Laser Etching machine works on vector and raster engraving

Harjit Singh

Mechanical Engineering Department, Lovely Professional University, Punjab.

Abstract

Laser etching machine is an advance technique of making complex designs on metals and ceramics materials. This method is adopted now days to make 3 D creatures. The advantage of laser engraving is non-contact type and also having coloring features also to make the objects looks beautiful. The only disadvantage of laser engraving is its radiation and nearby spot is got red hot zone. Researchers are working on it to make the beam so precious that this effect should be lower.

Keywords: Laser engraving, laser beam, raster engraving, vector engraving.

1. Introduction

Laser stamping is a more extensive classification of techniques to leave blemishes on an item which incorporates shading change because of substance/atomic modification, burning, frothing, softening, removal and that's only the tip of the iceberg. The system doesn't utilize any sort of color inks nor include device bits which makes contact with the etching area and destroy the surface, consequently giving a bit of leeway over elective etching or checking procedure where inks or apparatus bits must be routinely supplanted.

Laser markings sway has been articulated for explicitly structured "laserable" materials and furthermore for certain paints. These incorporate laser-touchy polymers and novel metal compounds.

2. Literature review

Macken et al inverted the non contact type laser engraving process and apparatus. They used the mask arrangement on which laser beam is directed upon the workpiece. The used mask will be transparent or reflective. The generated laser beam is transfer through optical means. The image on the workpiece is produced by the mask. The arrangement of setup consist of parallel arrangement, one side support table hold the mask and other side work piece is fixed. The laser beam sources are moved relative to each other such that the beam scans the mask and thus the work piece [1].

Ehrenwald et al utilize the laser system for diamond markings. The narrow line width and shallow penetration depth is get by harmonic convertor device which generates an output frequency i.e., second harmonic frequency of the primary laser frequency used in combination with a lens procure short focal length with a heavy density

pinpoint spot of high laser energy. This energy is controlled by polarization attenuator. The arrangement of set up consists of computer through which orientation commands given to the movable support on which diamond is kept [2].

Ostroff et al works on curved surface. They employ a single plane while focusing the focal point of the laser beam toward the plane by keeping the average functional gap among the surface being engraved and laser's focusing lens [3].

Garnier et al designs the portable electronically controlled engraving machine in 2-axis. In the set up, their use number of mirrors and a carriage assembly. This carriage assembly moves in X and Y axis. The workpiece is mounted on support member. As the carriage assembly are move which in turn causes movement of mirrors to control the laser beam fall on it and engrave on work piece [4].

Levy et al works on color laser engraving and digital water marking. The engraving is done by surface layer i.e., one or more sub layers. Now these sub layers are marked by different colors of ink [5].

Young et al proposed laser engraving on ceramic materials like tiles, stone articles and brick. The set up is so design that laser beam is steer to the surface repeatedly through traversing it[6].

3. Laser etching machine

A laser etching machine principally comprises of four fundamental components: a laser, a manipulator, and stepper motor. It resembles a pencil - the energy discharged allows the manipulator to make designs onto the material. The manipulator with the assistance of stepper motor chooses the heading, force, velocity of development, and expansion of the laser energy focused on a superficial level. The area is selected to coordinate where the laser can follow up.

Where the laser ("laser" and "laser energy" might be utilized reciprocally) contacts the surface ought to be at central area of the laser's framework. This point normally little, most likely not exactly a small amount of a millimeter which relies on the optical frequency of the laser. The zone inside this point of convergence is influenced when the laser bar disregards the surface. The outside of the material changes according to the laser convergence point. That warms up the area so in this way disintegrates the material or maybe the material may crack (known as "glassing" or "glassing up") and chip off the surface. Slicing through the paint of a metal part is for the most part how the material is laser engraved.

During the etching procedure, if the surface material is disintegrated, ventilation using blowers or a vacuum siphon is required to evacuate the toxic vapor and smoke emerging from the procedure. For the expulsion of flotsam and jetsam from the surface, the laser is permitted to etch constantly. A laser evacuates material proficiently because of its structure which takes the area in such way that converts a high level of light intensity

into heat vitality.

In the materials like wood, plastics and lacquer plane, as the light intensity is to warm increasingly effective. Be that as it may, on account of this proficiency, the gear utilized in laser etching gets heat up quickly. For this reason the cooling set up are demanded. As for our situation, we have connected a fumes fan to cool the laser persistently.

By programming the controller to navigate a specific way various examples can be engraved with the laser energy after some time. To accomplish a steady evacuation profundity of material the hint of the laser pillar is deliberately managed. For instance, confusing ways are kept away from to guarantee that each carved surface is presented to the laser just a single time, so a similar measure of material is evacuated. The velocity on which the pillar starts move over the plane is likewise examined in making etching designs. By altering the force and expansion of the energy permits greater adaptability in the plan. For instance, by changing the extent of time the laser is turned on during each heartbeat, the force conveyed to the etching surface can be controlled suitably for the material.

Hence, the situation of the laser is known precisely by the manipulator, so it's not important to add a hindrance to the surface to keep the laser from veering off from the endorsed etching design. Subsequently, no resistive cover is required in laser etching. This is basically why this strategy is unique in relation to more established etching strategies.

Laser etching innovation has been embraced into the business standard in the creation line. Right now, the bar is coordinated into turning or oscillating mirror. It's movement help in a way the laser to follow materials from the surface being machined. The laser machining permits structural materials like plastic and glass set apart "moving". Station where machining happens is known as a "stamping laser station".

A laser table is utilized for progressively exact and outwardly embellishing etchings. A laser table or X-Y table is a refined arrangement of gear utilizes to direct the laser bar all the more definitely. The laser is typically fixed for all time to the side of the table and discharges light towards a couple of portable mirrors with the goal that each purpose of the table surface can be cleared by the laser. At the purpose of etching, the laser bar is engaged through a viewpoint at the etching surface, permitting extremely exact and complicated examples to be followed out.

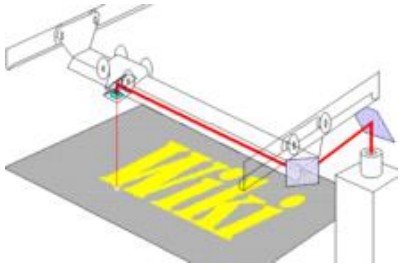

Fig.no. 1: Mirrors on both X and Y carriages for exact positioning

A typical setup uses two stepper motor to guide the laser in X and Y direction respectively. The laser move according to the drawing to be engraved in the X-Y plane. The workpiece is stationary and is generally of the size of the laser engraving machine. The rails which form the base for the movement of the laser determine the size and area in which the laser can move freely.

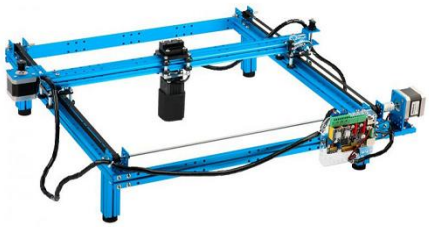

Fig.no 2: X-Y Laser Engraver

In other laser etching gadgets, for example, a level table or drum etching, the pillar is manipulate to coordinate the large portion of its vitality at a fixed entrance profundity into the material to be engraved. Right now, a specific profundity area are expelled during the etching happen. The arrangement favored for materials those don't shift in tallness apparently

Fig.no 3: Flat Table Laser Engraver

For a surface that changes in stature increasingly expound centering components have been created. Some are known as powerful self-adjust frameworks. The lasing parameters are balanced continuously to adjust to the adjustments in the material being engraved. The stature and profundity of the material are resolved with gadgets that track changes to ultrasound, infrared or obvious light which is focused on the etching surface. These lasers are called pilot energy or pilot lasers assists with directing the alterations built to focal point of the laser in deciding the ideal spot to concentrate on a superficial level or evacuate the material successfully.

This X-Y laser etching machine works in vector and raster mode.

Vector etching purse line and bend for example to be engraved, like a pen-based plotter draw by building a line portion from a portrayal frameworks. The starting etching signs and plaque utilized pre-put away textual style plots so the characters could be matched to estimate or replicated during precisely characterized movements. The fill territories were shockingly tricky, as cross-incubating examples and dab fills now and again displayed uber-designs brought about by the uncertain count of spot dispersing. The presentation of the PostScript page

depiction language currently permits a lot more noteworthy adaptability. PostScript programming like CorelDraw or Adobe Illustrator permits anything to portray in vectors loaded up with appropriate examples.

Raster etching cross the laser over the area into and fro gradually progressing straight example that takes after the print head on an inkjet or a comparable printer. This is enhanced by the manipulator utilizing a PC so the territory to either side of the sample that isn't required to be engraved are overlooked and the cross over the material is abbreviated bringing about better proficiency. The measure of the advance of each line is regularly not exactly the genuine speck size of the laser. The engraved lines some of the time cover somewhat to make a congruity of the etching process. Precise situating and repeatability are fundamentally critical to plan the machine as now and again the length of the bends or diagonals endure if the length or position if the raster line shifts even marginally comparable to the nearby raster filter. The upside of rasterizing is close to easy "fill" it produces. Most pictures to be engraved are strong letters or have huge consistently to-be engraved territories. While conventional sign and plaque etching would in general kindness the strong strokes of vectors due to legitimate need, present-day shops will, in general, run their laser etchers for the most part in raster mode, saving vector for a customary layout "look" or for expediently checking blueprints or "incubates" where a plate is to be cut.

4. Conclusions

Laser engraving is employed for design complex shapes on metals and ceramics materials. Later on the add on feature of ink jet is also came which creates sub layer cuttings. It can create 3 D creatures very quickly. The only disadvantage of laser engraving is its radiation and hot spot on which researches is going on.

5. References

1) Macken, J.A. and Palanos, P.N., OPTICAL ENGINEERING Inc, 1979. *Image transfer* laser engraving. U.S. Patent 4,156,124.

2) Ehrenwald, J. and Miller Jr, C.B., EHRENWALD JERRY 4001 JUDITH LANE OCEANSIDE NY 11572, 1984. *Method and apparatus for laser engraving diamonds with permanent identification markings*. U.S. Patent 4,467,172.

3) Ostroff, M.G. and Ostroff, S.K., Standard Chair of Gardner Inc, 1990. *Laser engraving method*. U.S. Patent 4,947,022.

4) Garnier, S.F. and Doran, J., Melco Ind Inc, 1991. *Portable electronically controlled laser engraving machine*. U.S. Patent 4,985,780.

5) Levy, K.L., Labrec, B. and Jones, R., Digimarc Corp, 2010. *Color laser engraving and digital watermarking*. U.S. Patent 7,763,179.

6) Young, M.J. and Marzano, C.E., Acme Services Co LLP, 2012. *Laser engraving of ceramic articles*. U.S. Patent 8,232,502.