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Design Modification and Analysis of Sugar Cane Leveler at Sugar Cane Processing Plant

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Abstract*: In sugar factory initially sugar cane is weighted on weighing machine after weighing it approaches towards leveler through conveyor. Leveler levels the sugar cane entering in crusher with the help of Blades but conventional levelers having fixed type of blades so sometimes sugar cane get blocked in it and blades edges will get damaged, so in this research we design and analyzed new Flexible blade type sugar cane leveler .*

1. Introduction

When sugar cane reaches from fibrizer it passes through fixed type cane leveler.

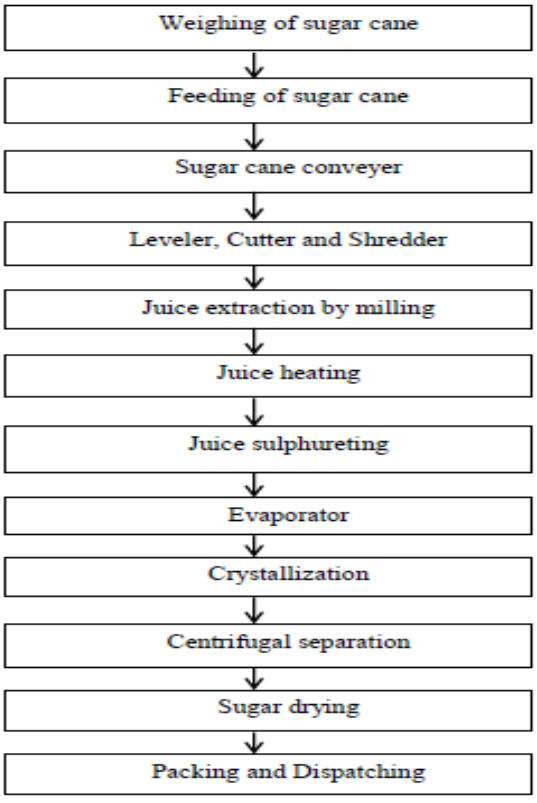

Figure 1: Flow Chart of Processing on Sugar Cane

When excess amount of sugar cane enter the cane leveler it gets blocked .because cane leveler have fixed type bitter. Due to blockage of leveler whole plant working gate stop. To prevent this stoppage of production we have suggested modified design of cane leveler which consists of flexible blades. The main advantages is to remove problem of blockage of leveler by exes amount of sugar cane, Increase production rate, Reduces the time required for repairing of cane leveler. [1]

2. Methodology

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge.

Type of methodology
1) Numerical
2) Analytical
3) Experimental

Efficiency in the sugar industry is so low and wastage so great that there is no hope for improvement unless the industry is placed under a Statutory Authority charged with the responsibility of running it on sound lines, keeping the national, interest in the forefront.

1. Mills Consume about 40 % Power consumed by the entire Power consumption of the Factory.
2. Mills influence the sugar production or the bagging of the sugar
3. Mills also are responsible for losses on account of
a. Sugar loss in bagasse (on account of higher bagasse moisture
b. Loss on account of Re-absorption and
c. Loss due to inefficient or low extraction efficiency
4. Further Mill station influences the factor of bagasse moisture and bagasse saving, which in turn

influences Boiler efficiency in general and cogeneration in particular.

5. If not provided for at the time of initial installation, Mill station expansion Generally requires total replacement of the existing Mills and calls for heavy write offs and new capital costs. Modified sugar cane supply arrangement offers the potential to improve the competitiveness of sugar industry. This is complex issue especially with vertical and horizontal expansion of where consideration of crushing capacity and harvest season length are necessary. Given this complexity and need to consider on form storage capacity, an operation research methodology appropriate the access the consequence of different cane supply operation.[2]

3. Literature Review

MJ Reid "Proceeding of The South African Sugar Technologist Association" June 1994. He said, "When higher extraction became more important it was realized that a greater proportion of broken cells could be more effectively achieved by hitting the cane with a heavy hammer at very high speed and in the process employing greater power. The cane knife was then relegated to the role of leveler or prereader in order to facilitate the operation of the shredder."[3]

R.C. Brooks "Proceeding of The South African Sugar Technologists" June 1983. The design criteria for a certain improved cane knife which is currently being developed are also included. The cane cutter expected to perform three operations with single tool but it would be impractical to change tools for each operations.

E.Hugot "Handbook of cane sugar engineering" Third completely revised edition 1986. The attempt at obtaining a completely even feed to the mill is never really successfully. By placing an "equalizer" over the carrier, a cane layer of nearly uniform thickness may be obtained. The leveler knives which are required mainly to even out the layer of cane. They are arranged to work with a high clearance and in consequence leave a large proportion of uncut cane.

Same Notes on Cane Leveller Knives at South Jahnstone By ROT CLARE;. April 2005 It has become common practice in modern milk to have two leveller knife units placed in cane carriers, and this has been practiced successfully at South Johnstone, for a number of years. The position of the knives in the cane carrier varies according to local conditions that is to sap, according to the manner in which the carrier is most generally loaded, and the engineer's personal ideas. In most cases one unit is placed at the bottom of the cane carrier, a few feet after elevation commences. and the other knit is generally placed near the top of the cane carrier, just before or just after it commences to return around the driving sprockets. The bottom knifes are mounted on a high speed shaft, with a speed of 330 revolutions per minute, and are balanced on the shaft to eliminate vibration as much as possible. They have a clearance of fifteen inches above the cane carrier boards. This unit is belt driven from a motor, and its average power con- assumption is .2X H.P. per ton of cane per hour : its object is to level or " top-off " the feed, and effect a more even delivery of cane to the top unit. The knives are changed weekly. They are made from g" boiler plate, and are not tempered, because if tempered they tell to snap off, instead of merely bending, when they come in contact with any hard "foreign matter." In this connection it is intercepting to note that last season, we did not have a broken knife in the bottom unit.[4]

Review of Design and Optimization of Fibrizer in Sugar Cane Industry. Kedar Ajit Ransing1, Dr. S. Y. Gajjal2 and V. V. Saidpatil3. IJISET - International Journal of Innovative Science, Engineering & Technology. In sugar cane industry fibrizer is in main role to cane preparation after the process of leveling of cane. Swing hammer type fibrizer is used in preparation & excellent in operation for in sugar industry. Preparation index is depended on power, grid plates, front wall etc. This is helpful with modification in so that preparation index is increased also it is easy in working, less maintenance, less power consumption & cost reduction machine. So, now a day's swing Vol. 2 Issue 4, April 2015. Hammer type fibrizer is used in all sugar cane industry for better results and high performances. [1]

4. Design of Cane Leveler

Input Data:
F = 45 KN
N= 587 RPM
P= 250 HP
= 250*746
=186500 W
=186.5 KW
P = 2π*NT*/ (60∗1000∗1000)
T = 3035.51 X 10^3 N.mm
T = F X r
3035.51x1000= F X 1440/2
F = 5325.4643 N

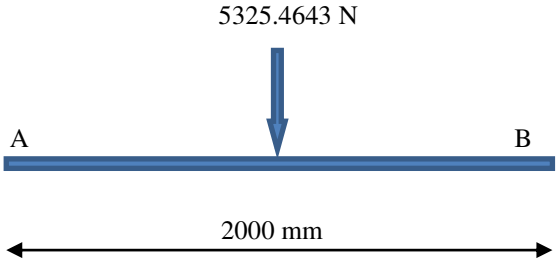

Figure 2: FBD of Shaft

RA = RB
= $F/2$
= 5325.4643/2
= 2662.73 N
Maximum Bending moment at P
M= RA X 1000
= 2662.73 X 1000
= 2662.73 X 10^3 N mm

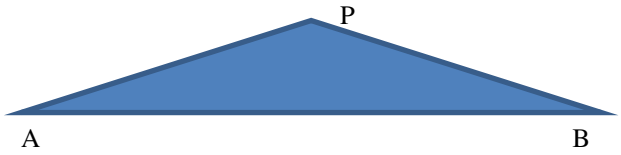

Figure 3: BMD of Shaft

Diameter of shaft by Based on Strength Basis
Te = √(Kb.M)2+ (Kt.T)2
=√(1.5 x 2662.7 x 1000)2+ (1.25 x 3035.51 x 1000)2
= 5509083 N.mm
T_{max} = (16 Te) / (π $d3$)
d= 80
Torsional Rigidity Basis
Θ = TL/GJ
Θ = $32TL180/G\pi 2d^4$
Θ = 0.25
T = 3035.51 X 1000 N.mm
G = 80 X 1000
L= 2000 mm
Therefore d = 115.39
d = 120 mm
Design for Lateral Rigidity
δ = (64 FL^3)/48πEd^4
1 = (64 x 5325.46 x 2000^3) / (48 x π x 200 x 1000 x d^4)
d= 97.52 mm
d = 100 mm
Design of Key
Assume rectangular key
W= d/4= 120/4= 30 mm
H= 2/3 W = 20 mm
Length of key = 1900 mm
Design of Leveller Hub
For previous data of leveler hub we change only the fixed blade into rotating blade into its small ends of section, So we wants to find the failure of pin/shaft support to the blade which is rotating in the pin Crushing failure of shaft in stander dia. of pin is 120mm, so crushing failure in the pin & Bush of belt and impact force consideration For C45 Material of Knives.
Considering C45 material for knives
S_{yt}= 360 N/mm^2
t = 89.95 mm
And P= 250KN
σ_c = $P/(dp\ t)$
d_p= 31.21 mm
d_p = 40 mm

Shearing of Pin
T = $4P/2\pi dp^2$
P= 250 KN
T = 30 N/mm^2
d_p = 72.85 mm
d_p = 74 mm
Outer dia of Blade:-
σ_t = $P/(D-dp)t$
σ_t = 360/6 = 60 N/mm^2
P = 250 KN
t = 89.95 mm
D = 120.81 mm
D = 122 mm

5. Modelling and Analysis

Modelling and analysis of conventional leveler that is fixed blade type.

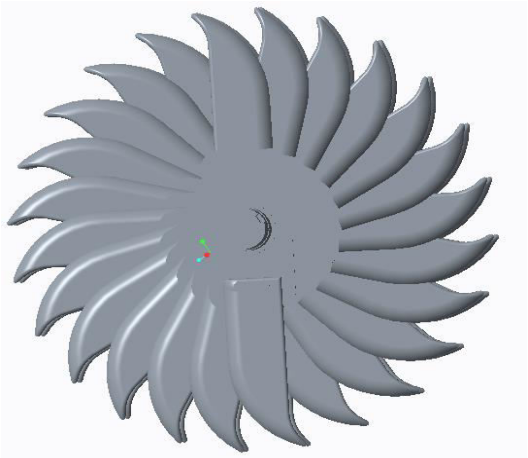

Figure 4: Modelling of old leveler

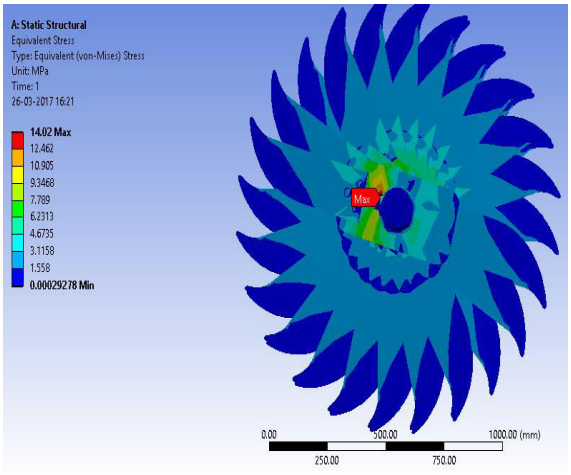

Figure 5: FEA Stress analysis of old leveler

Maximum stress 14.52 N/mm^2 occurred at junction of knives and key.

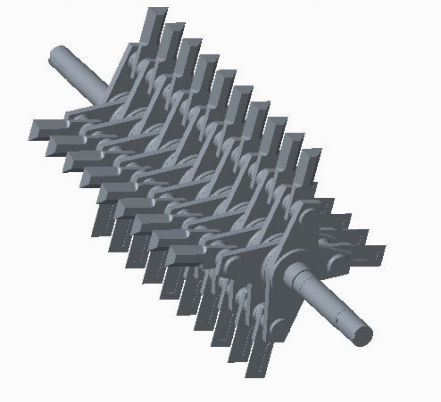

Figure 6: Modelling of new leveler

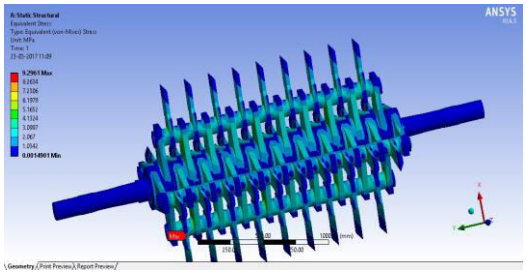

Figure 7: FEA Stress analysis of new leveler

Maximum stress 9.29 N/mm^2 occurred at junction of flexible blade and pin.

6. Conclusion

From above discussion we conclude that the efficiency of cane leveler can be increased by changing design from fixed bitter to flexible blades. By modifying design cane lever we will overcome the limitations of existing cane leveler. It will also increase the productivity of milling section. Efficiency of cane leveler increases then it also increase the production and also does not stoppage of work of worker in milling section. It is continuously supply of cane to the milling section and not fluctuating the supply of cane of the milling section.

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8. References

[1] Kedar Ajit Ransing1, Dr. S.Y. Gajjal2, V.V. Saidpatil3, "I Review of Design and Optimization of Fibrizer in Sugar Cane Industry," International Journal of Innovative Science, Engineering & Technology," Vol. 2 Issue 4, April 2015.

[2] R. K. Naresh*, S. P. Singh, A. K. Misra, S. S. Tomar, Pardeep Kumar, Vineet Kumar and Sanjeev Kumar, " Evaluation of the laser leveled land leveling technology on crop yield and water use productivity in Western Uttar Pradesh", African Journal of Agricultural Research, Vol. 9(4), pp. 473-478, 23 January, 2014 DOI: 10.5897/AJAR12.1741

[3] MJ REID, "A Review Of Cane Knifing", Proceedings of The South African Sugar Technologists' Association - June 1994 PP No. 159-161.

[4] ROT. CLARE; "Same Notes on Cane Leveler Knives at South Johnstone", Queensland Society Sugar cane Technologist, April 1934 PP No:- 137-140.