

# Design of Jig for Multihead Drilling Machine

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**ABSTRACT:** The project is about a design and development of multi head drilling jig for holding cylindrical parts for mass production of drilling operation. Drilling jig is used whenever is necessary to drill hole to exact location. It identified the numerous advantages that are associated with the use of jigs in manufacturing to include: production increase, cost reduction, interchangeability and high accuracy of parts, reduction of the need for inspection and quality control expenses, reduction of accident as safety is improved, automation of machine tool to an appreciable extent, easy machining of complex and heavy components, as well as low variability in dimension which leads to consistent quality of manufactured products. The work also explained that since the design is dependent on numerous factors which are analyzed to achieve an optimum output, that jigs and fixtures should be made of rigid light materials to facilitate easy handling. For adequate strength and rigidity, a mild steel with 16 millimeters diameter was chosen for the design of a sample jig. Mild steel which contain about 0.29% of carbon are very cheap, and because of their easy availability are often the choicest material for the making of jigs With 1.5 as the material factor „k” for mild steel, a feed rate of 0.17 millimeter per revolution, and a drill diameter of 10.2 millimeters, the value of the Clamping Force was also calculated as upto 500N. Finally jigs must be provided with adequate clearance which should allow for variations in size of components especially during forging, milling, and casting operations.

**KEYWORDS:** Components, Work-Holding, Manufacturing, Production, Operation, Devices, Machining, Work-Piece, Clamping, Bushes

## I.INTRODUCTION

Over the past decades, manufacturing has made considerable progress. Different new machine tools, High-performance cutting tools and modern manufacturing processes are used in today's modern industries to make parts faster and better than ever before. Mass production has a demand of fast and easy method of positioning work for accurate operations on it. Jigs are production tools used to manufacture duplicate and interchangeable parts. Jigs are specially designed so that the large numbers of components can be machined identically, and to ensure interchangeability of components. The most common jigs are for drilling and boring operation and they differ as per size, type, and placement of drill bushes. Drilling jigs are used to machine holes in mechanical products. To obtain positional accuracy of the holes, hardened drill bushes or jig bushes are used to locate and guide the drill, reamers etc., in relation to the work piece. These guide bushes are not essential but these prove to be economical and technically desirable as will be discussed ahead. The portion of the jig into which the hardened bushes are fitted is called bushes. Drilling jigs are either clamped to the work piece in which holes are to drill on the work piece is housed and clamped in the jig body. If more than one hole is to be drilled, the drill jig made to slide on the table of the drilling machine. Such a drill jig is moved by hand into the position under the drill so that the drill readily enters the bush. During the drilling operation, the jig is held by hand.

If the drill size is large enough to produce high torque, either stops should be provided or the drill jig clamped to the table on the drilling machine. Drilling jigs makes feasible the drilling of holes at higher speeds, with greater accuracy.

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## II. PROBLEM STATEMENT

In industries components for pipe connecting flanche drilling operation is performed by manual marking. Hence manual error occurs in marking for drilling operation .Also we observed that production cycle time is maximum.

### Due To Above Conditions Following Problem Occurs:

- Error observed in pcd of component at drilling operation.
- Spacing between equi-spaced holes is not maintained.
- A problem occurs in assembly of such components.
- Rework and rectification is required for such components.
- Production idle time is increased.
- Production cost increased.
- CDD (Contractual Delivery Date) is not maintained.

## III. PROBLEM SOLUTIONS

- Decided To Design And Manufacture Jigs By Using Mild Steel Material.
- Decided To Manufacturing of Common Jigs i.e. one PCD on a single jig

### 3.1 Why Mild Steel Material?

- Excellent mechanical machining.
- Lightness and toughness.
- Dimensional stability.
- Strength.
- Heat resistance.
- Availability.
- Safety.
- Weather resistance.
- Colour verity.

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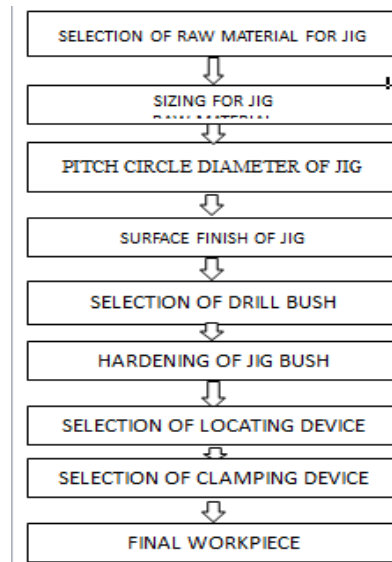


Figure 1: Production flow chart of jig for multihead drilling machine

## IV. DESIGN PROCEDURE

### 4.1.1 SELECTION OF BUSH;

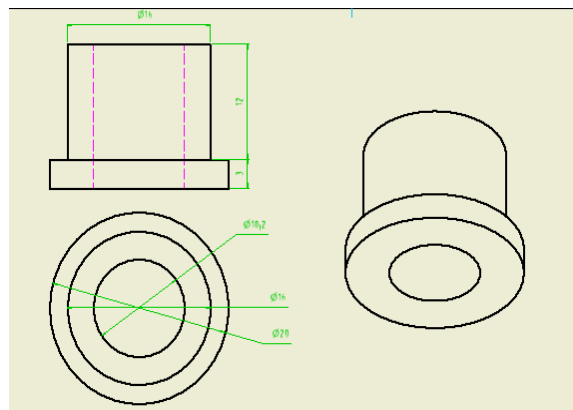


Fig-OHNS bush

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## OHNS bush

OHNS (oil hardening non shrinking die steel) are used for tool guiding. It is renewable and collared type. The dimensions are  $\phi 20 \times 15$ . It can change after a time interval or wearing out.

Fixed bush with hole range diameter 10mm. The diameter to be drill the work piece is  $\phi 10$ mm. For

10mm diameter  
D1 =  $\phi 10.2$ mm

D2 =  $\phi 17$ mm

And other dimensions of bush are

L1 = 18mm

L2 = 10mm

D3 =  $\phi 26$ mm

## 4.2 Locator

Locator are used to locating the workpiece component. It locates the workpiece in its exact position. The material used are same as base material. The dimensions are  $\phi 45 \times 5$ .

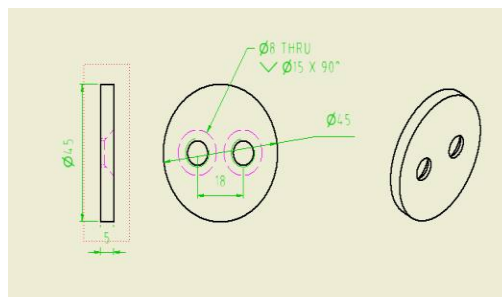


Fig Locator

## 4.3 Toggle clamp

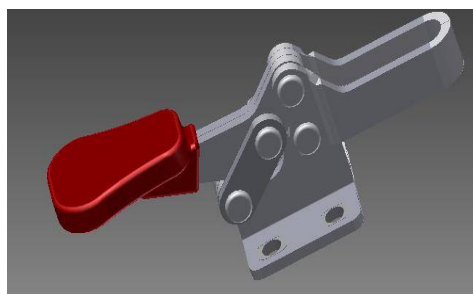


Fig. toggle clamp

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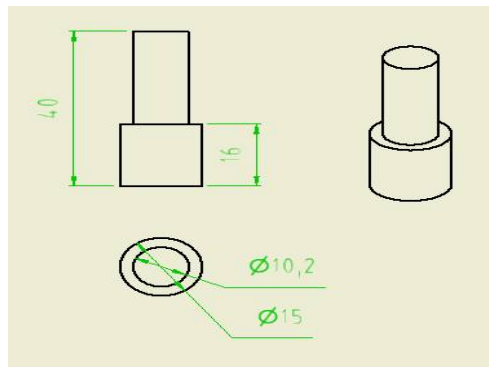
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It is horizontal type clamp. It can give upto 500N holding force. The material of toggle clamp are steel/zinc plated. It resists the movement of workpiece.

### C-clamp

It gives additional support to the clamping of the component.it is fitted with the toggle clamp by bolted connection. The material used are MS and the thickness are 3mm plate.

### Locating pin



**Fig-locating pin**

Locating pin used for locate the holes of the one side of face to same place as the another side of hole to be drilled. It enables the fast location. The dimension are  $\phi 15 \times 40$ . The material used are MS.

### 4.4 Dowel pin

Dowel pin are available in variety of sizes. It is used for prevention of rotating of plates between them. We have used the standard size of M8 $\times$ 32. The material of dowel pin are also MS.

**The standard formulae for the various forces associated with the operations of jigs and fixtures are explained below:**

$$\text{Torque, } M = K * A * f * 0.8 * d * 1.8 \quad (1)$$

$$\text{Thrust, } T = 2 * K * B * f * 0.8 * d * 0.8 + K * E * d * 2 \quad (2)$$

Where d is the diameter of the drill. A, B, E, and K are constants.

Also, Thrust/Drilling force

$$= 1.16 * k * d * (100 * s)^{0.85} \quad (3) \text{ Where } k = \text{material factor}$$

s = feed in mm/rev

d = the diameter of the drill in millimeter (mm) The Force acting on each of the lips

$$F_1 = \frac{(K_1 * d * s)}{4} \quad (4) \text{ The Torque, } M \text{ is also calculated as}$$

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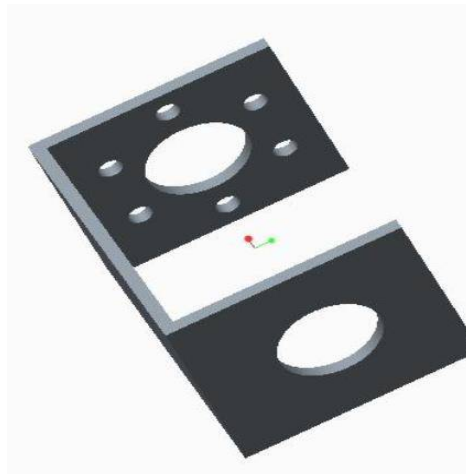
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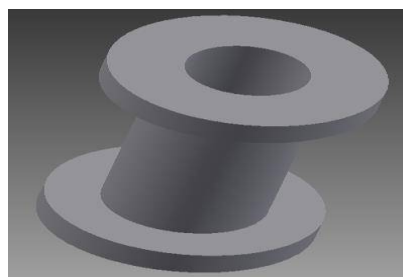
$(R * d) / 20$  (5) The clamping Force (Q) is given as

*Torque (M) \* safety factor*

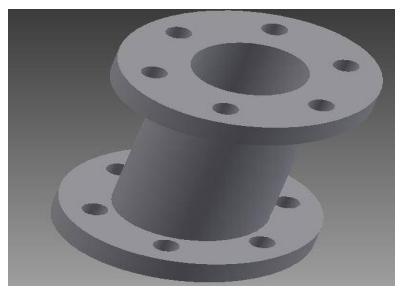


**JIG MATERIAL FOR THE MULTIHEAD DRILLING MACHINE**

**DRILL TO BE PRODUCED IN COMPONENT Before drilling**



**After drilling**



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## ADVANTAGES:

- It eliminates the individual marking.
- positioning and frequent checking.
- The operation time is reduced due to increase in speed, feed and depth of cut because of high clamping rigidity.
- It is very much useful in mass production. It makes possible to employ un- skilled or semi-skilled operator to make savings in labour cost.
- It partially automates the tools.
- It reduces the expenditures on quality control of machine parts.

## V. CONCLUSION

Since time has become precious in today's industrial environment. It is necessary to save the valuable time by all possible means. In our project the drilling time is reduced when compared to conventional operation. From this explicit we made our drilling operation in the workpiece as very easy and comfortable and without geometrical error occurring while drilling and it avoids human error also. We Eliminate the Error observed in pcd of component at drilling operation Spacing between equi-spaced holes is maintained. Production idle time is reduced. CDD (contractual delivery date) is maintained.

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