MANUFACTURING TECHNOLOGY

Exp. No:01 SINGLE V- BUTT JOINT

AIM:

To make a single V-butt joint, using the given mild steel flat pieces and by using Tungesten inert gas welding

MATERIALS USED:

Two mild steel flat pieces of 124 X 30 X 6 mm

TOOLS AND EQUIPMENTS USED:

Arc welding machine, Mild steel electrodes, Electrode holder, Ground clamp, Earth clamp, Flat nose Tong, Face shield, Ball peen hammer, Chipping hammer, wire brush, steel rule, hacksaw, try square and Grinding machine.

OPERATIONS TO BE CARRIED OUT:

1. Cutting and cleaning of the work pieces.
2. Filing
3. Tack welding
4. Full welding
5. Cooling
6. Chipping
7. Finishing

PROCEDURE:

1. Cut the two mild steel flat pieces of given dimensions and clean the Surface's thoroughly from rust, dust particles, oil and grease.
2. Remove the sharp corners and burrs by filing and prepare the work pieces for single V- butt joint.

3. The work pieces are positioned on the welding table to form a V-butt joint with the

required V- groove.

4. The arc is started with a tungsten electrode shielded by inert gas and filler rod is fed into the weld puddle separately. The gas shielding that is required to protect the molten metal from contamination and amperage are supplied during the TIG welding operation.

5. The ground clamp is fastened to the welding table.

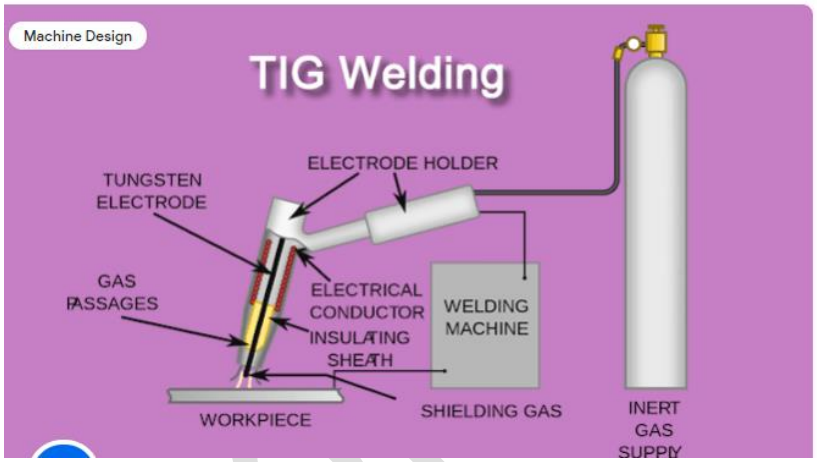
6. Wearing the apron, hand gloves, using the face shield, and holding the piece's, the arc is

struck and the work pieces are tack weld at the end of the both sides.

7. The alignment of the butt joint is checked and the tack weld pieces are reset, if required.

8. Welding is then carried out throughout the length of the butt joint.

9. Remove the slag, spatters and clean the joint.



RESULT:

The single V-butt joint is thus made, using the tools and equipments mentioned above.

SAFETY PRECAUTION:

1. Always wear uniform, shoes and gloves for safety.

2. Never operate any machines until you have been instructed properly.

3. Always wear goggles to protect your eyes from welding spark.

proper use and the safety risks involved with the machining operation.

4. Always be patient, never rush in the workshop.

5. Always use a guard when working on a machine.

6. Keep hands away from moving/rotating machinery.

Exp. No:2 MIG WELDING

AIM:

To make a MIG welding, using the given mild steel flat pieces and by using solid wire electrodes .

MATERIALS USED:

Two mild steel flat pieces of 124 X 30 X 6 mm

TOOLS AND EQUIPMENTS USED:

Arc welding machine, wire electrodes, Electrode holder, Ground clamp, Earth clamp, Flat nose Tong, Face shield, Ball peen hammer, Chipping hammer, wire brush, steel rule, hack saw, try square and Grinding machine. power source wire feed system,gun.

OPERATIONS TO BE CARRIED OUT:

1. Cutting and cleaning of the work pieces.

2. Filing

3.. Full welding

4. Cooling

5. Chipping

6. Finishing

PROCEDURE:

1. Cut the two mild steel flat pieces of given dimensions and clean the Surface's thoroughly from rust, dust particles, oil and grease.

2. Remove the sharp corners and burrs by filing and prepare the work pieces for joint.

3.MIG/MAG welding is a versatile technique suitable for both thin sheet and thick section components. An arc is struck between the end of a wire electrode and the workpiece, melting both of them to form a weld pool.

4. The wire serves as both heat source (via the arc at the wire tip) and filler metal for the welding joint. The wire is fed through a copper contact tube (contact tip) which conducts welding current into the wire. The weld pool is protected from the surrounding atmosphere by a shielding gas fed through a nozzle surrounding the wire. Shielding gas selection depends on the material being welded and the application.

5.The wire is fed from a reel by a motor drive, and the welder moves the welding torch along the joint line. Wires may be solid (simple drawn wires), or cored (composites formed from a metal sheath with a powdered flux or metal filling). Consumables are generally competitively priced compared with those for other processes. T

6. The process offers high productivity, as the wire is continuously fed

7. The ground clamp is fastened to the welding table.

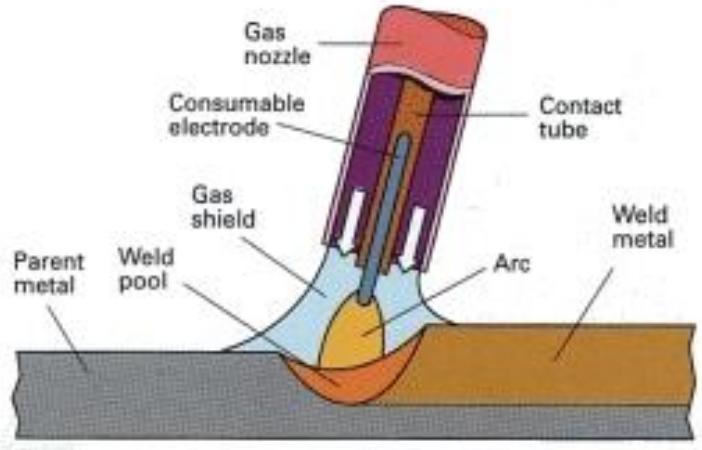
8. Wearing the apron, hand gloves, using the face shield, and holding the piece's, the arc is

struck and the work pieces are tack weld at the end of the both sides.

9.. The alignment of the butt joint is checked and the tack weld pieces are reset, if required.

10. Welding is then carried out throughout the length of the butt joint.

11. Remove the slag, spatters and clean the joint.



RESULT:

The single joint is thus made, using the tools and equipments mentioned above.

SAFETY PRECAUTION:

1. Always wear uniform, shoes and gloves for safety.

2. Never operate any machines until you have been instructed properly.

3. Always wear goggles to protect your eyes from welding spark.

proper use and the safety risks involved with the machining operation.

4. Always be patient, never rush in the workshop.

5. Always use a guard when working on a machine.

6. Keep hands away from moving/rotating machinery.

Exp. No:03 CASTING

AIM:

To Prepare a sand mould using a given single piece pattern.

TOOLS AND EQUIPMENTS USED:

Molding board ,molding boxes, rammer trowel, lifter,gate cutter,riser, runner, sprue pinand and other moulding tools.

THEORY:

ONE PIECE OR SOLID PATTERN

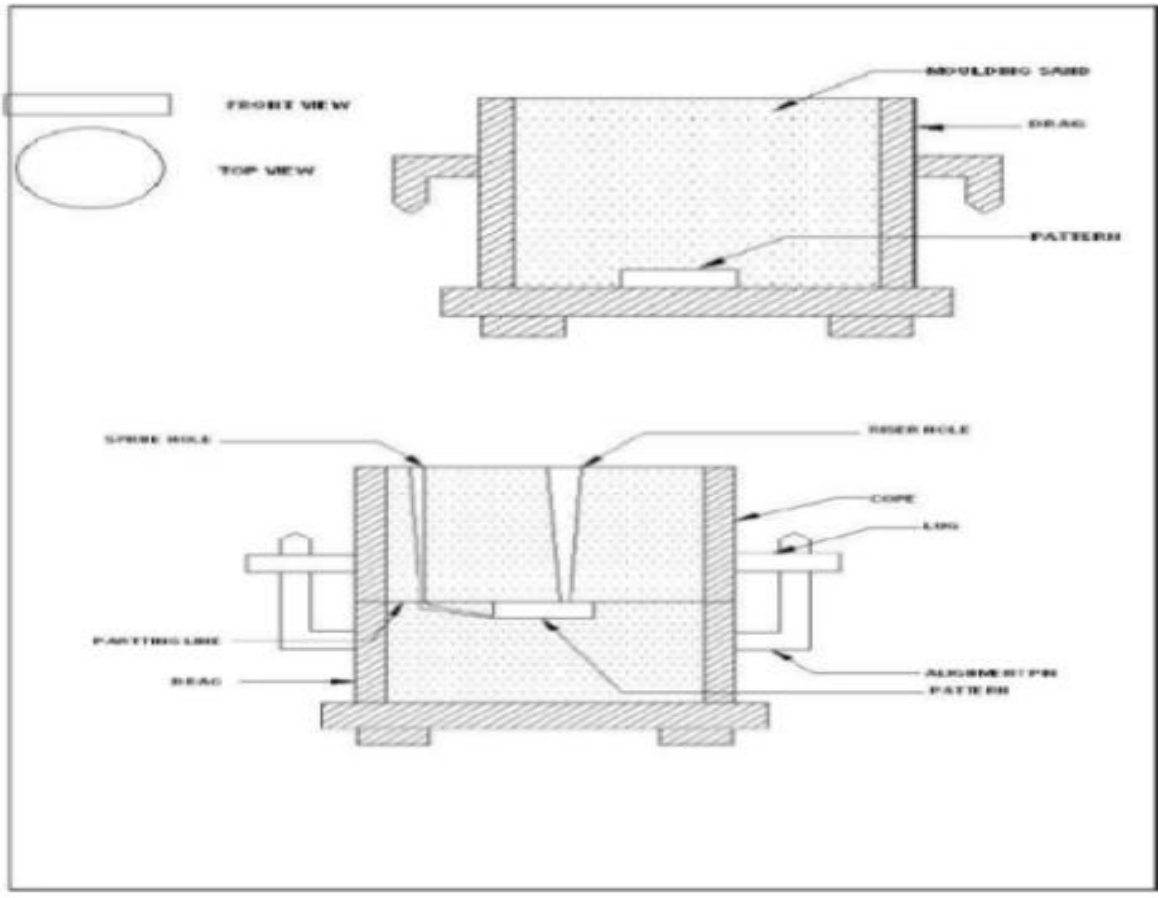
- It is simplest type of pattern. As the name suggest the pattern is made from one piece and does not contain loose piece or joints.
- It is expensive. It is used for making a few large size simple castings.
- Stuffing box of steam engine may be cast with the help of one piece pattern
- One piece pattern is usually made up of wood or metal depending upon the quantity of casting to be produced.

PROCEDURE:

- The mould box, pattern, tools and the table/floor are cleaned.
- The drag is filled with green sand after positioning the round on the table.3.
- The green sand is rammed carefully and the excess sand is struck off.4
- Tilt the drag upside down and sprinkle river sand on top of it.5.
- The cope is positioned on top of the drag.6.
- Position the square pin, then fill the cope with sand and ramming is done and the excess sand is struck off.7.
- Remove the sprue pin and the riser pin carefully.8.
- • Apply water on the edges of the pattern and remove it carefully using the draw spike and then finish the cavity.9.
- Vent holes are made using vent wire.10.
- A funnel shaped opening and gate is made to pour the molten metal.

RESULT:

Thus the mould cavity of the given solid single piece pattern is obtained.



Exp. No:04 CASTING

AIM:

To Prepare a sand mould using a given split pattern.

TOOLS AND EQUIPMENTS USED:

Molding board ,molding boxes, rammer trowel, lifter,gate cutter,riser, runner, sprue pinand and other moulding tools.

THEORY:

SPLIT PATTERN

- Patterns of complicated shape cannot be made of one piece because of inherent difficulties associate with moulding operation. Such patterns are made as split or two piece pattern.
- The upper and the lower part of the split pattern are accommodated in the cope and drag portions of the mould respectively.
- Dowel pins are used for keeping the alignment between the two parts of the pattern.
- Taps and Water stop-cocks are produced with the help of split pattern.

PROCEDURE:

- The mould box, pattern, tools and the table/floor are cleaned.
- The drag is filled with green sand after positioning the round on the table.3.
- The green sand is rammed carefully and the excess sand is struck off.4
- Tilt the drag upside down and sprinkle river sand on top of it.5.
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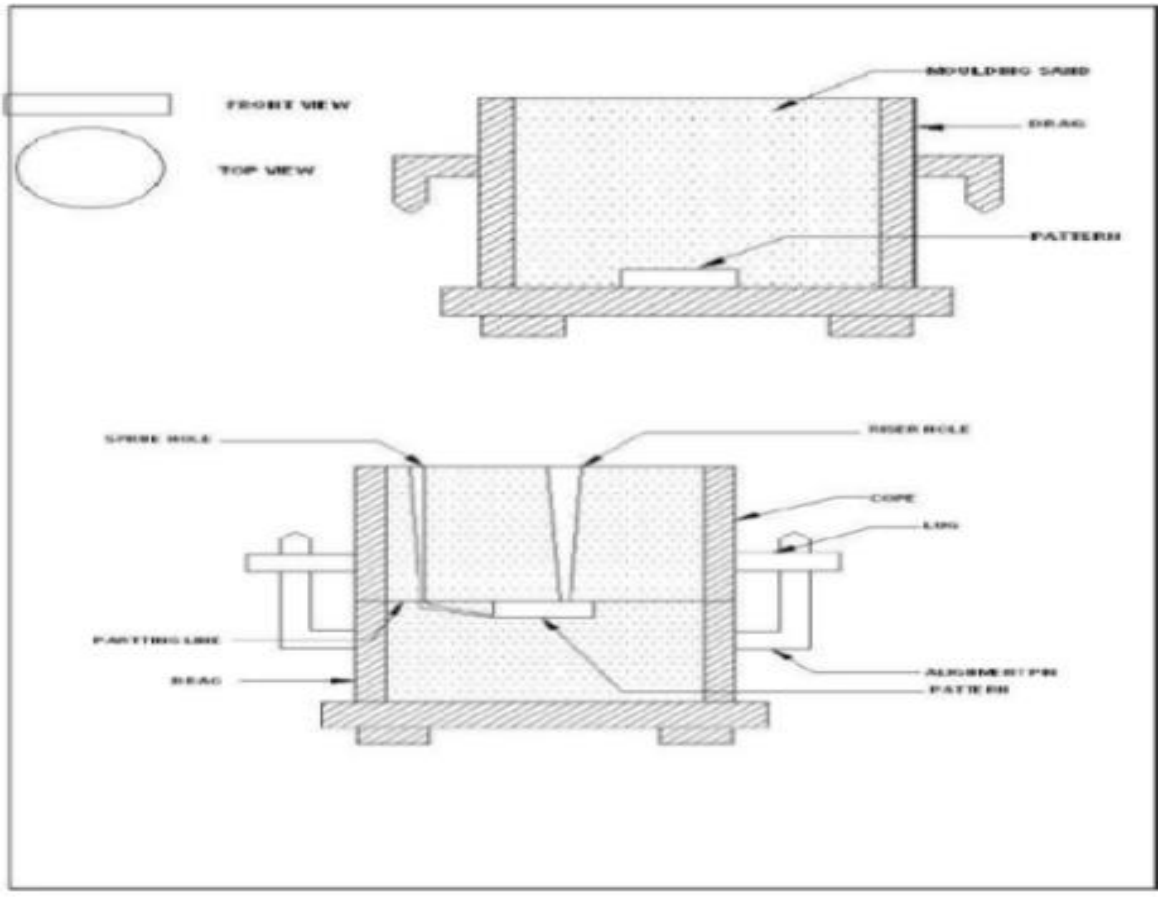
- Position the square pin, then fill the cope with sand and ramming is done and the excess sand is struck off.7.
- Remove the sprue pin and the riser pin carefully.8.
- • Apply water on the edges of the pattern and remove it carefully using the draw spike and then finish the cavity.9.
- Vent holes are made using vent wire.10.
- A funnel shaped opening and gate is made to pour the molten metal.

RESULT:

Thus the mould cavity of the given solid, split pattern is obtained.



Exp. No: 05 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.s Tong, Chipping Hammer, goggles Tungsten Electrode, Ceramic Nozzle and Filler rod. EQUIPMENT REQUIRED: Transformer, Rectifier and Argon gas cylinder.

THEORY:

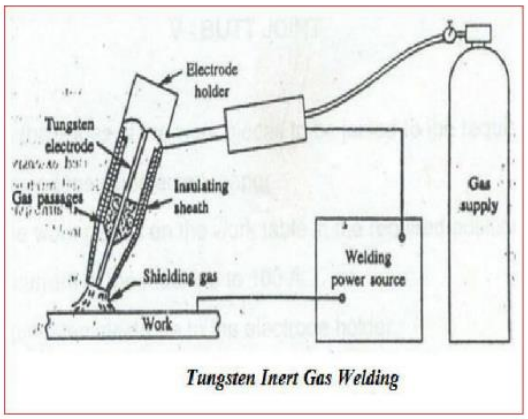
The Endeavour of welder is always to obtain a joint which is as strong as the base metal and at the same time, the joint is as homogeneous as possible. To this end, the complete exclusion of oxygen and other gases which interfere with the weld pool to the detriment of weld quality is very essential. In manual metal arc welding, the use of stick electrodes does this job to some extent but not fully. In inert gas shielded arc welding processes, a high pressure inert gas flowing around the electrode while welding would physically displace all the atmospheric gases around the weld metal to fully protect it. The shielding gases most commonly used are argon, helium, carbon dioxide and mixtures of them. Argon and helium are completely inert and therefore they provide completely inert atmosphere around the puddle, when used at sufficient pressure. Any contaminations in these gases would decrease the weld quality. Argon is normally preferred over helium because of a number of specific advantages. It requires a lower arc voltage, allows for easier arc starting and provides a smooth arc action. A longer arc can be maintained with argon, since arc voltage does not vary appreciably with arc length. It is more economical in operation. Argon is particularly useful for welding thin sheets and for out of position welding. The main advantage of Helium is that it can with stand the higher arc voltages. As a result it is used in the welding where higher heat input is required, such as for thick sheets or for higher thermal conductivity materials such as copper or aluminium.

Carbon dioxide is the most economical of all the shielding gases. Both argon and helium can be used with AC as well as DC welding power sources. However, carbon dioxide is normally used with only DC with electrode positive.

TUNGSTEN INERT GAS (TIG) WELDING:

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

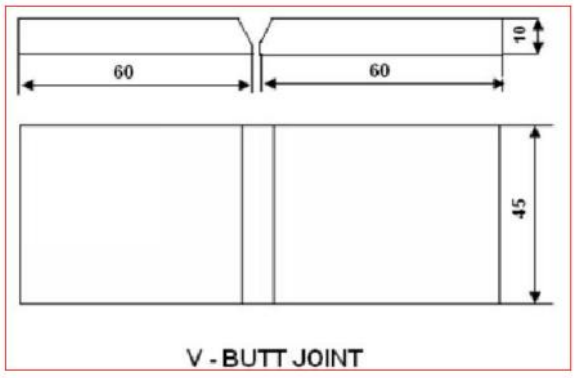
and maintain stable arc with relative ease. The zirconia added tungsten electrodes are better than pure tungsten but inferior to thoriated tungsten electrodes. A typical TIG welding setup is shown in fig.



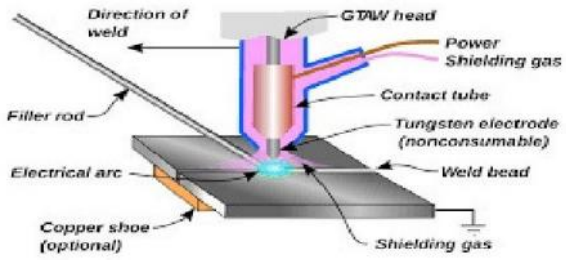
Tungsten Inert Gas Welding

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 aluminium, 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 fro deeper penetration welds DCEN is used. An Ac arc welding is likely to give rise to a higher penetration than that of DCEP.

PROCEDURE:



V - BUTT JOINT



1. Prepare the edges of the work pieces to be joined to the required V shape.

2. Finish the edges using emery paper.

3. Place the work pieces on the work table in the required position.

4. Set the current of the machine to 100 A.

5. Fix the tungsten electrode to the electrode holder.

6. Required size of the nozzle is selected and it is fixed to the torch.

7. Adjust the inert gas flow rate to the required rate.

8. Select the filler rod (same as base metals) of required diameter.

9. 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.

10. First tack weld is done on the work pieces.

11. 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.

12. Repeat the operation for the second pass, so that required amount of filler metal will be deposited on the work pieces.

PRECAUTIONS:

1. Never look at the arc with the naked eye. Always use a shield while welding.

2. Always wear the safety hand gloves, apron and leather shoes.

3. Ensure proper insulation of the cables and check for openings.

4. Select the parameters of the machine properly based on the metals to be welded.

5. Set these parameters properly before performing the operation.

6. Inflammable and combustible materials are removed from the vicinity of welding operations.

RESULT:

Exp. No :06 **PATTERN DESIGN AND MAKING**

AIM: To Design and Manufacture a Wooden Pattern for a given Casting.

MATERIAL REQUIRED:

Teak wood of 50 x 50 x 50 mm3

EQUIPMENT AND TOOLS REQUIRED:

Hack Saw, Jack Plane, Steel Rule, Wood Working Lathe, Drill bit, Boring Tool, Vernier Calipers and Emery Paper.

THEORY:

1. A pattern is a mold forming tool in the hands of foundry men.

2. A pattern is the model or the replica of the object to cast.

3. Except for the various allowances a pattern exactly resembles the casting to be made

4. A pattern may be defined as a model or form around which sand is packed rise to a cavity known as mould cavity in which when molten metal is poured, the result is CAST OBJECT

Functions of a Pattern:

1. A pattern prepares a mold cavity for the purpose of making a casting.

2. A pattern may contain projections known as core prints if the casting requires a core and need to be hallow.

3. Runner, gates and risers (used for introducing and feeding molten metal to the mold cavity) may form the part of the pattern.

4. pattern may help in establishing locating points on the mold and therefore on the casting with a purpose to check the casting dimensions.

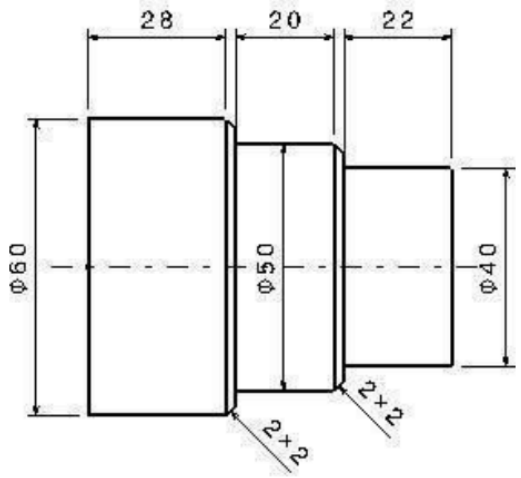
5. Pattern establishes the parting line and parting surfaces in the mold.

6. Patterns properly made and having finished and smooth surfaces reduce casting defects.

7. Properly constructed patterns minimize overall cost of the castings.

Pattern Making Machines:

Besides the hand tools, a modern pattern makers shop needs some power-driven machines also. These machines help the pattern maker in Increasing production. Improving accuracy and maintaining consistency in the patterns. Prepare a split wooden pattern of stepped pulley detailed below with allowance.



PROCEDURE:

1.The given work piece is prepared using the Jack plane.

2.The work piece is cut by using sawing tools according to the dimensions

3.Finish the same using wood rasp file

4.Fix the work piece on wood working lathe.

5.Fix a drill of required diameter in the tail stock.

6.Perform drilling operation according to the dimensions Fix a boring tool in tool post.

7.Finish the work using emery paper.

PRECAUTIONS:

1. The work piece should be held rigidly in the vice while performing cutting operation.

2. The work piece should be held rigidly in the chuck of lathe.

3. Make sure that the axis of drill coincides with the axis of work.

4. Optimum machining conditions should be maintained.

RESULT:

Exp. No :07 INJECTION MOULDING

AIM: To make an air tight bottle cap by using injection moulding.

EQUIPMENT :

Injection moulding machine.

MATERIALS REQUIRED :

Plastic pellets.

THEORY:

Plastics: Polymers can be divided into three broad divisions: plastics, fibers and elastomers (polymers of high elasticity, for example, rubber). Synthetic resins are usually referred to as plastics. Plastics derive their name from the fact that in a certain phase of their manufacture they are present in a plastic stage (that is acquire plasticity), which makes it possible to impart any desired shape to the product. Plastics fall into a category known chemically as high polymers. Thus Plastics is a term applied to compositions consisting of a mixture of high molecular compounds (synthetic polymers) and fillers, plasticizers, stains and pigments, lubricating and other substances. Some of the plastics contain nothing but resin (for instance, polyethylene, polystyrene).

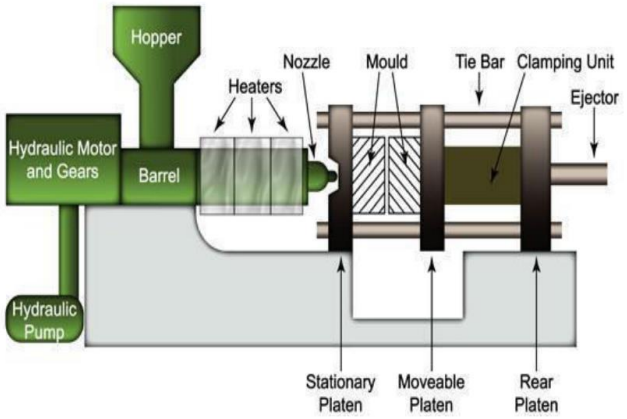
Types of Plastics: Plastics are classified on the broad basis of whether heat causes them to set(thermosetting) or causes them to soften and melt(thermoplastic).

Thermosetting Plastics: These plastics undergo a number of chemical changes onheating and cure to infusible and practically insoluble articles. The chemical change is not reversible. Thermosetting plastics do not soften on reheating and cannot be reworked. They rather become harder due to completion of any left over polymerization reaction. Eventually at high temperatures, the useful properties of the plastics get destroyed. This is called degradation. The commonest thermosetting plastics are: alkyds, epoxides, melamines, polyesters, phenolics and ureas.

Thermoplastic Plastics: These plastics soften under heat, harden on cooling, and can beresoftened under heat. Thus they retain their fusibility, solubility and capability of being repeatedly shaped. The mechanical properties of these plastics are rather sensitive to temperature and to sunlight and exposure to temperature may cause thermal degradation. 60 Common thermoplastics are: acrylics, poly tetra fluoro ethylene (PTFE), polyvinyl chlorides (PVC), nylons, polyethylene, polypropylene etc.

Injection Moulding: An important industrial method of producing articles of thermoplastics is Injection Mouilding (shown in fig.). The process is essentially as follows The moulding material is loaded into a

hopper from which it is transferred to a heating section by a feeding device, where the temperature is raised to 1500 C – 3700 C and pressure is built up. The material melts and is forced by an injection ram at high pressure through a nozzle and sprue into a closed mould which forms the part. The mould is in at least two sections, so that it may be split in order to eject the finished component. For the process to be competitive the mould must be fairly cool (between ambient temperature and the softening point of the plastic) and consequently the mould must be cooled by circulating air.



PROCEDURE:

Injection moulding makes use of heat softening characteristics of thermo plastic materials. These materials soften when heated and re hardens when cooled. No chemical change takes place when the material is heated or cool. For this reason the softening and re hardening cycle can be repeated any no. of times. 1. The pellet form of plastic is introduced into the container through hopper.

2. The plastic pellet enters into the container. The container is heated with the coil, which is wounded around it.

3. The plastic of powder form is converted into molten stage at a temperature of 80o C.

4. The die is placed exactly below the nozzle of the container.

5. The melted plastic is injected into the die with the help of lever arm and it is allowed to solidify say for about one minute.

6. Then retract the lever arm slightly and open the mould.

7. Then eject the mould piece of the required shape from the die.

PRECAUTIONS:

1. The material should not be heated rapidly.

2. The die should be placed exactly below the nozzle.

3. Proper temperature should be maintained while heating the plastic.

RESULT:

Air tight bottle cap is prepared by using injection moulding.

Exp. No.08 BLOW MOULDING

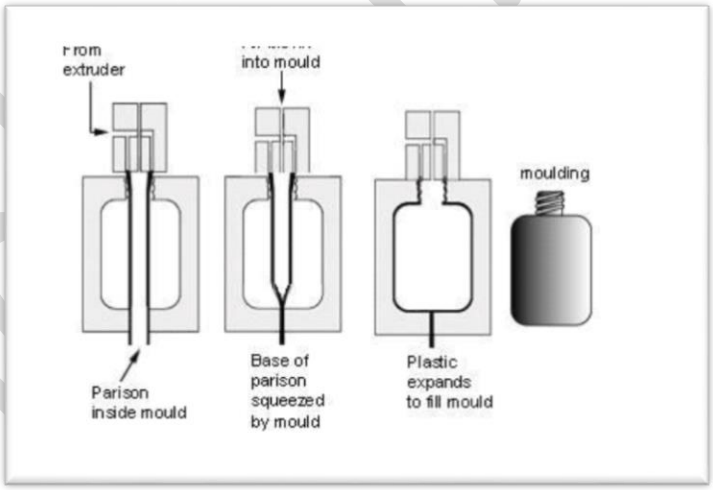
AIM: To prepare a bottle of 200ml using blow moulding machine.

EQUIPMENT:

Blow moulding machine.

MATERIAL REQUIRED:

Low grade poly ethylene.



THEORY:

Working Principle: The process is applied to only thermo plastics, which are used for producing hollow objects such as bottle, and flow table objects by applying air pressure to the sheet material when it is in heated and in soft pliable condition. Blow moulding can be accomplished in two manners; one is direct blow moulding and other indirect blow moulding. In the former case, a measured amount of material in

the form of tube is either injected or extruded in a split cavity die. The split mould is closed around the tube, sealing off the lower end. The air under pressure is blown into the tube, which causes the tube to expand to the walls of cavity. In the latter case, a uniformly softened sheet material by heat is clamped at the edges between the die and cover, which causes the sheet to attain a hemispherical shape or the configuration of mould whatever it may be parts obtained by indirect blow moulding have excellent appearance but they are more costly as only to percent of the sheet stock is utilized and also there is a tendency for excessive thinning of sheet at the deepest point.

PROCEDURE:

1. 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.

2. Ensure minimum die height is 80 mm. provide spacing plates if necessary.

3. Set the injection, release and blow pressure by rotating (clockwise) the regulator knob to suit the requirement of moulding the container.

4. Feed correct quantity & quality of plastic material and switch on the power supply.

5. Switch on the heater.

6. Set the required timings controller to control the bottom heater.

7. Allow sufficient time to stabilizer.

8. When temperature reached, operate the hand lever valve.

9. Extrude the parison (Tubular form) to the required length and close the two die halves. Release the injection cylinder.

10. 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.

11. Allow the component to cool.

12. Open the die & take the product out of the die.

13. Now the machine is ready for nest cycle.

PRECAUTIONS:

1. Send hot pressurized air with in the range.

2. Care about die

3. Care about person

RESULT:

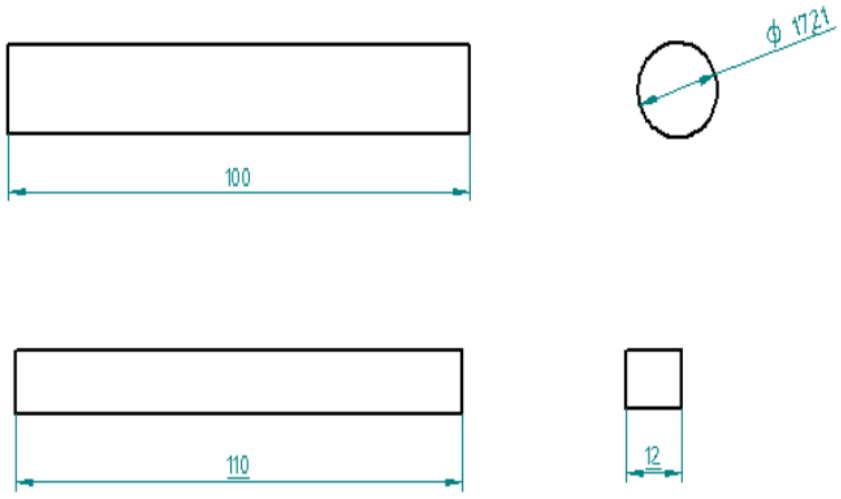
Required product is made using blow moulding process.

Exp. No.09 HOT FORGING

AIM: To prepare a tow jobs using hot forging .

Tools Required: Anvil, Sledge Hammer, Tongs, Fatter, Furnace.

(1) To forge a square rod from a given round rod.



PROCEDURE:

1. Cut the raw material to the required length using a hacksaw frame.

2. Dip a piece of cotton waste in Kerosene oil and place it on the furnace.

3. Place small dry wooden pieces on the cotton waste.

4. Ignite the furnace

5. After few minutes of burning, add coal to the furnace.

6. Switch on the blower to supply necessary air for burning

7. After the flame is stabilized, place the specimen to be forged on the hot coal pieces.

8. The specimen is heated till it red hot. (Temperature around 1000 – 1300° C).

9. When the material is in the red hot state, it is said to be in the plastic state.

10. The red hot specimen is then placed on the anvil and held by tongs

11. Hit the job hard by using the sledge hammer by holding one end with the help of tongs.

12. Change the position of the job and repeat hammering to change the rod from round to square.

13. Repeat heating and hammering until the required shape is obtained.

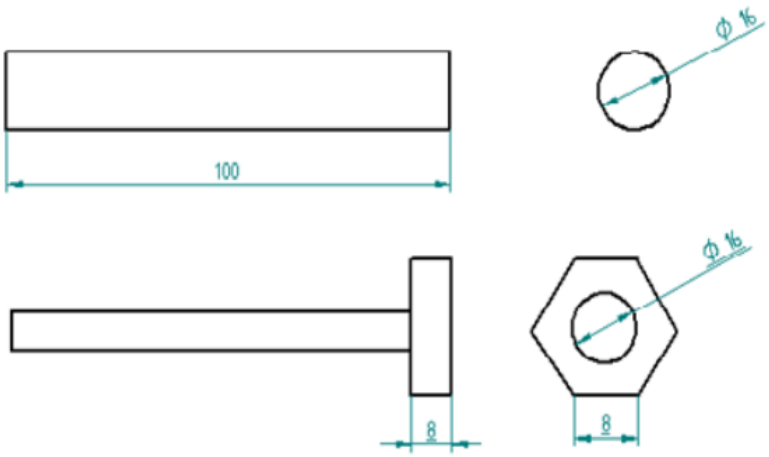
14. A flatter is used to obtain a fine finish on the job.

15. Finally, the job is cooled by dipping in water.

RESULT:

Thus the round rod is transferred to a square rod for the given dimensions as shown in the figure.

(2) To forge a Hexagonal Headed Bolt from a round rod of dia 16mm



PROCEDURE:

1. Cut the raw material to the required length using a hacksaw frame.

2. Calculate the final length of the hexagonal bolt by performing the volume calculations as shown.

3. Dip a piece of cotton waste in kerosene oil and place it on the furnace.

4. Place small dry wooden pieces on the furnace.

5. Ignite the furnace

6. After few minutes of burning add to the furnace.

7. Switch on the blower to supply necessary air for burning

. 8. After the flame is stabilized, place the specimen to be forged on the hot coal pieces.

9. The specimen is heated till turns red hot, (Temperature around 1000 – 1300° C).

10. When the Specimen turns red hot, remove the specimen with the help of tongs.

11. When the material is in the red hot state, it is said to be in the plastic state.

12. The red hot specimen is then placed on the anvil and held by tongs.

13. One end of the bar is heated in the furnace to the plastic state.

14. When the job is red hot hammer it from the top end of the rod, holding the job carefully while hammering.

15. Repeat Hammering until a round head is formed.

16. Turn the job for 60° and repeat hammering to change the round rod to hexagon.

17. Repeat Heating and Hammering until the required head is obtained.

18. The job is then consequently heated to get the required head is obtained.

19. The job is then consequently heated to get the required shape of the bolt as shown in the figure .

Volume Calculations:

To find the final length of the forged component

(1): dΠVolume of the raw material = 2 / 4 *L ----------(1)

Diameter of the raw material = d = 16 mm

Length of the raw material = L = 100 mm

Therefore substituting in the equation 1 we have:

Volume of the raw material =20109 mm2

Volume of the raw material = Volume of the forged component dΠ20109 mm2= 2 / 4 *1 ----------(2)

Where D = Diameter of the forged component = 12 mm Therefore Substituting the value of D in Equation 2 we have:

1 = 140mm The final length of the forged component is 140 mm.

The flatter then used to get a fine job on the surface. Finally, the job is then cooled by dipping it in water.

RESULT:

Thus the hexagonal bolt is obtained for the given dimensions as shown in the figure