ISSN XXXX XXXX © 2017 IJESC

Research Article Volume 7 Issue No.9

Design Development & Analysis of Twin Sinusoidal Convex Blade System

Snehal Vijay Ranbhare
Associate Engineer
Department of Mechanical Engineering
R.M.D School of Engineering, Pune, India

Abstract:
Basic three colors are mixed viz. red, yellow and blue in definite proportions to get desired color shade. The proportions of colors are decided by different methods but the mechanical part of the process is to mix them appropriately. There are many methods of paint mixing are available in the industrial market. Once the proportions are mixed, the vibration method is used as a traditional method. At the mass level, those are mixed with machines. The present project work is related with one of the mixing method which gives higher mixing quality with less time and more homogeneity. The paint or color mixture is taken in the container and the sinusoidal blades are used with rotational motion. The theoretical, practical and analytical study is done in the present project work. In the first part of experiment, the given proportions of colors are taken in the mixer and the quality of mixing is checked out. In the second part, the blades and the container system is designed and analyzed with different software tools. The third part includes the manufacturing of the machine with designed parameters. In short, the project work, includes, design, development, analysis and the manufacturing of the paint mixer.

Keywords: Paint mixer, design, analysis, sinusoidal blades etc.

I. INTRODUCTION

1.1 Color mixing

Color mixing is an important process which has a wide application in several fields. There are various kinds of color mixing that can be done. It can either be additive color mixing or Subtractive color mixing. Additive color blending of shades includes blending colors of light. In added substance blending of shades there are three essential colors: red, green, and blue. Without shade or, when no colors are indicating, the outcome is dark. In the event that each of the three essential colors is indicating, the outcome is white.

Types of paint mixing machines available

Generally there are various kinds of paint mixing machines available in the market. They vary in their size, shape, technology and methodologies. Some of the common types of machines are listed below.

1. Laboratory mixers

These are lab grade machines which are commonly used in laboratories now days. It depends on high shear lab mixing ideal for research and developmental works. These are used for various kinds of applications such as mixing, emulsifying and dissolving with great precision. Their capacity can vary from 1 ml to 12 liters and offer excellent reproducibility. These are used where process validation is required.

2. Ultra mix mixers

These are designed for applications which are beyond the capabilities of conventional mixers. They also require a lower shear. These are designed for clean in place and sterilize in place options. The dynamic mixing head provides excellent in tank movement. The large volume of materials is incorporated by a large vortex. This requires low maintenance with robust control process. The design suits excellent chemical services and sanitary requirements.

3. Inline mixers

These mixers are highly efficient and capable of reducing the mixing time up to a great extent. These can be modified by rapidly interchangeable work heads. This helps to mix, emulsify, homogenize and disperse the colors. The features include aeration free, self-pumping, no bypass and rapid dissolving.

II. RELEVANCE OF PROJECT

In case of process industries, process of mixing and stirring forms and integral and the important part of the total manufacturing process. Mixing is the process which determines uniformity and overall quality of product .Process industries like chemical plants , food processing plants, paint industry etc, largely employ mechanical mixers to carry out mixing of powders , semisolid jelly fluids etc. Mixing is a process where powder or jellies are mixed together through in the form of uniform mixture where stirring is the process to mix the fluid and powder to dissolve the powder thoroughly in given mixture and form a uniform product or output. In either of above cases thorough mixing of material is desirable to give and good and uniform quality output. Mixing of powders of different material in order to form a uniform product or a powder mix is quiet easy but when it is desirable to mix powder in a fluid matter specially when the density of powder is high the problem occurs due to heavy weight of particles of powder has a tendency to settle down.

Case Study

Let us study the following example ‘Preparation of Ionic Paints’. In this case it is required to mix the heavy density metal powder in the fluid mixture and pigment base together called as in vehicles .Vehicle is a low density evaporative fluid which when mixed with metal oxide powder thoroughly is applied by spray painting on to automobiles silencer to form an anticorrosion particle layer. In order to have good

quality and uniform layer of paint on the job it is necessary that the oxide powder is thoroughly mixed with vehicle

Conventional Method

In conventional method of mixing the metal oxide powder and vehicle mixing is carried out on 'Unidirectional Stirring Machine' In this machine the motor is driven on reduction gear box through coupling the output shaft of gear box is coupled to stirrer shaft to which the blades are connected, when the motor rotates output shaft of gear box rotates at slow speed. There by driving the stirrer. The stirrer rotates in one direction to agitate the mixture to prepare paint.

Figure.1. Static mixer

Static mixers are used for a wide range of different applications in many different market segments. A common application is mixing two-component adhesives (e.g., epoxy) and sealants (see Resin casting). Other applications include wastewater treatment and chemical processing. Static mixers can be used in the refinery and oil and gas markets as well, for example in bitumen processing or for desalting crude oil. In polymer production, static mixers can be used to facilitate polymerization reactions or for the admixing of liquid additives. A vibration technique for promoting fluid mixing and chemical reaction in a micro channel was proposed, and the effects of the mechanical vibration on mixing and reaction were experimentally examined. The fluids before flowing into a micro channel were oscillated by a small vibrating motor through two tubes connected to the channel. Instantaneous velocity and concentration were measured using micro PIV and LIF techniques, respectively. The results show that fluid mixing and chemical reaction is remarkably promoted by the proposed vibration technique. The mixing rate is well correlated with the maximum rms value of normalized fluid velocity fluctuation in a micro channel. When the basic frequency of the mechanical vibration is low, the fluid motion hardly changes and the mixing and reaction is little enhanced. However, with increasing the frequency, almost complete mixing and reaction can be accomplished at the high frequency more than 90Hz by the proposed technique.

III. DESIGN OF EXPERIMENT

System Design

In system design we primarily concentrated on the following parameters

1. System Selection Based on Physical Constraints:

While selecting any machine it must be checked whether it is going to be used in a large-scale industry or a small-scale industry. In our case it is to be used by a small-scale industry. So space is a major constrain. The system is to be very compact so that it can be adjusted to corner of a room. The mechanical design has direct norms with the system design. Hence the foremost job is to control the physical parameters, so that the distinctions obtained after mechanical design can be well fitted into that.

2. Arrangement of Various Components

Keeping into view the space restrictions the components should be laid such that their easy removal or servicing is possible. More over every component should be easily seen none should be hidden. Every possible space is utilized in component arrangements.

3. Components of System

As already stated the system should be compact enough so that it can be accommodated at a corner of a room. All the moving parts should be well closed & compact. A compact system design gives a high weighted structure which is desired. Man Machine Interaction The friendliness of a machine with the operator that is operating is an important criterion of design. It is the application of anatomical & psychological principles to solve problems arising from Man – Machine relationship. Following are some of the topics included in this section. Design of foot lever Energy expenditure in foot & hand operation Lighting condition of machine.

4. Chances of Failure

The losses incurred by owner in case of any failure are important criteria of design. Factor safety while doing mechanical design is kept high so that there are less chances of failure. Moreover periodic maintenance is required to keep unit healthy.

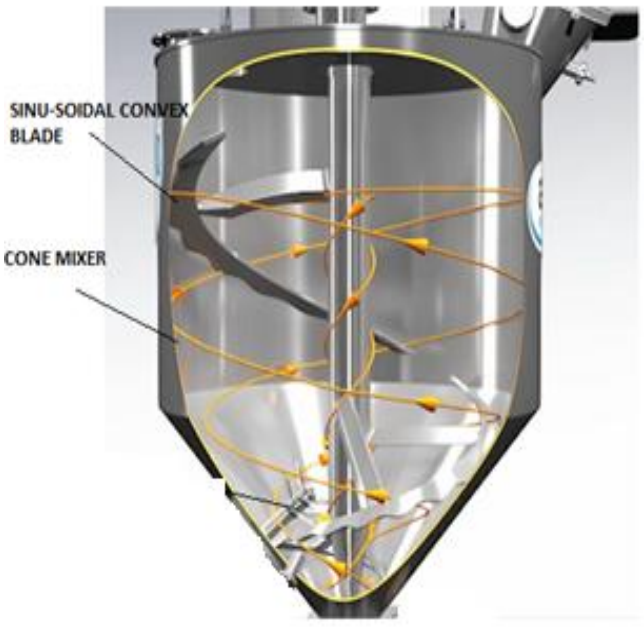

Figure.2. Conceptual Cut Section of Mixer

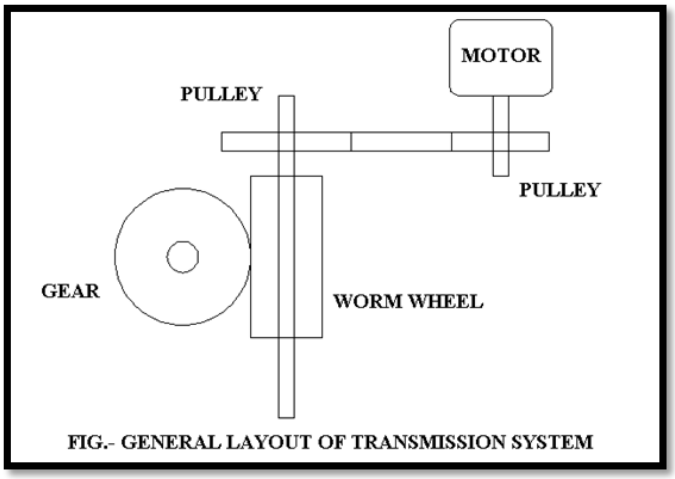

Figure.4. General layout of drive transmission system

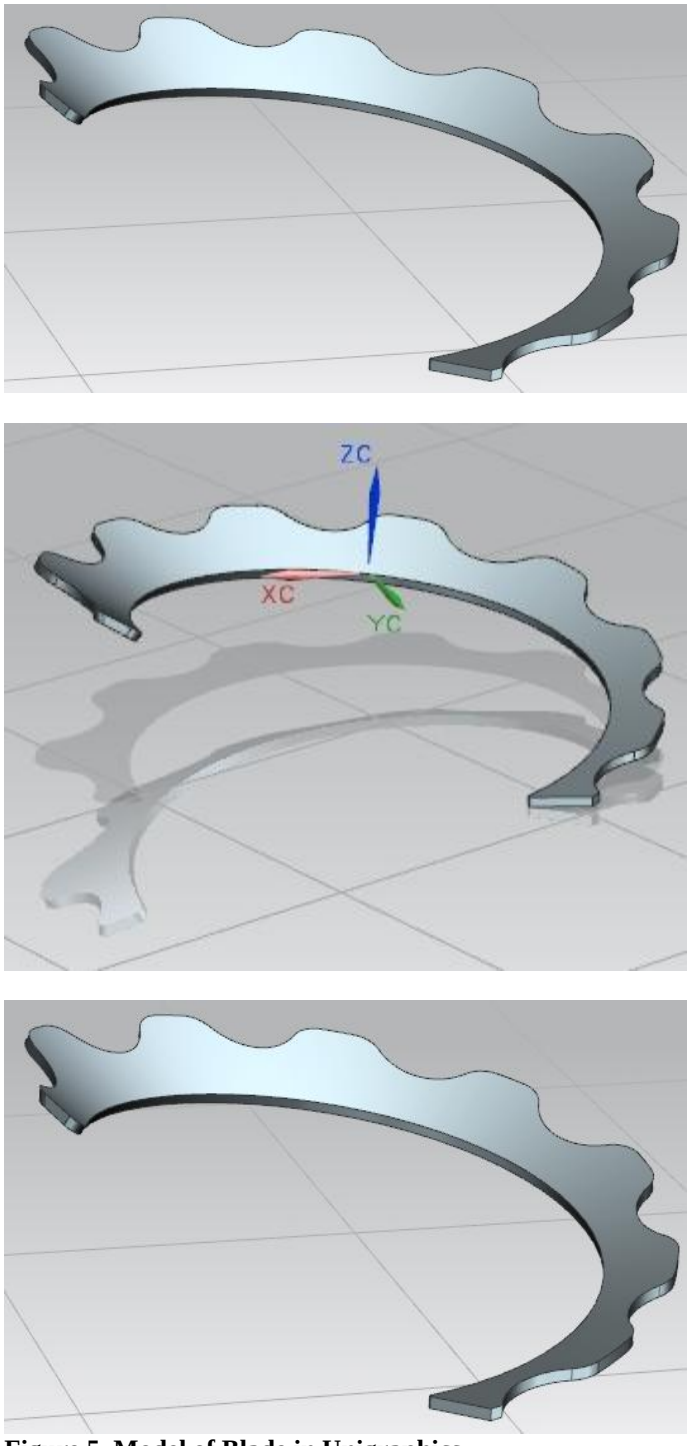

Figure.5. Model of Blade in Unigraphics

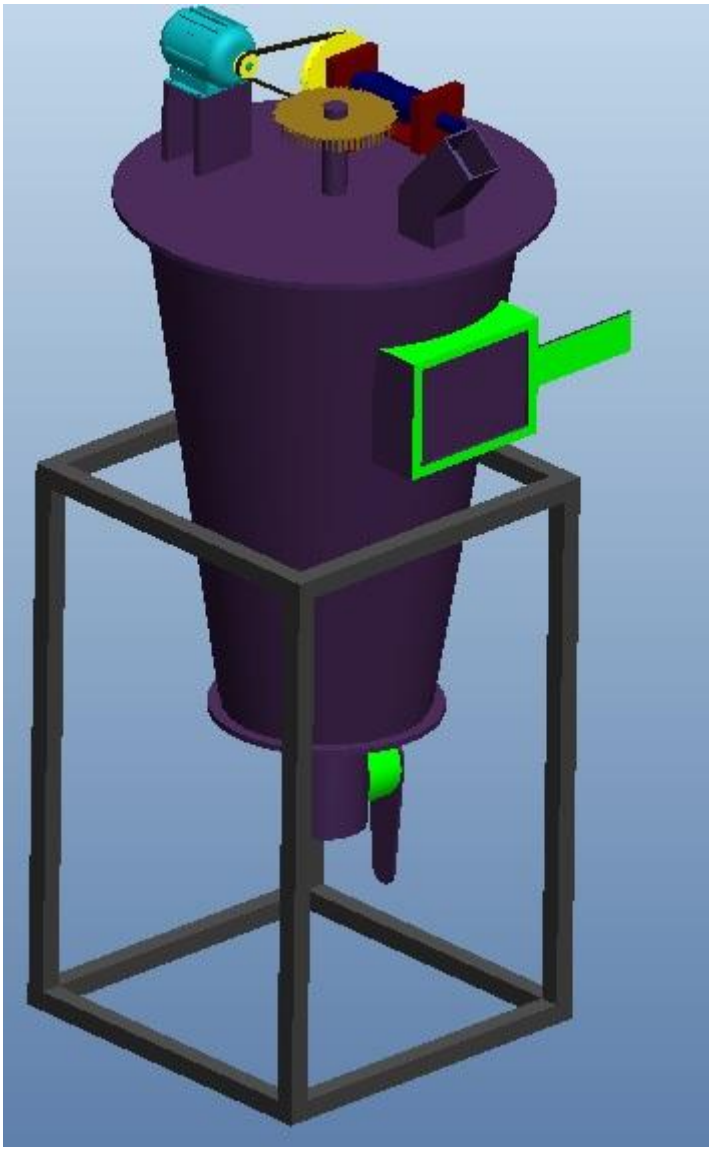

Figure.5. Model of Apparatus in Unigraphics

IV. REFERENCES

[1]. Samuel i. Iwuoha, "The design and development of versatile mixing machine", Dept. of Mechanical Engineering, Federal University of Technology, Owerri, Nigeria, Page No. 1-11.

[2]. Shiping Liu, and Andrew N. Hrymak, "Design modifications to SMX static mixer for improving mixing", AIChE Journal, 52, (2005), Page No. 150–157.

[3]. Thomas C. Nearhood, "Cooker-mixer apparatus", Patent US 4151792 A (1979)

[4]. Tapas Raj & Ashirvad Jena, "Design and Development of an Automated Paint Mixing Machine", A Thesis at National Institute of Technology, Rourkela

[5]. Sachin S. Giri et.al., ""Automatic colour mixing machine using PLC", International Journal Of Engineering And Computer Science ISSN: 2319-7242 Volume 3 Issue 12 December 2014, Page No. 9652-9655

[6]. Mr. Raghunath Rajaput et. al., "Bi-Directional Mixer", INTERNATIONAL JOURNAL OF INNOVATIONS IN

ENGINEERING RESEARCH AND TECHNOLOGY [IJIERT] ISSN: 2394-3696 VOLUME 2, ISSUE 4, APR.-2015

[7]. Liming Chen et. al., "Simulation and Design of Mixing Mechanism in Fertilizer Automated Proportioning Equipment Based on Pro/E and CFD", National Science & Technology Pillar Program (2007BAD89B00)

[8]. S N Waghmare et. al., "Electrically Operated Bi-directional Mixer: A Proposed Work", International Journal of Research in Advent Technology, Vol.4, No.2, February 2016 E-ISSN: 2321-9637