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AN EXPERIMENTAL APPROACH OF MANUFACTURING HARDENED BARREL SCREW ON TRADITIONAL LATHE MACHINE WITH DIFFERENT PARAMETERS

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***ABSTRACT**: Now a day manufacture has to think for most economical, less time consuming, accurate and perfect sequence of production process for manufacturing the product. He has to adopt the various parameters focusing on the above stated facts. The researcher has find out to control the different parameters for optimum process based on economical point of view by which the manufacturer can save round above 30 % cost of product.*

The Traditional lathe machine may be used as machine tool instead of special purpose CNC milling machine and three parametric changes has been made. (1) Using milling attachment. (2) Using special profiled milling cutter (3) using indexing attachment with main spindle and Threading Mechanism. For the above aspect the numbers of experiments are executed to decide the optimal process and then by doing the same process on SPTMM and lathe. It is concluded the level of efficiency, accuracy, economical and optimal process control. On the other end the initial cost of CNC SPM machine is round about 1.25 crores but the lathe machine cost is round about 5 to 7 lacs, so initial investment cost also affects the matters.

KEYWORDS: Barrel Screw, Traditional Lathe Machine, Different Parameter.

1. INTRODUCTION

BARREL SCREW :

A Screw to be shaped like an Archimedean spiral square threaded profiled on shaft. It works in a closed round chambered Jacket known as Barrel, Screw rotate according to required speed in barrel and it feed plastic material from one side located Hopper where the raw material is allowed to fall in a Barrel, on other side die consist of male and female two piece receives the raw plastic material in a semi liquid form and it shape the plastic material into required form. In fact the screw work as a material conveyor to be feed in a barrel from one side to another side, outside the barrel surface the heater are installed which maintain the required heat for plastic raw material easy to flow in a barrel and get to be shaped in a Die Cavity as per required shape and size.

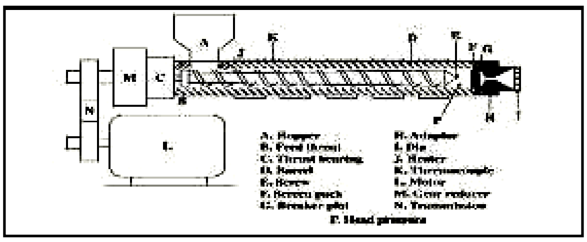

Fig : Plastic Injection Molding Machine

2. RESEARCH METHEDOLOGY

This project contents the fully factorial experimental method. The barrel screw is generally manufactured by high accuracy oriented CNC Milling Machine which is too much costly and it ultimately increase the cost of production. The other aligned processes are same if we manufacture barrel screw on traditional lathe machine by changing some of the parameters.

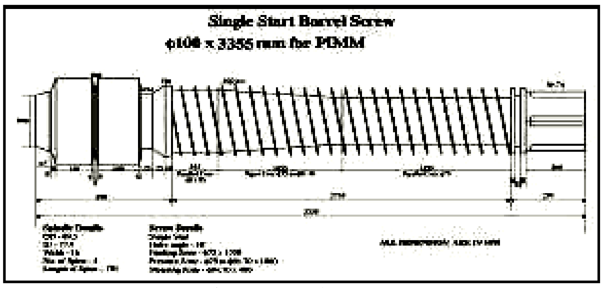

Fig.: Barrel screw

For manufacturing the sample barrel screw we have set the manufacturing process is identified and that the same sequence of process is carried out step by step by the traditional lathe machine with different parameters and then find whichever is optimal by different method like Toghuchi Approach, Full-Factorial Annova etc. We have adopted the full-factorial method.

The overall objective of the full factorial method is to identity the optimum combination of manufacturing process from all possible combination of process parameters. Full-factorial method tests the pairs of all possible combinations of process parameters and helps in identifying and determines which factors are most affecting. Experimental analysis may be carried out by using minitab 15 software.

3. EXPERIMENTAL SETUP

Lathe Machine specification :

(1) The length between centres = 12' = 3657 MM
(2) The overall length of machine = 14' = 4267 MM
(3) The centre weight of measured = 14' = 355.6 MM
(4) the swing diameter over bed = 16' = 406.4 MM
(5) The length of bed = 3662 MM

Fig.: Lath machine

4. PARAMETRIC CHANGES

Milling Attachment

Milling attachment as shown in figure is developed for threading the barrel screw. A separate AC variable drive motor is installed via V. Pulley block a central shaft with taper shank sleeve and collect chuck is fixed with box type fabricated structure both end of shaft is supported by Ball Bearing. The attachment is installed on cross slide of lathe machine with front support live rest. End mill cutter Ø 25 mm and specially profiled taper round nose cutter is installed in collect chuck.

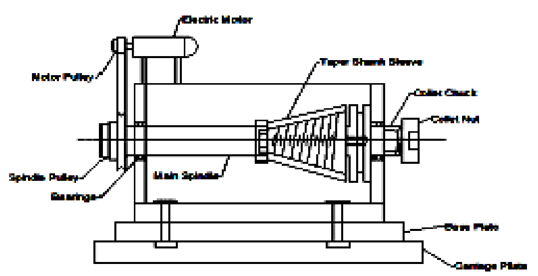

Fig. : Milling Attachment

5. OBSERVATION TABLE AND GRAPHS

Lathe Machine

Process :- 1	Turning
Material:-	EN41 Φ 110 mm Length: 3360 mm Round Bar
Machining:-	From Φ 110 mm to Φ 100.5 mm length:3360 mm
Tool:	P20 Carbide Tipped Turning tool

Observation Table 5.2.1.1

Sr. No	Total Depth of cut (mm)	Feed of tool (mm / min)	Cutting speed (mm/ min)	cutting time (min)	Job Speed (R.P.M.)
1	5	7	34.54	480	100
2	3	5	33.97	672	100
3	1.5	3	32.02	1120	100

Observation Table 5.1.1.2

Sr. No	Total Depth of cut (mm)	Feed of tool (mm / min)	Cutting speed (mm/ min)	cutting time (min)	Job Speed (R.P.M.)
1	5	15	51.81	224	150
2	3	10	49.45	336	150
3	1.5	5	48.04	672	150

Observation Table 5.1.1.3

Sr. No	Total Depth of cut (mm)	Feed of tool (mm / min)	Cutting speed (mm/ min)	cutting time (min)	Job Speed (R.P.M.)
1	5	20	69.08	168	200
2	3	15	65.94	224	200
3	1.5	10	64.05	336	200

Process :- 1	Turning
Material:-	EN41 Φ 110 mm Length : 3360 mm Round Bar
Machining:-	From Φ 110 mm to Φ 100.5 mm length:3360 mm
Tool:	P20 Carbide Tipped Turning tool

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1	**5**	**7**	**34.54**	**480**	**100**
2	**3**	**5**	**33.97**	**672**	**100**
3	**1.5**	**3**	**32.02**	**1120**	**100**

Process :- 2	Turning (Spline)
Material:-	EN41 Φ 110 mm Length : 3360 mm Round Bar
Machining:-	From Φ 100.5 mm to Φ 89.7 mm length:200 mm

Observation Table 5.2.2.1

Sr. No	Total Depth of cut (mm)	Feed of tool (mm / min)	Cutting speed (mm/ min)	cutting time (min)	Job Speed (R.P.M.)
1	**5**	**7**	**31.55**	**28.57**	**100**

2	**4**	**5**	**29.98**	**40**	**100**
3	**1.8**	**3**	**28.73**	**66.66**	**100**

Process :- 3	Spline Milling
Material:-	EN41 Φ 110 mm Length : 3360 mm Round Bar
Machining:-	Spline Milling 6 slot size: 89.7 mm to 77.9 mm
	Width 16 mm, Depth 11.5 mm Slot length 170 mm
Tool:	Hss milling cutter Dia 16 mm 4 flute Initial slot is generate by 16 MM Diameter End Mill Cutter then the taper cut is generated by radius End Mill Form Cutter

Observation Table 5.2.3.1

Sr. No	**Total Depth of cut (mm)**	**Feed of tool (mm / min)**	**Cutting speed (mm/ min)**	**cutting time (min)**
1	5	10	70.41	17
2	4	15	66.48	11.33
3	1.8	20	66.34	8.5
4	1	20	61.93	8.5

Process :- 4	Thread Milling
Material:-	EN41 Φ 110 mm Length : 3360 mm Round Bar
Machining:-	Helix machining of 100 mm pitch Length: 2735
	and machining from Φ 100.5 mm to Φ 92.5 mm assuming cutting speed of screw dia considering
Tool:	HSS Milling cutter 4 flute Φ 25 mm Cutter Spee

Observation Table 5.2.4.1

Sr. No	**Total Depth of cut (mm)**	**Feed of tool (mm / min)**	**Cutting speed (mm/ min)**	**cutting time (min)**	**Job Speed (Min per Revolution)**
1	4	6	78.89	455.83	16.66
2	3	8	74.18	341.87	12.5
3	1	10	71.82	273.5	10

Process :- 5	Thread Milling
Material:-	EN41 Φ 110 mm Length : 3360 mm Round Bar
Machining:-	Helix machining of 100 mm pitch Length: 1350 mm
	and machining from Φ 92.5 mm to Φ 75.5 mm Parallel core
Tool:	Hss Milling cutter 4 flute Φ 25 mm Cutter Speed: 250 R.P.M.

Observation Table 5.2.5.1

Sr. No	**Total Depth of cut (mm)**	**Feed of tool (mm / min)**	**Cutting speed (mm/ min)**	**cutting time (min)**	**Job Speed (Min per Revolution)**
1	5	6	72.61	225	16.66
2	5	7	68.68	192.85	14.28
3	5	8	64.76	168.75	12.5
4	2	9	60.83	150	11.11

Process :- 6	Thread Milling
Material:-	EN41 Φ 110 mm Length : 3360 mm Round Bar
Machining:-	Helix machining of 100 mm pitch Length: 1000 mm
	and machining from Φ 92.5 mm to Φ 75.5 mm Tapper core
Tool:	Hss Milling cutter 4 flute Φ 25 mm Cutter Speed: 250 R.P.M.

Observation Table 5.2.6.1

Sr. No	**Total Depth of cut (mm)**	**Feed of tool (mm / min)**	**Cutting speed (mm/ min)**	**cutting time (min)**	**Job Speed (Min per Revolution)**
1	5	6	72.61	166.66	16.66
2	5	7	68.68	142.85	14.28
3	5	8	64.76	125	12.5
4	2	9	60.83	111.11	11.11

6. COST CONSIDERATION

The major six manufacturing process is carried out on lathe machine (with different parameters) and also on CNC Milling machine and the screw made is observed and testing is also done both screw are as per standardize norms, but the cost of process is more comparing to both.

The cost of screw on lathe machine is Rs.43,500/-

While cost of screw on CNC Machine is Rs.79,900/-

The total cost of process by both machines are Rs. 1,23,400/-

The cost of saving by lathe machine is Rs. Rs. 36,400/-

So there is 30 % more cost considering total cost of both machine.

We have also verified the number of readings for each process and finalise the one set of observation table for each process and this way.

We have finalise only one table of reading for total six process and also consider the hour rate for lathe & CNC Milling.

7. CONCLSTION

- There appears by looking to the different observation table that the manufacturing process can be optimised.
- The total cutting time in a lathe machine comes more with respect to CNC Milling Machine.
- The accuracy in both of machines are same.
- The per hour cost in case of lathe comes Rs.300/hr. and for CNC Milling Rs.850/hr.
- The manufacturing cost in a lathe machine comes Rs.43,500/- while in a CNC Machine it is Rs.79,900/-.
- The cost of difference is Rs.36,400/- so to manufacture the barrel screw on lathe machine by changing different parameters is most economical.

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