FOUNDRY

INTRODUCTION : Founding has been used for shaping metals since the earliest days of civilization. A wide variety of sizes and shapes of simple and intricate nature can be produced using different metals. Founding or casting is the process of producing metal alloy component parts of desired shapes by pouring the molten metal alloy to cool and solidify. The solidified piece of metal alloy is known as a casting.

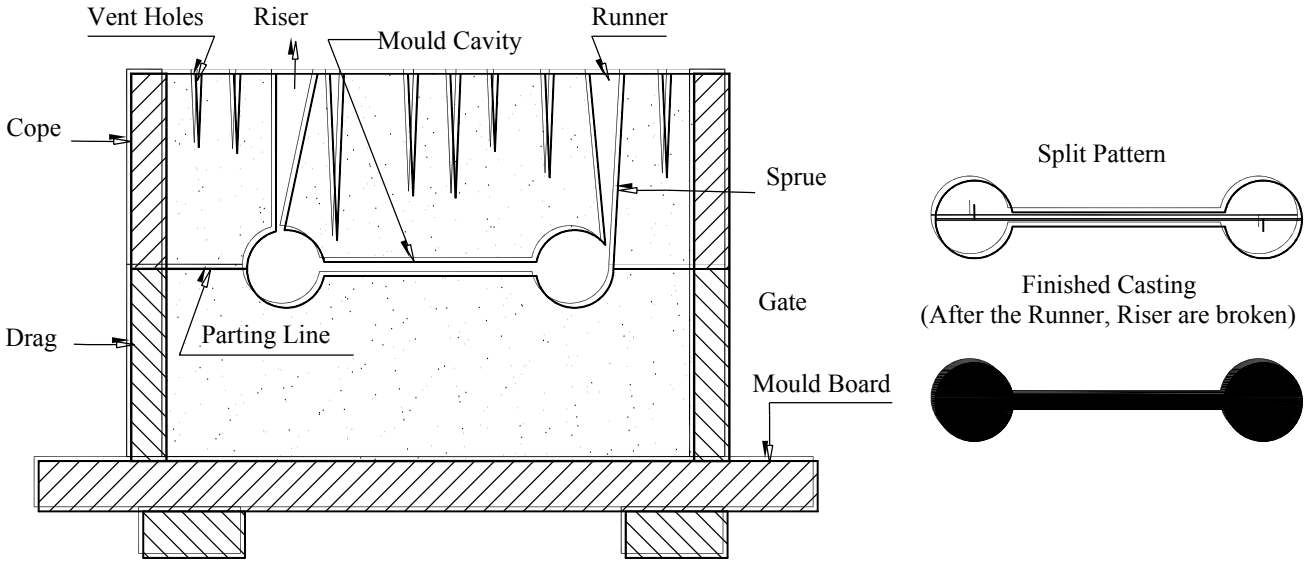
MOULD : Mould is a container (of sand or metal) having a cavity of the shape to be cast.

CORE : Core is a body (of sand etc) which is employed to produce a cavity in the casting.

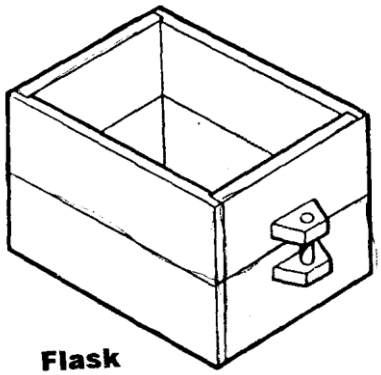
PATTERN : It is a replica of same size and shape of the casting to be produced.

STEPS INVOLVED IN MAKING A CASTING

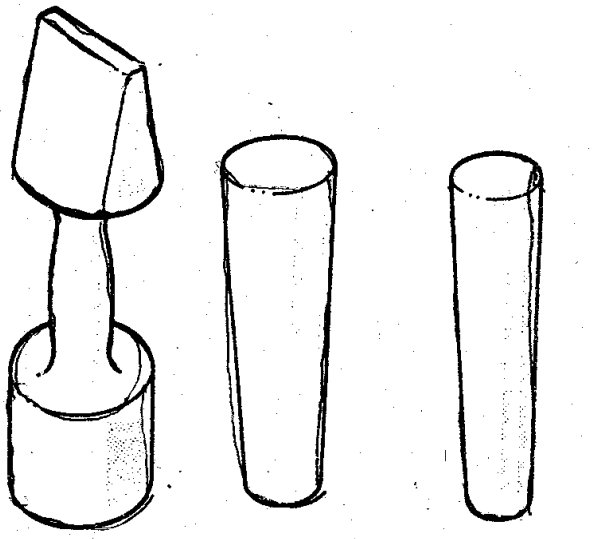
1) Making the pattern out of wood, metal or plastic.
2) In case of sand casting, test and prepare the necessary sand mixtures for mould and core making.
3) With the help of patterns prepare the mould and necessary cores.
4) Melt the metal alloy to be cast.
5) Pour the molten metal alloy in to the mould and remove the casting from the mould after the metal solidifies.
6) Clean and finish the casting.
7) Test and inspect the casting.
8) Remove the defects if any.
9) Relieve the casting stresses by heat treatment.
10) Again inspect the casting.



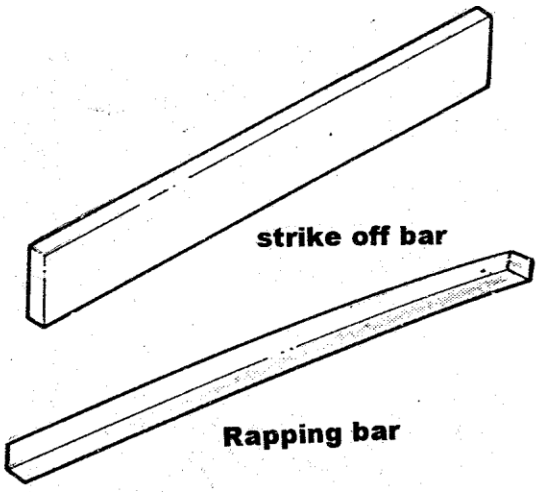
Foundry Lab Tools Sketches



Flask

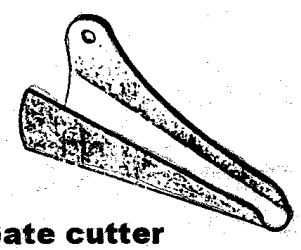


Rammer Riser pin Sprue pin

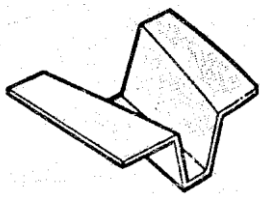


strike off bar

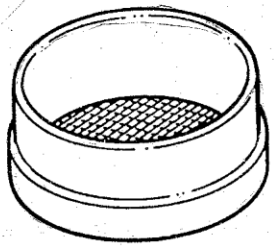
Rapping bar



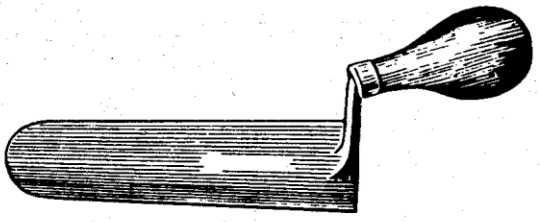
Gate cutter



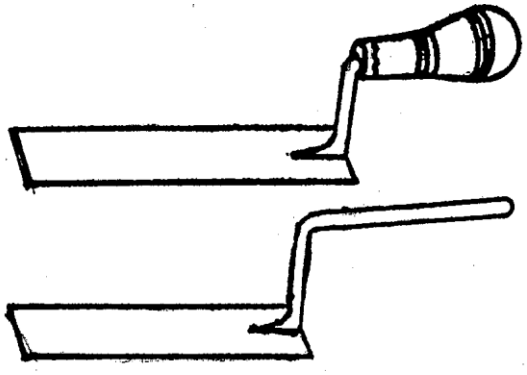
gate cutter



Riddle (sieve)



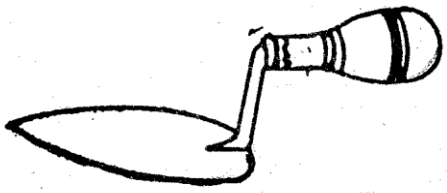
Moulders Trowel



English trowels

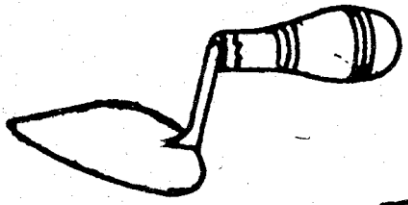
Leaf and Square

Leaf and Spoon

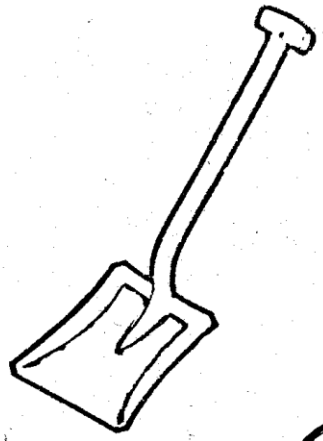


Long heart trowel

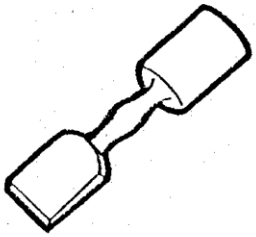
Scotch Cleaner



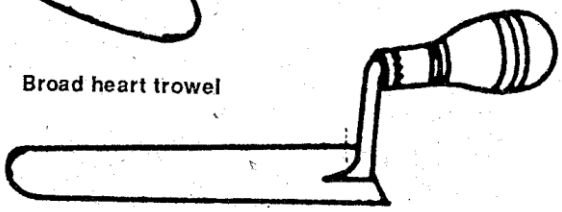
Broad heart trowel



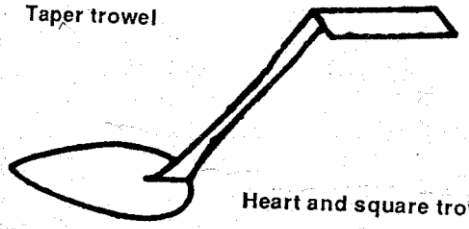
sand shovel



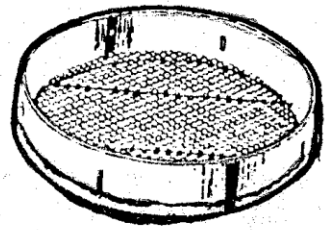
wooden hand rammer



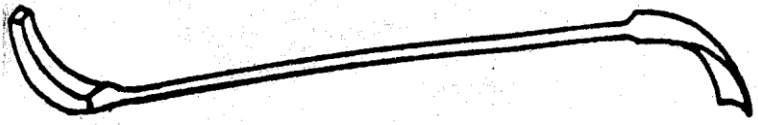
Taper trowel



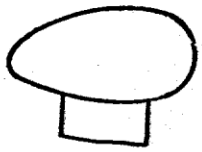
Heart and square trowel

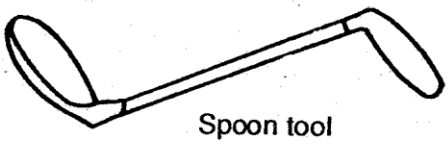


sieve for facing sand

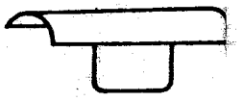


Flange bed



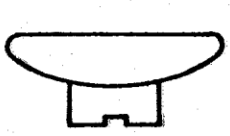


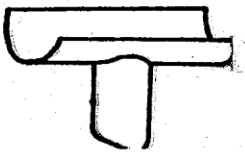
Spoon tool

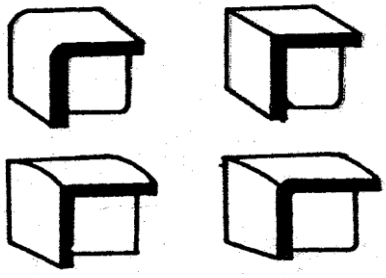


Spoon tool is convenient for cutting the pouring basin.

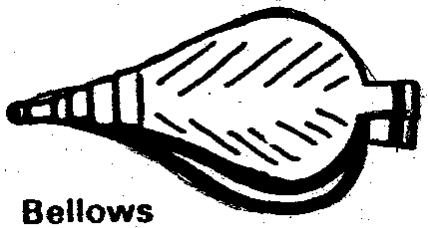
Safe edge heart and upset





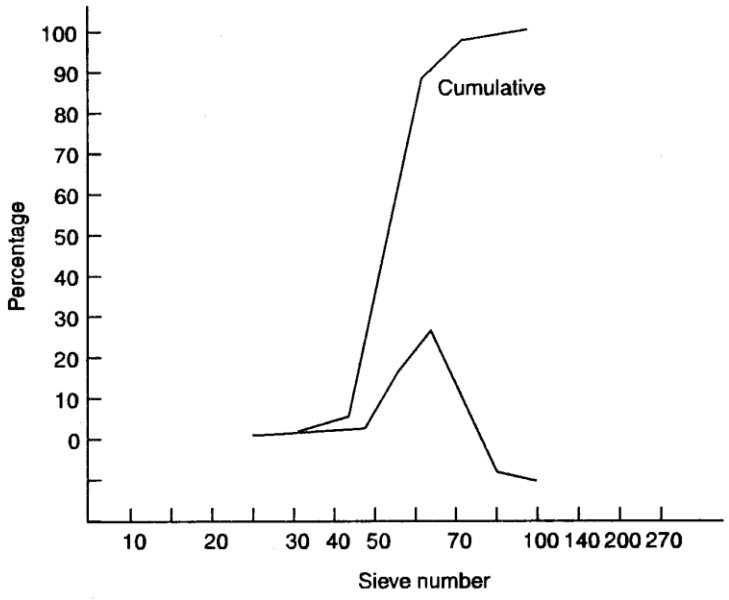


Smoothers

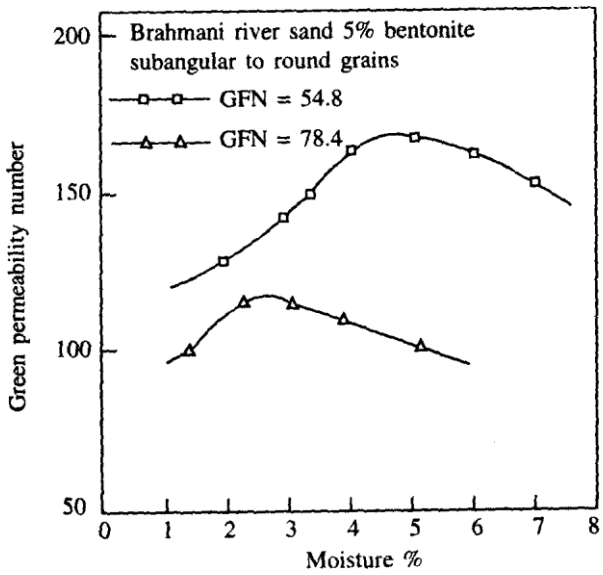


Bellows

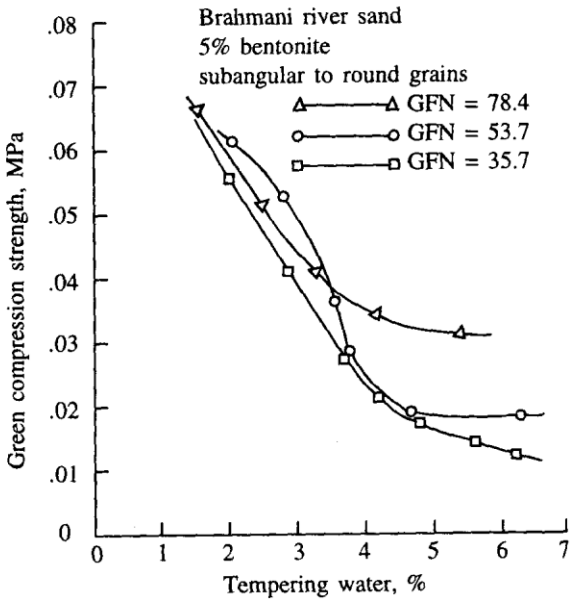
Graphs



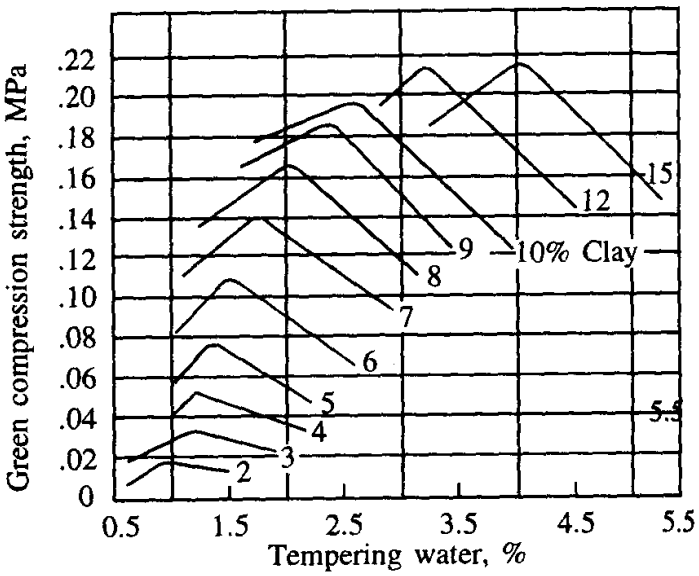
Sand grain size distribution.



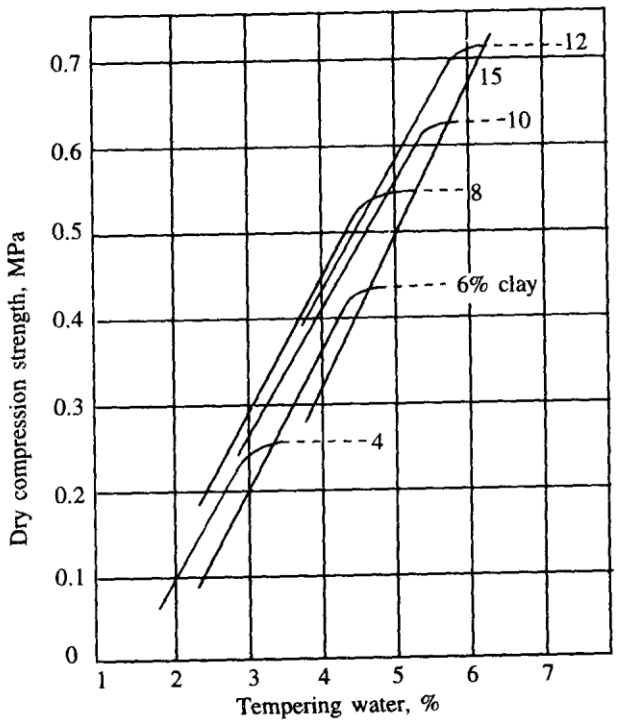
Variation of permeability with grain size



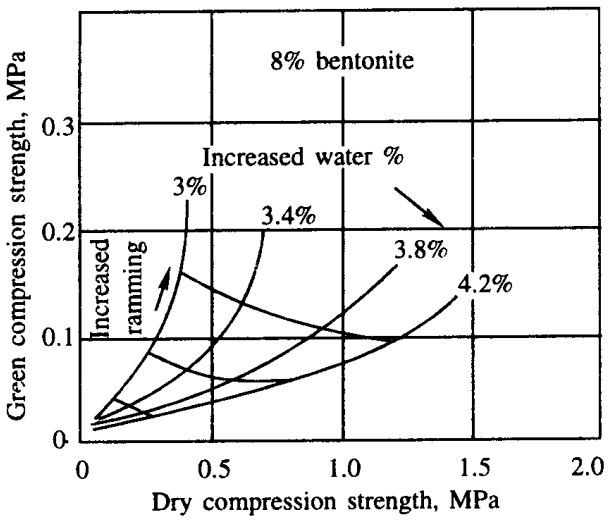
Variation of green compression strength with sand grain size



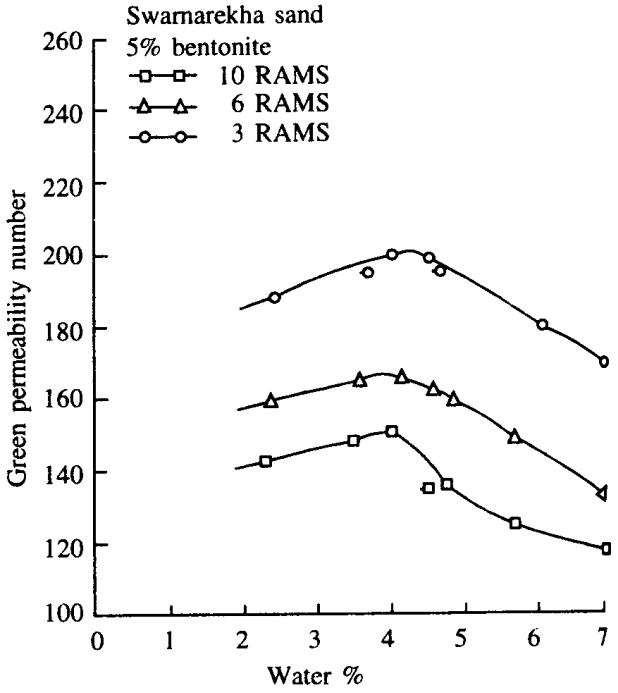
Variation of green compression strength with clay and water



Variation of dry compression strength with water content



Interrelation between sand properties with various constituents



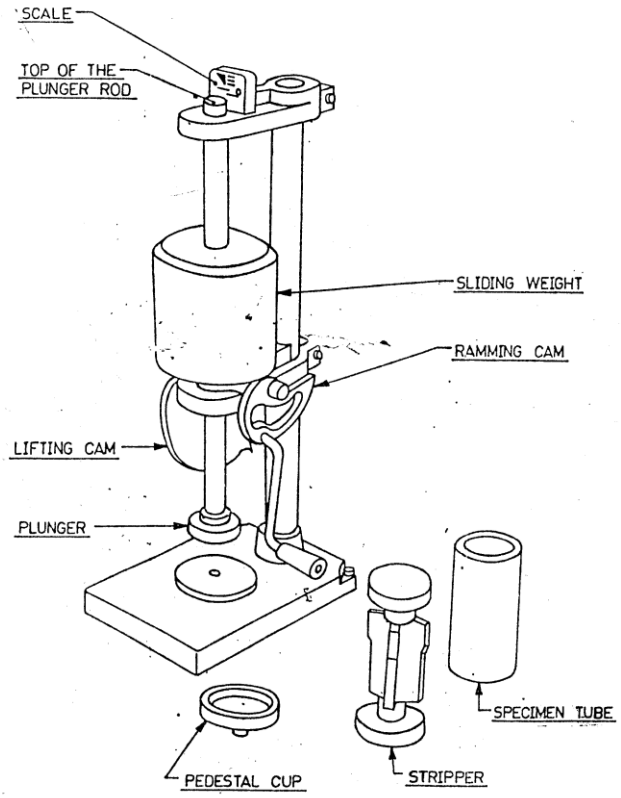
Change in the permeability of moulding sand with the degree of ramming

Experiment No 1

COMPRESSION AND SHEAR STRENTH OF FOUNDRY SAND

AIM: To determine the compression and shear strength of a given foundry sand (green and dry) using the universal sand testing machine.

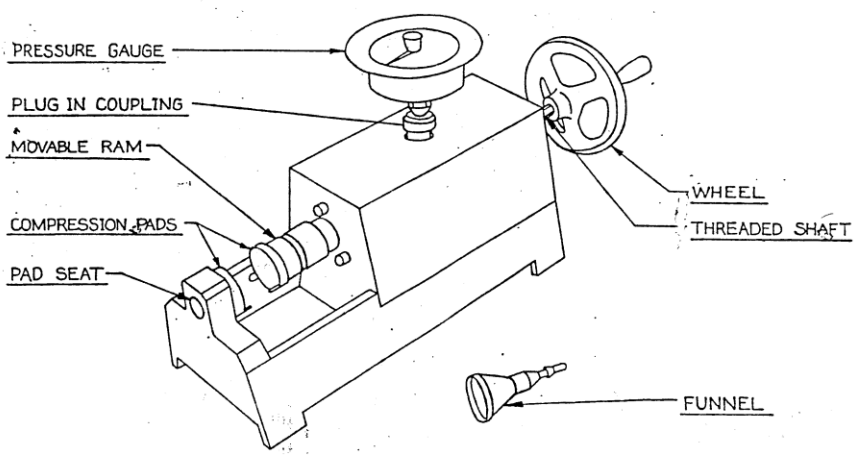
SAND SPECIMEN RAMMER



APPARATUS: Sand rammer, electronic weighing machine, universal sand testing, machine, compression and shear load shackles.

SAND PREPARATION: About 150 gms of sieved foundry sand is mixed thoroughly with specified proportions of linseed oil and bentonite oil. (1.5% to 2% for green sand. 2%to3% for dry sand) in a sand mixer or in a tray.

UNIVERSAL SAND STRENGTH TESTING MACHINE



PROCEDURE:

1) Take 145 to 150 gms of seiwed prepared sand. 2) Mix it thoroughly with specified percent of water that is 5%,6%,7%,8%,9%10%. etc. 3) Fill the Prepared sand into the specimen tube 4) Place the specimen tube below the sand rammer. 5) Prepare the standard specimen of dia 50mm and height 50 mm using sand rammer. 6) Release the cam and ram the

sand by giving three blows. 7) Insert the stripper to remove the specimen from the specimen tube. 8) Fix the compression shackles to the Universal Sand Strength Testing machine in respective position as shown fig. 9) Place the prepared specimen between the compression shackles, so that the plain surface of the specimen come against the compression shackles. (Shear shackles in the case of shear strength) 10) Rotate the hand wheel of the Universal sand strength testing machine clockwise until the load starts applying on specimen. (This is noticed by the movement of pressure gauge needle) 11) Continue to rotate the hand wheel of the machine uniformly at about 16 rpm, till the specimen collapses. 12) The red pointer also moves along with the needle, when the specimen collapses the block needle returns while the red pointer remains at the point on the scale reading where the specimen collapsed. 13) Compression scale and shear scale on the same pressure gauge are chosen to determine compression strength and shear strength respectively. 14) Take minimum three reading for different percent of moisture content and take the average. 15) Plot the graphs i.e., C-S, v/s moisture content and shear strength v/s moisture content (for both green and dry sand).

As soon as the sample collapses the needle returns while the red pointer remains at the maximum reading before collapse of the specimen. To read compression strength use C-S scale and to read shear strength use s-s scale, indicated by the idle pointer. Take minimum four readings for different percent of moisture content and take the average. Plot the graphs, i.e., C-S v/s moisture content and S-S v/s moisture content (for both green & dry sand).

RESULT:

A) (i) Compression strength of green sand :
(ii) Compression strength of dry sand :
B) (i) Shear strength of green sand :
(ii) Shear strength of dry sand :

TABULATION

Compression strength of green sand

Sl. No.	% of moisture	Compression strength in gm/cm^2	Average
1			
2			
3			
4			

Compression strength of dry sand

Sl. No.	% of moisture	Compression strength in gm/cm^2	Average
1			
2			
3			
4			

Shear strength of green sand

Sl. No.	% of moisture	Compression strength in gm/cm^2	Average
1			
2			
3			
4			

Shear strength of dry sand

Sl. No.	% of moisture	Compression strength in gm/cm^2	Average
1			
2			
3			
4			

DRAW THE GRAPHS OF :

1) Compression strength of green sand v/s percentage of moisture content.
2) Compression strength of dry sand v/s percentage of moisture content.
3) Shear strength of green sand v/s percentage of moisture content.
4) Shear strength of dry sand v/s percentage of moisture content.

Experiment No 2

TENSILE STRENGTH OF FOUNDRY SAND

AIM: To determine the tensile strength of a given foundry sand (green and dry) specimen**.**

APPARATUS: Universal sand strength testing machine, Tensile strength attachment. It consists of a movable and a stationary jaw with rollers guide bracket, 2 rods and knurled screw, sand rammer, electronic weighing machine.

PROCEDURE: 1) Prepare the sand specimen using the same procedure adopted for compression strength test. 2)The tensile specimen is placed in the specimen holder jaws carefully. 3) Follow the same loading procedure adopted for compression strength till specimen breaks. 4) Read the tensile strength (T-S) directly on inner scale. 5) Repeat the experiment for different moisture content specimen and plot the graph T-S v/s moisture content (for both green and dry sand).

RESULT:

(i) Tensile strength of green sand :
(ii) Tensile strength of dry sand :

TABULATION:

Tensile strength of green sand:

SL. No.	% of moisture	Tensile strength in gm/cm^2	Average

Tensile strength of dry sand:

SL. No.	% of moisture	Tensile strength in gm/cm^2	Average

Graphs:

1) Tensile strength of green v/s moisture content.
2) Tensile strength of dry v/s moisture content.

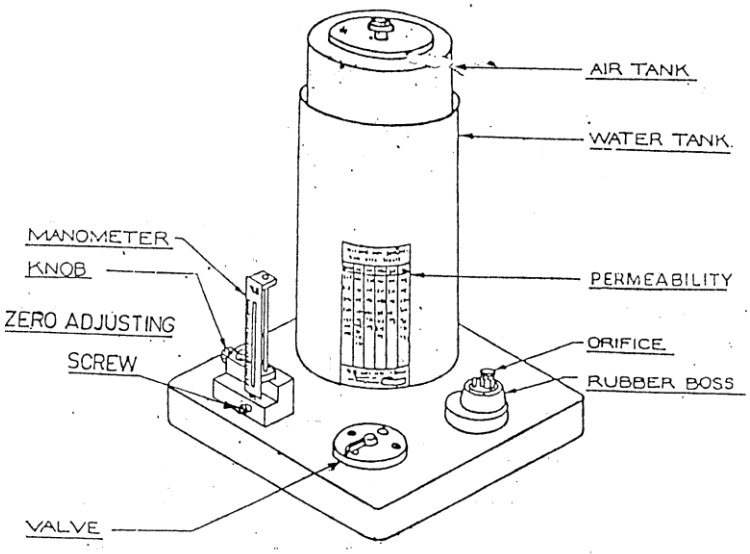
Experiment No 3

PERMEABILITY TEST OF SAND

AIM: To determine the permeability of foundry sand at different percent of moisture and to draw a graph of permeability number v/s percentage of moisture content.

APPARATUS: Sand rammer, permeability tester.

PERMEABILITY METER



PROCEDURE: 1) Since permeability is the property of rammed sand, a standard sized sand specimen is first rammed by a sand rammer and is then used in the permeability tester for finding its permeability. 2) 2000cc of air held in the inverted bell jar is forced to pass through the sand specimen. 3) A condition comes when the air entering the specimen equals to the air escaped through the specimen (to atmosphere). This gives a stabilized pressure reading (p) on the monometer and same can be read on the vertical scale. 4) Simultaneously using a stopwatch the time (T) required for the 2000cc of air to pass through the sand specimen is also recorded. 5) Finally find out the permeability or permeability number using the following relation.

Permeability number $= \frac{V.H}{A.P.T}$

Where V = Volume of air passed through the specimen =2000cc
H = Height of the specimen = 5.08 cm
A = Area of the specimen = 20.268 cm^2
T = Time (in minutes) taken by the 2000cc of air to pass through the sand specimen.
P = Air pressure recorded by the manometer = gm/cm^2

Repeat the experiment for different percentage of water content and plot the graph: permeability number v/s percentage of water content.

RESULT:

OBSERVATIONS

Tabulation:

SL. No	% of water	Time in minutes	Permeability number.
1			
2			
3			
4			

Graph:

Permeability Number V/s percentage of moisture.

Experiment No 4

MOISTURE CONTENT TEST ON FOUNDRY SAND

Define moisture content
Moisture content is defined as the amount of water present which is driven off at a temperature of 105° to 110°c expressed as a percentage by weight of the moist sand.

The moisture content of a sample of sand is determined by
i) Weighing out 100 grams of material
ii) dry it in an oven at a temperature between 105^0c to 110°c
iii) cool it in a dessicator to room temperature. iv) Weigh it again to find the loss.
v) The difference between the first and final weight of the sample will equal the original moisture content
vi) Report the exact percentages of moisture determined.
vii) Express moisture as percentage of moist sample.

Example: 1
If 100 gms of moist sand, when dried, weigh 90 grams, the moisture content is (100- 90)=10.
10/100=10%

Example:2
If a 50 gram sample of moist sand weighs 47.5 grams after heating and cooling as directed, the percentage of moisture in the sand sample was $\frac{(50-47.5)\times 100}{50} = \frac{2.5}{50} = 5\%$ moisture.

Sl. No.	Quantity of Foundry sand	Initial Weight	Final weight	Percentage of moisture
1	Sample 1			
2	Sample 2			
3	Sample3			

Experiment No 5

CLAY CONTENT TEST

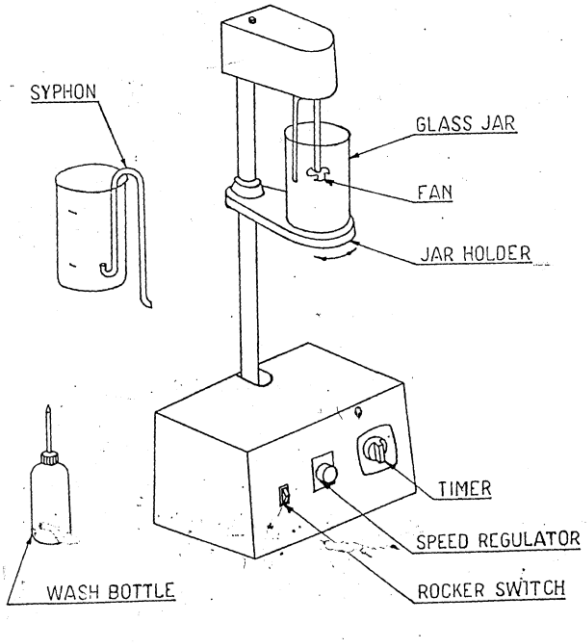
AIM: To determined the percentage of clay present in the foundry sand.

APPARATUS: Clay washer, glass jar, siphon, wash bottle, electronic weighing machine, electronic oven**.**

THEORY: Clay is responsible for bonding sand particles together, clay influences strength, permeability and other moulding sand properties.

Preparation of alkaline solution: Weigh 30gms of sodium hydroxide, dissolve it in 500cc of distilled water and make the volume to 1000cc by adding distilled water**.**

CLAY WASHER



PROCEDURE: 1) Take dried sand sample of 50gms in to glass gar and fill halfway with water. 2) Add 10cc of alkaline solution of sodium hydroxide. 3) Fill up the glass jar with distilled water up to 1000cc mark. 4) Turn jar holder side and hold the jar as shown in the diagram and take the jar holder under it. 5) Keep the jar on jar holder. Let the solution stir for 8-10minutes. 6) Remove the glass jar and rinse sand and fines adhering to the stirrer in to the glass jar by means of wash bottle. 7) Allow the sand to settle for 8-10 minutes then fill the siphon with fresh water and insert short leg in to glass jar as shown in figure to siphon out the muddy water. 8) Again add 10cc of sodium hydroxide solution, refill the glass jar with water up to1000cc, and stir for 5minutes. 9) Remove the glass jar and rinse sand and fines adhering to stirrer in to glass jar by means of wash bottle. 10) Allow the sand to settle for 5minutes. Then again siphon out muddy water. 11) Continue the procedure till clear solution free of clay obtained. Transfer the washed sand with water in to the sieve and dry completely under infrared lamp or in the electric oven. Allow it to cool and weigh the same. Find out percentage of the clay by following formula.

$$\text{PERCENTAGE OF CLAY} = \frac{A - B}{A} \times 100$$

Where A= Weight of the dry sand sample.
B= Weight of the washed and dried sand sample.

Result:

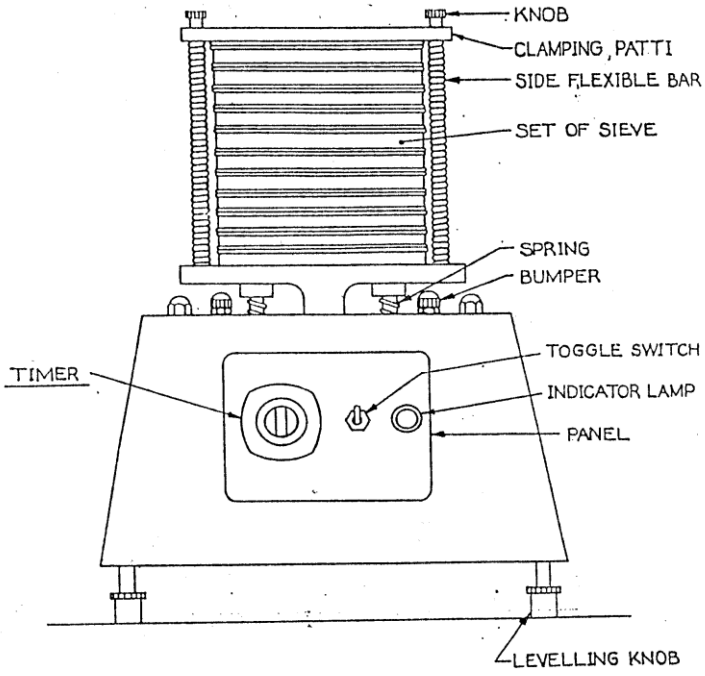
Experiment No 6

GRAIN FINENESS TEST OR SIEVE ANALYSIS

AIM: To determine the grain fineness of the given sand.

APPARATUS: Sieve shaker, electronic weighing machine.

PROCEDURE: 1) Use soft brush for cleaning sieves and pan. 2) Arrange set of sieves having pan at bottom and coarsest sieve on top. 3) Take 100gms of dried and washed sand sample on the top sieve and put the lid. Keep entire sieve set on shaking mechanism. 4) Slide the clamping device on two side flexible bars and clamp the set of sieves with the help of knurled screws provided. 5) Set the timer for desired sieving time (average time of the cycle is recommended as 10minuts). 6) Put 'ON' the switch. After completing, pre set timing, the sieving will be stop automatically. Disconnect the power supply. 7) Remove the clamping device. Weigh the grains remaining on the individual sieves. It is recommended to weigh each empty sieve before the test and again after the test along with sand. The difference between two will give accurate weight of grains.



Tabulation:

SL. No.	I.S sieve opening number in microns	Weight in gms on sieve	% Retained	Multiplying factor	Product
	(a)	(b)	(c) =b	(d)	(e) =c×d
1	1700				
2	850				
3	600				
4	425				
5	300				
6	212				
7	150				
8	106				
9	75				
10	53				
11	Sieve pan				

$$\text{A.F.S grain fineness number} = \frac{\text{Sum of products}}{\text{Total sum of the percentages of sand retained on Pan and each sieve.}}$$

$$\text{Fineness number} = \frac{\text{Total of (e)}}{\text{Total of (c)}} = \frac{E}{C}$$

The percentage of the retained grains on each sieve and the pan is to be multiplied with the multiplier and the results are to be added. This sum is divided by the total of percentage retained sand grains.

Graph:

Percent of sand retained v/s sieve number

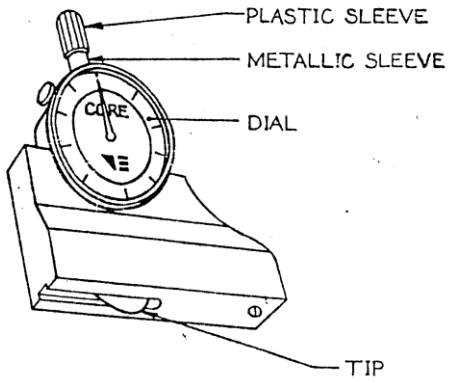
Experiment No 7

CORE HARDNESS TEST

AIM: To determine the core hardness of the given sand specimen.

APPARATUS: Core hardness tester

CORE HARDNESS TESTER



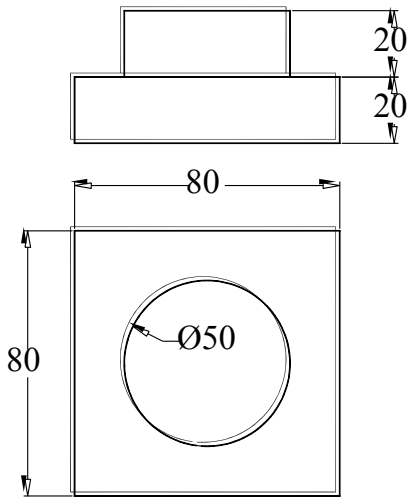
PROCEDURE: 1) Prepare the sand specimen of different percentages of moisture content. 2) The mould hardness tester has a spring loaded steel ball of 5mm in Diameter. 3) Keep the tester vertically against the sand specimen and press the tester ball on the surface of the specimen until the surface of the specimen get contact with the surface of the tester. 4) Now read the hardness number directly on the dial indicator. 5) Take the reading at 5 to 6 different points of the specimen and take the average**.**

Tabulation:

Sl. No.	% Of moisture	Core hardness number				Average
		P1	P2	P3	P4	
1						
2						
3						

FOUNDRY PRACTICE MODEL NO. 1

Aim : To prepare a sand mould as per the given figure.



Tools required : Mould boxes, shovel, rammer, strike off bar, spring divider, try square, vent rod and sprue pins, etc.

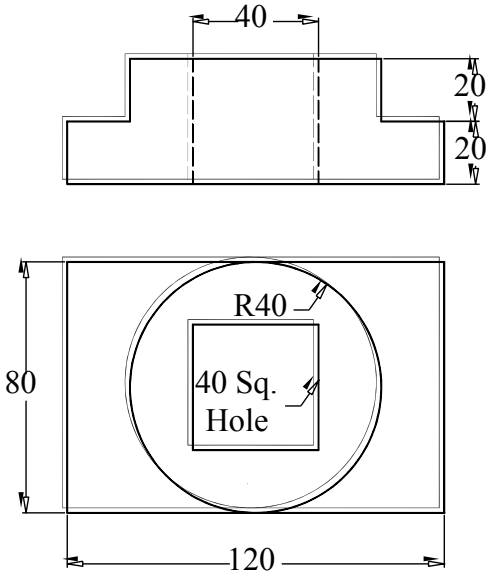
Procedure :

1. Select test and prepare necessary sand mixture for mould.
2. Clean moulding table and mould boxes.
3. Keep one mould box horizontally (drag) lying on the table and behind it keep another mould box (cope) vertically. Once again remove the impurities and dust from the mould boxes.
4. Pour the prepare sand into the mould box which is kept horizontally and start ramming gently on each and every corner of the box by applying constant blows.
5. The surface of the sand is leveled and finished. A layer of parting sand is sprinkled.
6. Using a steel scale and divider draw the required plan of the object to be prepared as shown in the given sketch.
7. Sprue pins are fixed at required positions.
8. Fix or keep another mould box (cope) on drag and fill the sand and again ram it gently by applying constant blows.
9. Remove the cope from the and again level the surfaces of cope and drag.
10. The mould cavity is cut using lifters and cleaner.
11. Finally the vent holes are made to gas escape.

Result :

FOUNDRY PRACTICE MODEL NO. 2

AIM : To prepare a sand mould as per the sketch shown below.



Tools Required : Mould boxes, Shovel, Rammer, Strike off bar, Spring divider Vent rod, Sprue pins, etc.

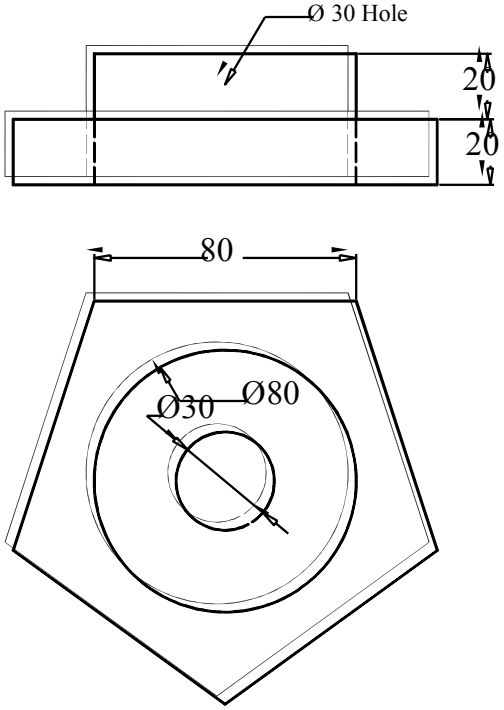
Procedure :

1) Select, test and prepare the necessary sand mixture for mould.
2) Clean the moulding table and mould boxes
1) Keep one mould box horizontally (drag) lying on the table and behind it keep another (Cope) vertically. Once again remove the impurities and dust from the mould boxes.
2) Pour the prepared sand in to the mould box, which is kept horizontally, and start ramming gently on each and every corner of the box by applying constant blows.
3) The surface of the sand is leveled and finished. A layer of parting sand is sprinkled.
4) Using steel scale and divider draw the required plan of the object to be prepared as shown in the given sketch.
5) Sprue pins are fixed at required positions
6) Fix or keep another mould box (Cope) on the drag and fill the sand and again ram it gently by applying constant blows.
7) Remove the cope from the drag and again level the surfaces of cope and drag
8) The mould cavity is cut using lifters and cleaners
9) Finally the vent holes are made to gas escape.

RESULT :

FOUNDRY PRACTICE MODEL NO. 3

AIM: To prepare a sand mould to cast an object as per the given figure.



Tools Required: Mould boxes, Shovel, Rammer, Spring divider, Vent rod, Sprue pins, etc.

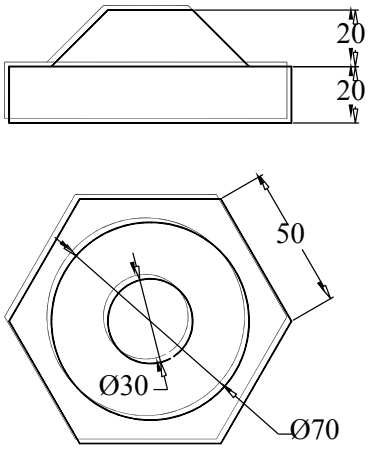
Procedure:

1) Select, test and prepare the necessary sand mixture for mould.
2) Clean the moulding table and mould boxes,
3) Keep one mould box horizontally(drag) lying on the table and behind it keep another(cope) vertically. Once again remove the impurities and dust from the mould boxes.
4) Pour the prepared sand into the mould box which is kept horizontally and start ramming gently on each and every corner of the box by applying constant blows.
5) The surface of the sand is leveled and finished, A layer of parting sand is sprinkled
6) Using a steel scale and divider draw the required plan of the object to be prepared as shown in the given sketch.
7) Sprue pins are fixed at required positions.
8) Fix or keep another mould box (cope) on the drag and fill the sand and again ram it gently by applying constant blows,
9) Remove the cope from the drag and again level the surfaces of cope and drag.
10) The mould cavity is cut using lifters and cleaners.
11) Finally the vent holes are made to gas escape.

Result:

FOUNDRY PRACTICE MODEL NO. 4

AIM: Prepare a sand mould to cast an object as per the sketch shown below.



TOOLS REQUIRED : Mould boxes Shovel, Rammer Spring divider Vent rod Sprue pins Lifters Gaggers Trowel etc,

PROCEDURE:

1) Select, test and prepare the necessary sand mixture for mould.
2) Clean the moulding table and mould boxes.
3) Keep one mould box horizontally (drag) lying on the table and behind it keep another(cope) vertically, Once again remove the impurities and dust from the mould boxes.
4) Pour the prepared sand into the mould box which is kept horizontally and start ramming gently on each and every corner of the box by applying constant blows.
5) The surface of the sand is leveled and finished. A layer of parting sand is sprinkled
6) Using a steel scale and divider draw the required plan of the object to be prepared as shown in the given sketch.
7) Sprue pins are fixed at required positions.
8) Fix or keep another mould box(cope) on the drag and fill the sand and again ram it gently by applying constant blows.
9) Remove the cope from the drag and again level the surfaces of cope and drag.
10) The mould cavity is cut using lifters and cleaners.
11) Finally the vent holes are made to gas escape.

FORGING

INTRODUCTION :

Forging may be defined as a metal working process by which metals and alloys are plastically deformed (reduced) to the desired shapes by the application of a compressive force. Forging may be done either hot or cold. How ever forging is always understood to be hot working, unless stated otherwise.

Depending upon the mode of application of compressive force, the forging equipment used may be grouped under two main categories.

1) Hammers.
2) Forging Press and Forging Machines (Up-setters).

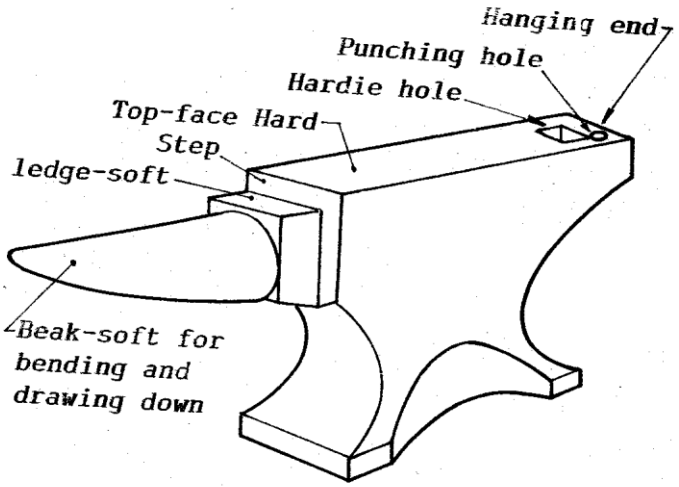
ADVANTAGES

1) Better mechanical properties, especially if the fiber flow lines are properly directed.
2) Minimum weight
3) Porosity in the metal is largely eliminated.
4) Ability of the forging.
5) Impurities in the metal in the form of inclusions are broken up and distributed throughout the metal.
6) Coarse or columnar grains are refined.
2) Minimum metal removing in machining.
3) Relatively smooth surface of the forging.
4) Freedom from internal defects.
5) Rapid duplication of the components.
6) Wide range forgeable metals is available.
7) Forgings are readily welded.
8) Forging can be held to with in fairly close dimensional tolerance.

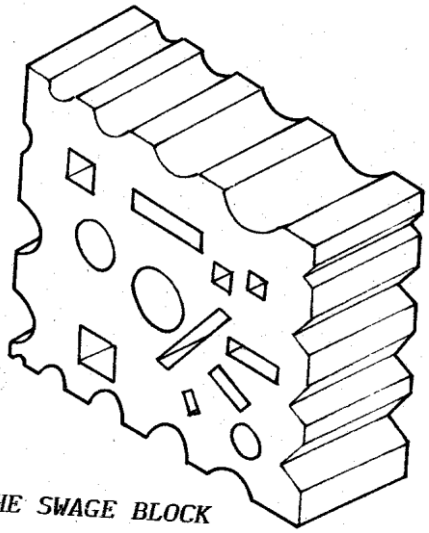
DISADVANTAGES :

1) In hot forging due to high temperature of metal there is rapid oxidation or scaling of the surface resulting in poor surface finish.
2) Tooling and handling cost are high.
3) Many intricate and cored shape possible by casting process can not be forged.
4) Usually forgings cost more than castings.

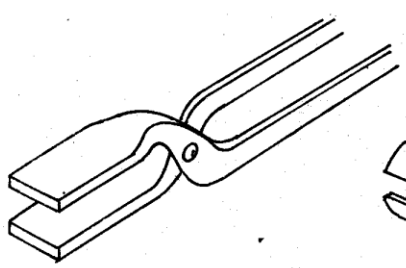
Forging Lab Tools Sketches



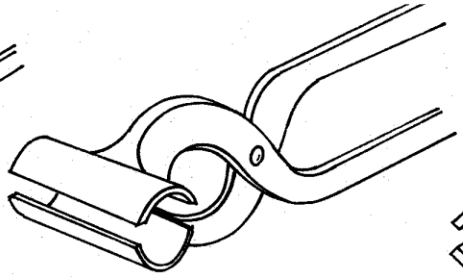
A Smith's Anvil



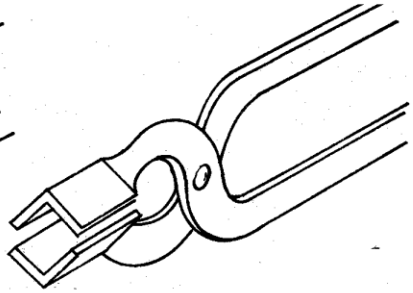
THE SWAGE BLOCK



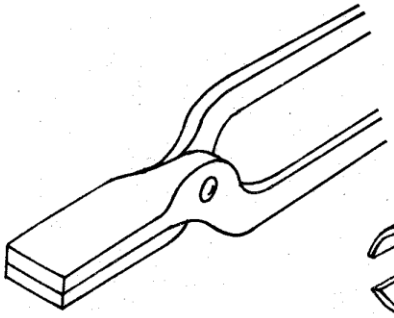
OPEN MOUTH



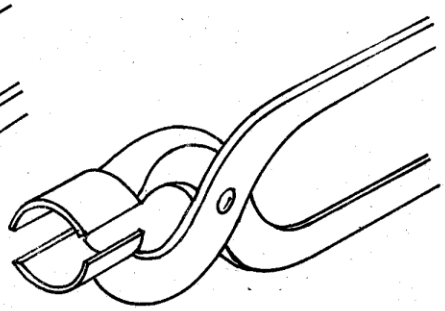
HOLLOW MOUTH



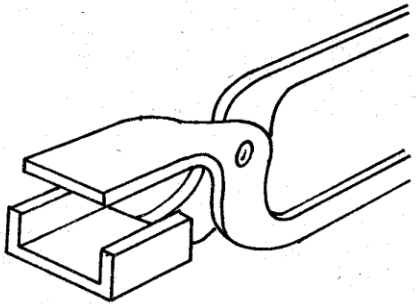
VEE MOUTH



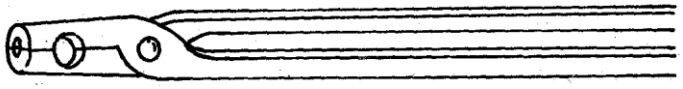
CLOSED MOUTH



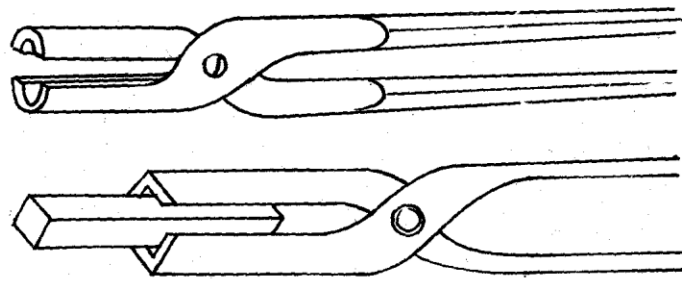
ROUND MOUTH



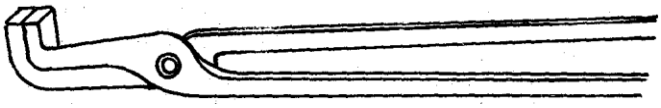
SQUARE MOUTH

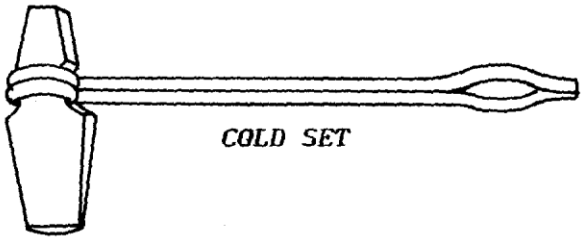


Double hollow bit

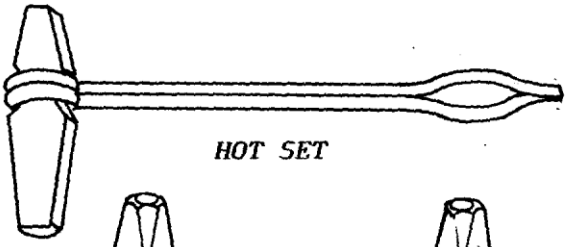


Hollow bit

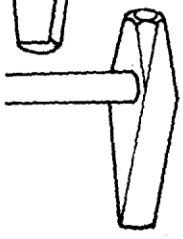




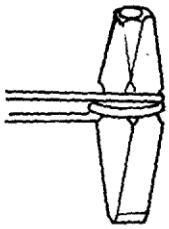
COLD SET



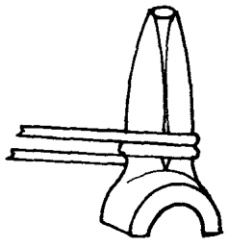
HOT SET

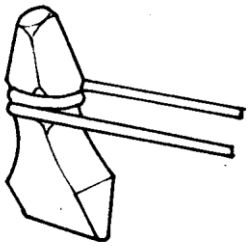


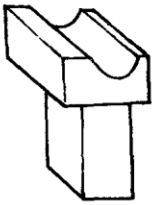
HOT SET WITH
WOODEN HANDIE



COLD SET WITH
STEEL ROD HANDIE

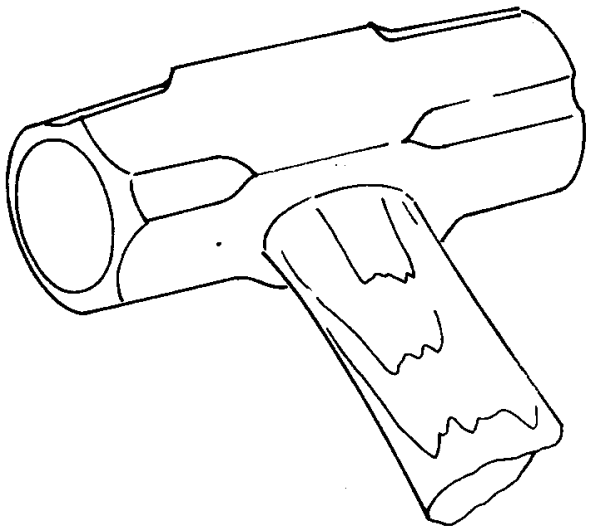






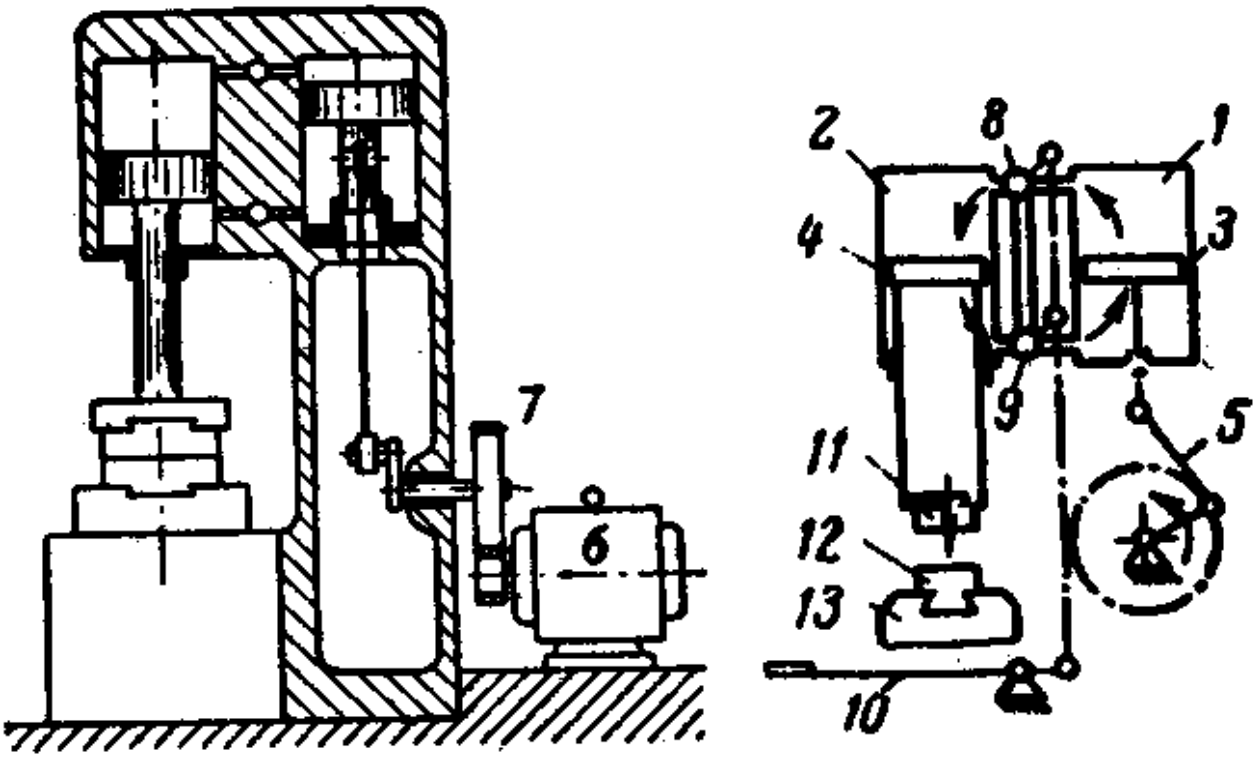
Swages

Fullers



Sledge hammer used by the striker

TYPICAL POWER HAMMER



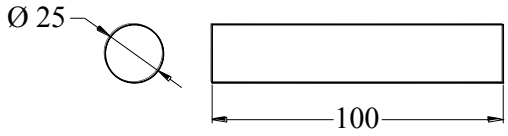
Parts List : 1. Compressor cylinder, 2. Ram cylinder, 3. Piston, 4. Ram, 5. Crank driver, 6. Motor, 7. Reducing gear, 8 & 9. Rotary valves, 10. Foot treadle, 11. Ram die, 12. Anvil Die, Cap

The size of a power hammer may vary in a range from 52 to 1000 kg. The hammers operate at 72 to 190 blows per minute. These hammers are widely used in public sectors. Metal industries.

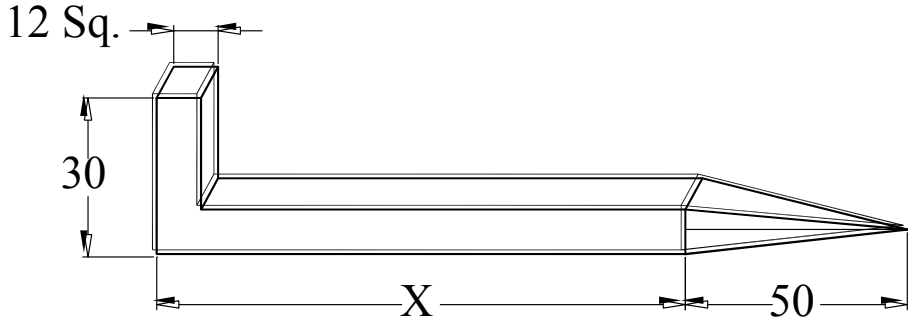
MDEL No. 1 "L SHAPE NAIL"

AIM: To prepare a L- shape nail of given dimension using a circular rod of mild steel of 25 mm diameter and 100mm long.

Given Material



Finished Model



TOOLS REQUIRED: Flat tong, Round tong, Sledge hammer, Ball peen hammer, Anvil (having hard die hole and pitchel hole) Leg vice, Flatter, Swage block, Open hearth Forge, Etc

PROCEDURE:

1) Hearth is cleaned by removing coal ashes.
2) Small pieces of coal with small pieces of dry wood are used for initial firing of the forge.
3) When the temperature reaches sufficiently, big pieces of coal (3cm×3cm×3cm Approx.) are introduced.
4) Then given work piece is introduced into the hearth, the inserted metals are covered up by coal, and coal powder is spread to prevent loss of heat.
5) When the work piece attains yellowish white colour (Orange, Yellow, White, are suitable colours of heat) it is taken out from the hearth using tongs and hammered on the surface of the anvil with sledge hammer at different positions of the work piece to obtain square prism of required correction.
6) During hammering if the temperature of the work piece reduces below the required temperature, the hammering should be stopped when the colour of the work piece attains orange and descends to cherry red. Once again heat the work piece in hearth to obtain the material with yellowish white colour.
7) To obtain a L-Shaped nail the one end of a square prism is hammered using ball peen hammer to get square pyramid and another end is bent to L-Shape using leg vice or swage block.
8) Finally measure the dimension "X" as per the figure and compare it with the theoretical calculations.

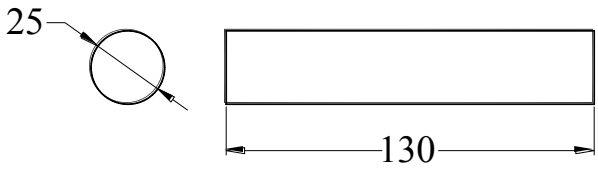
CALCULATIONS:

RESULT:

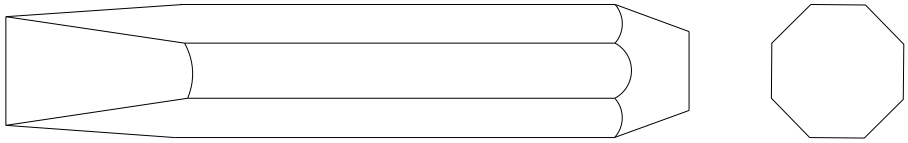
MODEL No- 2 —CHISEL

AIM: To prepare a bush of given dimension using a circular rod of mild steel of 25mm diameter and 130mm long.

Given Material



Finished Model



TOOLS REQUIRED: Flat tong, Round tong, Sledge hammer, Ball peen hammer Anvil, Flatter, Swage block, Open hearth forge etc.

PROCEDURE:

1) Hearth is cleaned by removing dust and ash.

2) Small pieces of coal with small pieces wood is used for initial kindling.

3) Then given Cylindrical Mild steel work piece is introduced in to the heated open hearth forge. And cover the work piece with coal, and coal powder is spread over the coal so as to prevent the loss of heat.

4) When the work piece attains the yellowish white colour it is taken out from the hearth using tong and hammered with sledge hammer at different positions of the work piece to obtain Octagon steel bar of required cross section.

5) During hammering if the temperature of the work piece reduces below the required temperature, the colour of the work piece descends to cherry red the hammering should be stopped and once again heat the work piece in the hearth to obtain yellowish white colour.

6) To obtain a required shape (chisel) Octagon bar is heated and Forge Chamfer on Head

7) Heat other end, Forge to flat taper.

8) Turn the chisel a quarter turn and holding the shank horizontally hammer the narrow sides to make them parallel. Alternate the blows, four or five on the wider surface, Then four or five on the narrow surface, and so on until the chisel is in the shape desired.

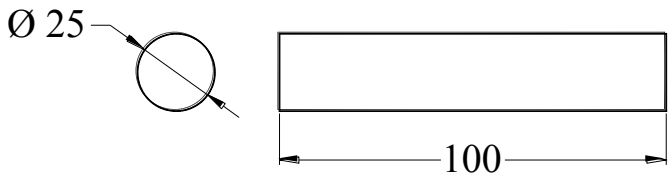
CALCULATION:

RESULT:

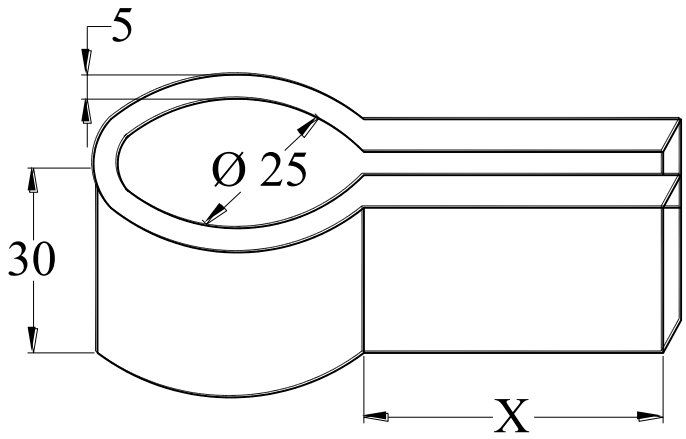
MODEL No. - 3

AIM: To prepare a model of given dimension as shown in the figure using a circular rod of mild steel of 25mm diameter and 100mm long.

Given Material



Finished Model



TOOLS REQUIRED: Flat tong, Round tong, Sledge hammer Ball peen hammer, Anvil ,Leg vice Flatter, Swage block, Open hearth forge etc.

PROCEDURE:

1) Hearth is cleaned by removing burnt coal ashes.
2) Small pieces of coal with small pieces wood waste is used for initial firing.
3) When the temperature reaches sufficiently high big pieces of coal are introduced.
4) Then given work piece is introduced in to the hearth and close with burning coal, and fuel powder is sprinkled on it.
5) When the work piece attains the yellowish white colour it is taken out from the heath using tong and hammered with sledge hammer at different positions of the work piece to obtain rectangular bar of required cross section.
6) During hammering if the temperature of the work piece reduces below the required temperature the colour of the work piece gains cherry red, hammering should be stopped at once. Once again heat the work piece again in the hearth to obtain yellowish white colour and hammering is repeated.
7) To obtain required model as per the figure using a cylindrical rod the rectangular bar is bent to circular shape and both the ends are straightened.

8) Finally measure the dimension “X” as per the figure and compare it with the theoretical calculations.

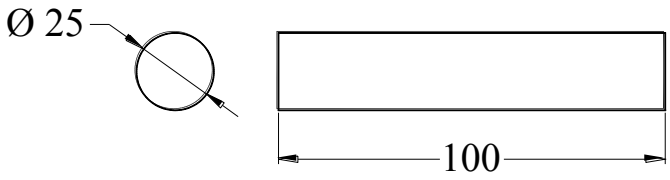
CALCULATION:

RESULT:

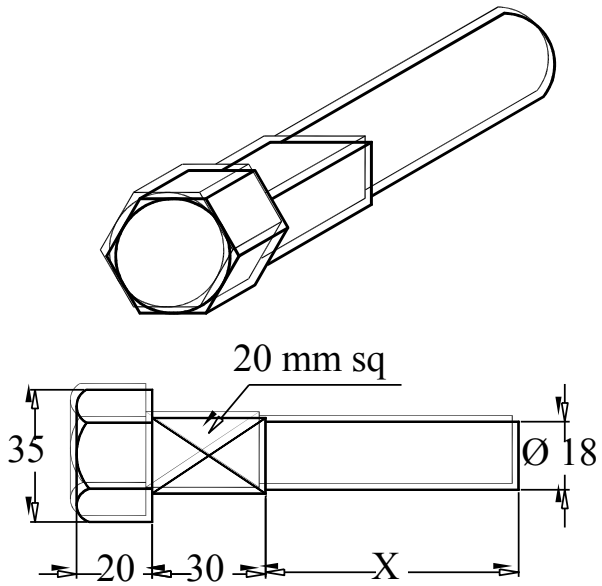
MODEL NO –IV HEXAGONAL HEADED BOLT

AIM: To prepare a model of given dimension as shown in the figure using a circular mild steel rod of 25mm diameter and 100mm long.

Given Material



Finished Model



TOOLS REQUIRED: Round tong, Ring tong, Sledge hammer, Ball peen hammer, Anvil with hardie hole and pitchel hole, Swages, Swage block, Forge hearth etc.

PROCEDURE:

1) Hearth is cleaned up by removing burnt coal ashes,
2) Small pieces of coal with small pieces of wood is used for initial firing. Air blower is put "ON".
3) When the temperature reaches sufficiently high, big pieces of coal are introduced.
4) Then given work piece is introduced into the hearth, it is covered by pieces of coal and then coal powder is spread over it so as to prevent the loss of heat.
5) The beated work piece(partially or so) is picked up by using a ring tong, and held vertically on the surface of the anvil. The heated portion is hammered so as to increase its diameter at the cost of its length(upsetting).The increased bar portion is shaped to cylindrical head This is done by housing the work piece in the pitchel hole of the anvil. Then hexagon shape is obtained by repeated heatings followed by hammering.

6) Remaining bar stock (usually larger than the required) is reduced to the required diameter by using swages.
7) Finally measure the dimension "X" as per the figure and compare it with the theoretical calculation.

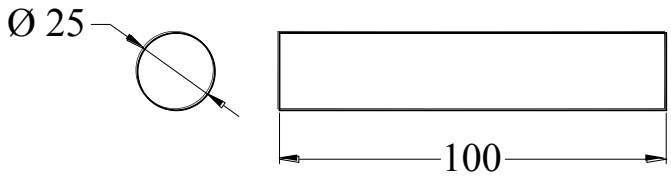
CALCULATION :

RESULT:

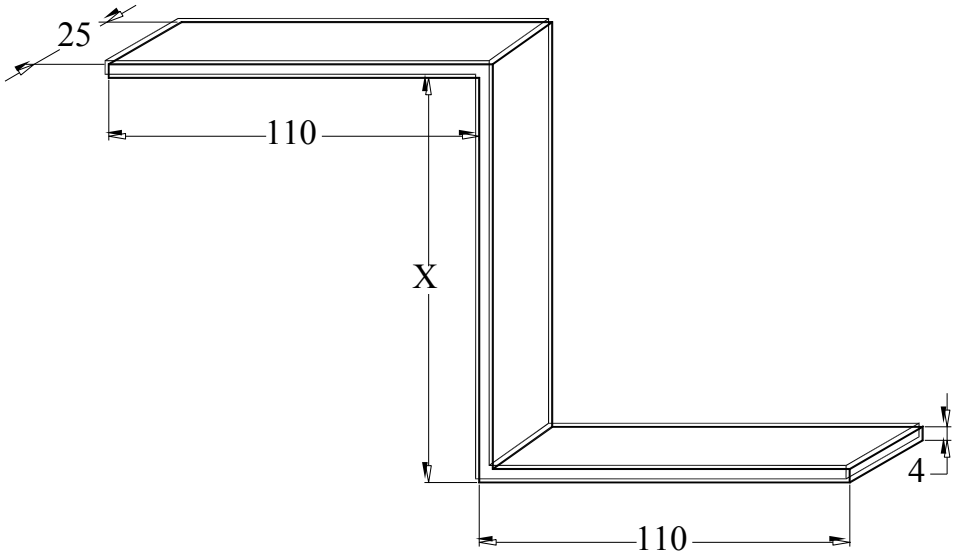
MODEL NO –V " Z"-CLAMP

AIM: To prepare a model of given dimension as shown in the figure using a circular rod of mild steel of 25 mm diameter and 100mm long.

Given Material



Finished Model



TOOLS REQUIRED : Flat tong, Round tong, Sledge hammer, Ball peen hammer Anvil Flatter Swage block Forge hearth etc.

PROCEDURE:

1) Hearth is cleaned by removing burnt coal ashes.
2) Small pieces of coal with small pieces of dry wood waste is used for initial firing. Air blower is put "ON."
3) When temperature reaches sufficiently high, big pieces of coal (3cm ×3cm×3cm approx) is introduced.
4) Then given work piece is introduced into the hearth and the same is covered with burning coal, and coal powder is spread on it.
5) When the work piece attains the yellowish white colour it is taken out from the hearth.

CALCULATION :

RESULT:

FORGING AND FOUNDRY LAB VIVA QUESTIONS

1) When compression load is applied how the material take cut?
2) When shear load is applied how the material breaks?
3) What is modernization and mechanization of Foundry?
4) What is solidification?
5) At what temperature the material possess magnetic property?
6) What is the other name for permeability?
7) Define permeability?
8) By which material hammers are made up of?
9) By which material rail track is made up of?
10) Draw cooling Curve at any perticular point?
11) What is the type of deformation take place in Forging?
12) Why Foundry lab is called so Foundry?
13) Is it possible to forge C.I ?
14) Name defects in castings?
15) What are forging operations?
16) What is the necessity of finding compression strength of Foundry sand?
17) What are the properties of foundry sand?
18) Name different types of Foundry sand?
19) What type of material is used in forging?
20) What is heat treatment? Explain.
21) What is galvanization?
22) What is gas welding and what is arc welding? When, do you use it?
23) Classification of welding process?
24) What are different -types of new Casting techniques?
25) What do you mean by Welding?
26) For Casting we need less clay or more clay?
27) What is the necessity of finding Clay % in Foundry lab?
28) What are the procedures followed in any Casting process?
29) What is Fusion welding and What is Plastic welding?
30) What is Forging and What is Foundry?
31) What is cohesiveness and What is Adhesiveness?
32) What are the defects in Forging?
33) What are the Contents of Foundry sand?
34) What is importance of silica in foundry sand?
35) Why do you want porosity?
36) What is permeability?
37) How do you measure the grain size or sand?
38) What does the No. i.e., 700, 425, 206, 75, 53, etc. sieve No. Indicate?
39) In Foundry to prepare the pattern what material you are going to use?
40) What is Cope and Drag?
41) What is Runner and Riser?
42) What is Pattern?
43) What are allowances in moulding?

44) ln forging to what temperature you are going to heat the Metal?
45) What material is the anvil made of?
46) What is the importance of clay in Foundry sand?
47) What are additives?
48) What is the necessity of sieve testing?
49) Why do you require grain fineness No. 50) Mould sand should be fine. Why is it so?
50) In Foundry sand why do the sand should .be permeable?
51) Why not C.I. shall be used for Forging?
52) What is the material used to cast a casting in mould?
53) What % of clay you have in the sand sample you have taken for testing?
54) How do you pour the molten metal for the intricate castings?
55) What do you mean by" PAT" in castings?
56) What do you mean by carbon equivalent in C. I.?
57) Why is white C.I. is used in rail wheels?
58) What is the influence of clay and silica in foundry sand?
59) What is the influence of size of sand particles in the property of foundry sand?
60) ln forging operation why is scales found on surface of metal under heat?
61) Why do you require compression strength or shear strength in foundry sand?
62) ln what way grain fines influence the property of foundry sand?
63) What is melting temperature of mild steel?
64) How furnace temperatures are measured?
65) After finishing the mould how is it use full ?
66) What fuel is used in forging to heat the material?
68) What is the function of riser? And what is side riser?
69) What is the necessity of vent holes?
70) What is GFN value that you use in foundry?
71) What is the difference between White C.I. And Grey C.I?
72) Where are you going to adopt the principles of White C.I?
73) What do you mean by, Inoculation, in Ferrous Foundry?
74) What is an Ideal Gas ?
75) What do you mean by forge welding? Where it is done?
76) What is tempering and what is oil quenching?
77) When material is heated and cooled. What is the value of Young’s Modulus?
78) Explain Stress, Strain?
79) What is meant by critical temperature and recrystallization temperature?
80) What is 'Green strength and What is Hot strength?
81) What are the advantages and disadvantages or Forging over Casting?
82) What is Die Forging ?
83) What is Upsetting? Drawing down? Punching? And Bending operations in Forging ?
84) What is the material that a Forging Die is made of?
85) What is the effect of moisture on shear strength of Foundry sand?
86) Name some of the Forging components that are generally used?
87) Name some of the C.I. components that are generally used?
88) What are the charges of CUPOLA?
89) What is pig iron? Why is the name pig iron so. How do you get it?
90) Name some common varieties or steels?

91) What is an alloy?
92) Name some nonferrous metals?
93) What do you mean by calorific value of fuels?
94) What is the difference between coal and coke?
95) Name some varieties of coal?
96) Distinguish between the term "recovery" and "re-crystallization"?
97) What is case hardening ? What is Flame hardening?
98) What is case carburizing? What is cyaniding?
99) What is shear loss? What is scale loss?
100) What are the different types of patterns?
101) What are the precautions taken While preparing a pattern?
102) Explain Draft, Shrinkage & Machining allowances?
103) What do you mean by Heat Treatment of steels? What are its advantages?
104) What is Plumbago? How is it useful?
105) What do you mean by Sand Reclamation?
106) Why a Steel industry and a Cement industry are usually located side by side?
107) Distinguish between Cold working and hot working?
108) What is 'work hardening' ?
109) What is a mild steel and What is a high carbon steel? How they are useful ?
110) How do you classify steels?
111) What is power forging ?Name some varieties of power hammers?
112) What is Wrought Iron? What are its uses?
113) What is Chilled C.I. ?
114) What do you mean by Ductility and Malleability?
115) Name some common methods employed for testing of steels?
116) How do you classify Steels?
117) What do you mean by the terms "ISO", "BIS", TIN, or "AFS"?
118) What do you mean by centrifugal casting & continuous casting?
119) What do you mean by least count of an Instrument ? Make an expression for L.C. of vernier Caliper, and Micrometer ?
120) What do you mean by "Isothermal Heat treatment" ? Give an example?
121) Discuss between Stainless steel, High speed steel, Cemented carbides & Stellites.
122) What do you mean by heat transfer and explain?
123) What is Electro plating?
124) What is a dry sand mould? And what is a core?
125) What is the composition of Cast Iron?
126) Name some other casting process?
127) Name some of the heating furnaces for forging?
128) To what temperature you are going to heat the metal in forging?
129) What type of coal you are using in forging? In preparing gold articles (ornaments) Do you use forging or Casting?
130) Why not you use a Wood or a Metal mould for Casting purpose?
131) What do you mean by metal forming?
132) What is the difference between forging and brazing?
133) What do you mean by “TTT” Curve?
134) What are the ingredients in a Shell moulding special casting technique?

135) What type of pattern you use in a investment Casting?
136) What effect does water gives to Foundry sand?
137) What is a directional solidification?
138) W hat is adhesiveness and what is cohesiveness?
139) Where do you use a Match plate pattern?

Text books for reference.

1. Work shop technology by O.P. Khanna
2. Work shop technology vol. 1 by S.K. Hazara Chowdhary.
3. Work shop technology by R.K. Jain.
4. Work shop technology by Raghu Wanshi.
5. M. S. M. by R.S. Khurmi