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ULTRASONIC WELDING FOR EAR LOOP MASK

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Abstract: ***The ultrasonic welding (UW) technique is an ultrafast joining process, and it is used to join thermoplastic composite structures, and provides an excellent bonding strength. It is more cost efficient as opposed to the conventional adhesive mechanical and other joining methods. In the paper, an ultrasonic atomization welding system is discussed, which composed of the high frequency ultrasonic power supply and the transducer. The high frequency ultrasonic power supply provides appropriate electric for the transducer, and the transducer transforms the electric energy into the ultrasonic kinetic energy. This project is focus on the theory analysis and the design of the mechanical system. Based on the analysis and argument of ultrasonic welding power, for ultrasonic welding of the specific requirements, other parts, gave the parameters of calculation and choice of methods.***

Keywords*- ultrasonic welding, transducer, kinetic energy*

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I INTRODUCTION

Composite materials are considered as the wonder material, as all the industries are obsessed to reduce weight and increase the specific stiffness. Fiber reinforced composites fit the bill perfectly and reduce weight significantly. However, there are still some associated obstacles to realize their true potential in the industrial manufacturing landscape. Polymer matrix composites are increasingly used in aerospace, automotive, marine, transport, sports and many other applications, as compared to conventional metals. This is due to lower weight, specific stiffness, corrosion resistance and high fatigue life, as compared to metals.

Matrix systems used in composites are thermo set and thermoplastic. Recently, thermoplastic composites havebecome the most demanding material, as these provide numerous advantages over thermo set composites. Thermoplastic (TP) composites are preferred due to their excellent vibration damping , high impact resistance , high productivity, high damage tolerance, fracture toughness , recyclability, reform ability, being wieldable and repairable, having flexural strength and their cost effectiveness compared to thermo set composites , and these properties attracted its usage for high end applications, such as manufacturing the fuselage and wing sections of an aircraft. Thermoplastic resin has an inherent ability to become softer once heated above the defined temperature range and retain their properties once they are cooled down. Hence, Thermoplastic composites are an attractive candidate for the welding of two similar TP composite materials or a TP aterials)

As per the industrial reports , the most anticipated research directions in the technological advancement of composite manufacturing technology for automotive, aerospace, sporting, marine, offshore and other applications are

- Reducing the raw material cost.
- Automation of manufacturing for mass production.
- Bonding/joining methodologies for complex compositeparts.
- Recyclability offered by the final composite part.
- Repair and structural health monitoring for damagedetection.

The cost of composite aircraft structures assembled using mechanical fasteners is reported to be 19%42% of the total aircraft cost , thus the effective and optimized fusion

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bonding will potentially reduce the overall manufacturing costs. A cost comparison study was performed by the Defense and Space Group of the Boeing Company, and it was reported that labor savings of greater than 61% could be obtained by fusion bonding (welding) a composite wing structure, as compared to a bolted one.These traditional methods have many drawbacks, such as, in mechanical joints, there is a stress concentration due to holes, there are chances of delimitation while drilling the hole, the additional weight of fasteners, rivets and bolts, extensive labor work and the time required. This highlights an intensive and growing need for an improved method of an automated joining of thermoplastic composites. A review study was also carried out by Costa et al., on different fusion bonding technologies that can be implemented in aerospace industries. In the study, the different fusion techniques, such as resistance welding, induction welding, ultrasonic welding, microwave welding, and others, were applied in aerospace structures based on the specific application and requirements.

Manufacturing large composite parts, such as the fuselage and wing section of aircraft, or the body of the automobile car, require a large and complex mold, which consequently means a Substantial increase in the cost. However, such a complex part can be manufactured through the assembling of small parts by using different joining techniques. There are several joining methods used for composite materials, as shown in Figure1. For assembling the large composite structures, the conventional methods which are used in industries are mechanical fastening using Rivets and bolts, co-consolidation bonding, and chemical bon ding by control adhesives.

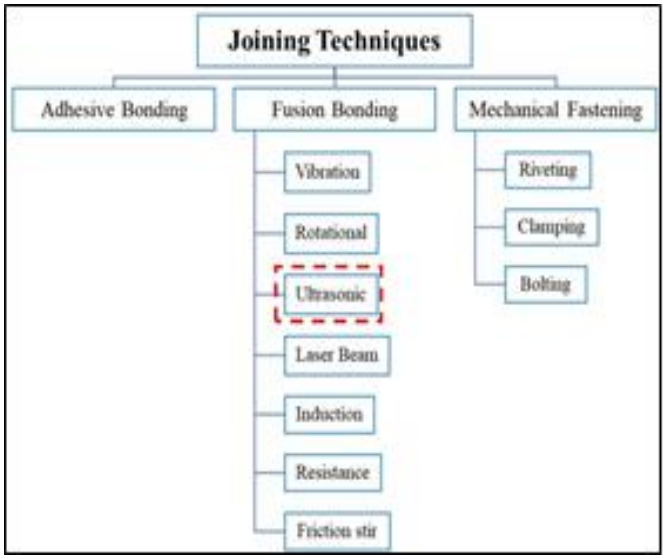

Figure1. *Different joining techniques for composite materials and their corresponding methods*

II. WORKING PRINCIPAL

The system of Ultrasonic power mainly consists of driving circuit, power amplifiers, matching circuits, transducer and feedback circuit components. Ultrasonic power supply theory as shown in figure 1. shows.

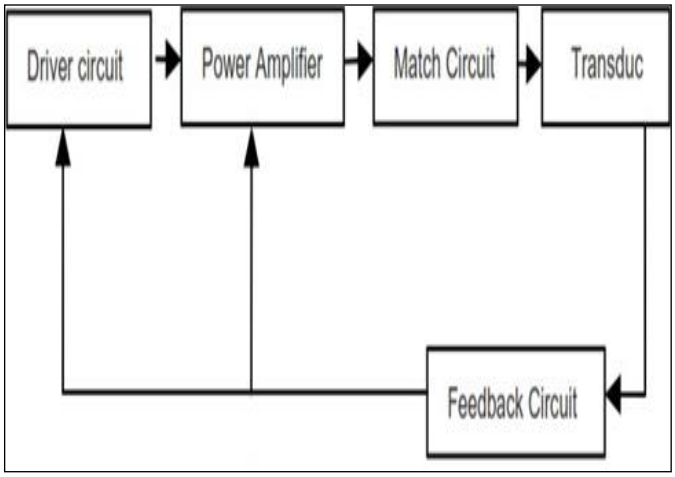

Figure 2: *principal of ultrasonic generator*

III. PROBLEM STATEMENT

Welding a non-woven plastic is a critical task which needs to be done in precise way. Also, strength of component after welding should meet the customer's demand. Need to develop an ultrasonic welding system to weld the ear loops of mask.

IV. OBJECTIVES OF PROJECT WORK

1. Procurement of Ultrasonic tuning system.
2. Mechanical assembly development.
3. Pneumatic cylinder selection & development of sliding joint.
4. Analysis of mechanical structure.
5. Testing of complete system

V. METHODOLOGY

Composite materials are considered as the wonder material, a s all the industries are obsessed to reduce weight and increase the specific stiffness. Fiber reinforced composites fit the bill perfectly, and reduce weight significantly. However, there are still some associated obstacles to realize their true potential in the industrial manufacturing landscape. Polymer matrix composites are increasingly used in aerospace, automotive, marine e, transport, sports and many other applications, as compared to conventional metals. This is due to lower weight, specific stiffness, corrosion resistance and high fatigue life, as compared to metals

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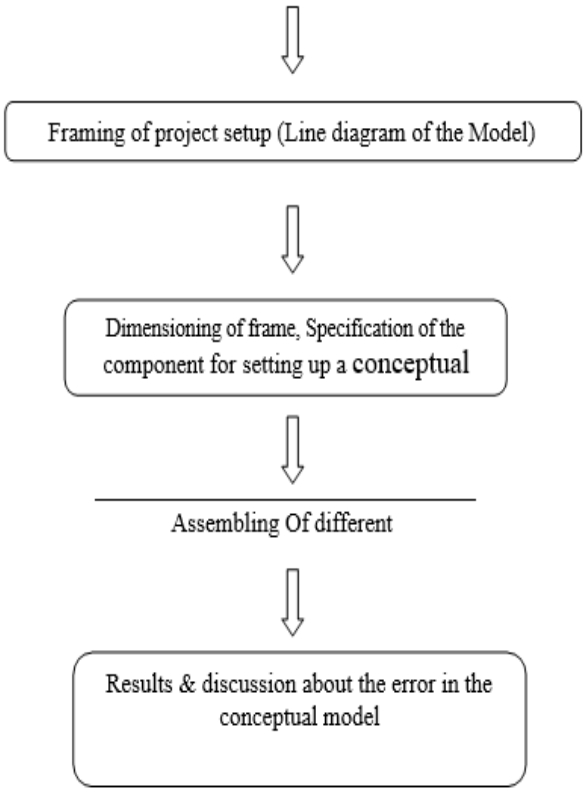


Figure 3 *Flow Chart for Working Process*

VI. SYSTEM DESIGN & ANALYSIS

In our attempt to design a special purpose machine we have adopted a very a very careful approach, the total design work has been divided into two parts mainly;

1. System design
2. Mechanical design

System design mainly concerns with the various physical constraints and ergonomics, space requirements, arrangement of various components on the main frame of machine no of controls position of these controls ease of maintenance scope of further improvement; height of m/c from ground etc.

In Mechanical design the components are categorized in two parts.

- Design parts
- Parts to be purchased.

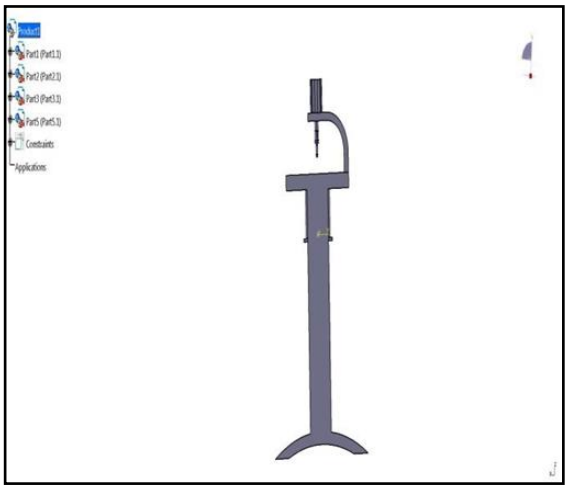
VII. MATERIAL SELECTION

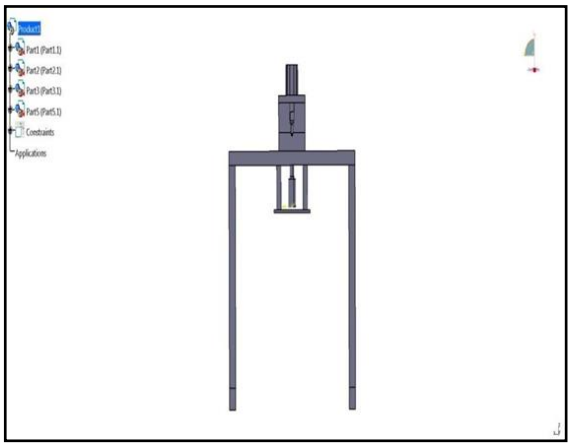
The proper selection of material for the different part of a machine is the main objective. In the fabrication of machine. For a design engineer it is must that he be familiar with the effect, which the manufacturing process and heat treatment have on the properties of materials.

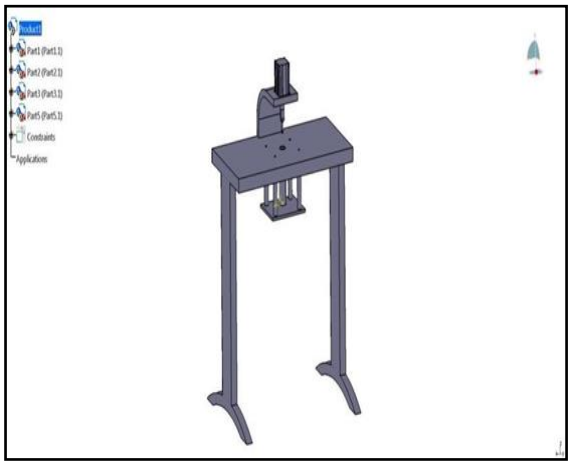
The Choice of material for engineering purposes depends upon the following factors:

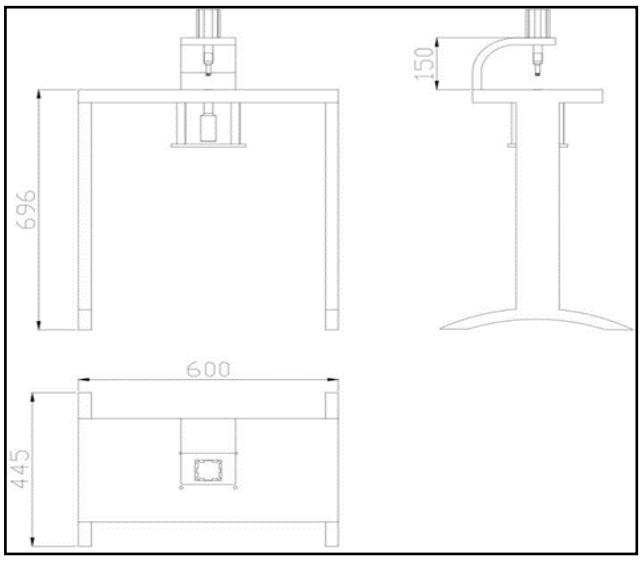
1. Availability of the materials.
2. Suitability of materials for the working condition in service.
3. The cost of materials.
4. Physical and chemical properties of material.
5. Mechanical properties of material.

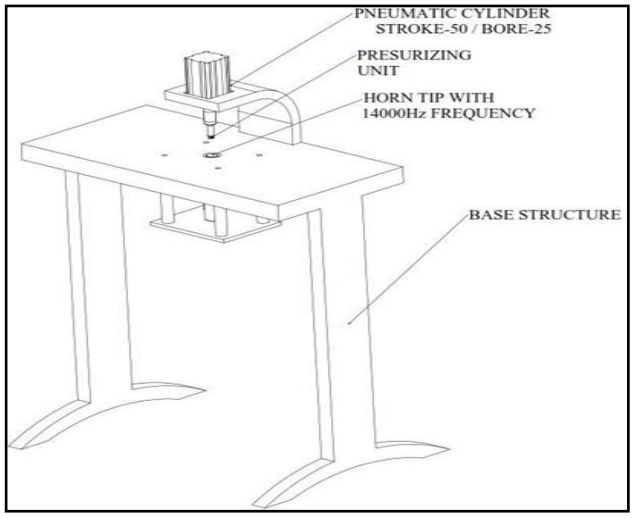
VIII. EXPERIMENTAL SETUP











VIII. BILL OF MATERIAL

Sr. No	Component Name	Quantity
1.	Ultrasonic system	01
2.	Development Titanium Horn	01
3.	Pneumatic cylinder	01
4.	Pressure regulator	01
5.	Foot Pedal for cylinder	01
6.	Mechanical Structure	01

IX. CONCLUSION

Presently, the ultrasonic system is widely used in the people's livelihood. such as ultrasonic pulverization in the pharmacy, ultrasonic welding and ultrasonic washing in the spinning and weaving, ultrasonic test and ultrasonic crack detection in the projection. At the same time, it has testified that ultrasonic has improved efficiency and brought convenience. For different applications, we should based on the different function step by step complete the theory analysis and the design then take the specific applications for it.

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