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THE IMPORTANCE OF FIRING PIN IMPRESSIONS IN THE IDENTIFICATION OF FIREARMS

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The importance of the firing pin impressions on fired cartridges in criminal cases is immense in our country. Firstly, the most common weapon of offence in the firearms category is shot gun. The projectiles fired through them do not offer much evidence to complete the link of the crime with the criminal, and therefore, the cartridge cases form the only important link. Secondly, the ammunition used by the criminals is more often than not old, which they have been able to collect from illegal sources. The pressure developed by the ammunition is often low, and the breech face marks, etc. are not properly imprinted, and, therefore, we have to depend upon the firing pin impressions for identification purposes. Lastly, the ammunition used by the criminals may be refilled cartridges. The cartridges normally are made by replacing the percussion caps, the rest of the cartridges being used as such. Thus a cartridge case (excluding the percussion cap) may bear impressions of more than one gun which can prove confusing to the expert. It is, therefore, important that the study of the firing pin impressions should be made thoroughly and foolproof.

The fired shells are very commonly left at the scene of heinous crimes, like murders, dacoities, and attempted murders. The culprits run away with the weapon, and the firearm sometimes becomes the only connecting link with the scene of occurrence. The fired shells are identified by firing test shells from the suspected weapon and comparison of the markings on the incriminating shells with the test shells. The various portions of the weapon which come into contact with the shells are firing pin or the striker; the breech face, the portion which surrounds the firing pin; the extractor; the ejector; and the chamber. These parts leave their imprints on the fired shells due to the immense pressure developed when the

cartridge is fired. The pressure is transmitted in all directions and to the extent of 3 to 22 tons per square inch, and brings the cartridge cases in contact with the various parts of the gun. In this way striation details from the surfaces are permanently left on the fired cartridges and form the basis of identification.

It is inherent in the process of manufacture that these surface irregularities on the various parts are never alike in any two weapons though they may be the same make, kind, and batch. Even in the case of double barrel weapons, there will be non-identity of the markings of the two barrels. This is due to the fact that in the way the surfaces are processed, it is impossible to obtain two surfaces alike. The surfaces are cut with cutters which get blunted after each stroke. The surfaces may be levelled with files/machines. Again the filing process is so irregular that no two surfaces are obtained with like striation. The surfaces may further be finished with sand and/or emery papers, etc. However, all these processes are again irregular, and the microscopic details left on the surfaces is never found identical. It is non-identity of these surfaces which individualize the weapon from which a particular cartridge case is fired, because it is the impression of the surfaces which forms the thumb print of the gun on a particular cartridge case.

It may be argued that the surfaces should also change when they come into contact with the cartridge cases at such a high pressure as mentioned above. Some changes do take place due to this contact, but weapons are normally made from steel while the cartridge cases are made either from brass or copper. The latter metals are much softer than steel. So the changes made on the surfaces of the weapon are, even after quite a good number of shots almost unnoticeable. However, if thou-

sands of shots have been fired from the same weapon, or it is ill-kept or misused, it may become difficult, if not impossible, to establish the identity of the markings on the shells of the first and last shot.

The most important constituent in the "thumb print" of the weapon is the firing pin impression. The cartridge is fired only if the firing pin strikes with a certain amount of force. Therefore, it has to come into contact with the cartridge without fail and leave its impressions on its percussion cap. The clarity of the markings of the firing pin will of course depend on the pressure which is developed by the cartridge. Only in a few cases will the markings be indistinct so as not to permit identification. As regards the breech face, it also comes into contact with the cartridge. However, its impression will be imprinted on the cartridge only if the case strikes back the breech face with a certain minimum velocity which may be prevented in most of the cases either by the low pressure created in the cartridge or by the chamber which may hold the cartridge case if it is slightly tight. The markings left by the ejector and extractor become prominent only if the firing develops sufficient pressure which is not a fact in most of the cases. Chamber marks are still less common due to the fact that the diameter of the chambers of the weapons are made slightly larger than the diameter of the cartridges which are intended to be fired from the weapon, and unless there is some defect in the chamber its markings are seldom encountered.

The author has made a critical study of the fired cartridge cases in about 600 firearm cases where the weapons used were mostly 12 bore guns, a few rifles, and a few revolvers and pistols. The breech face markings on most of these cartridge cases were practically non-existent. The extractor, ejector, or chamber markings were found only in rare cases. Therefore, only the firing pin impressions could be examined and compared with those impressions on fired test cartridges. They were characteristic and individualistic in, at least, 98% of cases while in less than 2% cases the impressions were feeble and could not permit identification. This excludes those cases where the firing pin impressions were mutilated by several hits or by attempts to destroy the cartridge cases by hammering, filing, or burning. Further, it also does not include cases where the firing pins of the suspected weapons were tampered with or destroyed altogether. The experience has convinced the writer

that the firing pin impressions are alone sufficient to permit positive identifications. These findings are consistent with those reported by Lucas.¹

The cartridge cases are normally examined under the stereo microscope for preliminary check up where three dimensional view is obtained with magnified image up to about 20 diameter. Larger magnification up to 100 diameter can also be easily achieved with the stereo microscope, but the same is seldom needed. After the preliminary examination the firing pin impressions are examined under comparison microscope, and the various points of similarity of the firing pin impressions are observed side by side and also adjudged for their relative positions. The combined result of the examinations, i.e. that of stereo microscope and of the comparison microscope does lead to foolproof results and can be illustrated by photomicrographs of the firing pin impressions taken side by side and also by composite photomicrographs to the layman.

From the above, it must not be construed that the identification of the fired shells from the firing pin impressions is a smooth-sailing process. In the absence of breech face, the extractor, and chamber marks, the difficulties of identification are increased manifolds. The main difficulties in identification of fired shells from firing pin impressions result from the smallness of the impressions, sometimes due to the shattering of the percussion cap and quite frequently due to tampering of the firing pin.

The firing pin impression is formed at some depth. The depth of the impression may vary from one cartridge to another depending upon the pressure created. If abnormal pressure is developed the cartridge case is shattered. Even with high pressure, the percussion cap bulges out and makes the study of the striation details more difficult. It is, therefore, desirable that the test cartridge should be of the same make and batch whenever possible. Or at least, the test cartridges fired should develop approximately the same amount of pressure which had been developed in the crime cartridge. This pressure can be adjudged by depth of the impression itself. When the pressures are almost alike the difficulty of the examination of the striation details is overcome to a great extent.

The important factor in the study of the stria-

¹ A. LUCAS, FORENSIC CHEMISTRY AND SCIENTIFIC INVESTIGATION, pages 210, 240 and 242. Lucas reports on an investigation of 250 cartridge cases that 97.8% contained firing pin impressions which were distinctive and characteristic.

tion details is proper type of illumination. The smallness of the firing pin impression and slight differences in the pressure developed in the cartridge cases make it imperative that the lights strike the cartridge cases at the same angle and with alike intensities. The striation details are studied by the brightness and the shadows created by them and unless the illuminations are at the same angle the details revealed by the brightness and the shadows will not be alike and can confuse the examiner. This is especially true, when the percussion caps in the fired cartridge cases had bulged out to different extents. However, if all the factors are taken into consideration and proper illuminations utilized the difficulties are not so great as are considered by some authorities.

The shattering of the percussion cap introduces a different type of difficulty in the study of the striation details. If it is so destructive that the portions of the percussion caps have blown off, nothing much can be done. If the firing pin has only pierced the cap at a particular point, the study can still be made. The portion bearing the impression is straightened and is properly cleaned to bring it to its original brightness. Great care is taken to avoid introduction of additional scratches etc. on the surface bearing the impression. The cartridges with pellet charge and some of the wads removed are fired for comparison purposes. Removal of pellet charge etc. prevents shattering. If however, the firing pin still shatters the cartridge case, the powder content of the cartridge case is also reduced by a suitable amount. The study of the striation details is then carried out in the usual way. It may be mentioned that the study can also be made with a shattered test cartridge, though it is not desirable.

The other type of difficulty in the study of the firing pin impressions is the tampering of the impression on the crime cartridges which is rare but frequently can prevent identification.

The last source of difficulty may be the relative positions of the firing pin impression and the breech face markings. They may not be identical in the crime and test cartridges. This happens sometimes due to either the looseness of the percussion cap or due to the revolving of the firing pin or due to the displacement of the base where the base is separate from the cartridge tube. It can confuse the inexperienced workers. In such cases the firing pin impressions and the breech face markings are compared independently.

It may be pointed out that in the course of my evidence, certain learned Sessions Judges and defence counsels remarked that the diameter of the firing pin is so small that the striation details contained on the firing pins and hence imprinted on the cartridge cases could yield erroneous results at least sometimes. However, it was pointed out to them that the small diameter of the firing pin which is about 2 millimeter or less may be insufficient to permit the examination of the details by the naked eye, but this examination should not be attempted with eyes alone. The cartridge cases are examined for the firing pin impressions under microscope where the magnification of a thousand times can easily be achieved and hence the small diameter of 2 mm can be enlarged to 200 cm but magnification of this order is never required and is never attempted.

Thus, we see that with proper examinations firing pin impressions can be identified and many shootings which otherwise cannot be cleared up are solved.