Firearm and Tool Mark Evidence

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Machines

- Lathe - turning
- Mill - rotary metal removal
- Drill Press - round holes
- Shaper - flat metal removal
- Grinder - abrasive machining
- Lapping / Honing - finishing processes
Tool functions

• Gripping
• Cutting
• Prying
• Threading
Lathe

• Material held in a chuck
• Material rotates while cutter remains stationary
• Types- bench, engine, turret, NC or CNC
Mill

- Horizontal or Vertical, NC or CNC
- Cutter rotates as metal is fed
Drill Press

- Drill bit rotates
- Round holes, either blind or through
- Gang drilling
- Sensitive or Auto feed
Shaper

• Material stationary while cutter reciprocates back and forth, removing metal with each pass
Grinder

- Abrasive wheel used to remove material
- Grinding wheel is consumed
- Capable of extremely smooth finish if desired
- Capable of removing material as hard as most tools used in other machining processes

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Coarse Wheel

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Fine Wheel
Chop Saw

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Lapping / Honing

- Uses an added abrasive to remove minor imperfections / machining marks from prior machining operations.
- Capable of creating the smoothest surface.
Gripping tools

- Pliers
- Wrenches
- Vise
- Crimpers

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Cutting tools- pinching/shearing

- Side cutting pliers
- End cutting pliers
- Bolt cutters
- Snips
- Shears
Prying tools

- Crow bar
- Flat bar
- Screwdriver
- Chisel
Threading tools

• Tap
• Die
Metals

- Aluminum
- Copper
- Brass
- Bronze
- Iron
- Plain Steel
- Alloy Steels

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Firearms and Ammunition
Components of a Firearm

- Frame
- Barrel
- Action
  - chamber
  - muzzle
  - single or double
Barrels

- Drilling
- Reaming
- Rifling
- finishing
Barrel Blanks

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Deep-Hole Drills
Drilled Barrels

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Gang Broaches
Close-Up: Wear of Cutting Edge

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Button Rifling Tool

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Button Rifling Press

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Barrel Rifling

6 Left

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Deliberate Controlled Deceleration
Chambered Cartridge

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Spent Cartridge Case Extraction from Chamber

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Extractor Markings
Cartridge Lifted by Magazine Follower
Chambering Facilitated by Forcing Cone

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New Cartridge Fed into Chamber by Bolt

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Magazine Lip Marks

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Breechface Markings on Primer
Example of Glock® Class Characteristics

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Firing Pin impressions: Rim Fire
Comparison Microscopy
3D data collected by Ms. Loretta Kuo using Zeiss Axio CSM 700

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MUZZLE
TARGET DISTANCE: 20 FEET

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Pipes

- Aluminum, Copper, Plastic, Brass, Black, Galvanized
- Most common containment vessel for improvised explosive devices
- Can be cut from a length and threaded or bought pre-threaded as a nipple from several sources
Pipes

- ASTM A 53 / A 135
- Schedule 40 most common
- 1/8th inch to 12 inch diameter
- Nipples: “close” to 12 inch from 21 foot length
Pipes

• Manufacture
  - continuous butt weld
  - electric resistance weld
  - seamless
Pipes

- Continuous butt weld, Mercer / furnace process
  - oxygen is added to chamber as flat metal strip is brought together to form pipe
  - results in rough finished surface
  - more common of US pipe manufacturers
Pipes

• Electric resistance weld ("cold" process using RF)
  - results in formation of "scarf" on welded seam
  - often removed on outside of pipe resulting in characteristic marks from tool used
  - more common of imported pipe
Pipes and Fittings

• Both pipe lengths and fittings are marked in some way by the manufacturer. Marks and labels include:
  - casting
  - stencils (ASTM requirement - manuf, type, size, spec, length) may use colored inks
  - stickers, including UPC codes
Nipple formation

• Bender-Klees Rule*: 4 - 3 - 2
  4 (jaw marks) = Industrial manufacturer
  3 (jaw marks) = Portable power threader
  2 (jaw marks) = Homeowner vise jaws

*Courtesy of Mr. Ed Bender and Mr. Greg Klees, ATF Laboratory
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Nipple formation

- Industrial- huge stationary machines that include a cutting (parting) operation and a threading operation where the threading chuck imparts 4 single straight lines to the pipe.
Nipple formation

• Portable / Semi-portable - Smaller power machines used by plumbers, home improvement and hardware stores to cut and thread pipes where the chuck imparts marks from the 3 jaws. The marks vary depending upon the machine manufacturer and model.
Nipple Formation

• Homeowner - Bench vise often used where the gripping action of the opposing jaws produces 2 marks on the pipe.
Thank you

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