CHAPTER I

INTRODUCTION

Indented writing, or second page writing, is the impression from the writing instrument captured on sheets of paper below the one that contains the original writing. This often manifests itself when pads of paper are used or in some record-keeping situations. Indented writing can be a source of identification in anonymous note cases and can be an invaluable investigation procedure when medical and other records are suspected of containing alterations. Often, a writing addition to a record or file can be revealed by an impression that has been transferred to the page below. Indented writing on subsequent pages may not be in agreement with what appears on the surface of the document. Writing found to be out of position, missing, or added after the fact can often be demonstrated by recovering and preserving indented writing from other pages.

We have all read mystery novels or been subjected to television and movie plots that have recovery of indented writing as part of a clue. The media method to "read" indented writing from suspect pages was to rub a soft lead pencil or carbon paper over the surface of the document. The indentations would be highlighted in relief. Although entertaining, the fact that this technique is one way to ruin or destroy what might be valuable evidence, should serve as a warning against amateur examinations.

Indented writing is normally recovered by one of two methods: either photographically using oblique (glancing) light or by use of an apparatus commonly referred to as ESDA, short for Electro-static Detection Apparatus. [1]

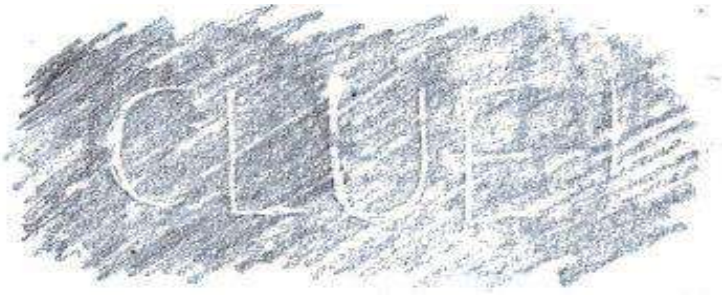

FIG.1 INDENTED WRITING[1]

In the written form of many languages, an indentation or indent is an empty space at the beginning of a line to signal the start of a new paragraph. Many computer languages have adopted this technique to designate "paragraphs" or other logical blocks in the program.

The "space" between the "text" and "left or right margin" within a document is called as "Indentation". There are "four types" of indents available in MS word: Left indent: indicates space between the "paragraph" and the "left margin". Right indent: indicates space between the "paragraph" and the "right margin". First line indent: used for "first line" of a paragraph. Hanging indent: used to define position of the text lines "below first line" of the Paragraph [2]

ESDA stands for Electrostatic Detection Apparatus. It is an instrument used for questioned document examination to reveal the indentations or impressions which may be present on paper. ESDA was manufactured by Foster and Freeman. It is a sensitive technique capable of detecting the indentations on paper. ESDA stands for Electrostatic Detection Apparatus. This instrument is used to produce a permanent 'lift' from paper which provides a visual map of indented impressions in that paper. It is extremely sensitive meaning that indentations found up to seven sheets below the page where the original writing was made may be visualized.

Document is a piece of written or printed matter that provides information or evidence or that provides as an official record. Questioned Document is a document where any signature, handwriting, typewriting or other marks whose source or authenticity is in dispute. Indentations: Indentations are created when two or more sheets of paper are resting atop one another during writing. The underlying pages contain the latent impression which can be developed by ESDA. Construction ESDA is a specialized piece of equipment made up of various parts which are ESDA machine, a thin base on which the document is to be kept, a cellophane which is a plastic film kept on the document with the help of vacuum, electrostatic charge device and a toner. The toner is more similar to the toner used in electro photographic printing device. Principle. The ESDA uses the principle that indented areas of the document carries less negative charge than surrounding areas. This causes the toner used in the Electrostatic

Detection Device (EDD) to be attracted to these areas, revealing indentations that are present. Using this technique, indented impressions have been recovered from up to seven layers of paper beneath the original writings. The impressions can be successfully visualized from documents up to sixty years old. ESDA provides a method of detecting and permanently recording latent writing impression on the surface of the paper. Virtually all materials, including conductors can be triboelectrically charged. The amount of charge is affected by material type, speed of contact and separation, humidity and several other factors. The EDD is able to visualize indentations because the surface is differently charged depending upon whether or not an indentation is present. The negatively charged toner particles are attracted to areas where there are indentations on paper surface. []

Figure 2: ESDA INSTRUNMENT[2]

ESDA works by stretching a Mylar film (like Clingfilm) over the document being examined. This Mylar film is then electro statically charged using a "wand" (a long thin stick or rod) containing a fine wire charged to 7 kV. Where the paper is smooth, the charging is generally uniform. However, where the fibers of paper have been disturbed by paper-paper contact caused by indentations, the electrostatic charge is different to the background. This creates a latent image. In order to visualize this

latent image, black toner similar to that used in laser printers is applied to the surface of the Mylar. The toner sticks where the electrostatic charge congregates (i.e. in the areas of indentations). The result is an image with a grey toner background and the darker toner traces in the areas where there are indented impressions. The image is made permanent as a „lift" by placing a clear „sticky backed plastic" over the toner producing a fixed transparent image. Toner can be put onto the Mylar film using three methods; by cascading tiny glass beads coated with toner over the surface, by puffing an aerosol of toner powder over the surface or by using a device similar to the powder puff to apply the toner. There are large numbers of variables which affect the quality of ESDA lifts. This includes the type of paper, the type of pen or stylus used, the number of sheets of paper between the writing and the sheet holding the impressions, the humidity at the time of impressions. The paper sandwiched between the grounded plate and the Mylar charging film acts as a type of a capacitor with the charge in capacitance being due to differing compensation of the paper. The page suspected of bearing indentations is covered with a cellophane material which is then pulled into firm contact with the paper by a vacuum drawn through a porous bronze plate. This serves to fasten the document and cellophane covering, to the plate. The cellophane covering prevents damage to the original document. The document and cellophane are than subjected to a repeated high voltage static charge.

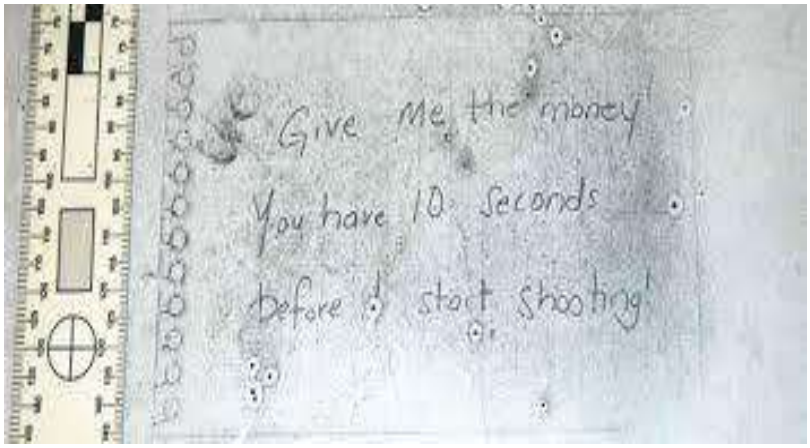

Figure 3: SAMPLE OF DEVELOPED INDENTED WRITINGS[3]

ESDA is used for visualizing traced forgery. A questioned document such as ransom note may exist which can be determined to be the source of indentation detected on another piece of paper. Decipherable indentations may also provide valuable information even when a second document is not present or cannot be located. Documents that don't contain visible identifiable marks may contain valuable impression evidence if they were underneath other documents when the writing was performed.

Advantages are ESDA has the advantage of being non-destructive so that the paper under examination remains in exactly the same state and is still available for other examination**.** It is extremely sensitive that means indentations found up to 7 sheets below the page where the original writing was made may be visualized.

Disadvantages are It is not suitable for the examination of loose paper such as newspaper or very glossy such as magazine covers. If a document gets wet by any liquid, it will completely destroy the ESDA impressions.[3]

CHAPTER II

LITERATURE REVIEW

Noblett, M. (1982) "Optimum Conditions for Examination of Documents Using an Electrostatic Detection Apparatus (ESDA) Device to Visualize Indented Writings". This study indicated that preconditioning a document in a humidity chamber maintained at 40 to 60% provided the most information from indented writings. It further indicated that aerosol application of the toner provided more information than cascade application. This study also indicated that electrostatic detection apparatus (ESDA) examination for indented writing has no deleterious effect on subsequent latent fingerprint development.

Steven J. Strach (1995) "Secondary impressions of writing detected by ESDA". Experiments have been performed which show conclusively that, under certain conditions, 'impressions' of writing can be detected by ESDA (Electrostatic Detection Apparatus) on paper which has been placed in contact with the reverse of paper bearing writing which has significantly embossed the back. Such indirect 'secondary' impressions are caused by some degree of lateral relative motion of the two sheets of paper. Secondary impressions can usually be distinguished from normal primary impressions (caused by the 'act' of writing) by several characteristics, in particular, by the indistinct, incomplete and, sometimes, diffuse nature of the secondary impression images.

Riebeling, I. (1993) "Some Parameters Affecting the Quality of ESDA Results". A systematic evaluation of the effect of humidity on ESDA images was made. The results showed that the quality of the ESDA images developed depends not upon the water content of the paper at the time the indentations are made, but rather on changes in the water content, which may occur during the period between the indentations being made and the paper being examined using the ESDA. In order to study the

effect of the moisture content on the quality of the image produced by the ESDA it was necessary to devise a system for producing standard impressions. This process has now found application as a quality control procedure for ESDA examination.

George J. Horanin (1988), "How long after writing can an ESDA image be developed" ESDA has been used for a number of years as a means of developing indented images on paper and is an essential tool for the document examiner. This paper reports on the results of experiments with various aged documents to determine how long after writing images can be developed with ESDA. The results indicate that the latent image from some writing may remain longer than fifty years. The paper also reports an actual case in which images were developed years after the document was executed, thus dating the preparation of key pages.

lN.NicDaéidin (2008), "Examining the effects of paper type, pen type, writing pressure and angle of intersection on white and dark dominance in ESDA impressions of sequenced strokes". An application of the likelihood ratio. Questioned document casework can occasionally involve the sequencing of impressions. Although some conclusions can be drawn from looking at ESDA traces of intersections there is currently no way of assessing the strength of the observations made in any given case. Using a range of paper and pen types this work examines points of intersection and evaluates the results statistically in order judge the value of the results obtained.

Om Prakash Jasujain (1991), "Preserving electrostatic detection apparatus (ESDA) images". A new approach. In the conventional method ESDA images are developed on insulating polymer film and preserved by covering them with protective, transparent adhesive tape and/or by recording the image photographically. The present paper considers a simple technique for fixing or 'fusing ESDA images on polymer film to produce a permanent recording. The quality of this ESDA image appears to remain unchanged with time

Moore, D. (1998) The Electrostatic Detection Apparatus (ESDA) and Its Effects on Latent Prints on Paper For almost a decade, document examiners have used the electrostatic detection apparatus (ESDA) to detect and visualize indentations on paper. Many of the same papers that undergo the ESDA process, however, may also be capable of yielding latent print evidence of vital importance to the successful prosecution of a case. Both the questioned document examiner and the latent print analyst, therefore, have a valid interest in the protection of paper evidence. It is common knowledge that treating a paper document with ninhydrin for latent prints can effectively destroy any indentations. This study was initiated to determine whether the ESDA process resulted in any corresponding detrimental effects to latent prints on paper documents. Four different variables were manipulated and evaluated during the testing process. The results, which seem to contradict earlier published data, are discussed as well as what steps may be necessary to best protect both latent print and indentation evidence.

Tadamitsu Sato (2007) "Electrostatic detection apparatus and method, and coordinate detection program". A shielding member is provided as an electrostatic protection device in extension lines that extend from a sensing area to switching devices via extension areas correspondingly. As a result, even if a body to be detected such as a finger contacts the extension area, it is possible to reduce the amount of the change of an electrostatic capacitance with respect to the movement of the body to be detected. Therefore, it is possible to reduce influences exerted on data to be detected, and an electrostatic detection apparatus having improved coordinate detection accuracy can be provided.

Dane T. Plaza (2015) "ESDA collection of DNA from latent fingerprints on documents". The ability to detect and non-destructively collect biological samples for DNA processing would benefit the forensic community by preserving the physical integrity of evidentiary items for more thorough evaluations by other forensic disciplines. The Electrostatic Detection Apparatus (ESDA®) was systemically

evaluated for its ability to non-destructively collect DNA from latent fingerprints deposited on various paper substrates for short tandem repeat (STR) DNA profiling. Fingerprints were deposited on a variety of paper substrates that included resume paper, cotton paper, magazine paper, currency, copy paper, and newspaper. Three DNA collection techniques were performed: ESDA collection, dry swabbing, and substrate cutting. Efficacy of each collection technique was evaluated by the quantity of DNA present in each sample and the percent profile generated by each sample. Both the ESDA and dry swabbing non-destructive sampling techniques outperformed the destructive methodology of substrate cutting. A greater number of full profiles were generated from samples collected with the non-destructive dry swabbing collection technique than were generated from samples collected with the ESDA; however, the ESDA also allowed the user to visualize the area of interest while non-destructively collecting the biological material. The ability to visualize the biological material made sampling straightforward and eliminated the need for numerous, random swabbing/cuttings. Based on these results, the evaluated non-destructive ESDA collection technique has great potential for real-world forensic implementation.

CHAPTER III

AIM AND OBJECTIVES

AIM:

To develop the indented writings through ESDA by using different Powders.

OBJECTIVES:

- To determine the development of indented writings by using different powders.
- To determine the color change in the indentation writings.

CHAPTER IV

MATERIALS & METHODLOGY

MATERIALS REQUIRED:

- Instruments:

✓ Electrostatic Detection Apparatus [ESDA]

- Chemicals:

✓ Potassium Permanganate Powder $KMnO_4$

✓ Phenolphthalein Powder

✓ $K_2Cr_2O_7$

✓ Cupric Sulphate/ Copper Sulphate

- Powders:

✓ Charcoal Power (carbon -66, oxygen- 29, calcium- 1.5, aluminium- 1.34)

✓ Green fluorescent powder (Y2O3- 91.6, Eu2O-3 7.8)

✓ Orange fluorescent powder (P2O5 -29.8, La2O3- 39.7, Ce2O3- 17.9, Tb2O3- 10.1)

METHODOLOGY:

Firstly, the questioned document is taken for examination those having suspect of presence of indented writings. So, few of the samples on which the unidentified indented writings are taken for examination. So, these indented writings are first thoroughly examined with the naked eye. With the naked eye the detection of indented writings is not possible. So, the next step used is with various powders. So, through various powders these indented writings are examined by using electrostatic detection apparatus (ESDA). So, not only the toner but different other powders can also be used to detect these indented writing so these powders should be thin, thick, smooth enough

to get these indented writings. $K_2Cr_2O_7$ powder is added to the suspected document of indented writings it does not stick to the document where indented writings are present. It is because the powder did not attract towards electricity and the powder is not smooth and fine.

Copper Sulphate powder is added on the suspected document of indented writings it does not stick to the document where indented writings are present. It is because the powder does not attract towards electricity and even the powder was not smooth and fine.

$KMnO_4$ powder is added to the suspected document of indented writings it also does not stick to the document because the powder does not attract towards electricity and even the powder was not smooth and fine.

Charcoal powder is taken for experimentation using ESDA instrument for developing suspected indented writings. When this powder is added to the mylar sheet where suspected document of indented writing is present partial development of indented writings is seen at the starting and after several trails it is seen clearly as it gets attracted to the electricity and it get substituted in the gaps of the writings and is clearly visible. It took some time to develop. So, a sticky sheet is placed on the Myler sheet where indented writings are present and it is lifted and placed on the white sheet that made writings visible clearly.

Green fluorescent powder is taken for experimenting using ESDA instrument for developing suspected indented writings. When this powder is added to the myler sheet where suspected document of indented writing is present partial development of indented writing is seen at the starting and after several trails it is seen clearly as it gets attracted to the electricity and it get substituted in the gaps of the indented writings. It took some time to develop. So, a sticky sheet is placed on the myler sheet where the indented writings are present and it is lifted and placed on the white sheet that made the writings visible clearly.

Orange fluorescent powder is taken for experimenting using ESDA instrument for developing suspected indented writings. When this powder is added to the myler sheet where the suspected document of indented writings is present partial development of

indented writing is seen at the starting and after several trails it is seen clearly as it gets attracted to the electricity and it get substituted in the gaps of the indented writings. It took some time to develop. So, a sticky sheet is placed on the myler sheet where the indented writings are present and it is lifted and placed on the white sheet which made the writings visible clearly.

CHAPTER V

OBSERVATIONS AND OBSERVATION TABLE

OBSERVATION TABLE: 1

S.NO	TYPES OF POWDERS	RESULT
1	$K_2Cr_2O_7$	Suspected indented writing not developed
2	COPPER SULPHATE	Suspected indented writing not developed
3	$KMnO_4$	Suspected indented writing not developed
4	CHARCOAL	Suspected indented writing developed
5	GREEN FLUORESCENT	Suspected indented writing developed
6	ORANGE FLUORESCENT	Suspected indented writing developed

Table 1

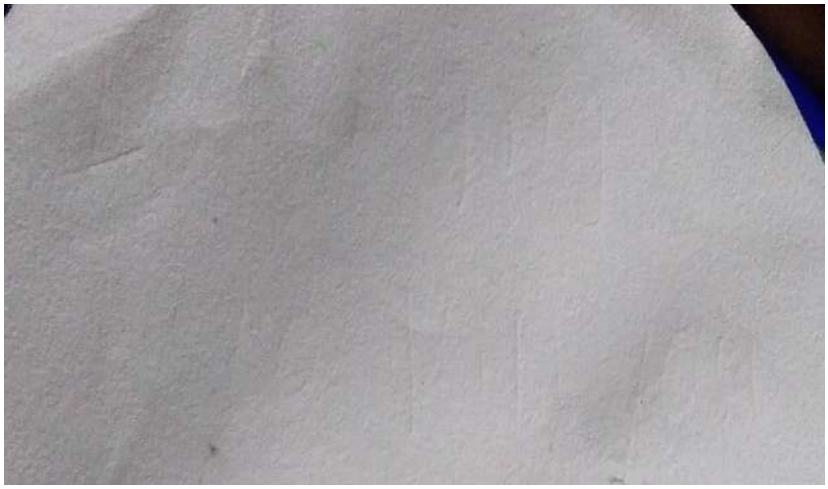

Fig. 4 Indented Writing developed by $K_2Cr_2O_7$

Fig 5. Indented Writings Developed by copper sulphate

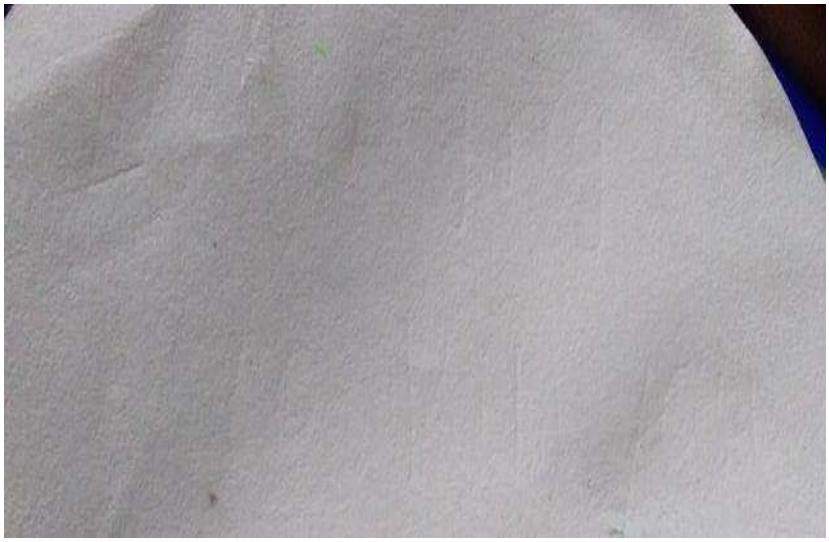

Fig.6. Indented Writings Developed by Kmno4

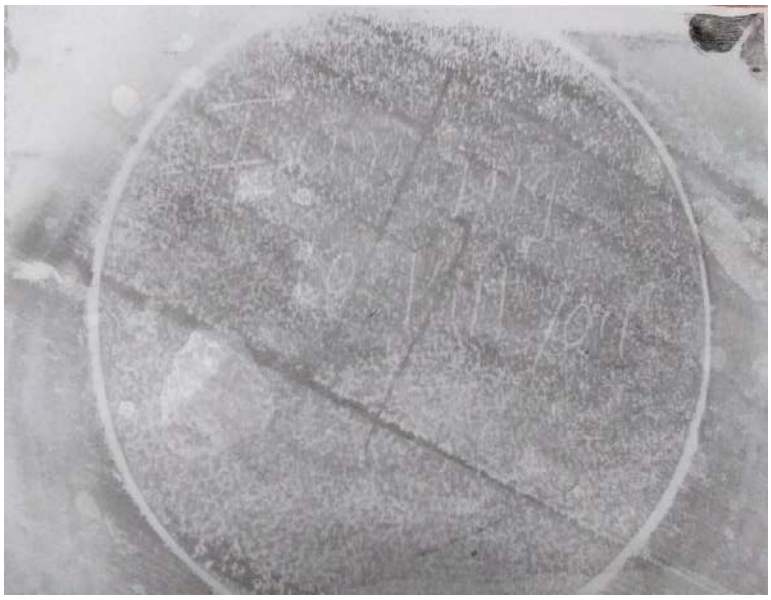

Fig. 7 Indented Writing Develop by Charcoal

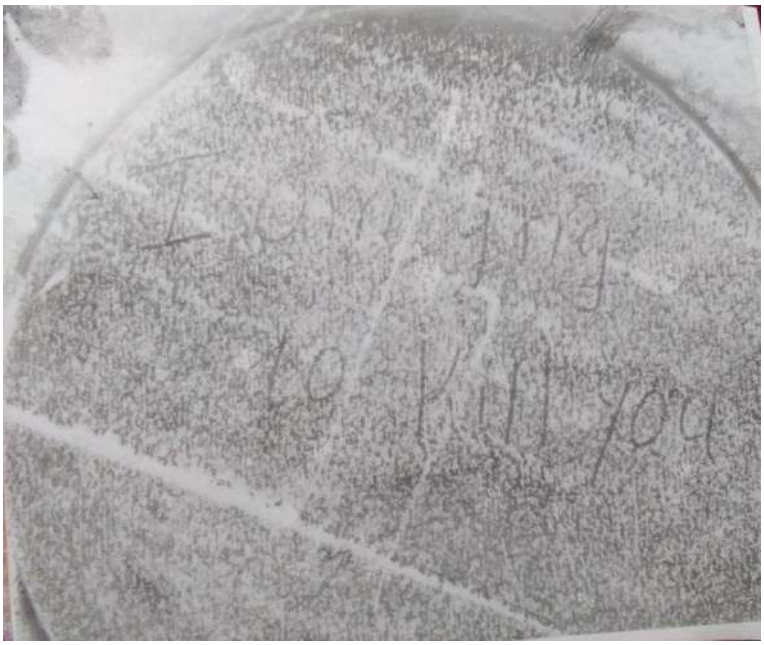

Fig. 8 Indented Writing Develop by Charcoal

Fig. 9 indented writings developed by green fluorescent

Fig 10 indented writings developed by orange fluorescent

CHAPTER VI

RESULT AND CONCLUSION

RESULT:

This study shows that not only the toner of ESDA but also through other powders we can develop the indented writings. So, the powders used for recovering these indented writings are K2Cr2O7 in one attempt the suspected indented writings are not developed. Copper sulphate in one attempt the suspected indented writings are not developed. KMnO4 in one attempt the suspected indented writings are not developed. Charcoal in one attempt the suspected indented writings are developed. Green fluorescent powder in one attempt the suspected indented writings are developed. Orange fluorescent in one attempt the suspected indented writings are developed. K2Cr2O7, copper sulphate, KMnO4 powders gave negative result by performing through ESDA to develop the indented writings. But with the help of charcoal, Green fluorescent, Orange fluorescent gave the positive result in developing the indented writings by using ESDA.

CONCLUSION:

This study concluded that not only from toner black powder of ESDA but also from other powders like charcoal, green fluorescent, orange fluorescent the suspected indented writings can be developed. Those powders are having the features of smooth and thin texture. So, we can develop the indented writings but the process is time consuming comparing to indented writing develop by toner black powder of ESDA. In future instead of toner black powder of ESDA the charcoal, green fluorescent, orange fluorescent can also be used.

CHAPTERVII

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