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Individual Characteristics Criteria

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Abstract

How to raise the new examiner's confidence level as to what consitutes individual characteristics and how they are made.

Firearm/toolmark identification is grounded in the fact that individual characteristics (also called accidental characteristics) produced by a particular firearm or tool are unique to that item -- just as fingerprints are unique to a particular individual. How can firearm/toolmark examiners be certain each firearm or tool leaves totally unique "prints" behind? What causes these individual characteristics of firearms and tools?

Certain characteristics are imparted during the time of manufacture. Others occur during the use of the firearm/tool. For example, a common flat blade screwdriver's tip, which during manufacture is ground to shape, is left with striations that may be visualized under microscopic examination. Then, the use or misuse of the flat blade over a period of time also has the effect of further individualizing the working end.

It is easy to accept that individualizing characteristics acquired during the use or misuse of a firearm/tool make the tool's "fingerprints" unique. But what of newly manufactured firearms or tools, especially those machine manufactured consecutively -- one right after the other? Are there enough individual characteristics present to distinguish between marks left by these tools?

For those who are beginning in the field, one part of the required training is to examine bullets fired from consecutively made barrels and/or toolmarks made by consecutively made tools. There is also a need for an examiner to be aware of not only how the production process is accomplished, but how that process effects the outcome of individual characteristics. These first steps of firearm/toolmark examination help to serve as a basis for the student's self confidence that "Yes, **most of the time** you **can** distinguish between two sets of bullets fired from two consecutively made barrels and marks made by consecutively made tools." Yet for those many firearm/toolmark examiners that do not live near barrel/tool manufacturing facilities, and work under tight budget conditions that preclude them from touring manufacturing facilities and witnessing first hand how barrels/tools are produced, the following information and resources may be of help in this important grounding.

First, in the area of firearms, let's review what barrel rifling methods are in use today: [1]

1. BROACH, GANG -- A tool having a series of cutting edges of slightly increasing height used to cut the spiral grooves in a barrel. All grooves are cut with a single pass of the broach.

2. BROACH, SINGLE -- A non-adjustable rifling cutter, which cuts all of the grooves simultaneously, and is used in a series of increasing dimensions until the desired groove depth is achieved.

3. BUTTON -- A hardened metal plug with a rifled cross section configuration. It is pushed or pulled through a drilled and reamed barrel so as to cold form the spiral grooves to the desired depth and twist. When the carbide button was first introduced it was described as a SWAGING PROCESS or SWAGED RIFLING.

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4. HOOK -- A cutting tool which has a hook shape and only cuts one groove at a time.

5. SCRAPE -- A cutting tool which cuts two opposing grooves at a time.

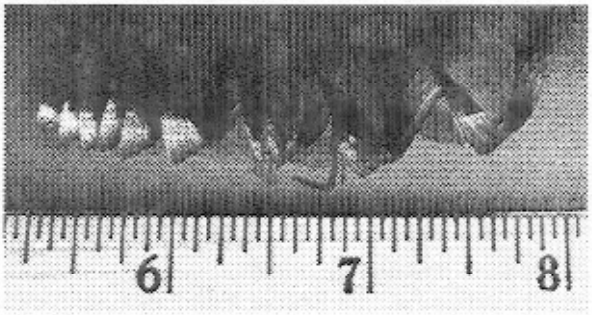
6. SWAGE -- An internal mandrel with rifling configuration which forms rifling in the barrel by means of external hammering. Also known as HAMMER FORGING. [2]

7. Recently the addition of Electrical Discharge Machining (EDM) had been applied to the "cutting" of rifling into gun barrels.

Broach rifling dominates rifled barrel production, followed by button rifling. Though all of the above cutting methods will leave unique individual characteristics within a firearm's barrel, as produced at the factory, the button, swage and EDM processes **may or may not** leave **enough** individual characteristics to separate one barrel from another **as it leaves the factory** (though this can change quickly with use). This is commonly seen in barrels produced by GLOCK. Even though there are individual characteristics present on the sides of the fired bullets, there may not be enough to separate one barrel from another.

Next, let's note valuable information that has been presented at AFTE Training Seminars. **Dave Brundage**, Indianapolis-Marion County Crime Lab, reported in his presentation at the 1994 seminar, the results of testing by a number of laboratories of bullets fired from consecutively made 9mm Ruger barrels. In this case, those bullets were identifiable to each barrel. These barrels are presently the property of the Carbondale Laboratory, Carbondale, Illinois and are available upon request. In 1996, Collaborative Testing issued a consecutively made letter stamp proficiency test. Again, each of the stamps were found to have enough individual characteristics to leave unique "prints." These consecutively made letter stamps are presently the property of this author and available upon request for your own testing and study.

Lastly, a source of valuable and personal experience that is available to all agencies and individuals can be found in a waste chip (photograph #1) left over as scrap, from a common metal lathe used at local machine shops (photograph #2). The cutting tool (photograph #3) of the lathe is normally formed by grinding it to shape and then placing it into the tool post holder (photograph #4). The shaping/sharpening of this single cutting tool is similar to the process applied to the gang broaches (photograph #5) that firearm manufacturers such as Smith & Wesson have used for a number of years.[3]



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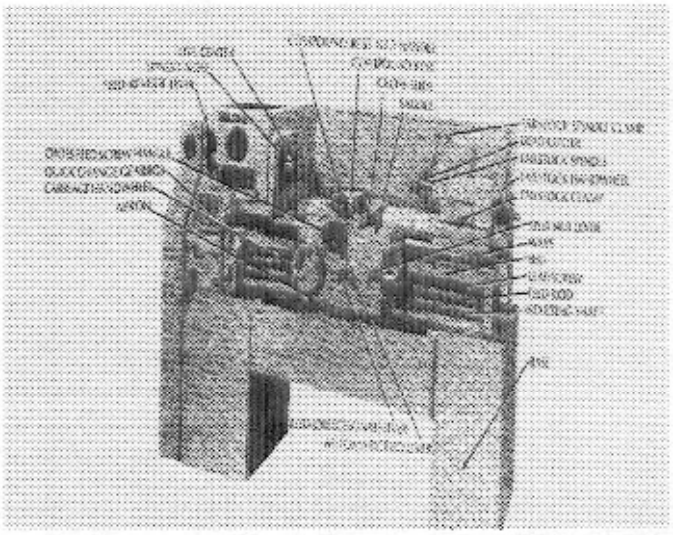

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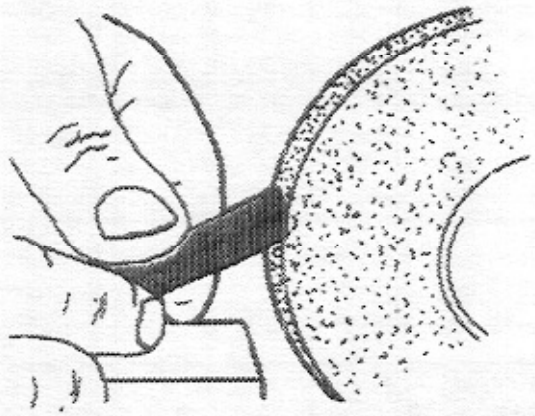

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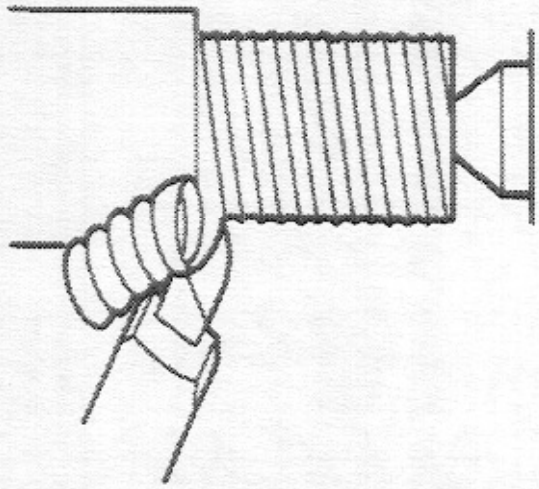

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When the lathe's cutting tool is applied to the base metal (photograph #6) during the turning process, a ribbon of metal is produced. This ribbon , or chip, can vary in width and thickness, but one thing in common is the linear striations produced by the cutting process (photograph #7). This chip will be virtually a mirror of the cutting tool's edge, and will microscopically continue to change during the cutting process as the tool's edge wears away. (The cutting process that occurs in the barrel of a gun when the cutter(s) is being drawn through the barrel also leaves short, small pieces of ribbons with similar striations.) If a Mirosil cast is made of several areas on this ribbon of metal, approximately 1/2 inch apart along its length, then, these Mirosil casts can be inter-compared under a comparison microscope to verify each one's individuality and *family characteristics*.

What are family characteristics? The identification of lathe shavings was first reported by **David Townshend** and **Robert Cilwa** back in 1978. [4] As was expected, there were fine individual microscopic differences along the chip, even just 1/2 inch apart. But, what **Dr. Robert Levine** noted (1990 AFTE Seminar presentation: "Family Characteristics in H&R Barrels"), was that mixed within the individual characteristics (photograph #8), were what he called "family characteristics." Family characteristics can be broadly viewed as gross stria that carries from barrel to barrel, or along the flat of the chip as it is removed from the metal parent material. **George F. Reich** of the Suffolk County Crime Lab, also at the 1990 AFTE Seminar, discussed similar "family characteristics" found when examining large numbers of 25 caliber Titan semiautomatic pistols. *Family characteristics are not to be confused with individual characteristics.*

So, what can knowledge of tool/firearm manufacturing techniques, the results of previous testing of consecutively made firearm barrels and tools, and a common waste chip from a lathe teach us? It can teach us at least two important pieces of information. 1) For those new to the field of firearm/toolmark identification, do not mistake *family* characteristics for *individual* characteristics, and 2) individual characteristics **are** discernible, even within a short section of material. This knowledge can reinforce the confidence level of the new examiner in court when he or she makes the statement, "This bullet was fired from this gun, to the exclusion of all other firearms."

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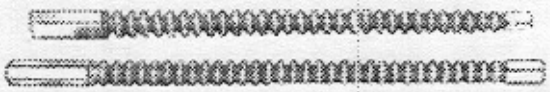
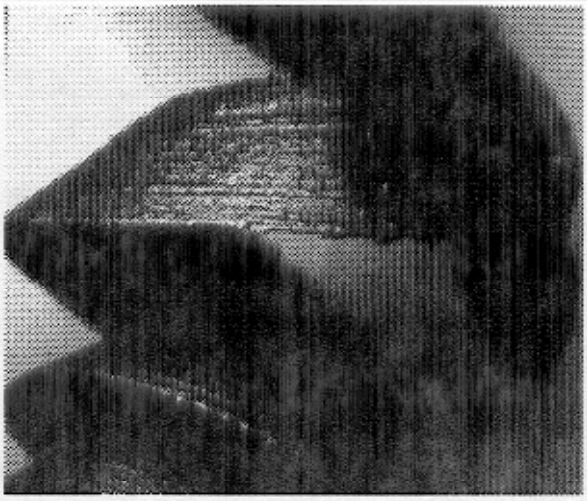


Broach #5



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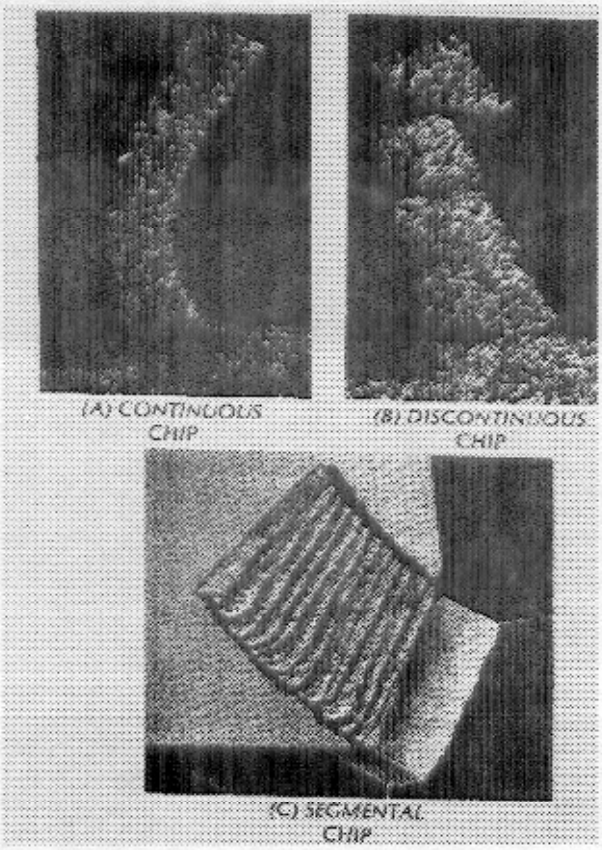

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[1]AFTE Glossary-3rd Edition page 92
[2]AFTE Glossary-erd Edition page 92
[3]Currently in the process of switching over to EDM produced barrels within their product line.
[4]AFTE Journal (Volume 10, Number 1) 1978