INTRODUCTION

•Facilitate production (machining, assembling and inspection operations) when work-pieces are to be produced on a mass scale.

•Once a jig or fixture is properly set up, any number of duplicate parts may be readily produced without additional set up.

•Jigs and fixtures are essential tools used in manufacturing and machining processes to improve efficiency, accuracy, and repeatability. They play a vital role in ensuring the precise alignment and positioning of workpieces during various production operations.

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Jigs:

A jig is a specialized tool or device that guides, holds, and supports a workpiece in a fixed position during a machining, assembly, or fabrication process. The primary purpose of a jig is to ensure that the workpiece is correctly located and secured, allowing for consistent and accurate production of multiple identical parts. Jigs are commonly used in drilling, tapping, reaming, and other processes that require precise hole placement and alignment.

Key features of jigs:

- **Guidance:** Jigs guide the cutting or forming tools, ensuring that they follow the correct path.
- **Repeatability:** They enable the mass production of identical parts with high accuracy and consistency.
- **Quick setup:** Jigs expedite the setup process, reducing downtime and increasing productivity.
- **Interchangeability:** Many jigs are designed to accommodate multiple workpieces with similar features.

Jig

Fixture

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❖Fixtures:

A fixture is a device used to hold and position a workpiece securely during a manufacturing operation. Unlike jigs, fixtures are generally used in processes where the workpiece does not require a specific path or shape but must remain stable and stationary. Fixtures are commonly used in milling, grinding, welding, and other operations where rigid clamping is essential to maintain accuracy and prevent workpiece movement.

❖Key features of fixtures:

- **Clamping:** fixtures use various clamping mechanisms to securely hold the workpiece in place.
- **Stability:** they ensure that the workpiece remains stable and does not vibrate or shift during machining.
- **Customization:** fixtures can be tailored to accommodate different workpiece shapes and sizes.
- **Safety:** they improve safety by reducing the risk of accidents during manufacturing processes.

❖Benefits of jigs and fixtures:

- **Improved efficiency**: jigs and fixtures enhance productivity by reducing setup time and minimizing errors.
- **Consistency:** they enable the production of uniform and standardized parts.
- **Accuracy:** jigs and fixtures help achieve precise and repeatable measurements.
- **Cost savings:** by reducing errors and rework, they contribute to cost savings in the manufacturing process.

Overall, jigs and fixtures are indispensable tools in modern manufacturing, contributing significantly to the quality and cost-effectiveness of production processes.

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GENERAL APPLICATIONS

- To reduce the cost of production, as their use eliminates the laying out of work and setting up of tools.
- To increase the production.
- To assure high accuracy of the parts.
- To provide for interchangeability.
- To enable heavy and complex-shaped parts to be machined by being held rigidly to a machine.
- Reduced quality control expenses.
- Increased versatility of machine tool.
- Less skilled labour so saving labour cost.
- Their use partially automates the machine tool.
- Their use improves the safety at work, thereby lowering the rate of accidents.

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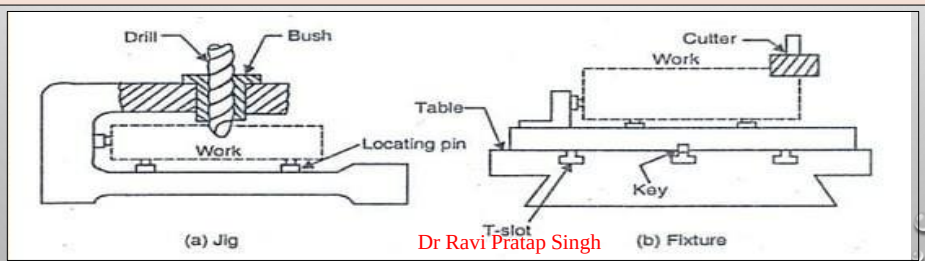
Components of Jigs and Fixtures

- Jigs and fixtures consist of several components that work together to hold, guide, and support the workpiece during manufacturing processes. The specific components may vary depending on the type and complexity of the jig or fixture, but some common components include:
- **Base or body:** the base or body is the main structural component of the jig or fixture. It provides a stable foundation and supports other components. The material used for the base is often sturdy and rigid, such as steel, cast iron, or aluminum.
- **Clamping mechanism:** the clamping mechanism is responsible for securely holding the workpiece in place during the machining or assembly process. It may include various clamps, vices, or other devices that can be adjusted to accommodate different workpiece shapes and sizes.
- **Guide or bushing:** guides or bushings are used in jigs to ensure the precise movement of cutting tools or drill bits. They act as a template for the tool, guiding it along the desired path and preventing any lateral movement.



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- **Locators and stops:** locators and stops help position the workpiece accurately within the jig or fixture. They provide reference points to ensure consistent alignment during multiple production cycles.
- **Set screws and adjusters:** set screws and adjusters allow fine-tuning of the jig or fixture to accommodate slight variations in workpiece dimensions. They provide a means of making minor adjustments to achieve the desired accuracy.
- **Drill bushings:** drill bushings are hardened and precisely machined components used in drilling jigs to guide the drill bit accurately and prevent drill wandering
- **Rests and supports:** rests and supports are used to hold the workpiece firmly in place during the machining or assembly process. They help distribute the clamping force and prevent deformation of the workpiece.
- **Handles and knobs:** handles and knobs are used for tightening or releasing the clamps and adjustments. They allow the operator to securely hold and operate the jig or fixture.

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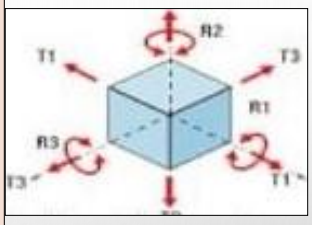
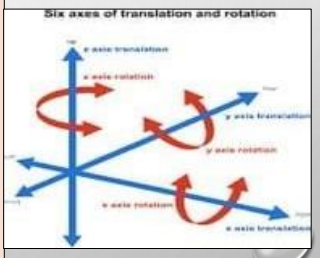
Location and Clamping

- **Principle of location:** the principle of location refers to the process of precisely positioning the workpiece within the jig or fixture so that it is in the correct orientation and alignment for the manufacturing operation. The primary goal of location is to establish specific reference points or surfaces on the workpiece that are used as a basis for all subsequent machining or assembly steps.
- The workpiece is assumed to have true and flat faces. In a state of freedom
- It may move in either of the two opposed directions along three mutually perpendicular axes, XX, YY and ZZ These SIX movements are called "movements of translation". Also, the workpiece rotate in either of two opposed directions around each axis, clockwise and anticlockwise
- These six movements are called "rotational movements". The sum of these two types of movement gives the twelve degrees Of freedom of a workpiece in space.





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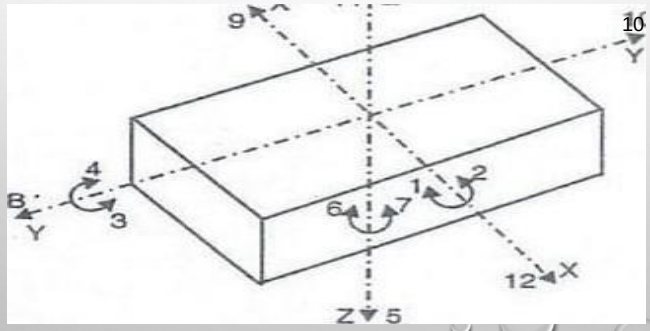
- **Principle of clamping:** the principle of clamping involves securely holding the workpiece in place within the jig or fixture to prevent any movement during the manufacturing process. Effective clamping is crucial to maintaining the accuracy and repeatability of the operations, especially in machining where cutting forces can be substantial.
- To confine the workpiece accurately and positively in another fixed body jig or fixture), the movement of the workpiece in any of the twelve degrees of freedom must be restricted.



Workpiece in Space

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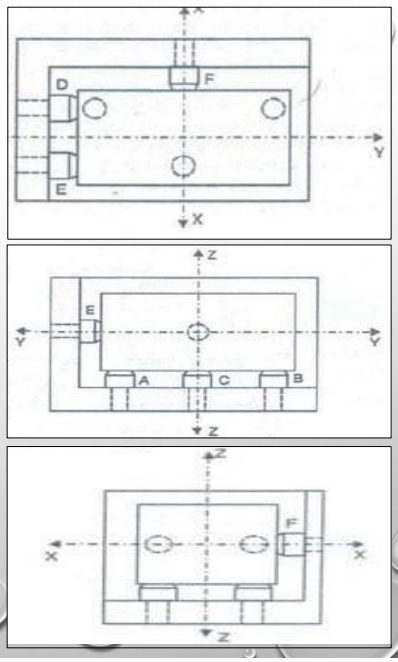
- The workpiece is resting on three pins A, B and C which are inserted in the base of the fixed body. The workpiece cannot rotate about the axes XX and YY and also it cannot move downward. In this way the five degrees of freedom l, 2, 3, and 5 have been arrested.
- Two more pins d and e are inserted in the fixed body, in a plane perpendicular to the plane containing the pins a. B and C. Now the workpiece cannot rotate about the z-axis and also it cannot move towards the left. Hence, the addition of pins D and E restrict three more degrees of freedom, namely 6, 7 and 8.
- Another pin f in the second vertical face of the fixed body, arrests degree of freedom 9.



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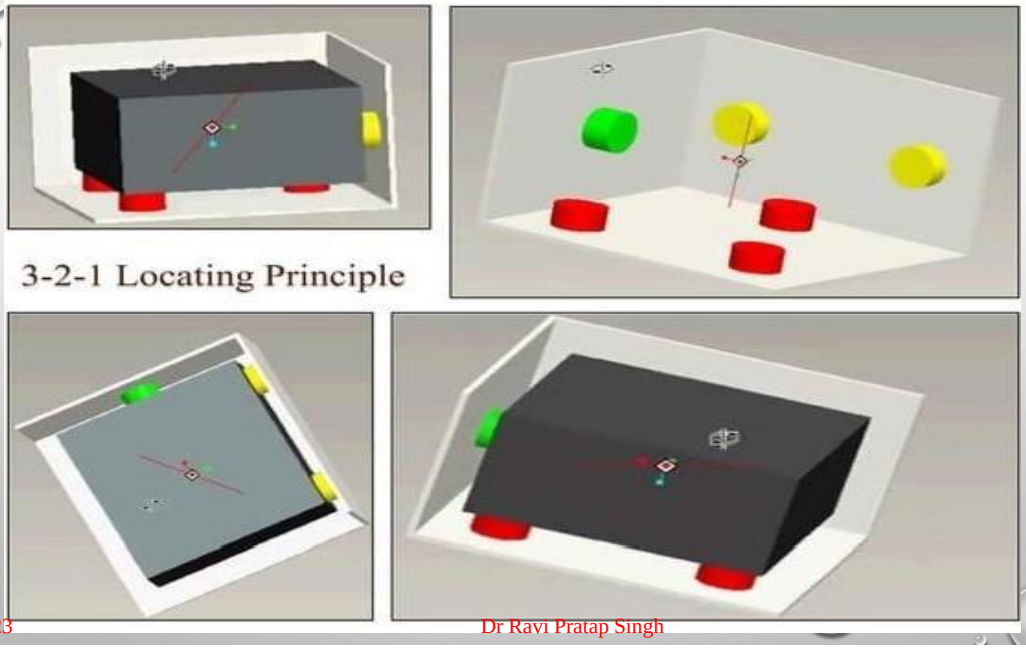

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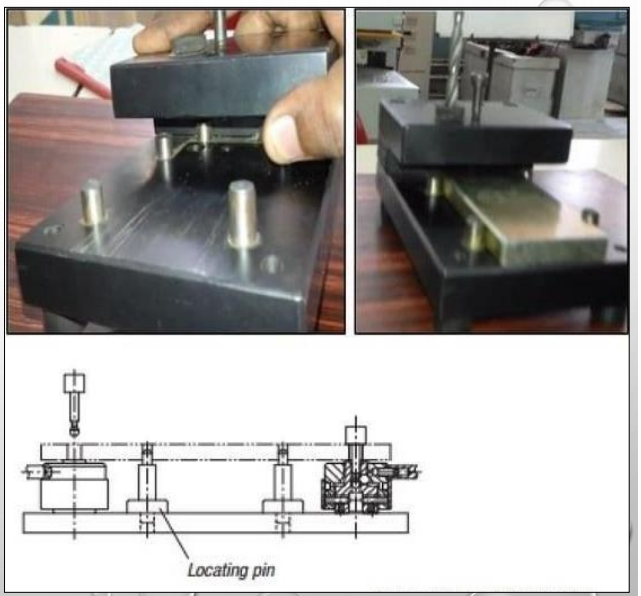
LOCATING DEVICES

- Pins of various designs and made of hardened steel are the most common locating devices used to locate a workpiece in a jig or fixture.
- The locating diameter of the pin is made larger than the shank to prevent it from being forced into the jig or fixture body due to the weight of the workpiece or the cutting forces.
- Depending upon the mutual relation between the workpiece and pin, the pins may be classified as :
  1. Locating pins
  2. Support pins
  3. Jack pins



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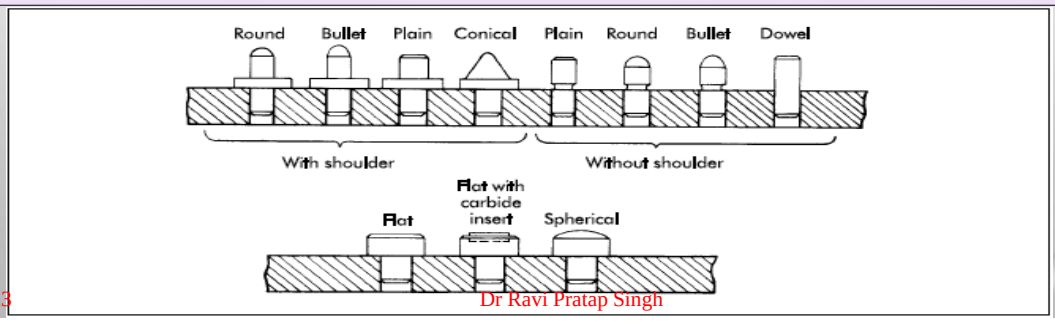
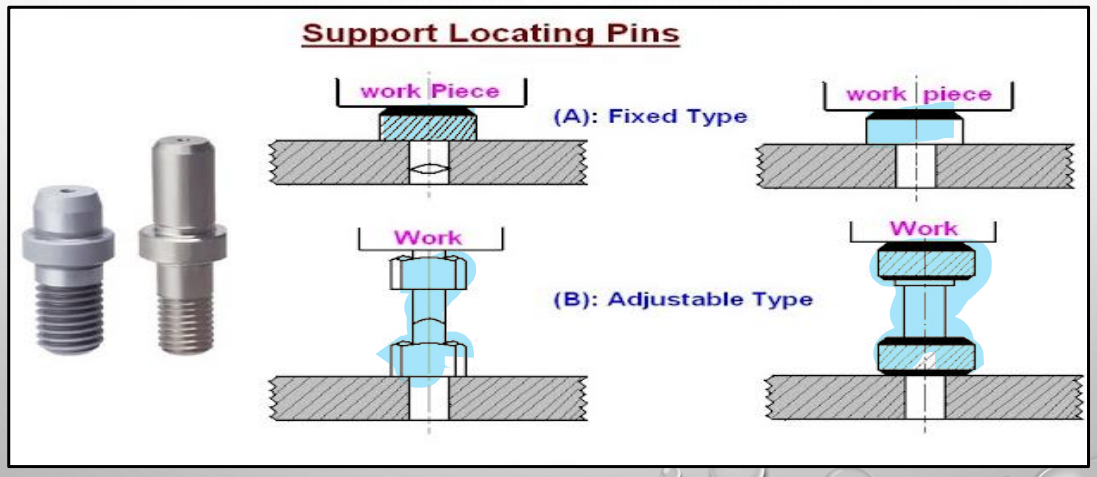
LOCATING PINS

- Typically, locating pins are used for controlled, fine tolerance positioning of a work piece. For example, a pallet that is moved along one axis, where the drive mechanism is not accurate and stable enough to place it in a position sufficiently accurate to execute a particular process, the use of locating pins may be the best solution.
- Usually two locating pins are enough to properly locate the work piece on one plane.
- The location and number of locating pins generally is determined by the size, shape, and configuration of the part. However, in most cases the 3-2-1 principle is applied, wherein there are three pins placed under the part to control five directional movements, and three more pins placed perpendicular to the base to control four more directional movements. The remaining two directional movements are controlled by the clamping element.



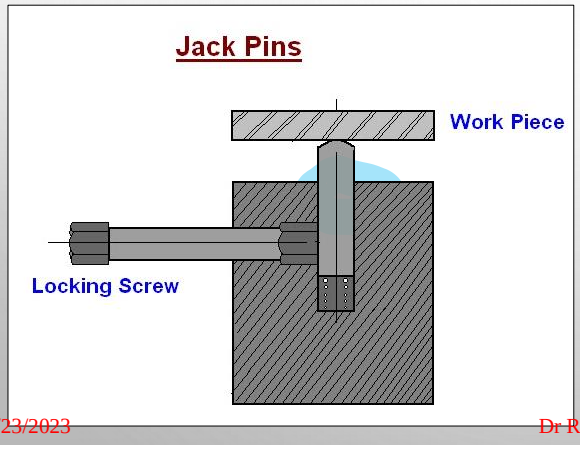
SUPPORT PINS

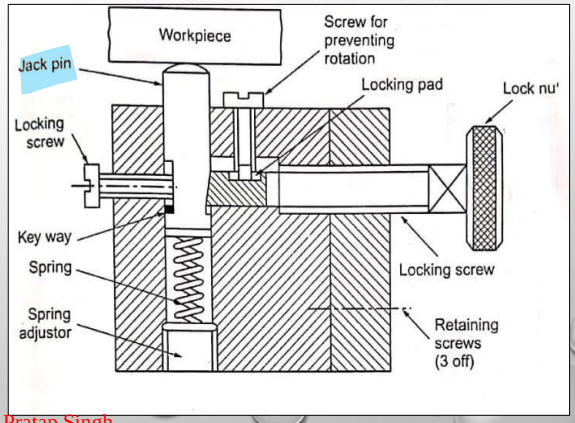
- With these pins (also known as rest pins) workpiece with the flat surface can be supported at convenient points.



JACK PINS

- Jack pins/spring pins are also used to locate the workpieces whose dimensions are subject to variation.
- The pin is allowed to come up under spring pressure or conversely is pressed down by the workpiece. When the location of the workpiece is secured the pin is locked in this position by means of the locking screw.





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CLAMPING DEVICES

- In engineering and mechanics, clamping often involves the use of devices like clamps or screws to hold two or more components together firmly. This prevents unwanted movement or displacement and ensures the stability of the system. For example, in construction, clamping might be used to hold beams together securely.
- The purpose of clamping is to exert a pressure to press a workpiece against the locating surfaces and hold it there opposition to the cutting forces i.e. to secure a reliable (positive) contact of work with locating elements and prevent the work m the fixture from displacement and vibration in machining. Common example: bench vise

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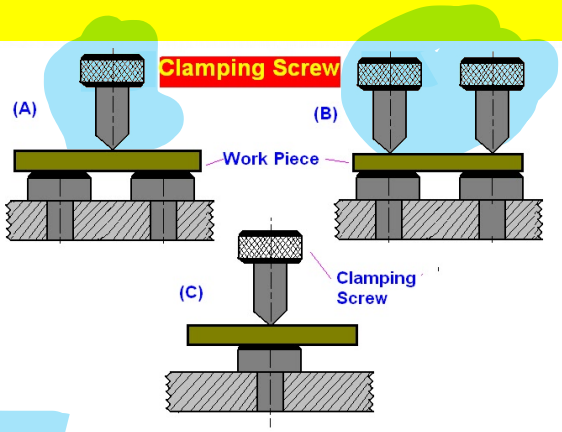
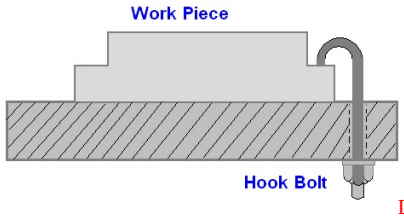
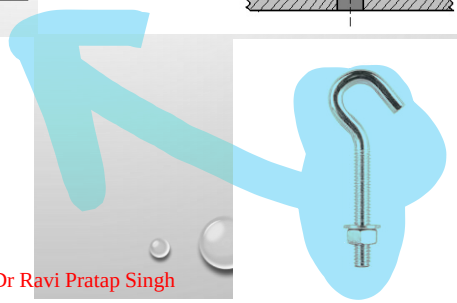
1. **Clamping screws: -** Clamping screws are used for light clamping and typical examples are shown in fig.

2. **Hook bolt clamp: -** This is very simple clamping device and is only suitable for light work and where the usual type of clamp is inconvenient.







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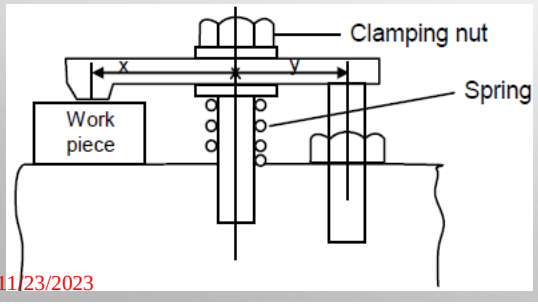
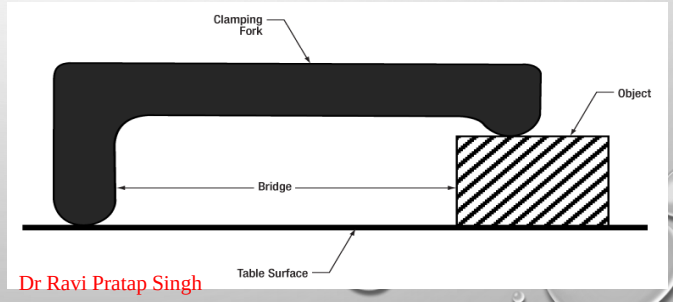
3. **Lever Type Clamps:**

i. **Bridge clamp:** the clamping force is applied by the spring loaded nut. Slotted strap: to avoid the complete removal of the nut every time a workpiece is changed the clamp may be slotted to draw it back.

ii. **Heel clamp:** these consist of a robust plate or strap, center stud and a heel. The strap is strengthened at the point where the hole for the stud is cut out by increasing thickness around the hole.





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iii. Strap Clamps:

Strap clamps are the simplest and least expensive type of clamping device used for jigs and fixtures. The basic strap clamp consists of a bar, a heel pin (or block), and either a threaded rod or cam lever to apply the holding force. Additional accessories for this type of clamp include hand knobs and spherical seat nut and washer sets

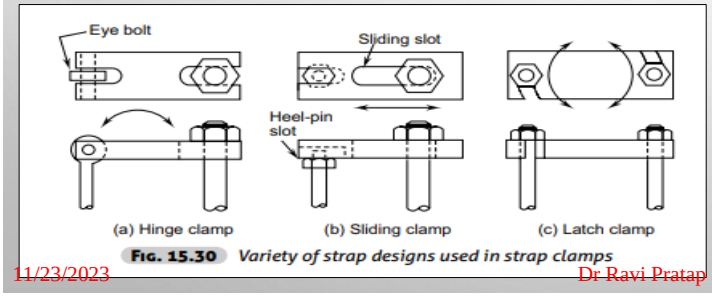
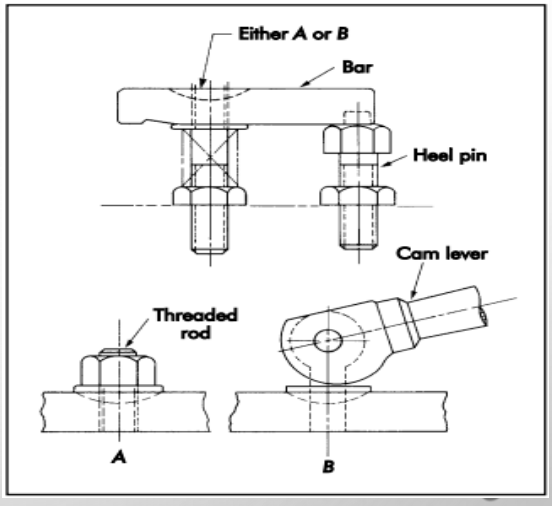


FIG. 15.30 *Variety of strap designs used in strap clamps*



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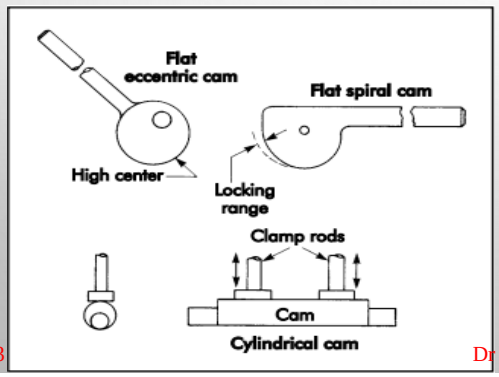
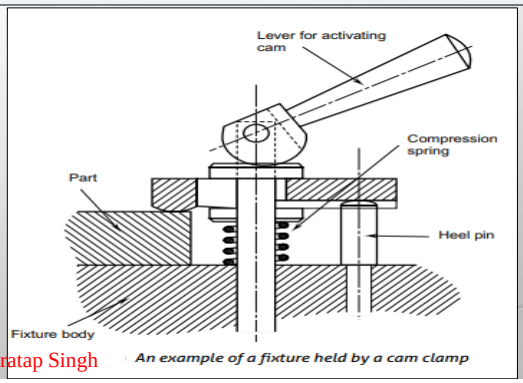
iv. Cam Clamps:

Cam clamps provide clamping force because of the contour of the cam surface that comes into contact with the plate used for the clamping. Notice that a plate is pushed down by the cam against the spring pressure to hold the part in place. Cam clamps are quick in operation. Cam clamps are of three types, eccentric cam, flat spiral cam and cylindrical cam. This is more stable and the vibrations during machining do not affect the clamping.





An example of a fixture held by a cam clamp

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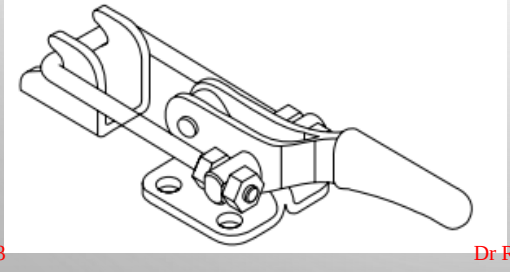
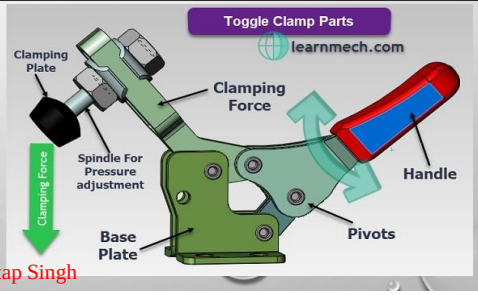
V. Toggle Clamps:

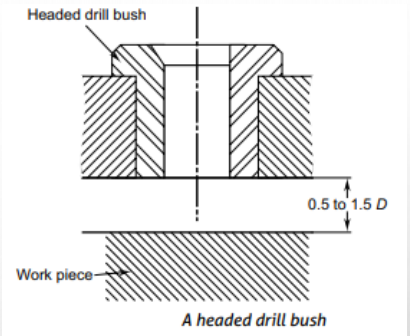
- These are commercially available clamps in various designs. A toggle clamp is a quick-acting mechanical linkage where two of the elements make up a toggle action. Actuating the clamp first moves it into position, then applies clamping force by compressing or stretching the linkage elements after contacting the work piece, then positively locks it by moving the toggle action's center pivot past the centerline of the other two pivots, against a stop
- Toggle clamps are mainly used because of their fast action for clamping and unclamping, their ability to completely clear from the work piece, and the force amplification possible for clamping.



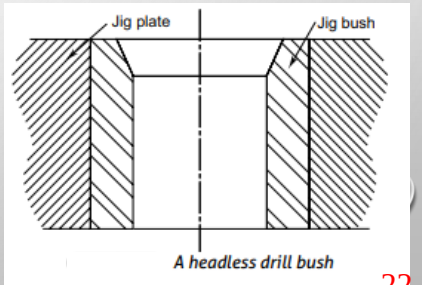


Jig Bushes

- The main problem with hole making operations is the slenderness of the tool. It further gets complicated by the geometry of the hole as well as its location. Hence a jig bush is used to position and guide the cutting tool for the cutting operation. Jig bushes are made of materials with sufficient hardness to ensure long life. Typical materials used are hardened steel, carbide, bronze and stainless steel.
- There are a number of varieties of jig bushes used to cater to the requirements of hole making. Fig. Shows a headed drill bush, which is the most commonly used. These are used when the hole depth must be controlled. To reduce the drill bending and improve the hole accuracy, drill bushes are mounted as close to the work piece as possible while allowing adequate chip clearance.
- The necessary clearance depends on work piece material and type of chip formed. In the case of cast iron, discontinuous chips are formed and hence would require only about 0.5 times drill diameter for chip clearance.



A headed drill bush



A headless drill bush

Drilling Jigs

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 drill, reamers etc., In relation to the workpiece.

❑ **Design Principles for Drilling Jigs:**

A. A drilling jig should be of light construction consistent with adequate rigidity to facilitate its handling because it has to be handled frequently during the operation.
B. A drilling jig which is not normally clamped to the machine table should be provided with four feet.
C. The stability of a drilling jig should be as good as possible since it is not usual to clamp it to the machine table and to ensure this, the feet or base of the jig should extend outside the holes to be drilled.
D. Drill bushings should be fitted in fixed portion of the jig.

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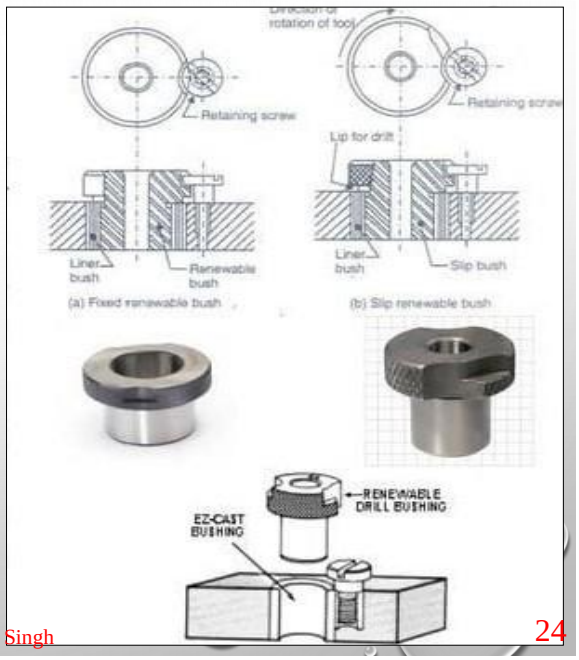
❑ The stiffness of the cutting tool may be insufficient to perform certain machining operations. To eliminate the elastic spring back in machining and to locate the tool relative to the work, use is made of guiding parts, such as, jig bushings/templates. These must be precise, wear resistant and changeable.

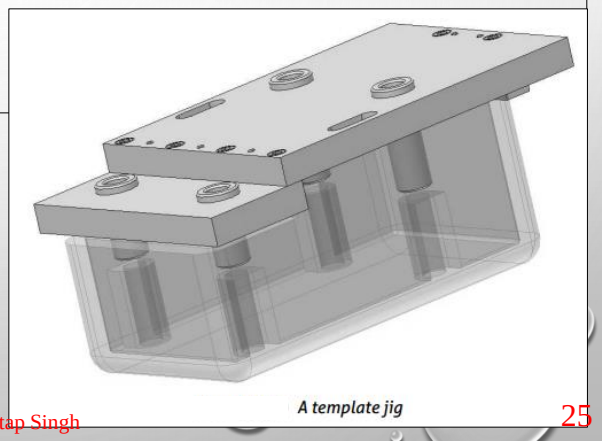
A. Press fit bushings
B. Renewable bushes.
C. Slip bushes
D. Screw bush.
E. Liner bushings



Types of Jigs

There are a large variety of jigs used for the hole making operation. The type of part geometry involved dictates the actual choice of these designs. The common varieties of jigs are

1. Template jigs
2. Plate jigs
3. Leaf jigs
4. Channel and tumble jigs
5. Indexing jigs


A template jig

❑ **Template Jigs:**

It is not a true jig since it does not incorporate a clamping device. However these are used in a number of situations. A template jig consists of the jig plate with the necessary locating arrangement and the provision of the jig bushes where the hole needs to be made as shown in Fig.

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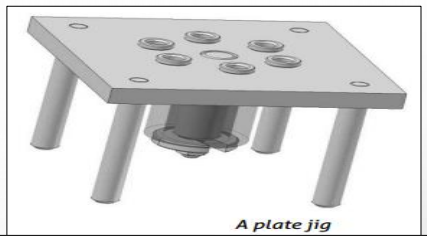
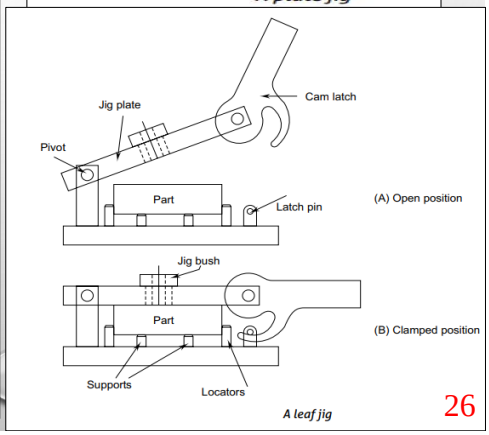
❑**Plate Jigs:**

This is an improvement over the template jig. A plate jig is a template jig with an added clamping arrangement. Fig. Shows a plate jig for drilling the six holes in a part. The part, shown as transparent, is clamped to the central cylindrical locator underneath the plate with the help of a c-washer. The jig plate has the six bushes arranged around the locator as per the part print dimensions. Because of the open construction employed in the plate jig, it is easy to load and unload parts and also dispose of the chips.


A plate jig

❑**Leaf Jig:**

Plate jig is the simplest of all jigs in which the component is positioned between location elements, sandwiched and the jig plate. A pair of alignment dowels ensures that the jig plate is correctly orientated relative to the base. The two parts are clamped together by a cam latch as shown in fig. The hinged leaf with bushes will also apply the clamping force. Most of the designs are normally limited to small and simple parts for easy handling. The main disadvantage is that as wear or distortion takes place in the pivot pins, the accuracy of machining will deteriorate.



A leaf jig

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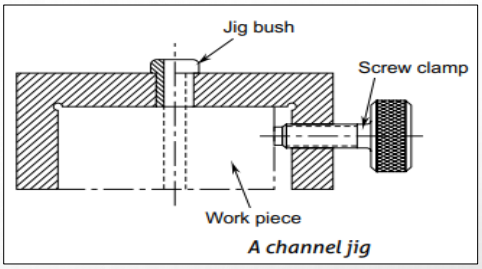
❑**Channel and Tumble Jigs:**

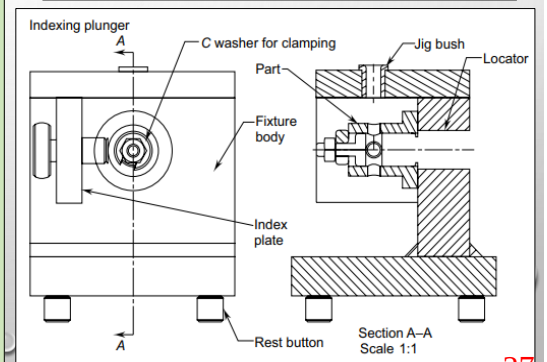
Channel and tumble jigs allow for drilling in more than one surface of a part without relocating it in the jig. As a result the accuracy of the part is higher, and less handling of the part is required to complete the machining operations. However the jigs are more complicated and expensive compared to other jigs discussed so far. A simple channel jig is shown in fig.



A channel jig

❑**Indexing Jigs:**

Indexing jigs are used to drill holes in a pattern. The location for the subsequent holes are normally done through the prior hole drilled. An indexing arrangement will be provided in the jug from an appropriate datum to ensure the required accuracy. An example is shown in fig. 15.47 where the part is located from the central hole and then indexed about its axis by means of a plunger located to the left side, to drill the 4 holes around the cylindrical surface.



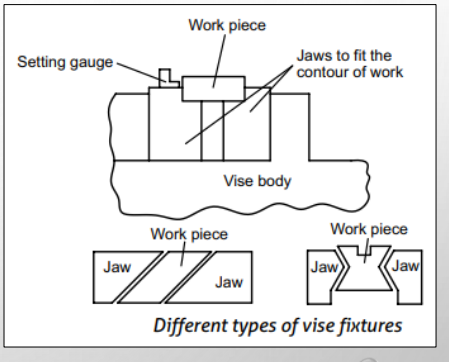
An indexing jig

FIXTURES

➢ As explained earlier the function of a fixture is to securely fasten the part to the machine tool table, with accurate location of the part during the machining operation. In addition to the function of holding the work piece, the fixtures also provide for setting the cutting tool for the actual machining operation as shown in fig. Generally a fixture is supposed to be securely fastened to the machine tool table during the machining process.

❖ **Vise Fixtures:**

The simplest type of milling fixture is a vise mounted on the milling machine table. As explained earlier the standard machine vise has all the elements of a typical fixture. Hence standard machine vises can be adapted with special jaws depending upon the contour of the part to be machined. For example for a cylindrical holding surface the plain jaws of a vise can be replaced by V-shaped jaws to transform it as a fixture with minimal change. As shown in fig. the shape of the jaws will be designed to specifically fit the contour of the work piece to be machined. Care also needs to be taken to see that surface of the part is not marred by the excessive force applied during clamping.



Different types of vise fixtures

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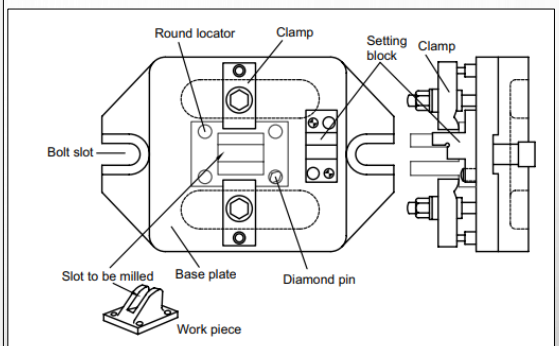
❖ **Milling Fixtures:**

Milling fixtures are the most common type of fixtures that are in general use today. The reason for this is the geometric complexity of the work pieces that are milled. However, as the work piece size, shape, or complexity becomes more sophisticated, so too must the fixture. Similar to a jig, the fixture consists of five main parts,

1. The base,
2. Locators,
3. Clamps,
4. Supports
5. A setting block



Milling fixture to mill the slot as a single milling operation

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❖**Lathe Fixtures:**

Majority of the lathe operations are completed using chucks and mandrels since most of them are axi-symmetric in nature. However for some cases that have odd shapes, a face plate will be required. Procedure to be followed is similar to the design of milling fixtures. In milling, the work piece is stationary and the cutting tool revolves. In turning operations, the work piece revolves and the cutting tool is stationary

➢ Some principles to be considered while designing lathe fixtures are:

a. Tool designer must deal with centrifugal force. The complete fixture must be designed and constructed to resist the effects of the rotational, or centrifugal, forces present in the turning.
b. Since lathe fixtures are designed to rotate, they should be as lightweight as possible.
c. Lathe fixtures must be balanced. While perfect balance is not normally required for slow-speed turning operations, high rotational speeds require the fixture to be well-balanced.
d. Projections and sharp corners should be avoided since these areas will become almost invisible as the tool rotates and they could cause serious injury.
e. Parts to be fixtured should, whenever possible, be gripped by their largest diameter, or cross section.

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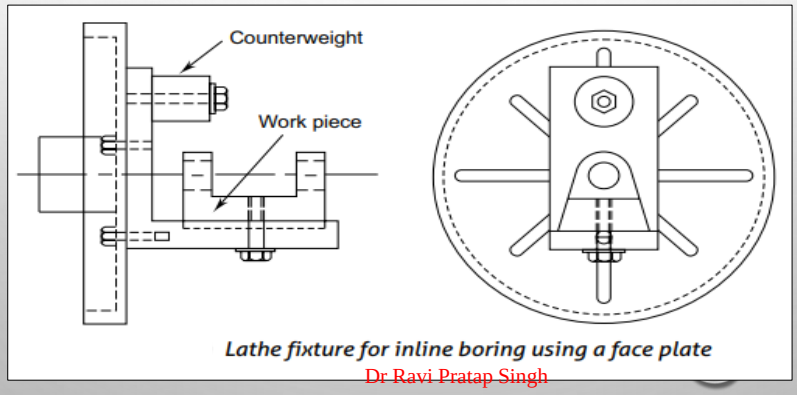
f. The part should be positioned in the fixture so that most of the machine operation can be performed in the first fixturing.

g. Clamps should be positioned on surfaces, or areas, which are rigid before and after machining.

h. As with other fixtures, some means of cutter setting should also be incorporated into the design.

However, since the work holder will be rotating, this setting device should be removed.



Lathe fixture for inline boring using a face plate

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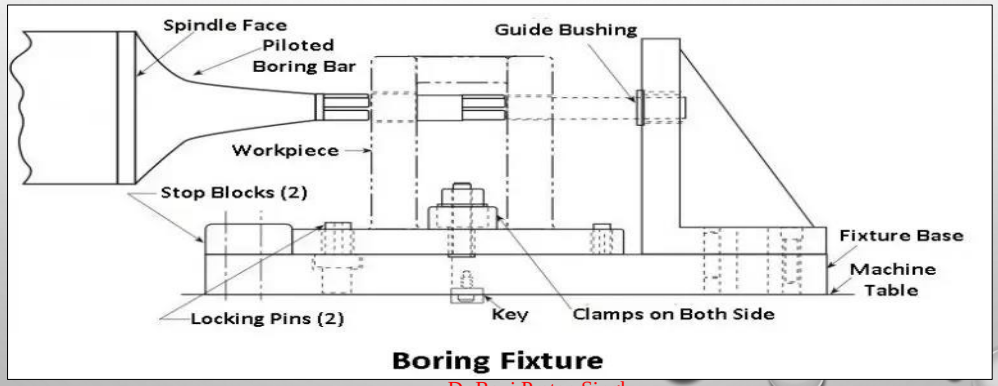
❖ **Surface Grinding Fixtures:**

- The procedure used to design surface grinding fixtures is similar to that of milling. However since grinding is used as a finishing operation, the accuracies required in manufacturing the grinding fixtures is higher compared to that of milling. The locating methods to be used must be precise and clamping pressure should not affect the work piece in any manner.
- Also because of the large amount of heat generated during the grinding operation, a large amount of cutting fluid is used. So the grinding fixture should make the necessary provision for draining swarf and the cutting fluid. Whenever possible using magnetic chucks to hold the ferrous work pieces greatly simplifies the grinding operation. Provide coolant containment devices or splash guards to keep the fixture from spilling coolant on the floor around the machine. Also include provisions for rapid wheel dressing and truing in the design of the fixture, if not built into the machine.

BORING FIXTURES

- Boring fixtures are designed to hold the workpiece while the part is bored. These fixtures differ from boring jigs in that they do not have any provision for guiding or supporting the boring bar. Boring fixtures are normally used for large parts with large holes where the boring bar is rigid enough to provide additional support. A pilot bushing is not needed.
- Boring fixtures, like milling fixtures, should have some provision for setting the position of the cutting tool relative to the part. In cases where a boring fixture is to be used on a large machine, such as a boring mill or vertical turret lathe, it is also good practice to include alignment areas on the fixture to ensure proper alignment with the machine.



Boring Fixture

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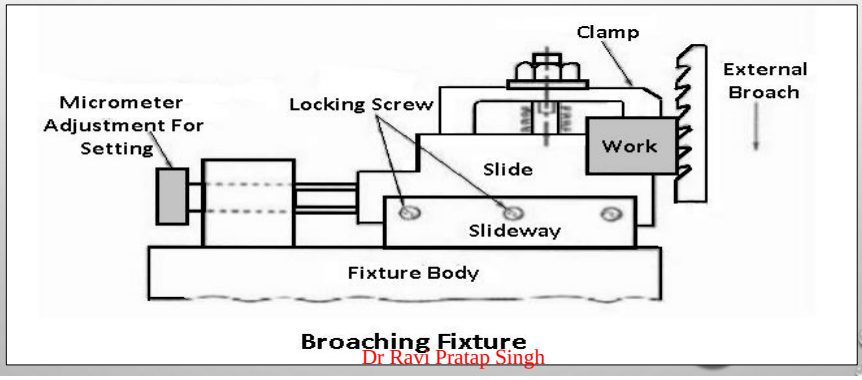
BROACHING FIXTURE

- Broaching fixtures are designed to simply hold and locate a part relative to either an internal or external broach. Since there is a great deal of cutting force exerted during broaching, the complete fixture must be built more substantially than those for other processes.
- Internal broaching fixtures need only locate and hold the part in proper position relative to the hole in the broaching machine. Most broaching is of the pull type and tends to keep the part firmly seated on the fixture.
- External, or surface broaching, requires a different approach to fixturing. Since this type of broaching is performed on the outside of a part, the fixture must be designed to resist both pulling and perpendicular thrust that tends to try to push the part away from the broach.



Broaching Fixture

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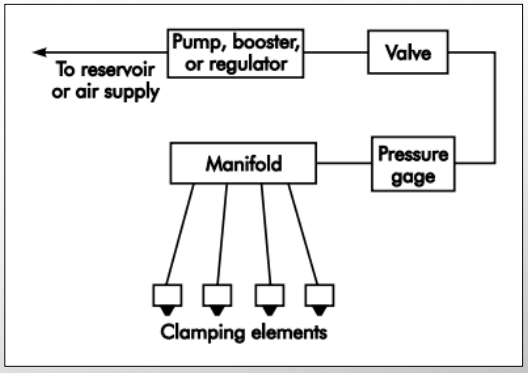
POWER CLAMPING

- Power clamping devices are frequently used for applications where speed and uniform clamping pressures are important considerations. Figure shows how a typical power clamping system is constructed. Power clamps normally are operated by hydraulic or pneumatic pressure, or a combination of both.
- One problem in using any power clamping system is the basic law of "no hydraulic pressure—no clamping pressure." If any clamping element leaks, or is disconnected, pressure is lost and the clamps loosen. One system of components that uses a mechanical locking principle in combination with a pressurized hydraulic system is the stay-lock clamping system.
- These clamps are built using a mechanical lock activated by hydraulic pressure. Once locked, the hydraulic pressure and hoses may be removed and the clamps stay locked firmly against the part.



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DIFFERENT MATERIALS FOR JIGS AND FIXTURES

Jigs and fixtures are tools or devices used in manufacturing and machining processes to aid in the accurate and efficient production of components. They are essential for ensuring precision, repeatability, and consistency in various manufacturing operations. The choice of materials for jigs and fixtures depends on factors like the application, the specific manufacturing process, and the expected wear and tear. Here are some common materials used for jigs and fixtures:

1. **Steel**: steel is a widely used material for jigs and fixtures due to its strength, durability, and resistance to wear. Tool steel, such as A2, D2, and O1, is commonly used for its hardness and ability to maintain precise dimensions over time. Stainless steel is used in applications where corrosion resistance is essential.
2. **Aluminum**: aluminum is a popular choice for lightweight fixtures. It is easy to machine, has good corrosion resistance, and is often used for fixtures that don't undergo heavy stress. It's ideal for applications where weight reduction is a priority.
3. **Cast iron**: cast iron, particularly gray cast iron, is known for its stability and damping properties. It is often used for heavy-duty fixtures that require stability and vibration damping.
4. **Plastic**: certain plastic materials like nylon, Delrin, and UHMW (ultra-high-molecular-weight polyethylene) are used in applications where non-metallic, non-marring materials are required. These plastics are lightweight, corrosion-resistant, and can be easily machined.

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5. **Bronze**: bronze is used in applications that require excellent corrosion resistance. It is often employed in marine and chemical industry applications.
6. **Copper**: copper is used for electrical fixtures, as it conducts electricity well and has good thermal conductivity. Copper is also corrosion-resistant and can be used in applications where these properties are important.
7. **Composite materials**: some advanced materials like carbon fiber-reinforced composites are used in applications where weight reduction, high strength, and stiffness are required. These materials are often used in aerospace and high-tech manufacturing.
8. **Wood**: in some cases, wood is used for jigs and fixtures, especially in woodworking and pattern making. It can be easily machined and is relatively inexpensive.
9. **Ceramics**: ceramics can be used when very high-temperature resistance is required. They are often employed in applications like metal casting.
10. **Rubber and elastomers**: soft materials like rubber and elastomers are used for clamping and holding fixtures where parts need to be held firmly but gently to prevent damage.

The choice of material for a jig or fixture depends on various factors, including the manufacturing process, the environmental conditions, the specific requirements of the operation, and the expected service life. Cost considerations and ease of machining are also important factors in material selection.

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ECONOMICS OF JIGS AND FIXTURES

- Jigs and fixtures are essential tools used in manufacturing and production processes to improve efficiency, precision, and productivity. They play a significant role in the economic aspects of manufacturing by reducing costs, improving quality, and increasing overall productivity. Here's a closer look at the economics of jigs and fixtures:

1. Cost reduction:
   - Labor cost: jigs and fixtures enable semi-skilled or unskilled labor to perform tasks that would otherwise require skilled workers. This reduces labor costs and makes the manufacturing process more economical.
   - Scrap reduction: properly designed jigs and fixtures help prevent errors and defects, reducing the amount of scrap or rework required. This leads to cost savings in materials and labor.
   - Machine tool utilization: jigs and fixtures ensure that machines are used efficiently and effectively, maximizing their utilization and reducing idle time.
2. Improved quality:
   - Precision and consistency: jigs and fixtures help maintain precise dimensions and tolerances, resulting in higher product quality and fewer rejects or rework.
   - Standardization: using standard jigs and fixtures ensures consistency in production, reducing the likelihood of errors and defects.
3. Increased productivity:
   - Reduced setup time: jigs and fixtures simplify the setup process, reducing downtime between production runs and increasing the number of units produced in a given time.
   - Faster cycle times: jigs and fixtures can lead to faster manufacturing processes, allowing for higher production rates.

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4. Customization and versatility:
   - Jigs and fixtures can be designed for specific tasks, which allows manufacturers to adapt and change their production processes with relative ease. This flexibility can be cost-effective in industries where product designs change frequently.
5. Long-term savings:
   - Although there is an initial investment in designing and building jigs and fixtures, their long-term use can result in significant cost savings, making them economically viable over time.
6. Scalability:
   - Jigs and fixtures are scalable, meaning that as production volumes increase, their economic benefits become more pronounced. They are particularly useful in mass production scenarios.
7. Reducing human error:
   - Automation and precision provided by jigs and fixtures reduce the risk of human errors, which can be costly in terms of material wastage, rework, and customer satisfaction.
8. Competitive advantage:
   - Companies that invest in well-designed jigs and fixtures gain a competitive advantage by producing high-quality products at lower costs, which can lead to increased market share and profitability.

In summary, jigs and fixtures are crucial tools in the manufacturing industry that contribute to cost reduction, quality improvement, increased productivity, and long-term savings. While there is an initial investment involved in their design and fabrication, the economic benefits they offer make them an essential part of modern manufacturing processes.

DRAWING AND DESIGN OF JIGS FOR GIVEN COMPONENTS

To design a jig it is very important to follow the steps methodically. It is necessary to think and plan various elements that will be forming part of the final jig. It often helps in sketching the details around the part to understand the interactions between the various elements. With the availability of 3D CAD systems, it is far more easier now to design jigs compared to a manual process on the drafting board. The following are some steps that are identified to help in designing a jig.

- Method of locating the part – identify the standard components required for locating purpose.
- Design the clamping method. Make a proper choice of clamps – c-washer, swing washer, nut, strap clamp, toggle clamp, etc.
- Design any supports required
- Design the jig bushes required.
- Design the jig body.