ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

DESIGN DEVELOPMENT AND APPLICATION OF 3-DIMENTIONAL SCHATZ GEOMETRY KINEMATIC LINKAGE FOR 3-D MOTION MIXER MACHINE

Mr.T.C.Doijad*, Prof.N.S.Hanmapure

Student of Master of Mechanical Engineering, Tatyasaheb Kore Institute of Engineering & Technology, Warananagar.
Master of Mechanical Engineering, Tatyasaheb kore institute of Engineering Technology, Warananagar.

ABSTRACT

Powder mixing as demonstrated previously is an important step in the manufacturing process of many industrial products such as pharmaceuticals, foodstuffs, plastics, fertilizers, and ceramics. The schatz geometry shaker-mixer is used for a homogeneous mixing of powdery substances with differing specific weights and particle sizes. The product is mixed in its own closed container. The exceptional efficiency of the schatz geometry shaker-mixer arises from the use of rotation, translation and inversion according to the Schatz geometric theory. The mixing container is set into a three-dimensional movement that exposes the product to continuously changing, rhythmically pulsing motion. It operates by tumbling the solids inside a revolving vessel, at speeds up to about 40 rpm. It is also possible to mix wet and dry components or different wet components. The production process is hygienic and dust-free; making the schatz geometry easy to clean.

KEYWORDS— Rotation, Translation, Inversion.

INTRODUCTION (BAYESIAN TECHNIQUE)

Mixing of powders is a common operation in any industry. Most powders are known to be cohesive, many agglomerate spontaneously when exposed to humid atmosphere or elevated storage temperature. Agitation of the powder may result in migration of smaller particles downwards and of larger ones upwards. Conventional Method: In conventional method of mixing the metal oxide powder and vehicle mixing is carried out on a vertical shaft mixer with a static mixer blade at the bottom, 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. Problem Statement:- The stirrer of conventional machine rotates in one direction only which creates a particular flow pattern in the fluids hence the particles tend to stick to the walls of container owing to the centrifugal force rather than mixing thoroughly in mixture of paint , ultimately results into poor quality mixture of paints there by poor quality output of paint . The product is mixed in its own closed container. The exceptional efficiency of the schatz geometry shaker-mixer arises from the use of rotation, translation and inversion according to the Schatz geometric theory. The mixing container is set into a three-dimensional movement that exposes the product to continuously changing, rhythmically pulsing motion. It operates by tumbling the solids inside a revolving vessel, at speeds up to about 40 rpm. The schatz geometry shaker-mixer is used for the homogeneous mixing of powdery substances with differing specific weights and particle sizes.

LITERATURE REVIEW

1. C-C Lee et al [1], have carried out work on, this paper investigates different con jurations of the Schatz linkage based on the analysis of a reciprocal screw and of the relationship between the reciprocal screw and its stem-screw system, which consists of twists of freedom located at six revolute joints of the linkage. A new method of using

ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

cofactors of an augmenting screw is used to obtain the reciprocal screw. The special relationship between the reciprocal screw and the stem-screw system is analysed and used to characterize the constraint wrench and con.

2. Ingrid Bauman et al [2], have carried out work on, Mixing of powders is a common operation in any industry. Another problem is segregation whose main cause is the difference in particle size, density shape and resilience. The results were statistically calculated and graphically presented. The results obtained by those three devices, the particle size effect and cohesion indexes, bring us to the conclusion that static mixers could be used for mixing of powders, but their shape, number of mixing elements and the mixer length should be adapted for each mixture separately, experimentally and mathematically, through modelling of the system.

3. P.S. Jadhav et al [3], have carried out work on Mixing of powders is a common industrial operation now days. Powders are often cohesive, many agglomerate spontaneously when exposed to humid atmosphere or elevated storage temperature. There is the need of producing the apparatus having the combination of rotating, tumbling and shaking movements of a material in a container which has a closed and constrained invertible kinematic link-work of which at least one link serves as receptacle for the container; and motive power for driving the link work can be provided by imparting thrusting power, rather than the rotating power Experimental

THEORETICAL AND FE ANALYSIS

In this various components are used in 3-dimentional schatz geometry 3D mixer machine. :
1. Design of container casing

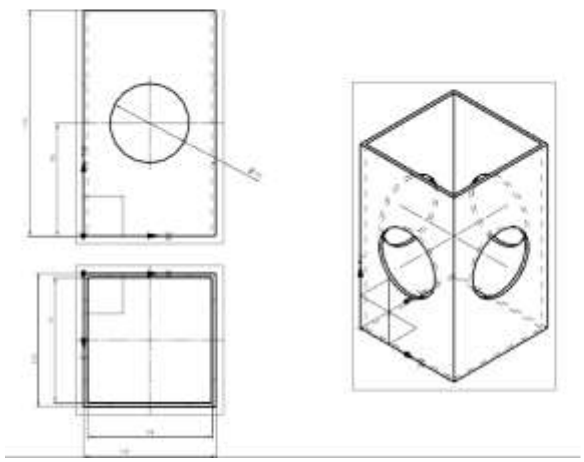


Fig 1

Material selection: Ref :- (PSG – 1.12)
Fc_{all}
Tensile Strength =400 N/mm^2
Yield Strength=320 N/mm^2
Direct tensile stress due to an pull load :-
Load = Torque / radius = 15120 /25 =604 N
fc_{act} = W/A (A=3.14/4*dc^2)
fc_{act} = 0.75 N/mm^2
As $fc_{act} < fc_{all}$: Casing is safe under shear load

ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

Analysis of Casing

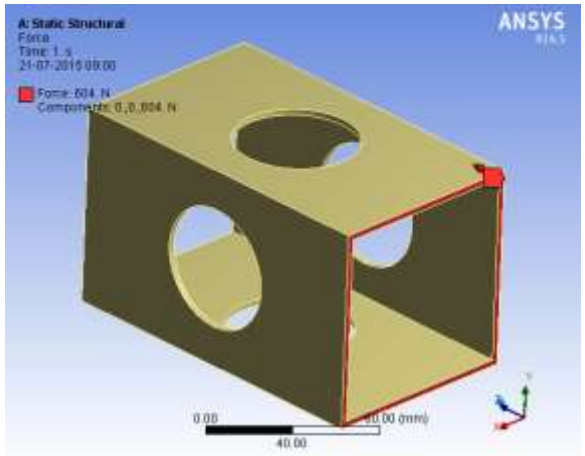
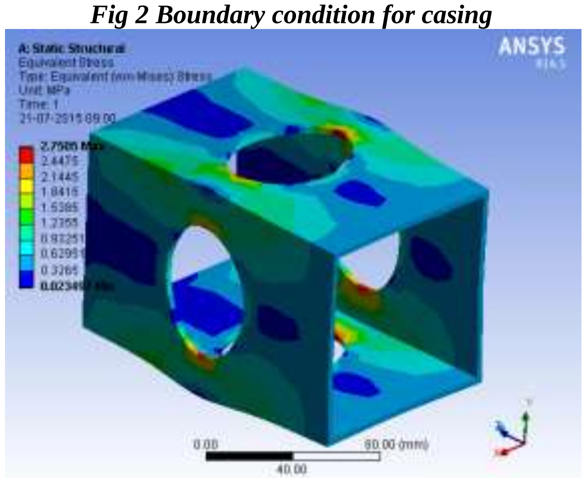


Fig 2 Boundary condition for casing



Part Name	Maximum theoretical stress N/mm^2	Von-mises stress N/mm^2	Maximum deformation Mm	Result
casing	0.75	2.75	0.0086	Safe

Fig 3 Von mises stress

Result:

1)maximum stress by theoretical method and von-mises stress are well below the allowable limit, hence the casing is safe.

2)casing shows negligible deformation under the action of system of forces

ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

Design of schatz bracket

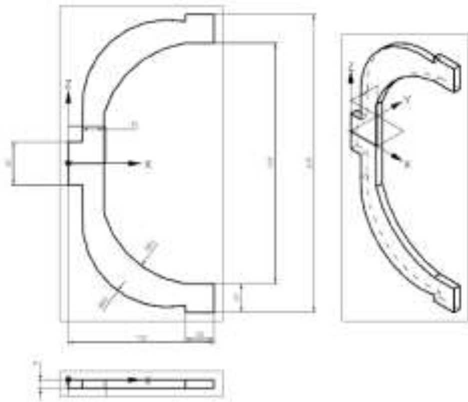


Fig 4

Direct Shear Stress Due To An Pull Load :-
load = torque / radius = 15120 /25 =604 N

fc_{act} = W/A (A=3.14/4*dc^2)

=604/15*6

= 6.71 N/mm^2

As $fc_{act} < fc_{all}$; Schatz bracket is safe under shear load

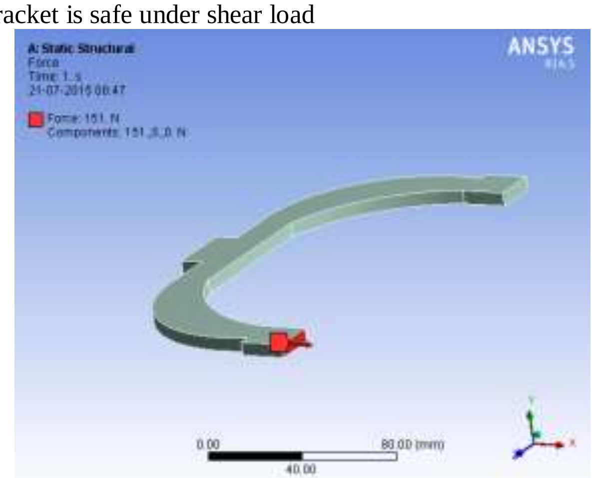


Fig 5 Boundary condition for bracket

ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

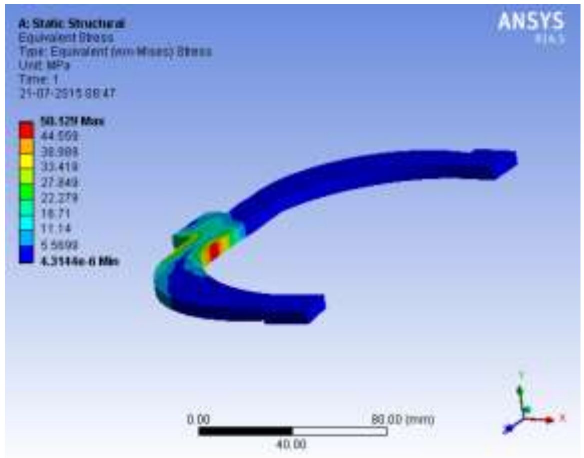


Fig 6 Von mises stress

Part Name	Maximum theoretical stress N/mm^2	Von-mises stress N/mm^2	Maximum deformation Mm	Result
Bracket	6.71	50.129	0.1553	Safe

DESIGN OF CONNECTING ROD

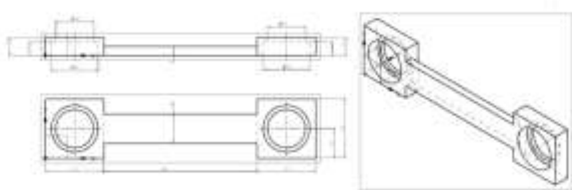


Fig 7

Material selection: Ref :- (PSG – 1.12)
Designation = EN9
Tensile Strength =600 N/mm^2
Yield Strength=480 N/mm^2

Direct tensile stress due to an pull load :-
here Pull load is due to the tangential load genereated when the crank drives the connecting rod linkage at eccentricity of 25 mm
Load = Torque / radius = 15120 /25 =604 N

$\mathbf{fc_{act} = W/A}$

$= 604/20*6 = 5.033$ N/mm^2

As $fc_{act} < fc_{all}$; connecting rod is safe under shear load.

ANALYSIS OF CONNECTING ROD

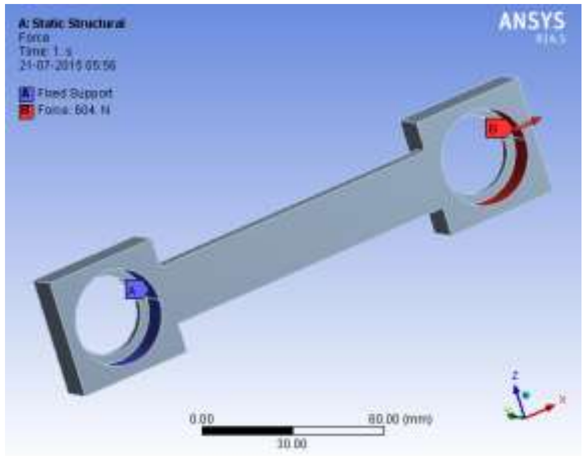


Fig 8 Boundary condition for connecting rod

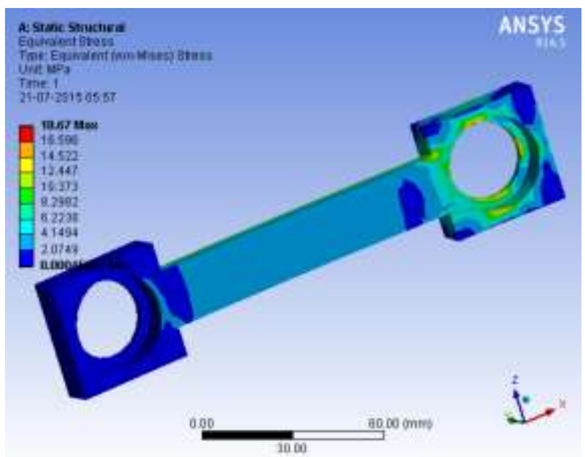


Fig 9 Von mises stress

Part Name	Maximum theoretical stress N/mm²	Von-mises stress N/mm²	Maximum deformation Mm	Result
Connecting rod	5.03	18.67	0.118	Safe

Result:

1) Maximum stress by theoretical method and von-mises stress are well below the allowable limit, hence the connecting rod is safe.

 ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

2) Connecting rod shows negligible deformation under the action of system of forces

Thus it is recommended that the battery be properly charged to obtain maximum cutting capacity from the cutter

RESULT AND DISCUSSION

comparative graphs 0f resultant viscosity vs time

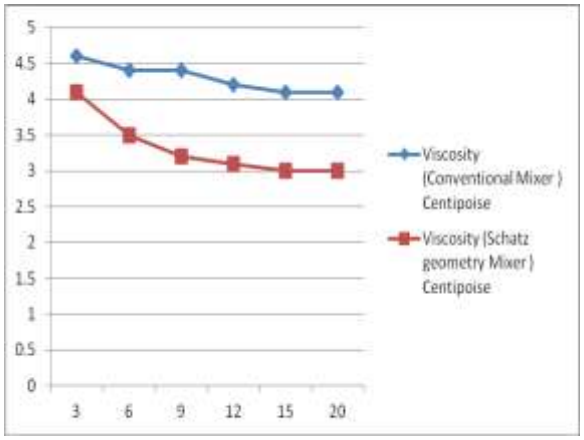


Fig 10

Graph indicates the viscoisty of paint reduces with increase in time , lower paint viscosity is desirable characteristic. The Schatz geometry mixer shows better performance and better quality as compared to conventional mixer. Minimum paint viscoity obtained by the Schatz geometry mixer is close to 3 centipoise which is best desirable for maximum lustre and better application of paint along with least quanity of paint required per unit area of application.

comparative graph of spreadablility of paint vs time

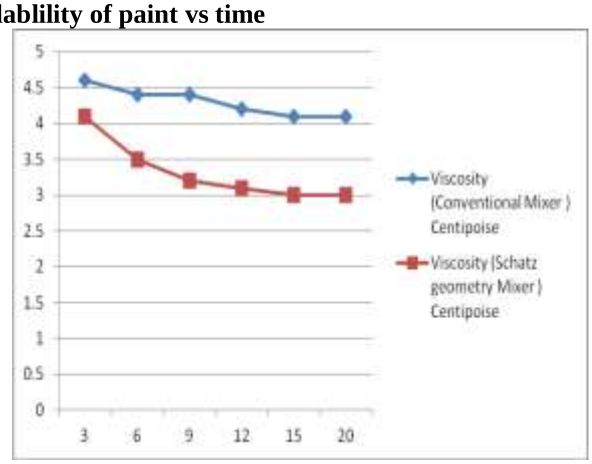


Fig 11

The Schatz geometry mixer shows better performance and better spreadability as compared to conventional mixer. Maximum paint spreadability obtained by the Schatz geometry mixer is close to 200 mm which is best desirable for maximum lustre and better application of paint along with least quanity of paint required per unit area of application.

REFERENCES

[1] C-C Lee and J S Dai, Configuration analysis of the Schatz linkage, J. *Mechanical Engineering Science*, Vol. 217, (2013)

[2] Ingrid Bhuman, Duska Curic and Matija Boban, "Mixing of solid in differant mixing devices", *Sadhana*, Vol.33: part6, December (2008) 721-731.

[3] P.S.Jadhav, B.R.Jadha, "A study on mixing of composite solids in the three dimensional turbula mixer", *IJAERS*, Vol.II, June, (2013) 138-141

[4] T. Yukawa, T. Takahashi, Y. Satoh and S. Ohshima, "Combined-Type Continuous Variable Transmission with Quadric Crank Chains and One-Way Clutches", *Computer Technology and Application,* 3**, (**2012) 649-656

[5] Marjan Rafiee a, Prof Mark J. H. Simmons, Dr Andy Ingram Prof E. Hugh Stitt "Development Of Positron Emission Particle Tracking For Studying Laminar Mixing In Kenics Static Mixer", *14th European Conference on Mixing Warszawa,* 10-13 September, 201

[6] H. M. Xia, C. Shu1, S. Y. M. Wan and Y. T. Chew, "Influence of the Reynolds number on chaotic mixing in a spatially periodic micromixer and its characterization using dynamical system techniques", *J. Micromech. Microeng*, 16 (2006) 53–61