ANNALS of the ORADEA UNIVERSITY.

Fascicle of Management and Technological Engineering, Volume VI (XVI), 2007

DRILLING DEEPENING AND BORING BLOCKING SYSTEM FUNCTIONAL REMODELING USING CAD TECHNIQUES

Dragoş Alexandru CAZACU[1], Florina ANGHEL[1] Tiberiu DOBRESCU[1]

[1] University Politehnica of Bucharest, UPB-PREMINV Research Centre,

alex@mix.mmi.pub.ro; florina@mix.mmi.pub.ro; tibidobrescu@yahoo.com

Keywords: calculus, blocking system, auxiliary times, optimization

Abstract In order to obtain any kind of parts for any assembly we have to use blocking systems to fix the blanks while cutting its shape. The universal blocking systems are very cheap and very easy to use. For large-scale series production it is more convenient to design special blocking devices personalized for each operation. The blocking system that we designed is specially conceived for the drilling, deepening and boring operations.

1 INTRODUCTION

The analyzed part is a flange for a hydraulic pomp. The part has two diameters for bore for the two shafts, four threaded holes that will be used for fixing the body pomp on the flange and two catching eyes.

The purpose is to design a blocking system that will fix the part for the following operations: drilling, deepening and boring, in order to obtain the two holes.

After the system is designed we will do a calculus to find out the necessary clamping force and we'll try to determine the standard time for processing a number of parts.

Depending on the time resulted will do an optimization and automation for lowering the auxiliary times.

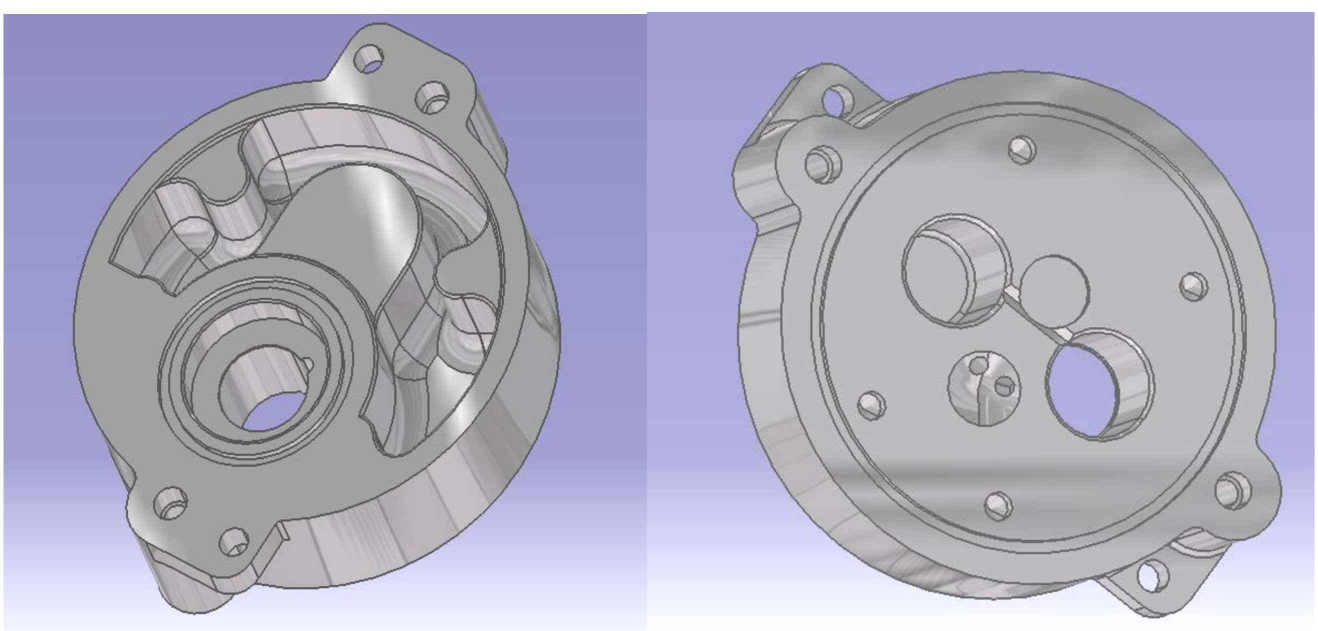

Figure 1. The part to be obtained

2 DESCRIPTION OF THE BLOCKING SYSTEM

The blank is placed on the three taps located on the support plate between the two clamping devices (the prismatic fix support and the mobile one). When the lever is used the eccentric shaft will block the blank.

For extracting the black one needs to pull the lever in the opposite direction and rotate the upper support plate.

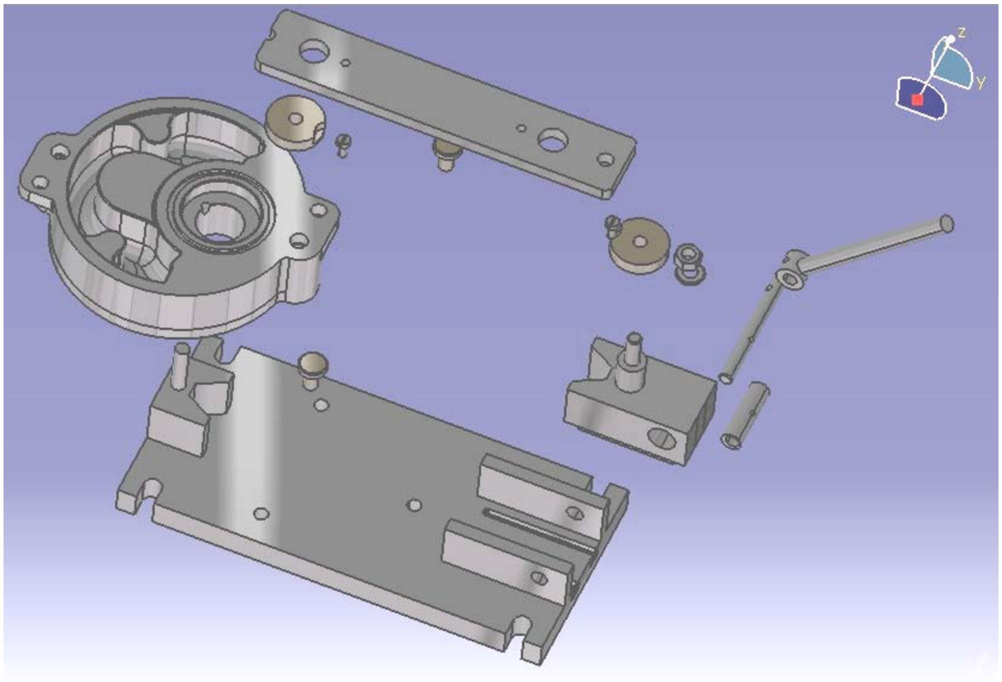

Figure 2. The blocking device – components

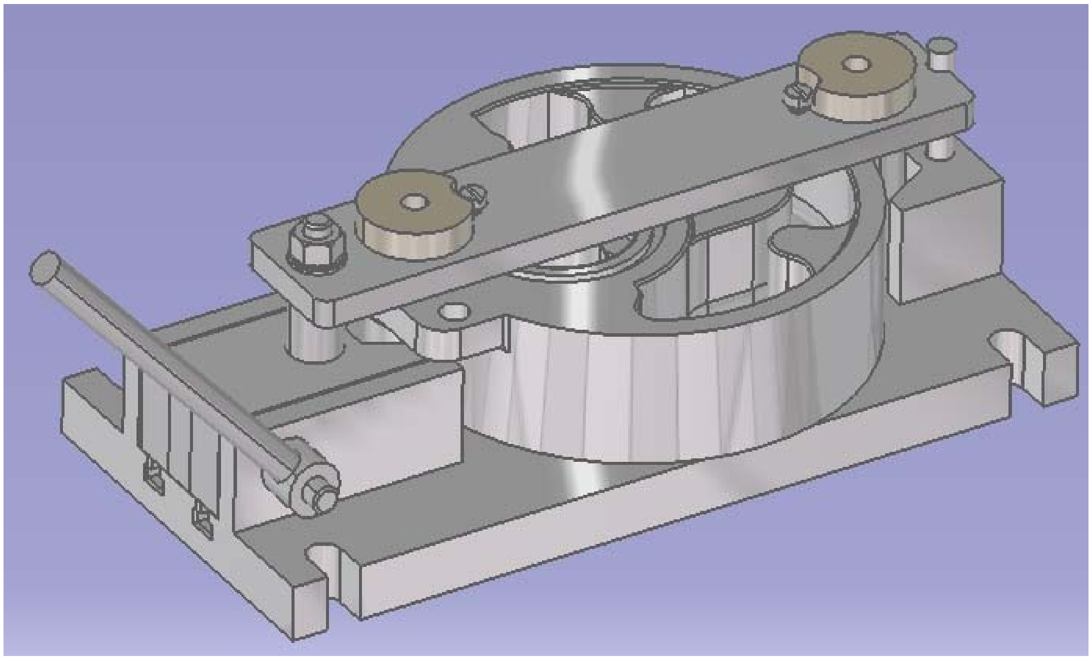

Figure 3. The blocking device

When using these systems the operator needs to be careful not to suffer any injuries and it is also advisable to change the worn-off systems. The clamping screws need to be positioned so that these can easily be reached.

3 THE CALCULUS OF CLAMPING FORCE AND STANDARD TIME

The clamping force (F_S) is composed from two perpendicularly forces, normal to the prismatic support's faces.

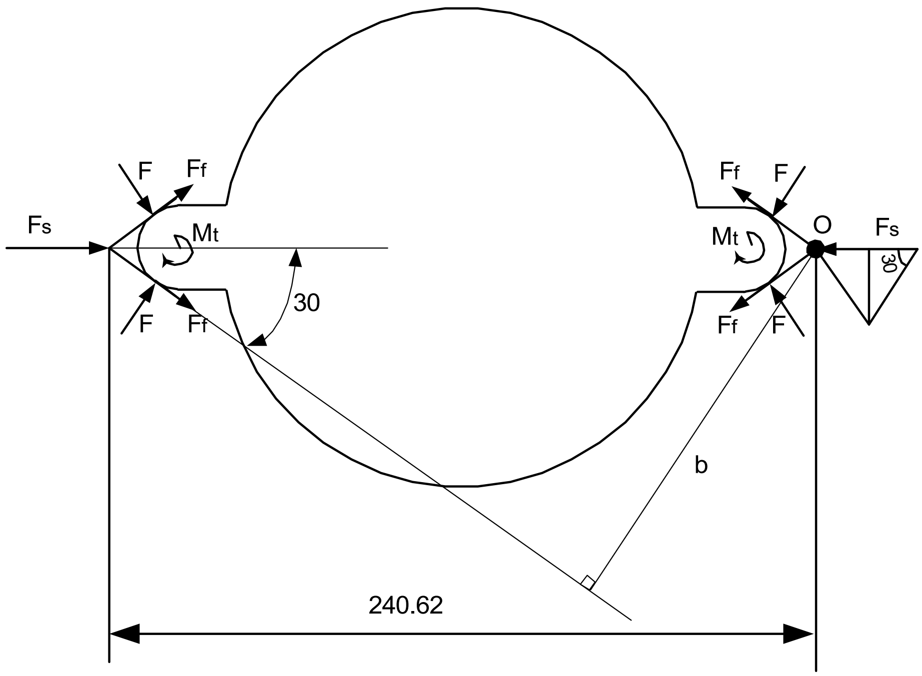

Figure 4. Forces diagram

$$0 : \sum M_i = 0$$

$$M_t + M_t - 2 \cdot F_f \cdot b = 0$$

$$b = \sin 30 \cdot 240.62 = 120.31$$

$$2 \cdot M_t = 2 \cdot F_f \cdot 120.31$$

$$F_f = \frac{608}{120.31} \quad F_f = 5.05\, daN$$

$$F_t = \mu \cdot F \quad F = \frac{5.05}{0.58} \qquad F = 8.7\, daN$$

$$F_s = 2 \cdot \cos 30^\circ \cdot F \qquad F_s = 15\, daN$$

1. Drilling:

Basic time on drilling:

- l = 48 mm (blank's thickness)
- l_1 = $\frac{D}{2} \cdot ctg\alpha + 1$ = 3.74 mm
- l_2 = 1.5 mm

- i = 1 pass

$$T_b^1 = \frac{48 + 3.74 + 1.5}{0.30 \cdot 700} \cdot 1 = 0.26 \min$$

The following auxiliary times are taken from special tables in order to calculate the standard time:

- Auxiliary time for fixing and removing the part:

t_{a1} = 0.23 mins

- Auxiliary time for operating the machine:

t_{a2}= 0.03 + 0.02 + 0.03 + 0.02 + 0.03 + 2 · 0.07 + 2 · 0.07 = 0.41 min

- Total auxiliary time:

T_a^1 = t_{a1}+ t_{a2} = 0.23 + 0.41 = 0.64 min

- Time for technical assistance:

T_{dt} = 2% · T_b = 0.008 min

- Time for organize assistance:

T_{do}=1% · (T_b + T_a) = 0.009 min

- Total assistance time:

T_d^1 = T_{dt} + T_{do}= 0.008 + 0.009 = 0.017 min

- Rest time:

T_{on}^1 = 3% · (T_b+ T_a) = 0.027 min

2. Deepening:

Basic time on deepening:

- l = 10 mm (depth of the hole)
- l_1 = 1.5 mm
- l_2 = 0 mm
- i = 1 pass

$$T_b^2 = \frac{10 + 1.5}{0.43 \cdot 700} \cdot 1 = 0.038 \min$$

- Auxiliary time for operating the machine:

t_{a2} = 0.03 + 0.02 + 0.03 + 2 · 0.07 + 2 · 0.07 = 0.36 min

- Total auxiliary time:

T_a^2 = t_{a2} =0.36 min

- Time for technical assistance:

T_{dt}=2% · T_b = 0.001 min

- Time for organize assistance:

T_{do}=1% · (T_b+ T_a) = 0.004 min

- Total assistance time:

T_d^2 = T_{dt} + T_{do}= 0.001 + 0.004 = 0.005 min

- Rest time:

T_{on}^2 = 3% · (T_b+ T_a) = 0.012 min

3. Boring:

Basic time on boring:

- l = 10 mm (depth of the hole)
- l_1 = 1.5 mm

- l_2 = 0 mm
- i = 1 pass

$$T_b^3 = \frac{10+1.5}{0.30 \cdot 250} \cdot 1 = 0.153\,\text{min}$$

- Auxiliary time for operating the machine:

$$t_{a2} = 0.03 + 0.02 + 2 \cdot 0.03 + 2 \cdot 0.07 = 0.25\ \text{min}$$

- Total auxiliary time:

$$T_a^3 = t_{a2} = 0.25\ \text{min}$$

- Time for technical assistance:

$$T_{dt} = 2\% \cdot T_b = 0.003\ \text{min}$$

- Time for organize assistance:

$$T_{do} = 1\% \cdot (T_b + T_a) = 0.002\ \text{min}$$

- Total assistance time:

$$T_d^3 = T_{dt} + T_{do} = 0.003 + 0.002 = 0.005\ \text{min}$$

- Rest time:

$$T_{on}^3 = 3\% \cdot (T_b + T_a) = 0.006\ \text{min}$$

- Finishing time:

$$T_{pi} = 9 + 0.7 \cdot 4 = 11.8\ \text{min}$$

So, the standard time for one operation is:

$$N_t = T_b + T_a + T_d + T_{on} + T_{pi}/n$$

$$N_t = (T_b^1 + T_b^2 + T_b^3) + (T_a^1 + T_a^2 + T_a^3) + (T_d^1 + T_d^2 + T_d^3) + (T_{on}^1 + T_{on}^2 + T_{on}^3) + \frac{T_{pi}}{n}$$

$$N_t = (0.26 + 0.038 + 0.153) + (0.64 + 0.36 + 0.25) + (0.017 + 0.005 + 0.005) +$$

$$+ (0.027 + 0.012 + 0.006) + \frac{11.8}{60000}$$

$$N_t = 1.773\ \text{min}$$

The calculus was made considering a production of 60000 pieces (n= 60000 pieces).

4 OPTIMIZATION AND AUTOMATION

Do to the problems that occur during manufacturing process and to the fast worn off that appears on the eccentric shaft clamping, this type of blocking system is not safe. Because of the vibrations that appear in the system the lever might get to resonance and the eccentric shaft may release the blank during the process. It is impossible for the operator to use the same clamping force every time; in time this might cause damage to the blocking system or even to the blank.

Changing the eccentric system with a pneumatic linear motor easily solved this problem. This will also reduce the auxiliary time for fixing and removing the part.

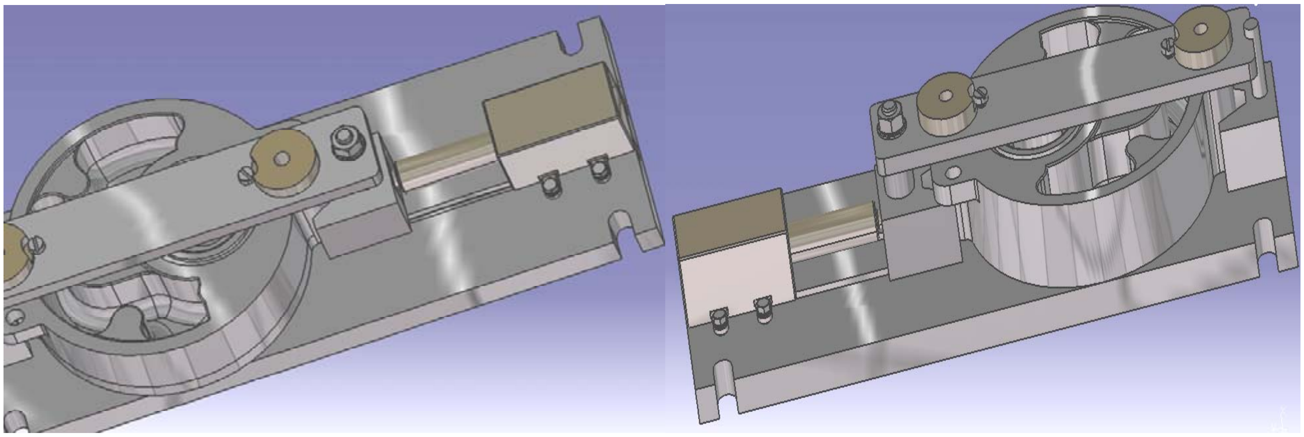

Figure 5. Automation blocking system

5 CONCLUSIONS

This blocking system can be used in automatic production. It reduces considerably the auxiliary time for fixing and removing the part and the implication of the human resources in the working process.

The pneumatic linear motor is exercises the same force in the system, assuring a constant tightening. In this way the worn out of the blocking device is delayed.

This kind of device can be used for any blanks that have caching eyes for generating any type of shapes, with almost any cutting process except turning.

REFERENCES

[1] Catrina D., Totu A., Croitoru S., Căruțaşu G., Căruțaşu N., Dorin A. – Sisteme flexibile de prelucrare prin aşchiere, vol.1. Ed. MATRIX – ROM, Bucureşti, 2005
[2] Catrina D., Totu A., Croitoru S., Căruțaşu G., Căruțaşu N., Dorin A. – Sisteme flexibile de prelucrare prin aşchiere, vol.2. Ed. MATRIX – ROM, Bucureşti, 2006
[3] Catrina D., Velicu Şt., Zapciu M. – Sisteme flexibile de producție. Ed. Printech, Bucureşti, 2005
[4] Croitoru S. – curs „Analiză economică", anul universitar 2005 – 2006
[5] Oprean A. – Bazele aşchierii şi generării suprafețelor pe maşini – unelte. Ed. Didactică şi Pedagogică, Bucureşti, 1981
[6] Popescu I., Minciu C., Tănase I., Brandasu D., Tonoiu S., Marinescu A. – Scule aşchietoare. Dispozitive de prindere a sculelor aşchietoare. Ed. MATRIX – ROM, Bucureşti, 2004
[7] Vlase A., Sturzu A., Atanase M. – Metodologie şi tabele normative pentru stabilirea adaosurilor de prelucrare, a regimurilor de aşchiere şi a normelor tehnice de timpi la frezare. Ed. Tehnică, Bucureşti, 1979
[8] *** – Scule aşchietoare şi prelucrarea metalelor, vol. 1şi 2. Colecție STAS. Ed. Tehnică, Bucureşti, 1987
[9] *** – Standarde, Norme uzuale, Prospecte, Materiale, Scule, Dispozitive, Mijloace de control. Ed. Tehnică, Bucureşti, 1987 – 2004
[10] *** – Tehnologii, calitate, maşini, materiale, reviste, articole. Ed. Tehnică, Bucureşti, 1987 – 2004