PRINTING TECHNIQUES USED TO SECURE BORDER CROSSING DOCUMENTS

Cristina Marcela BOROTA

Abstract

The issue of counterfeiting travel documents has always been and still is a current issue. It developed in our modern world where science and technique made possible to use or even purchase high technology devices (scanners, copiers and last generation high performance computer-aided printers, special printing machines, thus contributing to increasing the number of counterfeit documents and all these have made more difficult for the competent authorities to find counterfeit documents or even made impossible to tell which are the genuine documents issued by the competent authorities. Along with the technical progress and the use by the counterfeiters of most recent techniques and means to make or even change the documents, there’s a constant need for the progress of technologies to achieve or protect travel documents. This paper is intended to outline printing types used to secure border crossing documents, the procedures to obtain and achieve them and the features particular to each printing type; these features can be identified by means of magnifying devices and not only.

Keywords: relief printing, flexography, offset, rotogravure printing, intaglio, serigraphy, dot-matrix, ink-dot, laser printing, digital offset printing, laser gravure, innosec fusion, thermal transfer printing, thermal dye sublimation, photo technique.

Introductory notes

Generally, a state border crossing document is an official paper issued by a competent authority of a state or an international organization acknowledged worldwide entitling the holder to cross through an especially developed place, intended for international passenger traffic. We would like to mention here the simple passport, work, diplomatic passport, identity card, travel document as well as other documents established based on some international agreements entered between countries. Travel document certifies before the Romanian and foreign authorities, holder’s identity, citizenship, quality and it also entitles the holder to travel abroad.¹

Upon the examination of a border crossing document, a number of form and content requirements are taken into abroad. These are manufactured at ever increasing standards as these standards are required by an International Civil Aviation Organization (ICAO) as they tried to apply new safety measures and it is more and more difficult to be reproduced by the counterfeiters.

Criminal law does not distinguish between the various means to manufacture

¹ Chapter II, Section 1, Art. 6 paragraph (4) of Law 248 / 2005 concerning the free movement of the Romanian citizens abroad.
counterfeit documents as it refers only to their effects – a forensic technical report outlines a wide variety of counterfeits in travel documents, the counterfeiters resort to various methods to commit the crimes, from the simplest ones bringing about gross fakes, detectable with the naked eye, to the perfect ones which could mislead even the specialists.

According to counterfeiter’s reach, counterfeits can be divided into the following categories:

a) **intellectual COUNTERFEIT** - a counterfeit difficult to be detected as the documents are issued by individuals who are entitled by law to make it.

b) **material COUNTERFEIT** which can be of two types: **TOTAL COUNTERFEIT** consisting of total counterfeiting (imitation) of a document and **PARTIAL COUNTERFEIT** consisting of the alteration of a part of the original document.

One of evidence means listed by criminal law (art. 64 of the Code of Civil Procedure) the overwhelming importance of which when establishing the truth is outlined by the frequency with which judicial bodies resort to its administration in the legal proceedings is represented by “the technical and scientific findings as well as expertise”. The convincing power of the technical-scientific finding report is conferred by the rigorous scientific substantiation of the opinions expressed within its contents. For a legal expert to find a material which is counterfeit whether partially or totally must have sound knowledge of safety measures, of the technologies of how to make and protect travel documents.

Hereinafter I shall focus on the main printing techniques to secure border crossing documents, on their features as well as on how important is for the forensic specialist to be acquainted with them in his activity to find a counterfeit material.

**Printing techniques**

A **RELIEF PRINT** is an image created by a printmaking process where protruding surface faces of the matrix are inked; recessed areas are ink free. Printing the image is therefore a relatively simple matter of inking the face of the matrix and bringing it in firm contact with the paper. In intaglio, the recessed areas are the printed areas. The whole matrix is inked, and the ink then wiped away from the surface, so that it remains only in the recesses.

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2 Tactics of border police, lecture notes, Module II, Oradea, 2006
Fig. 1. Relief print – ink accumulation on borders

This process is easily recognizable from pearl-like borders. This aspect is also influenced by other factors such as: contact pressure, the structure of the area to be printed and ink composition.

Moreover, the strong contact of the moulding cylinder with paper area is also outlined by the effect of a raised seal which can be noticed by the use of a spotlight laterally. In many documents, this print is used in printing of a serial number or the number of the document.

Fig. 2. Relief print – effect of a raised seal

Another printing procedure used in the case of travel documents is FLEXOGRAPHY also called INDIRECT RELIEF PRINT. Flexography is a printing process which utilizes a flexible relief plate that can be adhered to a printing cylinder. A plastic substrate is mounted on its surface and it is used as a dye to press and form the raised areas. The use of this cylinder with rubber layer outlines the so-called pearled borders. However it does not confer the effect of an embossed seal. This procedure is generally used to protect the laminated cardboard.

Fig. 3. Flexography – pearl-like borders

In the case of FLAT PRINT, printing elements are at the same level with non-printing elements. OFFSET PRINT belongs to the category of flat printing but printing is of a high quality. Through this procedure, inked images have a uniform appearance when regarded by means of a magnifying device.

Fig. 4. Offset printing – uniform aspect
Offset printing is a commonly used printing technique in which the inked image is transferred from a plate to a rubber blanket, then to the printing surface. It is based on the repulsion of oil and water, the offset technique employs a flat image carrier on which the image to be printed obtains ink from ink rollers, while the non-printing area attracts a water-based film keeping the non-printing areas ink-free. In the case of many travel documents, background drawing of pages is impressed by means of this printing type. The procedure employed is IRIS or RAINBOW printing. In this case, there’s no clear delimitation of colors as these interpenetrate.

**EMBOSSED PRINTING** is a category of printmaking techniques in which the image is incised into a surface, known as the matrix or plate, and the incised line or area holds the ink. It is distinguished by the fact that the printing elements are arranged lower than the non-printing elements. **ROTOGRAVURE** or **GRAVURE** and **INTAGLIO** printing fall within this category.

**ROTOGRAVURE PRINTING** is a printing technique using printing plates with recessed areas or alveoli making up the inked image. Printing plate is in direct contact with the support. The depth and the size of recessed alveoli determine the quantity of ink which is transferred to the support. Very fluid and quick drying inks are used. It also allows ink overlapping. Alveoli structure can be visible in many cases. Microscope examination shows the cogged borders of images which are to be printed. This printing is palpable and can be seen in oblique light. Generally, this print is used to secure passport laminated cardboards.

**Fig. 5. Rotogravure**

**INTAGLIO** print also belongs to the category of embossed printing which is a printing technique through which the printing image is engraved on the surface of a printing plate. First of all, thick and highly colored ink is applied on a printing plate, and then ink is cleaned from the areas which cannot be printed (which are not recessed). Finally, the ink left on the engraved parts of the printing plate (the image to be printed) is transferred on the support at a high pressure. Pressure pushes
the support to penetrate the recessed areas of the printing plate thus achieving a raised tactile background which could be recognized in oblique light. It can be generally seen on the inner covers of passports and visas.

**SCREEN PRINTING** is a direct printing method, the process of producing an image by pressing color to a thin piece of canvas (matrix) directly on the printing surface. When regarded through the magnifier it appears to be made up of points. This printing type is obtained by pressing ink by means of a unifying blade (doctor blade) through the porous areas of a lattice on the screen support frame beneath.

Serigraphy allows the application, in a single operation, of a thicker ink layer than any other printing procedure. One can also see, besides the fact that ink is very dense, a pattern in the form of a grid mesh, a structure having cogged borders. Generally, this printing type is encountered when printing Optical Variable Ink – OVI.

**DOT MATRIX - A DOT MATRIX PRINTER** is a type of computer printer with a print head that runs back and forth, or in an up and down motion, on the page and prints by impact, striking an ink-soaked cloth ribbon against the paper, much like the print mechanism on a typewriter.

Each dot is produced by a tiny metal rod, also called a "wire" or "pin", which is driven forward by small levers (pawls).

The image made up of these dots is structured in vertical columns. Printing quality differs. Characters can be made up of 8, 11, 13, …dots. It is generally used when filling in personal details in the crossing border papers.
Ink jet printing uses **liquid ink**. Ink is heated. A vapor jet is created which pulverizes ink in the form of drops on the printing surface.

**INK-JET PRINTING** is achieved by means of two techniques:

a) **Continuous Jet**

b) **Bubble Jet**

**Bubble jet** is used in the case of travel papers.

Drops and dots are of a fix size randomly dispersed. It has the appearance of dispersed layer of points. It is generally used when filling in with personal details as well as when inserting holder’s picture. It is also used when counterfeiting background drawing.

As for **LASER PRINT**, no liquid ink is used but powder or graphite – toner. Printed images or characters remain on paper surface as they do not penetrate the paper. These are made up of separate dots of various sizes, located at fix distances one from another. It is also likely to find slight traces of powder around the printed area. It is generally used when filling in with personal details as well as when inserting holder’s picture.

**Fig. 9. Ink-jet printing**

Besides **LASER PRINT** representing digital printing, **DIGITAL OFFSET PRINTING** is also used. These printing types resemble but present many differences both as printmaking process as well as printing outcome.

**DIGITAL OFFSET PRINT** does not use toner but uses liquid ink penetrating the paper and it does not remain on its surface. Ink is taken over from polymer matrix. This printing method uses the 4 basic colors; yellow, purple / red, turquoise and black. Increased image shows that each ink colour has its own angle. Details are very well defined, much better than those printed by laser print.

**Fig. 10. Laser print – powder traces around the printed area**
The method of **LASER ENGRAVING** does not use ink, it is a darkening process based on burning special plastic with a laser ray. Laser engraving can be made on 2 types of data supports, on security laminated cardboard and on plastic card.

In the first case, the photography and data are engraved within the laminate. Then, security paper is laminated with plastic on both sides and then put into the passport.

In the second case, personalized images can be manufactured by means of two methods:

- laser marking through encrusting,
- laser marking by means of encrusting at the OVD (Optical Variable Device) lower level,
- tactile laser marking (it is raised),
- hidden laser engraving or laser latent image can be of two types: CLI (Changing Laser Image) – vertical dot-matrix lines) and MLI (Multiple Laser Image - horizontal matrix-dot lines).

An important observation is that the images achieved would be just black-and-white (because of laser ray burning). This procedure is generally encountered at polycarbonate computerized pages. Moreover, it is also used to fill in personal details and integration of holder’s photography. It is also used to secure the photography in shadow by polycarbonate perforation.

**INNOSEC FUSION TECHNIQUE** represents an innovative method allowing the integration of color images within the polycarbonate. Until this technique was discovered, images could be introduced on polycarbonate only by means of laser (black-and-white) engraving.

**Exemple:** The identity card issued in Germany, the new model (November 2010), holder’s image is integrated by means of ink-jet print on polycarbonate (innosec fusion).
Printing by means of THERMOGRAPHY could be THERMAL TRANSFER PRINTING and THERMAL DYE SUBLIMATION.

a. THERMAL TRANSFER PRINTING

It is achieved through heat application on a heat sensitive ribbon containing wax or resin based ink.

Colored ink ribbon is heated on a certain portion. Then melted ink is completely transferred from the ribbon to the support. The size of transferred ink portion varies according the heating process. Semitones are generated by applying a raster (dot printing). The transfer of a homogenous color layer generates dots and areas with well defined borders. There can be also used special ink ribbons, for instance metal pigments.

This printmaking is used only when customizing a computerized page. For instance, in the case of an integrated photo, one could notice the traces of a heated unit used when printing (the end of cylinder). Concerning the characters, an important feature would be character border – taking the form of a ladder.

Fig. 13. Thermal transfer printing

b. THERMAL DYE SUBLIMATION

Sublimation printers use an ink ribbon and these resemble very much heat transfer printers.

The dye on the foil is heated at a specific temperature which evaporates after it penetrates the support. This penetration process needs a support covered with a special material. The quantity of dye penetrating the support varies according to the applied temperature. It facilitates the creation of an image with continuous color tones. The quality of printed image is very close to that of a photo. However, image is more diffuse, more blurred.

One should also notice that character border takes again the shape of a ladder. However, this is not as obvious as in the case of heat transfer. Dye sublimation heat transfer imprinting is a technique making possible to integrate identity details, photo or signature.
Another integration technique employed in the case of travel documents is PHOTO TECHNIQUE. This method requires emulsion stratification paper – PHOTO PAPER.

Fig. 14. Thermal Dye Sublimation

Fig. 15. Photo technique

Conclusions

The new techniques developed for document printing were brought about by the technical progress of the most recent technology which made possible to replace old technologies with the most recent ones helping to detect the counterfeiter’s criminal action. What is now regarded as a high-performance way to integrate images and text will soon be seen old-fashioned as counterfeiters will eventually succeed in reproducing it. This is why the continuous progress of printing technologies and not only is permanently required.

References

Law no. 248 of July 29th 2005 concerning the system of free movement of the Romanian citizens abroad.


Sorin Alămoreanu Senior Lecturer PhD – Criminal Investigation – lecture aid, ”Babeș Bolyai” University, Faculty of Law, Cluj-Napoca, 2008.

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http://www.igpr.ro/Criminalistic/expertize_grafice.htm