

COMPARISON MICROSCOPE OVERVIEW:

INTRODUCTION

HISTORY

WORKING PRINCIPLE

APPLICATIONS

LIMITATIONS

CASE STUDY

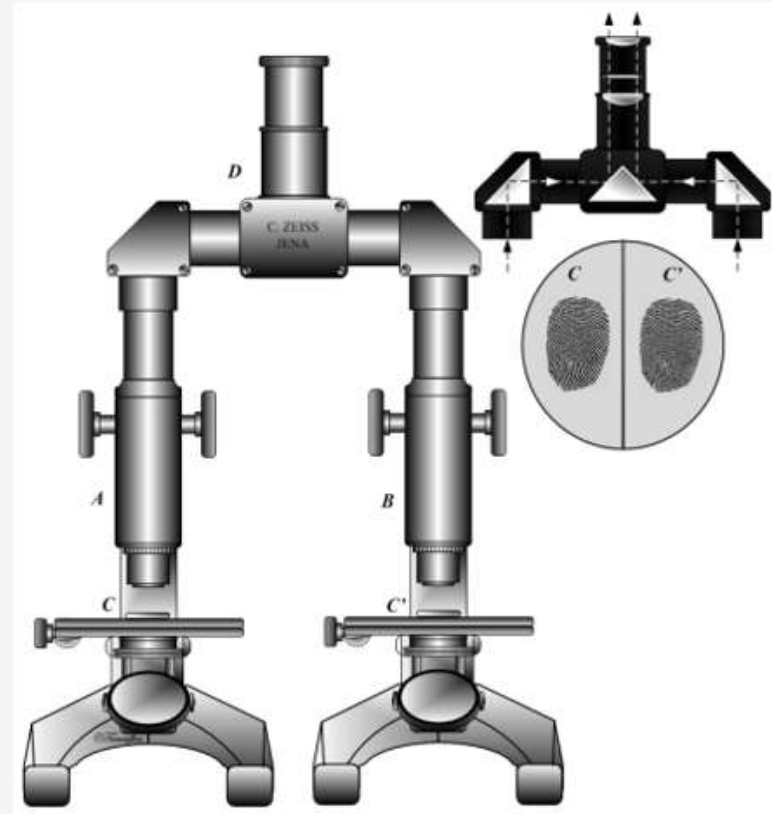
CONCLUSION



INTRODUCTION:

➤A comparison Microscope is a combination of two compound Microscopes that are connected with a comparison bridge used to observe and match evidence side by side which results in a split view window enabling two separate objects to be viewed simultaneously. This avoids the observer having to rely on memory when comparing two objects under a conventional microscope.

The primary use of this type of instrument is criminology as in ballistics, other scientific fields including paleontology and archaeology utilize these special compound microscopes.



HISTORY 1/2

- The comparison microscope was invented in the 1920s by American Army Colonel Calvin Goddard (1891 -1955)
- He was working for the Bureau of Forensic Ballistics of the city of New York.
- Along with him , Philip O Gravelle, a chemist, developed a comparison microscope for use in the identification of fired bullets and cartridge cases with the support and guidance of Forensic ballistics pioneer Goddard. Goddard also benefited from the help of Colonel Charles Waite and John Fisher.



HISTORY 2/2

- It was a significant advance in the science of firearms identification in Forensic Science.
- The firearm from which a bullet or cartridge case has been fired is identified by the comparison of the unique striae left on the bullet or cartridge case from the worn, machined metal of the barrel, breach block, extractor, or firing pin in the gun.
- The microscope was popularised in 1927 during the Sacco and Venzatti case.(Explained in the case study, slide No.13)

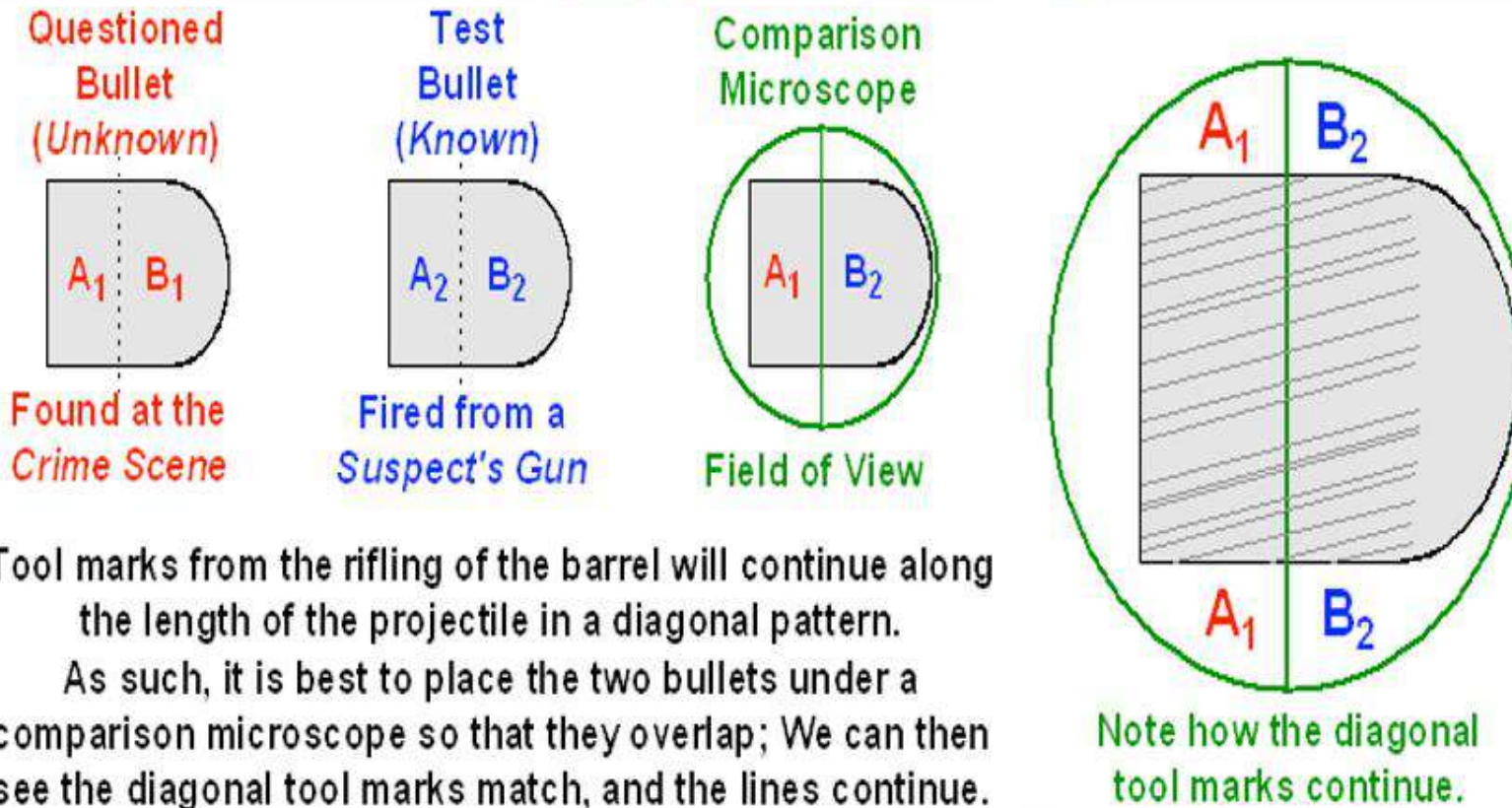
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WORKING PRINCIPLE 1/4

- The idea behind the Comparison microscope is simple.
- Two microscopes are placed next to each other and the optical paths of each microscope are connected together by the optical bridge.
- The optical bridge consist of a series of lenses and a mirror that brings the two images back together at the single eyepiece.
- The user looks through the eyepiece as with a regular microscope except that a line in the middle separates the circular view field into two parts.

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WORKING PRINCIPLE 2/4



Tool marks from the rifling of the barrel will continue along the length of the projectile in a diagonal pattern. As such, it is best to place the two bullets under a comparison microscope so that they overlap; We can then see the diagonal tool marks match, and the lines continue.

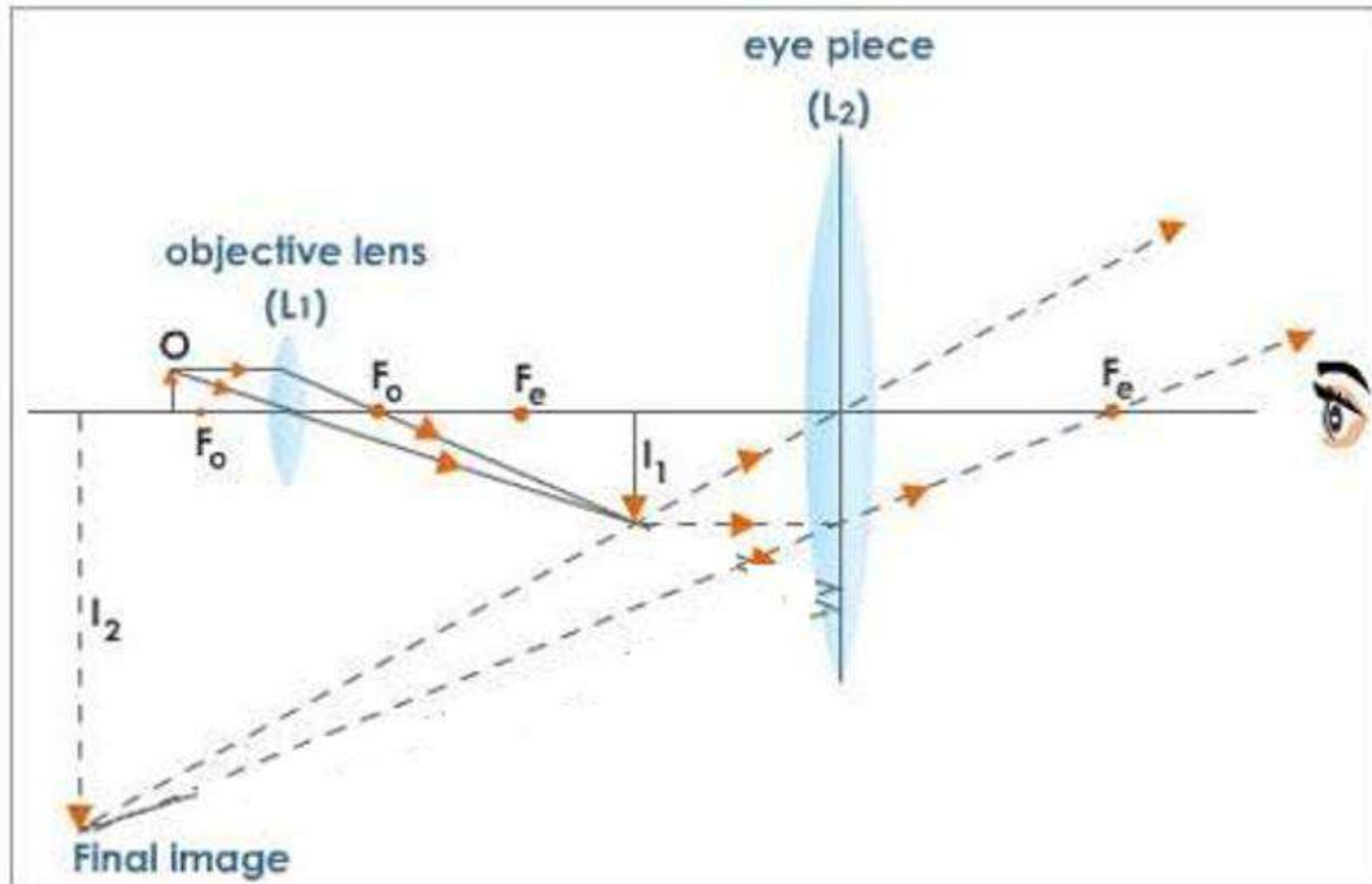
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WORKING PRINCIPLE 3/4

- The left side of the view field is the image produced by the left microscope, and the right side of the view field is the image produced by the right microscope. In some more modern or sophisticated comparison microscopes, it is also possible to super-impose the view fields generated by the two microscopes.
- Comparison microscopes are mostly used in a reflected light setting, but a transmitted light setting is also available in some instances, and fluorescent light settings are found on higher-end models. This allows for comparison of more than just bullets and tool marks.
- Virtually all modern comparison microscopes have a camera mounted on the eyepiece to capture the compared images.

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WORKING PRINCIPLE 4/4



APPLICATIONS1/4

- Forensics examination of spent cartridges
- Micro-stamping gun firing pins
- Forensics examination of bullets:-
 1. According to class characteristics:

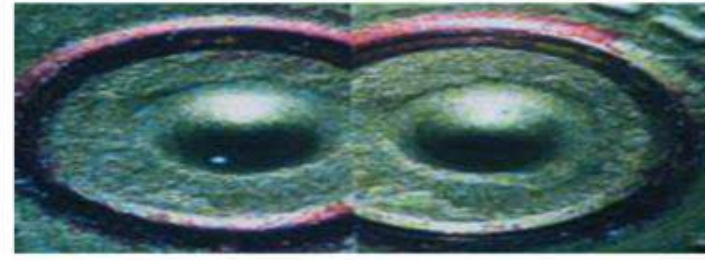
The three main class characteristics of all bullet are

 - a) the lands and grooves
 - b) The caliber of the bullet, and
 - c) the rifling twist.
 2. According to individual characteristics

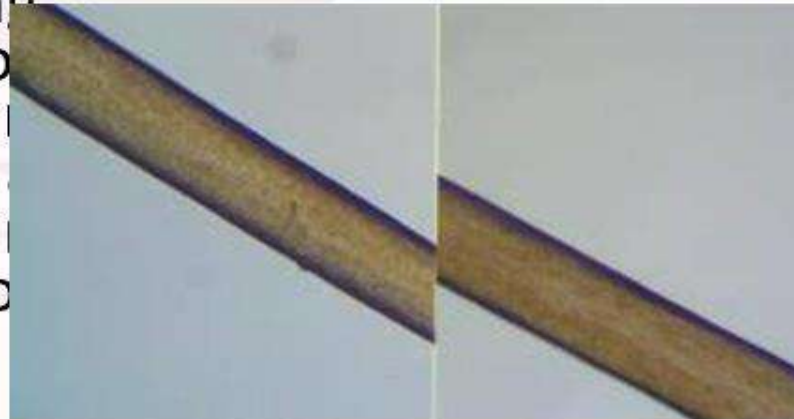
-by individual striation mark on bullet.

APPLICATIONS 2/4

- Marks on spent cartridge
Firing pin Mark
- Individual to each gun
- Left on Cartridge and firing pin strikes the bottom of the cartridge
- Other evidence, including impressions of serial numbers or characters from a typewriter can also be compared. When used in transmitted light setting, hair fibers or the extruding striations of plastic bag can be compared



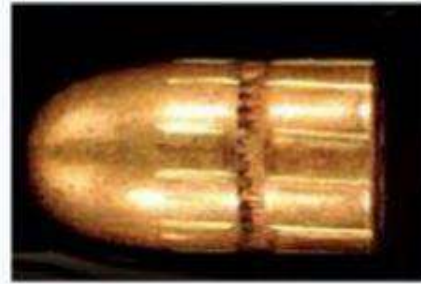
Images of two bullets casings as seen through a comparison microscope



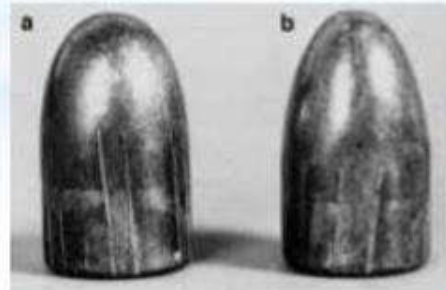
APPLICATIONS 3/4

* Forensic examination of bullet

Land and groove marks

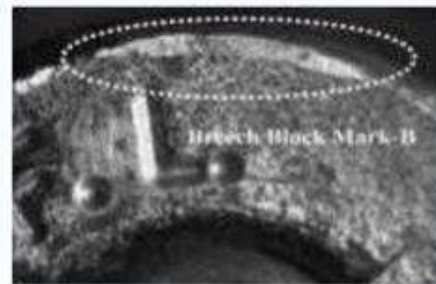
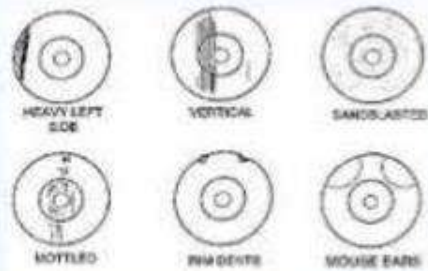


Rifling Twist

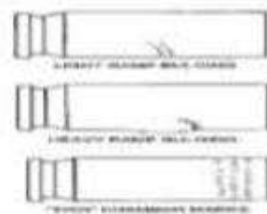
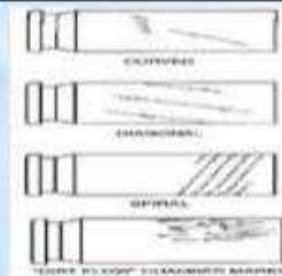


APPLICATIONS 4/4

Breach mark



Extractor or ejector mark



LIMITATIONS

- The device is very costly.
- It requires very accurate handling.
- The person using the device must be an expert.

CASE STUDY

Sacco and Vanzetti Case

- Forensic innovator Calvin Goddard solved the case of murder of Beardelli.
- He fired a bullet from Sacco's into a wad of cotton and then put the ejected casing in the comparison microscope next to casing found at the scene.
- The first two casings didn't match Sacco's gun, but the third one did. It was found that the two cartridges fired from the same bullet.
- On April 8, 1927 were finally sentenced to death on electric chair.

CONCLUSION 1/2

- Comparison microscope is a very important tool from forensic point of view. It is very less time consuming device as it helps to compare side by side instead of comparing the evidence separately. Use of a comparison microscope is straight forward.
- The incriminated impression, typically a bullet or casing found at a crime scene or a tool mark's cast from a crime scene, is placed under the left microscope and thus, appears in the left part of the circular view field.
- A comparison impression, such as a bullet fired from a revolver found on a suspect, is placed under the right microscope and thus, appears in the right part of the view field.

CONCLUSION 2/2

- When comparing striations, the Forensic Scientist moves the comparison object until the striations match the ones present on the incriminated object. If the striations do not present similarities, then the two objects cannot be associated with a common origin. If the striations match, then a common source between the two objects is established. When comparing impression marks, the Forensic Scientist can use the super-imposition option and, again, by moving the comparison object on the right, try to find common characteristics between the two objects.

References:

- ["A Double Microscope with One Eyepiece"](#). Popular Mechanics Magazine. **19**: 642. May 1913 – via [HathiTrust](#).
- <https://www.slideshare.net>
- Jurgen Thorwald, **The Century of the Detective**, New York: Harcourt, Brace & World, 1964
- John H. Dillon, Jr , Comparison Microscopy: The Origins of Firearms identification, A Practical Application of Forensic Science, Technology and Engineering to Case Linkage in Shooting Incidents Not Previously Related by Investigative personnel, BulletTRAX-3D, [MatchPoint Plus](#) and the Firearms Examiner, 2005.



THANK YOU

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