Hand-Type Cutting Tools

Objectives

- Select and use the proper hacksaw blade for sawing a variety of materials
- Select and use a variety of files to perform various filing operations
- Identify and know the purpose of rotary files, ground burrs, and scrapers

Sawing, Filing and Scraping

- Often necessary to perform certain metal-cutting operations at bench or on job
- Common tools
  - Hacksaws
  - Files
  - Scrapers
- Usually need practice to become proficient

Pistol-Grip Hand Hacksaw

- Composed of three main parts
  - Frame, handle, and blade
- Solid frame more rigid and will accommodate blades of one specific length
- Adjustable frame more common and will take blades from 10 to 12 in. long
  - Wing nut provides adjustment

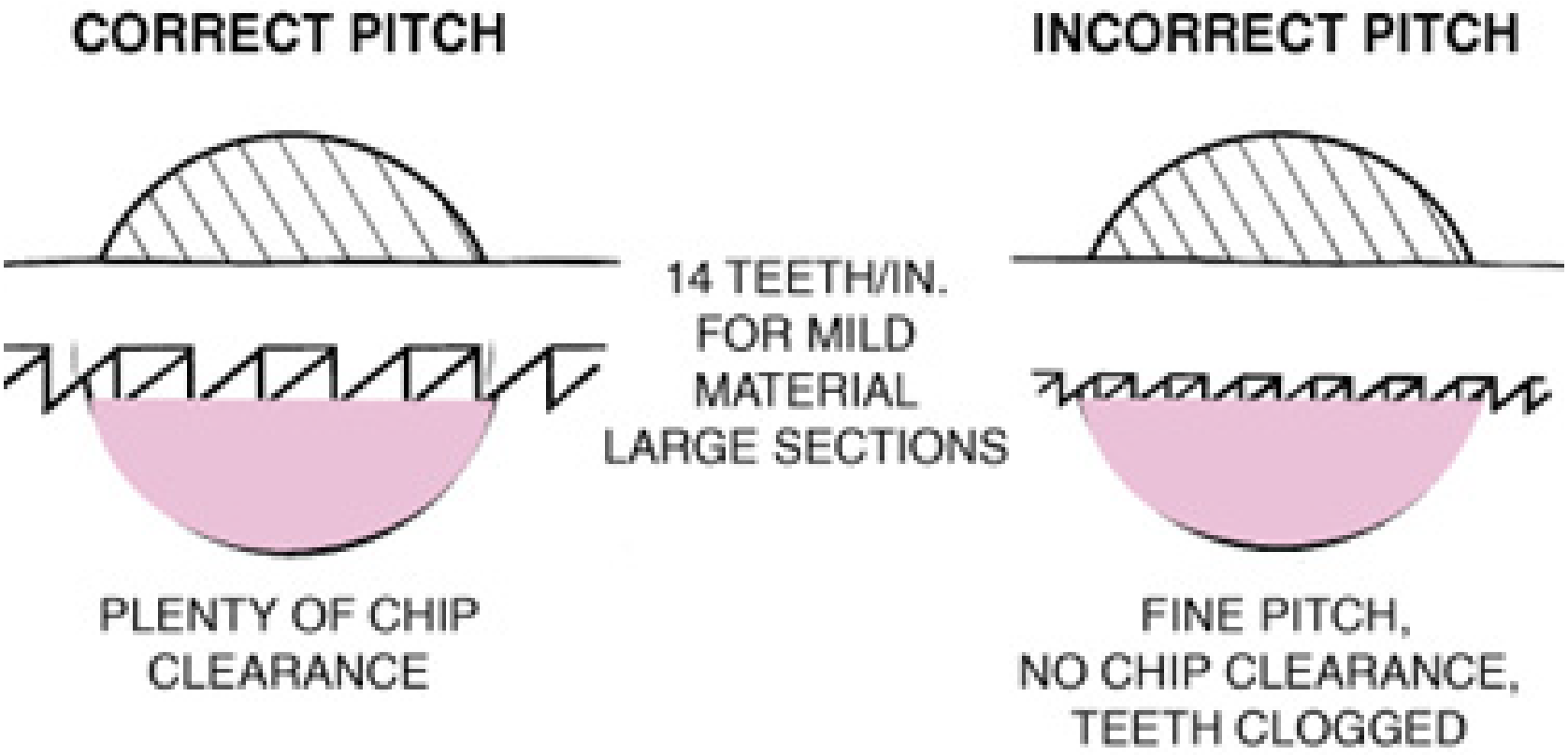
Hacksaw Blades

- Made of high-speed molybdenum or tungsten-alloy steel (hardened and tempered)
- Two types
  - Solid blade (all-hard)
    - Hardened throughout and very brittle
  - Flexible blade
    - Teeth hardened, while back of blade soft and flexible
    - Stand more abuse than all-hard blade, but will not last long in general use
    - Used on channel iron, tubing, copper and aluminum

Blade Pitch

- Number of teeth per inch
- Manufactured in various pitches
  - 14, 18, 24, and 32
- General use choice – 18 in. tooth blade
- Choose as coarse blade as possible
  - Provides plenty of chip clearance and to cut through work as quickly as possible
- Should have at least two teeth in contact with work at all times
  - Prevent work from jamming and stripping teeth

Guide for Proper Blade Selection



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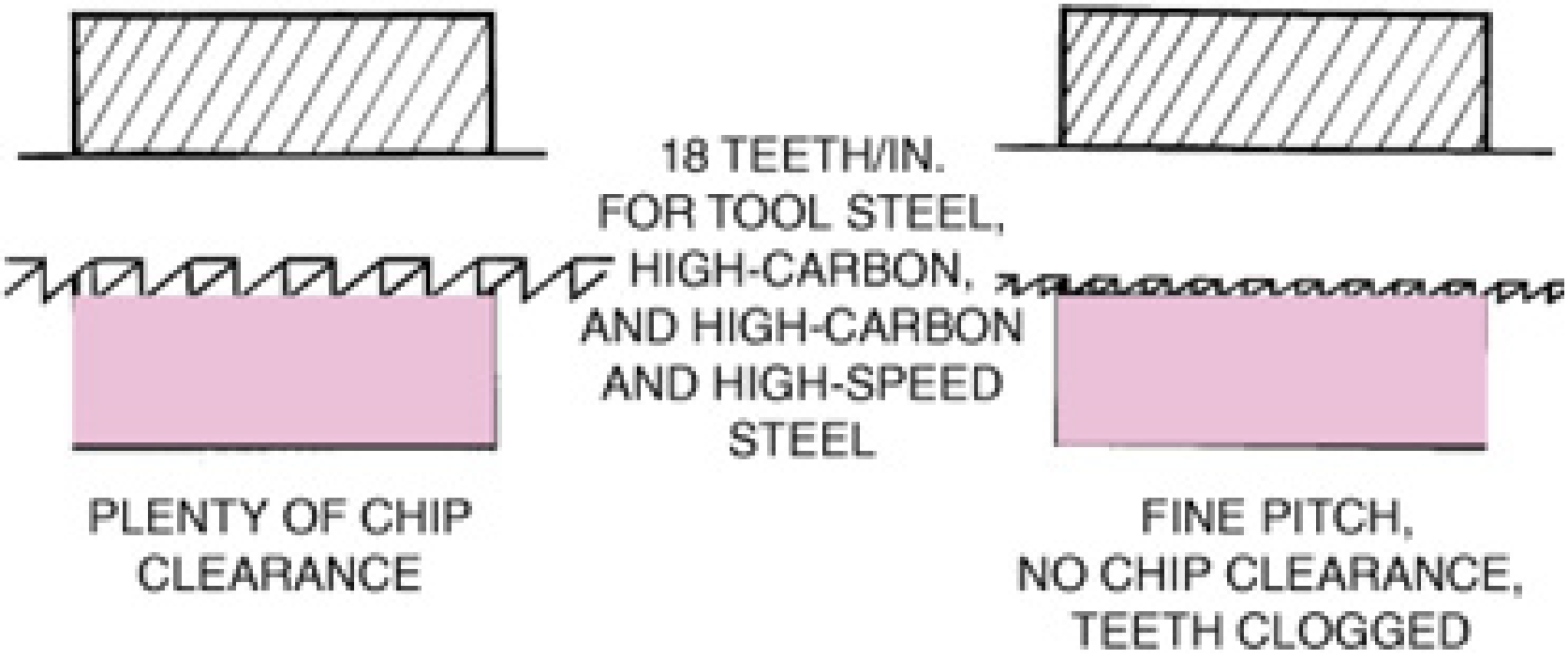

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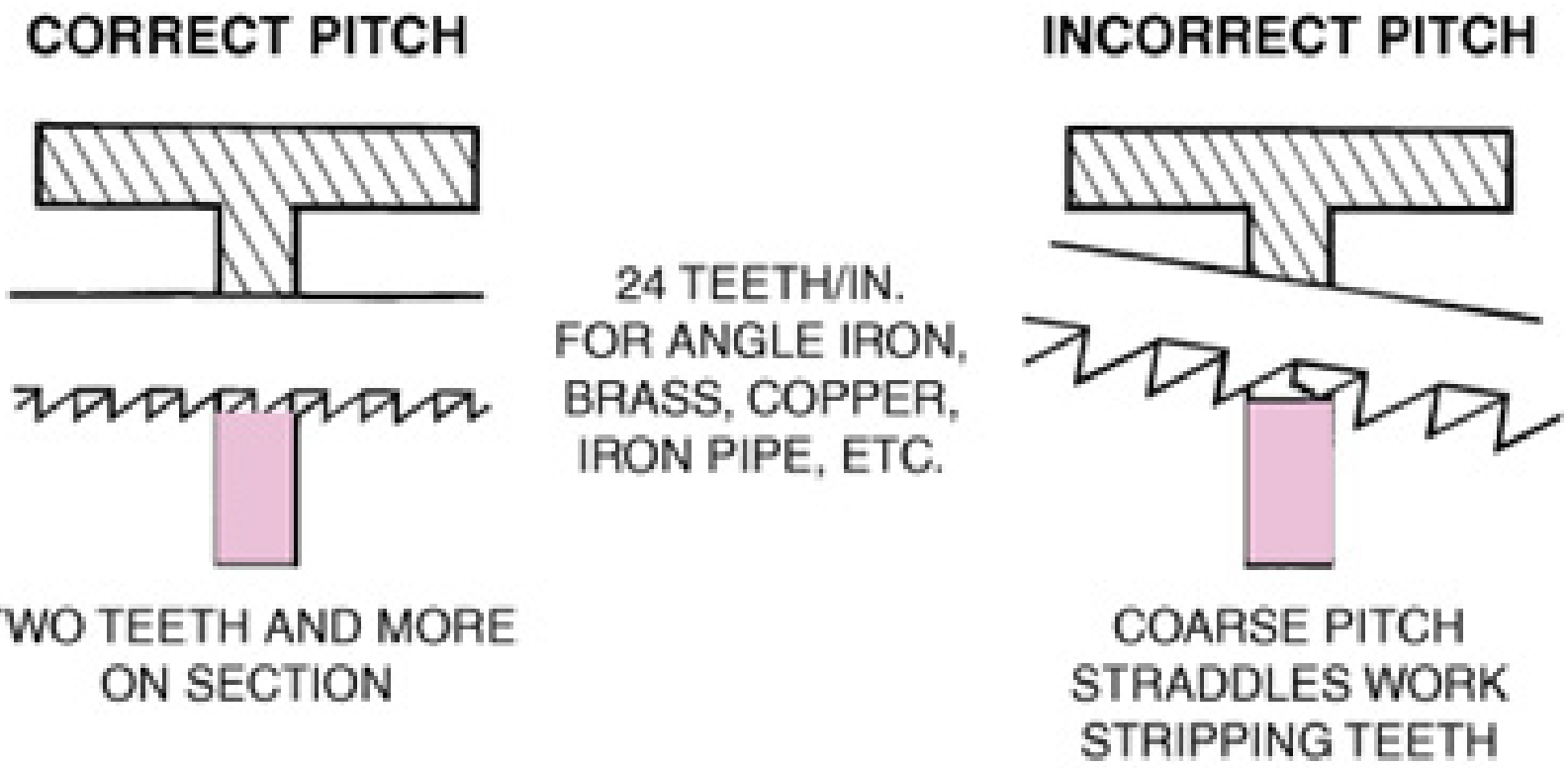

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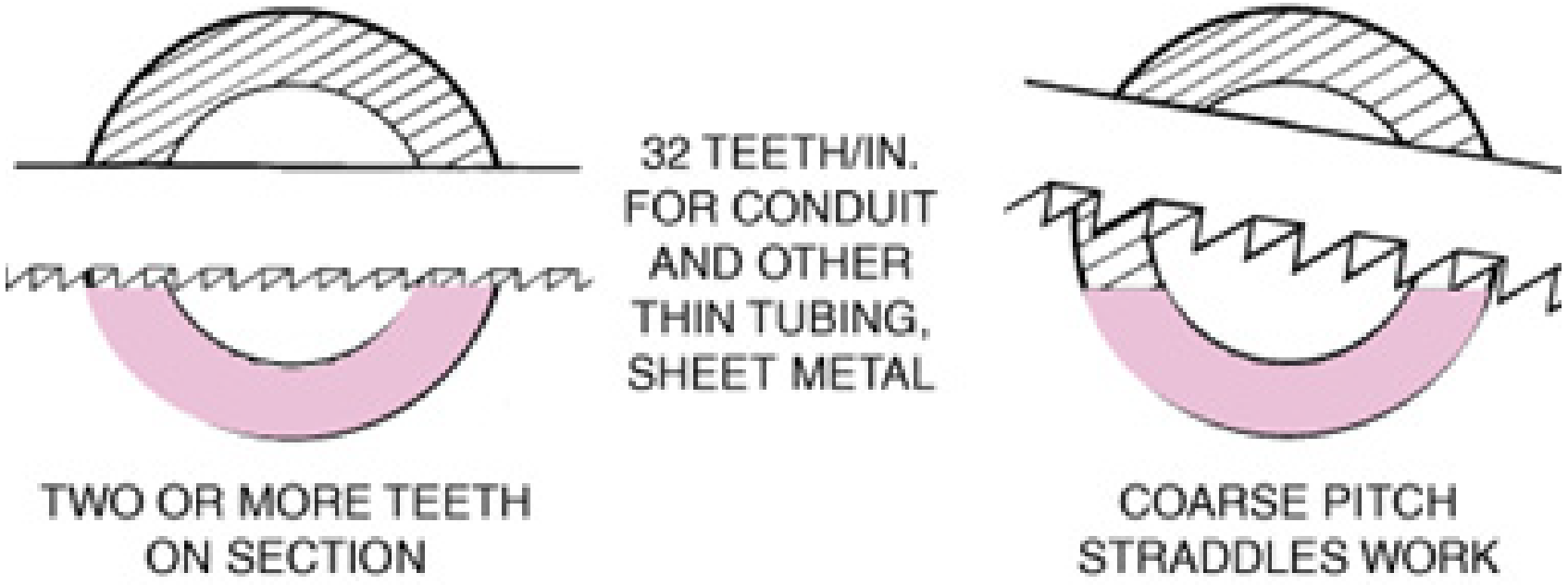


To Use the Hand Hacksaw

1. Check to make sure blade is proper pitch for job and teeth point away from the handle
2. Adjust blade tension so blade cannot flex or bend
3. Mount stock in vise so cut will be about .250 in. from vise jaws

4. Grasp hacksaw, assume comfortable stance, standing erect with left foot slightly ahead of right foot
5. Start saw cut just outside and parallel to previously scribed line
    - File V-shaped nick at starting point
6. After cut has started, apply pressure only on forward stroke
    - Use about 50 strokes per minute

7. When cutting thin material, hold saw at angle to have at least two teeth in contact with work at all times
    - Thin work often clamped between two pieces of wood and cut made through all pieces
8. Slow down to control saw when nearing end of cut

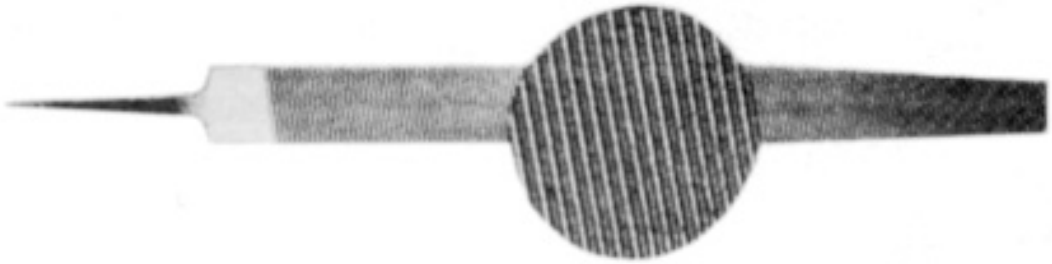
If saw blade breaks or dulls in partly finished cut, replace blade and rotate work one-half turn so old cut is at bottom. New blade will bind in old cut.

Files

- Hand cutting tool made of high-carbon steel
- Series of teeth cut on body by parallel chisel cuts
- Used to remove surplus metal and to produce finished surfaces
- Manufactured in variety of types and shapes
  - Each has specific purpose
- Two classes: single-cut and double-cut

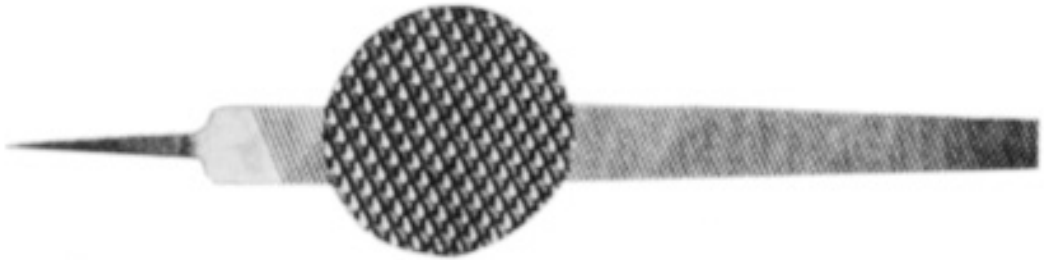
Single-cut Files

- Single row of parallel teeth running diagonally across face
- Used when smooth finish desired
- Include mill, long-angle lathe, and saw files



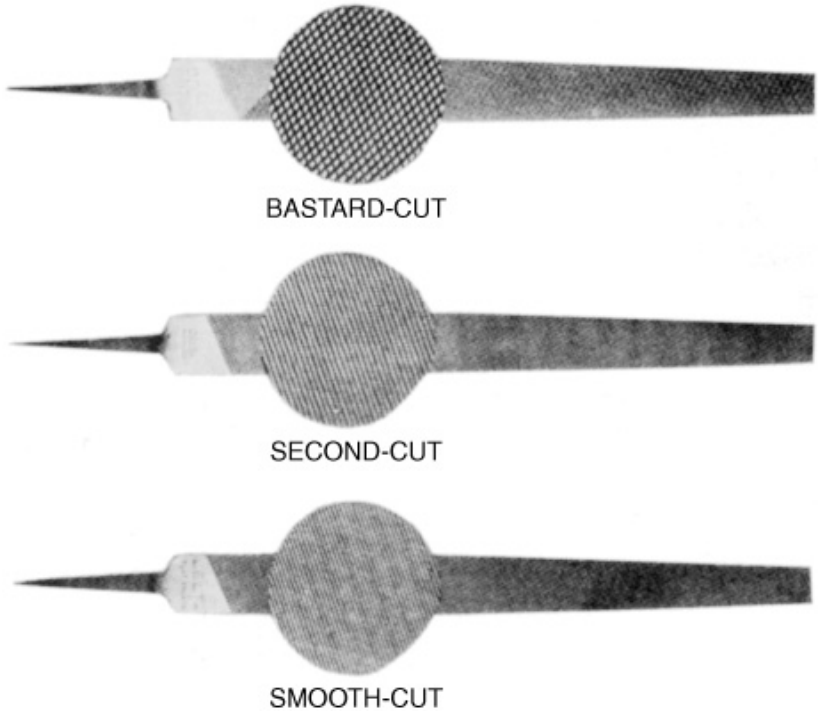
Double-cut Files

- Two intersecting rows of teeth
  - First row coarser and called **overcut**
  - Second row called **upcut**
- Hundreds of cutting teeth
  - Provide for fast removal of metals and easy clearing of chips



Degrees of Coarseness

- Both single- and double-cut files come in various degrees of coarseness
  - Rough
  - Coarse
  - Bastard
  - Second-cut
  - Smooth
  - Dead smooth

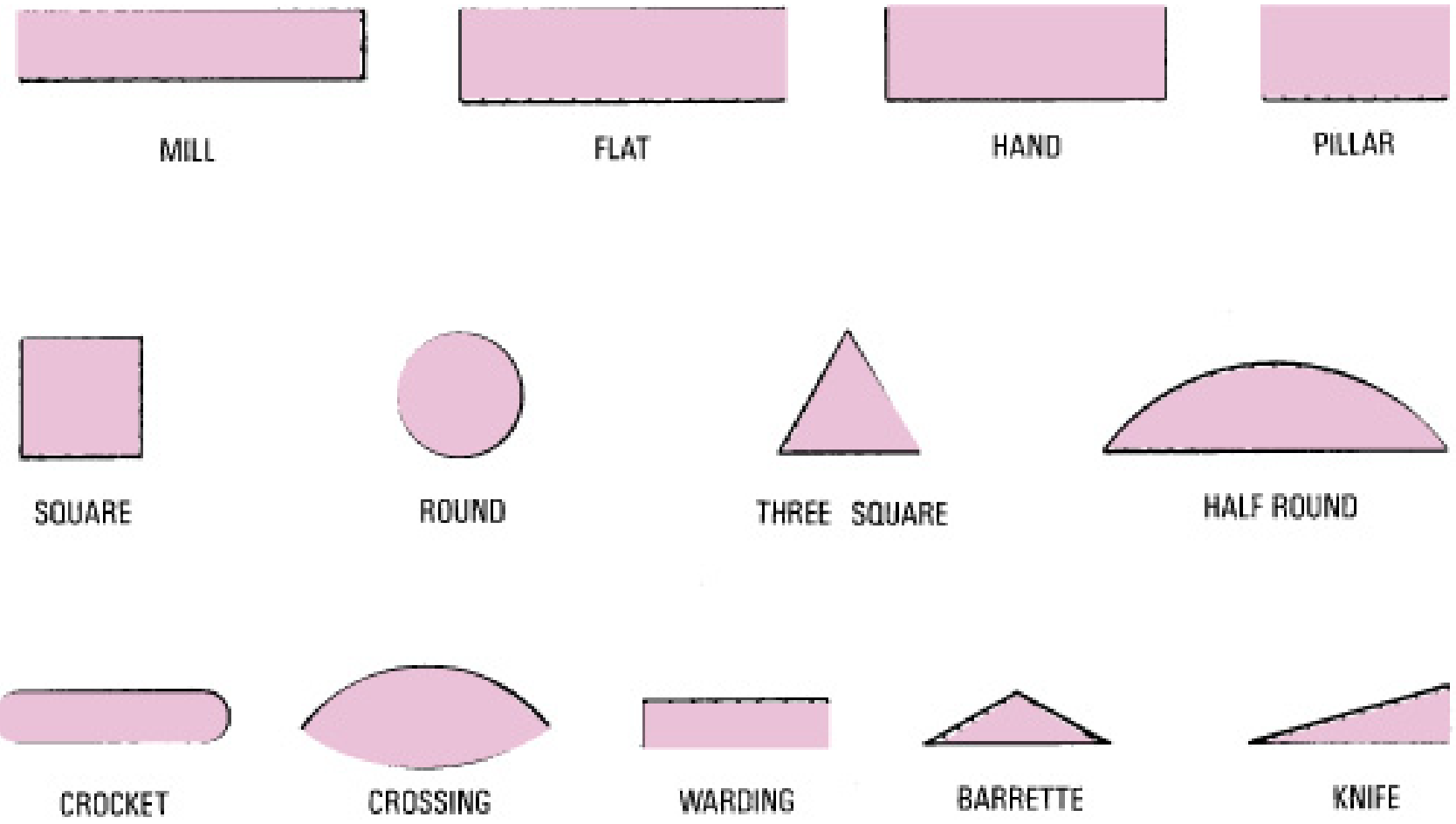


Most Common

Machinist Files

- Types most commonly used by machinists
  - Flat
  - Hand
  - Round
  - Half-round
  - Square
  - Pillar
  - Three-quarter
  - Warding
  - Knife

Cross-sectional Views of Machinists' Files



Care of Files

1. Do not store files where they rub together
2. Never use file as pry of hammer
3. Do not knock file on vise or other metallic object to clean it (use brush or file card)
4. Apply pressure only on forward stroke
5. Do not press too hard on new file
6. Too much pressure also results in "pinning" which scratches work surface
    - Small particles wedged between teeth

Points to be Observed When Cross-filing

1. Never use file without handle
2. Fasten work to be filed in vise, at about elbow height
3. To produce flat surface, hold right hand, right forearm and left hand in horizontal plane
   - Push file across work face in straight line
   - Do not rock file

4. Apply pressure only on forward stroke
5. Never rub fingers or hand across surface being filed
    - Oil will clog file
    - Oil causes file to slide over instead of cutting
6. Keep file clean by using file card frequently

For rough filing, use double-cut file and cross stroke at regular intervals to keep surface flat and straight. When finishing, use single-cut file and take shorter strokes to keep file flat.

Draw Filing and Polishing

- Draw filing
  - Used to produce smooth, flat surface on workpiece
  - Removes file marks and scratches left by cross-filing
- Polishing
  - After surface filed, finished with abrasive cloth to remove small scratches left by file
    - Moved back and forth along work

Special Files

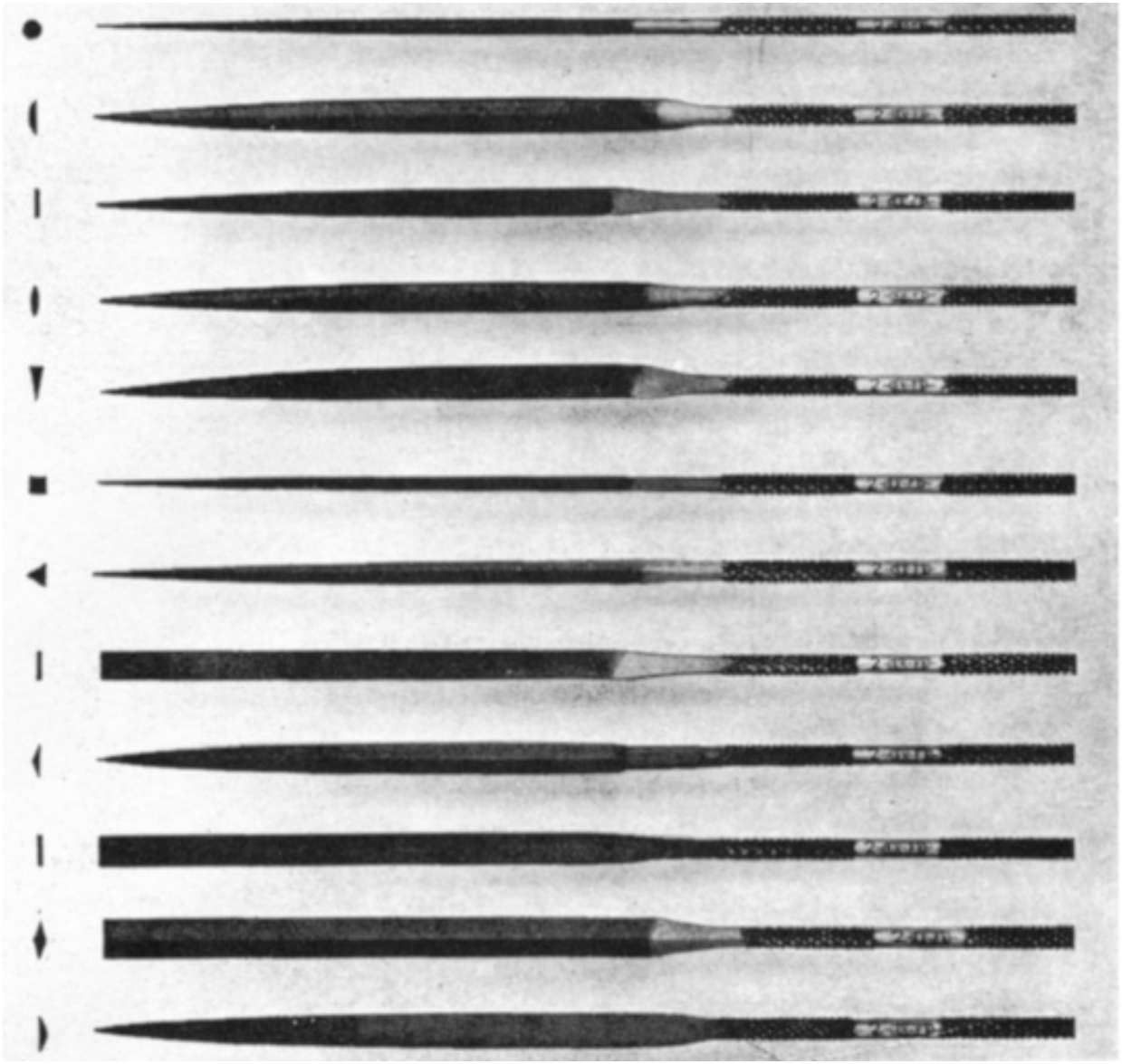
- Long-angle lathe files
  - Used for filing on lathe because they provide better shearing action
  - Long angle tends to clean file, eliminate chatter, and reduces possibility of tearing metal
- Aluminum files
  - Designed for soft, ductile metals
  - Upcut tooth deep and overcut fine
  - Produces small scallops on upcut, which breaks up chips and permit them to clear more easily

Special Files

- Brass files
  - Small upcut angle and fine, long-angle overcut
  - Produces small, easily cleared chips
  - Almost straight upcut prevents grooving
- Shear tooth files
  - Combine long angle and single-cut coarse tooth
  - Used to file materials such as brass, aluminum, copper, plastics and hard rubber

Precision Files

- Swiss pattern and needle files
  - Small files with fine tooth cuts and round integral handles
  - Made in several shapes
  - Generally used in tool and die shops for finishing delicate and intricate pieces
- Die sinker rifflers
  - Curved up at ends to permit filing bottom surface of a die cavity



ROUND

HALF ROUND

FLAT

CROSSING

KNIFE

SQUARE

THREE SQUARE

EQUALING

BARRETTE

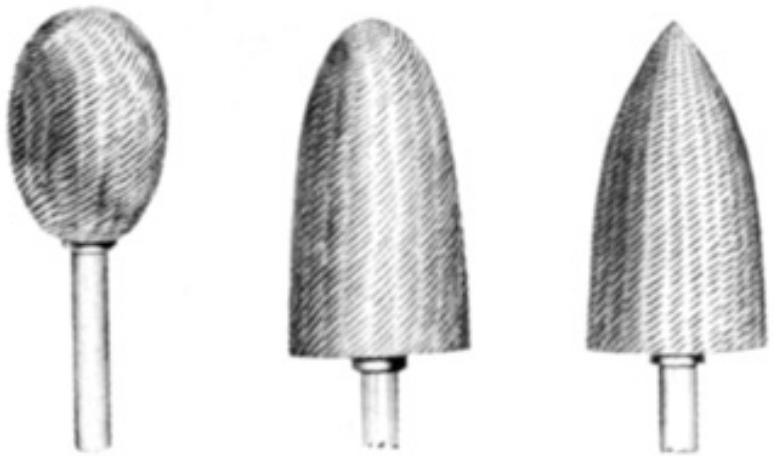
JOINT (2 ROUND EDGES)

SLITTING

MARKING

Rotary Files

- Teeth cut and form broken lines
- Dissipate heat of friction
- Useful for work on tough die steels, forgings, and scaly
  surfaces

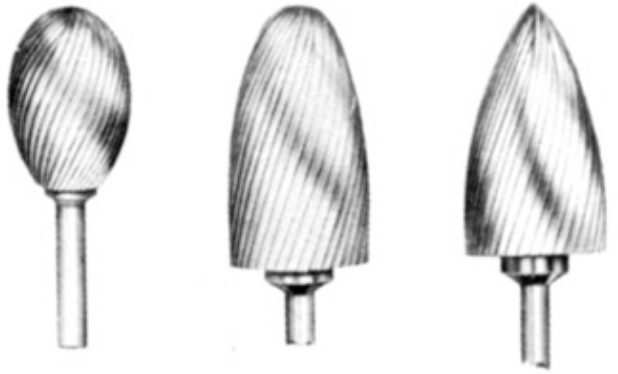


Ground Burrs

- Teeth uniform in tooth shape and size
  - Unbroken flutes
  - Flutes machine ground to master burr to ensure uniformity of tooth shape and size

–May be made of high-speed steel or carbide

  - Carbide last up to 100 times longer
- Used on nonferrous metals
- Better chip clearance



Using High-Speed Steel Rotary Files and Burrs

1. Move file or burr at even rate to produce smooth surface
   - Uneven rate of pressure produces surfaces with ridges and hollows
2. Use proper speed for burr diameter or file
3. Use only sharp burrs or files
4. Grip grinder as close as possible to its end for more accurate control of burr or file
5. Medium-cut burrs and files provide satisfactory metal removal and finish for most jobs

Scrapers

- Used when truer surface required than can be produced by machining
- Involves removing small amounts of metal from specific areas to produce accurate bearing surface
  - Used to produce flat surfaces or in fitting brass and babbitt bearing to shafts
  - Long and tedious process
- Various shapes, made of high-grade tool steel, hardened and tempered