# Twist Drill Geometry and Cutting Logic

(refer to Anatomy of the Drill Bit)

## *History*

There is evidence the Egyptians used drilling as far back as 4000 B.C. Twist drill bits, as we know them today, are the most common and widely used metal cutting tools. Try this test. Ask every customer you see if they have any cutting tools and chances are they will answer that at a minimum they have a few drill bits. Little did Stephen A. Morse realize the Twist Drill he patented in 1863 would become as successful as it is today.

## *Geometry*

Geometrically, the twist drill is one of the most complex metal cutting tools in use. It's designed with a cone-like internal structure – narrow at the top or the **WEB** with a gradually increasing thickness to the **SHANK**. This structure provides added strength and rigidity. At the tip of the drill bit is the **CHISEL EDGE**, which is the line across the point, the **CUTTING LIPS** which are the leading sharp knife edges on a drill point and the **HEELS** which are the trailing edge of the drill point. The **CHISEL EDGE, CUTTING LIPS** and **HEELS** are the areas that can be re-sharpened on a drill bit.

## *Point Angles*

Twist drill bits come in various materials and diameters with different **POINT ANGLES** designed to cut different sized holes in a variety of materials. The general rule about **POINT ANGLES** is that the softer the material the steeper the **POINT ANGLE** and the harder the material the flatter the **POINT ANGLE**. Standard drill bits have a 118° point. A drill bit with a 135° point is designed for harder materials.

## *Cutting Logic*

A twist drill bit penetrates the center of the material it is to remove with its **CHISEL POINT**. The **CHISEL POINT** wears into the material to the point where the **CUTTING LIPS** begin to scoop out the material, making chips. These chips then follow up the **FLUTES** where they are discharged away from the hole. The hole is then reamed to size by the sharp edge of the **LAND** which is known as the **MARGIN**.

## *Drill Point Wear*

A drill bit begins to wear as soon as it is placed into operation. The maximum drill wear occurs at the corners of the **CUTTING LIPS**. The **CHISEL POINT** begins to deform under the heat generated during drilling. The increase in wear at the corners travels back along the **LANDS** resulting in a reduction in the drill bit diameter and a decrease in tool life.

Wear occurs at an accelerated rate. When a drill bit becomes dull it generates more heat and wears faster. In other words, there is a bit of wear on the 10th hole, more still on the 20th hole, and so on. As wear progresses the torque and thrust required also increases. As a result of increased torque and thrust, drill bit breakage occurs. This is commonly the result of excessive torque and or thrust.

Simply put, running a drill bit beyond its practical cutting life (i.e. when it is sharp) is like driving a car with a tire going flat. Both drill bit and tire are headed for destruction. The answer to the flat tire and the dull drill bit is maintenance; air for the tire and sharpening for the drill bit.

## *Sharpening*

Sharpening a drill bit with a Drill Doctor is the easiest, most efficient way to keep a drill bit from ruining a job, wasting time, and ending up in the coffee can with the other dull drill bits.

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