TECHNICAL NOTE

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Letter Quality Impact Printer Hammer Impressions

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ABSTRACT: While acquiring typewriter standards, an unusual mark was encountered. Scrutiny of the mark and the electronic typewriter (ET) that produced it disclosed that the impression was a reproduction of the ET's hammer. This was the result of a missing character as a result of a broken spoke. Initially, it was thought that encountering such a mark would assist in the identification process. Subsequent examination of hammer marks from various manufacturers shows them to be highly distinguishable. Potential therefore exists for dating, classification, and make and model determinations when impressions of this type are present in typescript cases. Hammer marks from letter quality (LQ) impact printers are illustrated, and their value in case work is discussed.

KEYWORDS: questioned documents, impressions, typewriters

In the course of collecting typewriter standards several years ago an unusual mark was encountered. Closer examination disclosed that the mark was actually an impression of the printhead mechanisms hammer, the result of a missing printwheel spoke. Initially, it was thought that encountering such a mark while examining typescript would be of assistance in the identification process. Discovery of subsequent hammer impressions revealed that these marks can be distinguished according to manufacturer, which would be of value in typescript classification problems. Additionally, there exists a potential for dating a document. Configuration differences of hammer impressions from letter quality (LQ) impact printers are illustrated.

Discussion

Examination of impressions caused by printwheel printer hammers from different letter quality impact printing systems reveals them to be highly distinguishable. It would appear from samples collected to date that the design of printhead hammers varies from manufacturer to manufacturer. Figure 1 shows a portion of a sample obtained from a Royal Alpha electronic typewriter (ET). The marks preceding the bracket and following the colon were typed when the exclamation mark and the one quarter keys were depressed. Additionally the uppercase "K" from the same printwheel was also missing, causing the same mark to print

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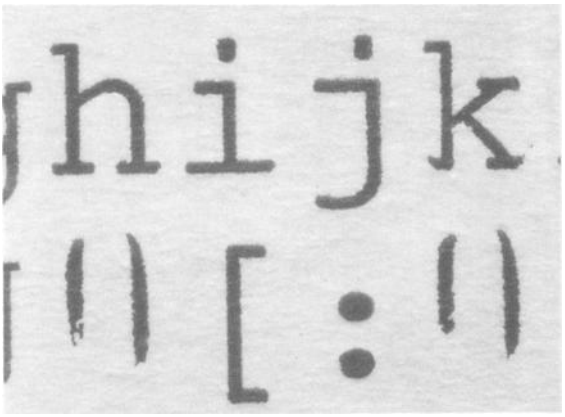

FIG. 1—*Portion of strike-up from a Royal Alpha 2015 obtained in 1984.*

when the uppercase "K" was depressed. The ET from which the samples were obtained was a demonstration machine at a department store and had certainly undergone some mistreatment. It is not known whether the characters were broken because of customer abuse or from flaws in the spoke as a result of the manufacturing process. It is known, however, that the shearing off of characters does occur on daisywheels and thimble elements. Buyers Laboratory Inc., an organization which conducts reliability testing on ETs, reported in 1986 that, during a 560-h test of a Silver-Reed EX42 Penman, three daisywheels broke, requiring replacement. During the testing of an Adler 320 ET, also known as Royal 420, the lowercase "e" failed after 340 h of testing. In another report, a Richo Easy Typer 510 ET printwheel failed to print the lowercase "t" because of a broken spoke which failed after 372 h of testing. A discussion with the service manager for the Electronic Typewriter Division of Panasonic Industrial Company revealed that hammer impressions can occur for reasons other than broken spokes. Anything that impairs the rotation of a daisywheel, such as improper installation of a correction ribbon, can cause the hammer to strike between two characters.

Figure 2 is a portion of a business letter prepared on a NEC printer Model 3550. The preparer was at first perplexed at what the strange looking figures representing the "B" and "y" were. The spoke containing the uppercase "B" and the lowercase "y" had sheared off the thimble. The element was used moderately for approximately two years.

Figures 3 and 4 depict one type of ET hammer mechanism. Hammer marks which are illustrated in the paper and appear similar to parallel lines are produced by a slotted ham-

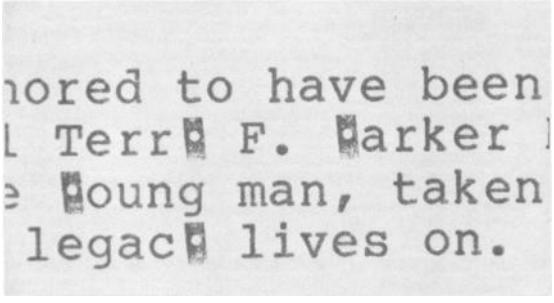

FIG. 2—*Portion of business letter prepared on NEC Letter Quality Printer Model 3550.*

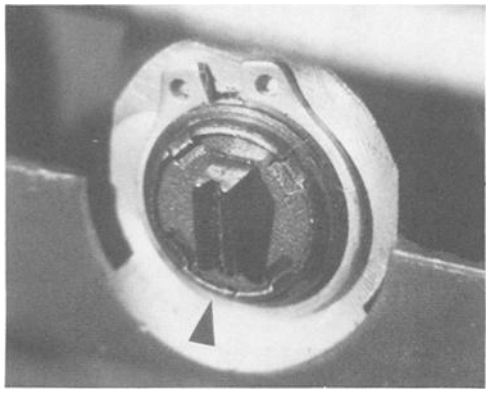

FIG. 3—*Frontal view of a Xerox Memorywriter 6010 hammer in rest position. The vertical parallel protrusions seat with the back pads on each spoke of the daisywheel.*

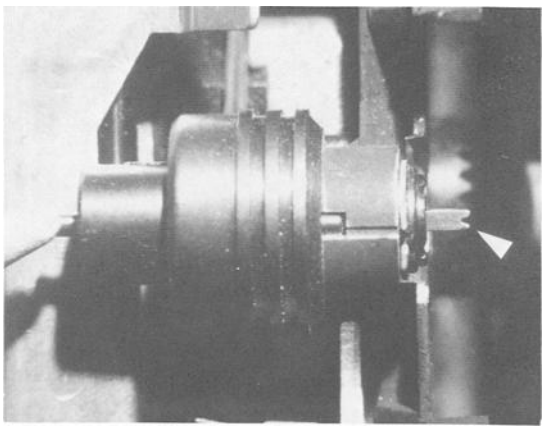

FIG. 4—*Top view of Xerox hammer mechanism with surrounding electronic solenoid. The striking portion of the hammer is at right center of the figure. Note the hammer is being manually pushed forward.*

mer, as shown in Fig. 3. The wedge shaped back pad on each spoke of the daisywheel joins with the hammer to form a mortise and tenon-type union. Another method used on some ETs and printers is a paddle-type hammer which strikes the flat surface of an element's back pad. Impressions produced by this method appear more dense than the vertical parallel line impressions.

Figures 5 through 14 are sample hammer impressions from ETs and computer printers obtained by removing spokes from printwheels and thimbles purchased for that purpose. Figure 15 is a portion of a strike-up from a Collegiate ET given to the author.

During the course of this investigation it was discovered that two ETs, a Xerox Memorywriter 6010 and a Canon AP 400 with an add-on unit, both equipped with an encoded printwheel would not strike in the missing characters' position. Other ETs using encoded printwheels may react similarly.

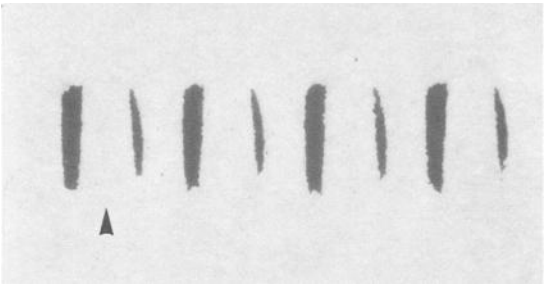

FIG. 5—*Sears Communicator ET hammer mark. The Communicator series of ETs are manufactured by Nakajima Ltd. of Japan. Other Nakajima products include Swintec line of ETs which may use the same hammer design.*

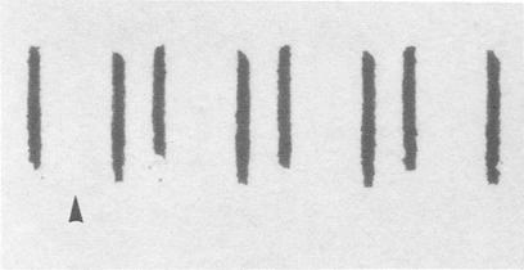

FIG. 6—*IBM Wheelwriter hammer impressions. Wheelwriter Models 3 and 5 from the Selectric® 2000 series as well as IBM Wheelprinters introduced at the same time use the same printhead mechanism.*

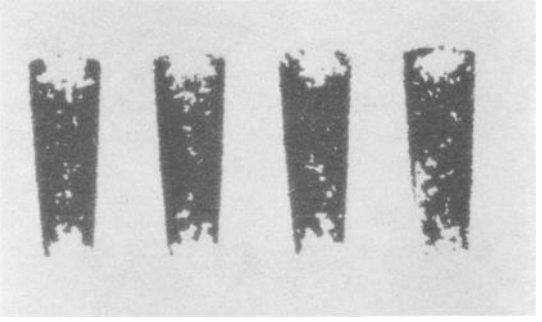

FIG. 7—*Canon AP 400 ET hammer marks. The marks were produced by a paddle-type hammer.*

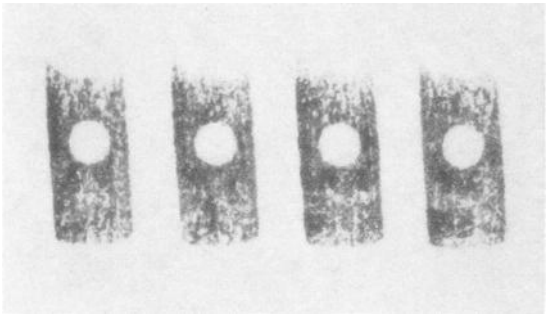

FIG. 8—*NEC Letter Quality 3550 printer hammer impressions. Note the consistent left tilt of these marks as opposed to the more vertical NEC Model 2000 marks in Fig. 11.*

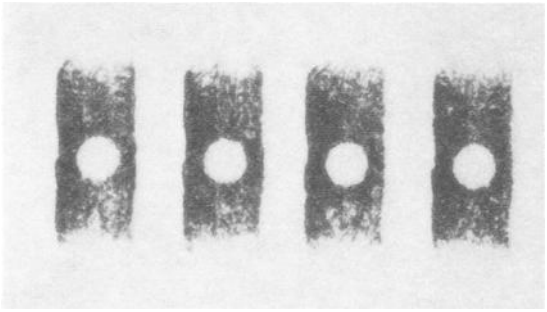

FIG. 9—*NEC Spinwriter® printer Model 2000 hammer marks.*

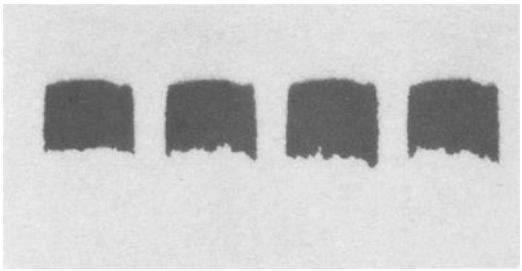

FIG. 10—*Impressions from a Xerox Memorywriter 620.*

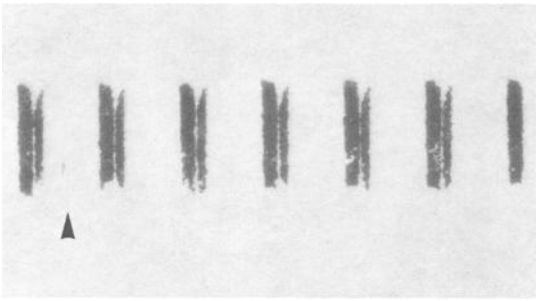

FIG. 11—*Impressions from a Royal Alpha 700D portable or low end model ET.*

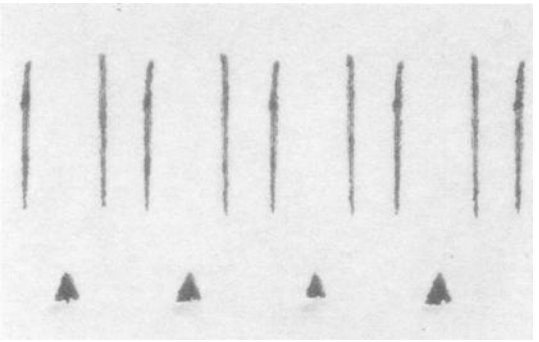

FIG. 12—*Royal 5000 series hammer marks. The triangular images below the marks are caused by a remnant of the spoke.*

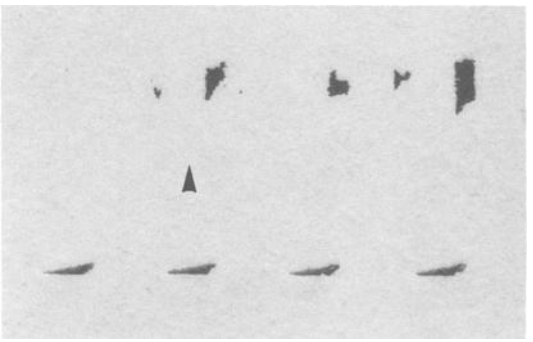

FIG. 13—*Partial impressions from a SCM Typetronic®. Impressions would not fully print.*

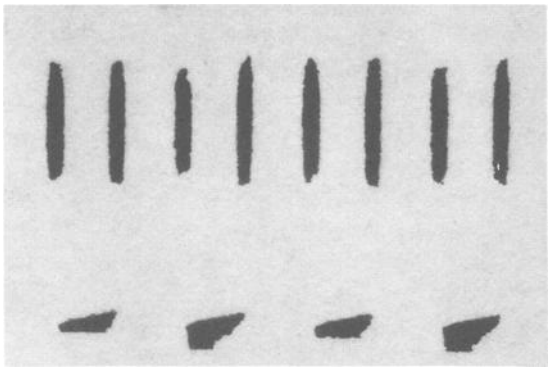

FIG. 14—*Hammer marks from a Smith Corona Memory Correct 400 Messenger ET.*

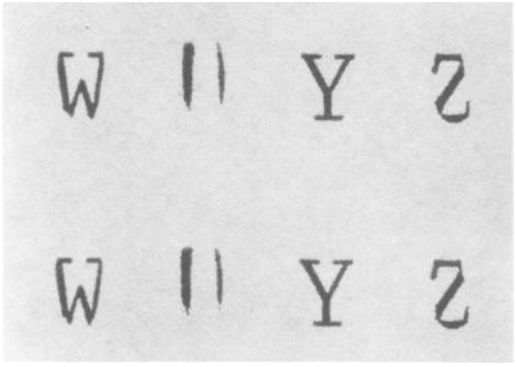

FIG. 15—*Portion of a strike-up from a Collegiate ET showing hammer marks. The manufacturer of this ET is not known. Note similarity of impressions to those in Fig. 5.*

Summary

The value of the foregoing information is of course dependent on finding a LQ impact printer hammer impression mark in typescript cases under examination. The frequency of doing so is not known. I feel the likelihood of finding a hammer mark would be far greater in criminal work as opposed to civil document matters. A business or corporation would not tolerate a work product such as depicted in Fig. 2. Many factors such as the cost of element replacement would not be of major importance to a business. However, an individual might not replace a broken daisywheel, especially if the missing character was one not frequently used.

The potential also exists for the dating of a document by knowing the introduction date of a specific model ET or printer which produced a hammer impression. For example, a document containing an impression from an IBM Wheelwriter 3 or 5 ET and bearing a date before 1984 would be highly questionable.

The presence of a known hammer mark in a questioned typewritten document would aide in classification problems, as well as make and model determinations. It is extremely difficult to identify the work of modern LQ impact printers to the exclusion of all others. Should the good fortune arise that a similar hammer mark appears in both a disputed document and the standards, its value would be considerable.

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