Fabrication of Motorized Low Speed Double Cone Blender

P. Balamurugan, S. Deepak raja, N. Sesha Sai baba, Ajay Pratap Kushwaha, Md Nasrullah

Abstract: ***Blending in powder metallurgy process is an important stage which affects the performance of the composite prepared through the process. In the present study an attempt is made to fabricate a double cone blender for enhancement of mixing process during the preparation of composite through powder metallurgy process.***

Keywords **: *double cone, blender, powder metallurgy.***

I. INTRODUCTION

Powder metallurgy process is getting popularized because of the advantages such as ability to mix the reinforcement having greater density difference with the matrix which is not possible in casting process[1]. Blending is critical step in powder metallurgy for obtaining the uniform distribution of particle reinforcement in metal matrix composite, to efficiently mix the different particle size materials for reduced porosity[2]. Manual blending often results in agglomeration of particles[3]. Blender are also used widely in the pharmaceutical industries[4]. Tanabe et al[5] studied the effect of blender size on granular mixing. Brone et al.[6] enhanced the performance of the blender by having deflector plates by several folds. Even though commercial blenders are available but they are expensive, so an attempt has been made to fabricate double cone blender at low cost.

II. DESIGN OF COMPONENTS OF DOUBLE CONE BLENDER

Frame is the structural member supports one end of a shaft to which the motor is connected. It is on the right side of the arrangement. It transfers the load or forces acting on the shaft to the base. The Frame is made up of mild steel made in a triangular truss arrangement in order to reduce the deflection and to support the double cone aperture. 3D CAD model of the frame along with the base is shown in fig. 1

Base is the component over which the whole setup is placed. It takes all the loads from the frame and it is made up of a mild steel material, which is difficult to deform. The base is fitted with the triangular beam truss, which converts the load of the double cone to the base. Shaft is used to transmit the power from the motor to the blender through belt drive with the help of pulleys. Four pulleys are used in this blender for power transmission. The pulleys are made up of cast iron. The pulleys are of two small and two large. The small pulley is attached to the motor and driver shaft while the other two large pulleys are connected to drive shaft and main shaft of blender. The belt from motor connects the large pulley over the driver shaft. The small pulley on the driver shaft is connected to the large pulley over main shaft, which is large.

Initially the speed from motor is reduced and given to the driver shaft by means of belt drive where about 12.30% of initial speed is achieved making 1420 rpm to 174 rpm. Then it is given to the secondary belt drive where the speed is much reduced making the speed from 174 rpm to 21 rpm. The power transmission through belt drive mechanism is shown in fig. 2

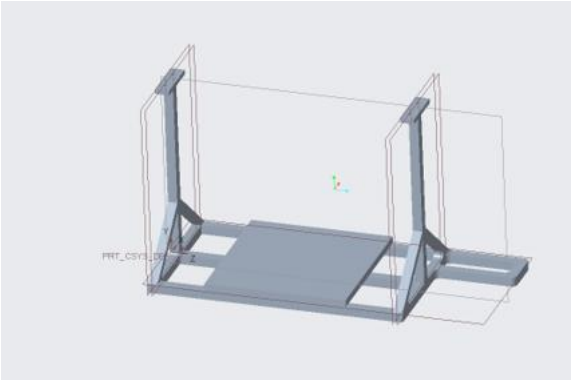

Fig. 1 3D CAD Model of Frame

Double cone mixing chamber is fabricated according to the dimensions shown in figure 3. Chamber is made up of stainless steel to provide corrosion resistance property for prolong life. The chamber is made up of 3 parts, two end parts are of frustum of a cone and the center part is made of cylindrical shape. The three parts are fabricated individually through sheet metal work and welded together through arc welding process, in order to avoid the distortion during welding first spot welding is done around the edge to arrest the distortions and then gap filled with continuous seam. The mixing chamber after welding is shown in figure 4. Grinding is one on the bead to provide uniform surface. The motor used to rotate the chamber is of specifications shown in table 1.

Revised Manuscript Received on December 30, 2019.

***** Correspondence Author

P. Balamurugan*, School of Automotive and Mechanical Engineering, Kalasalingam Academy of Research and Education, Krishnankoil, India. Email: pbala.klumech@gmail.com

S. Deepak Raja, School of Automotive and Mechanical Engineering, Kalasalingam Academy of Research and Education, Krishnankoil, India.

N. Sesha Sai baba, , School of Automotive and Mechanical Engineering, Kalasalingam Academy of Research and Education, Krishnankoil, India.

Ajay Pratap Kushwaha, School of Automotive and Mechanical Engineering, Kalasalingam Academy of Research and Education, Krishnankoil, India.

Md Nasrullah, School of Automotive and Mechanical Engineering, Kalasalingam Academy of Research and Education, Krishnankoil, India.

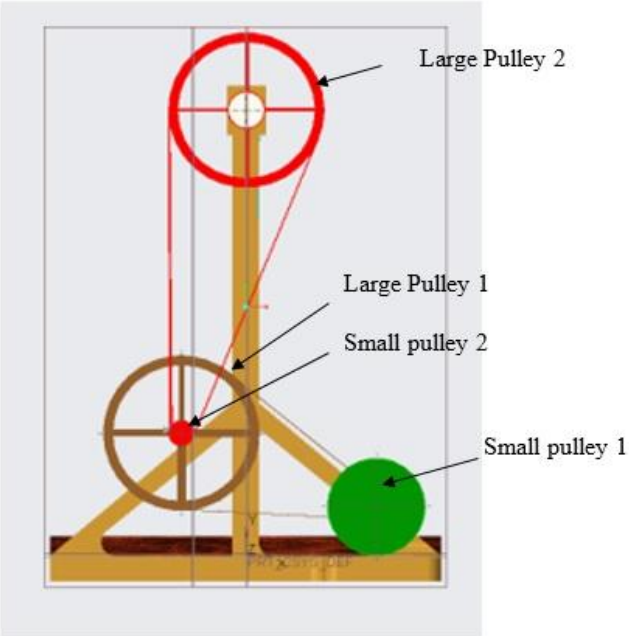

Fig. 2. Power transmission mechanism

Table - I Specifications of the motor

Particulars	Details
Build	Lakshmi ayya grinding motors
HP	0.25HP
Speed	1420 rpm
Phase	Single

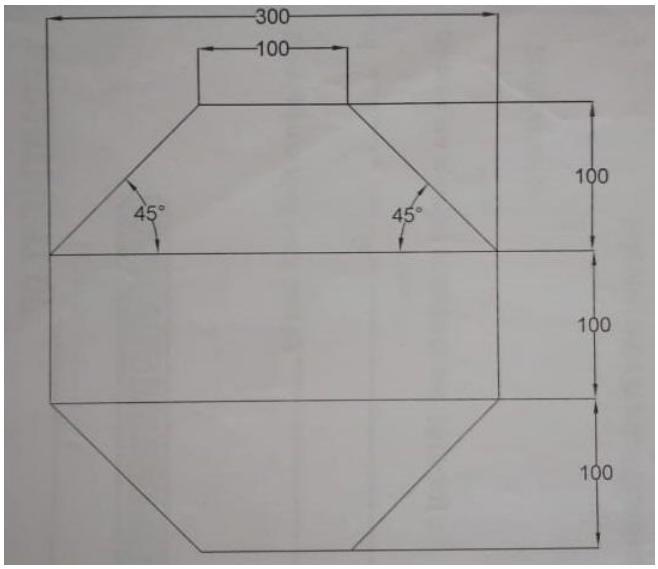

Fig. 3. Dimensions of the Mixing Chamber

Fig. 4. Mixing chamber after welding

III. FABRICATION AND ASSEMBLY

The fabrication and assembly of components of the machine is done as per the steps given below.

- Firstly the double cone setup was made by sheet metal operation.
- A cylinder was made based on the specification in design.
- The cone and cylinder were welded together using arc welding.
- A pair of shafts were welded in a metal plate and were again welded to the double cone set up.
- They where mounted on two journal bearings to give free rotary motion.
- The base and frame is made using mild steel pipes.
- Pipes were cut to specific dimensions and welded together to form the frame of the blender.
- The motor that is available commercially suited for the application is selected and is bought
- The pulleys are casted using cast iron to the dimensions required based on speed reduction. Pulleys were select to satisfy the speed reduction and were fit to the frame.
- They were fit to a set up used to help them fit to the frame.
- The double cone is fitted over the support placed on the base framework by means of a pair of bearings and clamps that restrict linear motion of the shaft.
- The motor, the pulleys were aligned and the belts were used to connect the pulleys and to transmit power
- The whole blender is polished to remove the weld spots and make it clear.
- The base is painted with the anti-rusting paint to prevent rusting and to make a good appearance of the blender. The fabricated double cone blender is shown in the figure 5

Fig. 5. Assembled double cone blender

IV. CONCLUSION

- The double cone blender was successfully fabricated with the pulley transmission mechanism driven by V belt.
- Speed of mixing chamber is achieved as 21 rpm by speed reduction from the motor rpm of 1420.
- The blender was prepared at low cost compared to the commercial blender available

REFERENCES

1. P. Balamurugan and M. Uthayakumar, "Influence of Process Parameters on Cu–Fly Ash Composite by Powder Metallurgy Technique," *Mater. Manuf. Process.*, vol. 30, no. 3, pp. 313–319, 2015.
2. A. Upadhyaya and G. S. Upadhyaya, *Powder Metallurgy: Science, Technology, and Materials*. 2018.
3. P. Balamurugan and M. Uthayakumar, "Wear Studies on SiC and Fly Ash Reinforced Copper Based Composites by Grey Relational Analysis," *Adv. Mater. Res.*, vol. 984–985, pp. 304–312, 2014.
4. S. Naik *et al.*, "Quantification of Tribocharging of Pharmaceutical Powders in V-Blenders: Experiments, Multiscale Modeling, and Simulations," *J. Pharm. Sci.*, vol. 105, no. 4, pp. 1467–1477, Apr. 2016.
5. S. Tanabe, S. R. Gopireddy, H. Minami, S. Ando, N. A. Urbanetz, and R. Scherließ, "Influence of particle size and blender size on blending performance of bi-component granular mixing: A DEM and experimental study," *Eur. J. Pharm. Sci.*, vol. 134, pp. 205–218, Jun. 2019.
6. D. Brone and F. . Muzzio, "Enhanced mixing in double-cone blenders," *Powder Technol.*, vol. 110, no. 3, pp. 179–189, Jun. 2000.

AUTHORS PROFILE

Dr. P. Balamurugan has obtained his Doctoral Degree from Kalasalingam University, India. He is doing research in the area of Characterization, Mechanical, Tribological, Corrosion and erosion studies of metal matrix composites, Powder Metallurgy. Currently he is working as Associate Professor in Department of Mechanical Engineering, Kalasalingam Academy of Research and Education, India.

Mr. S. Deepak Raja, Studying B. Tech Mechanical Engineering at Kalasalingam Academy of Research and Education, Krishnankoil, India

N. Sesha Sai baba, Studying B. Tech Mechanical Engineering at Kalasalingam Academy of Research and Education, Krishnankoil, India

Ajay Pratap Kushwaha, Studying B. Tech Mechanical Engineering at Kalasalingam Academy of Research and Education, Krishnankoil, India

Md Nasrullah, Studying B. Tech Mechanical Engineering at Kalasalingam Academy of Research and Education, Krishnankoil, India