TOOL BIT

SHARPENING

UNIT

Tool Bit Geometry & Sharpening

Introduction

For Quiz Purposes:

Read Unit 36-10 to 15 and accompanying handout on tool bit angles.

Tool Bit Materials:

From the Industrial Revolution of the 1860's to World War II, the primary material in cutting tools was high carbon tool steel (SAE 1090). Many students in our class have made screwdrivers, chisels, and punches from this same material. Speeds and feeds were quite slow because the cutting edges would fail if forced beyond the designated speed. Chrome and chrome/vanadium alloys became available in the 1940's and thus the birth of "High Speed Steels." The name was applied because the alloy bits could cut at a high speed - double that of the carbon steel tools. In the more recent times, cemented carbides, ceramics and glass have been used as cutting tools in modern industrial situations. Some of these materials are capable of cutting at the speed of sound.

Cemented Carbide:

At this point it is essential to explain the term "Cemented Carbide." This material comes to us from the miracle of powdered metallurgy. Various materials in powder form are compacted under 60 - 200 tons of pressure in a mold or set of dies. This process is known as briquetting. Once the green, weakly bound briquette is removed from the dies, it is then sintered by bringing the briquette up to a temperature equal to 2/3 that of the materials melting point. At this point, the powder is fused or "cemented" together. Many products of industry are "cemented carbide" - graphite impregnated bushings (Oilite), carbide router inserts, carbide insert scissors (surgical instruments, carbide insert tool bits, etc.

High Speed Tool Bits:

As the general purpose tool bit is ground in this laboratory, two major concepts must always be remembered. All angles:

- will **relieve** the cutting edge
- will **support** the cutting edge

Keep the above in mind as you grind a cutting tool for any purpose.

Angles Ground on a Tool Bit:

Front Included Angle: 60 degrees included/30 degrees removed. This is on the front of the bit to provide proper relief and support under the point of the bit.

Relief Angle: 60 degrees included/30 degrees removed. Generally this is the angle right of the point. It has the two basic purposes described above.

Lead Angle: 15 degrees off of 180/ or 175 included angle through the bit. This is the cutting edge. This angle provides a shearing action instead of a chopping action as it cuts the material.

Side Clearance: 6 to 12 degrees off of 90. This provides clearance underneath the lead angle edge to allow the cutting edge to enter the material and prevent all the bit under the cutting edge from rubbing and generating a lot of friction thus failing to enter the material.

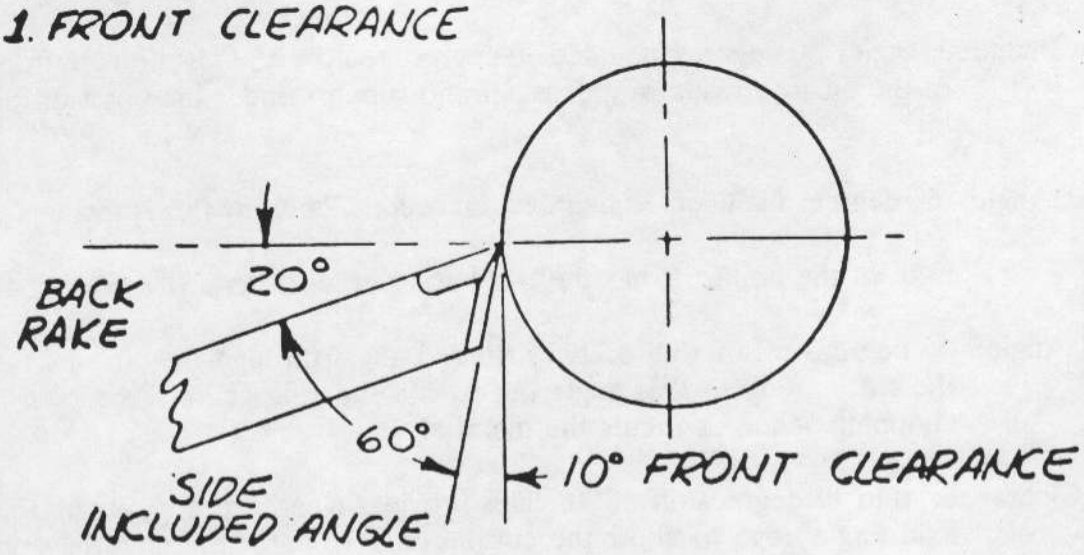
Side Rake: This is a varying amount of slope downward from the cutting edge on the top surface of the bit. The angle varies by the material to be cut:

- 0 - 3 degrees - Cast Iron, Bronze and Brass
- 4 - 5 degrees - Tool Steel in annealed state
- 7 - 14 degrees- Mild Steel
- 15 degrees - Aluminum

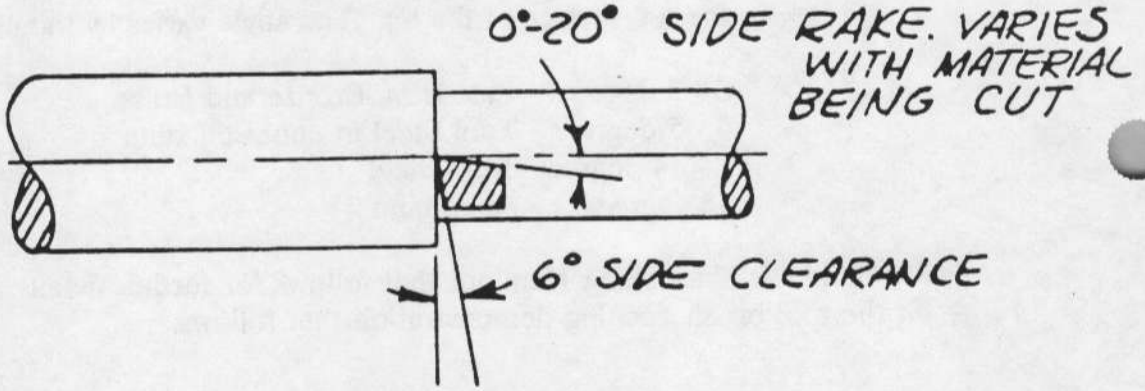
See Tool Bit Sharpening Handout that follows for further details. Also take notes on the tool bit sharpening demonstration that follows.

BASIC TOOL BIT DIAGRAMS

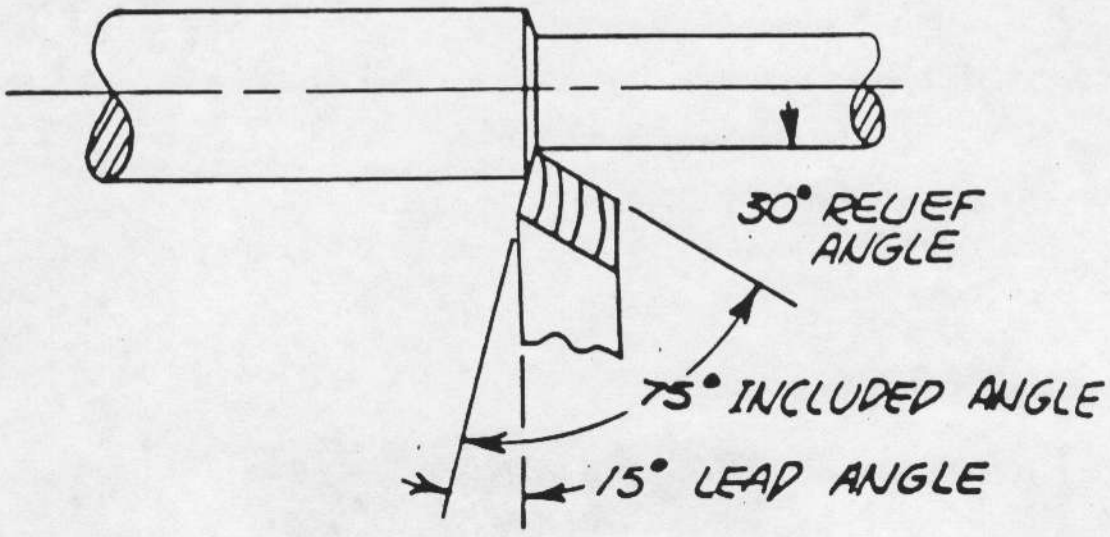
1. FRONT CLEARANCE



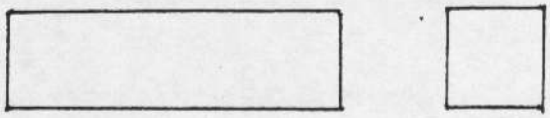
2. SIDE CLEARANCE



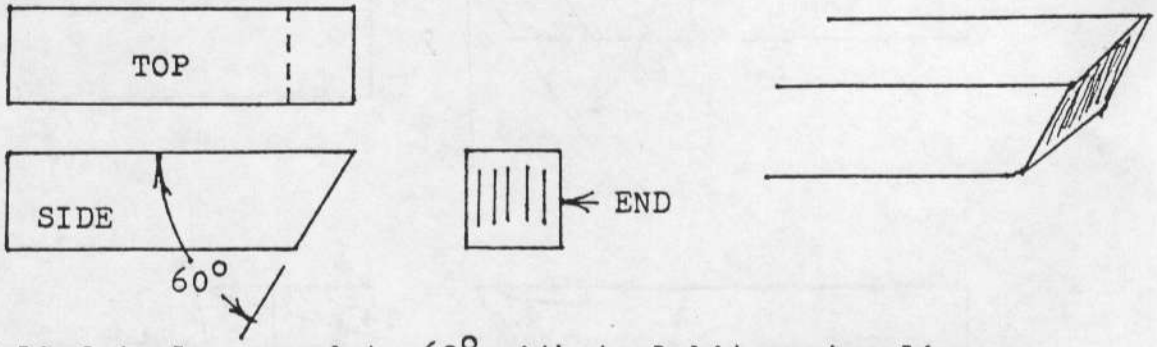
3. LEAD ANGLE



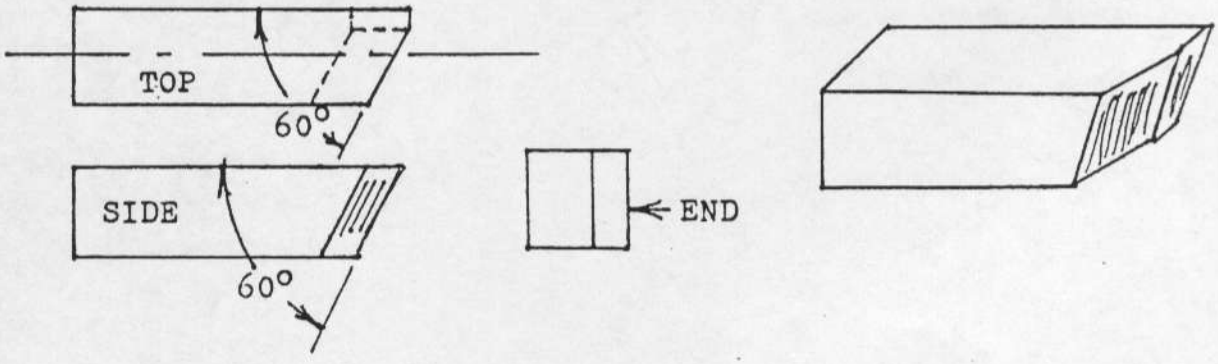
1. High Speed Tool bit before grinding.



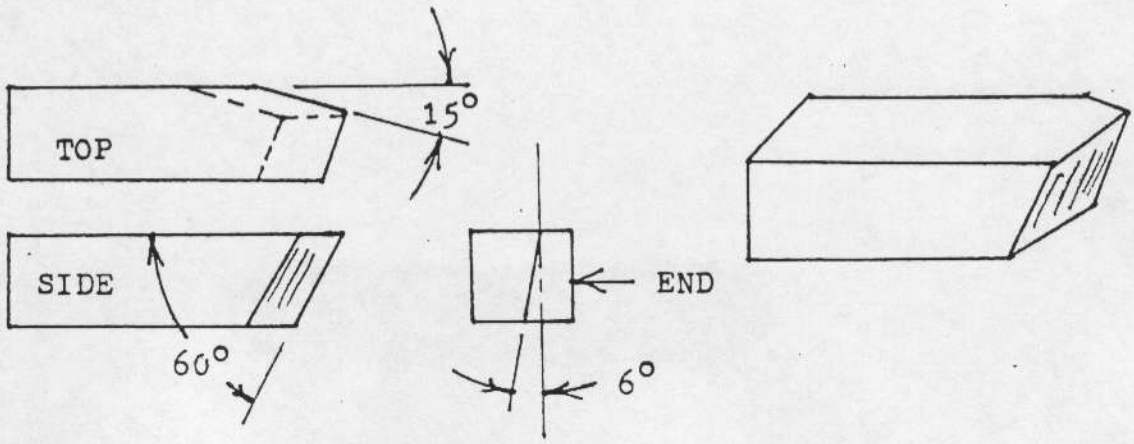
2. Front Included Angle ground to 60°



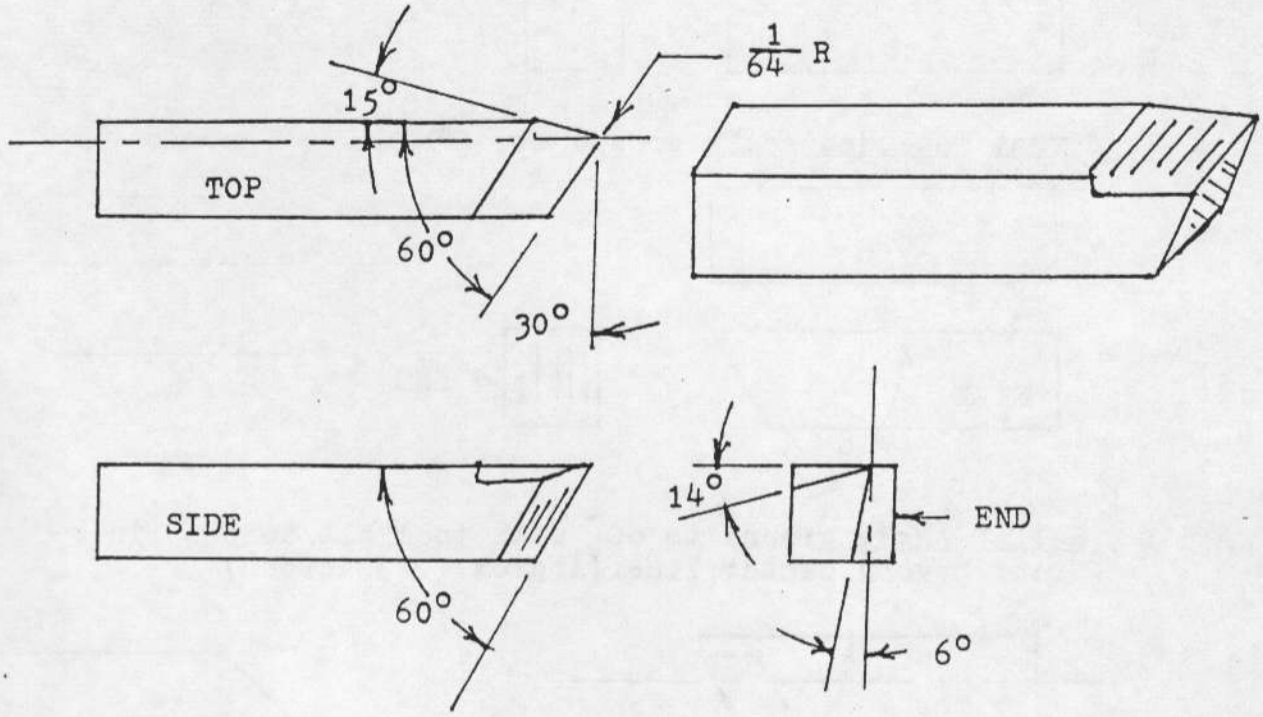
3. Relief Angle ground to 60° with tool bit center line. Grind beyond center line.(Approx. 2/3 across)



4. Lead Angle ground to 15° with tool bit center line with a 6° Side Clearance Angle.



5. Side Rake angle ground 14° down from top surface of tool bit.



DEMONSTRATION NOTES AND THOUGHTS