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Anovel approach of portable fixture for stamping punch to improve lead time

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Abstract-

This project work deals with the design and fabrication of portable fixture to make hexagonal punch quickly and efficiently to reduce the production lead time. In this work, small portable fixture has been designed through unique construction features of lathe and milling machine. This fixture helps to fabricate square and hexagonal punch produced on surface grinder machine. The set up comprises of base plate, chuck, tail stock, head stock, indexing plate and indexing pin. In this process time taken for the forming of punch is less. so it is an effective process for producing punch.

***Key words-** punch and die, die casting, wire EDM.*

1. Introduction

Design and manufacturing of Punches and dies plays a vital role in forming industries. Stamping process is one of the most widely used process in forming industries to produce the sheet metal components quickly with intricate shapes [1]. Sheet metal parts finds its wide range of applications in automobiles, agriculture machinery, aircraft and aerospace. The yielding of final parts depends largely upon the effective fabrication of punches and dies for further processing. The researchers are now relied more on focusing to optimize the process parameters to reduce the lead time [2], advances to control sheet metal operation [3], improving the quality of final parts [4], die design optimization [5]. The existing fabrication methods available to manufactured punches and dies are wire electric discharge machining [6],5 axis CNC machine, electric discharge machine [7] etc. The available existing methods have certain advantages like accuracy, precision and can machine hardened steel irrespective of their strength and hardness but has major issue with effective machining time. This issue of more lead time to make punches and dies leads to reduce effective lead time and production rate. Thus, current literature could not able to address effective way to produces punches and dies with reduced lead time. Therefore, the idea is to design a portable fixture that assist the process of punch fabrication. The portable fixture comprises of base plate, chuck, tail stock, head stock, indexing plate and indexing pin to be installed beneath the surface grinder.

2. Construction details of fixture

The fixture is used to produce hexagonal punch which is further used for producing hexagonal L-key nut by means of punching. The fixture is attached to the magnetic base of surface grinder machine by means of magnetic attraction. The base of the fixture is well finished so that it can't move while operation. This process cheap and less time consume according to the punch size.

Main components of the hexagonal punch are,

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2.1 Base plate
2.2 Head stock
2.3 Tail stock
2.4 Indexing plate
2.5 three jaw chuck

2.1 Base Plate

Base Plate is a flat supporting plate on which the whole fixture is placed.it is rectangular in shape of having length of 390 mm, breath of 100 mm, and a depth of 25 mm. Material used to process base plate is mild steel, because it is having some good mechanical properties [8]. It provides excellent surface finish which helps base plate to maintain solid seat on ground and maintain the accuracy during the punch fabrication. Fig 1 shows the plan view of base plate. The operation sequence to fabricate the base plate is shown in table 1.

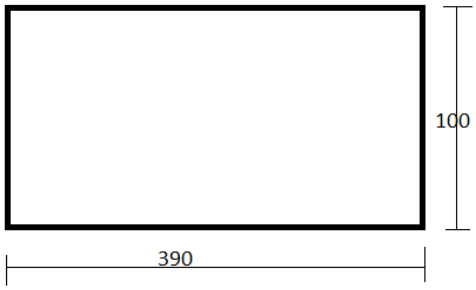

Fig 1. Plan view of base plate

Table 1: Machining operation sequence to process Base plate

Serial No.	Operation	Initial Dimension (mm)	Final Dimension (mm)	Machine used	Tool used
1	Measuring	L=395 b=105 h=30	L=392, b=102, h=27	-	Try square, Scale
2	Marking	L=395, b=105, h=30	L=392, b=102, h=27	-	scriber, marker
3	Touch cut	L=395, b=105, h=30	L=392, b=102, h=27	Shaper	SPCT
4	Measuring	L=392, b=102, h=27	L= 390, b= 100, h=25	-	Try square, Scale
5	Marking	L=392, b=102, h=27	L= 390, b= 100, h=25	-	scriber, marker
6	Finishing	L=392, b=102, h=27	L= 390, b= 100,h=25	Grinder	Grinding Tool

2.2 Head Stock

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Head stock is one of the main components of hexagonal fixture. It is located on the left side of the base plate. It is rectangular in shape which holds the chuck and the indexing plate. Chuck is connected through the shaft with the indexing plate. Bearing is used to provide a smooth and precise movement. The head stock is made of mild steel. The head stock is fitted with the base plate by the means of bolts and nuts. The fig 2 shows the head stock of fixture assembly and parts of it. The head stock is machined on lathe machine from a starting block of dimensions Length= 65mm, Breadth= 98mm, Height= 98.3mm to final dimensions as shown in fig 2 part b.The operation sequence to fabricate head stock is given in table 2.

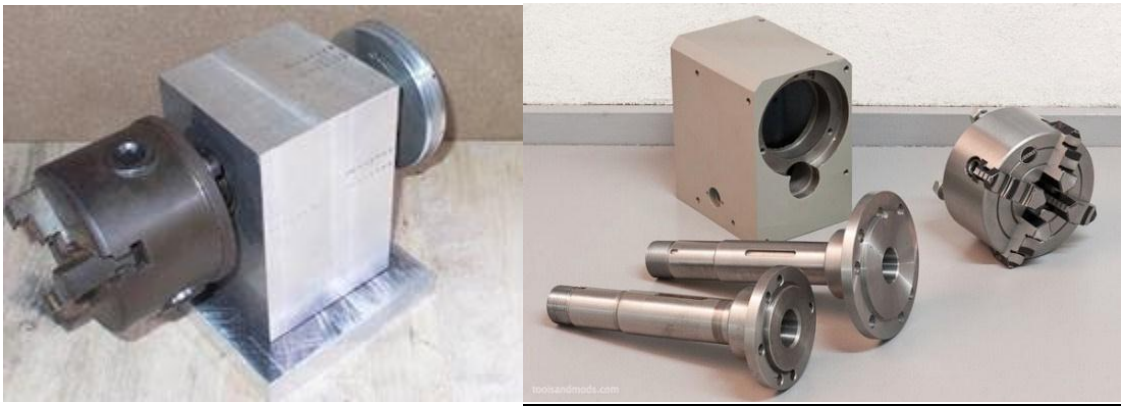

Fig 2(a) Head stock**b)** Parts of head stock

Table 2: Machining operation sequence to process head stock

Serial No	Operation	Initial Dimension(mm)	Final Dimension(mm)	Machine Used	Tool Used
1	Marking	L=65, B=102 ,H=98.3	-	-	scriber
2	Levelling	-	-	Lathe	Try square
3	Facing(One Side)	L=65,b=102,h=98.3	L=65,b=101,h=98.3	Lathe	SPCT
4	Levelling	-	-	Lathe	Try square
5	Facing(One Side)	L=65, b=101,h=98.3	L=65, b=100,h=98.3	Lathe	SPCT
6	Chamfering	-	-	Lathe	Chamfering Tool
7	Levelling	-	-	Lathe	Try square
8	Facing(other Side)	L=65, b=100,h=98.3	L=65, b=99,h=98.3	Lathe	SPCT
9	Facing	L=65, b=100,h=98.3	L=65, b=98,h=98.3	Lathe	SPCT
10	Marking(For Bearing)	-	56mm upwards from base plate	-	Centre Punch
11	Drilling	D=18	D=18	Lathe	Drilling tool

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12	Boring	D=18	D=19	Lathe	Boring tool
13	Boring	D=19	D=20	Lathe	Boring tool
14	Boring	D=20	D=21	Lathe	Boring tool
15	Boring	D=21	D=22	Lathe	Boring tool
16	Boring	D=22	D=23	Lathe	Boring tool
17	Boring	D=23	D=24	Lathe	Boring tool
18	Boring	D=24	D=25	Lathe	Boring tool
19	Internal Facing	-	D=52.02	Lathe	SPCT
20	Fitting of bearing	-	-	-	Hammer

2.3 Tail stock

Tail stock another important component for the fixture of hexagonal punch. It's made of mild steel which supports the work piece for the machining purpose and it also reduce the sudden jerk. Basically, it is placed on the right end side of the fixture. It's clamped on the base plate using the L-key bolts of size M8*2'' long. Fig 3 shows the tail stock used in fixture assembly. The operation sequence to fabricate tail stock is given in Table 3.

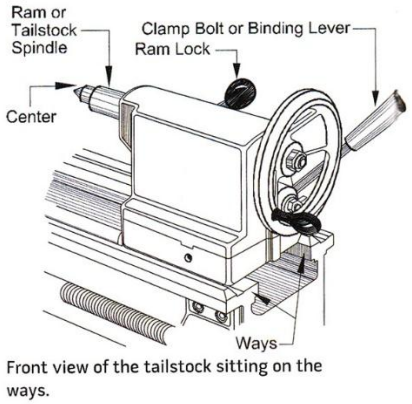

Fig 3 Schematic of tail stock

Table 3: Machining operation sequence to process tail stock

Serial No	Operation	Initial Dimension(mm)	Final Dimension(mm)	Machine Used	Tool Used
1	Marking	L=76,b=102,t=46	L=76,b=98,t=46		Scriber
	Levelling	-	-	Lathe	Try square
2	Facing	L=76,b=102,t=46	L=76,b=101,t=46	Lathe	SPCT
3	Facing	L=76,b=101,t=46	L=76,b=100,t=46	Lathe	SPCT
	Levelling	-	-	Lathe	Try square
4	Facing(on other	L=76,b=100,t=46	L=76,b=99,t=46	Lathe	SPCT

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	side)				
5	Facing(on other Side)	L=76,b=99,t=46	L=76,b=98,t=46	Lathe	SPCT
6	Drilling	M20	M20	Lathe	Drill tool
7	Boring	D=20	D=21	Lathe	Boring tool
8	Boring	D=21	D=22	Lathe	Boring tool
9	Boring	D=22	D=23	Lathe	Boring tool
10	Boring	D=23	D=24	Lathe	Boring tool
11	Boring	D=24	D=25	Lathe	Boring tool
12	Boring	D=25	D=25.5	Lathe	Boring tool

2.4 Indexing plate

An indexing head is a device used to index the circumference of work part as per the requirement. The index plate comprises of equiaxed holes which helps to facilitate indexing mechanism. The concept of indexing finds its application in gear making, bottle filling plant, escapement devices etc. Indexing heads are usually used on the tables of milling machines for dividing the work part , but may be used on many other machine tools including drill presses, grinders, and boring machines. Common jobs for a dividing head include machining the flutes of a milling cutter, cutting the teeth of a gear, milling curved slots, or drilling hole around the circumference of a part. In case of hexagonal fixture, the indexing plate is having two different circles, on circle is having six holes and another is having four holes for indexing circular bars into of hexagonal and square punch. A pin is used to fix the position known as indexing pin. Indexing plate is used to divide the circular part into the certain division. It is containing 4 and 6 holes for producing hexagonal and square punch. Drilling is done on the indexing plate using center punch, center drill, drill tool. First of all, marking is done on the indexing plate by the using of scriber for drilling 6 and 4 holes on different paths. Division of holes is done by compass manually. Fig 4 shows the indexing plate used for fixture. Table 4 shows the operation sequence to make index plate

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Fig 4 Indexing plate for square and hexagonal indexing

Table 4: Machining operation sequence to process Index plate

Serial No	Operation	Initial Dimension(mm)	Final Dimension(mm)	Machine Used	Tool Used
1	Facing	20	19.5	Lathe	SPCT
2	Facing	19.5	18.5	Lathe	SPCT
3	Facing	18.5	17.5	Lathe	SPCT
4	Facing	17.5	17	Lathe	SPCT
5	Drilling	M20	-	Lathe	Drill tool
6	Boring	20	21	Lathe	Boring tool
7	Boring	21	22	Lathe	Boring tool
8	Boring	22	23	Lathe	Boring tool
9	Threading	M16	-	Lathe	Threading tool

3. Assembly of fixture for hexagonal punch

The various components manufacture red are assemble to make the fixture for hexagonal punch as shown in fig 5. It gives flexibility in making the square as well as hexagonal punch by designing the indexing plate as discussed in section 2. This fixture helps to process the punch with minimum set up time and its cost effective.

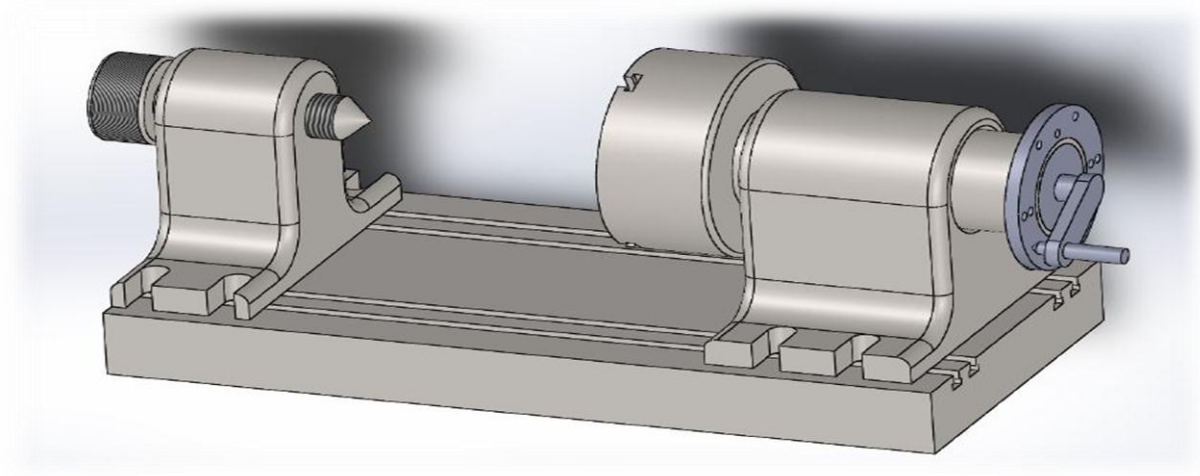

Fig 5. Assembly of fixture

Conclusion

1. The existing methods available for punch and die manufacturing are time consuming and costlier.

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2. Existing research are more focus on improving the existing methods through parametric analysis.
3. This fixture helps manufacturer to quickly and efficiently fabricate the punch for further processing.
4. The overall lead time can be squeeze effectively by implementing portable design.

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