Design of a Mechanical Lifter for the Forging Industry
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Abstract—In industrial sectors, in India, transportation is a major factor, in the production rate of the goods, products, raw materials, etc. Transportation affects the production rate, cost and hence the profit of the company. Transportation of products requires time which as a result decreases the productivity and hence decreases the profits. Hence, to increase the production rate and the profits, we design a lifter which will work in less available space and thus reduce the time required to shift the loads from one machine to another. The project discusses the mechanisms used in manual lifting/stacking. We are going to use chain sprocket, gearbox and forklift for lifting application.

Key words: Forklift, chain and sprocket, Gearbox

I. INTRODUCTION
In various departments of a company, there is a necessity to shift the job from one machine to another. This requires a lot of man power and human efforts to do shifting of material. And as there is less availability of space, no robotic arms, or no automatic machine Lifter s can be used in the department. Hence as a solution, for the lifting purpose, We have come up with an idea of a lifter which will work in less space with more efficiency. It will help the department to avoid the loss of time and will help increase the production rate of the department. This will provide industries with requirement of less man power and increase in the efficiency of the production of the industry. It will work in the least allotted space of a workshop. It will also keep in check the smooth flow of work without much effort and a reduced time required to move the job from one place to another.

There are certain guidelines which are used to simplify the design, decrease assembly cost, improve product reliability and reduce operation time required to bring a new product into market. The guidelines are:

- Reduce the part cost
- Reduce the worker fatigue.
- Optimizing part lifting
- Reduced shifting time

Types of lifts can be classified as follows –

A. Classification Based on the Type of Energy used
a) Hydraulic lifts
b) Pneumatic lifts
c) Mechanical lifts

B. Classification Based on Their Usage
a) Scissor lifts
b) Boom lifts
c) Vehicle lifts

As per the space and cost considerations and requirements of the company, we decided to select the mechanical lifter. It is completely manually operated and easy to manufacture. Cost of manufacturing is less and it also satisfies the requirements and fulfills the constraints of the company. The design procedure for the chosen lifter is stated below:
Total load with safety factor 2 = 740Kg
Shaft length = 29 cm
Max permissible deflection; 
d=L/800 = 0.03625
Required moment of inertia for such deflection;
I=WL^3/48Ed = 4.9392063 cm^4
Diameter of suit above M.I;
D^4=I*64/3.14=3.1670706 cm

Fig. 2:
4) Selecting diameter of shaft = 3.5cm
Area of shaft;
A=3.14*D^2/4
= 9.622375 Sq. cm
Stress induced in shaft;
S=P/A
= 76.904091 Kg/sq. cm
77<1000, Therefore, selected section is safe.
5) Bearing used for shaft
Bearing is mechanical element that permits relative motion between two parts, such as shaft and the housing, with minimum friction. The functions of the bearing are as follows:
   1) Ensures free rotation of shaft
   2) Supports the shaft or the axle and hold it in correct position
   3) Takes up the forces that act on shaft and transmits them to the frame
IS UCP 207 D1, MAKE-NTN
6) Sprocket selection
¾”P SIMPLEX (Based on chain selection)
No of teeth= 25
P.C.D= 15.167 cm

III. MATERIAL SELECTION
It is necessary to evaluate the particular type of forces imposed on components with a view to determining the exact mechanical properties and necessary material for each equipment. A very brief analysis of each component follows thus:
   Chain: of ¾” with two strands is selected after the calculations are done.
   Sprocket: ¾”P simplex, no. of teeth-25
   Shaft: Material-EN8
   Gearbox: W110,MAKE-BONFIGLIOLI
   Hand wheel: Radius- 0.1m

IV. WORKING
Working of the lifter is based on rotating motion of hand wheel converted to reciprocating motion of fork followed by a chain and sprocket connected to a single speed gear box.

V. CONCLUSION
The manual mechanical lifter as designed properly keeps in check the company requirements and also is easy to manufacture and the cost of manufacturing is subsided. So, from the above design considerations and calculations, the design is safe to be manufactured according to the requirements of the forging industry.

REFERENCES