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Examination Techniques for Determining Whether or Not a Key Is an Original or a Duplicate

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ABSTRACT: Various examination techniques for determining whether or not a key is an original or a duplicate were discussed. It was found that based on "production processes," original keys made for cylinder locks of the pin tumbler and wafer variety can be distinguished from store duplicated keys. In addition, an example of a positive comparison between two keys manufactured simultaneously was presented.

KEYWORDS: criminalistics, toolmarks, keys, locks

Often, the toolmark examiner is faced with cases where he must examine lock mechanisms and keys. Examples of such cases may include determining the method in opening a lock, whether or not a particular key matches the "combination" of a certain lock, whether or not a lock was picked, and so forth. Although there is much literature available relating to the locksmithing trade [*1-4*], articles and technical notes appearing in forensic science literature regarding this topic are few and far between [*5-8*]. As a result, much of the information and experience gained by examiners is unavailable to others, inducing many to start their own basic research.

Occasionally, the problem arises of determining whether or not a key apprehended is one of the original ones, supplied by the manufacturer with its corresponding lock, or a duplicate cut on a standard duplicating machine. A basic knowledge of locks and keys along with a simple visual and microscopic examination may suffice to answer this question.

The principles to be presented here apply to keys for cylinder locks of the pin tumbler and wafer type used in facilities other than automobiles. Although there are exceptions to the information presented here, the basic precepts may be adapted to the varying cases.

Technique

Locks are initially supplied with original manufacturers' keys (usually from one to five keys). The keys may be later duplicated on either original manufacturer blanks or on a comparable substitute blank supplied by key blank manufacturers (see Fig. 1 and Table 1).

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FIG. 1—*Comparative key blanks.*

TABLE 1—*Example of comparative key blank listings* [9].

	Blank Manufacturer						
	Original	Cole	Curtis	Dominion	Hudson	Ilco	Keil
Code	GM	B10	B10	H98LA	B10	H1098LA	153PH
Code	GM	B11	B11	U09LA	B11	01098LA	153PG

Thus, the first stage in the examination is to determine whether or not the key in question has been cut on an original or a comparable substitute blank. However, finding that the key has been cut on an original blank is not conclusive since a duplicate key may have been cut on an original blank.

The next stage depends on whether or not the key is plated. Many quality cylinder lock keys are made from brass and are thus originally brass colored. For cosmetic purposes, these keys may be plated so that they become the color of their plating (for instance, silver colored in the case of nickel plating).

There are two accepted manufacturing processes used in the plating of original keys. In the first, blanks are cut to the needed combination and then plated. In the second process, the blanks are first plated and then cut to specification. When the key in question is examined and one finds that the cuts on the key's bitting are plated (Fig. 2), one may safely conclude that the key in question is an original, since it is unreasonable to expect store duplicated keys to be plated after they are cut. Even in the case in which a plated key has undergone extensive use and wear, microscopic examination can usually reveal areas on the key's combination cuts which have remnants of plating. An example of such an area is the back slope of the No. 1 cut which does not have to pass through the entire length of the keyway each time it is inserted [*10*] (see Fig. 3).

The next stage in the determination is to examine the surface texture within the cut portion of the key bit. Of interest to the examiner is what is termed "roughness" or "primary texture." Simply defined, this relates to the number of peaks per unit length and their average height [*11*] (see Fig. 4). This is seen by the examiner as striae on the cut portion of the bit, running perpendicular to the longitudinal axis of the bitting.

Because "production processes" and degree of roughness are closely related, examination of the roughness aids in determining the key cutting method used. "Production processes" refers to functions having a role in the manufacturing of a product such as machining opera-

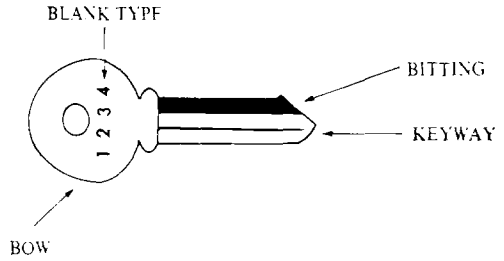

FIG. 2—*Pertinent terminology used to describe the various parts of a key blank.*

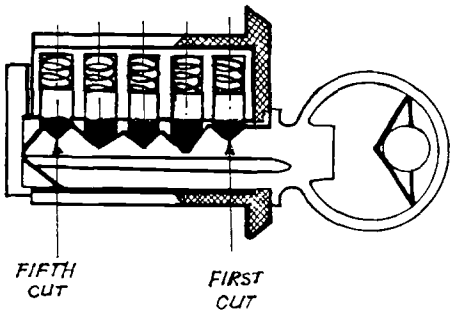

FIG. 3—*View of a pin tumbler lock with the properly cut key inserted into the keyway, noting the number one and five cut on the key.*

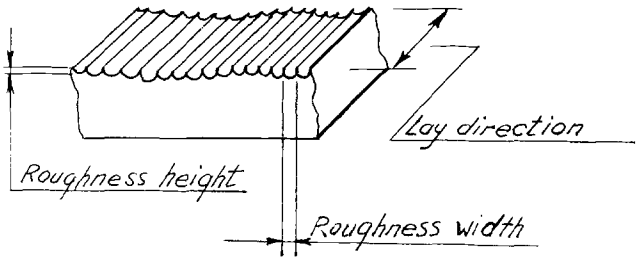

FIG. 4—*Drawing of various surface characteristics.*

tions, cutting tools, production rate and quantity, quality control, and so forth. If one compares the "production processes" of a key in a factory and the duplication of a key on a "retail" duplicating machine, many differences are evident. Although some of the differences in the "production processes," such as cooling and lubrication during cutting, movement of the key in relation to the cutting tool, method of clasping the key blank, and so forth, are of great influence on the production process, these factors are difficult to quantitate. Some factors, however, such as motor speed, feed rate, number of teeth on the mill cutter, and so forth, may be quantified.

In our case, it is enough to consider the difference in the size and number of teeth on the mill cutter used in mass production and that used on a duplicating machine to realize the influence on "roughness." The mill cutter of the manufacturer is of a larger diameter and

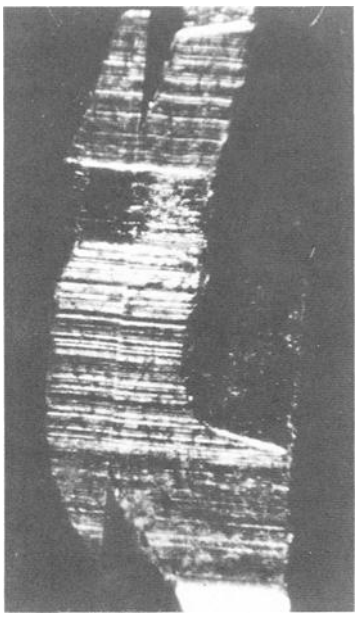

FIG. 5—*Comparison between two original keys that were simultaneously cut on the same machine.*

has more teeth per centimetre. Assuming that the motor speed and feed rate are constant, the larger diameter of the mill cutter results in a faster cutting speed. This in turn results in more peaks produced per area (roughness width smaller). The greater quantity of teeth on the cutter results in each tooth having to contribute less work in the removal of material. This results in a shorter peak height (roughness height). Thus, the primary texture (striae) in the cuts of an original key may readily be distinguished from those of a duplicated one as they are much finer.

The last stage of the examination can be of aid in cases where a known, original key is available. As was previously mentioned, in mass production methods, several keys for the same lock are cut simultaneously. This enables one to compare the striae on the known original key and the key in question in the hope of finding a positive comparison (Fig. 5).

Conclusion

Various techniques used for determining whether a key is an original or a duplicate were discussed. It was shown that, in certain cases, a visual and microscopic examination may suffice to answer this question.

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