EXPERIMENT No. 01 SPOT WELDING (LAP JOINT)

AIM: To prepare a lap Joint on the given G.I. sheet using spot welding equipment.

MATERIAL REQUIRED: G.I. Sheet of 50 x 50 mm, 2 Nos.

APPARATUS REQUIRED: Spot Welding Equipment, Snips and Gloves

THEORY: In resistance welding a low voltage (typically 4-12volts) and very high current (typically 15,000 A) is passed through the joint for a very short time (typically 0.25 s). This high amperage heats the joint, due to the contact resistance of the joint and melts it. The pressure on the joint is continuously maintained and the metal fuses together under this pressure.

The heat generated in resistance welding can be expressed as

$$H = k.\ I^2\ .R.\ t$$

Where H = the total heat generated in the work,

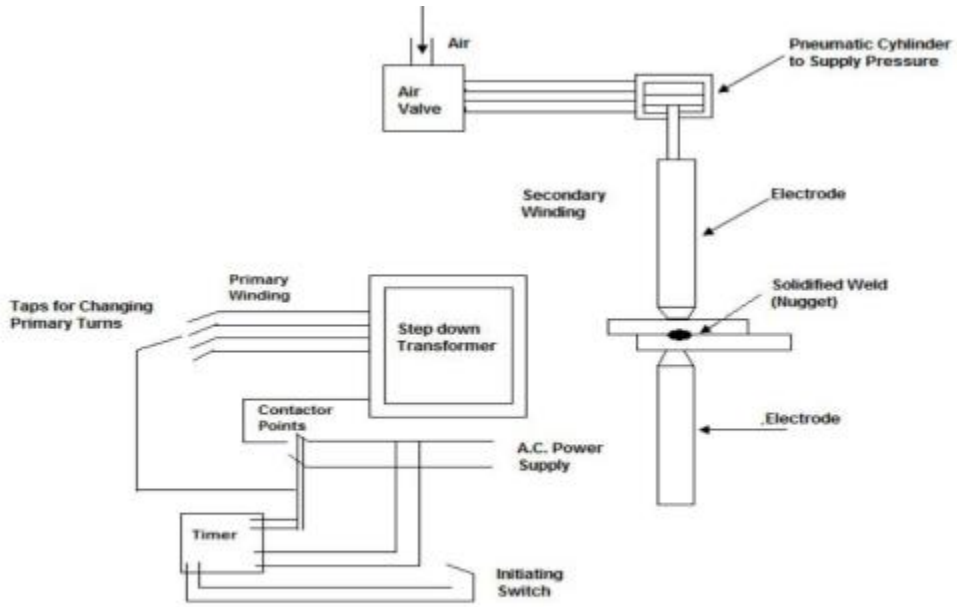
I = electric current, Amp.

t = time for which the electric current is passing through the joint, Sec.

R = the resistance of the joint, ohms and

k = a constant to account for the heat losses from the welded joint.

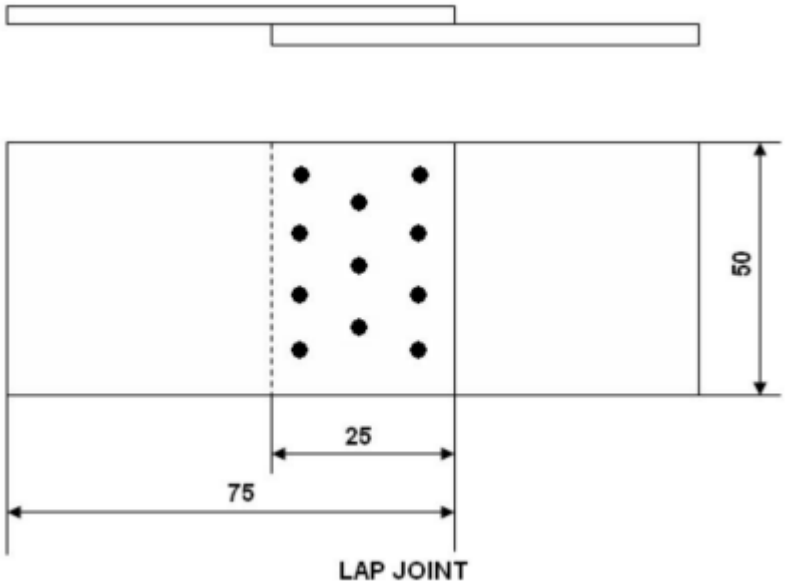
The amount of heat released is directly proportional to the resistance. It is likely to be released at all of the above-mentioned points, but the only place where a large amount of heat is to be generated to have an effective fusion is at the interface between the two work piece plates. Therefore, the rest of the component resistances should be made as small as possible, since the heat released at those places would not aid in the welding. Because of the squaring in the above, equation, the current I needs to be precisely controlled for any proper joint. The main requirement of the process is the low voltage and high current power supply. This is obtained by means of a step down transformer with a provision to have different tappings on the primary side, as required for different materials. The secondary windings are connected to the electrodes which are made of copper to reduce their electrical resistance. The time of the electric supply needs to be closely controlled so that the heat released is just enough to melt the joint and the subsequent fusion takes place due to the force (forge welding) on the joint. The force required can be provided either mechanically, hydraulically or pneumatically. To precisely control the time, sophisticated electronic timers are available. The critical variable in a resistance welding process is the contact resistance between the two work piece plates and
their resistances themselves. The contact resistance is affected by the surface finish on the plates, since the rougher surfaces have higher contact resistance. The contact resistance also will be affected by the cleanliness of the surface. Oxides or other contaminants if present should be removed before attempting resistance welding.



RESISTANCE WELDING SETUP

PROCEDURE:

- The two pieces to be joined by spot welding are placed between the two electrodes in the required position.
- Set the timer for which the current flows through the electrodes with reference to the thickness of the plates
- Press the foot lever, so that the movable electrode moves towards the fixed electrode.
- This causes to develop a pressure of about 200-1000 Kg / cm^2 on the sheets.
- A low voltage and very high current is passed through the joint for a very short time. The duration of the current flow is for about 2 sec (This high amperage heats the joint, due to contact resistance at the joint and melts it).
- Then the metal under electrodes pressure is squeezed and welded.
- Pressure is then released and the process is repeated until the job is completed.
- The welding is carried out in a regular pattern as shown in fig.



PRECAUTIONS:

- Proper pressure should be applied on the electrodes.
- Correct electrode diameter needs to be chosen depending on the material thickness to be joined.
- Proper weld time should be selected for welding.

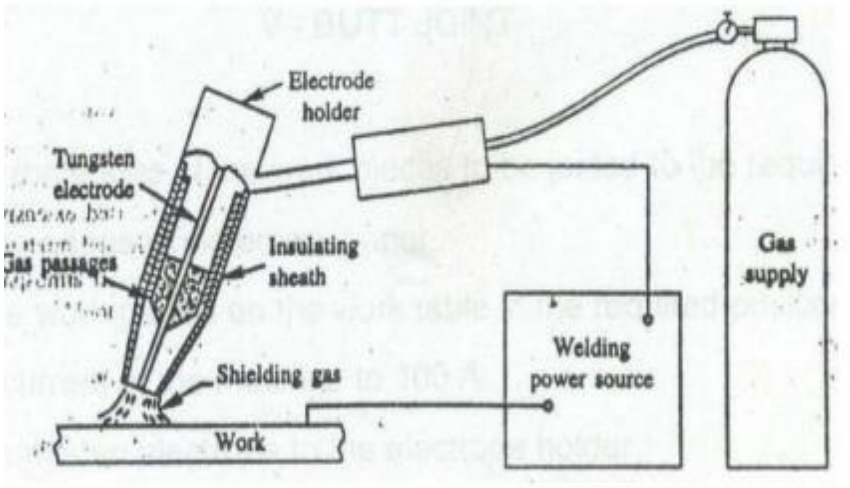
EXPERIMENT No.02 TUNGSTEN INERT GAS (TIG) WELDING

AIM: To prepare a V – Butt Joint Using TIG Welding.

MATERIAL AND APPARATUS REQUIRED: MS flat 50 x 60 X 10 mm3 ---2 No., Tong, Chipping Hammer, goggles Tungsten Electrode, Ceramic Nozzle and Filler rod, Transformer, Rectifier and Argon gas cylinder.

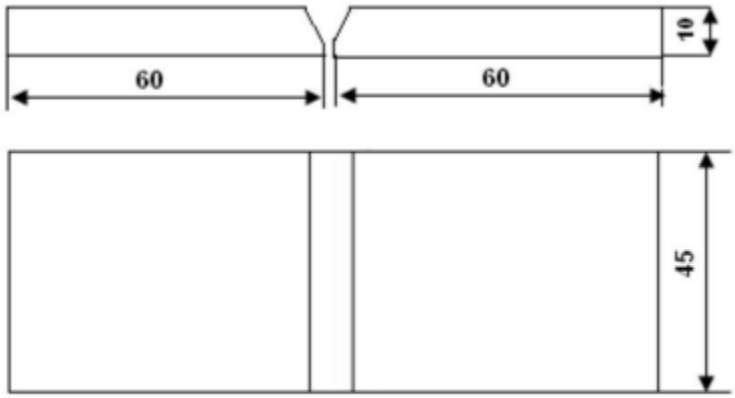
THEORY:

Tungsten inert gas (TIG) welding is as inert gas shielded arc welding process using non consumable electrode. The electrode may also contain 1 to 2% thoria mixed along with core tungsten or tungsten with 0.15 to 0.4% zirconia. The pure tungsten electrodes are less expensive but will carry less current. The thoriated tungsten electrodes carry high currents and are more desirable because they can strike and maintain stable arc with relative ease. The zirconia added tungsten electrodes are better than pure tungsten but inferior to thoriated tungsten electrodes. A typical TIG welding setup is shown in fig.



It consists of a welding torch at the centre of which is the tungsten electrode. The inert gas is supplied to the welding zone through the annular path surrounding the tungsten electrode to effectively displace the atmosphere around the weld puddle. The TIG welding process can be used for the joining of a number of materials though the most common ones are aluminum, magnesium and stainless steel. The power sources used are always the constant current type. Both DC and AC power supplies can be used for TIG welding. When DC is used, the electrode can be negative (DCEN) or positive (DCEP). With DCEP is normally used for welding thin metals where as for deeper penetration welds DCEN is used.

PROCEDURE:



V - BUTT JOINT

- Prepare the edges of the work pieces to be joined to the required V shape.
- Finish the edges using emery paper.
- Place the work pieces on the work table in the required position.
- Set the current of the machine to 100 A.
- Fix the tungsten electrode to the electrode holder.
- Required size of the nozzle is selected and it is fixed to the torch.
- Adjust the inert gas flow rate to the required rate.
- Select the filler rod (same as base metals) of required diameter.
- Touch the electrode to the work, so that current flow will be established and then separated by a small distance and the arc will be generated.
- First tack weld is done on the work pieces.
- Move the electrode slowly along the length of the joint with the filler rod, so that the filler metal will be deposited in the joint.
- Repeat the operation for the second pass, so that required amount of filler metal will be deposited on the work pieces.

PRECAUTIONS:

- Never look at the arc with the naked eye. Always use a shield while welding.
- Always wear the safety hand gloves, apron and leather shoes.
- Ensure proper insulation of the cables and check for openings.
- Select the parameters of the machine properly based on the metals to be welded.
- Set these parameters properly before performing the operation.
- Inflammable and combustible materials are removed from the vicinity of welding operations.

EXPERIMENT NO. 03 PATTERN DESIGN AND MAKING

AIM: To design and prepare a pattern for the casting made by malleable cast iron with consideration of suitable allowances.

MATERIALS: Teak wood

EQUIPMENT: Steel rule, Try square, Marking gauge, Rip saw, Tenon saw, Mortise chisel, Mallet, Jack plane, Wood rasp file, drilling machine.

PROCEDURE:

1. Pattern Design (Shrinkage and Machining allowances are taken into consideration)

• Calculate the amount of shrinkage allowance for each dimension of given casting drawing based on the cast material.

• Calculate the amount of shrinkage allowance for given casting material.

• Calculate the total amount of allowance provided on the pattern.

• Sum the allowance and actual dimension.

• Redraw the casting drawing with the dimensions including allowances.

2. Pattern Making

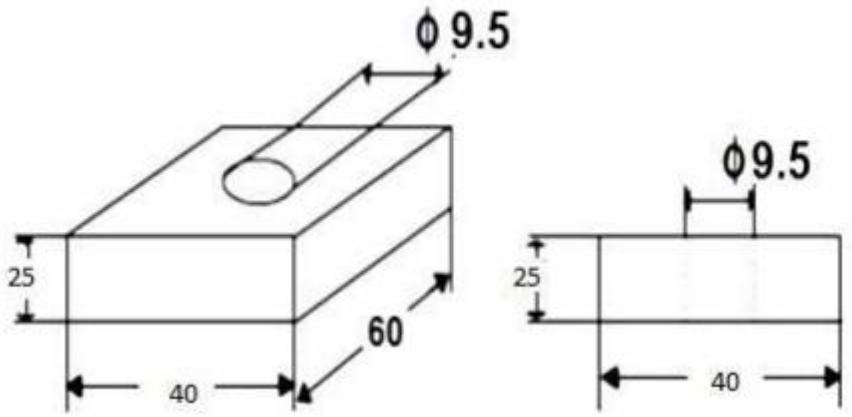
• Check the dimensions of wooden piece for pattern making and mark it according to the given dimensions.

• Sides of pieces are planned with jack plane for straightness.

• Wooden piece is cut by using sawing tools according to the dimensions given in redrawn casting drawing.

• Finish the same using wood rasp file.

• Fix the wooden piece in the drilling machine rigidly and Perform drilling operation according to the dimensions shown in fig.



Pattern drawing (without allowances)

Tabular Form:

Dimension No.	Actual Dimension	Machining Allowance	Total Dimension with M.A	Shrinkage Allowance	Total Dimension with S.A

PRECAUTIONS:

- Reaper should be free from moisture.
- Marking is done without parallax error.
- Care should be taken while cutting and drilling.

EXPERIMENT NO. 04 SAND MOULD MAKING

AIM: To prepare a mould for sand casting for given split piece pattern.

EQUIPMENT AND MATERIALS: Split piece Pattern, molding flasks, molding tools, green sand and additives.

PROCEDURE: **Mould Making**

• The first step in making mold is to place the pattern on the molding board.

• The drag is placed on the board.

• Dry facing sand is sprinkled over the board and pattern to provide a non sticky layer.

• Molding sand is then riddled in to cover the pattern with the fingers; then the drag is completely filled.

• The sand is then firmly packed in the drag by means of hand rammers. The ramming must be proper i.e. it must neither be too hard or soft.

• After the ramming is over, the excess sand is leveled off with a straight bar known as a strike rod.

• With the help of vent rod, vent holes are made in the drag to the full depth of the flask as well as to the pattern to facilitate the removal of gases during pouring and solidification.

• The finished drag flask is now rolled over to the bottom board exposing the pattern.

• Cope half of the pattern is then placed over the drag pattern with the help of locating pins. The cope flask on the drag is located aligning again with the help of pins.

• The dry parting sand is sprinkled all over the drag and on the pattern.

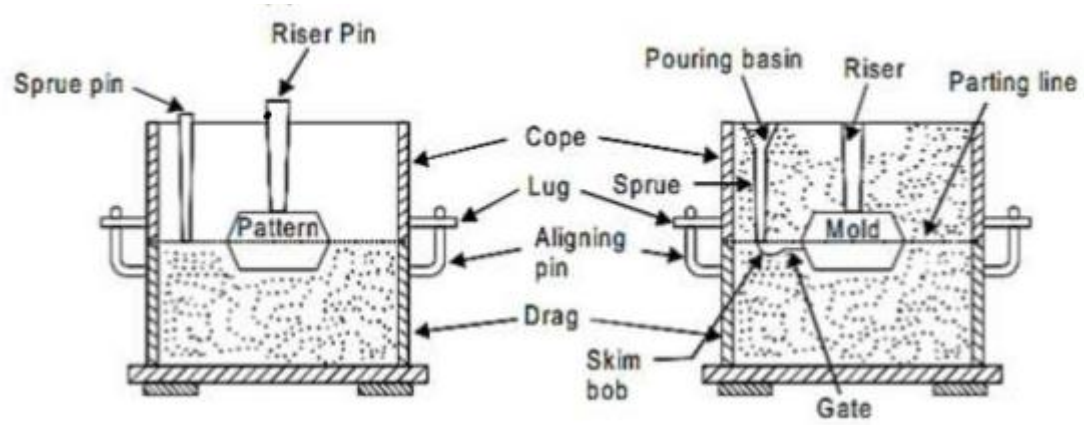
• A sprue pin for making the sprue passage is located at a small distance from the pattern. Also, riser pin, if required, is placed at an appropriate place.

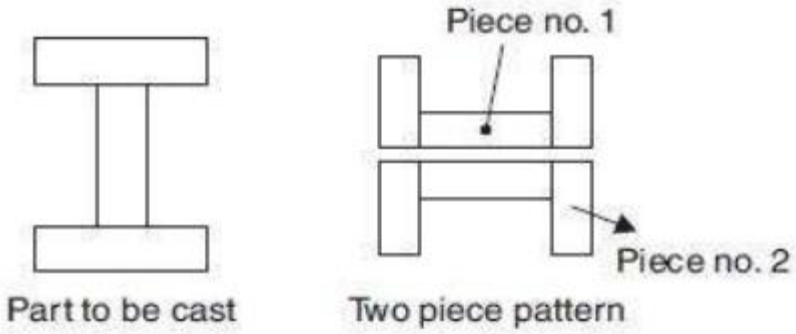
• The operation of filling, ramming and venting of the cope proceed in the same manner as performed in the drag.

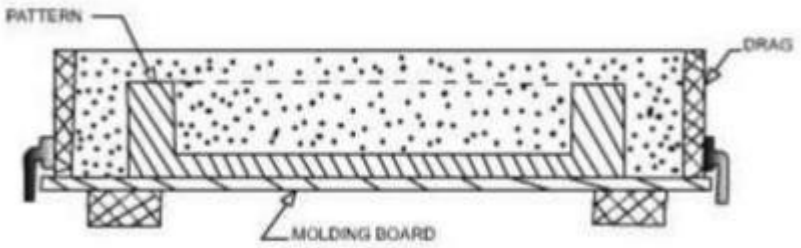
• The sprue and riser pins are removed first and a pouring basin is scooped out at the top to pour the liquid metal.

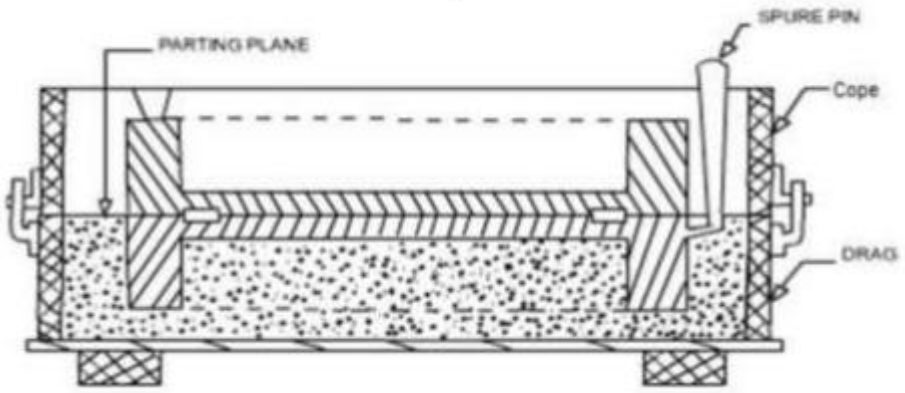
• Then pattern from the cope and drag is removed and facing sand in the form of paste is applied all over the mold cavity and runners which would give the finished casting a good surface finish.

• The mold is now assembled. The mold now is ready for pouring.









PRECAUTIONS:

- Ramming should be uniform to impart uniform strength to the mould.
- Apply parting sand at the partitions for ease separation of boxes.
- Locate the two halves of pattern properly to avoid mismatch.

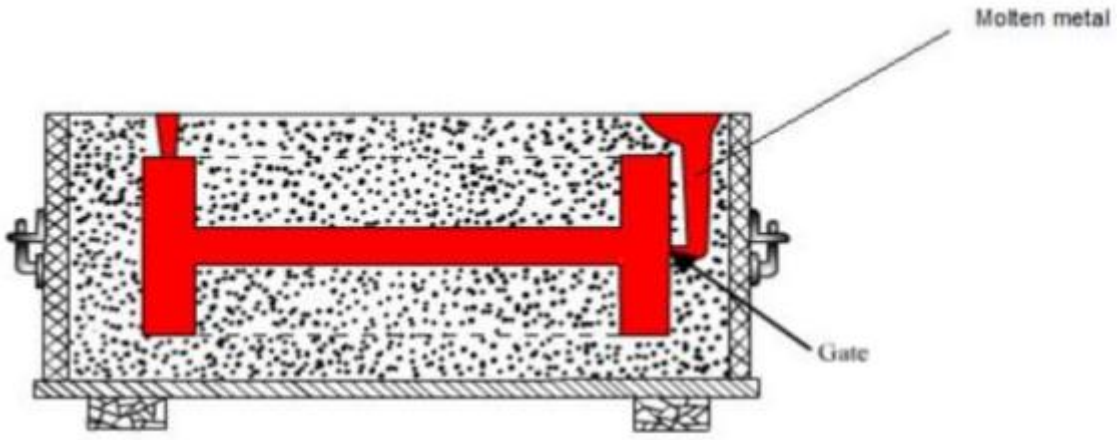
EXPERIMENT NO. 05 CASTING

AIM: To prepare a casting using mould made in experiment no.04 and use wax in place of molten metal.

MATERIAL AND EQUIPMENT: Wax, melting furnace, ladle, previously made mould, pyrometer.

PROCEDURE: melting and pouring

- Melt the wax in the furnace. Use appropriate fluxes at proper stages and measure molten wax temperature from time to time.
- Pour the molten wax into the pouring ladle at a higher temperature than the pouring temperature. As soon as the desired pouring temperature is reached, pour the molten metal into the mould in a steady stream with ladle close to the pouring basin of the mould. Do not allow any dross or slag to go in.
- Allow sufficient time for the wax to solidify in the mould. Break the mold carefully and remove the casting.
- Cut-off the riser and gating system from the casting and clean it for any sand etc.
- Inspect the casting visually and record any surface and dimensional defects observed.



PRECAUTION:

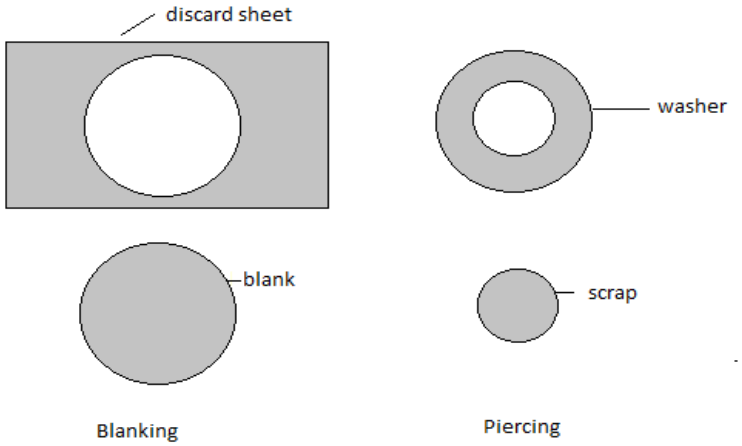
- Carefully handle the molten wax.
- Always pour the molten wax into the pouring ladle at a higher temperature than the pouring temperature.
- After solidification carefully break the mould.

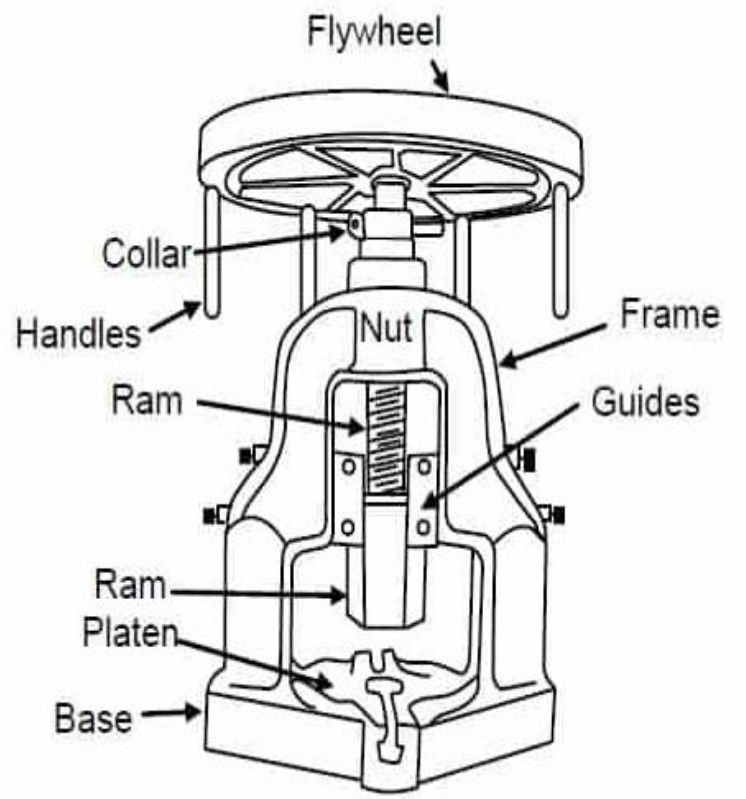
EXPERIMENT NO.06 MANUFACTURING OF WASHERS

AIM: To manufacture a washer using flywheel press.

MATERIAL AND EQUIPMENTS: aluminum sheet, flywheel press, dies.

THEORY: Blanking and **piercing** are shearing processes in which a punch and die are used to produce parts from coil or sheet stock. Blanking produces the outside features of the component, while piercing produces internal holes or shapes. The web is created after multiple components have been produced and is considered scrap material. The "slugs" produced by piercing internal features are also considered scrap. The terms "piercing" and "punching" can be used interchangeably.





PROCEDURE:

- Position the bottom part of the die just under the ram of the press.
- Place the material between the punch and die.
- Fix the top part of the die (punch) in the die holder and tighten it.
- Rotate the flywheel so that punch will move towards die.
- As the punch move downward punching and blanking operation take places and required washer is manufactured successfully.

EXPERIMENT NO.07 PREPARTION OF CHISEL FROM ROUND ROD

AIM: To make square head chisel from given mild steel round rod.

TOOLS REQUIRED: Smith's forge, Anvil, Steel rule, Hand Hammer, Sledge Hammer, Flat Tong, Round Tong, and Flatter.

PROCEDURE:

• The dimension of the given material is checked with steel rule.

• Suitable length the rod is heated to red hot condition with smith's forge.

• Holding the rod with round tong, the rod is placed on the anvil face. The top surface of the rod is then hammered such that two flat faces (at the top and bottom) are formed.

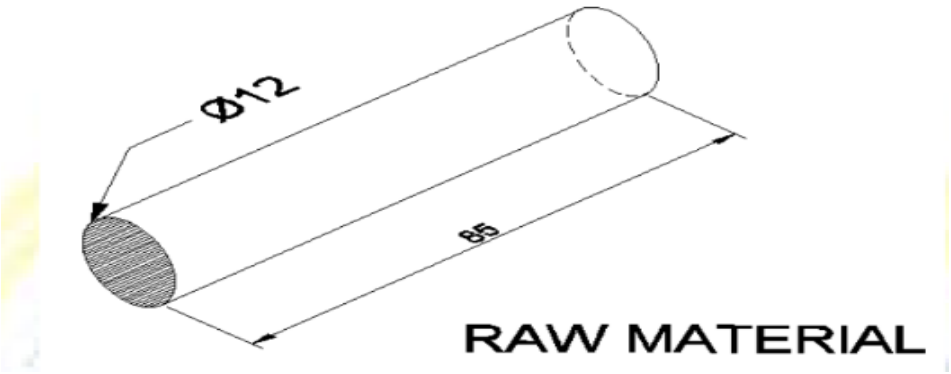
• The rod is turned through 900 and then faced on the anvil face. The top surface of the rod is then hammered such that the square shape is formed over half of the length of the rod.

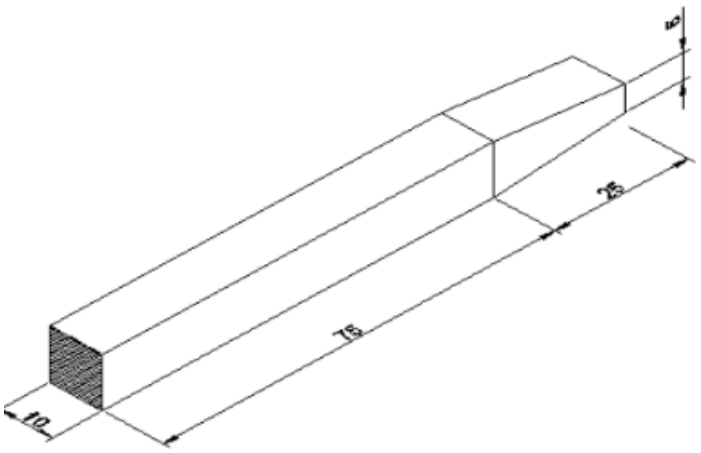
• Follow the above stages for the remaining length of the rod to obtain the square shape.

• The flat faces of the square shape are corrected if required using the flatter.

• Heat one end of the square rod and draw into thinner section and make it as a cutting edge of the chisel.

• Finally check the dimensions by using steel rule.





FINISHED SQUARE HEAD CHISEL

SAFETY PRECAUTIONS:

- Observe the work piece for proper heating.
- Hammering on the work piece should be done in red hot condition only.
- Proper tongs and hammers should be used.
- Beware of cloths, don’t expose them to heat.
- Don’t divert attention while working.

EXPERIMENT NO. 08 BLOW MOULDING

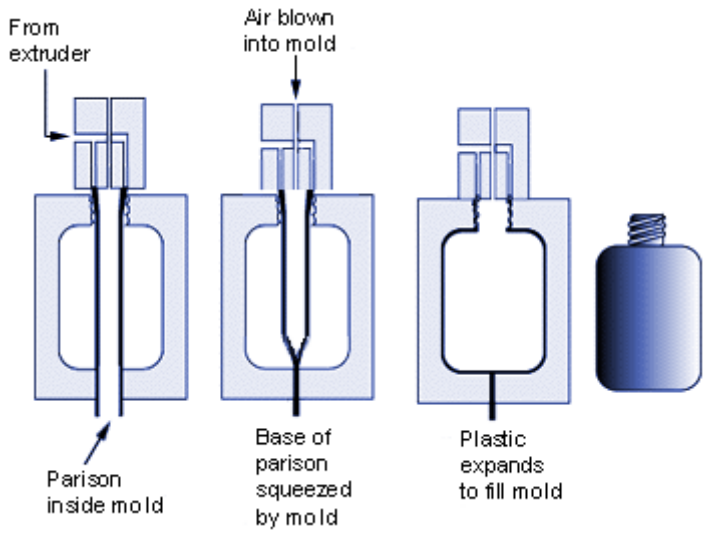
AIM: To prepare a bottle of 200ml using blow moulding machine.

APPARATUS REQUIRED: Die, blow-moulding equipment, air compressor.

MATERIALS REQUIRED: Plastic pellets

PROCEDURE:

- Set the die in position. Adjust the guide rod nuts to suit die height. Align the tapered face of the die for sealing the parison while blowing also checks for the face opening and closing of the die.
- Ensure minimum die height is 80mm. provide spacing plates if necessary.
- Set the injection, release and blow pressure by rotating (clockwise) the regulator knob to suit the requirement of moulding the container.
- Feed correct quantity & quality of plastic material and switch on the power supply.
- Switch on the heater.
- Set the required timings controller to control the bottom heater.
- Allow sufficient time to stabilize.
- When temperature reached, operate the hand lever valve.
- Extrude the parison (Tubular form) to the required length and close the two die halves. Release the injection cylinder
- Operate the hand lever valve and blow the air so that the parison to form the shape of the container as designed in the die.
- Allow the component to cool.
- Open the die & take the product out of the die.
- Now the machine is ready for nest cycle.



PRECAUTIOS:

- The material should not be heated rapidly.
- The die should be placed exactly below the nozzle.
- Proper temperature should be maintained while heating the plastic.

EXPERIMENT NO.09 INJECTION MOULDING

AIM: To Prepare a Plastic product using Injection Molding machine.

EQUIPMENT: Injection molding machine Setup.

MATERIAL REQUIRED: High grade poly ethylene

PROCEDURE:

• Pour the raw material in the hopper.

• Place the die in such a way that its hole coin sides with the central axis of the cylinder.

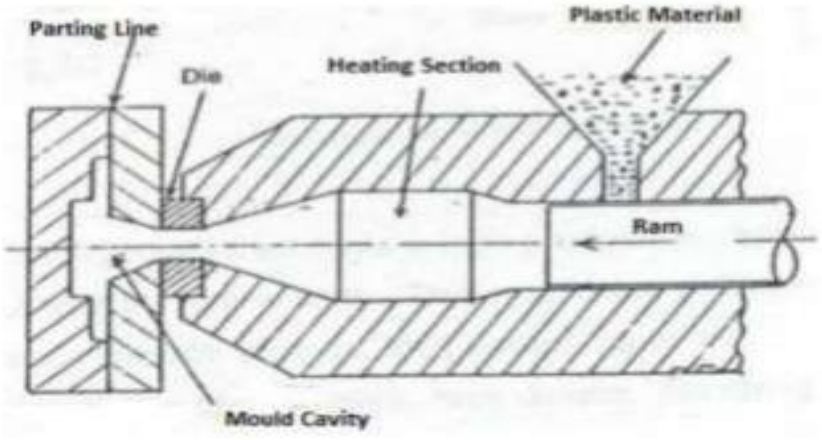
• Heat the cylinder by pouring plastic pallets in it.

• When the material is heated to desired temperature it softend.

• Press the lever so that the softened plastic will enter into the die and gets the desired shape of the mould.

• Allow it to cool for some time.

• Open the die and eject the article.



PRECAUTIONS:

- Align the opening of the die and an orifice of the cylinder carefully.
- Use gloves while holding die.