



(11) **EP 1 832 435 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.09.2007 Bulletin 2007/37

(51) Int Cl.:
B41M 5/24^(2006.01) B41M 5/26^(2006.01)

(21) Application number: **07380059.1**

(22) Date of filing: **05.03.2007**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE
SI SK TR**
Designated Extension States:
AL BA HR MK YU

(30) Priority: **07.03.2006 ES 200600554**

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

(57) The process provides for marking identification signs by prior determination of individual segments of the outline that correspond to respective series of points with predetermined parameters for the number of points per segment, the extent of the individual points and the individual marking trajectories, each of the points of each

segment of the distinctive sign being produced individually and successively, achieving marking with multiple reflection directions for each point and greater visibility under particular illumination.

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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] 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.

[0006] 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.

[0007] 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.

[0008] 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.

[0009] 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)
- 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)

- and so on for all the points that make up the marking.

[0010] 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.

[0011] 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.

[0012] 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.

[0013] 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.

Claims

1. Process for marking surfaces by laser, **characterised in that** identification signs are marked by prior determination of individual segments of the outline that correspond to respective series of points with predetermined parameters for the number of points per segment, the extent of the individual points and the individual marking trajectories, each of the points of each segment of the distinctive sign being produced individually and successively, thus achieving marking with multiple reflection directions for each point and greater capacity to be seen under partic-

ular illumination.

2. Process for marking surfaces by laser, according to claim 1, **characterised in that** multiple sets of alphanumeric characters are produced beforehand in which each segment of the characters is defined by a predetermined series of points.
3. Process for marking surfaces by laser, according to claim 1, **characterised in that** marking is produced by laser equipped with galvanometers.
4. Process for marking surfaces by laser, according to the previous claims, **characterised in that** the outline of the individual segments of the distinctive sign is produced by individual, successive tracing of each of the points with prior application of two preadjusted time periods, for moving the galvanometer and for the waiting time respectively, ensuring the correct position of the galvanometer, after which the marking time occurs for another predetermined period for each physical point produced, continuing in the same way for the other points to be marked.
5. Process for marking surfaces by laser, according to the previous claims, **characterised in that** marking is produced by one-dimensional or two-dimensional codes.

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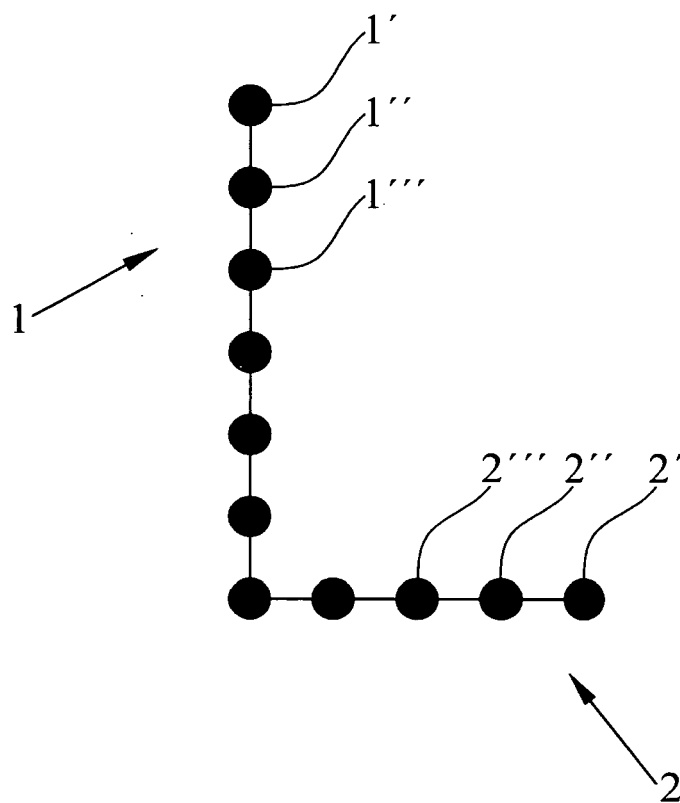


FIG.1

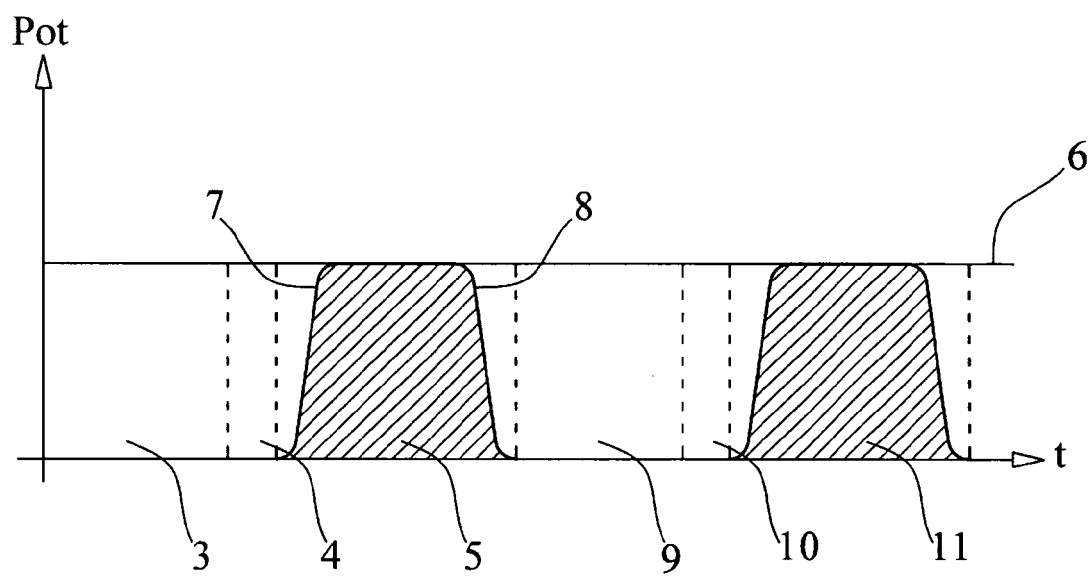


FIG.2

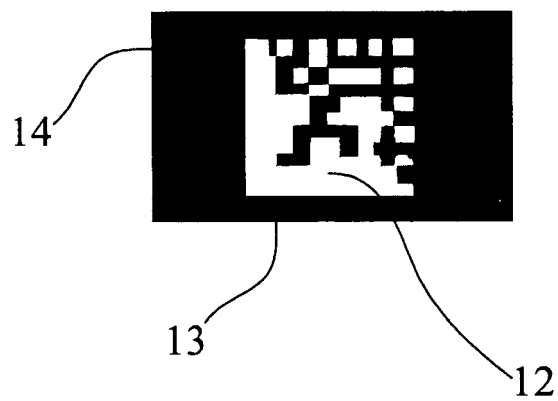


FIG.3