# Changing of Dimension and Microstructure of Flow Forming Cylinder Tube after Compress by Swaging Machine

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***Abstract*—Cylinder tube is an important part of rocket motor. At the end of the cylinder tube we made surface thickness more than front and center of tube, because at the end of tube is an assembly area and need to machine later. Flow forming process is the cold forming process that fix inside diameter of cylinder tube. It's mean outside diameter at end of tube was bigger than other area. Swaging Machine was required to reduce outside and inside diameter to follow the tube designed. We found direction of compress is effect to size obtained, compress inside to outside longitudinal direction result was different with compress outside to inside longitudinal direction.**

***Keywords—Cylinder tube; Outside diameter; Inside diameter; Compression; Radial compress.***

## I. INTRODUCTION

Flow forming is cold metal forming process which fitted into rotating mandrel, inside diameter was fix equal to mandrel diameter [1]. In this case cylinder tube was designed that different inside diameter, compress in radial were required. Compression is the application of pushing forces to different points on a material or structure. Swaging Machine was produced to use in this situation. Press mechanism was used in machine. We can separate type of Swaging Machine by power transfer mechanism [2] as shown in figure 1.

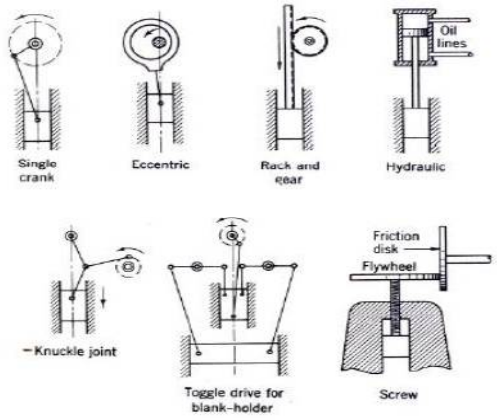


Figure 1: Mechanism of power transfer

Swaging Machine in this case use hydraulic mechanism. The tube alloy and production process are important factors regarding the part design and the forming method. This process is cold forming process, material that use in this process must be accommodate the necessary amount of deformation [3]. Machine part that contact with specimen piece call segmented tool sizing. The process uses a set of segmented part as shown in figure 2.

Figure 2: Swaging Machine segmented part

Swaging process usually utilizes three, four or eight dies arranged uniformly in the circumference of the workpiece [4-5]. The swaging dies was fixed and the cylinder was rotate. Fig.3 shows the stress state of the tube workpiece after extracting the 1st, 2nd and 3rd principal stress data. Figure 3 shows the stress state of the tube workpiece after extracting. The 1st, 2nd and 3rd principal stress representative the axial, radial and circumference stress, respectively [6]. Swaging process has advantages such as small loading and high accuracy of the material. To design the rotary swaging process it is necessary to understand the relations between the parameters of the technological process, the microstructure and properties [7].