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Of the numerous problems confronting a large laboratory there will always be certain cases that are highlighted by their interesting background and importance. One such problem arose here in the Chicago Police Laboratory in the past year. Agents of the United States Secret Service submitted to the laboratory two sets of exhibits which consisted of one stack of counterfeit money and three stacks of legitimate advertising matter. The investigating agents asked at the time whether or not both sets of exhibits had been cut on a common machine.

A preliminary examination by oblique light indicated there was a strong possibility that the same cutting blade had been used to trim both exhibits. The agents then submitted three 41½″ knives, and the preliminary examination of these knives, under low power magnification suggested that one of the three knives was used.

We then accompanied the Secret Service agents to the suspected print shop. Photographs were obtained of the premises, particularly of a Challenge-Diamond 35″ Power Paper Cutter. The three blades were mounted in turn in the cutter and impressions taken on paper samples found on the suspected premises. Photographs were taken of the blade in position, illustrating the action of the blade in relation to the paper. The samples were bound, marked for identification, the cutting knives removed, and the evidence returned to the laboratory.

A further and more complete examination of the exhibits submitted indicated that one of the cutting knives was the blade used in trimming the counterfeit money. With this finding the Government was later able to prove that the counterfeit money was prepared in the suspected print shop.[1]

A search of available literature revealed little that would aid us in

1. There are many other interesting aspects which led to the successful conclusion of this matter, such as, the identification of paper by fiber and spectrographic analysis by the Director of the Research Division, Bureau of Printing and Engraving; the identification of handprinting of numerals and letters by James Kelley, Document Examiner, Postal Inspector's Office; the identification of the printing process and the indication of discrepancies between genuine money and the counterfeit by Secret Service agent assigned to the Bureau of Printing and Engraving.

the present problem. Lt. Stanley S. Smith of Pennsylvania State Police Laboratory wrote that the matching of a sheet of paper in an anonymous letter case to a particular pad found in the home of a suspect was possible and practicable.[2] This involved matching of cutter knife marks. John Tyrrell and Clark Sellers showed in the Allis-Chalmers strike matter that certain series of ballots were trimmed by a common blade and that the sheets had never been removed from the stack and distributed. John E. Davis of the Missouri State Highway Patrol stated that from his investigation and observations as to the possibilities of the identification of a paper cutting knife from impression in its cutting edge was feasible and provable.[3]

Paper is cut and trimmed commercially by large guillotine type machines, in which a manual or automatic clamp descends to compress the paper and hold it firm while a long hollow ground blade is brought down at great pressure through the stack of paper. The stroke of the knife has a sideway motion as it descends. Depending upon the type of shear stroke, single or double, the edge of the blade will be either parallel to the table top or higher on one end when it starts through a stack. A rocking motion close to the end of the stroke in a double shear action will bring the blade parallel to the table. This type of shear is more like a pair of scissors.

A machine of this sort lends itself to the final process of printing where many duplicate copies of a single design are printed on a single sheet of paper, and many of these sheets piled together can be separated simultaneously. It is this final touch that gives the character to a piece of printed matter. A perfectly printed job may be ruined by poor cutting.

When a machine of this sort is in fine working order and the blade is razor-sharp, a smooth "glass edge" cut will be obtained. If the machine is not in order, or the edge of the blade is dull or marred in any way, then small marks, depending upon the nature of the defect, will be left in the stack of paper cut. The marks will be at the same angle as the blade was in while traveling through the stack.

It is by these marks, nicks, burrs, or chips on the cutting edge that a knife can be identified. These defects may occur in many different ways and all are important. In the grinding operation a nick in a new or old blade might not be fully removed even though the blade is honed to a

2. Stanley S. Smith, "Paper Identification" *Identification News,* International Association of Identification, July, 1952.
3. John E. Davis, "The Identification of a Paper-Cutting Blade," *Technician,* Sept., 1943, Vol. I, No. 5, Page 3-6.

razor-sharp edge. A nick approximately 3/16″ wide was noticed by the writer in a brand new unused blade. Most manufacturers claim this could never happen, but like all mass produced articles a few defects pass inspection. The method used in grinding will also determine to some degree the type of defects that will occur and the life of the edge. A few of the general rules in grinding are that the cutting edge at all times should be parallel with the back of the blade; that the edge should always be straight and not bowed; that a definite bevel be maintained and be either flat or very slightly concave.

The manner of handling, storing, and mounting the knife may also be a factor in placing defects in the blade. Care must be taken to protect the edge at all times or the quality of the cutting will be lessened and the possibility of identification increased.

Incidentally, the utmost care must be exercised in the handling and use of these blades while in the custody of an investigating officer. The physical safety of the handler is involved as well as the damaging of the edge which might hinder an identification.

The greatest proportion of defects occur during the operation of the blade while it is mounted in the cutter. From general use defects will occur due to weak sections in the blade or foreign material in the paper. The loading of a cutter by the operator and the type material cut will also affect the blade. Newsprint, bond, ledger, book, and onionskin papers can be loaded to nearly the full lift of the cutter without harming the blade. Boards, and coated and gummed papers are very hard on the edge of a blade. Most of the papers falling in this latter class have to be trimmed in small lifts and cut with a very sharp knife. This type of paper will nick and dull a knife very readily. In the trade publications it is recommended that a cutting schedule be set up where material needing a sharp knife be cut first, followed by material that is more easily cut. Before resharpening it can be used on newsprint and press board where the quality of the trim is not important. It is also recommended that a knife be sharpened before each shift or day's work begins. A knife will last longer with frequent sharpening than one that is allowed to become dull with many large nicks. A greater amount of the tool steel of the blade will have to be removed when the nicks are large.

A paper cutting knife is made up of two different types of steel, each having its own purpose. A low to medium carbon steel is used in the mounting portion of the knife while a high speed tool steel is used on

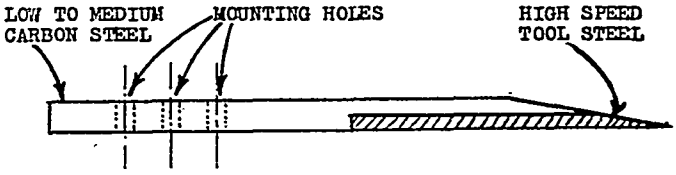

Figure 1
Diagram of a Cutting Blade.

the blade. The sketch, figure 1, shows a general cross-section of a paper cutting knife and its parts.

The identification of a paper cutting knife from the marks left on the edges of a stack of paper would have to be made before the knife was resharpened, which would remove all identifiable marks if done properly, or before too much additional wear had been placed on the blade. The edge of a blade can be changed very rapidly or completely damaged by cutting a hard material such as glassine. In the case in question the knife was removed from the machine and was to be resharpened when seized by the Secret Service agents.

Each defect in a blade has its own characteristic such as its width, depth, and contour. These defects can either be burrs, concave or convex dents, nicks or broken sections. Defects can also be identified by measurement in relation to each other and to the edge of the cutting machine.

It is on these points that a knife was identified as being used to cut one stack of approximately $20,000 in counterfeit paper currency. This stack was made up of five separate trimmed sections. On the four sides of all five sections definite cutting-knife defect marks could be noticed. On one section of the stack the marks appeared to be from a slightly different portion of the blade than the rest. The five sections and the marks can be seen at the top of figure 2 which shows one of the longer sides of the stack.

On the three stacks of legitimate printing, the edges also contained knife defect marks similar to those appearing upon the counterfeit money.

The test strips taken with the knife selected as being the one that trimmed the counterfeit money and the legitimate printing is shown at the bottom of figure 2. The test strips were photographed in two parts so as to show all points of identification at the same scale as the counterfeit material.

Ten outstanding points of identification as to cutting knife marks were located and nine of these are indicated in figure 2. The counter-

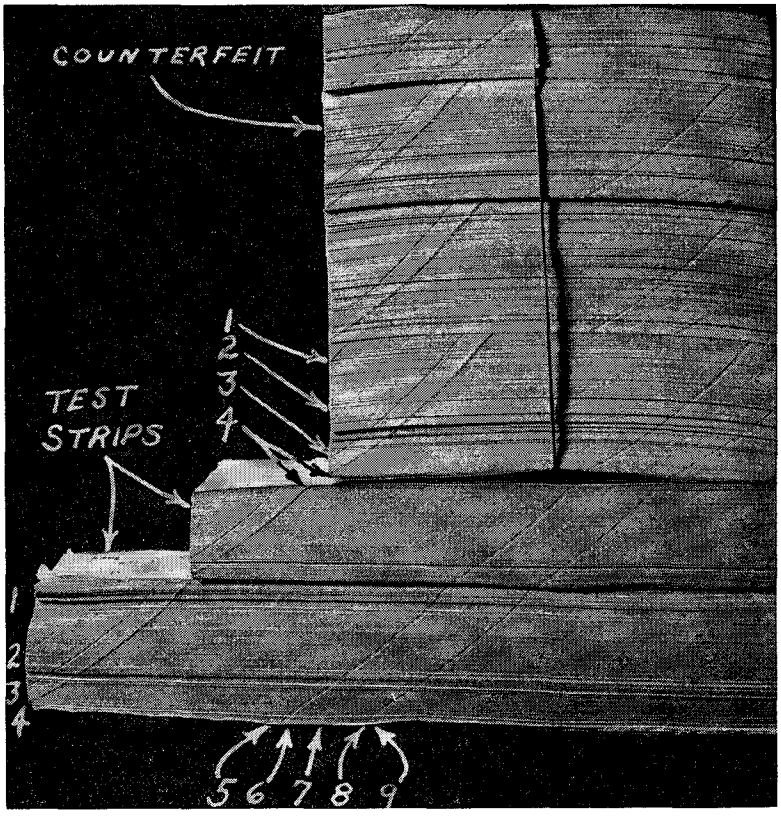

Figure 2
Comparison of Cutting Blade Marks on Counterfeit Bills and Test Strips.

feit money marks matched to those on the legitimate printed material in the same way. The illustration shows the counterfeit currency marks matching the test strips. The nine points of identification are marked on the bottom section of the counterfeit stack, and on the test strips. The tenth point of identification appears upon the fourth section from the bottom and on the reverse side from that shown in illustration 2, and also on the second portion of the test strip. The nine points of identification appeared on the left hand section of the knife while the tenth point was nearer the middle of the blade. Point of identification No. 1 was shown as to its relationship with the other markings as well as its position to the edge of the cutting machine. It depended upon the height of the pile whether this mark would be reproduced.

By again referring to figure 2 an illustration can be made on how identification marks are developed and changed. In the counterfeit money, a very fine mark appears alongside point No. 7 while in the

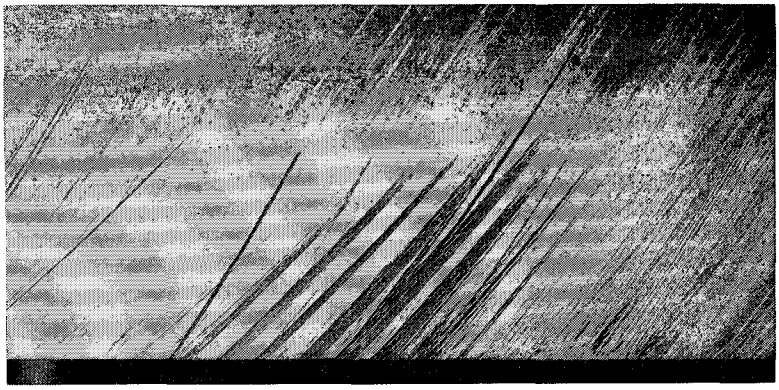

Figure 3
Clamp Imperfections.

legitimate printing it appears slightly more pronounced. In the test strips of figure 2 this mark has developed to a larger degree. Also, point No. 10 has grown in width, depth, and shape from the counterfeit stack to the test strip, but it is still in the same position as to the other points and maintains its general shape.

As the character of the blade changes with each sharpening there is one part of the machine, the clamp, that retains its form as long as it is part of the machine or until a clamp face is used. The clamp is a cast material with a two side machine polished face. The leading edge is solid and square while the rear section is made up of fingers approximately two inches long and one half inch wide.

The leading edge of a clamp may become scored by the same types of defects on the blade which have been mentioned. When the clamp is brought down at great pressure on a pile of paper, the marred part of the leading edge will impress its form into the top few sheets of the pile. An example of this is shown in figure 3 of the marred edge of the clamp attached to the paper cutter in the Chicago Police Print Shop. In figure 4 the identifiable impressions left on a sheet of paper are indicated.

Figure 4
Impressions of Clamp Imperfections on Paper.

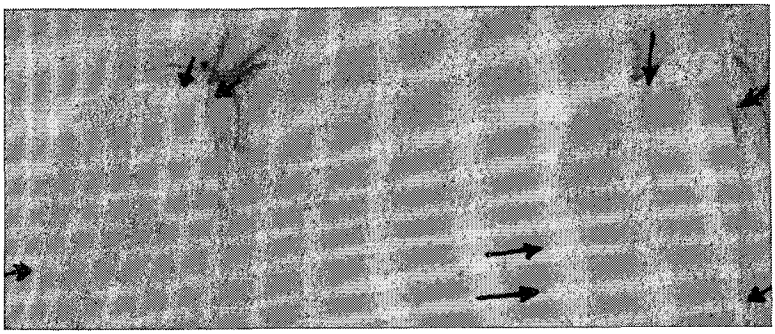

Figure 5
Clamp Fingers Impressions on Paper.

The fingers will also lend itself to a similar type of identification. Here we have the marks left by the edges as well as the form of the fingers with which to work. In figure 5 a few of the outstanding identifiable marks are indicated. Such markings imposed by the clamp are greater when applied with the grain of the paper than against the grain. These marks of the clamp are not as dramatic as the marks left from the knife but are still of a very practical value.

This article demonstrates the value of scientific evidence, but it also shows that an investigator at a crime scene who possesses the ability to recognize and interpret the possibilities of this means of identification and preserves the evidence holds the full solution of the case in his hands. While it is true that the laboratory was able to identify the knife and present convincing expert testimony, credit for the case goes to the investigators who had knowledge of what the laboratory was capable of doing with properly presented evidence.