"INCREASE IN PRODUCTIVITY OF TURRET PUNCHING PROCESS(TPP)"

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ABSTRACT

Productivity is defined as the amount of output that is generated over a certain time period divided by the sum of the inputs needed to produce this output in the same time frame.

Productivity is a very important measure in manufacturing operations, besides turnover and profit, because it provides insight into the efficiency and effectiveness of your operations. Improving your productivity will have a positive impact on the direct costs of your products, as the same output is produced with less input or as the same inputs are producing more output. This can create new opportunities and improve the competitiveness of your manufacturing operations.

This project is done at powerica ltd, Bangalore. On the increase of productivity of TPP.

Punching process is the first process in acoustic manufacturing process. Punching process cycle time is 5400 strokes per hour is very high compare to other processes cycle time. In punching process which is machine dependent because of this the machine idle time will affect the overall productivity of the punching process. There is a slight increase in the productivity of the TPP after attending the break down problem.

KEYWORDS: Productivity, Turret Punching Process(TPP), Computer Numerical Control (CNC), Manufacturing Operations

INTRODUCTION

The method of controlling machines by the application of digital electronic computers and circuitry. Machine movements that are controlled by cams, gears, levers or screws in conventional machines are directed by computers and digital circuitry in computer numerical control (CNC) machines. Productivity is a process of continuous improvement in the production/supply of quality output/service through efficient, effective use of inputs, with emphasis on teamwork for the betterment of all.”

DEFINITION OF THE PROBLEM

It is essential to improve the productivity because of the limited sources. The main aim of the project is to improve the productivity by avoiding the breaking problems on turret punching press process.

LITERATURE REVIEW

Many of the commands for the experimental parts were programmed "by hand" to produce the punch tapes that were used as input. While the system was being experimented with, John Runyon made a number of subroutines on the famous Whirlwind to produce these tapes under computer control. Users could input a list of points and speeds, and the program would generate the punch tape. In one instance, this process reduced the time required to produce the instruction list and mill the part from 8 hours to 15 minutes. This led to a proposal to the Air Force to produce a generalized "programming" language for numerical control, which was accepted in June 1956.
Starting in September Ross and People outlined a language for machine control that was based on points and lines, developing this over several years into the APT programming language. In 1957 the Aircraft Industries Association (AIA) and Air Material Command at the Wright-Patterson Air Force Base joined with MIT to standardize this work and produce a fully computer-controlled NC system. On 25 February 1959 the combined team held a press conference showing the results, including a 3D machined aluminum ash tray that was handed out in the press kit.

Meanwhile, Patrick Hanratty was making similar developments at GE as part of their partnership with G&L on the Numericord. His language, PRONTO, beat APT into commercial use when it was “released” in 1958. Hanratty then went on to develop MICR magnetic ink characters that were used in cheque processing, before moving to General Motors to work on the groundbreaking DAC-1 CAD system.

APT was soon extended to include “real” curves in 2D-APT-II. With its release, MIT reduced its focus on CNC as it moved into CAD experiments. APT development was picked up with the AIA in San Diego, and in 1962, to Illinois Institute of Technology Research. Work on making APT an international standard started in 1963 under USASI X3.4.7, but many manufacturers of CNC machines had their own one-off additions (like PRONTO), so standardization was not completed until 1968, when there were 25 optional add-ins to the basic system.

Just as APT was being released in the early 1960s, a second generation of lower-cost transistorized computers was hitting the market that were able to process much larger volumes of information in production settings. This so lowered the cost of implementing a NC system that by the mid 1960s, APT runs accounted for a third of all computer time at large aviation firms.

**CAD MEETS CNC**

While the Servomechanisms Lab was in the process of developing their first mill, in 1953 MIT's Mechanical Engineering Department dropped the requirement that undergraduates take courses in drawing. The instructors formerly teaching these programs were merged into the Design Division, where an informal discussion of computerized design started. Meanwhile the Electronic Systems Laboratory, the newly rechristened Servomechanisms Laboratory, had been discussing whether or not design would ever start with paper diagrams in the future.

In January 1959, an informal meeting was held involving individuals from both the Electronic Systems Laboratory and the Mechanical Engineering Department's Design Division. Formal meetings followed in April and May, which resulted in the "Computer-Aided Design Project". In December 1959, the Air Force issued a one year contract to ESL for $223,000 to fund the Project, including $20,800 earmarked for 104 hours of computer time at $200 per hour. This proved to be far too little for the ambitious program they had in mind, although their engineering calculation system, AED, was released in March 1965.

In 1959 General Motors started an experimental project to digitize, store and print the many design sketches being generated in the various GM design departments. When the basic concept demonstrated that it could work, they started the DAC-1 project with IBM to develop a production version. One part of the DAC project was the direct conversion of paper diagrams into 3D models, which were then converted into APT commands and cut on milling machines. In November 1963 a trunk lid design moved from 2D paper sketch to 3D clay prototype for the first time. With the exception of the initial sketch, the design-to-production loop had been closed.

Meanwhile MIT's offsite Lincoln Labs was building computers to test new transistorized designs. The ultimate goal was essentially a transistorized Whirlwind known as TX-2, but in order to test various circuit designs a smaller
version known as TX-0 was built first. When construction of TX-2 started, time in TX-0 freed up and this led to a number of experiments involving interactive input and use of the machine's CRT display for graphics. Further development of these concepts led to Ivan Sutherland's groundbreaking Sketchpad program on the TX-2.

Sutherland moved to the University of Utah after his Sketchpad work, but it inspired other MIT graduates to attempt the first true CAD system, Electronic Drafting Machine (EDM). It was EDM, sold to Control Data and known as "Digigraphics", that Lockheed used to build production parts for the C-5 Galaxy, the first example of an end-to-end CAD/CNC production system.

By 1970 there were a wide variety of CAD firms including Intergraph, Applicon, Computervision, Auto-trol Technology, UGS Corp. and others, as well as large vendors like CDC and IBM.

PROLIFERATION OF CNC

The price of computer cycles fell drastically during the 1960s with the widespread introduction of useful minicomputers. Eventually it became less expensive to handle the motor control and feedback with a computer program than it was with dedicated servo systems. Small computers were dedicated to a single mill, placing the entire process in a small box. PDP-8's and Data General Nova computers were common in these roles. The introduction of the microprocessor in the 1970s further reduced the cost of implementation, and today almost all CNC machines use some form of microprocessor to handle all operations.

The introduction of lower-cost CNC machines radically changed the manufacturing industry. Curves are as easy to cut as straight lines, complex 3-D structures are relatively easy to produce, and the number of machining steps that required human action has been dramatically reduced. With the increased automation of manufacturing processes with CNC machining, considerable improvements in consistency and quality have been achieved with no strain on the operator. CNC automation reduced the frequency of errors and provided CNC operators with time to perform additional tasks. CNC automation also allows for more flexibility in the way parts are held in the manufacturing process and the time required changing the machine to produce different components.

During the early 1970s the Western economies were mired in slow economic growth and rising employment costs, and NC machines started to become more attractive. The major U.S. vendors were slow to respond to the demand for machines suitable for lower-cost NC systems, and into this void stepped the Germans. In 1979, sales of German machines surpassed the U.S. designs for the first time. This cycle quickly repeated itself, and by 1980 Japan had taken a leadership position, U.S. sales dropping all the time. Once sitting in the #1 position in terms of sales on a top-ten chart consisting entirely of U.S. companies in 1971, by 1987 Cincinnati Milacron was in 8th place on a chart heavily dominated by Japanese firms.

Many researchers have commented that the U.S. focus on high-end applications left them in an uncompetitive situation when the economic downturn in the early 1970s led to greatly increased demand for low-cost NC systems. Unlike the U.S. companies, who had focused on the highly profitable aerospace market, German and Japanese manufacturers targeted lower-profit segments from the start and were able to enter the low-cost markets much more easily.

DATA COLLECTION

The data is about the process time, average output and quality level of the turret punching press mechanism and also the process time, average output, quality level, cost of machine and running cost of the proposed turret punching press mechanism. To make the generators by the using of Cummins diesel engine
Table 1: Ambient Vs KVA

<table>
<thead>
<tr>
<th>Ambient °C</th>
<th>30</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating KVA%</td>
<td>105</td>
<td>100</td>
<td>96</td>
<td>92</td>
<td>88</td>
<td>84</td>
</tr>
</tbody>
</table>

Table 2: KW Vs PF

<table>
<thead>
<tr>
<th>Power Factor</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
<th>0.9 to 1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating Factor (KW)</td>
<td>0.68</td>
<td>0.82</td>
<td>1.0</td>
<td>1.10</td>
</tr>
</tbody>
</table>

A punch is often made of hardened steel or carbides. The punch press forces the punch into a work piece piercing a hole that has a diameter equivalent to the punch. A die is located on the opposite side of the work piece and supports the edge of the hole created to keep it from deforming during the punch. There is a small amount of clearance between the punch's diameter and the die's. This clearance depends on the work piece material and various tolerances. The slug from the hole falls through the die into some sort of container to either dispose of the slug or recycle it.

- Punching is the most cost effective process of making holes in strip or sheet metal for average to high fabrication
- It is able to create multiple shaped holes
- Punches and dies are usually fabricated from conventional tool steel or carbides
- Creates a burnished region roll-over, and die break on sidewall of the resulting hole

The work piece is often in the form of a sheet or roll. Materials for the work piece can vary, commonly being metals and plastics. The punch and die themselves can have a variety of shapes to create an array of different shaped holes in the work piece. Multiple punches may be used together to create a part in one step.

Most punch presses are mechanically operated, but simple punches are often hand-powered. Major components of this mechanical press are the frame, motor, ram, die posts, bolster, and bed. The punch is mounted into the ram, and the die is mounted to the bolster plate. The scrap material drops through as the work piece is advanced for the next hole. A large computer controlled punch press is called a computer numerical controlled turret. It houses punches and their corresponding dies in a revolving indexed turret. These machines use hydraulic, pneumatic, or electrical power to press the shape with enough force to shear the metal.

FORCES

The punch force required to punch a piece of sheet metal can be estimated from the following equation:

\[ F = 0.7tL \text{(UTS)} \]

Where \( t \) is the sheet metal thickness, \( L \) is the total length sheared (perimeter of the shape), and \( UTS \) is the ultimate tensile strength of the material. Die and punch shapes affect the force during the punching process. The punch force increases during the process as the entire thickness of the material is sheared at once. A beveled punch helps in the shearing of thicker materials by reducing the force at the beginning of the stroke.

However, beveling a punch will distort the shape because of lateral forces that develop. Compound dies allow multiple shaping to occur. Using compound dies will generally slow down the process and are typically more expensive.
than other dies. Progressive dies may be used in high production operations. Different punching operations and dies may be used at different stages of the operation on the same machine.

METHODOLOGY

This chapter includes the calculation of idle time of existing in turret punching press mechanism and to avoid the breaking problems and there by calculating total cycle time and idle time and the turret punching press [TPP] machine available time.

Productivity=((total cycle time-idle time)/total availability time

TOTAL AVIALABLE TIME ON TURRET PUNHING PRESS [TPP]

Total available Time on TPP = 8hours per one shift

= 8×60

= 480minutes per one shift

Breaking Time on TPP = 50 minutes per one shift

Total Available Time 0n TPP = (total available time on TP Breaking time on T P- PP) = (480 – 50)

= 430 minutes per one shift

Total Available Time 0n TPP = 430minutes per one shift

TOTALCYCLETIMEON PUNCHING PRESS [TPP]

It is defined as the time taken for one complete nest or job to be finished is called total cycle time. In this there are several factors are affecting. They are;

Total punched sheets=70per one shift

a. Time taken for input of CNC programmer: The time taken is 2.7min for one shift.

b. Time taken to load sheet from pallet to machine bed: The time taken is 42min for one shift.

c. Time taken for setting the clamp position: The time taken is 0.667min for one shift.

d. Time taken for punching process: The time taken is 210min for one shift.

e. Time taken for removal of punched sheets: The time taken is 54.83min for one shift.

f. Time taken for unloading of blanks in the specified location: The time taken is 29.17min for one shift.

Therefore, the total cycle

time =a+b+c+d+e+f

=2.7+42+0.667+210+54.83+29.17

=339.3minutes

IDLE TIME ON TURRET PUNCHING PRESS BEFORE AVOIDING THE BREAK DOWN PROBLEMS

a. Tool break down due to unsharpening: The time taken to change the tools is 15minutes per one shift
b. Due to wrong fixing of the tool into turret: The time taken to fix the correctly of any wrong is 15 minutes per one shift.

c. Lubrication oil to remove into TPP: The time taken to remove lubrication oil into TPP 10 minutes per one shift.

d. Tool turret cleaning: The time taken to tool turret cleaning 10 minutes per one shift.

e. Remove scrap with heap under turret: The time taken to remove scrap with heap under turret 10 minutes per one shift.

f. Oil temperature: The time taken to oil temperature 20 minutes per one shift.

Total idle time on TPP before avoiding breakdown problem

\[a+b+c+d+e+f\]

\[= 15 + 15 + 10 + 10 + 20 + 10\]

\[= 80 \text{ minutes}.\]

TOTAL PRODUCTIVITY ON TPP BEFORE AVOIDING BREAK DOWN PROBLEMS

Total Available Time on TPP = 430 minutes per one shift.

Total Cycle Time on TPP = 339.3 minutes

Total Idle Time on TPP Before avoiding Breakdown Problem = 80 min

Productivity = (total cycle time - idle time)/total availability time

Productivity = \((339 - 80)/430\)

\[= 0.60 \times 100\]

\[= 60\% \text{ (Existing)}\]

Total Productivity on TPP Before Avoiding Break Down Problems = 60%

TOTAL IDLE TIME ON TURRET PUNCHING PRESS AFTER AVOIDING THE BREAK DOWN PROBLEM

a. Oil temperature: The time taken oil temperature is 20 minutes per shift.

The oil temperature is major break down problem on TPP because of ram the oil temperature goes on increases which leads to stop the machine for 20 mints/shift. We found that the oil leakage in the ram causes the problem due to finishing of its life time and the solution is replacement of ram, spare parts. Remove of scrap and slug: The time taken to remove of scrap and slag 10 minutes per one shift.

b. Tool break down due to un sharpening: The time taken to tool break down due to un sharpening 15 minutes per one shift.

c. Due to wrong fixing of the tool into turret: The time taken to due to wrong fixing of the tool into turret 15 minutes per one shift.

d. Lubrication oil to remove into TPP; The time taken to Lubrication oil to remove into TPP 10 minutes per one shift.
e. Tool turret cleaning: The time taken to tool turret cleaning 10 minutes per one shift.

Total Idle Time On Turret Punching Press Before Avoiding The Breakdown Problem

\[ =a+b+c+d+e+f \]
\[ =5+5+10+10+15+15 \]
\[ =60 \text{ minutes} \]

**TOTAL PRODUCTIVITY ON TPP AFTER AVOIDING BREAK DOWN PROBLEMS**

Total Available Time On TPP = 430 minutes per one shift

Total Cycle Time On TPP = 339.3 minutes

Total Idle Time on Tpp Before After Breakdown Problem = 60 min

Productivity = \( \frac{\text{total cycle time}-\text{idle time}}{\text{total availability time}} \)

Productivity = \( \frac{339 - 60}{430} \)

\[ = 0.65 \times 100 \]
\[ = 65\% \text{ (Improved)} \]

Total Productivity On Tpp After Avoinding Breakdown Problems = 65% (Improved)

The following results are obtained by the calculation of idle time and productivity.

♦ Total idle time on TPP before avoiding the

  Breaking problems = 60 minutes per one shift

♦ Total productivity on TPP after avoiding the

  Breaking problems = 65%

<table>
<thead>
<tr>
<th>Description</th>
<th>Before avoiding Breaking Problems</th>
<th>After avoiding Breaking Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.Idle Time</td>
<td>80 minutes</td>
<td>60 minutes</td>
</tr>
<tr>
<td>2.Productivity</td>
<td>60% (Existing)</td>
<td>65% (Improved)</td>
</tr>
</tbody>
</table>

**CONCLUSIONS**

- Based on our results we conclude that idle time is considerably high. Therefore by eliminating Breakdown problems we can improve the productivity.

- Because of decreasing the idle time, total idle time required to prepare a product becomes minimum and so cost per product decreases and this influence the sales.

- To decrease idle time we have observed breakdown problems in TPP where the main problem is increase in temperature of oil.
Because breakdown problem results this leads to leakage of oil from TPP. It’s concluded that oil temperature is more of the TPP operations. So it is better to replace the ram in TPP to increase productivity and thereby profit.

Based on our observation, management can take a decision to replace with a new one ram in TPP. This leads to improved productivity.

REFERENCES


