

## UNIT 2 DRILLS AND THEIR CLASSIFICATION

### **PART 1. GENERAL INFORMATION ABOUT DRILLS**

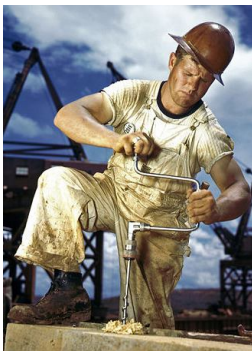
#### **LEAD –IN**

**1** Explain the sentences below in your own words.

- **Modern science and techniques have taught mankind at least one lesson: nothing is impossible.** Lewis Mumford (US philosopher)
- **It is only when they go wrong that machines remind you how powerful they are.** Clive James (Australian critics)

**2** Discuss the following questions.

1. What are drill bits?
2. What kinds of drills do you know?
3. What materials is it possible to drill?
4. Have you ever made holes with the help of drills? If yes, say some words about your experience.



*fig.1 hand drill*



*fig.2 pneumatic drill*



*fig.3 electric drill*

#### **READING**

**3** Read the text about drills and choose the correct item below.

### **USEFUL INFORMATION ABOUT DRILLS**

Drills are cutting tools used to create cylindrical holes. Drills are held in a drilling machine, which rotates them and provides axial force to create the hole. Specialized drills are also available for non-cylindrical-shaped holes.

The twist drill was invented by Steven Morse in 1861. The original method of manufacture was to cut two grooves in opposite sides of a round bar, then to twist the bar to produce the helical flutes. This gave the tool its name. Nowadays, the drill is usually made by rotating the bar while moving it past a grinding wheel to cut the flutes in the same manner as cutting helical gears.

The geometry and sharpening of the cutting edges is crucial to the performance of a drill. Users often throw away small drills that become blunt, and replace them with new drills, because they are inexpensive and sharpening them well is difficult. A special tool grinder is available for sharpening or reshaping cutting edges on twist drills to optimize the drill for a particular material.

The most common twist drill has a point angle of 118 degrees. This is a suitable angle for a wide array of tasks, and will not cause the unskilled operator stress by wandering or digging in. A more aggressive (sharper) angle, such as 90 degrees, is suited for very soft plastics and other materials. The drill will generally be self-starting and cut very quickly. A shallower angle, such as 150 degrees, is suited for drilling steels and other tougher materials. This style requires a starter hole, but will not bind or suffer premature wear when a proper feed rate is used.

Another geometrical aspect of a drill, the spiral, or helix angle, controls the rate of chip removal in a drill. A fast spiral drill is used in high feed rate applications under low spindle speeds, where removal of a large volume of swarf is required. Low spiral drills are used in cutting applications where high cutting speeds are traditionally used, and where the material has a tendency to gall on the drill or otherwise clog the hole, such as aluminum or copper.

1. What kinds of holes can you create with specialized drill bits?
  - A Rectangular
  - B Non-cylindrical
  - C Only cylindrical
  
2. What factor(s) determine(s) the performance of the bit?
  - A The direction of rotation
  - B The cost
  - C The geometry of cutting edges
  
3. What is the most suitable point angle which permits to perform a lot of tasks?
  - A 118 degrees
  - B 90 degrees
  - C 150 degrees
  
4. What kinds of materials require a sharper angle?
  - A Brittle
  - B Soft
  - C Hard
  
5. Does a shank type play any role in the process of drilling?
  - A Yes, we use drills with different shanks for various applications.
  - B No, it doesn't.

**C** All drills have the same shank.

## VOCABULARY PRACTICE

### 4 Match the technical terms from the text with their definitions.

1. *Drill* a) the velocity at which a drill is fed;
2. *Flute* b) a round, end cutting tool with one or more cutting lips and one or more straight or helical flutes used to create cylindrical holes by rotational action;
3. *Grinding wheel* c) fine metallic filings or shavings removed by a cutting tool;
4. *Drilling machine* d) the angle included between the cutting lips projected upon a plane parallel to the drill axis and parallel to the two cutting lips;
5. *Point angle* e) a disk having an abrasive material such as alumina or silicon carbide bonded on its surface;
6. *Feed rate* f) a machine tool for boring holes, having a stand and worktable with facilities for lowering the tool to the workpiece;
7. *Swarf* g) a long narrow channel in a drill;

**Cover the definitions of the terms and try to reproduce the explanations without reading.**

### 5 Fill in the sentences with the verbs.

*clog*      *replace*      *require*  
*rotate*      *cause*

1. A drilling machine \_\_\_\_\_ drills and create holes.
2. Users often throw away bits that become blunt and \_\_\_\_\_ them with new bits.
3. Some materials such as aluminum or copper can \_\_\_\_\_ the hole.
4. Harder materials \_\_\_\_\_ a larger point angle.
5. A greater lip angle will \_\_\_\_\_ the drill to cut more aggressively under the same amount of point pressure as a drill with a smaller lip angle.

### 6 Fill in the blanks with the suitable words, without consulting the text you've read.

*shanks*      *grooves*      *bits*      *point angle*  
*lip angle*      *chip removal*      *angle*      *twist drill*

1. \_\_\_\_\_ are held in a tool called a drill.

2. The \_\_\_\_\_ bit was invented in Massachusetts in 1861.
3. Firstly they cut two \_\_\_\_\_ in opposite sides of a round bar and twist it.
4. The most common twist drill has a \_\_\_\_\_ of 118 degrees.
5. The spiral controls the rate of \_\_\_\_\_ in a drill.
6. Softer materials require a sharper \_\_\_\_\_.
7. The \_\_\_\_\_ determines the amount of support provided to the cutting edge.
8. Most drills have straight \_\_\_\_\_ for consumer use.

**7 Find the following English equivalents in the text.**

Цилиндрические отверстия; вращать и создавать осевое усилие; спиральное сверло; первый способ производства; круглый пруток; шлифовальный круг; косозубые шестерни; заточка режущих кромок; ; становиться тупым; оправка для заточки; заточной станок; широкий спектр заданий; смещение от оси или врезание; заглубляться самостоятельно (без предварительного засверления); преждевременный износ; отходы обработки; налипать на сверло; забивать отверстие; двойной угол в плане.

**8 Use the word in capitals at the end of each line to form a word that fits in the space in the same line.**

**Materials For Drill Construction**

Many (1)..... materials are used for drill bits, depending on the required (2) .....	DIFFER APPLY
Soft <b>low carbon steel</b> bits are used only in wood, as they do not hold an edge well and require frequent (3).....	SHARP REDUCE EXPENSE
Working with hardwoods can cause a noticeable (4) ..... In lifespan. They are (5) ..... when compared to other tools with a longer life.	
<b>High carbon steel</b> bits are made from high carbon steel and are an (6) ..... on plain steel due to the hardening and tempering (7) ..... of the material. These bits can be used on wood or metal, however they have a low tolerance to (8)..... heat which causes them to lose their temper, resulting in a soft cutting edge.	IMPROVE CAPABLE EXCESS
<b>High speed steel</b> (HSS) is the cutting tool material which makes bits much more (9) ..... to the effect of heat. They can be used to drill in metal, hardwood, and most other materials at greater cutting speeds than carbon steel bits and have largely replaced them in (10) ..... application.	RESIST
<b>Cobalt steels</b> are (11) ..... on high speed steel which have more cobalt in them. Their main advantage is that they hold their (12) ..... at much higher temperatures, so they are used to drill stainless steel and other hard materials.	COMMERCE VARY HARD
The main (13) ..... of cobalt steels is that they are more brittle than standard HSS.	ADVANTAGE

**9 Rewrite the following sentences using the words given.**

1. The construction is stronger because of the use of steel.

*The use of steel* \_\_\_\_\_.

2. The mechanism does not overheat because this fan rotates.

*This fan rotates* \_\_\_\_\_.

3. The dial is luminous, enabling it to be read at night.

*Since* \_\_\_\_\_.

4. Brakes are applied in order to slow the machine down.

*Applying* \_\_\_\_\_.

5. A valve closes. Therefore, the correct pressure is maintained.

*Owing* \_\_\_\_\_.

6. Polycrystalline diamond (PCD) bits are used in the automotive, aerospace and other industries to drill abrasive aluminum alloys.

*The automotive, aerospace* \_\_\_\_\_.

7. Diamond coated bits have to be water cooled to prevent damage to the bit or the workpiece.

*In order to* \_\_\_\_\_.



fig.1 drill device

10 Name the parts of a drill device.

Brush access    Chuck key hole    Power cord    Power trigger  
 Threaded side handle attachment point    Chuck

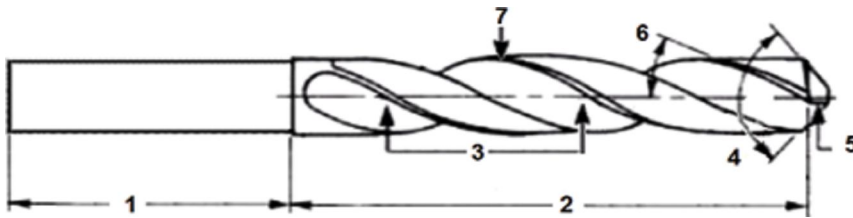


FIG.2

Lip  
 Body  
 Cutting edges  
 Shank  
 Point angle  
 Helix angle  
 Flutes

## GRAMMAR PRACTICE

### 11. Put the verbs in brackets in the correct form.

1. A black oxide coating \_\_\_\_\_ (provide) heat resistance and lubricity.
2. A titanium nitride bit cannot properly \_\_\_\_\_ (sharpen).
3. Users often \_\_\_\_\_ (throw) away small bits that become blunt.
4. The twist drill \_\_\_\_\_ (invent) by S. A. Morse.
5. Large amounts of heat \_\_\_\_\_ (generate) and diamond coated bits have to be water cooled to prevent damage to the bit or the workpiece.
6. Drill bits are cutting tools \_\_\_\_\_ (use) to create holes.
7. A drill \_\_\_\_\_ (rotate) bits and \_\_\_\_\_ (provide) axial force.
8. Zirconium nitride also \_\_\_\_\_ (use) as a drill bit coating for some craftsmen tools.
9. This name \_\_\_\_\_ (give) due to the special method of groove manufacture.
10. A fast spiral drill \_\_\_\_\_ (use) in high feed rate applications.
11. They are inexpensive when \_\_\_\_\_ (compare) to other tools with a longer life.
12. It \_\_\_\_\_ (become) common in workshops to use solid carbide drills.
13. Bit \_\_\_\_\_ (fabricate) using this material by either brazing small segments to the tip of the tool to form the cutting edges.
14. The material \_\_\_\_\_ (consist) of a layer of diamond particles, bonded as a sintered mass to a tungsten carbide support.
15. Drills with no point angle are used in situations where a blind, flat-bottomed hole \_\_\_\_\_ (require).

### 12. Make up questions to the following sentences. Start with these question words.

1. The main advantage of high speed steel is that they hold their hardness at much higher temperatures.  
**What** \_\_\_\_\_ ?
2. Soft low carbon steel bits are used only in wood, as they do not hold an edge well and require frequent sharpening.  
**Why** \_\_\_\_\_ ?
3. PCD bits are typically used in the automotive, aerospace, and other industries to drill abrasive aluminium alloys.  
**Where** \_\_\_\_\_ ?
4. Diamond powder is used as an abrasive, most often for cutting tile, stone, and other very hard materials.  
**For what purpose** \_\_\_\_\_ ?
5. The twist drill was invented by Steven A. Morse.  
**Who** \_\_\_\_\_ ?
6. Drill bit geometry has several aspects.  
**How many** \_\_\_\_\_ ?
7. It drills holes in metal, plastic and wood.  
**Where** \_\_\_\_\_ ?