are supported by a follower rest that is attached to and moves with the saddle.

The work that is short compared with its diameter is usually held with a lathe chuck which is mounted on the headstock spindle nose. [2]

Two kinds of lathe chucks are in common use. One has four work-holding jaws that each may be adjusted toward or away from its center independently to hold workpieces that are irregular in shape as well as those which are cylindrical, [3] it is also called the independent chuck; the other has three work-holding jaws that may be adjusted toward or away from its center simultaneously and at a uniform rate. This kind of chuck, therefore, is most useful for holding workpieces that are cylindrical in shape because it is self-centering.

**2. Milling Machine**

There are a lot of types of milling machines. Most, however, are very similar. The column-and-knee type is the most common one.

In most knee-type milling machines, there are three possible table movements—longitudinal, crosswise, and vertical. In some, there is also a rotary movement.

The three types of most common column-and-knee machines are horizontal, vertical and universal. The horizontal machine consists of the following important parts: the column, knee, saddle, table, overarm, spindle, etc.

There are two methods of milling—conventional or up milling, and climb or down milling.

In conventional milling, the cutter rotates against the direction of feed. This method has been regarded as the only practical way to use milling cutters for a long time. Now climb milling has been recognized as an acceptable method of operation. In climb milling, the cutter rotates in the direction of feed. (Fig. 2-2)

The advantages of climb milling are as follows:

1. Feed can frequently be doubled over conventional milling.
2. Metals can be removed fast without vibration.
3. Finish can be considerably improved.
4. Tool life may be prolonged.

Climb milling is not recommended for use on cast iron or forgings. Therefore, conventional milling remains useful in milling work.

**3. The Planer**

The planer is one of the biggest machine tools that employ a reciprocation cutting action. It generates flat or contoured surfaces in a series of straight cuts. Its efficiency is higher than that of the shaper.[4] (Fig. 2-1)

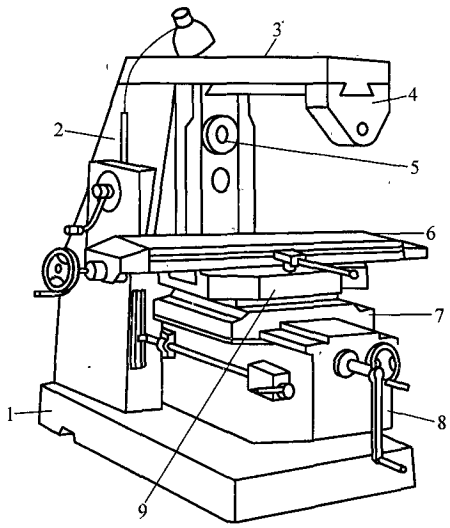


Fig. 2-2 Milling machine
1—bed (床身) 2—boxlike column(箱式立柱)
3—overarm(悬臂) 4—tool post(刀架)
5—spindle(主轴) 6—table(工作台)
7—slide(溜板) 8—knee(升降台)
9—slide(溜板)

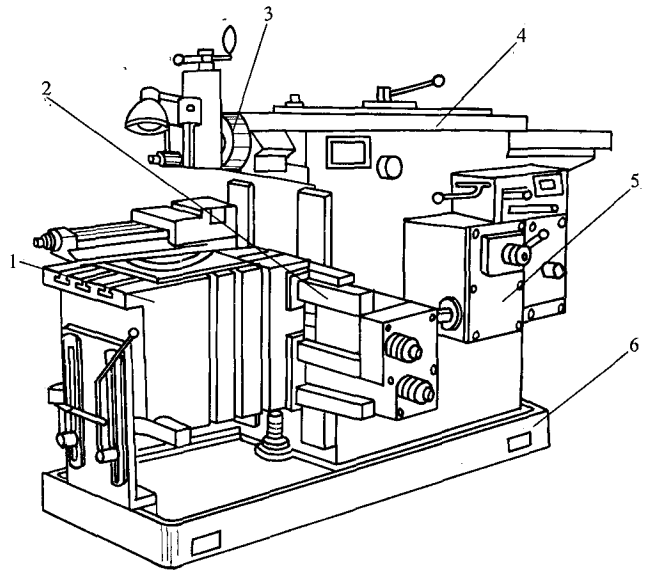


Fig. 2-3 Planer

1—table(工作台) 2—feed box(进给箱) 3—tool post(刀架)
4—ram(滑枕) 5—head stock (主轴箱) 6—foundation(底座)

The work on the planer is held on the machine table and moves under the tool which is carried on the rail. The bed must be approximately twice as long as the table[5] to support it at all positions during the stroke. The double-housing planer has two housings to support the rail at each end.[6] The open-side planer has the housing on one side only. Open-side planers are designed for workpieces which are so wide that they cannot pass between the housings of double-housing planers. The double-housing machine, however, offers greater rigidity.

Some of the work that was formerly done on the planer is now done on the planer-type milling machine since the former is not so efficient as the later. However, there are still many jobs that can be carried out better and more economically on the planer than on any other machines. For example,

angular surfaces are often easier to machine on a planer. Planing is also most effective in the machining of long and narrow surfaces. In addition, the planer usually takes the important first cut on the rough forging or casting to establish a reference surface for subsequent machining.

## New words

column [ˈkɔləm] *n.* 圆柱，(铣床、牛头刨床)床身
knee [niː] *n.* (铣床)升降台
overarm [ˈəuvərɑːm] *n.* 横臂
longitudinal [lɔndʒiˈtjuːdinl] *adj.* 纵向的
crosswise [ˈkrɔswaiz] *adj.* 横向的；交叉的 *adv.* 横向地；交叉地
contour [ˈkɔntuə] *n.* 外形 *a.* 轮廓
approximately [əˈprɔksimitli] *adv.* 近似地，大约地
housing [ˈhauziŋ] *n.* 轴套；壳，罩
rigidity [riˈdʒiditi] *n.* 刚性，硬度
angular [ˈæŋgjulə] *adj.* 角的，斜(角)的
forging [ˈfɔːdʒiŋ] *n.* 锻造；锻件
casting [ˈkɑːstiŋ] *n.* 铸造；铸件
subsequent [ˈsʌbsikwənt] *adj.* 以后的
turret [ˈtʌrit] *n.* 转塔刀架
thread [θred] *v.* 切削螺纹；攻螺纹
bore [bɔː] *v.* 镗
characterize [ˈkæriktəraiz] *v.* 显示……特征，赋于……特征
sequence [ˈsikwəns] *n.* 序列；顺序
construction [kənˈstrʌkʃən] *n.* 结构，构造
jaw [dʒɔː] *n.* 爪
chuck [tʃʌk] *n.* 卡盘；夹头
adjust [əˈdʒʌst] *v.* 调整，调节
simultaneously [siməlˈteiniəsli] *adv.* 同时地
uniform [ˈjuːnifɔːm] *adj.* 一致的；均匀的

## Useful expressions

in addition 此外
in sequence 按顺序
conventional or up milling 逆铣
climb or down milling 顺铣
angular surface 斜面
reference surface 基准面；参考面

## Notes

[1] Workpieces to be machined can be held between centers, attached to a face plate, supported in a jaw chuck, or held in a draw-in chuck or collet.

被加工的工件可以夹持在两个顶尖之间，或者固定在法兰上，或由卡盘夹持，或由内拉卡盘和弹簧夹持。

[2] The work that is short compared with its diameter is usually held with a lathe chuck which is mounted on the headstock spindle nose.

短的工件通常由卡盘夹持，卡盘安装在主轴箱上主轴的前端。

[3] One has four work-holding jaws that may be adjusted toward or away from its center independently of each other to hold workpieces that are irregullar in shape as well as those which are cylindrical。

一种卡盘有四个爪，用于夹持不规则及圆柱形的工件，这种卡盘的每个爪可以向心或离心分别调节。

[4] Its efficiency is higher than that of the shaper.