CHAPTER 4

DESIGN OF SWAGING PROCESS SETUP FOR
TEXTILE SPINDLES

4.1 INTRODUCTION

The swaging process is usually a cold working process which can be
used to reduce the diameter, produce a taper and point with increase in length
of the material being swaged. Materials of spindle blade and aluminum plug
of textile spindles can be swaged thereby achieving a material saving and
eliminating a reasonable machining time. This will give rise to material
productivity and machine productivity. Presented here is a design of swaging
process setup for the manufacture of textile spindles and a computer program
developed for analysing the process economy.

4.2 TECHNICAL SPECIFICATION OF SWAGING SETUP

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>1500 mm</td>
</tr>
<tr>
<td>Width</td>
<td>1200 mm</td>
</tr>
<tr>
<td>Swaging roller speed</td>
<td>2000 rpm</td>
</tr>
<tr>
<td>Area of reduction</td>
<td>15 to 20 %</td>
</tr>
<tr>
<td>Motor drive</td>
<td>10 kW 3 Ph 440 V 50 Hz 1440 rpm</td>
</tr>
<tr>
<td>Gear box</td>
<td>4-speed</td>
</tr>
</tbody>
</table>
Figure 4.1 Schematic diagram of the swaging process setup

Figure 4.2 Front operator controls
The motor and gear box are mounted on the bottom of the fabricated frame to give a low centre of gravity. Electrical controls for start / stop and overload relay and pneumatic controls are fitted on the front panel of the machine.

Rollers, four in number, have a diameter of 75 mm and width of 200 mm and are manufactured of tool steel, which is hardened and ground to the right taper and dimensions.

They are mounted inside the eccentric housing in strong taper roller bearings and internally synchronised by means of gear wheels. It is driven by a chain from the gear box which in turn through a ‘V’ belt and drive motor.

On the left side is a pneumatic chuck for holding the material to be swaged. ReVolution is controlled with the help of a coupling and gear box.

4.2.1 Drive

Driven by an AC Induction motor through ‘V’ belt transmission.

4.2.2 Maintenance

For easy lubrication, one shot-lubrication is provided to all the lubrication points that are connected to one single point through a system of pipes.

4.2.3 Safety

Covered with a safety guard and closed before the start of the machine.
4.3 THE SWAGING PROCESS

The swaging process setup works by using four rollers, which separate and close upto 2000 times a minute. This is achieved by mounting the rollers in an eccentric housing mounted to machine spindle on taper roller bearings which is driven by a motor through a gear box. As the housing rotates, the rollers hit against the spindle blade or aluminium plug to be swaged which is held by the pneumatic chuck. The process is similar to cold forging.

The chuck is rotated by a separate motor through a ‘V’ belt in opposite direction to eliminate the formation of surface cracks and wrinkles on the material being swaged.

Initially, work piece is clamped in the chuck and fed into the rollers and then rollers are rotated to form the required diameter, length and taper.

![Figure 4.3 Swage block](image)

**Figure 4.3 Swage block**
4.4 COMPUTER PROGRAM FOR PROCESS ECONOMY

A computer program (Matlab) has been developed to analyze the various machining processes of spindle blade and aluminum plug during their manufacture with the usage of different machines for a better process economy.
4.4.1 Computer Program

#include<stdio.h>
#include <conio.h>

Void main ()
{
    int a,b;
    Clrscr();

    printf("ENTER THE RATE OF LABOR PER DAY, a AND MATERIAL RATE PER Kg,b:\n");

    scanf("%d %d",anda,anda);

    intx[100],y[100],p[100];
    int n;

    printf("enter the process No.:\n");

    scanf("%d",andn);

    for(int i=1;i≤n;i++)
    {
        printf("ENTER THE AMOUNT OF LABOR REQUIRED FOR THE MANUFACTURING PROCESS, x%d",i);

        scanf("%d",andx[i]);

        printf("ENTER THE NO. OF OF MATERIAL REQUIRED FOR THE MANUFACTURING PROCESS, y%d",i);
    }
 scanf("%d",&y[i]);
 }
 for(int i=1;i<n;i++)
 {
 P[i]=(a*x[i])+(b*y[i]);
 printf("p %d=%d",i,P[i]);
 }

 int t;
 for(int j=1;j<=n;j++)
 {
 for(int k=1;k<=j;k++)
 {
 if(P[k]>P[k+1])
 {
 t=P[k];
P[k]=P[k+1];
P[k+1]=t;
 }
 }
 }

 j=1;
Material weight and machining time of spindle blade and aluminum plug during the machining process using copying lathe, single spindle automate and swaging process, setup are analyzed and compared as shown in Table 4.5.

**Table 4.5 Comparison of swaging process with machining on copying lathe and single spindle automate**

<table>
<thead>
<tr>
<th>Process</th>
<th>Spindle blade / En 31</th>
<th>aluminum plug / LM4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mat. wt.</td>
<td>Mc.time</td>
</tr>
<tr>
<td></td>
<td>kg.</td>
<td>min.</td>
</tr>
<tr>
<td>Raw material</td>
<td>0.157</td>
<td>-</td>
</tr>
<tr>
<td>Copying lathe</td>
<td>0.157</td>
<td>20.0</td>
</tr>
<tr>
<td>Single spindle automate</td>
<td>0.145</td>
<td>18.0</td>
</tr>
<tr>
<td>Swaging</td>
<td>0.105</td>
<td>17.0</td>
</tr>
</tbody>
</table>

**4.5 CONCLUSION**

Through the swaging process, a saving of not only in material, but also in machining time is achieved. This also leads to an increase in tensile strength of the textile spindles. This trial machine setup can be further studied and improved.