REDUCTION IN CYCLE TIME IN THE PROCESS OF MANUFACTURING OF ROLL OVER PROTECTIVE STRUCTURE

[1]Nikita Harishchandra Meher, [2]Mayur Ramakant Murade, [3]Rahul Sharad Lahane, [4]Aniket Laxman Ghumare, [5]Prof. Anupriti Sakhare

[1,2,3,4]B.E.Mechanical Engineering Students, [5]Assistant Professor
Dr. D.Y.Patil Institute of Technology
Pimpri, India

***Abstract*—Productivity improvement is an everlasting continuous activity in manufacturing. Continuous improvement is the need of the hours which can be achieved by incorporating flexibility in layout, design and processes. This project aimed to improving productivity of production system of manufacturing industry through reduction in cycle of the processes involved in the manufacturing of ROPS. The objective of project is to increase the productivity of ROPS by doing some improvements in the processes such as drilling, reaming and cutting process. Time consumed in the drilling and reaming process is quite higher than any other process as it is to be done externally. Hence we are working on optimization of drilling process also design die for improvement in production of ROPS.**

Key Words: Productivity, Rops, Reaming.

I. INTRODUCTION

In this project, we are going to reduce the time required for manufacturing of child parts of ROPS. The time required for the drilling of parts R141118 and R197510 is bit more and can be reduce considerably to increase the productivity. We are planning to convert the drilling operations into press tool operation by use of proper die, which will be ensuring faster operations. Also time required for cutting of ROPS strut tube is much higher as it is done on conventional machine running at lower rpm and manual feed also adding some lag to it as a result increasing overall lead time. So there is chance of improvement which can be overcome by replacing it with automatic cutting machine having hydraulic and pneumatically operated mechanisms for feed. We are also looking for changes in layout of process flow line as there is some lag in movement of parts from one shop floor to another for different operations to be performed on same product. The design of die for the part R141118 will be a major aspect as it affects the cycle time thoroughly. Hence overall objective of project is to reduce the lead time by analyzing the processes and finding the area of improvement followed by the implementation.

II. PROBLEM STATEMENT

ROPS covers almost 15% part of the production of Chromewell Engineering Limited which is sponsored for our project. Chromewell produces ROPS for JOHN DEERE Company. In case if demand increases, company should withstand the higher demand few processes consuming higher time can be optimized. Drilling and reaming process consumes more time hence can be optimized to another process. Also cutting of rops tube is done on conventional cutting machine which causes extra lag in production line. Movement of parts or materials also contributes for extra time hence can be optimized. Hence our problem statement is nothing but the higher lead time in the manufacturing process of rops.

III. OBJECTIVE

As discussed in problem formulation, the time required for two processes drilling, reaming and cutting is more. So our objective is to reduce the time lag caused by these processes. Hence the objective of the project is to reduce the time required for not only drilling and reaming process but tube cutting process also which is done on conventional machine

IV.POSSIBLE OUTCOMES

1) Increase in productivity
2) Increase in Capacity
3) Maximum time utilization
4) Cost reduction

V. LITERATURE REVIEW

A.K.Kumaresh

This paper mainly focuses on different operations done in single die set with various stations just like a progressive die. But the difference is mode of operation – Progressive die can perform a sequence of operation at a single stroke of press, here this die can perform an individual operation in each station on the die set at a single stroke of press. This should constantly eliminate the loss in

production time and reduces the man power from loading and unloading the sheets. The parts of the die sets, punch and die are designed in the solid works assembled. [1]

Steven A. Freeman

A fully implemented ROPS retrofit program for equipment dealers would have reduced the number of tractors sold without ROPS in Central Iowa by over 40%. The results suggest that such a policy could have a significant impact in reducing the number of farm fatalities and thus should be investigated further. [2]

Sneha S. Pawar, R. S. Dalu

The evolution of products, dictated by the necessity to survive in the market, requires changing in manufacturing processes. This requires an integrated approach of Constructive aspects, technological, organizational and Management of the development stages in order to reduce as much as possible time and cost of the new products

Xian-Chun Tan

This methodology integrates process determination from three different levels: new production processing, selected production processing and batch production processing. This approach is taken within a manufacturing enterprise based on prior research. The methodology is aimed at providing decision support for implementing Environmentally Benign Manufacturing (EBM) and low-carbon production to improve the environmental performance of the manufacturing industry.

Sei-Hwan Kim

This paper provides technical support guidelines that address problems related to nail clipper progressive die for Three Seven Inc., also known as "777" in the global beauty supply market. The company's nail clippers have not been recognized as the best of their kind because the cross sectional areas on the sides of these multipurpose nail clippers that are more recognized in the global market than in Korea are not even and have a large fracture angle and rough surface.

VI. ANALYTICAL WORK

Study of the flowchart of processes

Flowchart study has been made for following parts

a. Tube ROPS strut

b.Bracket ROPS Pivot R141118

c. Bracket Crossbar Pivot R197510

Data collection of cycle time

Tube cutting

Bracket crossbar Pivot

Bracket ROPS Pivot

***Conclusion made from study of cycle time*:** As lead time for cutting of tube strut takes more time on conventional cutting machine i.e. Band saw cutting machine. BAND SAW CUTTING MACHINE→ AUTOMATIC CUTTING MACHINE. Time required for drilling and reaming process is more as it is performed on other machine. DRILLING, REAMING → PIERCING, SHAVING. As drilling consuming more time we decided to convert it into press tool operation, piercing and reaming. Hence we came up with the conclusion that we need to design a die in order to convert drilling into piercing and shaving.

VI. DIE DESIGN

As discussed earlier we will be designing a shaving die for part R141118 bracket rops pivot. Basic fundamentals needed for die design are discussed below.

Why to choose press tool over drilling and reaming

a. Suit the type of production whether it will be small batch, large batch or mass production.

b. Dimensional accuracy and surface finish.

c. Ensure required hourly output and ease of maintenance.

d. Safer operation and reliable fastenings in press.

e. Less skilled operator required.

f. Higher percentage material utilization.

g. Press operations are faster than drilling.

h. The thickness of plate is within the press tool range – 8.1mm

Die construction

The die set is the primary portion of every die construction. It made up of upper die and lower die both are machined in parallel in size. The portion of the die is provided with the shank which is used to clamp in the ram of the press. Both the upper die and lower die are aligned with the guide pins. They are firmly attached to the stripper and the upper die is equipped with the bushings into which these pin slip-fit. The die blocks are mounted in the lower die in which they are attached through the die buttons. The punch plate is mounted on the upper shoe in which same manner as the die block. It holds all the punches which are perforated the sheet with the help of die at the bottom. While doing the punching operations, the punches can be prevented from the cracks by the spring loaded stripper plate. The stripper plate is held in the top plate with an offset location of forces of springs by means of guide pins. This die set is the combination of two die set. The upper die set is rectangular in shape with four post die set. The lower die set is rectangular in shape with open die set which is used for simple parts in larger quantities. [05]

Materials used in die

The die set is made up of Aluminum – Silicon alloy by replacing the tool steel material which enhances the high ductility and high hardness level. This material is suggested for light weight of the die and it tends to deforms while the thrust force is applied, regain its original shape. However it is good corrosion resistance. It is able to sustain up to 10 bar pressure which is applied by the hydraulic press

Press force calculations

1) Cutting force:

Cutting force (F) = L x t x T max

L = Length of periphery to be cut in 'mm'.

t = Sheet thickness in 'mm '

T max = Shear strength in N/mm

2) Stripping force:

Striping force = 10% - 20% of cutting force (F)

Movement of stripper Y_{STR} = t + 2

Where Y_{STR} = Movement of stripper

t= Thickness of stock

Spring deflection (Y)

Y = (3 to 4) Y_{STR}

= (3 to 4) (t+2)

Where Y = Total spring deflection at F max load

3) Ejection force

Ejection force = 10% cutting force (F)

Press force = Cutting force + stripping force

VII. CONCLUSION

By use of automated cutting machine with advancement in the clamping of tubes, the extra time required for mounting and alignment for proper angle of tube strut is reduced. By implementing the die the rate of production of par R141118 has increased to considerable level. This die design specifically designed for the MSME industries which are facing the problems regarding their own criteria. By implementing this type of die design to compete few recommendations such as

Increase of production rate/batch
Get a possible product in a die
Reduction of man power

REFERENCES

1. Compound Die Design: A Case Study
2. Potential Impact of a ROPS Retrofit Policy in Central Iowa
3. DESIGN AND ANALYSIS OF PUNCHING DIE -A.K.Kumaresh1, B.Balaji, M. Raj
4. Introduction to production Engineering –P.C.Sharma
5. Company Manual.
6. Improved Methods for Production Manufacturing Processes in Environmentally Benign Manufacturing.
7. Progressive Tool Design and Analysis for 49 Lever 5 Stage Tools -H. Ameresh, P.Hari Shankar.
8. Design of Progressive Draw Tool Vishwanath M.C,Dr.Ramni,Sampath Kumar L.