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RESTORATION AND DECIPHERMENT OF ERASURES AND OBLITERATED OR INDENTED WRITING*

Anthony Longhetti and Paul L. Kirk

Paul L. Kirk, Ph.D., has contributed a number of outstanding papers to this JOURNAL and has for several years served as an Associate Editor on our Editorial Board. He is Professor of Biochemistry, School of Medicine, University of California, Berkeley, and last year was also appointed Professor of Criminalistics in the newly established School of Criminology of the University.

Anthony Longhetti is a graduate of the University of California where last year he served as an assistant to Professor Kirk. He has recently been appointed to the staff of the Minnesota Bureau of Criminal Apprehension.—EDITOR.

Many studies have been made of methods for restoration of various erasures, obliterations, and indentations from writing implements, and these are well known to document examiners. Examination with oblique illumination, the use of ultraviolet and infrared rays, fuming of the paper with thiocyanic acid, ammonium sulfide, iodine, and other gaseous materials are all useful at times, and frequently more than one method may be employed successfully in the study of a single document. No discussion of these procedures is necessary at this point.

It remains true that instances arise in which none of the above methods are successful, or in which none of them produce completely satisfactory results. Photography with oblique illumination is difficult. Writing restored by chemicals is often evanescent, allowing no good permanent record, and photography of faint fluorescence of some erased writing materials is extraordinarily difficult. Pencil writing, both with lead and indelible pencils, may often be erased so as virtually to defy restoration. It is the purpose of this communication to describe certain techniques that have been found to yield highly satisfactory results in some of the restorations that have proven difficult or impractical by other methods. Also described are some modifications of standard methods that give superior results in many instances.

THE NEBULIZER

The DeVilbiss Co. of Toledo, Ohio, markets a device used for treatment of sinus and other respiratory ailments which emits a liquid in the form of an extremely fine mist or fog termed an aerosol. The apparent advantages of such a device for fuming are that a uniform concentration of liquid fuming reagents can be applied to a paper surface without any apparent wetting and resulting staining. It should apply the reagent in higher concentration than is possible with gaseous materials such as ammonium sulfide or thiocyanic acid.

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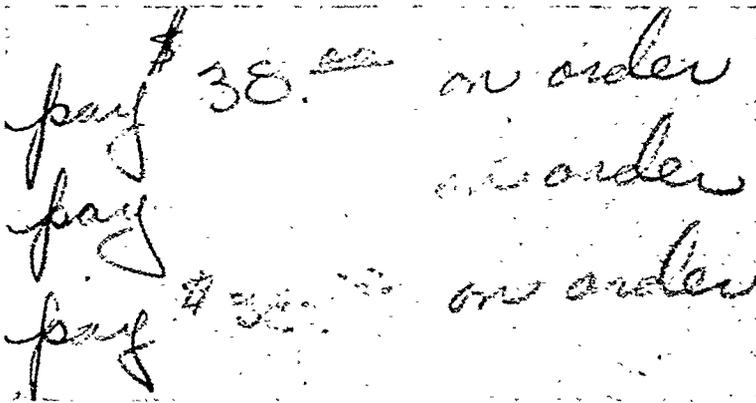


Figure 1.

Top, unerased indelible pencil; middle, as erased; bottom, restored by alcohol.

Experimental test of the device verified all the expectations. In 5 to 10 seconds, ink writing obliterated with sodium hypochlorite was fully restored with either ammonium sulfide or thiocyanic acid. As strong lines were observed as were possible by direct application of liquid, yet the paper did not appear wet nor was there any staining or irregularity. Several minutes fuming with the corresponding gases did not produce either as strong or as regular results. Reagents such as potassium ferrocyanide which do not form gases may also be applied effectively. Only iodine fuming has not yet been found practical by this procedure. The fine differential action of the vapor was not duplicated by the liquid aerosol.

Indelible pencil writing which has been well erased poses a difficult problem to which the nebulizer offered a simple and very effective solution. By applying an aerosol of ordinary alcohol, the minute fragments of dye remaining on the paper fibers were locally dissolved and spread, thus bringing out the original writing with considerable clarity. This technique has been employed most successfully in investigation of this type of erasure. Other liquids were tried, but none was found that produced the immediate striking results given by alcohol. (Figure 1.)

It is believed that the nebulizer should have many important applications in applying reagents to evidence where staining and alteration of the original must be avoided while at the same time a considerable concentration of reagent must be applied uniformly.

WRITING INDENTATIONS

Pencil writing, particularly, produces relatively strong indentations

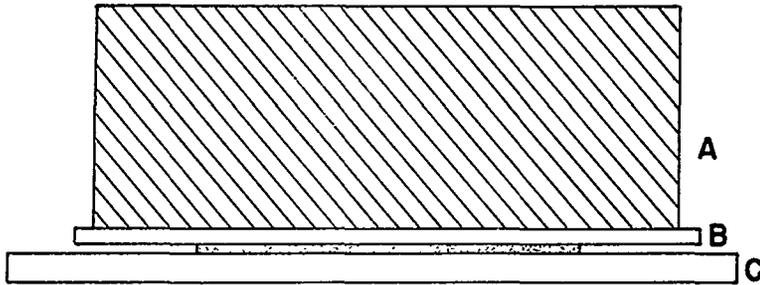


Figure 2.

Arrangement for casting replicas: A, lead weight; B, plate glass; C, paper pad carrying questioned document. The plastic sheet is placed between B and C.

both in the paper itself and at times in underlying paper. The same is true of ball point pens, and to a lesser extent, ordinary steel and fountain pens. Whether the indentation carries no color, as with an underlying paper or blotter, or whether the writing is erased or obliterated, the indentations remaining may offer an opportunity for restoration or decipherment. The only common method for this lies in the use of flat or other special illumination, which may be rendered ineffective by other markings or obliterations, or by the shallow or confused character of the indentations themselves. Recording by photography of these indentations is also very difficult at times, particularly when there is superimposed writing, printing, or other disturbing element.

For some years in this laboratory, fine structures have been duplicated by means of replicas made with Vinylite or other thermoplastics.¹ It appeared that a replica of an indented writing sample might be made to carry all of the significant characteristics of the original indentation, while losing the disturbing features of obliteration and opacity of the paper. Such a replica would have the added advantage of being transparent and relatively permanent. All of these advantages were realized along with others such as greater speed of recording, greater ease of decipherment, and universal application to indentations of all types. In order to make replicas of paper surfaces, the method previously used with hair¹ required modification to avoid the somewhat difficult use of the hot plate, and to obtain better control of the temperature and time of heating. The technique finally developed was found to be far more convenient and reproducible than previous methods and to be equally satisfactory for hair casting and other similar applications as well.

1. Kirk, P. L.; Magagnose, Stanley; and Salisbury, Doris, Casting of Hairs—Its Technique and Application to Species and Personal Identification, *J. of Crim. Law and Criminol.* 40, 236-241 (July-August 1949).

PREPARATION OF REPLICAS

The paper to be reproduced was placed on a tablet or scratch pad to give a slightly resilient backing. On it was placed a sheet of Vinylite plastic 3 inches square and $1/32$ inch thick. On this was laid a sheet of plate glass about 5 inches square and $1/8$ inch thick. On the plate glass was placed a specially cast lead weight having a square opening 3 inches on a side, outside dimensions of 4 by 5 inches and a height of $1\frac{1}{2}$ inches. The arrangement is shown in Fig. 2. Heat was applied by means of an ordinary infrared heat lamp with reflector placed immediately over the opening in the lead weight and as close as convenient. The heat rays were little absorbed by the glass but strongly absorbed by the plastic which rapidly became warm and softened. The process was observed visually, noting that the plastic appeared to wet the paper as it softened. When this wet appearance was uniform over the entire surface, the heat lamp was removed, and the plastic allowed to cool after which it could be readily removed without adhering to the paper.

This process could be carried out as often as desired with the same paper without in any way damaging the paper or diminishing the depth of any indentations on it. As many as 24 replicas were made from a single sample, and no visible differences could be observed between the first and the last.

VIEWING OF REPLICAS

The replica, being different in thickness at the point of all indentations, would seem to be examined best by pressing the surface showing the indentation against a glass plate and filling the thin space between with some colored material which would give a differential coloration to the various portions. Many materials were tried, ranging from red lacquer and balsam through to printers ink. Of all the materials tried, nothing was completely satisfactory, and this attempt was eventually abandoned. Another method which was used with some success was direct projection in an enlarging camera using the replica as a negative. The slide was treated with rouge before projection. This produced on photographic enlarging paper a black on white picture of the indented material which was legible but usually quite flat, the contrast being insufficient in the replica. The most satisfactory rapid method found until the very last stages of investigation was the rubbing of the surface of the replica with finely powdered rouge. The rouge tended to adhere in the low regions and to rub off the raised portions of the replica so as to enhance considerably the differences between the two. Illustrations of the results achieved by this procedure are shown in Fig. 3. This

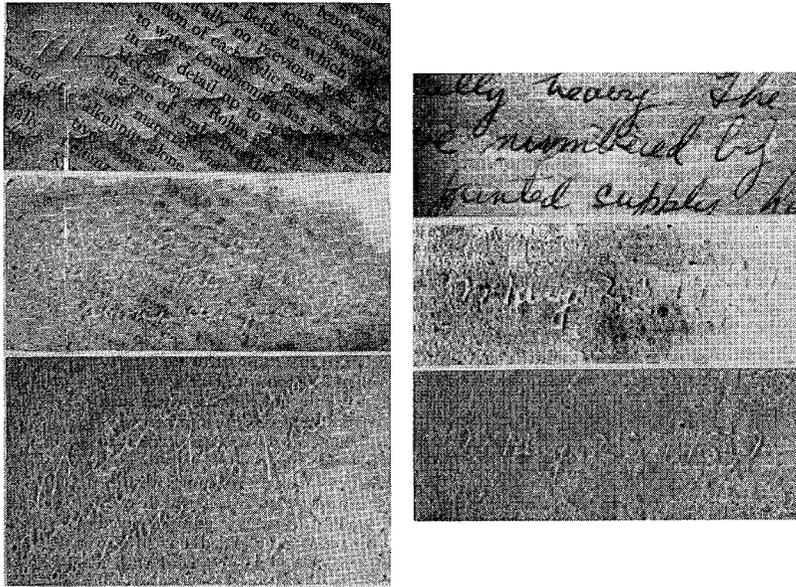


Figure 3.

Replica Reproductions.

Top: The originals photographed with oblique illumination; Middle: Replicas buffed with powdered rouge before photographing; and Bottom: Replicas reproduced by shadow photographs.

method, while satisfactory, still left something to be desired inasmuch as the technique of rubbing the replica smoothly and uniformly with rouge required considerable care. Toward the end of the rather extended investigation of the best method of developing the replica for photography it was discovered that if the latter was raised very slightly above a piece of white paper with illumination at about 45° , the shadows from the replicas showed on the light paper with startling clarity. By photographing through the replica to obtain a picture of the shadows as white on black, excellent results were obtained as is also illustrated in Fig. 3. It should be mentioned that replicas were rather easily viewed directly with the eye by holding the replica before a light in the proper position. Almost always the material reproduced on it was clearly visible. It could not, however, be photographed readily because of the very critical illumination necessary. The use of a shadow, however, eliminated this difficulty rather effectively. Either the rouge development or the shadow method is quite suitable for photography. Naturally, the photograph does not show as much as can be seen by careful visual inspection.

It seems clear that the use of plastic replicas as a means of developing indented material on documents marks a definite step forward in the technique of decipherment and restoration of indented writing, of erasures, and of obliterations to the extent that indentations are present.