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(54) **Process for marking surfaces by laser**

Verfahren zur Oberflächenmarkierung durch Laser

Procédé de marquage de surfaces par laser

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Description

[0001] The present invention relates to a process for marking surfaces by the application of laser beams.

[0002] As is already known, marking different types of surface is of great industrial interest as in many types of manufacture there is a requirement to mark the article on its surface. To solve the problem of marking the article surfaces, where it may be difficult to achieve permanent marking, laser marking processes have been used for a long time. These processes produce marking by means of a laser beam projector which controls the laser beam itself in such a way that the selected path to outline the characters is travelled. In other words, lines are traced using a particular model of direction, length and form, to suit the different characters or signs to be traced. To do this, the laser beam marking equipment has means for storing information relating to different types of marking characters, means for selecting the different types of marking, means for controlling the movements of the laser beam projector unit apart from the laser beam projector itself, which may be of the type provided with galvanometers. The process performed by the equipment consists of interpreting instructions on the types of writing and lettering to use so that the equipment control device generates instructions for moving the laser beam projector and switching on and off said laser beam projector to perform the marking to be produced.

[0003] With the equipment and methods currently known laser marking of the required surface can be carried out by any of three processes.

- Ablation
- Chemical change of colour
- Removing a surface layer of paint

[0004] Clearly, the different processes will be used optionally by the technician depending on the characteristics of the surface on which marking is required. Thus, for example, surfaces that allow a chemical change of colour do not necessarily require an ablation process and surfaces with a surface layer of paint require a special process for the local removal of said layer of paint to form the characters or signs. However, the surfaces of materials such as glass or metal will preferably be marked by ablation, a process in which material is specifically removed in the part of the surface to be marked according to the characteristics of the laser beam projected.

[0005] US Patent application publication n° 2005/0123864 A1 discloses a system to convert graphic images converting an image by means of progressively smaller contours of the image. The contours are defined by continuous lines with points therealong.

[0006] US Patent 6400037 discloses a marking method in which each sign is made by melting of the surface layer of the metal, which is re-solidified and smoothed to differentiate a mirror-like surface from the areas engaged by melting.

[0007] In the case of ablation the main problem is that despite having penetrated deep into the material, the visual impression is one of very little contrast. This occurs mainly on transparent materials marked by laser, but also on metals, etc. This optical effect is produced by light reflection, reflected only in the direction of the vector, and as a result the visual marking is poor.

[0008] To avoid the aforementioned problem and achieve satisfactory marking from the point of view of the ability to see the marked signs in spite of the existing ambient light, the inventors have developed a new process to which the present invention relates, based fundamentally on marking characters avoiding the continuous tracing currently known which produces little distinction by light reflection on lines produced individually by the laser device, by substituting said marking for marking by individual points which successively form each of the sections of the characters or signs to be marked. Accordingly the different points corresponding to each character are defined in such a way that the number of points, their separation and the characteristics of the points for each character to be marked are predetermined. In this way the individual characters are determined for each section of their outline, by series of previously determined points which reflect light in a plurality of directions, producing a much more visible result, which improves marking quality, since ultimately this quality can be defined by the ability to be read in the ambient illumination.

[0009] The invention will be better understood with the help of the accompanying drawings illustrating the present process, given as an explanatory but not limiting example.

Fig. 1 shows diagrammatically the outline of a letter according to the present process.

Fig. 2 also shows diagrammatically the functional operation of marking according to the present invention.

Fig. 3 also shows diagrammatically a marking application for two-dimensional code.

[0010] As illustrated in Fig. 1, the process according to the present invention is based on substituting the individual determinant outlines of a written character, for example, the arms -1- and -2- of a letter, in the case illustrated the letter "L", for respective series of individual points such as the points -1'-, -1"-, -1"-, etc. for the arm -1- and the points -2'-, -2"-, -2"-, etc. for the arm -2- of said character. The number of points will be defined beforehand so that the characters or character source of the system will comprise the definition of the individual characters by series of points that are predetermined in number, arrangement and characteristics, for example, the marking trajectories, to obtain characters with a great capacity to reflect the ambient light in different directions which, as has been proven experimentally, very significantly increases the visibility of the marking.

[0011] When marking by laser with galvanometers the

following operations are carried out, using the previously determined character source described in outline above:

- the galvanometer is moved to the marking position for the first point (moving) 5
- a waiting time is defined to ensure that the galvanometer is in the correct position (wait)
- emission of the beam begins for an adjustable period (dot)
- the galvanometer is moved to the marking position for the second point (moving) 10
- and so on for all the points that make up the marking.

[0012] An illustration of the process described can be seen in Fig. 2, showing the power applied in ordinates and the process time in abscissae. Thus, for example, starting from a first time period -3- when the galvanometer moves, there will be a waiting period -4- to improve the precision of point positioning and avoid imprecision due to inertia and times of increased power, moving next to the specific marking period -5- in which the maximum power indicated by the abscissa -6- is reached after an ascending curve -7-, which then descends following the curve -8- to no power, in other words, the switched-off position. Next, the process continues for another period -9- of movement and a waiting period -10- to another marking period -11- and so on. 25

[0013] As has been shown, the values of the different parameters for different signs, for example, alphanumeric signs, will have been predetermined and stored in the control equipment of the laser equipment so that they can be selected at the required time, to produce the specific marking required. 30

[0014] The process according to the present invention can also be applied to marking applications such as two-dimensional code, using the same process, allowing very high precision marking to be performed owing to the application of the waiting time between each two marking points. For example, in Fig. 3 a two-dimensional figure -12- has been shown arranged on a rectangular frame with sides -13- and -14-, each individual outline having also been defined in said Fig. by means of series of predetermined points similar to what has been indicated above. Clearly, the operation would basically be the same as has been indicated for the marking of each of the points, after its corresponding period of movement and waiting. 35

[0015] As will be understood, although the invention makes known the functional examples illustrated and described above, it is not limited to these examples but on the contrary, may be extended to many other variants included within the scope of the following claims including the introduction of equivalent elements. 40

Claims

1. Process for marking surfaces by laser whereby :

- a) Signs or characters are to be marked on a surface;
- b) The outlines of the signs or characters are substituted by series of individual points whereby the number, arrangement and characteristics of the points are predetermined in order that the points, once created, will reflect ambient light in different directions;
- c) The values of the parameters for the points are stored in the control equipment of the laser equipment and
- d) The specific marking required is created by laser.

Patentansprüche

1. Verfahren zum Markieren von Oberflächen mittels Laser, bei dem

- a) Zeichen oder Buchstaben auf einer Oberfläche zu markieren sind;
- b) die Konturen der Zeichen oder Buchstaben ersetzt werden durch eine Reihe individueller Punkte, wobei die Anzahl, die Anordnung und die Charakteristika der Punkte zu dem Zweck vorbestimmt werden, dass die Punkte nach ihrer Erzeugung Umgebungslicht in verschiedene Richtungen reflektieren;
- c) die Werte der Parameter für die Punkte in der Steueranlage der Laserapparatur gespeichert werden, und
- d) die spezifische erforderliche Markierung durch Laser erzeugt wird.

Revendications

1. Procédé de marquage de surfaces par laser dans lequel :

- a) des signes ou des caractères doivent être marqués sur une surface ;
- b) les contours des signes ou des caractères sont substitués par des séries de points individuels où le nombre, la disposition et les caractéristiques des points sont prédéterminés afin que les points, une fois créés, reflètent la lumière ambiante dans différentes directions ;
- c) les valeurs des paramètres pour les points sont stockées dans l'appareil de commande de l'installation laser ; et
- d) le marquage spécifique requis est créé par laser.

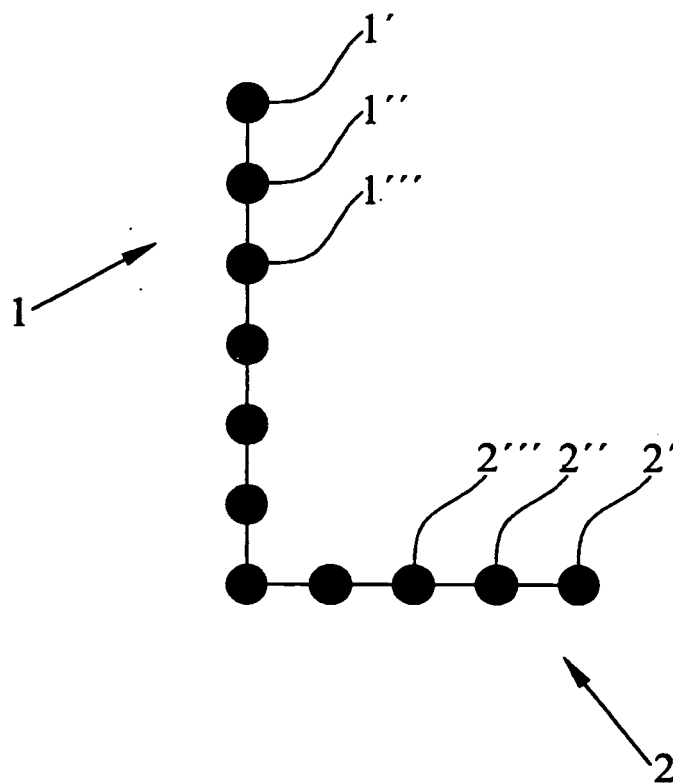


FIG.1

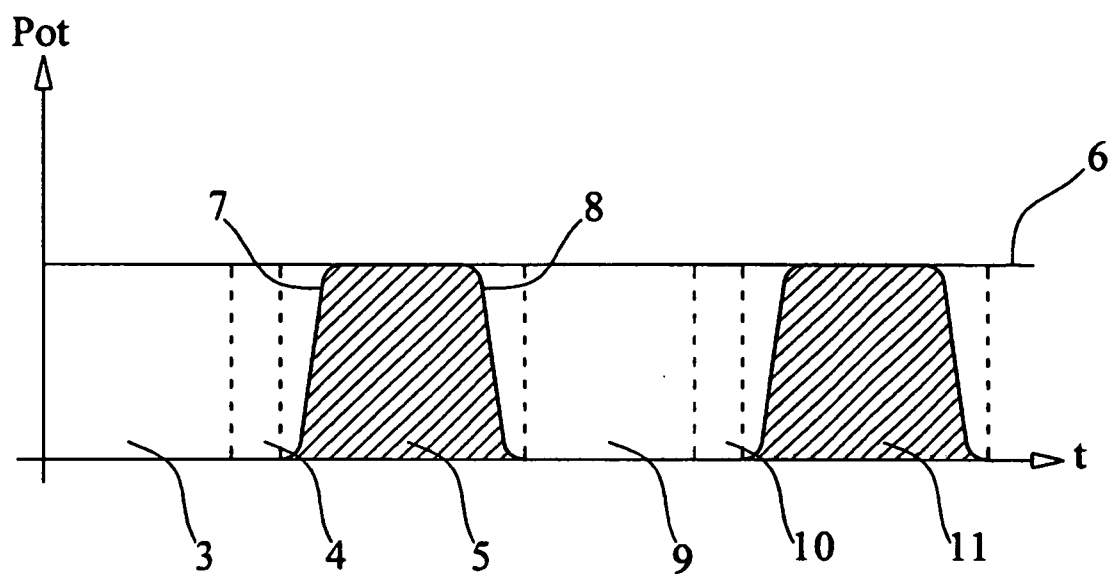


FIG.2

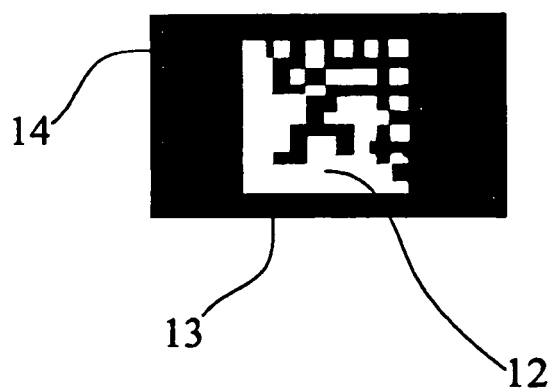


FIG.3

REFERENCES CITED IN THE DESCRIPTION

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