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Restoration techniques for obliterated Vehicle Identification Numbers on different metal surfaces: A comparative review

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ABSTRACT:

Vehicle Identification Number is code which is unique for every automobile, just like an automobile's fingerprint, as no two vehicles can have the same Vehicle Identification Number. It consists of 17 alphanumeric which acts as a unique identifier and is useful in establishing the identity of the vehicle. Its importance is paramount in identifying any vehicle involved in any crime or is stolen. The chassis and engine numbers that are useful in identification of the vehicle are first to get obliterated or erased and are replaced with new numbers in order to change the identity of the vehicle. Therefore it becomes more important for a forensic expert to restore the obliterated alphanumeric. Usually, numbers are casted, punched or engraved on the metal. These marks can be restored by applying suitable procedure and appropriate chemicals. For identifying these marks, firstly the exact location of these numbers or marks is determined. Then the area is photographed before starting with further examination. Further examination consists of both non-destructive and destructive techniques. These methods include: a) destructive methods: chemical etching, electrochemical etching and heat treatment; b) non-destructive methods: magnetic imaging, IR thermography, ultrasonic cavitation, X-Ray imaging, eddy current, scanning acoustic microscopy, thermal wave imaging and relief polishing Katterwe.

A review of these restoration techniques is presented in this article along which includes a brief description about the various methods of forming and restoring the obliterated marks and a comparative study was done to conclude suitability of restoration methods for different surfaces.

KEY WORDS: Vehicle Identification Number, obliteration, restoration techniques, deformation zone, cold working, reagent

INTRODUCTION

The chassis and engine numbers that are useful in identification of the vehicle are first to get obliterated or erased and are replaced with new numbers in order to change the identity of the vehicle. While investigating a vehicle theft case from the forensic point of view, looking for obliterated or erased vehicle identification number (VIN) and its restoration is of utmost importance. There are a number of possible ways, both physical and chemical methods that are used for erasures or obliterations. Likewise, there are various techniques available for restoring the erased mark even when the new fake number is punched above the original VIN present on chassis or the engine. Restoring these numbers is quite tedious and after application of appropriate method, as soon as result (obliterated numbers) is seen, they are immediately photographed. There are quite high chances of losing the restored marks as the metal surface has already been treated with chemicals that deteriorate its surface.

The restoration method depends upon the expertise of the expert. There are both destructive and non-destructive methods present for restoring the marks.

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As soon as the theft is reported and the vehicle is found, the forensic expert must look out for the possible exact location of the engine and chassis numbers and cross-check for their location with the manufacturer or seller of the vehicle.

Usually, three types of markings are encountered that are used for marking the numbers on the metal surface: a) cast marks, b) engraved marks and c) punched or stamped marks [1]. The restoration of these marks can be achieved by applying suitable procedure and using appropriate chemicals.

Following types of obliteration and erasure practices are common in India [1]:

1) Over stamping: Stamping of new number over previous one.

2) Peening: Metal surface is hammered with round punch for hiding the older number.

3) Substitution: A new metal plate is pasted or welded over older one that contained original number.

4) Filing: Using a powder grinder, old number is filed away and the surface is polished and later a new number is over-stamped.

5) Drilling: A drill is used for scraping off the older number along with metal surface surrounding it, creating a cavity which is later filled with welding material.

6) Center Punching: The number is obliterated with a pointed punch.

7) Welding: Metal surface is heated until it flows (using a oxy-acetylene welder) and then a new number is punched over it.

Figure 1: *Over stamped numbers*

Figure 2: *Peened characters*

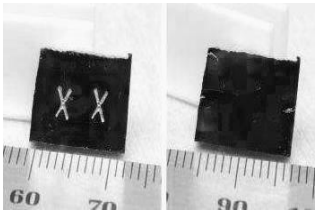

Figure 3: *Substituted characters*

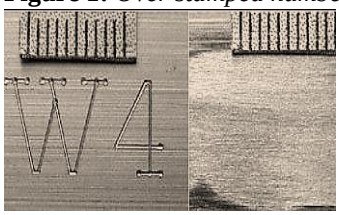

Figure 4: *Filed metal surface*

Figure 5: *Drilling metal surface*

Figure 6: *Center punching*

Figure 7: *Welding metal surface*

For identification of these marks, firstly the exact location of these numbers or marks is determined. The area is photographed before starting with further examination. Further examination consists of both non-destructive and destructive techniques. These methods include: a) destructive methods: chemical etching, electrochemical etching and heat treatment; b) non-destructive methods: magnetic imaging, IR thermography, ultrasonic cavitation, X-Ray imaging, eddy current, scanning acoustic microscopy, thermal wave imaging and relief polishing Katterwe.

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When a metal surface is either struck forcefully with a deformation or is engraved, there is a distortion in regularity of the metal surface. This creates permanent plastic deformation zone. When a metal surface is punched, it causes the metal to compress and deform which results in disturbing of metal properties and this is called "cold working". The basic properties of that material changes in that zone which includes change in hardness, electrical resistance, X-Ray diffraction pattern, thermal conductivity of the material. So if this zone is still present after obliteration, the original VIN can be restored.

The restoration of erased identification marks that were engraved on vehicular surface (engine and chassis) has truncated success rate. In contrast to stamping, when a metal surface is engraved it leaves no enunciated, enduring subsurface deformation in the crystalline structure (dislocation) that can be revealed using suitable methods [6].

In their experiment, Quattrocchi et al [2] found out that by using IR thermography and viewing the results in Mid-Range Infra-Red, at 180 micro meter abrasion depth, the numbers on their sample could be identified for deformations by laser, dot peen and impact marking and partial result was obtained for scribe marking but in case of cold press deformation, none of the numbers could be detected.

The method used for obliteration is identified and accordingly, the appropriate chemical technique is used. Finally, the area is photographed during and after the processing. According to Mukesh, chemical and electrochemical etching is able to recover obliterated marks, especially if they are engraved using plastic deformation. This process works by creating a visible contrast between damaged and undamaged surface based on the principle that the damaged surface has different electrochemical potential than regular surface [2].

Following is the table which includes the reagents that were focused upon for this article and based on which the conclusion is drawn:

Name of reagent	Composition
Reagent 1	Glycerol (30 mL), HCl (20 mL), HNO_3 (10 mL)
Reagent 2	Copper (II) chloride (30 gm), conc. HCl (40 mL), Distilled water (25 mL)
Reagent 3	Iron (II) chloride (25 gm), HCl (25 mL), Distilled water (100 mL)
Reagent 4	Iron (III) chloride (10 gm), Glacial acetic acid (20 mL), Distilled water (100mL)
Reagent 5	Conc. HCl (20 mL), Acetic acid (10 mL), Ethanol (10 mL)
Reagent 6	Conc. HNO_3 (10 mL), Acetic acid (10 mL), Ethanol (10 mL)

CONCLUSION

Although destructive techniques generally give best results [3] but they can't be repeated. Chemical etching is widely used for restoration purposes for most metal surfaces and is most successful amongst all the currently used techniques. Still, the reagents which are currently in use are toxic and therefore hazardous for health of user, therefore it is the need of the hour to develop new reagents that give much better results than those already in use (like Fry's reagent: reagent 3) but are at the same time, less toxic.

The experiments for the same reasons has been carried out by Nalini Shankar et al [3] where they developed a new etching reagent (reagent 4) for copper and its alloys, which gave best results and was even less toxic than the already existing standard reagent (reagent 3). Also,

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the marks developed after etching were stable for relatively longer time period and developing the marks was less tedious and less time-consuming.

When considering the toxicity issue, Yi Jin [4] developed a least toxic method for restoring marks using Reagent 5 for vehicle surfaces containing Aluminium and Silicon in their frame material and those having Manganese and Silicon, for them Reagent 6 gave much better results and were even way less toxic.

Recommended reagent used in chemical etching for Aluminium alloys is Reagent 1 and for Iron Alloys is Reagent 2 [1].

Chemical etching makes restored characters visible momentarily. Owing to the use of strong chemicals, they disappear in a short span of time. [5] Therefore the photography of the restored characters must be done as soon as they are spotted so that a record is maintained for future reference.

REFERENCES:

[1] Sharma, M., & Jha, S. (2015). Vehicle identification numbers (VIN). *Evidence technology magazine.September-October 2015*, 06-11. doi:10.3403/bsau175

[2] Quattrocchi, A., Piccolo, S., & Montanini, R. (2016). Restoration of abraded and covered marks engraved in steel using active infrared thermography. *Proceedings of the 2016 International Conference on Quantitative InfraRed Thermography*. doi:10.21611/qirt.2016.103

[3] Richa, Kesharwani, L., Gupta, A., & Mishra, M. K. (2013). Development of new reagent for restoration of erased serial number on metal plates. *Egyptian Journal of Forensic Sciences*, *3*(1), 26-34. doi:10.1016/j.ejfs.2012.11.004

[4] Jin, Y. (2012). Recovering Obliterated Engraved Vehicle Identification Number on Vehicle Frame Surfaces by Etching Technique. *Advanced Materials Research*, *503-504*, 56-60. doi:10.4028/www.scientific.net/amr.503-504.56

[5] Reedy, P. (2013, November 26). Document control number: 1365 Revision: 3 FEU08 – SOP for Serial Number Restoration of Obliterated: Stampings in Various Metal Surfaces. *District of Columbia Department of Forensic Sciences*, (1365), 01-06.

[6] Zaili, M. A. M., Kuppuswamy, R., & Harun, H. (2007). Restoration of engraved marks on steel surfaces by etching technique. *Forensic science international*, *171*(1), 27-32.