FIXTURE DESIGN FOR RIMMING MACHINE

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ABSTRACT

The title of the project is to design and modify the reaming machine.The project's objective was to design, construct model, analyze and implement it to real world for an efficient working of reaming machine .The design objective is to build out a useful, effective, convenient, reliable and safe for workers using the reaming machine.Research has been done to fulfill the requirements. By using fixtures we have modified the reaming machine. The new modified reaming machine from this project was proved to be efficient and able to function in minimum time. The testing of this new design was carried out to meet the objective of the design.The designing of the fixture has helped the workers a lot as it has reduced the workload and the risk of accidents during the reaming operation.

KEY WORDS : fixture, accuracy, clamping, productivity.

INTRODUCTION

Our project is related to fixture design for reaming machines. Earlier during the reaming operation, workers had to hold the workpiece with one hand and pull the lever with the other hand. There was a risk of an accident and also the rejection of products was very high. That's why we designed this fixture. Due to which the rejections in products and chances of accident have been reduced a lot.

Importance of fixtures :

Designing and fabricating a fixture contributes considerably to overall manufacturing cost and also consumes time. But it will eliminate individual marking, positioning and frequent checking before machining operation starts, thus resulting in significant savings in set-up time.

Steps of fixture design

Successful fixture designs begin with a logical and systematic plan. With a complete analysis of the fixture's functional requirements, very few design problems occur. When they do, chances are some design requirements were forgotten or underestimated. The workpiece, processing, tooling and available machine tools may affect the extent of planning needed.

Preliminary analysis may take from a few hours up to several days for more complicated fixture designs. Fixture design is a five-

step problem-solving process. The following is a detailed analysis of each step.

Step 1: Define Requirements

To initiate the fixture-design process, clearly state the problem to be solved or needs to be met. State these requirements as broadly as possible, but specifically enough to define the scope of the design project. The designer should ask some basic questions: Is the new tooling required for first-time production or to improve existing production?

Step 2: Gather/Analyze Information

Collect all relevant data and assemble it for evaluation. The main sources of information are the part print process sheets, and machine specifications. Make sure that part documents and records are current. For example, verify that the shop print is the current revision, and the processing information is up-to-date. Check with the design department for pending part revisions. An important part of the evaluation process is note taking. Complete, accurate notes allow designers to record important information. With these notes, they should be able to fill in all items on the "Checklist for Design Considerations." All ideas, thoughts, observations, and any other data about the part or fixture are then available for later reference. It is always better to have too many ideas about a particular design than too few. Four categories of design considerations need to be taken into account at this time: workpiece specifications, operation variables, availability of equipment, and personnel. These categories, while separately covered here, are actually interdependent. Each is an integral part of the evaluation phase and must be thoroughly thought out before beginning the fixture design.

Step 3: Develop Several Options

This phase of the fixture-design process requires the most creativity. A typical workpiece can be located and

clamped several different ways. The natural tendency is to think of one solution, then develop and refine it while blocking

out other, perhaps better solutions. A designer should brainstorm for several good tooling alternatives, not just choose one

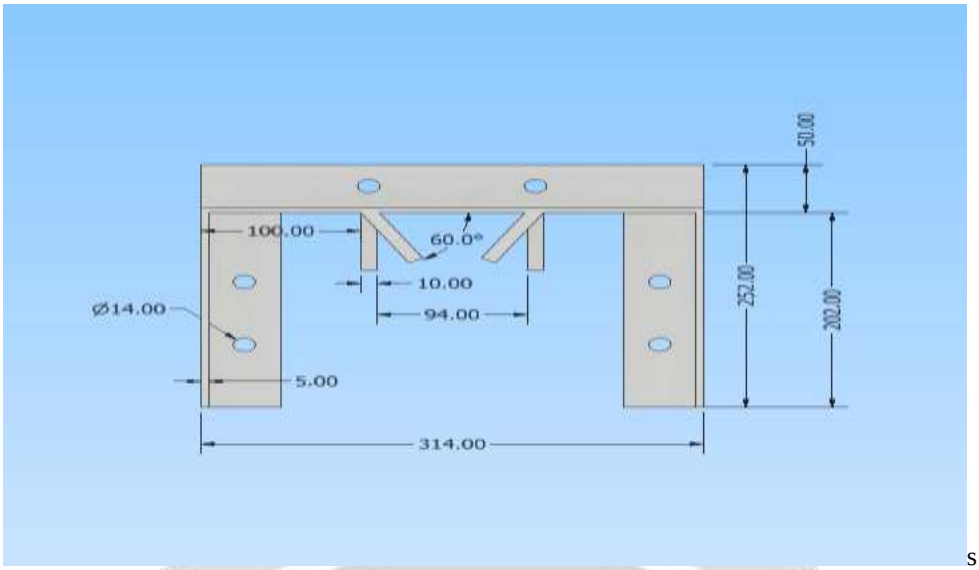
path right away.clamping devices. Finally, add the machine tool and cutting tools. Sketching these items together helps identify any problem areas in the design of the complete fixture.

Step 4: Choose the Best Option

The total cost to manufacture a part is the sum of per-piece run cost, setup cost, and tooling cost. Expressed as a formula, These variables are described below with sample values from three tooling options: a modular fixture, a permanent fixture, and a hydraulically powered permanent fixture.

Step 5: Implement the Design

The final phase of the fixture-design process consists of turning the chosen design approach into reality. Final details are decided, final drawings are made, and the tooling is built and tested. The following guidelines should be considered during the final-design process to make the fixture less costly while improving its efficiency.



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I .IMPORTANT CONSIDERATIONS WHILE DESIGNING JIGS AND FIXTURES.

Designing of jigs and fixtures depends upon so many factors. These factors are analyzed to get design inputs for jigs and

fixtures. The list of such factors is mentioned below :

a. Study of workpiece and finished component size and geometry.

b. Type and capacity of the machine, its extent of automation.

c. Provision of locating devices in the machine.

d. Available clamping arrangements in the machine.

e. Available indexing devices, their accuracy.

f. Evaluation of variability in the performance results of the machine.

g. Rigidity and of the machine tool under consideration.

h. Study of ejecting devices, safety devices, etc.

i. Required level of the accuracy in the work and quality to be produced

OBJECTIVE :

Our project aim is to perform reaming operations smoothly by using modified fixtures. By using this fixture we reduce human errors. The main function of this fixture is to reduce rejection of the job and prevent accidents, and to ensure smooth surface finish.This type of fixture provides work partially at low cost and low maintenance and less risks of accidents at the workplace.

PROBLEM :

When we were observing their operational process we found that their Reaming machine takes too much time to complete its operation because there was not any fixture for holding the job.

Because of no holding fixture, the job was shifted to the left or right side continuously and this caused variation in job dimension. And if there is a new operator for the Reaming machine then he cannot complete the operation because he cannot hold the job properly.

SOLUTION :

To overcome the problems faced during operations we are introducing a fixture which would hold the workpiece steady to avoid errors or damage during operations and ensure smooth operations for final finished goods.

The fixture would also reduce human involvement which would eventually reduce the human errors and ensure their safety.

FLOW PROCESS CHART

Flow process Chart for Making the Fixture :

Man Type

Task: Making the Fixture

1	Material moved for cutting
1	Cutting operation
1	Visual Inspection
2	Moving for finishing operation
2	Visual Inspection
2	Moving for welding
3	Visual Inspection
3	Welding of joints
4	Visual Inspection
4	Finishing the welded joints
5	Visual Inspection

Other advantages of fixtures in drilling are :

- More productivity.
- Repeatable clamp location.
- Eliminates human error.
- Ergonomic efficiency.

some of calculations about job location

1
A1 = 202 X 5 =1010 MM2
X1 = 202 / 2 = 101 MM
Y1 = 5 / 2 =2.5MM

2

A2 = 304X 5 =1520MM2
X2 = 5 / 2 = 101 MM
Y2 = 304 / 2 + 5 = 157 MM

3
A3 = 202 X 5 =1010 MM2
X3 = 202 / 2 = 101 MM
Y1 = 5 / 2 + 304 + 5 = 311.5MM

NOW TO FIND CENTRE OF GRAVITY OF C CHANNEL

$$X\ BAR = \frac{A1X1 + A2X2 + A3X3}{A1 + A2 + A3}$$

$$X\ BAR = \frac{(1010 \times 101) + (1520 \times 2.5) + (1010 \times 101)}{(1010 + 1520 + 1010)}$$

X BAR = 58.7062 = 59 MM

$$Y\ BAR = \frac{A1Y1 + A2Y2 + A3Y3}{A1 + A2 + A3}$$

$$Y\ BAR = \frac{(1010 \times 2.5) + (1520 \times 157) + (1010 \times 311.5)}{(1010 + 1520 + 1010)}$$

Y BAR = 157 MM

CUTTING SPEED

$$V = \frac{\pi D N}{60} \quad M/S$$

AS WE KNOW
D = 23.40 MM = 0.234 MM
N = 500 RPM (WHEN THERE IS NO FIXTURE)

$$V = \frac{\pi \times 0.234 \times 500}{60} \quad M/S$$

= 6.126 M/S

$$V = \frac{\pi D N}{60} \quad M\backslash S$$

AS WE KNOW
D = 23.40 MM = 0.234 MM
N = 1000 RPM (WHEN THERE IS FIXTURE)

$$V = \frac{\pi \times 0.234 \times 1000}{60} \quad M\backslash S$$

= 12.25 M/S

SO WE CAN CONCLUDE FROM ABOVE CALCULATION THAT, IF WE USED FIXTYRE IT WILL GIVES MORE EFFICIENCY
IT CAN SEEN BELOW

V = 6.126 M/S .....WITHOUT FIXTURE
V = 12.25 M/S .....WITH USING FIXTURE

BEFORE AFTER ANALYSIS

Before :

We observed that during the operational process their Reaming machine takes too much time to complete its operation because there was not any fixture present for holding the job.

Because of no holding fixture, the job was shifted to the left or right side continuously and this caused variation in job dimension. And if there is a new operator for the Reaming machine then he cannot complete the operation because he cannot hold the job properly.

As there was no fixture to hold the job at its particular place there were high risks of accidents during the reaming process. Also the rejection of products was very high. This affected the safety of the workers and also affected the production and quality rating of the products.

As the safety of workers and the production and quality rating of the products cannot be kept at risk we had to find a solution for the problem of keeping the job at a particular place for the efficient working of the reaming machine.

After:-

To overcome the problems faced during operations we are introducing a fixture which would hold the workpiece steady to avoid errors or damage during operations and ensure smooth operations for final finished goods.

The fixture would also reduce human involvement which would eventually reduce the human errors and ensure their safety. A fixture is a production tool that locates, holds and supports the work securely in a fixed orientation with respect to the tool so that the required machining operations can be performed. In machining fixtures, minimizing workpiece deformation due to clamping and cutting forces is essential to maintain the machining accuracy.

After the design of the fixture and mounting it onto the reaming machine the work or process to be performed on the reaming machine was very feasible to work with. The addition of fixtures to the reaming machine eventually reduced the high risks of accidents for the workers. Also the rejection of products has reduced very much.

Hence, the addition of fixtures to the reaming machine resulted in an increase in the safety of the workers and also the daily rejection rate reduced very much. Also the production and quality rating increased to a greater extent.

CONCLUSION

In this way we can conclude that our project "Fixture design for reaming machine" is useful for producing jobs. The addition of fixtures in the reaming machine has increased the safety of the workers and also has decreased

the rejections per day of the products. Based on the overall performance of the fixture we can definitely say that the project will satisfy the need of the manufacturer. So in this way we can solve the present problem with the solution of a proper fixture

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