

Design of Decoiler Mechanism for Improving Productivity

¹Tejas V. Sonawane, ²Prof. B. M. Dusane

¹M. Tech. Student, ²Assistant Professor, Department of Mechanical Engineering, School of Engineering and Technology, Sandip University, Nashik, Maharashtra, India.

¹sonawanetejas700@gmail.com, ²bhushan.dusane@sandipuniversity.edu.in

Abstract: Cost efficient and rapid process of production are the important aspect of the industries in the material handling system. Design of the material handling system is one of the challenging tool. Though various types of material handling systems are available but comfortness as well as simple operating gives efficient way to complete process. The main aim of this study is to design and fabricate a system for loading and unloading the coils on the decoiler machine. This research is related to design, manufacturing and analysis of decoiler mechanism for industry. As per demand of industry they want to make the overall process speedy with high accuracy and safety. The manufacturing method of new decoiler mechanism reduce the manufacturing cost and also increasing the rate of productivity with reducing lead time. The design of old decoiler mechanism was very uninteresting than new one and also time consumable. Therefore, it was important to make necessary changes in old design of decoiler. The new decoiler have clean and robust design and also cost effective. This new decoiler mechanism is easy to use for workers and it can also be modified as per demand. This mechanism will provide low operational cost, no power requirement, high accuracy, high safety to the manpower. This decoiler mechanism will help to improve the material handling system of the industry. It will also reduce the final cost of production by great margin which help to improve oval profit for industry. The implementation of this project has major benefits to improve the productivity. The design and analysis of decoiler mechanism will be done with the help of suitable softwares.

Keywords: Comfortness, Decoiler, Material handling system.

I. INTRODUCTION

The decoiler mechanism is one kind of mechanism which provided with cutting as well as welding parameters which is special in the European market. The exact and accurate works that performed with help of decoiler mechanism are not achievable with help of manual labor as well as common machines. The additional main use of the decoiler mechanism is to permit definite rolling of coil which is place on the jaw of decoiler mechanism.

The decoiling is the operation which takes place on decoiler mechanism, the decoiling operation consists of unwinding the coil which is to be turn around the jaw of decoiler mechanism. The coil cuts in the form of sheets on shearing machine and the sheets can consists of various dimensions as per customer requirements. In other words, the decoiling is the action in which the unrolling of steel coil as well as cutting of steel coil takes place. As the coil unrolled from the rolled coil which is progress through levelling machine. Levelling is action done on levelling machine. Levelling is the highly professional action which carry out to avoid problems that occurs in coil machining process such as cutting, shearing, etc. The levelling is one

of the simple technique use to receive flat sheets which are free from internal stresses that results in saving of end product from scrap.



Fig. 1. Steel Insert on Jaw of Decoiler



Fig. 2. Steel Out from Decoiler

In every sheet metal industry, the operation starts with the decoiler mechanism. Because the decoiler mechanism is main material handling system in the sheet metal industry. By using the decoiler mechanism the safety of workers increases as well as accuracy of work also increases. The manually operated decoiler ranging from 2000 lbs (1 ton) up to 11000 lbs (5 ton) capacity to our automatically operated decoilers 4400 lbs (2 ton) up to 22000 lbs (10 ton).

In any sheet metal industry, the most significant process is to unwind the coil for further fundamental operation on industrial machinery. The decoiler mechanism is a kind of mechanism which is to be design for proper rolling of coil into cut to length line as well as workers safety. The decoiler is a unique modernization with a robust and creative design in which all parts are made of heavy material to avoid accidents in heavy work industrial environment. By using the decoiler mechanism we save our valuable lead time and hence it results in increases productivity. At the same time, we obtain the qualitative work by using new technology with decoiler.



Fig.3. Actual Decoiler Mechanism

A. Objectives

1. Developing machine which applicable to meet changes requires for worker.
2. Developing machine with new and innovative techniques, process.
3. Developing machine which is easy to operate for workers.
4. To develop machine having less lead time and hence improving productivity.
5. Design and develop the machine which having high reliability, safety and highly efficient.

B. Problem Identification

1. In industry the decoiler which is currently using is manually operates and requires three workers that continuously engaged with decoiler mechanism for checking the proper working of the mechanism, accuracy as well as continuous smooth flow of coil towards shearing machine for cutting.
2. The more time required to adjust coil position, there are one or two workers are continuously engaged with decoiler mechanism.

3. Due to this reason the lead time required for the mechanism increases and hence it results in decreases in productivity.
4. Hence, from above mention points we select the topic of decoiler mechanism to improve the workers safety, reduces lead time and increases productivity.

II. LITERATURE REVIEW

Galina A. SIVYAKOVA developed a simulation structure with electric motor at sheet rolling industry. The existing developed structure which used to observe current, magnetic flow as well as rotating speed of engine. In sheet rolling industry, the rolling of coil is not desirable without tension hence to calculate the tension the structure can be used. [1] Jatin Singh has done analysis on accidents which happened in sheet metal industry. Job Safety Analysis (JSA) done for analysing the various risks which are dangerous for occurring accidents in industry and making work work environment hazardous. It is necessary to done JSA in every department of the plant. The advantage of JSA is to appliance of safety curriculum to reduce accidents in sheet metal industry for safety of workers and clean environment in future. [2] K. A. Mahajan developed a semi-automatic spooling machine which helps to reduce number of workers required. In this machine, the tension in wire is high so that it gets break and hence to prevent breakage of wire the slip clutch is provided. The advantage of this machine is that is required less space due to compact construction. The floor area reduced from 2.8 m² to 3.9 m² by the system. The speed of this machine cannot be increased [3]. Mr. Ashutosh K. Mhaisky studied the various papers related to decoiler mechanism and find out the deep knowledge related to various designs of decoiler, the failure analysis of decoiler as well as stresses acts on decoiler mechanism [4]. Mr. Pratik R. Umathe design the coil making machine by using suitable software and the analysis also done with the help of software explanation and understanding of the designed model. The coil making machine designed for circlips, the circlips are used for fast and more accurate process [5]. Pawel Kazanowski established the model which is efficient to sustain the spring back effect in plate which use for welding process. They mentioned that it not essential to know the actual value of stress which acts on plate. The place for neutral plane and gesture of stresses are more significant [6].

III. METHODOLOGY

1. Problem Identification
2. Literature Survey
3. Study of Existing Model and Process
4. CAD Model
5. Design and Fabricate the Components
6. Inspection of Components
7. Assemble all Components
8. Machine Assembled

9. Testing and Results
10. Analysis
11. Conclusion
12. Final Report Submission

Table. 1. Time Study of Decoilers

Operation	Previous Mechanism	Decoiler	New Mechanism	Decoiler
Scrap Removal	50 Sec		0 Sec	
Provide Stand as a Support	0 Sec		5 Sec	
Pipe Structure, Bolt and Tightening	0 Sec		10 Sec	
New Coil Installation on Decoiler	150 Sec		60 Sec	
Stand Removal	0 Sec		5 Sec	
Total	200 Sec		80 Sec	

IV. RESULTS

A. Time Study

The time study analysis gives the detail information relates to time require for complete procedure which are done before cutting operation. The time analysis done on old as well as new decoiler mechanism. The old decoiler requires 200 sec for pre-cutting procedure whereas new decoiler requires 80 sec for same procedure. The detail analysis given in following table.

B. Productivity

Productivity is termed as a measure of the capability or performance of a person, machine, organization, etc., in converting inputs into valuable outputs.

The productivity of decoiler can be calculated as –

Let,

The sheets cut by previous decoiler mechanism in 1 hour = 237

The sheets cut by newly installed decoiler mechanism in 1 hour = 313

Productivity = $\frac{\text{Sheets cut by new decoiler mechanism} - \text{Sheets cut by previous decoiler mechanism}}{\text{Sheets cut by previous decoiler mechanism}} \times 100$

$$= \frac{313 - 237}{237} \times 100$$

$$= 0.3 \times 100$$

$$= 30\%$$

However, the productivity is increased by 30 percentage by using the newly installed decoiler mechanism.

C. Jaw Analysis

In new decoiler mechanism we change the design of jaw. The jaw is one of the most important components which is place on the shaft and the whole coil rolled around the jaw. By designing the new jaw for decoiler mechanism we reduce the scrap of the coil. The percentage of scrap removal by using new jaw is 0%. Hence, the new jaw design helps to reduce the scrap.



Fig. 4. Old Jaw



Fig. 5. New Jaw

D. Labor Analysis

As per mentioned, our aim was to reduce the labor cost. In the old decoiler mechanism 3 manpower required for complete cutting operation of coil. First for rolling purpose, second for supporting coil, third for cutting of coil on shearing machine. In new decoiler mechanism only 2 manpower required for complete cutting operation. First for rolling purpose, second for cutting of coil on shearing machine.

E. ANSYS Analysis

i. For 2-ton Weight Coil

For 2-ton weight of coil the total deformation and equivalent stress analysis given in following figures.

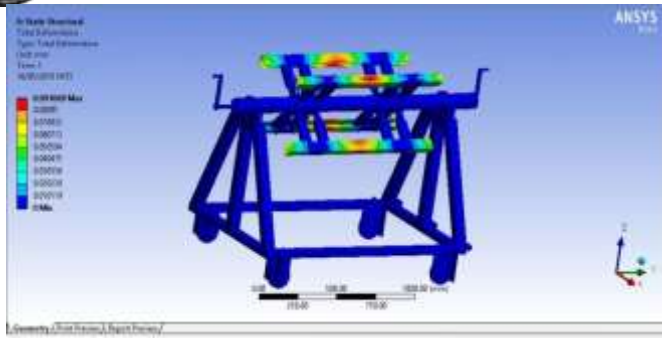


Fig.6. Total Deformation

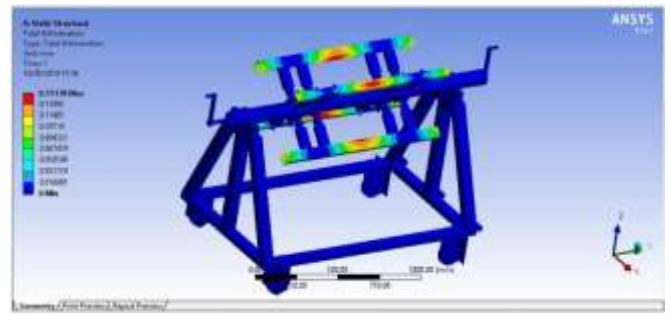


Fig.10. Total Deformation



Fig.7. Equivalent Stress

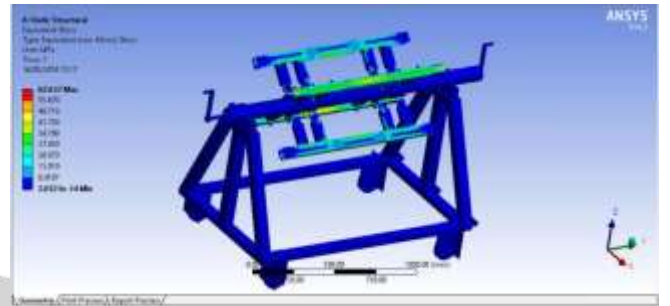


Fig.11. Equivalent Stress

ii. For 2.5-ton Weight Coil

For 2.5-ton weight of coil the total deformation and equivalent stress analysis given in following figures.

Now, the following table shows the minimum and maximum values of total deformation and equivalent stress analysis.

Table.2. ANSYS Results

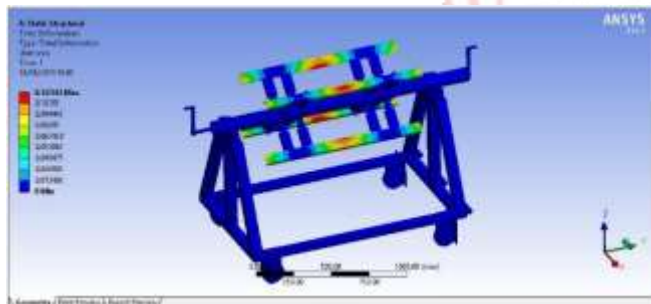


Fig.8. Total Deformation

Definition	Weight	Results	
		Min	Max
Total deformation	2	0	0.091069 mm
	2.5	0	0.12143 mm
	3	0	0.15178 mm
Equivalent Stress	2	1.229e- 14	37.582 Mpa
	2.5	1.6389e- 14	50.11 Mpa
	3	2.0523e- 14	62.637 Mpa



Fig.9. Equivalent Stress

iii. For 3-ton Weight Coil

For 3-ton weight of coil the total deformation and equivalent stress analysis given in following figures.

V. CONCLUSION

From the productivity calculations and analysis of decoiler mechanism the following conclusions are carried out.

1. The mechanism reduces the lead time and increases productivity with high grade accuracy
2. Productivity increases up to 30 percentage.
3. Improve the safety of the workers.
4. The mechanism has reduced labor cost.
5. The mechanism has robust design and easy to operate.
6. The mechanism has less manufacturing cost.

VI. FUTURE SCOPE

Electric Motor: By using the electric power motor the decoiler mechanism becomes fully automatic mechanism. Due to this, the rolling operation becomes noiseless with

accuracy. The fully automatic machine leads to requirement of man power.

Design Constraint: The designer can change the design of decoiler mechanism as per workers point of view.

REFERENCES

1. Galina A. SIVYAKOVA, Sergey Y. ORLOV, Waldemar, WOJCIK, Pawel KOMADA, “Development of simulation model of electric drive of decoiler”, Karaganda State Industrial University, Kazakhstan (1), LLP RVSA, Karaganda, Kazakhstan (2), Lublin University of Technology, Poland (3), doi:10.12915/pe.2014.11.45.
2. Jatin Singh, Veerendra Suryawanshi, Praveen Patel, “Hazards Analysis & Evaluation in Steel Processing Plant”, International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 3 Issue 5, May – 2014.
3. K. A. Mahajan, J. M. Solomon, S. J. Sukhu, K. V. Deshpande, L. S. Singh, “Design, Testing and Manufacturing of Decoiler Unit of a Semi-Automated Spooling Machine”, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN(e): 2278-1664, ISSN(p): 2320-334X, PP:01-05.
4. Mr. Ashutosh K. Mhaisky, Dr. Achal Shahare, Mr. Siraj Sheikh, “Case Study in Wire Coiling Zone to Reduce Time Losses in Manual De-coiler – A Review”, IJSRD – International Journal for Scientific Research & Development Vol. 5, Issue 05, 2017 | ISSN (online): 2321-0613.
5. Mr. Pratik R. Umathe, Prof. V. H. Bankar, “Design & Analysis of coil making machine”, IORD Journal of Science & Technology, E-ISSN: 2348-0831 Volume 1, Issue II (JAN-FEB 2014) PP 01-04.
6. Pawel kanzanowski and Wojciech Z. Misiolek, “Evaluation of Residual Stresses and their Influence on Distortion in the De-coiling and Welding Processes”, Institute for Metal Forming at Lehigh University Bethlehem, PA.