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Research paper

Management of Aesthetic Properties of Engravings Obtained Using Laser

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Abstract

The current paper discusses methods for managing the quality of engravings obtained using lasers. It is shown that in order to achieve a high aesthetic value of engravings it is necessary to adjust the layout with regard to the saturation of the tone of material and its tonal limit.

Keywords: *engraving, psd-template, laser, tone saturation, aesthetic properties.*

1. Introduction

There are four methods to control the quality of engravings.
The first - without adjusting the layout by random selection of rational values of the elements of the engraving mode - pulse power P and speed V [2].
The second - with adjustment of the layout of the template (digitized image of the material background variant) and the choice of elements of the engraving mode according to the recommendations provided on the sites or in the descriptions of the programs supplied with laser settings [3-5].
The third - without adjusting the layout, when the choice of a rational mode of engraving is performed according to the results of the aesthetic evaluation of engravings obtained on the material with a systemic variation of the values of Rome and V. And fourth - with adjustment of the layout according to the results of engraving on the material of a halftone wedge replicas [6,7].

2. Comparative analysis of management methods

The first option is the most simple and costly. To select a rational mode of engraving, you will need to make a significant number of prototypes, and the optimal result, which allows you to fully use the aesthetic properties of the material, is difficult to achieve due to the selection of the engraving mode randomly.
The second method involves modeling the layout in computer programs such as PhotoGrav, LaserCut, ArtCam, etc.
When working in the PhotoGrav program, tonal pattern of the material being engraved, for example, wood, on which the image of the original is applied, and displayed on the monitor. Assign the values of the impulse power Pim and the velocity V recommended in the writing of the program or in other sources of information, and visually evaluate the resulting layout. Changing windows of the monitor the values of P and V adjust the tone of the picture and bring the layout to the type that satisfies the customer. An image is engraved on a consistent layout.
The ArtCam program, unlike the previous one, does not contain recommendations on the choice of the values of P and V. The designer assigns them based on his own experience or sources of information.
When modeling the layout, programs do not take into account the fact that the materials have a tonal limit and difference in the computer pattern in tone and texture (if available) from the actual workpiece. These shortcomings lead to discrepancies in the perception of the layout and engraving, incomplete use of the aesthetic properties of materials and a decrease in the aesthetic value of engravings.
In accordance with the third option [1], images are engraved on the material at varying values of P and V. Then, the quality of the obtained samples is examined and the area of P and V values is determined, ensuring their highest aesthetic value of engravings. The set values are used in the future when engraving various images on the material without adjusting the layout. In this case, both the tonal limit of the QT material and its initial tone Kf are taken into account, but the method is rather laborious and expensive and does not take into account the fluctuation of material properties within one species, one breed. Figure 1 shows the engraving obtained on the harvesting of a single wood species, glued together from bars with different physicochemical properties and texture. The presence of a joint “breaks” the image, and a different initial tone of the material in the upper and lower parts of the workpiece demonstrates the possible fluctuation of the tone of the engravings within the same rock [8-10].
In all three variants, it is likely that those dark areas of the original, the saturation of the tone which exceeds the tonal limit of the QT material, will either have the same tone in the engraving or even weaken with increasing tone of the original. And all the light areas, the saturation of the tone of which is lower than the saturation of the tone of the source material Kf, in the engraving will be equal in tone to the starting material. The absence of a gradient tone in the two mentioned groups of image areas reduces its facsimileness and obviously worsens the aesthetic perception of engravings. It is possible to provide a tone gradient in the considered areas by adjusting the layout, however, to do this, it is necessary to know the values of the initial tone Kf and the tone limit of the CT material.

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Fig. 1: The engraving obtained on the furniture panel glued from the bars of the wood of one breed; beech; 95x155 mm

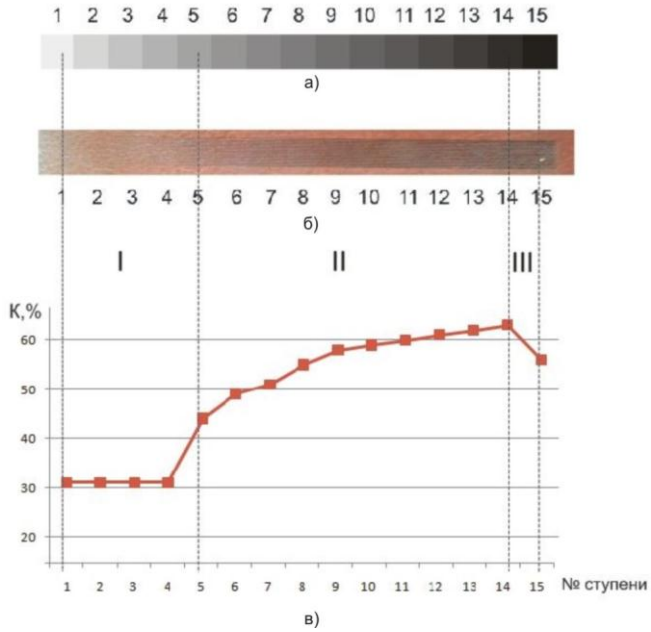

Fig. 2: Comparison of the black saturation of the replicas of a halftone wedge, made by printing on paper (a) and laser engraving on artificial leather, article number NEBRASKAA220 (b); the dependence of the percentage of black color made on artificial leather engraving in the CMYK palette on the wedge step number (c); I - the area where the tone does not change and corresponds to the tone Kf of the material; II - the tone increases to the tonal limit CT of the material; III - the tone is reduced due to the opening of the substrate material

In accordance with the fourth option of managing the aesthetic properties of engravings, the required Kf and KT values can be determined by engraving on the same blank replica of a wedge halftone for facsimile equipment (GOST 24930-81). The optical density of the halftone wedge varies from 0.1 at the first stage to 2.0 at the fifteenth, and the black saturation in the CMYK palette varies from 7 to 100%, respectively. Engraving several replicas of a halftone wedge with values of pulse power P and speed V near their average values for a given material, choose a replica in which one or several first steps match in tone with the background tone, and the tone saturation of one or several right steps below maximum (fig. 2).

When adjusting the layout according to the graph presented in Figure 2, the hue saturation of the lightest areas of layout should be set to 43% black, then the brightness difference between the light engraving areas and background will exceed the threshold value of human eye, and the image will stand out from the material. And the saturation of the tone of the darkest parts of the layout must be taken equal to 62% of black. In this case, the tonal range of the material is fully used and the maximum possible contrast between image and background and high quality engraving are achieved.

3. Conclusion

The proposed recommendations contribute to the choice of a rational method of managing the quality of engravings, to achieve their greatest aesthetic value.

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