

L.P. Machine (Laser Cutting and 3-D Printing Machine)

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Abstract

L.P machine consists of two main machines which are laser cutting and 3D printing combined in one machine, these all machines are very expensive in the market so instead of buying two machines we can buy only one machine with both functions and having high accuracy.

In our project we have decided to develop working model of laser cutting and engraving machine. This machine is very useful in our department since it's a kind of rapid prototyping machine. It can cut out paper patterns and thermoplastic sheets to produce desired shape and patterns. Till now we have collected information on laser cutting, laser and what engraving is. Laser cutting is different from laser engraving; in case of engraving very low intensity laser torch is used as compared to laser cutting. We got a brief introduction on laser, how it works, what are its properties, how to generate it and how to control its intensity. It might not cut through chunks of wood but surely burn the top layer.

So combining both the machines in one we can make both the processes economical efficient and easy to use. This will also occupy less space and reduce men power required.

Keywords: *Light Amplification, 3D printing, Machines, Laser cutting, L.P machine*

INTRODUCTION

Laser stands for Light Amplification by Stimulated Emission of Radiation, was discovered in 1960. Laser light beam is different from normal light beam because of its high temporal and narrow spectral bandwidth. Here amplification of light is achieved by a laser active medium (gain medium). This medium is obtained by stimulated emission of photons from a lower energy state to a higher energy state previously populated by a pump source.

3D printing or rapid prototyping started from meager beginnings, but it has grown one of the best technology in manufacturing sector. Basically the origin of rapid prototyping have been branched from the CAD industry. Solid modelling which is a feature of CAD which produces 3D objects in an electronic format was introduced in the 1980s. Rapid prototyping technology was born in the late 1970s when scientists at ultra violet products, Inc. worked to develop a technology that could build 3D parts using laser. This technology worked by curing or hardening a thick liquid substance called resin in the shape of the required prototype as the photopolymer was exposed to the head it became harder and eventually became completely rigid.

Laser cutting and 3D printing shows clear advantages versus traditional processes such as unlimited choice of material, the directional use of computer coded design structure data high geometric flexibility and non-contact type of tool. Laser cutting requires the selection of optimal machining parameters for the job unlike the mechanical Incision the depth of the single remove layer is chosen from the beginning as input power for the process parameters such as laser power and scan speed.

Our project consists of laser cutting and 3D printing.

LITERATURE SURVEY

European Journal of Advances in Engineering and Technology, 2015, 2(10):70-76.

A literature review on laser cutting on stainless steel-304

Authors- Vidya N. Nair, Gandhinagar, India

Vikrant B. Mahajan

This paper presents a review on conclusion of various research papers available on laser beam machining on various properties that affect the quality of the process such as heat affected zone formed in the work piece, the laser cutting quality

and also why laser beam machining is more advanced than other machining processes.

ISSN: 2278 – 909X International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 5, Issue 7, July 2016

Abstract— A 3D printer is a machine that uses a CAD (Computer Aided Design) model to perform rapid prototyping. While traditional 2D printers use ink to print digital information onto paper in two dimensions (x and y axes), 3D printers have the ability to print in three dimensions (x, y, and z axis).

OBJECTIVES:

The objectives of the work are:

- To reduce the large scale industrial cutting machine to a small portable lab equipment.
- To decrease the cost of making prototypes.
- To reduce the cost of manufacturing.
- To make it useable for cutting paper, polystyrene and thin sheets
- Make the machine mobile.

- Developing concept sketches and then reviewing it with the customers to find according to them what the shapes should be made.
- Small models with high precision and high accuracy can be made.

WORKING PROCEDURE AND METHODOLOGY

- L.P machine is the combination of two machines which are combined for working on a small scale basis. The two machines are laser cutting and 3D printing machines similarly CNC milling head and reaming head can be combined into one machine to form all in one small scale machine.
- The L.P machine is designed in such a way that the head attached to the machine can be removed and other working heads can be attached to it.
- Laser cutting is a technology that uses a monochromatic beam of light to cut materials and is used for industrial manufacturing applications, small scale applications and so on.

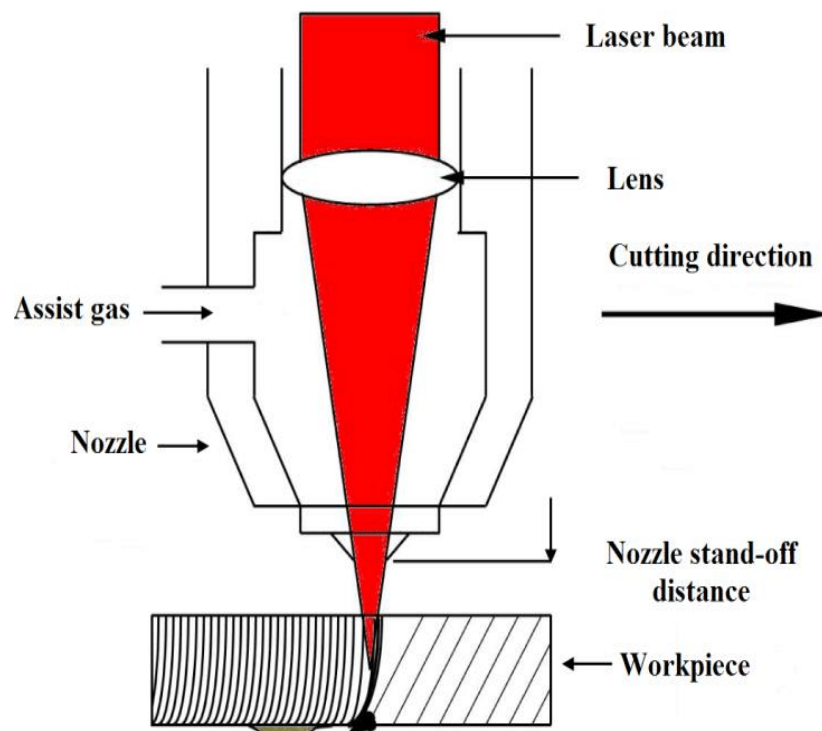


Figure:-1

- Laser cutting works by directing the output of a high power laser most commonly through optics the focused laser beam is directed at a material which then either melts, burns, vaporises away and is also sometimes blown away by a jet of gas leaving an edge with high quality surface finish, the laser beam is directed through a set of code languages and software to cut the desired shapes and designs.
- 3D printing is an additive manufacturing process which can be defined as layer by layer fabrication of 3 dimensional physical models directly from a computer aided design data.

- Additive manufacturing process involves five steps.

CONCEPTUALISATION

It is a process in which one needs to imagine and also develop a thought about the function and appearance of the product. This may be done in the form of textual description, sketches and 3D computer models.

CAD

CAD is modeling of a computer aided design software in which solid modeling packages such as solid works, pro engineering, catia and unit graphics are use to represent 3D objects more accurately

than 2D wireframe modelling packages and gives better results.

COVERSION TO STL

The STL file format of a 3D cad model captures all surfaces of a 3D model by the means of stitching triangles of various sizes on each surface.

BUILD AND POST PROCESSING

In this step slicer program is used to divide the models into layers in the build

direction based on their desired thickness ideally the thickness would be slightly larger than the mean diameter of powder to achieve high coupling of laser energy input into the absorption heating and melting of powder.

Post processing is an optional technique in which several additional steps of processing can be carried out such as surface dimensions or material property of the build part.

MECHANICAL COMPONENTS

FRAME

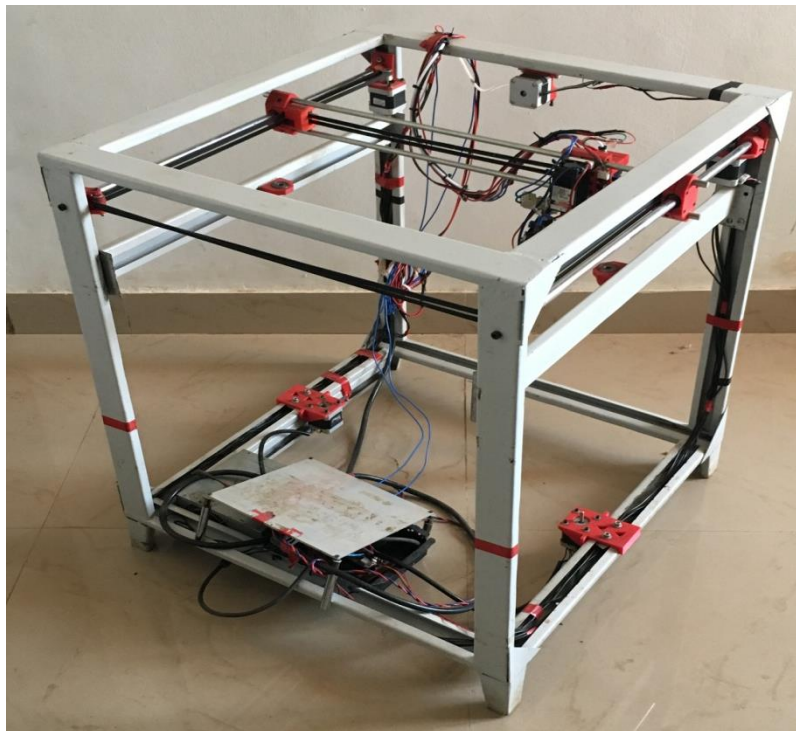


Figure:-2

The function the frame is to hold the machine together. It houses all the parts of the machine.

EXTRUDER



Figure:-3

An extruder is a device which is used to form objects of a fixed cross sectional profile. A material in its molten form is extruded to form the given profile.

LASER HEAD



Figure:-4

A laser diode is electrically a PIN diode. The active region of the laser diode is in the intrinsic (I) region and the carriers are pumped into that region from the N and P regions respectively.

POWER SUPPLY



Figure:-5

A machine requires electricity in order to operate its motors, control boards, and heating elements. The most readily available source of electricity is the standard wall outlet. However, the 110~120 AC power cannot directly power the 3D printer. The components require a low voltage DC power to operate, and would quickly burn out from the high voltage therefore a power supply unit (PSU) is necessary to convert the 110~120 AC to DC, Typically 12~24 volts which can be used to power the printer

CONTROL BOARD



Figure:-6

The control board is made up of two different components a microcontroller circuit, a microcontroller and a circuit board.

Here the microcontroller used ADRENO board this is based on microcontroller chip ATMEL ATMEGA 328.

ADVANTAGES

- Design complexity and freedom.
- Complex components can be create within hours, with limited human resources.
- 3D printing processes allow for mass customization.
- Additive manufacturing can eliminate the need for tool production.
- Extreme lightweight design.
- Environmentally friendly.
- No storage cost.
- Increased employment opportunities.

DISADVANTAGES:

- Questionable accuracy.

- Limitations of raw material.
- Good skills required for application design and to set process parameters.
- Cost are more than used for traditional manufacturing.
- Limitations of size.
- The cost of 3D printer is more.

CONCLUSION

The LP machine opens up a wide variety of fields in laser cutting and 3D printing; these are very helpful in building bright future in 3D printing and laser cutting. Laser cutting technology enables us to cut complex shapes without the need of tooling and at similar or faster speeds than other methods.

Additive manufacturing helps in increasing the speed at which the parts are produced compared to traditional manufacturing methods.

These are some of the major advantages that will help us peak in manufacturing and design sectors to produce complex parts and intricate shapes with ease and increase speed.

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