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Advancement and Automation in Pulverizer Machine to Increase its Production Rate

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ABSTRACT

This paper presents the modified design of a blade made up of EN-8 Carbon Steel used to further reduce the size of the granular aluminum foil material of more and above grade size of 90.This research is done on the logical approach based on the study done on the pulverizer machine when it is in running condition and also to study the design of blade so as to achieve higher production rate in the ongoing process at the NPM Industry and to do the advancement in the blade design to achieve higher production rate. This paper also presents the upgraded design and analysis of the blade and various remedial solutions for its advancement that has increased its production rate.

Keywords: Pulverizer Machine, EN8 Carbon Steel

I. INTRODUCTION

A pulverizer or grinder is a mechanical device for the grinding of many different types of materials. So as to reduce the size of a particular material up to a certain desired size or to grind it further till the requirement. This additional resources that assist you in writing a professional technical paper.

Operating principle of Pulverizer

The pulverizer consists of an encased rotor carrying swing hammers, whizzer classifier for fineness regulation and pressure gradient creator mounted on a solid shaft. Raw material to be pulverized enters the crushing chamber through the hopper or the automatic rotary feeder. The impact of the hammers on the feed material against the liner plates reduces it into fine powder. The ground material is carried towards the whizzer classifier for classification and the oversize particles are rejected by the classifier and returned to the crushing chamber for further grinding. The classified material is then conveyed into the cyclone for collection and bagging. A dust collector is provided in the system for ensuring dust less operation and for no loss of ground powder.

Typical application of Pulverizers

The techno wings impact pulverizers are used for a wide range of application e.g. Agricultural, chemicals, carbon and graphite, coal, coke, coconut shell and wood saw dust, clay, dye stuff and pigments, detergents, ferro-alloys fertilizers, fillers, food products, herbs and spices, insecticides and pesticides, katha, marine feeds, minerals, plastics, pharmaceuticals, resins.

Figure 1. Pulverizer Machine

II. METHODS AND MATERIAL

Factors affecting the production in pulverizer due to blade design.

The width of the blade is of 2.5 inches due to which the grinding of the aluminum foil doesn't takes place as per the desired requirement of the industry.

Rotation of the blade that is currently 35 rpm which is to be increased so as material can be grinded at a faster cutting rate and can also increase the production rate of the grinded short sized powder form aluminum.

Thickness of the blade affects the cutting of aluminum foil that is greater that the Grade size 10. The thickness of the blade is small therefore the material grinding doesn't place as per the requirement.

Faster and improper mannered pouring of the raw material into the hopper of the machine that is the pouring of material is done at higher rate as compare to the slower cutting rate of the grinder blade.

Material used to make the blade EN8 carbon steel is a common medium carbon and medium tensile steel, with improved strength over mild steel, through-hardening medium carbon steel. EN8 carbon steel is also readily machinable in any condition.

EN8 steels are generally used in the as supplied untreated condition. But EN8 steels can be further surface-hardened by induction processes, producing components with enhanced wear resistance. Steel EN8 materials in its heat treated forms possesses good homogenous metallurgical structures, giving consistent machining properties

1. EN8 Steel is Steel Grade in BS 970 1955 Specification

EN8 steel grade belongs to the standard of BS 970-1955, which is a standard for wrought steel for mechanical and allied engineering purpose. In BS 970 standards, there are some other common steel grades, like EN9, EN19, EN24, EN36 etc. And the most equivalent is grade 080M40 steel in BS 970-1991.

2. EN8 Carbon Steel is Available in Following Shape:

We could supply EN8 steel in bright round bar in drawn/turned condition or round hot rolled, hexagon, square, steel flats and plate.

EN8 Steel Round Bar: 8mm-1600mm

EN8 Steel Cold Drawn Bar: 5mm-70mm

EN8 Carbon Steel Flat & Plate: 10-1500mm x 200-3000mm

Sizes of other shapes are available, please send emails to us for specific checking.

3. EN8 Carbon Steel Grade Equivalents

Other steel grades in ASTM, DIN, JIS standards are similar and equivalent to EN8 steel, as follows:

BS 970-1991:080M40

AISI/ASTM A29:1038, 1040, 1045

DIN Werkstoff No.: 1.0511, 1.1186, 1.1189

BS & DIN European: C40, CK40, C45, CK45

JIS G4051: S40C, S45C

4. EN8 Carbon Steel Properties

4.1 Carbon Steel EN8 Chemical Composition

Standard	Grade	C	Mn	P	S	Si
BS 970	EN8/080M40	0.36-0.44	0.60-1.00	0.05	0.005	0.10-0.40

4.2 EN8 Medium Carbon Steel Mechanical Properties and Hardness

Heat Treatment	Tensile Strength Rm	Yield Strength Rm	Rp 0.2	A min on	Impact		Hardness
				5.65√So	Izod Ft.lb	KCV J	
	MPa	MPa	MPa				HB
N	550	280	–	16	15	16	152/207
	510	245	–	17	–	–	146/197
Q	625/775	385	355	16	25	28	179/229
R	700/850	465	450	16	25	28	201/255

5. Forging of Carbon Steel Grade EN8/080M40

Preheat the EN8 steel carefully, then raise temperature to 1050°C for forging. Do not forge below 850°C. After forging cool en8 steel slowly, preferably in a furnace.

6. Heat Treatment of EN8 Carbon Steel

EN8 steel is usually supplied untreated but also be able to be supplied to order in the normalized or finally heat treated, which is adequate for a wide range of applications.

Tempering – Carbon steel EN8 or 080m40 can be tempered at a heat of between 550°C to 660°C (1022°F-1220°F), heating for about 1 hour for every inch of thickness, then cool in oil or water.

Normalising of EN8 bright mild steel takes place at 830-860°C (1526°F-1580°F) then it is cooled in air.

Quenching: in oil or water after heating to this temperature will harden the steel.

7. Applications of EN8 Carbon Steel

EN8 steel material is suitable for the all general engineering applications requiring a higher strength than mild steel such as:

general-purpose axles
shafts,
gears,
bolts and studs.
spindles,
automotive and general engineering components,
Other general engineering parts etc.

We supply steel grade EN8 to some customers in middle east like UAE, Europe countries like UK and also in Africa like south Africa. We will have some EN8 carbon steel promotion at the end of almost every month. Just send emails with detailed requests for EN8 carbon steels price.

Figure 2. EN8 Carbon Steel

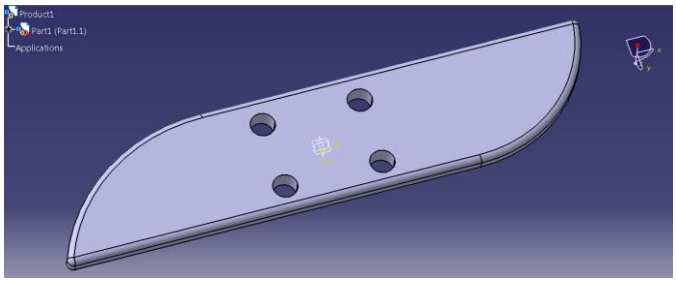
Designing of the modified blade Mainly the modification is done in the two desired factors that has completely changed the aspects of the blade design which are as followed:

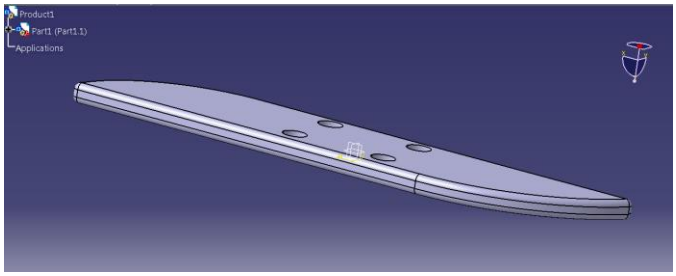
The main modification in the design of the blade is done by increasing the width of the blade to 4 inches. The previous blade was of the width 2 inches and the modified blade is increased with the 2 inch width and the total width of the blade is now 4 inches and the length of the blade is 18 inches.

The thickness of the blade is also increased, firstly the blade thickness was of 10-12 mm and now the thickness is increased up to 18-20 mm.

The designing of the blade is done in the CATIA V5 software.

Designing of the modified blade in the CATIA V5 Software





Solutions

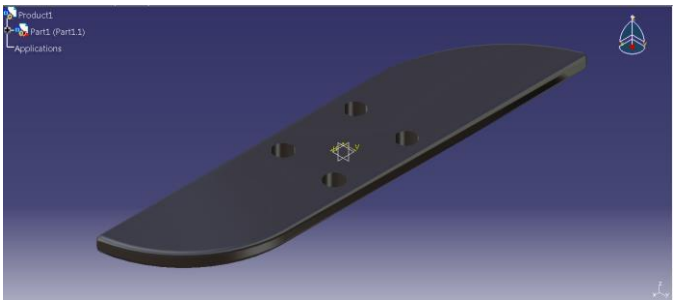
The product quality up to the industrial requirement can be achieved by increasing the width of the blade that actually results in cutting of more amount of material. Firstly the blade was of 2 inches which doesn't allows the material to grind as per the industry requirement that is the output to be received is in the grinded powdered form therefore as per the desired requirement if the width is increased then the more amount of material can be cut down that is the aluminum foil of grade 9-12 can be easily cut down as the width will be increased. The main benefit for this width size blade is that the product quality that is achieved from this blade marks up to the industry requirement and grinded material received is of needed grade size.

The rpm of the blade is needed to be increased that is firstly the blade use to run at 35rpm and after testing it at higher speed the rpm of the machine is further increased by 40-45 rpm and now the blade runs at the speed of 75-80 rpm which cuts and grinds the material in the desired size needed and the product that is to be achieved in the thick powdered form is now being achieved in that particular thick powdered form.

The thickness of the blade is now changed to 20 mm from the previous thickness of old blade that was of 10-12 mm, the old blade was not able to grind the material due to the grade size of the aluminum that is of grade size 9-12 which is tough for the 10-12 mm blade to grind that much hard material so the grinding doesn't use to takes place as per the requirement and now after the thickness is changed to 20mm, the grinded material achieved from the modified blade is of good quality and the desired grade size that is required in the industry.

The manner of pouring of the material has also been changed now that is the material being poured is now poured in a desired amount of material which grinds the material uniformly.

EN8 Material applied to the blade to do the further Analysis on it



Analysis of the blade

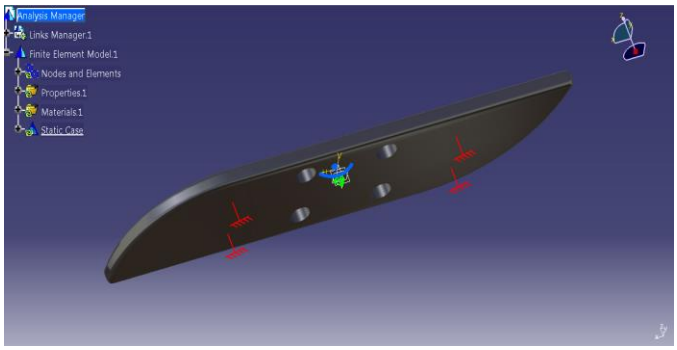
The analysis is done on the blade by applying the pressure of 100N/m2. That is mainly the material is poured into the machine with the help of hopper which doesn't applies any amount of pressure on the blade. That is so low amount of force or the pressure is applied on the blade when it is in rotation. Therefore the following analysis is done just by applying a low pressure of 100N/m2 on the blade.

The analysis is carried out in three ways that is:

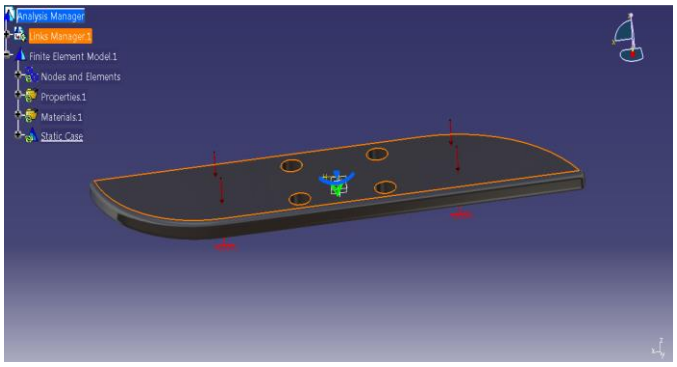
Von-Misses Stress Analysis

Displacement Analysis

Further are the analysis carried out on the CATIA software.

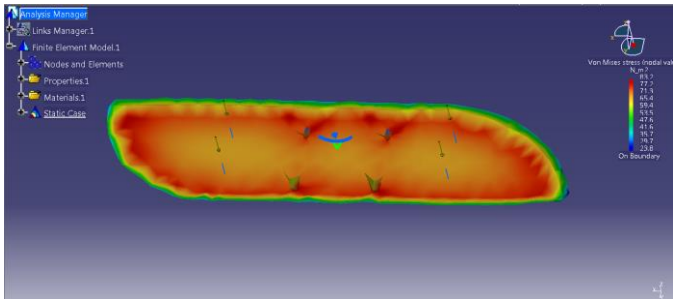


The clamps have been mounted on the base as the material comes down into the machine from the hopper so the pressure and the force that is mainly applied at the top of the blade.



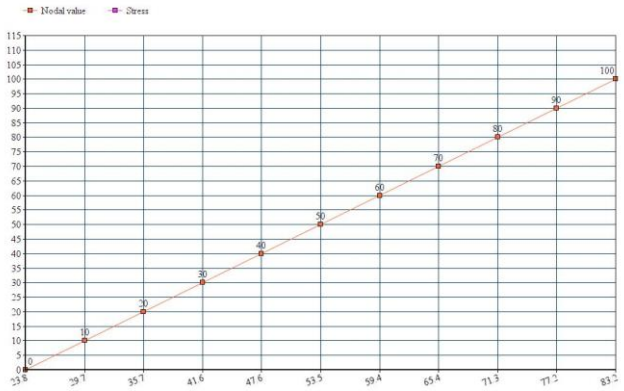
The pressure points have been applied to the top of the blade as compared to the alignment of the clamps mounted at the base of the blade. That is the pressure of 100 N/m2 is being applied on the blade and then the computation is done so as to achieve the further analysis of the desired part.

Von-Misses Stress Analysis

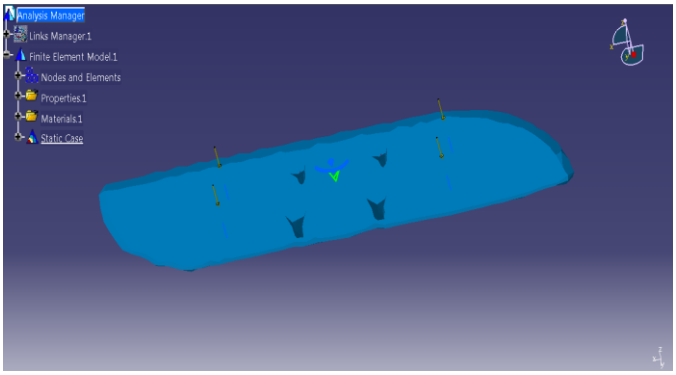


The von Misses stress is used to predict yielding of materials under complex loading from the results of unaxial tensile tests. The von Misses stress satisfies the property where two stress states with equal distortion energy have an equal von Misses stress.

The various changes can be seen in the part body as the various color represents where the exact amount of pressure is been exerted. That is the dark blue color shows where the pressure exerted is less and the red color shows which is highly affected by the pressure exertion on the part body.



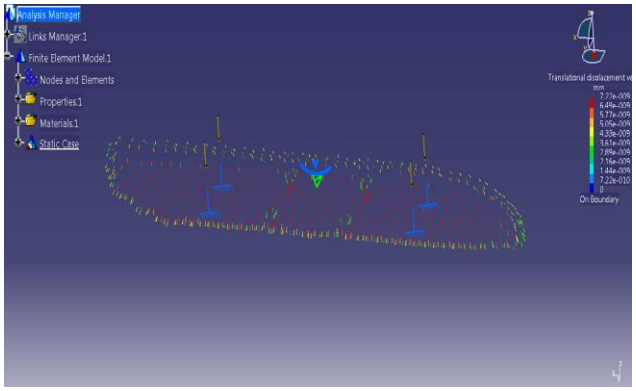
Graph made from the obtained result of nodal values by applying gradual stress of 100N/m2.



Deformation Analysis

Deformation analysis shows a analyzed image of the blade while applying the pressure of 100N/m2. In actual practice the blade will not get deformed but it will definitely reduce its sharpness from the corners from where the material grinding takes place.

Translation Displacement Analysis



III. CONCLUSION

The modified blade has been implemented at the industry in actual practice and the production rate at the industry by this blade results in increase of production of the thick powdered aluminum by 500 kg of grinded material by one machine in one single shift firstly the production was so low and the company was facing a major issue with it which is positively solved and the positive results have been achieved from the modified design. The implementation has been done by the industry as they saw a positive outcome in this modified design.