A COMPARISON OF MANUFACTURING MARKS ON SMITH & WESSON FIRING PINS

WILLIAM MATTY and TORREY JOHNSON

The impression left by the firing pin on a center-fire cartridge primer is generally noted by a firearms examiner during cartridge case comparisons. It is usually not the basis of routine identifications because other markings such as breech face, extractor, or chamber marks are more easily compared. There are instances, however, where the firing pin impression is the best mark available for comparison. Some ammunition generates low pressure which may not leave sufficient breech face markings. Also the breech of a weapon may be very smooth yielding no transfer of marks to the fired cartridge case. At these times an examiner might rely on the firing pin impression for comparison.

There is general agreement in the literature that firing pin impressions are unique to a weapon when sufficient detail is noted. This detail would include machining marks, toolmarks, or random wear imperfections. Concentric striations are discussed in a number of books and a journal article. Most consider the concentric rings from the manufacturing process to be unique to that individual firing pin (1,2,3,4), however, two sources urge caution when evaluating such marks (5,6).

A study was done to evaluate the nature of machining marks on firing pins. Three consecutively manufactured firing pins were obtained from the Smith & Wesson factory. These pins are the hammer-mounted variety that fit the stainless K-frame series of revolvers (photo 1). Smith & Wesson refers to the firing pin as the 'hammer nose'. The concentric toolmarks on the tip of the firing pin (photo 2) are created in a lathe turning operation. The cutting tool is not a single-point cutter which moves in two directions, as in a simple manually operated lathe. The cutter in this case is a shaped blade with the outline of the cut to be made. This shaped cutter moves perpendicular to the work in one simple in-out motion from the side. The firing pins which come to this stage as a flat, stamped part are fed into the lathe, cut, and ejected automatically. This is similar to the type of operation used to cut the extractor groove on cartridge cases (7). This turning operation creates the concentric rings which can be impressed into the primer during firing.

CA DOJ LABORATORIES

The firing pins to be compared were collected from the lathe as they were turned and were sequentially marked. For this study no further factory machine work, tumbling, or hardening was done. Normal production firing pins are tumbled and hardened.

The firing pins were compared microscopically on a Leitz comparison microscope. The first thing noticed was the remarkable carryover of concentric striations. The cutting tool transferred the imperfections of its cutting edge to the firing pins to the extent that very small lines were repeatably reproduced on them. Based on striations alone, any of the three pins could be matched to each other (photo 3). The cartridge case study referred to above (7) showed that the toolmarks on the extractor grooves could be easily matched and that they persisted for several thousand units in production. These firing pins are produced by essentially the same process, but how long these marks persist in manufacturing has not yet been established.

One feature noted was that the striations did not follow a true circular shape. Instead the lines followed almost a figure-eight shape on all three pins. This apparently occurred when the cutting edge or the work shifted somewhat during cutting. This shape is in the same orientation on all three pins with respect to the flat sides, and would therefore be in the same orientation when mounted in a hammer.

In addition to direct comparison, test marks were made in lead. The impressions made in lead with different firing pins could be matched when comparing the concentric rings. Finally two of the firing pins were mounted in different K-frame revolvers and cartridges were fired. Cartridge case comparisons (photos 4 and 5) were similar to the lead impression comparisons with the exception that the lead impressions recorded finer detail.

In firearms identification the random or unique features of a firing pin must be determined. Such random marks were found on these firing pins where metal had ripped away instead of cutting cleanly. In these areas the striations stopped for a short distance and then continued. These areas were random in placement on the three pins examined. Another source of random marks occurred later when these firing pins were mounted in revolvers for test firing. Marks were made on the top surface of the nose of the firing pins where they contacted the frame slightly. The firing pin is held in the hammer by a rivet, and since it can rock slightly in the hammer it is allowed to graze the frame as the hammer falls. Apparently the acceleration of the falling hammer holds the firing pin in an upward position. Since the placement of such a wear mark will be similar on numerous revolvers, the location should be used as a class characteristic. The wear mark itself may contain individual detail, however.

In an effort to determine if these turning marks make it to the real world in a finished and used firearm, twenty S & W revolvers from random sources were examined. Those examined were all K-frame revolvers, but were of various model numbers. The firing pins of the revolvers were examined microscopically. Concentric rings were present on 18 of the

20. The tumbling process and use had not obliterated the rings. The nature of the rings on the twenty pins varied. Some had coarse striations while others had very fine striations. No two firing pins had toolmarks that could be matched. Also, none exhibited the figure-eight pattern found on the consecutive pins. The main change to the firing pins subsequent to manufacturing was caused by contact with the frame due to the movement allowed by the rivet. The change occurs at the top part (12 o'clock) of the firing pin striking surface. This was seen in 17 of the 20. Some S & W revolvers have a spring between the hammer and the firing pin to hold the pin down during hammer-fall. One of the revolvers examined was a Model 66-1. It was the only revolver of the twenty to have this spring. The firing pin on the Model 66-1 had well preserved concentric rings and the top of the nose of the firing pin was unmarred by frame contact. Cartridge cases were examined from a different Model 66 known to have fired over 500 cartridges. The primers showed clearly marked concentric rings. This indicates that the toolmarks on the firing pin are not easily deformed through normal firing.

In summary, the concentric rings created by this type of machining process should not be used as an absolute identification. It is actually an identification of the cutting tool. An identification should be based on some feature unique to a weapon. While the striations discussed are of value, an identification based on such a firing pin would have to include some feature produced randomly. Random features would include pitting, scratches, or any other damage subsequent to manufacture. Also random are areas where the metal had ripped, rather than cut, during turning. The damage to the firing pin by contact with the frame may be useful for individualizing that pin, however, bear in mind that similar damage can occur in the same area on other weapons. It should be noted that Smith & Wesson J-frame and N-frame revolvers, which have the similar firing pins, also exhibit these circular toolmarks.

References

1. Mathews, J. Howard Firearms Identification. Springfield, Ill.: Charles C. Thomas, 1962, 2nd printing, pg. 26, 27

2. Sharma, B.R. "The Importance of Firing Pin Impressions in the Identification of Firearms." J. Crim. Law and Criminology. Vol.54 no.3 (Sept. 1963), pg. 378.

3. Davis, John E. An Introduction to Toolmarks, Firearms and the Striagraph. Springfield Ill.: Charles C. Thomas, 1958, pg. 78, 79.

4. Hatcher, J. S., Jury F. J., and Weller, J. Firearms Investigation, Identification and Evidence. Harrisburg, Penn.: Stackpole Co., 2nd Ed. 3rd printing, pg. 18, 123, 487.

5. Gunther, J. D. and Gunther C. O. The Identification of Firearms. New York: John Wiley and Sons Inc., 1935, pg. 101, 282.

6. Burrard, G. The Identification of Firearms and Forensic Ballistics. New York: A.S. Barnes and Co., 2nd Amer. printing 1964, pg. 113.

7. Johnson, Torrey D. "The Persistence of Toolmarks in R-P .25 Auto Cartridge Case Extractor Grooves" Presented at the 1982 AFTE Training Seminar; Orlando, Florida.

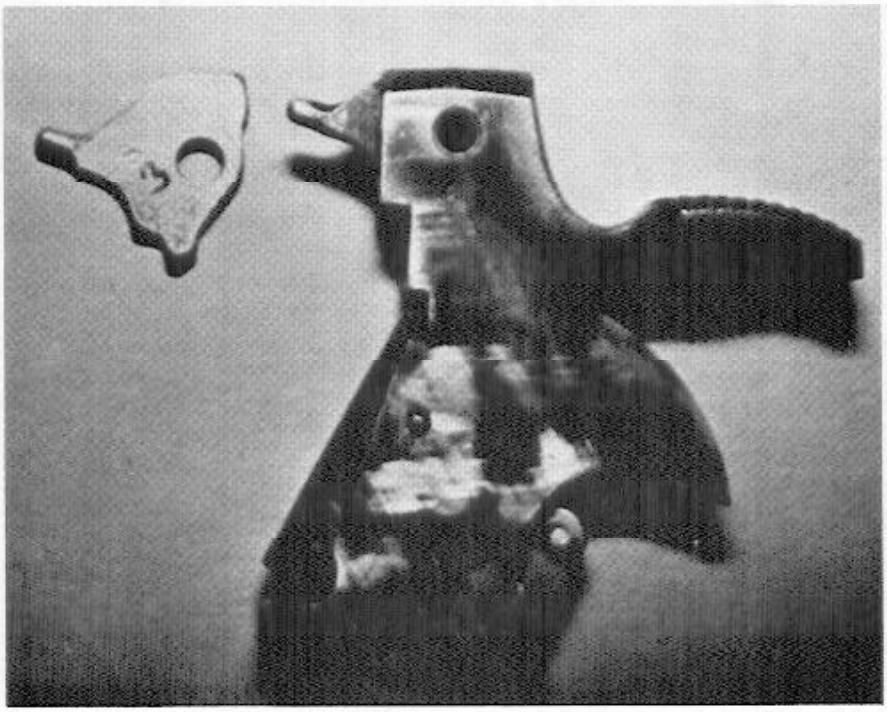

photo 1

Consecutive firing pin #3 shown in correct orientation for mounting in the S&W hammer

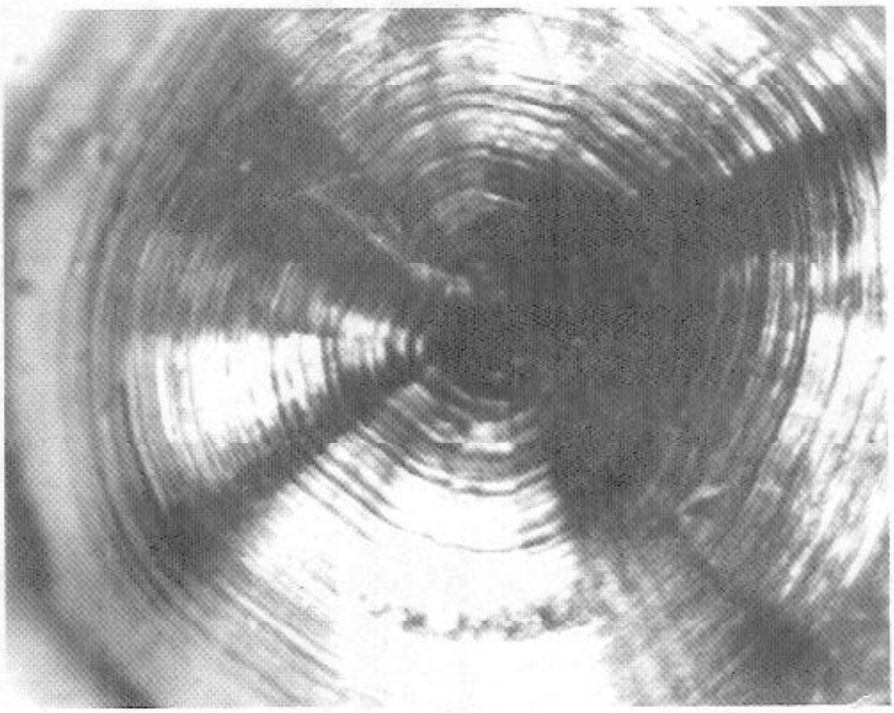

photo 2

Toolmarks on striking end of firing pin. Note dark area at 6 o'clock where metal has ripped rather than cut cleanly.

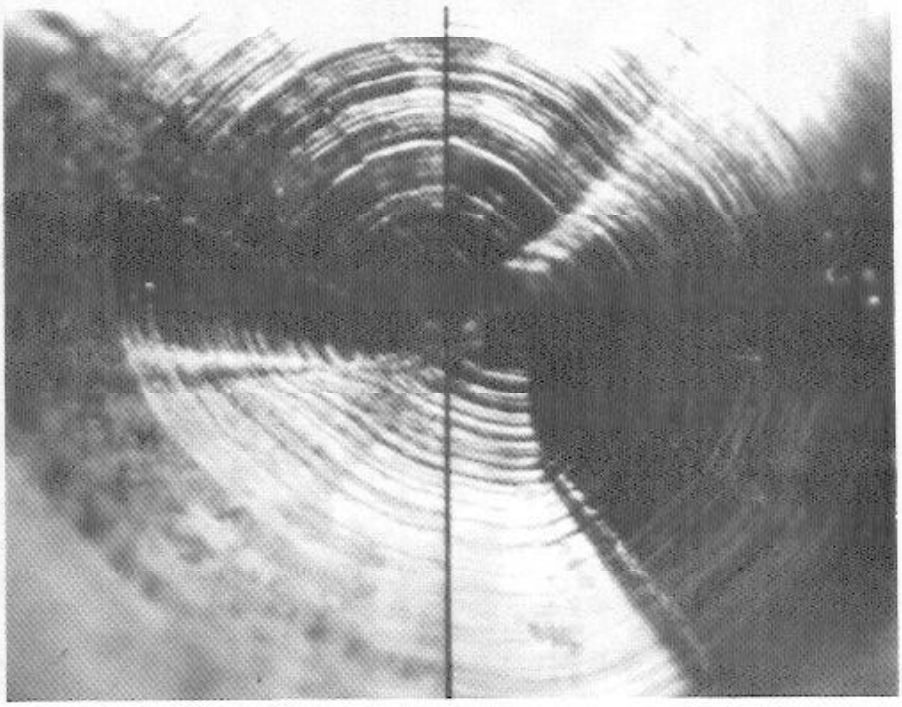

photo 3

Comparison of firing pins #1 and #3

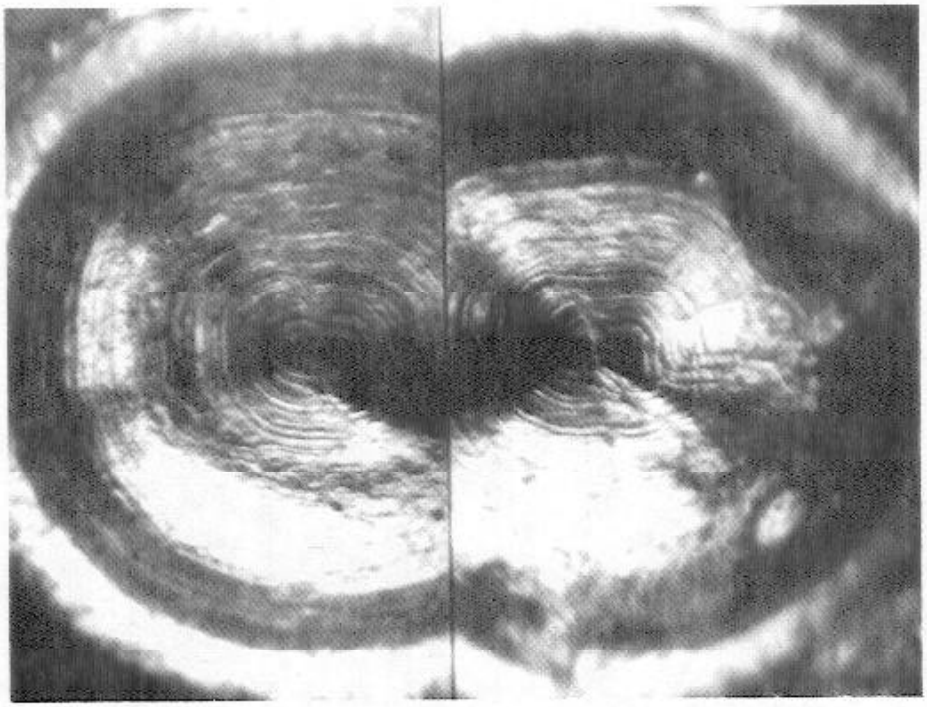

photo 4

Firing pin impressions on test fired cartridges.
Left: from firing pin #1
Right: from firing pin #2
Note non-circular (figure-eight) pattern to striations

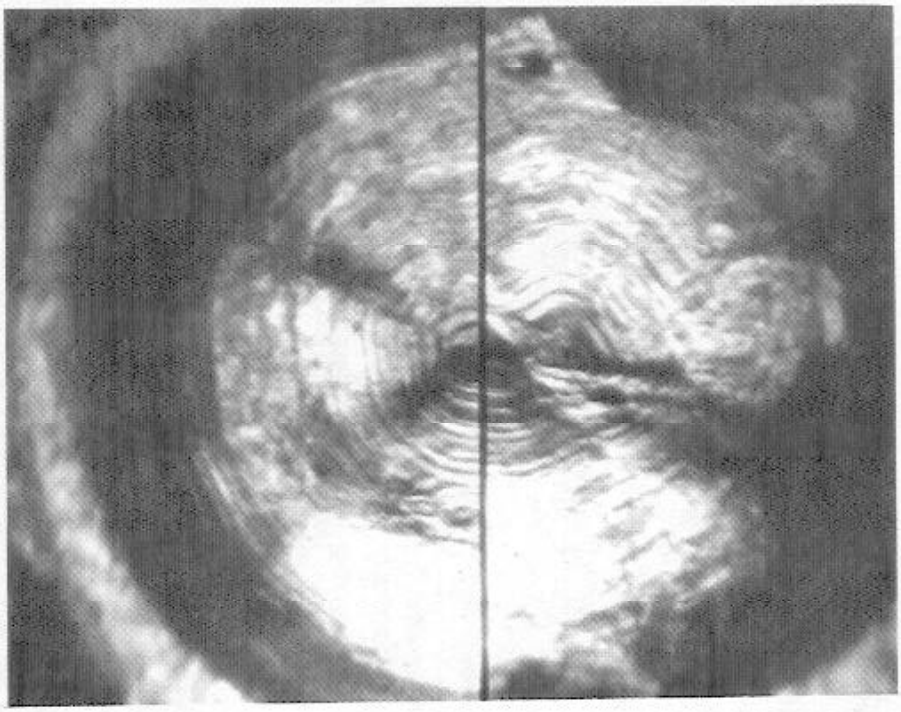

photo 5

Comparison of test firings from firing pins #1 and #2