Firearm and Tool Mark Evidence

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Impression and Pattern Evidence Symposium

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Acknowledgements

- Jack Hietpas
- Meghan Miller

- Dr Nicholas Petraco
- Leeds Precision Instruments

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

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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

Coarse
Wheel

Fine
Wheel


DO NOT EXCEED MAXIMUM R.P.M.
USING, DISCARD IF DAMAGED
STARTING • STORE AND
SPECIFICALLY DESIGNED FOR
GUARD AND
WHEN
UNLESS
WHEEL
1-7-87

Chop Saw

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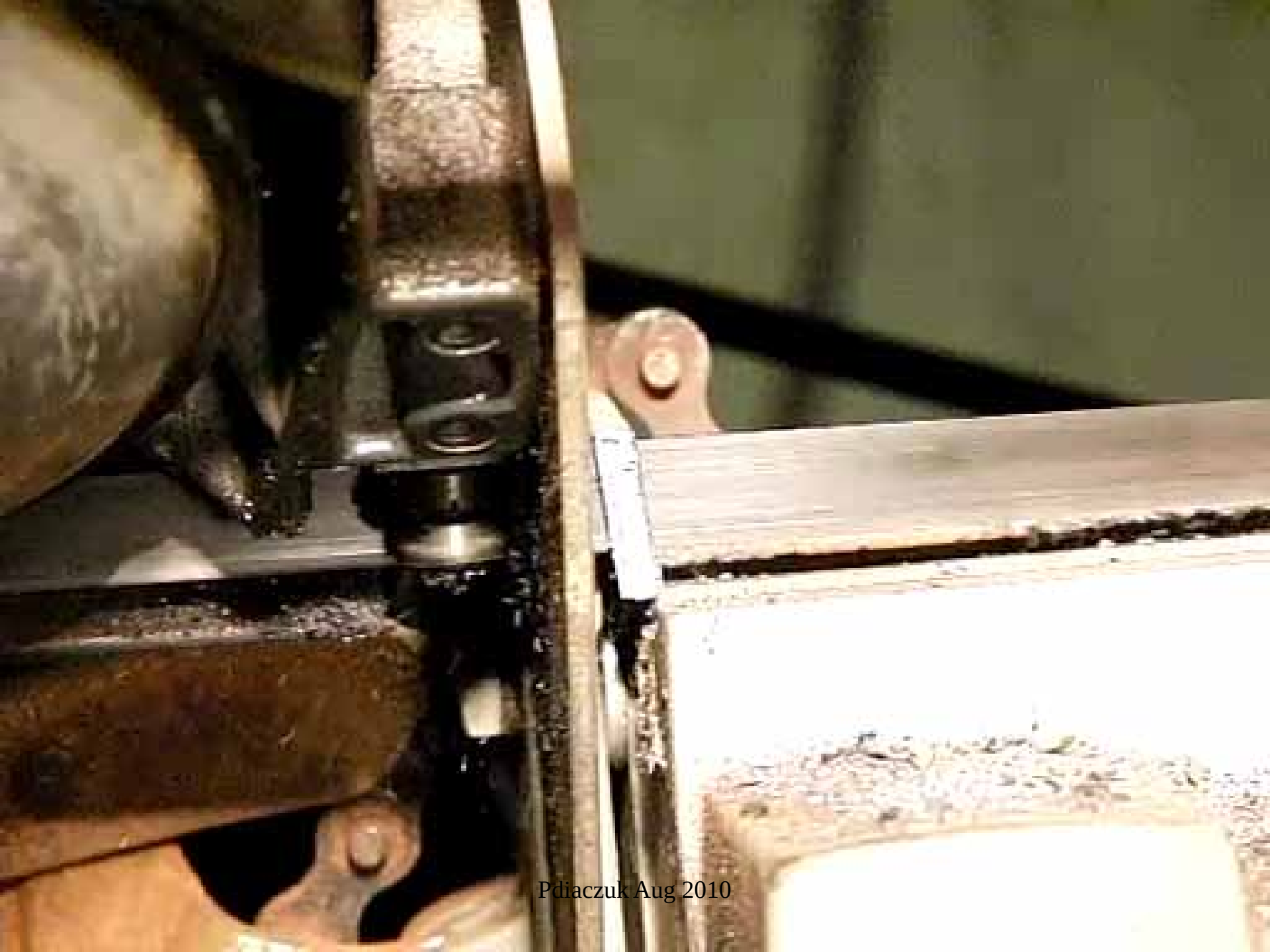

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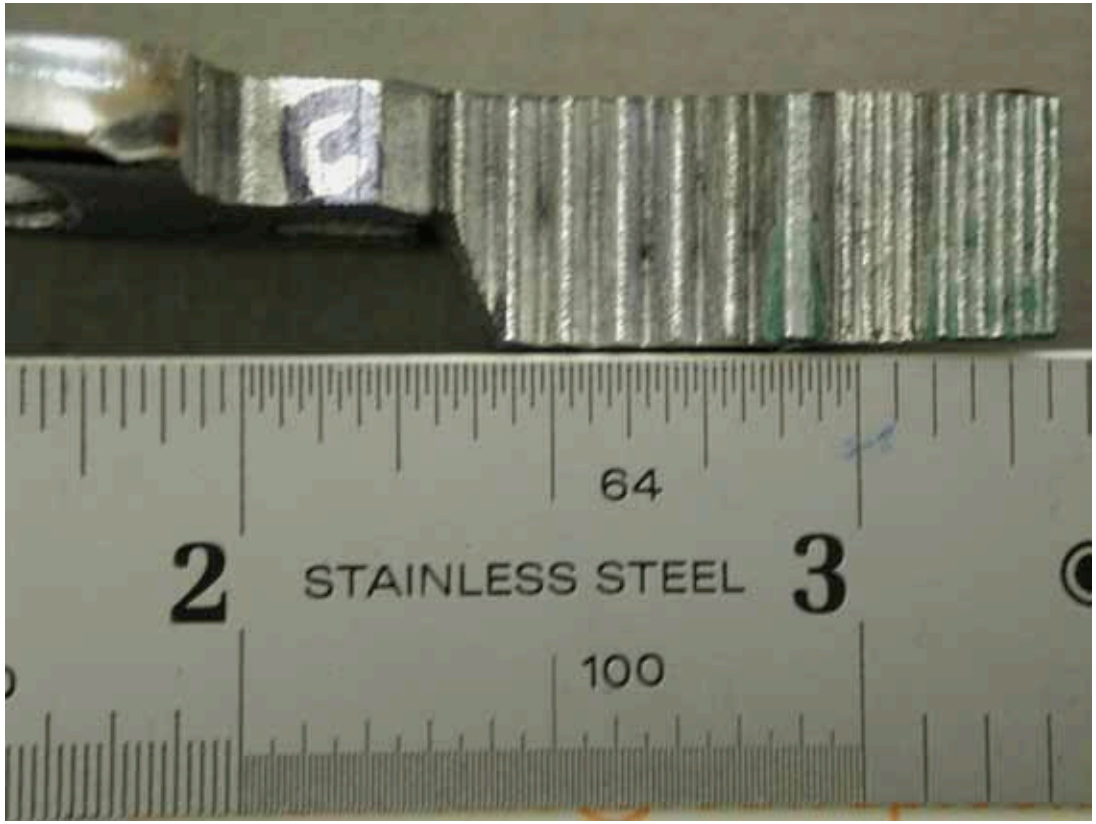
Lapping / Honing

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

Gripping tools

- Pliers
- Wrenches
- Vise
- Crimpers



Cutting tools- pinching/shearing

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

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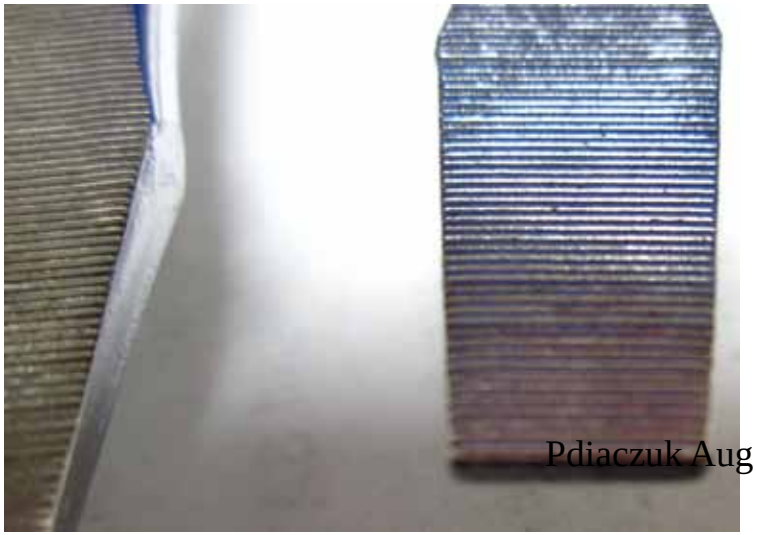
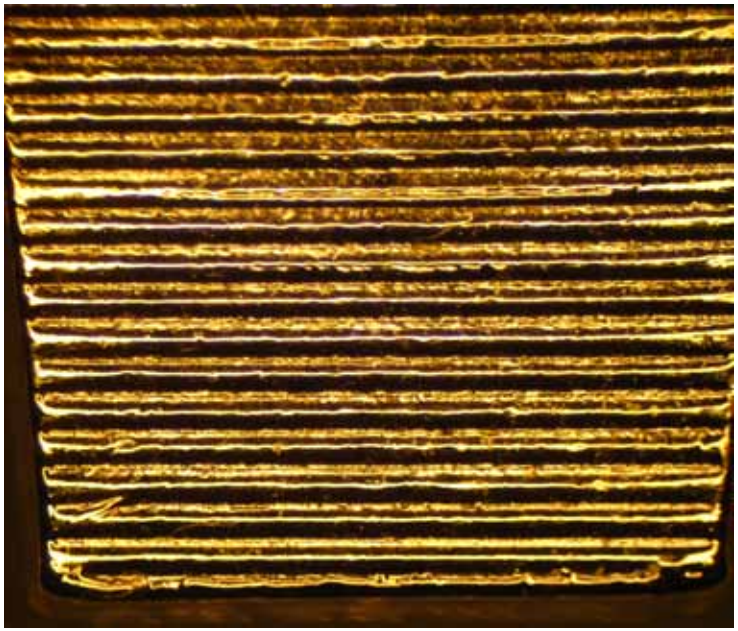
Prying tools

- Crow bar
- Flat bar
- Screwdriver
- Chisel





Threading tools

- Tap
- Die

Metals

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

Firearms and Ammunition

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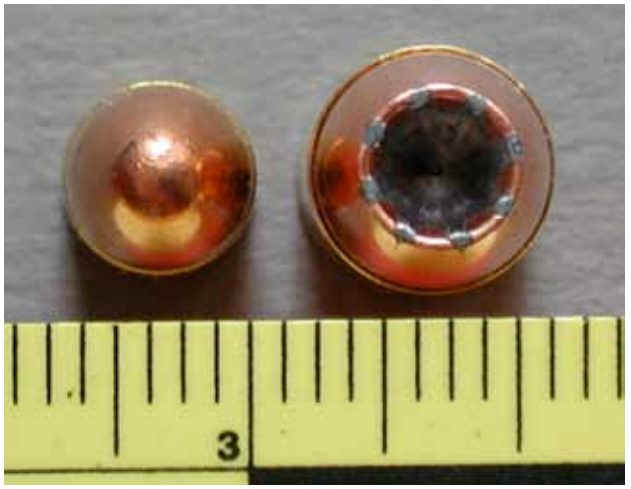

Components of a Firearm

- Frame
- Barrel

  chamber  muzzle
- Action

  single or double

Barrels

- Drilling
- Reaming
- Rifling
- finishing

Barrel Blanks

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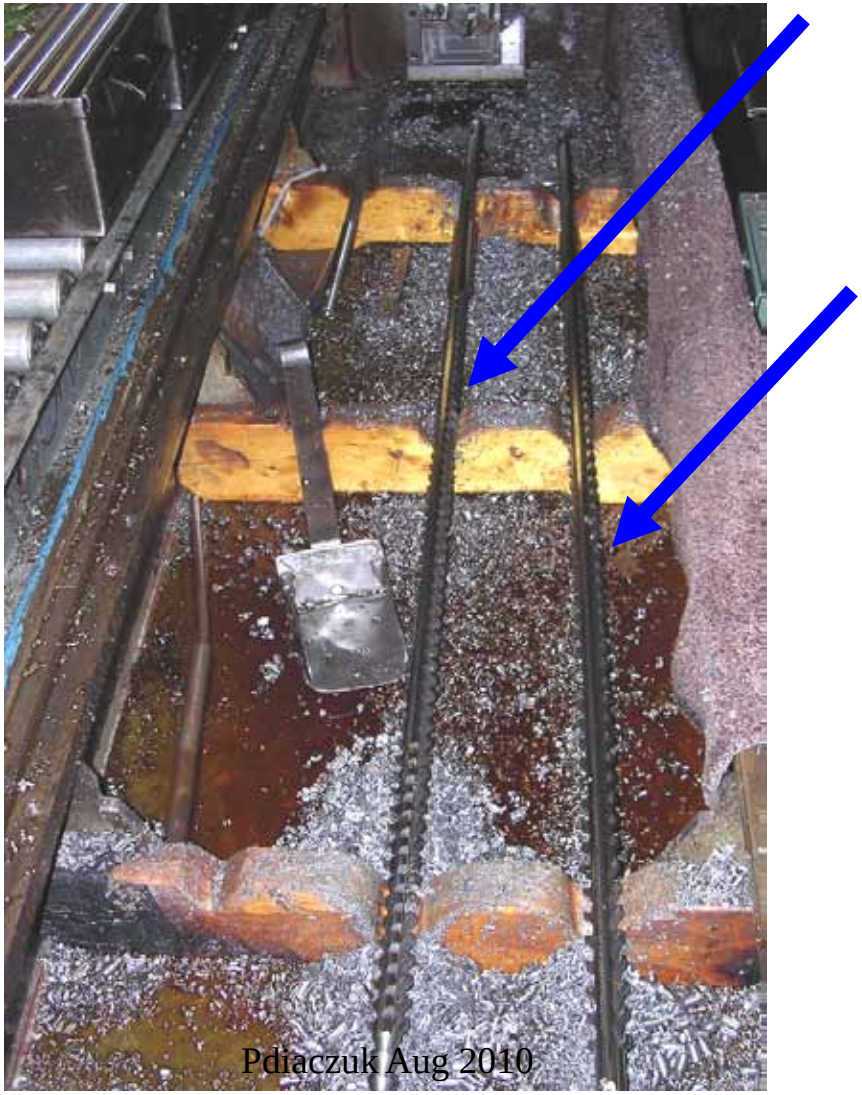
Deep-Hole Drills

Drilled Barrels

Gang Broaches



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Close-Up:
Wear of Cutting Edge

Button Rifling Tool

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Button Rifling Press

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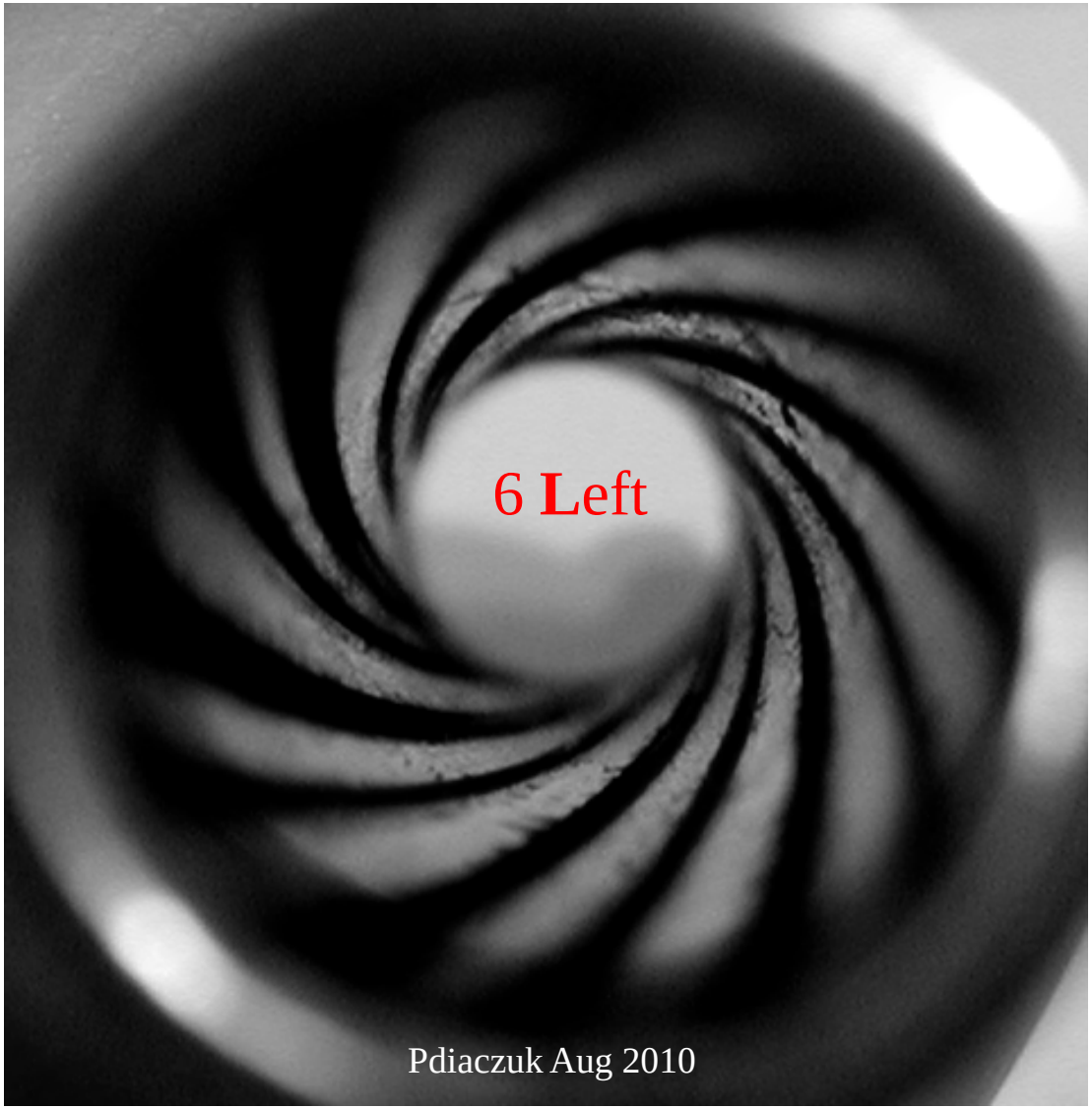
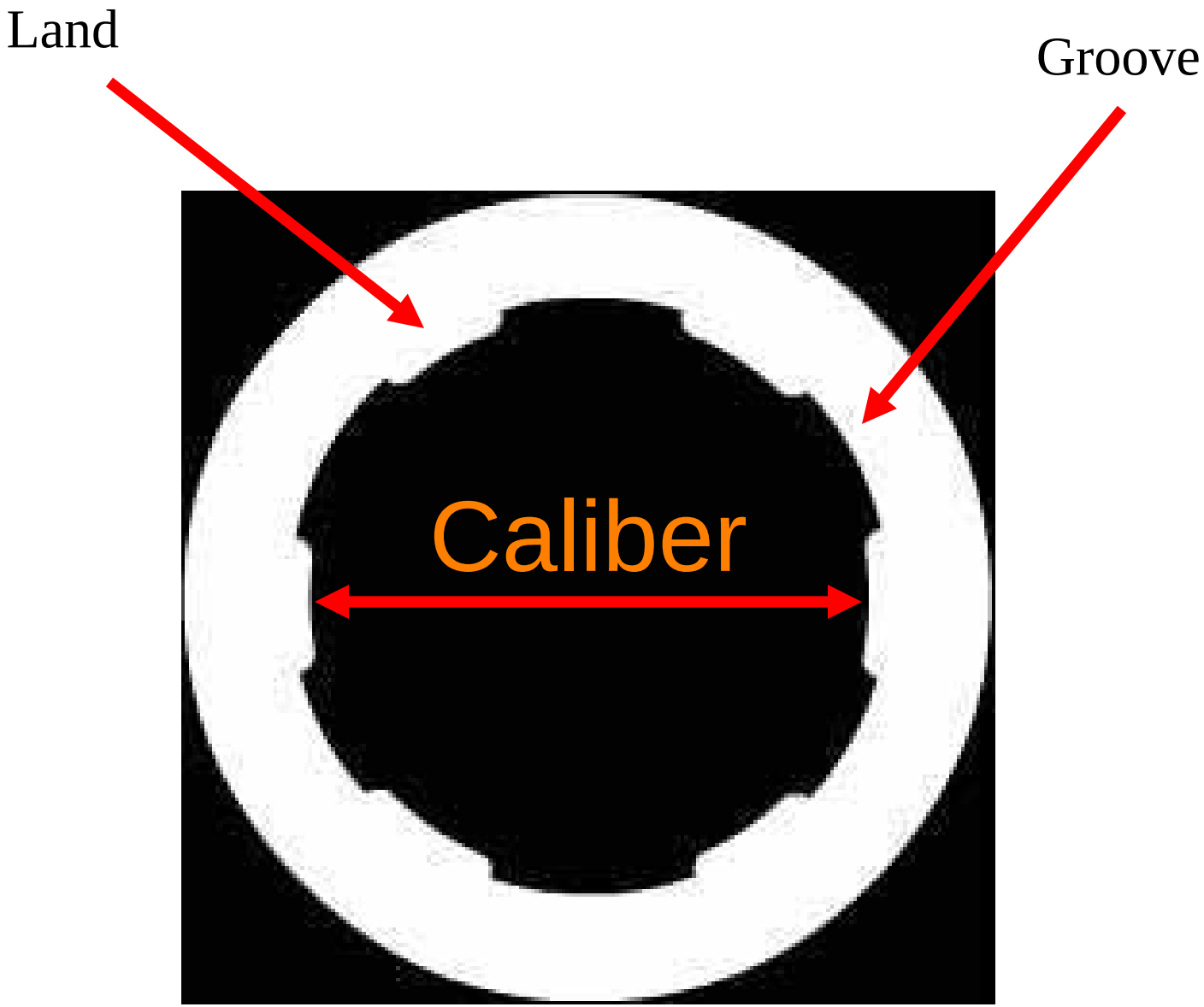
Barrel Rifling




Land
Groove
Caliber

Deliberate Controlled Deceleration

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Chambered Cartridge

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Spent Cartridge Case Extraction from Chamber

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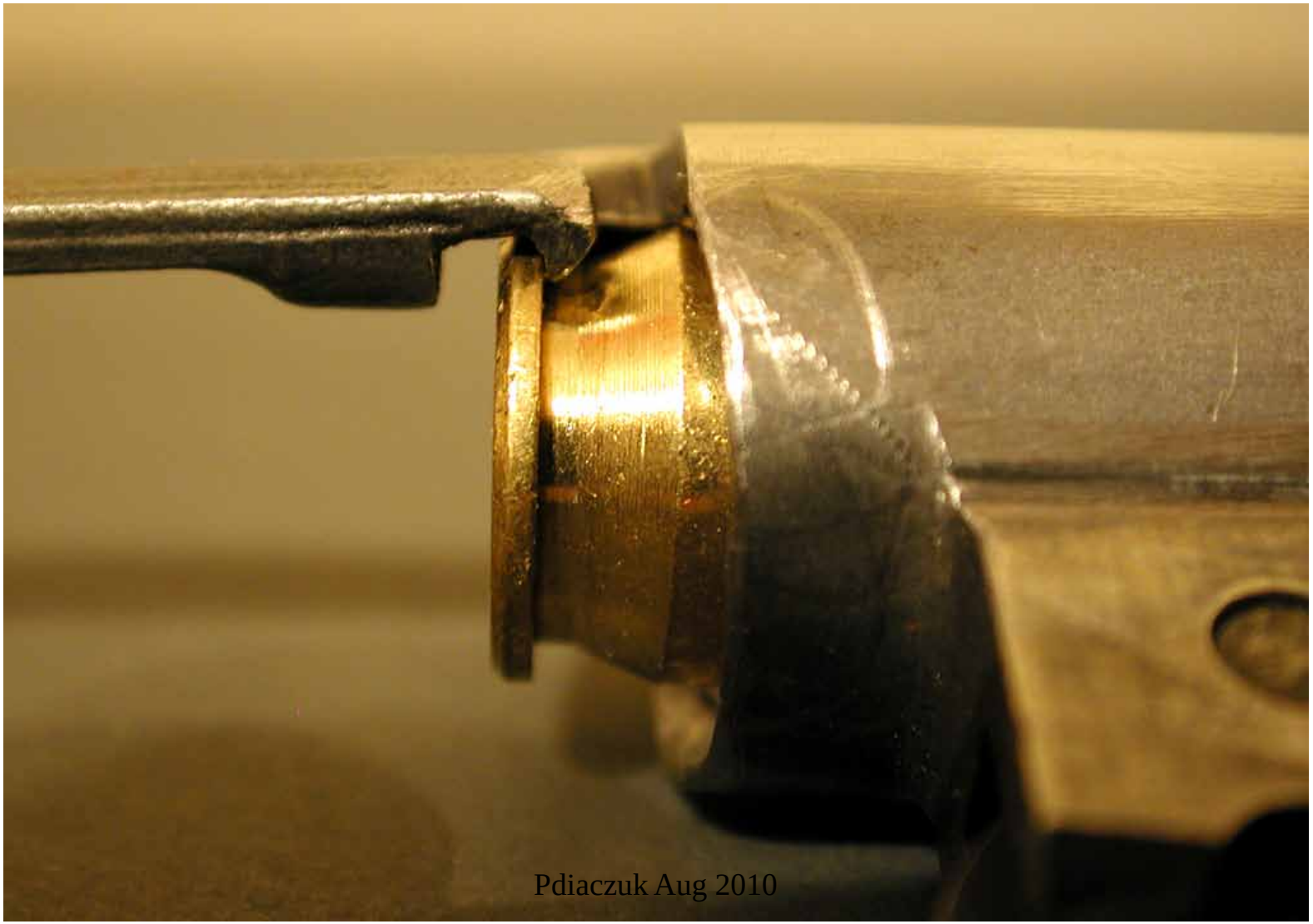
Extractor Markings



Cartridge Lifted by Magazine Follower

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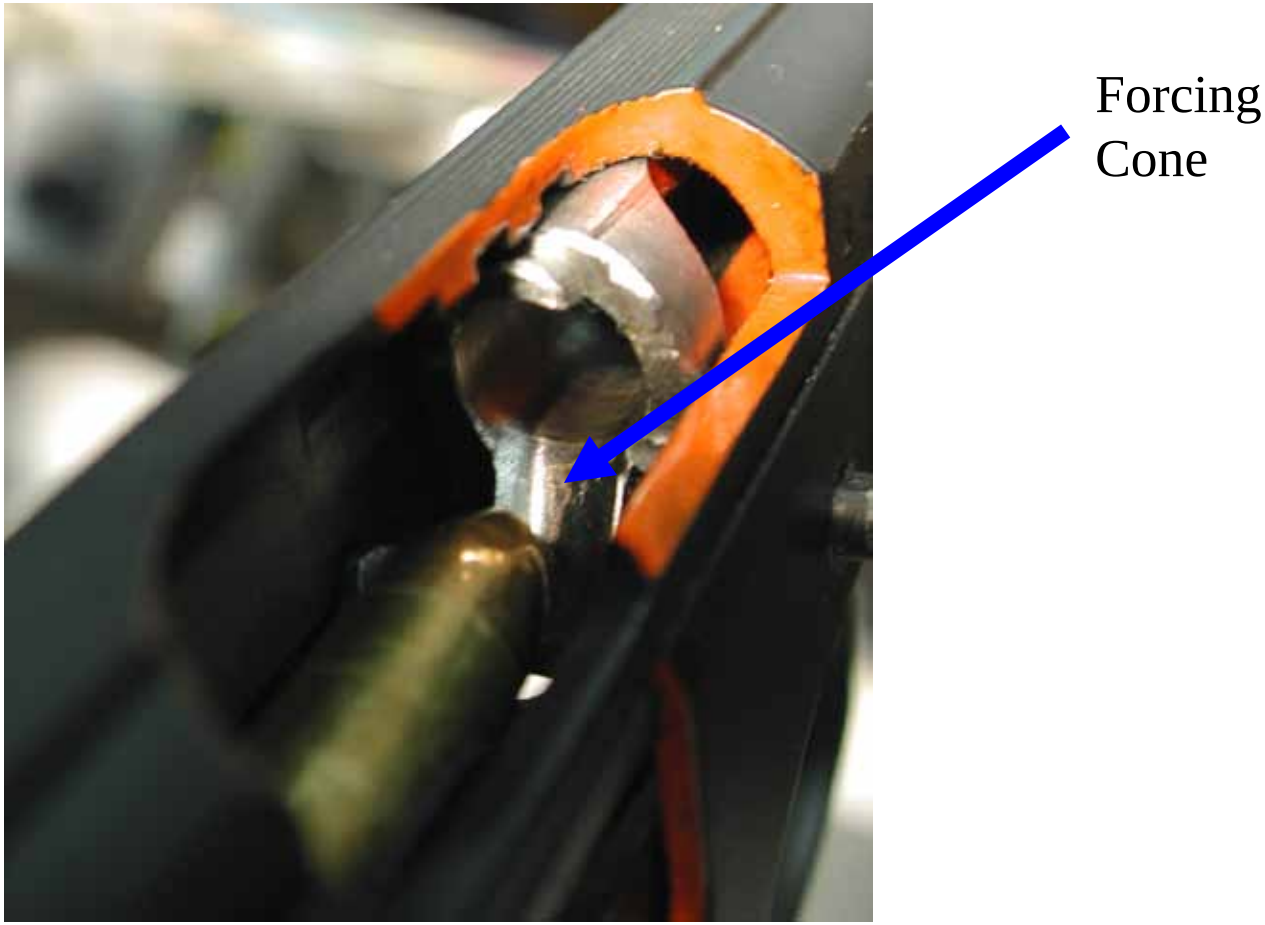
Chambering Facilitated by Forcing Cone



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New Cartridge
Fed into Chamber by Bolt

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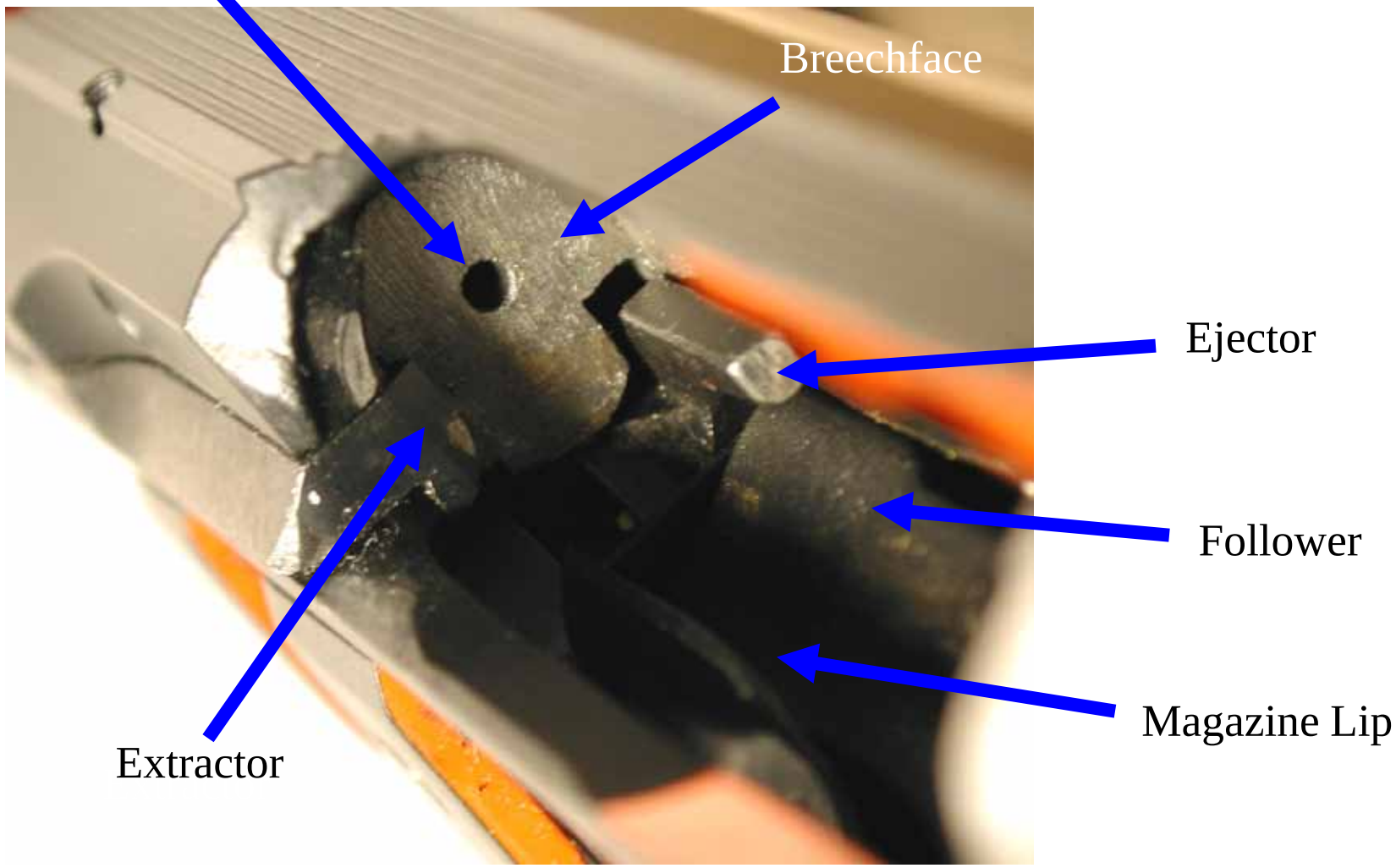
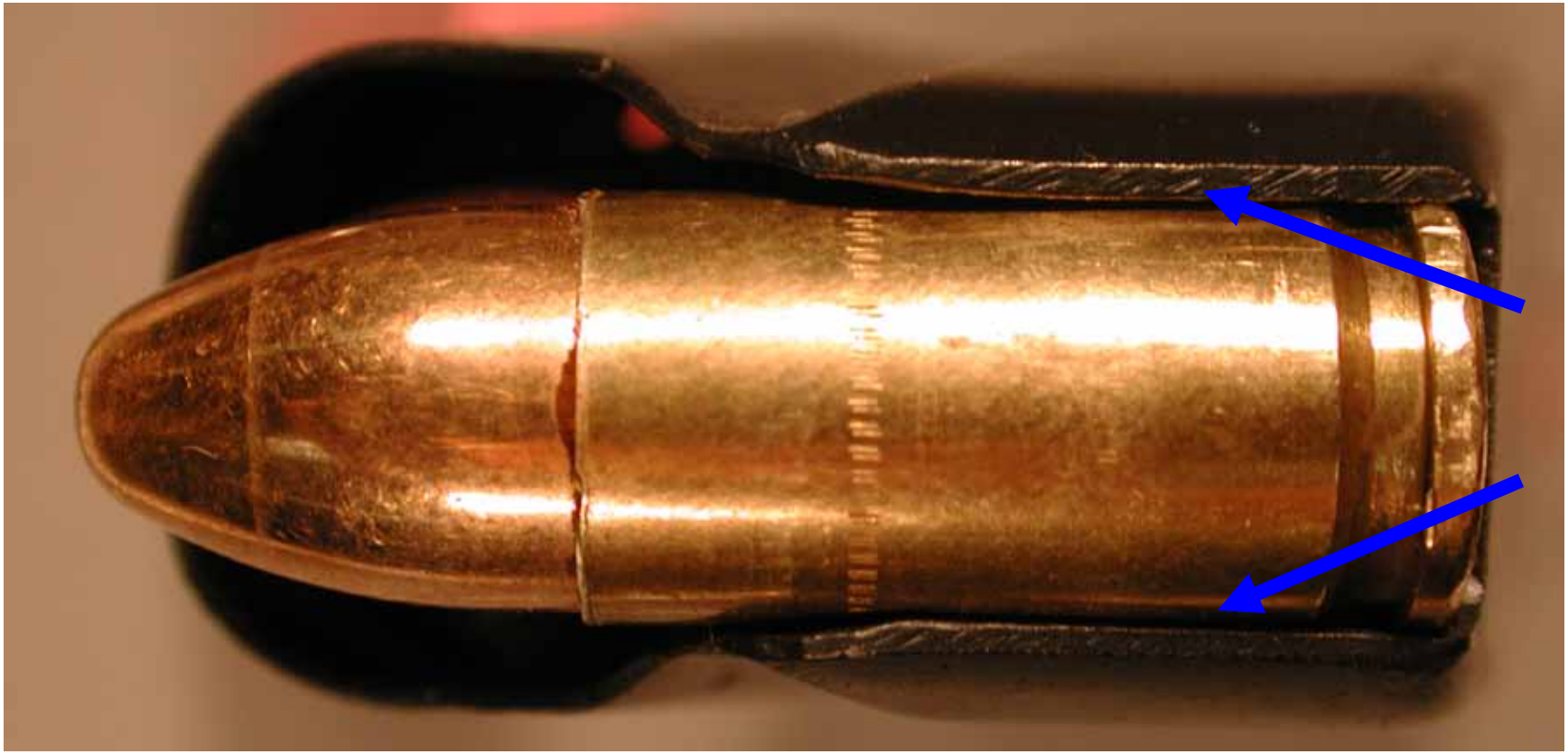
Close-Up: Action Mechanism



Magazine Lip Marks



Breechface Markings on Primer

Example of Glock® Class Characteristics

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Firing Pin impressions: Rim Fire

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Comparison Microscopy

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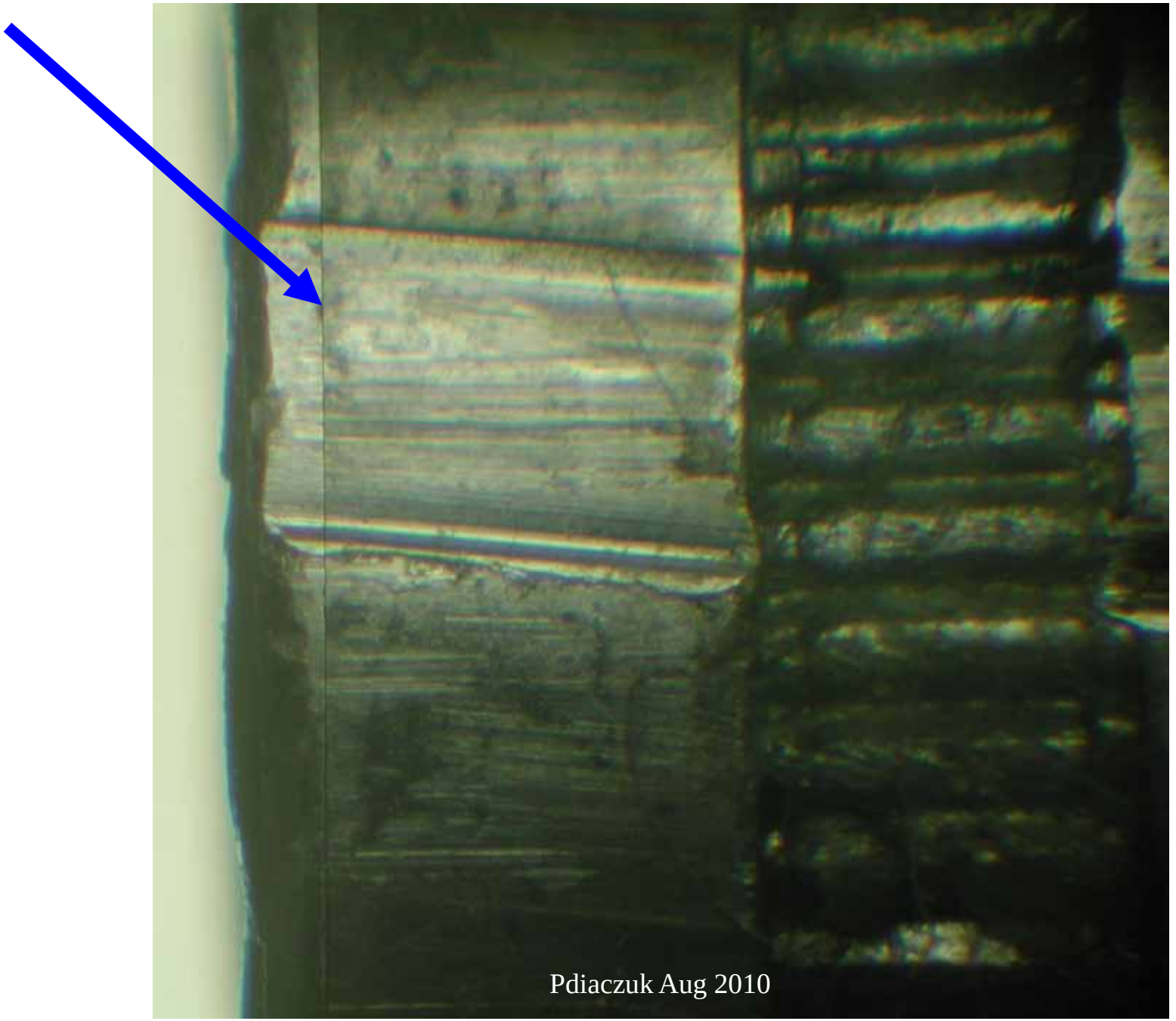
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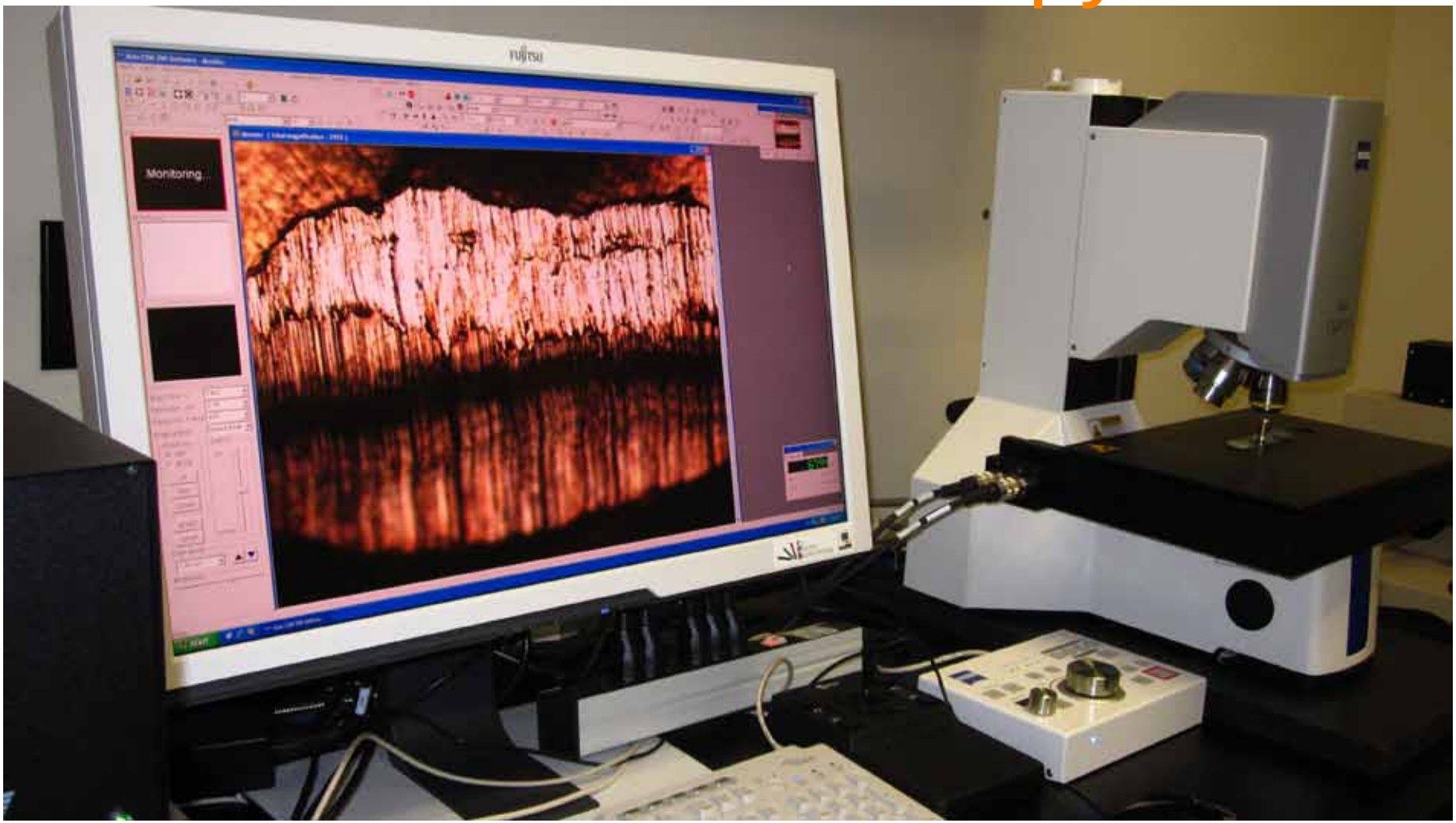
Confocal Microscopy



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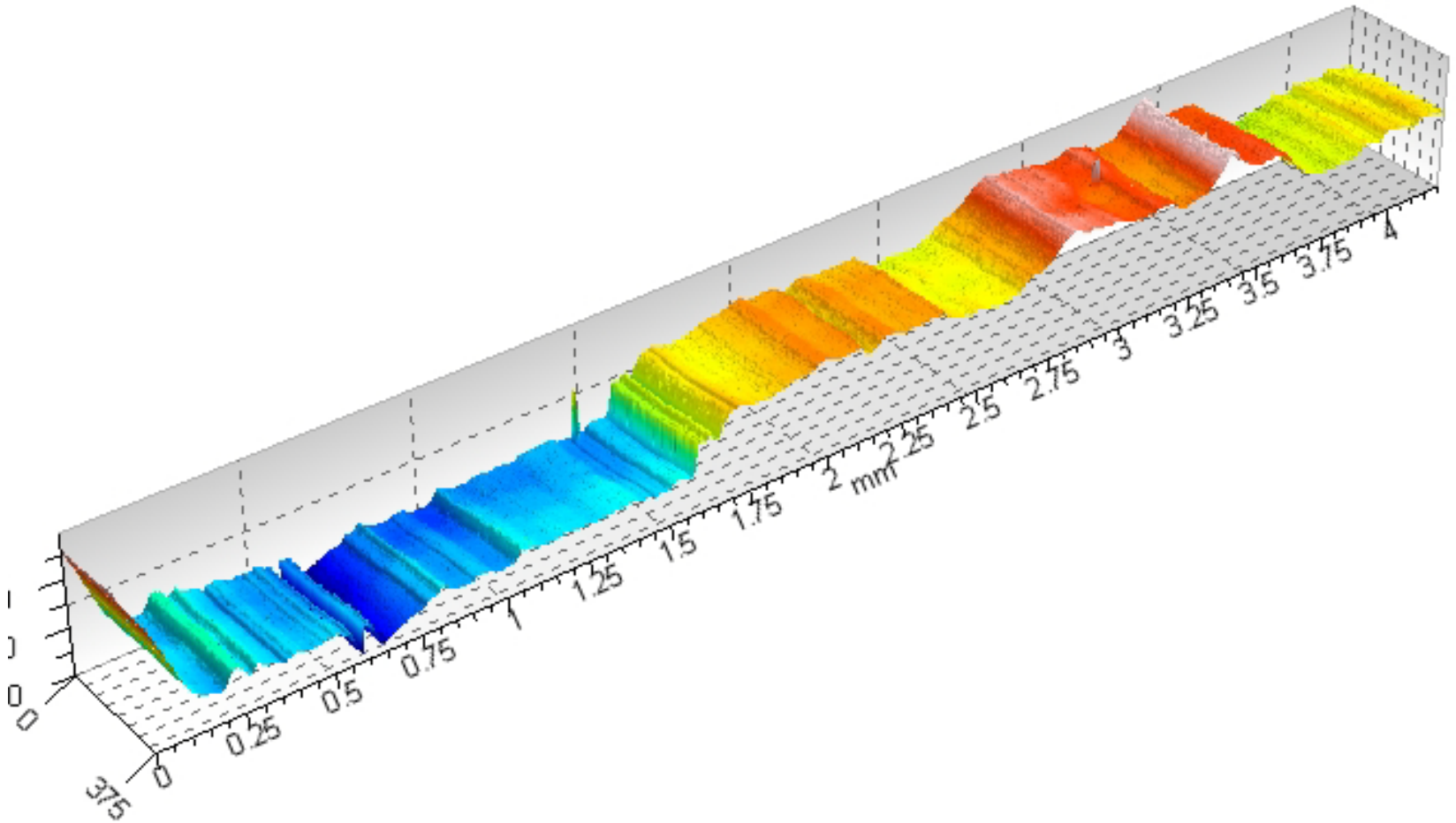

3D data collected by Ms. Loretta Kuo using Zeiss Axio CSM 700

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MUZZLE TO TARGET: 5 FT

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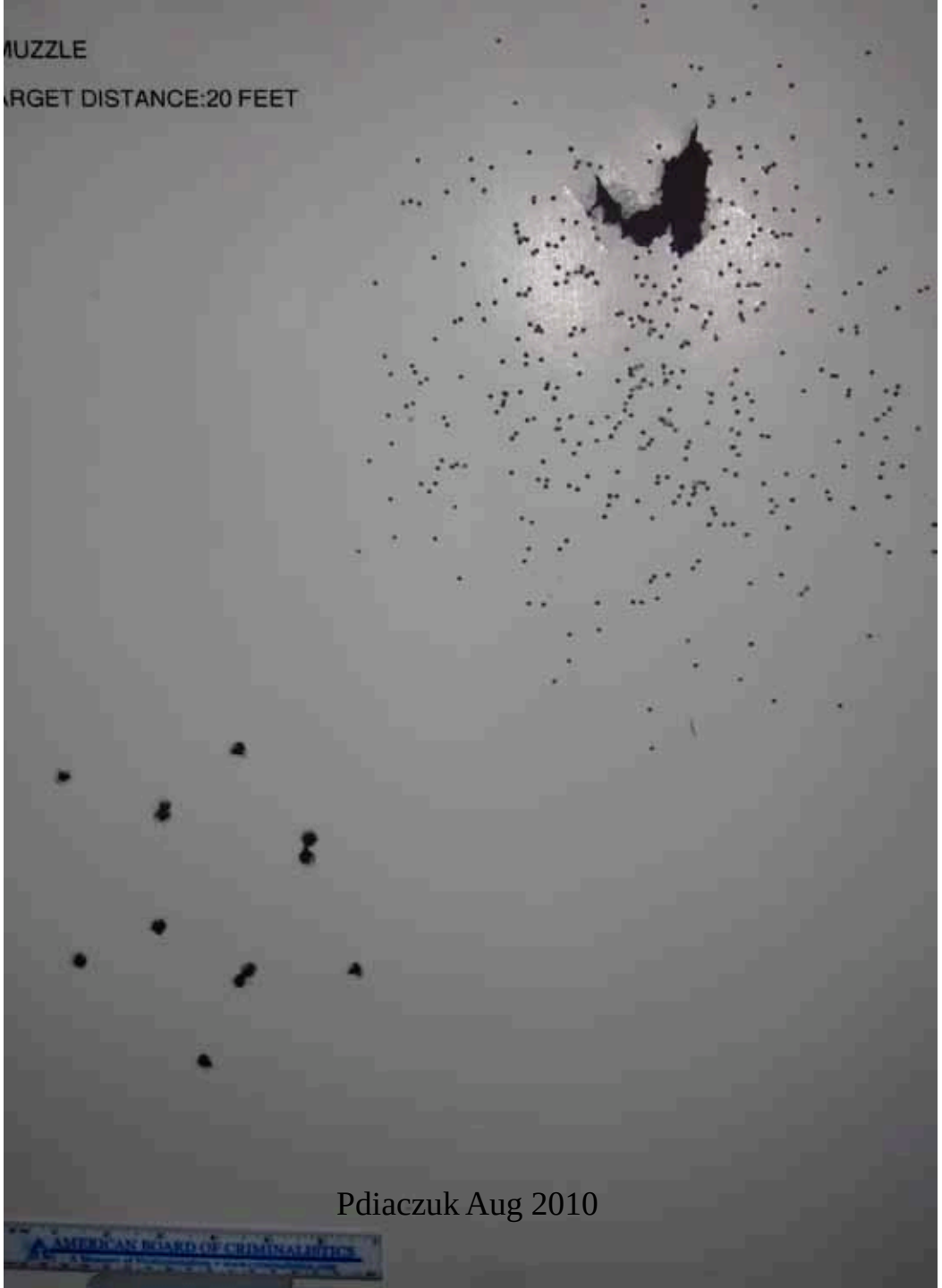

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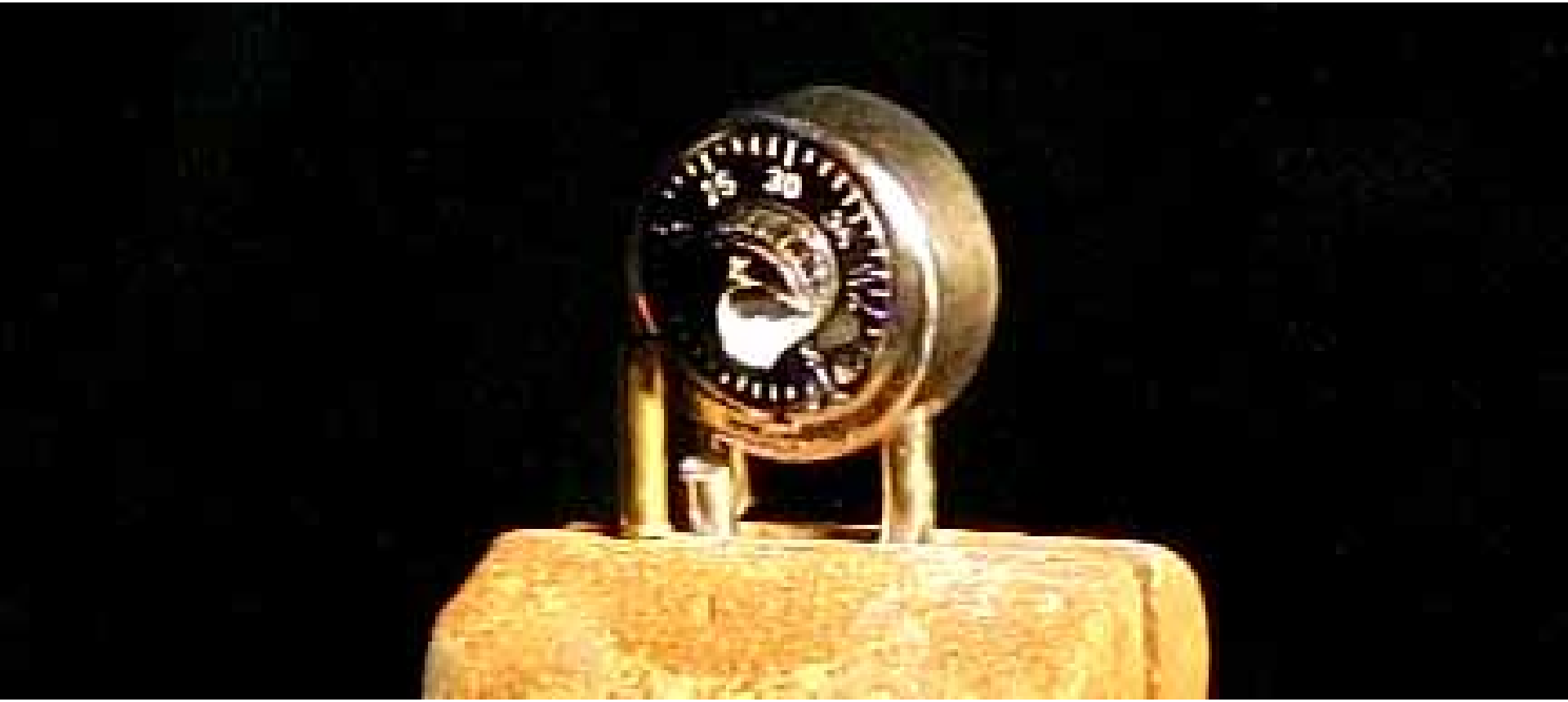

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Pipes

- 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

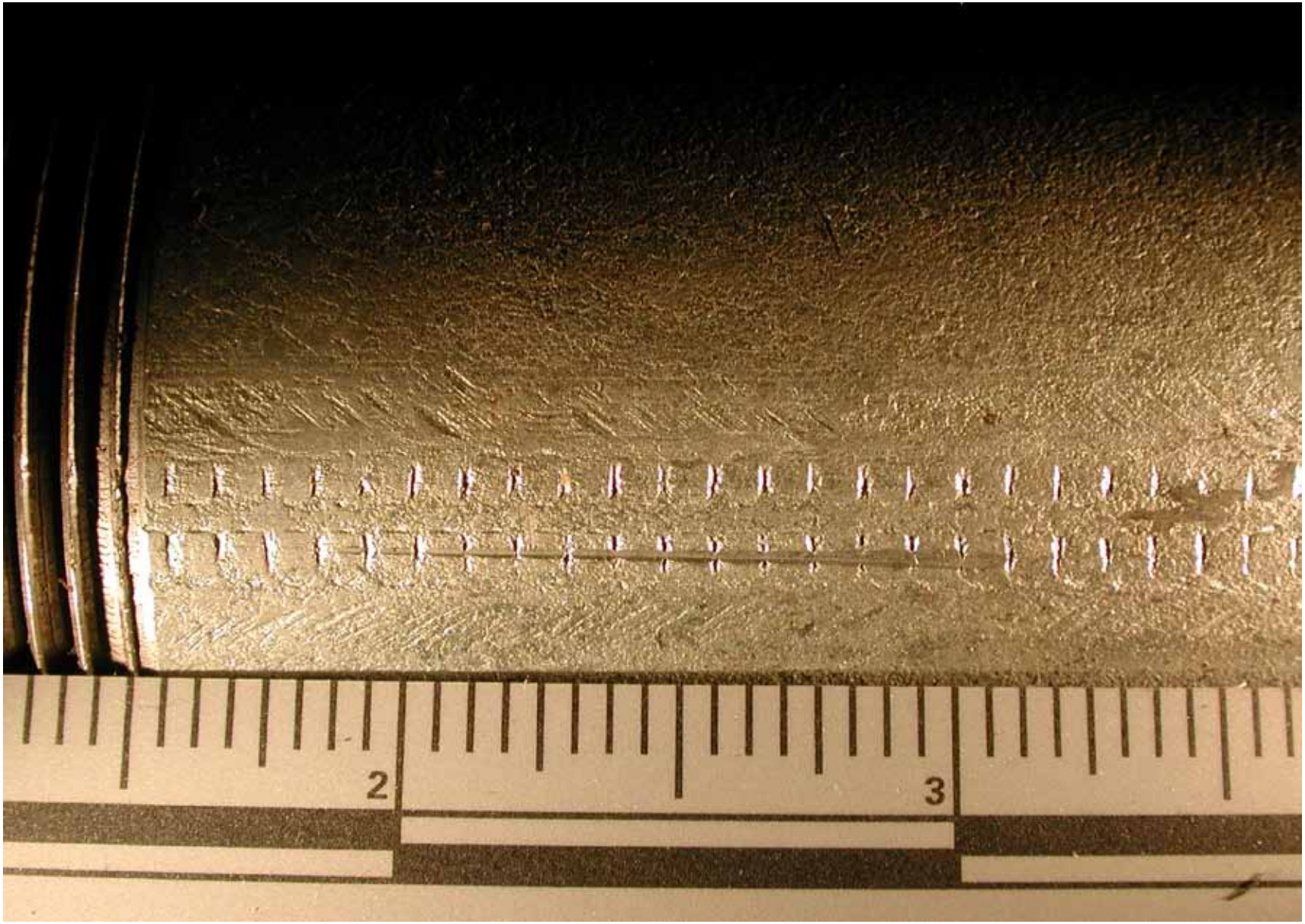
- ASTM A 53 / A 135
- Schedule 40 most common
- 1/8th inch to 12 inch diameter
- Nipples: “close” to 12 inch from 21 foot length

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



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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

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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

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Factory Mu[illegible]

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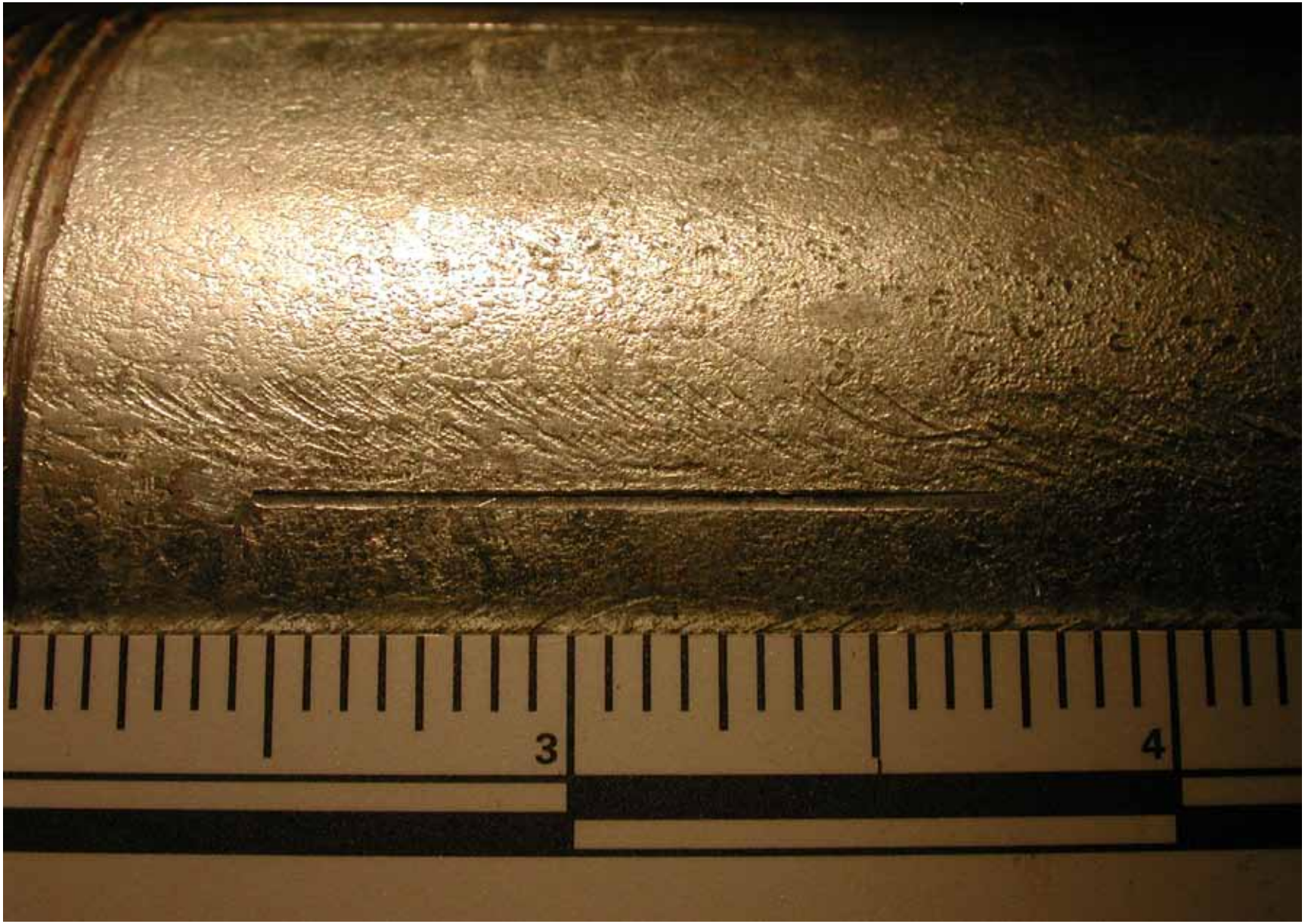
Nipple formation

- 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

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.



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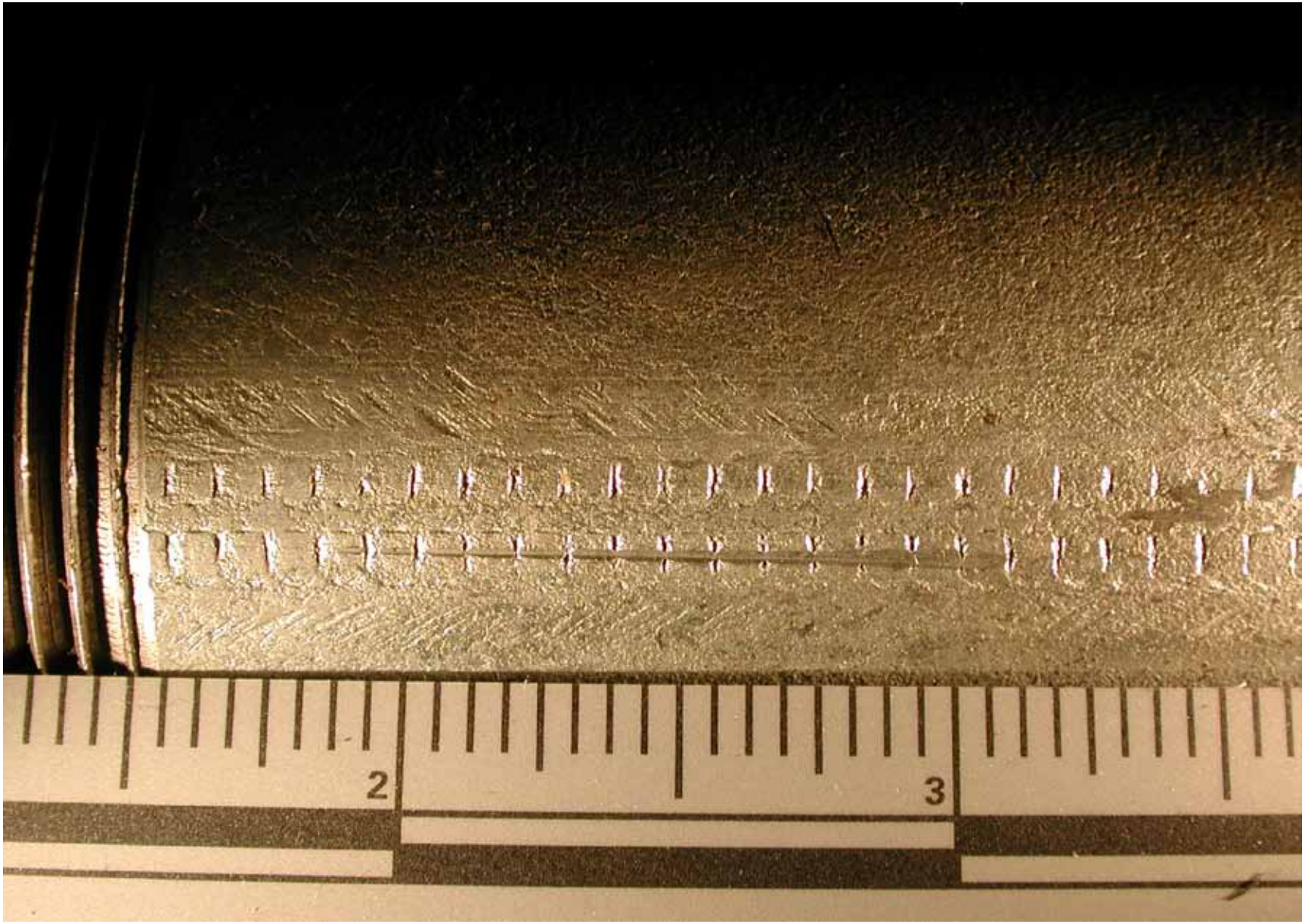

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Nipple formation

- 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.

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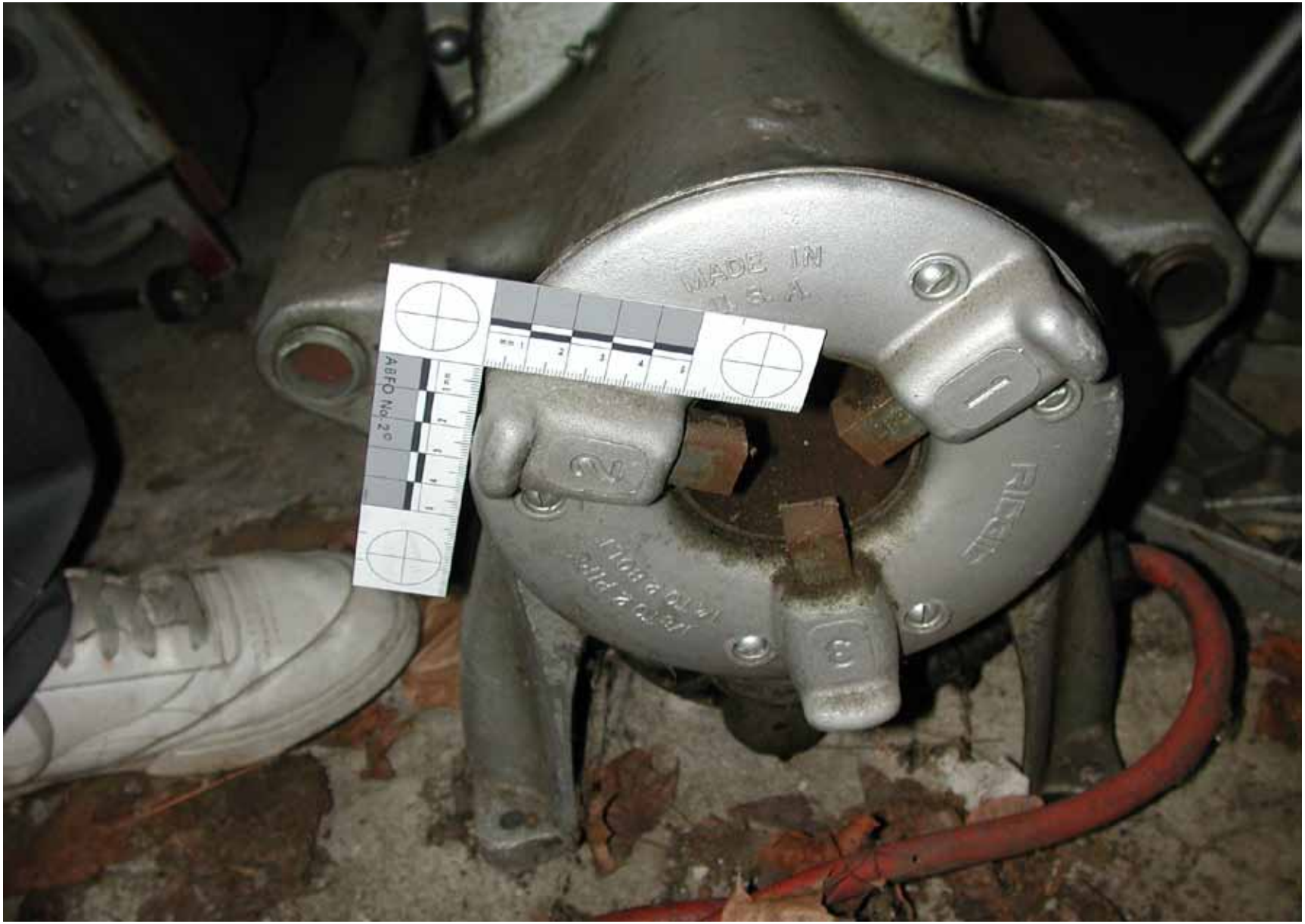

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Nipple Formation

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

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Thank you

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