ANALYSIS & DESIGN OF DRILLING CUM ORBITAL RIVETING MACHINE.

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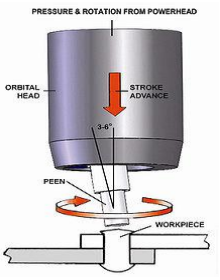
***Abstract*— In Manufacturing aspect it is very important to know about all machining processes. Conventionally all these processes were performed manually by the workers but that was very tedious work. It is impossible to get higher production in such a case also there is chances of human error in the processes which affects the quality of the product. Today we have been suffering from lack of problem to achieve maximum productivity. it is impossible to get higher production by performing these processes separately on different machines it is time consuming as well as it is very difficult to maintain accuracy in the product. So it is necessary to design and manufacture a machine which performs two or more operation on a single machine. The objective of paper is to design the drilling cum orbital riveting machine, which will help to increase production by minimizing time constrain.**

***Index Terms*— ORM, SPM, DRILLING, RIVETTING.**

I. INTRODUCTION

ORM is the orbital riveting machine which will perform the riveting operation automatically along with drilling operation. We use two spindles on one machine to reduce operation time and performing the drilling & riveting operation at same time To get accuracy with productivity in riveting 2 to 3 degree offset spindle is use; the upper part of rivet is expanding over the plates without hammering.



By riveting we mean the upsetting of a rivet to form a head to hold several assembled parts together. The rivet can be in the form of a pin or an eyelet. The conventional riveting process consists of pull riveting and push or hammer riveting was referred to as impact riveting, usually done by manually or machining operation Orbital riveting machines have a spinning forming tool (known as a peen) which is gradually lowered into the rivet which spreads the material of the rivet into a desired shape depending upon the design of the tool. Orbital forming uses a spinning tool mounted in a rotating spindle and inclined at an angle about 3 to 6 degrees toward the center of the spindle.

II. CONSTRUCTION

The orbital riveting machine consists of the following parts:

1. 3-Phase Induction motor:- The motor used in the machine is a 3-phase induction motor, Power-0.5 Hp, Speed-1440 rpm, Foot mounted, Frame size-71.
2. Motor pulley (2.5”):-The power transmission from motor to the main spindle is done by an open belt drive. Motor pulley is a cast iron pulley (2.5” diameter), single groove ‘A-Section’, keyed to the motor shaft.
3. Spindle Pulley (4”):- Spindle pulley is a cast iron pulley (4” diameter), single groove ‘A-Section’, keyed to the main spindle. Thus the transmission ration 1:1.6, i.e. the spindle rotates at 900 rpm.

4. Belt:- Belt is an 'A-Section' belt with included angle 400 length 29 inches, hence the specification 'A-29'.
5. Top Spindle housing:-The top spindle housing is a rectangular element made from structural steel EN9, bolted to the C-frame. It carries the single row deep groove ball bearing 6005zz.
6. Bottom Spindle housing:- The bottom spindle housing is a rectangular element made from structural steel EN9, bolted to the C-frame.
7. Ball Bearings:- The spindle is held at the top and bottom ends in single row deep groove ball bearings 6005zz. Internal diameter of bearing is 25mm, outside diameter of bearing is 47mm and width of bearing is 12mm
8. Spindle:-The spindle is a high grade steel member (EN24), held in heavy duty ball bearings at either ends supported in the bearing housings. The spindle carries the spindle pulley at the top end where as the tool holder at the bottom end. The spindle runs at high speed 900 rpm.
9. Tool Holder:-The tool holder is high grade steel member (EN24), keyed to the spindle at the lower end. The tool holder holds the rivet set (tool) at an angle 50, to the spindle axis. The rivet set is held in ball bearing 6002 in the tool holder and is held in position by an internal circlip.
10. Rivet set (Tool):-The rivet set or tool is a hardened steel component OHNS (Oil Hardened Non Shrinkage Steel). It is placed at an angle 50, to the spindle axis and is held in the tool holder.
11. Work holder:-Work holder is made from structural steel (EN9), it is basically a fixture to the hold the job while carrying out the riveting operation. The work holder is held on the work table.
12. Work table:-Work table is made from structural steel (EN9); it is basically a table to the hold the work holder while carrying out the riveting operation. The work table is held on the Table slide.
13. Table slide:-Table slide is made from structural steel (EN9), it is basically a slide to the move the work table up or down while carrying out the riveting. The Table slide is held in the Table guide.
14. Table guide:-Table guide is made from structural steel (EN9), it is basically a guide to the hold the Table slide while it moves up or down while carrying out the riveting operation. The Table guide is bolted to the C-frame.
15. Rollers:-Rollers are basically two ball bearings namely 6002 and 6201 held on the end of the Feed handle on the handle roller pin, it moves the table slide up or down when the feed handle is operated. Pin is made from hardened steel (En24).
16. Feed handle:-Feed handle is mounted in the handle hinge; it carries the roller at one end and the knob at other end. It moves the table slide up or down when operated.
17. Handle Hinge:-Handle hinge is fabricated from MS , it is welded to the C-Frame , it carries the hinge pin on which the feed handle is mounted.
18. C-Frame:-The C-Frame is the basic structure of the machine on to which entire assembly of machine is made. It is made of Mild steel.
19. Belt Tension adjuster:-Belt tension adjuster is a arrangement to adjust the tension in the open

belt drive. The position of the lock nuts is adjusted to adjust the belt tension.

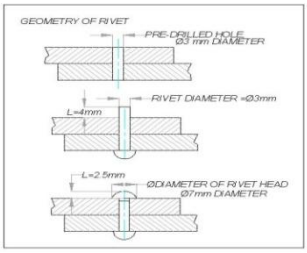
MANUAL CALCULATION:-

As per the requirement of the use machine has been designed.

Δ = mean thickness of deforming zone / length of deforming zone

$\Delta = h/2L$

$\Delta = 3/2(4) = 0.375$



$\Delta = 0.375$

$C = 0.8 + 0.2\ \Delta$

$= 0.8 + 0.2\ (0.375) = 0.875$

C = Constant (Constraint factor) =0.875

σ = mean flow stress = 100 N/mm^2

A = Forging projected area ; mm^2

$= \pi \times D^2 /4$

$= \pi \times 3^2 /4 = 7.06$ mm^2

$P = \sigma\ A\ C$

$= 100 \times 7.06 \times 0.875$

$=617.75N$

Most of the work during orbital forming is focused at the tool's line of contact, not along the entire tool surface. This reduces axial loads by as much as 80%, which has several advantages.

Hence , Peff = 0.2 x 617.75 = 123.5

Peff = 124 N

This is the load that acts in the downward direction while forming the rivet, where as the rivet head diameter is 6mm, hence the torque required at the spindle is given by :

$T = P_{eff} \times r$

$= 124 \times 3$

$= 372$ N-mm

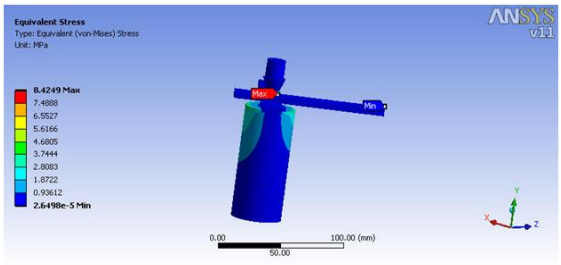
T = 0.372 N-m

Power required at spindle is given by ,

$P = 2\ \pi\ N\ T\ /60$

$= 2\ \pi \times 900 \times 0.372\ /60 = 70$ watt

III. ANALYSIS IMAGES FOR EQUIVALENT STRESS



Equivalent von mices stresses

Max=8.4249 MPa Min=2.6498 MPa

IV. CONCLUSION

It is concluded from the paper that this machine works safely and fulfill the actual condition required for machining operations like drilling and riveting, It is found that this machine is very useful in industry as it reduces time constraint also it increases the productivity.

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