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FIRING PIN SCRAPE MARKS AND THE IDENTIFICATION OF FIREARMS

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Firing pin scrape marks are frequently found on the fired cartridges. They are very useful in the identification of the fired shells in the following conditions:

1. When the percussion cap is pierced through and thus firing pin indentation is rendered nonidentifiable,
2. When the percussion cap is blown off,
3. When 'multi-hits' on the shell spoil other marking details,
4. When the shells are fired through high grade weapons with too smooth firing pin to leave individualizing details in their impressions,
5. When the firing pin imprint is too feeble for identification purposes,
6. When the firing pin nose is filed slightly by the culprit in order to escape identification, the pertinent edge may still be left intact, (thorough tampering invites suspicion),
7. When the anvil swells up the bottom of the firing pin imprint and masks or distorts the details therein.

In the author's laboratory the last listed phenomenon has been found often in 12 bore cartridges manufactured at Kirkee (India), and less frequently, in the cartridges of foreign make.

The swelling of the bottom of the firing pin impression, for want of a better term, may be designated as "anvil impression," as the swelling is caused by the anvil. As a rule the anvil should be reasonably sharp and rigidly supported at the bottom in order to ensure the cap adequate sensitivity and rigidity. The anvil may or may not be integral part of the chamber, but it rests on the bottom of the chamber. The lack of rigidity of the anvil is the probable cause of this trouble. Other factors, such as high pressure, soft cap metal, unfavourable shape and position of anvil, etc. may also accentuate this trouble. When anvil impression is present, identification under stereo-microscope becomes very difficult. A composite photograph

(of crime and test cartridges) may convince an expert, but the presentation of the photograph in court becomes a handicap to the expert rather than a help as illustration.

In fact "anvil impression" has diverted our attention to explore the possibility of using firing pin scrape. The firing pin scrape marks on cartridges are found owing to lack of clearance in the following type of weapons:

1. Hammerless guns in which firing pin retreats to its hole only when the breech is broken open,
2. Locally made weapons, the weapons made by an iron smith who is ignorant of theoretical ballistic considerations and has no specific precision tools within his reach which are required for the purpose,
3. Defective weapons.

The explanation may be any one of the following:

1. The firing pin is a bit too long. It is more likely in the case of locally made guns or high grade guns with side locks (with back or bar action), in the latter the firing pin is not integral part of the tumbler (striker) and is replaceable.
2. The spring which restores the pin to its original position after firing, is too slow in its action.
3. This spring is absent, and the firing pin remains protruded due to sustained pressure of hammer. It is frequently found in locally made guns.
4. The pressure developed in the firing is high. In this case it is likely that the metal of the cap surrounding the pin may mould itself around the pin and retard the motion of it.

A perusal of the literature reveals that no study has been made to establish utility and importance of firing pin scrape marks for identification of the

weapons. Burrard¹ observes, "When a striker scrape is noted it can be of great help as it enables one to orientate the fired case correctly, that is to place it in the same position which it must have occupied in the chamber. It is always useful to know and frequently difficult to find out how cartridge fitted in the chamber (that is which way it was up). But a striker scrape settles this question at once." It shows that firing pin scrape marks are recognized as agency which merely helps to fix up orientation of a fired cartridge with respect to the chamber of the weapon. In a non-repeating break-action gun scrape marks are produced at 6 o'clock, whereas in a repeating gun the scrape marks of the firing pin are at the orientation of the ejector impression, stated in other words the scrape marks and the ejector imprint are situated on the same angular coordinates (polar) usually expressed in o'clock position. It is significant to note that no mention has been made by this noted author of the ability of the firing pin scrape marks to provide conclusive evidence for identification of weapons. Other workers and authors have also overlooked and undervalued the agency of scrape marks in the identification of firearms. The author is not aware whether the importance of the firing pin scrape marks has been stressed previously for direct identification purposes.

The reason, that this aspect of identification is not probed properly, may be traced back to the lack of interest in it. Weapons of offence in advanced countries are usually pistols, revolvers, rifles, light machine guns, but rarely 12 bore guns. In our country, however, 12 bore weapons form a very significant percentage (about 80%) of weapons used in offence. In autoloading and rifled weapons, as a rule, the pressure developed is sufficient to obtain even breech face marks. An expert is seldom required to probe thoroughly the evidence in firing pin impressions and other markings. Hence in those countries the interest and studies were limited. In 12 bore weapons, however, breech face marks etc. are usually non-existent. One has to take recourse to firing pin impression for the identification. Sharma² has brought home this point graphically. Some of the cases which defy identification through firing pin impression, may find their solution by matching of firing pin scrape

marks on test and crime cartridges. A systematic study of the firing pin scrape marks was therefore made to find out whether the scrape marks can be used for identification purposes.

Theoretically, firing pin scrape marks stand on the same footing on which the firing pin impression marks stand, which in turn are based on the principles of tool marks identification. Tool marks are divided into two categories:

1. Impression type marks which are produced due to static contact under pressure between a tool and a surface,
2. Striated or scratch type marks produced by a tool on a softer surface due to sliding contact, or to be more specific due to relative motion between the two surfaces.

In the case of impression type tool marks the impression is negative, the pits and bumps on the tool, for example, are imprinted as bumps and pits, respectively. In the case of sliding contact tool marks, instead of bumps and pits, ridges and valleys are scratched. The shape, size and relative location of these striations will be as characteristic as the details in the tool. As individualizing agents both type of tool marks enjoy well established recognition.

The firing pin, ejector, chamber, as well as breech face marks are produced on account of static contact, hence may be classified as impression type. The firing pin scrape marks are produced due to relative motion between firing pin (tool) and the surface (cap). When impression type tool marks of the firing pin are accepted, as it should be, for identification purposes, its sliding contact marks that is its scrape marks also deserve same recognition. It may be said that outer shape of the scrape marks may vary from round to round for the same weapon, but the striation details remain the same.

The usual difficulty with the striated marks is that one has to do a lot of experimentation for finding out correct region of contact, angle of tilt, and angle of the progression of the tool concerned in order to prepare specimen (control) marks under practically identical conditions for comparison purposes. Fortunately in the case of firing pin scrape marks the determination of these angles does not trouble an expert, for a firing pin scrapes at the same position in the same manner. The primer surface (copper or brass) is soft in comparison with metal of firing pin (steel), the details should not, and do not change quickly.

The idea of introducing sliding contact type tool

¹ BURRARD, MAJOR G., *THE IDENTIFICATION OF FIREARMS AND FORENSIC BALLISTICS*, New York, Scribners (1934), pp. 117, 120-121.

² SHARMA, B. R., *JOUR. CRIM. LAW, CRIMINOLOGY & POL. SC.*, 54, 378-380, (1963).

marks in the identification of weapons is not new. A bullet bears striated marks due to sliding contact between the bullet and the rifled barrel³.

While experimenting with a large number of weapons, mostly 12 bore shot guns of variety, it was observed by the author that, if a weapon produces scrape marks on the cartridges fired through it, it produces them with good consistency. It was also observed that the scrape marks do not remain confined to the cap, but frequently are also found on the base of the cartridge. Hence even if the cap is pierced through or blown off, this mode of identification is still applicable.

If a crime cartridge case is found to bear firing pin scrape marks, the following procedure of identification is used. Similar test cartridges are fired through the suspect weapon. Crime and test cartridges are placed on the stages of a comparison microscope and illuminated with beams of equal intensity falling at equal angles of incidence. The striations in the firing pin scrape marks on the two cartridges are compared and matched on the comparison microscope using matched lenses. Depth and curvature of the scratched surfaces are given due allowance.

It may be suggested that a cartridge fired through one weapon may bear scratches of another weapon. It may be done intentionally by placing the fired cartridge in the chamber of second weapon and extracting it. If such a cartridge case is identified merely by matching firing pin scrape marks, the result of the examination will be misleading. Such a suggestion can be countered on practical as well as theoretical grounds. It is conceded for the sake of argument that in addition to the weapon of offence the culprit has some other weapon at his disposal and is conversant with the principles of identification (though remotely possi-

ble), and has sufficient skill to mislead investigation on the suggested lines. Motivated as he is to disentangle himself and run away from the scene of crime as quickly as possible, he will find it more convenient to plant there a cartridge case fired through some other weapon in place of the genuine incriminating cartridge case.

Theoretical considerations of the starting point of scrape mark (it either starts from the bottom of the firing pin impression or is in continuation with upper end of the firing pin impression), eccentricity of the firing pin, location and shape of extractor mark will help an expert to avoid such pitfall.

Identification of weapons from scrape marks has been taken recourse to by the author in his laboratory in some otherwise insoluble cases. The learned judges were convinced with the explanations and satisfied with the presentation of the composite photomicrographs.

SUMMARY

In the identification of fired cartridges in respect of smooth bore weapons usually firing pin indentations provide useful and sufficient evidence for identification. When this evidence is not available, firing pin scrape marks, found in the case of certain categories of weapons, should be employed for identification purposes. Firing pin impressions are produced by static contact and the scrape marks by sliding contact. Both type of marks are equally good for identification. Scrape marks caused by firing pin bear individualizing features and should be given due weight for direct identification purposes.

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³ DAVIS, JOHN E., *TOOL MARKS, FIREARMS, AND THE STRIAGRAPH*, Springfield, Ill., Chas. C Thomas Co., 1958.