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- To learn the importance of present day tools.
- To learn the range and characterisation of measuring instruments.

2.0 INTRODUCTION:

Whenever we do any work, we need to keep in mind that the work should be done in a simple and quality manner with minimum time and material damage. To complete the work as per the above statement, we need instruments. At the same time the amount of pressure, temperature, fuel and electricity which applied on the job at each stage should be known, for this purpose measuring tools are used. By the use of measuring tools, the supply pressure, temperature, fuel supplied and electricity consumption is monitored and controlled and the job is done with good quality. The most important thing in choosing the instruments

and measuring tools is based on the nature of the work and working environment. Depends on the conditions, instruments, and measurements are classified into many types.

- In automobile service stations, various types of tools, equipment and machines are used. To understand the purpose of tools, they are mainly classified into two types. Figure 2(a), 2(b) shows Ordinary and Power Tools, Tool Trally

They are,

1. Ordinary Tools
2. Power Tools



Figure 2(a) Ordinary and Power Tools



Figure 2(b) Tool Trolley

2.1 ORDINARY TOOLS

In the automobile industry, the tools which are used to handle the small defects in the vehicle are called as ordinary tools. Depends on the handling, these tools are classified into many types.

They are,

1. Hand tools
2. Bench tools
3. Machine tools
4. Special tools.

2.1.1 Hand Tools

In automobile industries or in factories, the tool which are able to carry in hand, in and there where the defected vehicle is located and by means of which the defects are cleared is known as hand tools. Depends on the handling, hand tools are classified into many types.

- | | |
|-------------|-----------------|
| 1. Spanners | 5. Screwdrivers |
| 2. Pliers | 6. Hacksaw |
| 3. Hammers | 7. Files |
| 4. Punches | 8. Drill Bit |

2.1.1.1 Spanners and Wrenches

- a) Open-Ended Spanners
- b) Ring Spanners
- c) Box Spanner
- d) Adjustable Wrench/ Pipe Wrench
- e) Spark Plug Spanner (Or) Tubular Spanner
- f) Allen Wrench

a) Open-Ended Spanner

Both single-ended spanner and double ended spanner are inclusive of this type. Figure 2.1.1.1 shows Spanners. It is used to



Combination Spanners



Ring Spanners



Double Open Ended Spanners



Other Special Spanners

Figure 2.1.1.1 Spanners

loosen and tighten the four and six flat head bolt and nuts. It is made up of with Chromium, Vanadium and Alloy Steel metals. In all the spanners their sizes are mentioned in terms of mm or inch. Open Ended Spanners are shown in Figure 2.1.1.1(a).

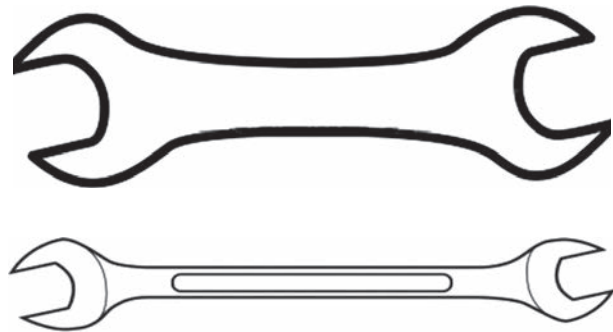


Figure 2.1.1.1(a) Open Ended Spanner

Sizes of Spanner

- | | |
|------------|------------|
| • 6-7 mm | • 18-19 mm |
| • 8-9 mm | • 20-22 mm |
| • 10-11 mm | • 21-23 mm |
| • 12-13 mm | • 24-27 mm |
| • 14-15 mm | • 25-28 mm |
| • 16-17 mm | • 27-32 mm |

b) Ring Spanner

This type of spanner has ring shape on both the ends or at one end, with the ring portion is subdivided into 12 flat. It is used to loosen and tighten the four flat and six flat bolts. It is used in crucial and critical places where the other spanners are not able to loosen and tighten the bolts and nuts. Shown in Figure 2.1.1.1(b).

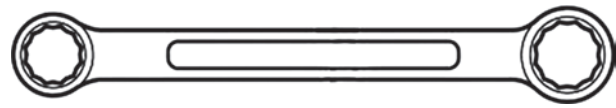


Figure 2.1.1.1(b) Ring Spanner

c) Box Spanner

It consists of with two portions namely head (Box or Socket) and handle. Different combination of socket and handles might be used for different purpose. Small Handle, T Handle, Long Handle, and 'U' Joint Reversible Ratchet are the handles which are commonly used. Shown in Figure 2.1.1.1(c)

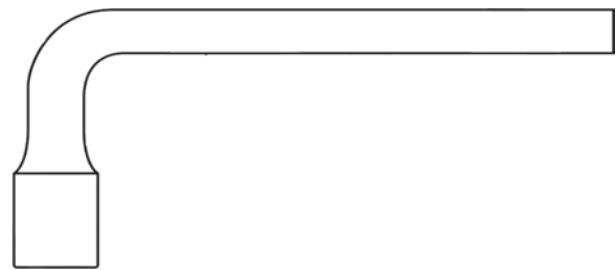


Figure 2.1.1.1(c) Box Spanner

d) Adjustable Wrench and Pipe Wrench

This is an arrangement in which the holding edge can be varied. There will be a fixed jaw and a moving jaw. By rotating knurled nut the moving jaw can be moved to the desired extent. An adjustable wrench can be used in rotating the bolt and nut. It is made up of high carbon steel. The pipe wrench is used for tubular cross section. Shown in Figure 2.1.1.1(d)

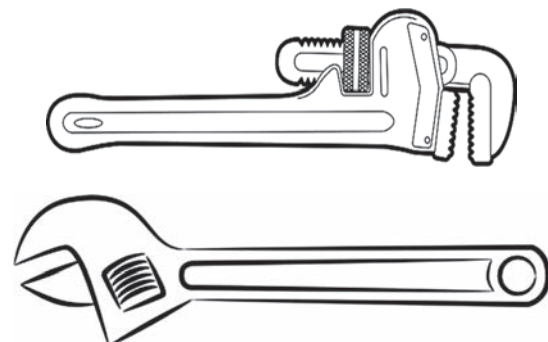


Figure 2.1.1.1(d) Adjustable Wrench and Pipe Wrench

e) Spark Plug (Or) Tubular Spanner

It is used to tighten or loosened the BOLT or NUT which are in pits. And also It is used to tighten or loosen the spark plug. So that, It is also called as Sparkplug spanner. Fig 2.1.1.1(e) shows Spark Plug Spanner.

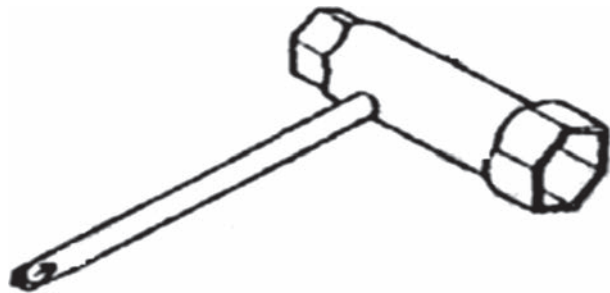


Figure 2.1.1.1(e) Spark Plug Spanner

scales. Likewise, it is also available in 'mm'. It is made up of high graded alloy steel. Fig 2.1.1.1(f) shows Allen Key.



Figure 2.1.1.1(f) Allen Key

Various Sizes of Allen Key

- 2.5 mm
- 3 mm
- 4 mm
- 5 mm
- 6 mm
- 7 mm
- 8 mm
- 10 mm
- 12 mm

f) Allen Key

It looks like 'L' shape which had the six edges. It is used to loosen or tighten the bolts which are having the six edges of the bolt head. It is available in both metric and inch

2.1.1.2 Pliers

Plier is the tool which is used to do the bending, tearing, hardening of the thin wire, cutting, squeezing and pressing of the wires. Types of Pliers shown in Fig 2.1.1.2.



Figure 2.1.1.2 Plier

Types of Plier

- a) Electrician Plier
- b) Long Nose Plier
- c) Circlip Plier

a) *Electrician plier*

In this two jaws are able to open to a certain limit. Inside of this have groves which are cut in terms of lines. These pliers handles are insulated with plastic material. Due to the above reason, these types of pliers are called as electrician plier and are used by the electricians. Electrician Plier is shown in Fig 2.1.1.2(a).

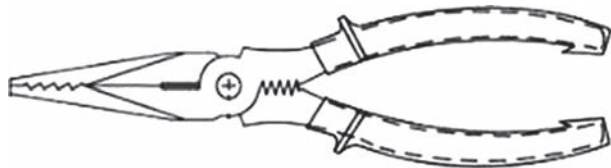


Figure 2.1.1.2(a) Electrician Plier

b) *Long Nose Plier*

This is mostly used for twisting the wires. That is, to grab and enlarge the wire in a tight way. It is made up of with Iron Alloy metals. Long Nose Plier shown in Fig 2.1.1.2(b).

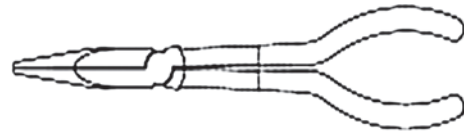


Figure 2.1.1.2(b) Long Nose Plier

2.1.1.3 Hammer

According to the need of the work, hammers may be used with different shapes and weights. The main purpose of using a hammer is to perform the operations like punching, bending and riveting. Hammer is shown in Fig 2.1.1.3.

Types of Hammer

- a) Ball Peen Hammer
- b) Cross Peen Hammer
- c) Straight Peen Hammer
- d) Sledge Hammer
- e) Mallet Hammer
- f) Claw Hammer

a) *Ball Peen Hammer*

Its head is in the round like shaped. Due to this structure, it is called a ball peen hammer. It is mainly used for to perform the riveting operation. Ball Peen Hammer shown in Fig 2.1.1.3(a).



Figure 2.1.1.3 Hammers



Figure 2.1.1.3(a) Ball Peen Hammer

b) Cross Peen Hammer

A cross PEEN hammer is a hammer used by blacksmiths to complete metal work. The wedge-shaped end of the hammer allows you to make the metal puller when used with heat. The main functions of a cross peen hammer are forging and riveting. Forging is a process in which you heat a single piece of metal and use tools to obtain a particular shape. Fig 2.1.1.3(b) shows Cross Peen Hammer.

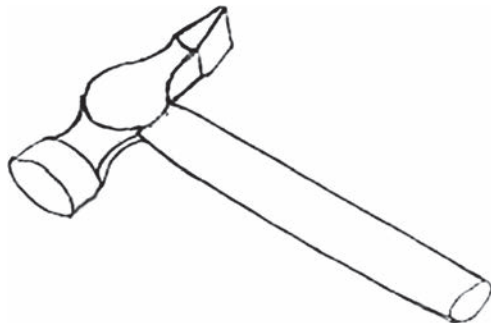


Figure 2.1.1.3(b) Cross Peen Hammer

c) Straight Peen Hammer

In this hammer, either side of the face does not have any projections, unlike other hammer types. This is used for general purpose. Fig 2.1.1.3(c) shows Straight Peen Hammer



Figure 2.1.1.3(c) Straight Peen Hammer

d) Sledge Hammer

The weight of this hammer is two or three times more than the ordinary type hammer. This is mainly used for blacksmith purpose. Their handles are made only of wood. Fig 2.1.1.3(d) shows Sledge Hammer.

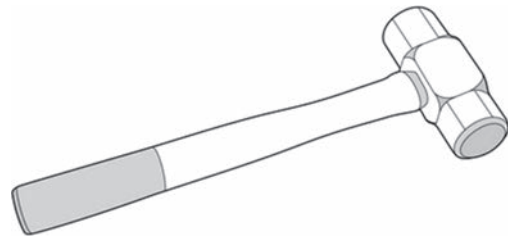


Figure 2.1.1.3(d) Sledge Hammer

e) Mallet Hammer

This is often used for SHEET METAL jobs. MALLET HAMMER can be used to adjust curves in some sophisticated and smooth objects. This makes the vehicle more useful during tinker. Fig 2.1.1.3(e) shows Mallet Hammer.

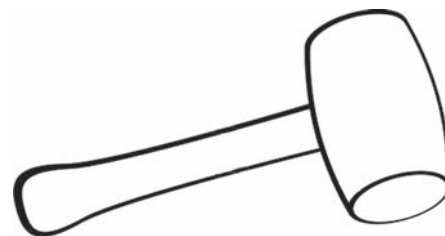


Figure 2.1.1.3(e) Mallet Hammer

f) Claw Hammer

It is used to split the nail and to general jobs. Figure 2.1.1.3(f) shows Claw Hammer

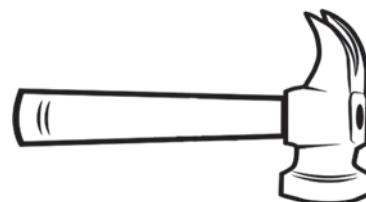


Figure 2.1.1.3(f) Claw Hammer

2.1.1.4 Punches

Punch is used to place a punch at the drilling point before drilling an object. It makes drilling easier. Its nose will be at many angles. It is categorized as such.

- a) Centre Punch
- b) Dot Punch
- c) Prick Punch
- d) Hollow Punch
- e) Letter / Number Punch

a) Centre Punch

In the drilling jobs, the edge of the drill unit has to be at and rotate. For this small and wide punch is made at the center. It is called as center punch. Its angle 90° . Fig 2.1.1.4(a) shows Centre Punch.

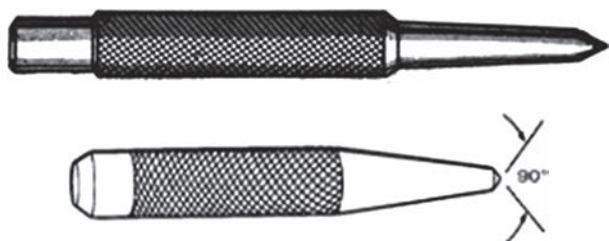


Figure 2.1.1.4(a) Centre Punch

b) Dot Punch

The lines which are drawn by the scriber can be made clearly visible by using dot punches. In this dots are put over the line. Its angle is 60° . Fig 2.1.1.4(b) shows Dot Punch



Figure 2.1.1.4(b) Dot Punch

c) Prick Punch

Deep points are made of the soft metals and some tactical works with the help of prick punch. Its angle is 30° . Figure 2.1.1.4(c) shows Prick Punch.



Figure 2.1.1.4(c) Prick Punch

d) Hollow Punch

The tool which has a hollow section inside the nose is used to cut the hole in the skin, rubber card etc. This tool is called as hollow punch. Fig 2.1.1.4(d) shows Hollow Punch.



Figure 2.1.1.4(d) Hollow Punch

e) Letter and Number Punch

In this punch, the letters or numbers are labeled or cut over the punch in order to punch letter and number in places where we need them. These types of punches are made up of high carbon steel. Fig 2.1.1.4(e) shows Letter and Number Punch.



Figure 2.1.1.4(e) Letter and Number Punch

2.1.1.5 Screw Drivers

The screw driver is used to fix or remove the screw based on the requirement. Refer Figure 2.1.1.5(a). The screwdrivers are classified mainly based on their tip shape and their types are given below.

Types of Screw driver

- a) Star Screw Driver
- b) Ratchet Screw Driver
- c) Offset Screw Driver

Different types of Screw Drivers are shown in Fig 2.1.1.5(2).



Figure 2.1.1.5(1) Screw Driver

a) Star Screwdriver

This is mainly used to screw and unscrew the star-shaped screw heads.

b) Ratchet Screwdriver

Screwdrivers with the ratchet system are often used to screw and unscrew the large number of long screws in the long run.

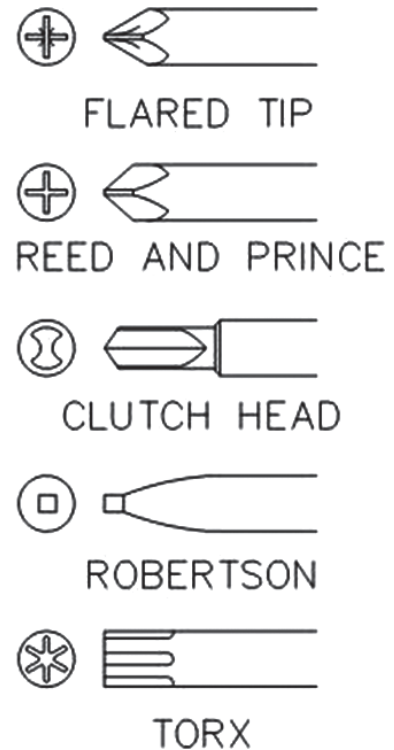
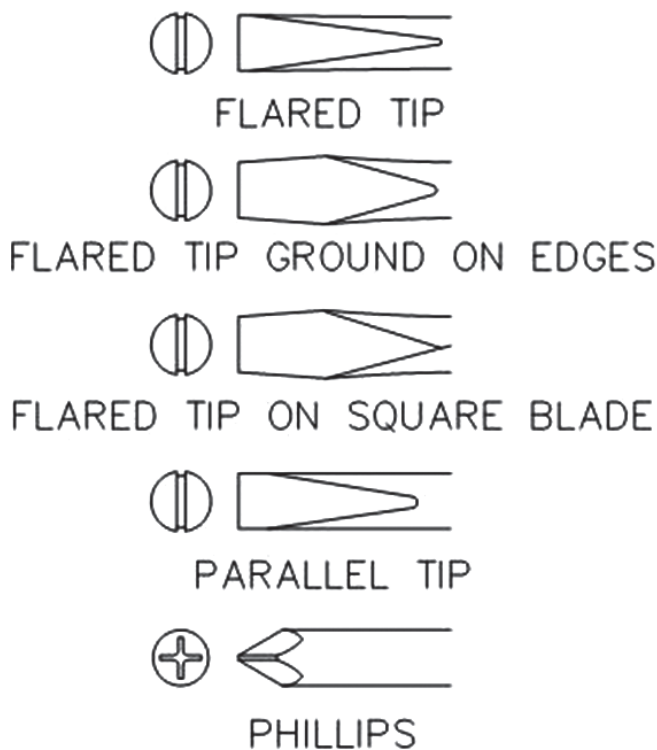


Figure 2.1.1.5(2) Different Types of Screw Driver

2.1.1.6 Hacksaw Frame with Blade

It is used to cut metal items, unnecessary portions, cutting wire, bar and tap. The frame is made up of mild steel and blade is made up of low alloy steel. The tip of the teeth, which is 250 MM to 300 MM alone, can be hardened by heat treatment process. The gap between the two tips is called pitch. Fig 2.1.1.6 shows Hacksaw Frame with Blade.

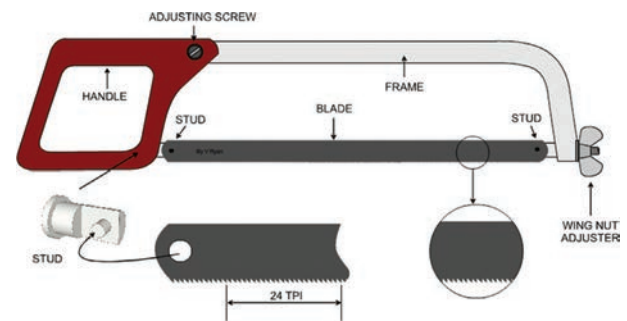


Figure 2.1.1.6 Hacksaw Frame with Blade

Type of hacksaw frame with blade:

- I. Solid Type
- II. Tubular Type

Solid Type

- Fixed type
- Adjustable type

Tubular type

- Fixed type
- Adjustable type

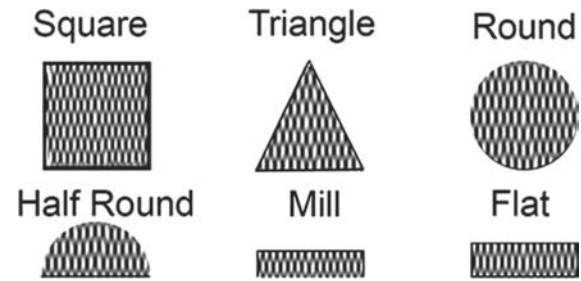


Figure 2.1.1.7(a) Shapes of file

2.1.1.7 Files

The main task of this file is to removing the small size of the materials in the work-shops. The metal is extracted when it is pushed forward in the workload. Fig 2.1.1.7 shows File.

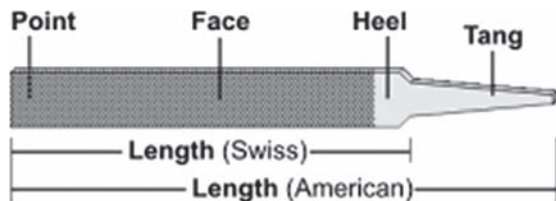


Figure 2.1.1.7 File

The files are classified based on the shape and kind of cut and are listed below.

a) Shape (or) Cross Section:

Fig 2.1.1.7(a) shows different shapes of File.

1. Square File
2. Flat File
3. Half Round File
4. Triangular File
5. Knife Edge File



b) Kind of Cut

Fig 2.1.1.7(b) shows different of files based on kind of cut.

1. Single Cut File
2. Double Cut File
3. Rasp Cut File
4. Curved Cut File

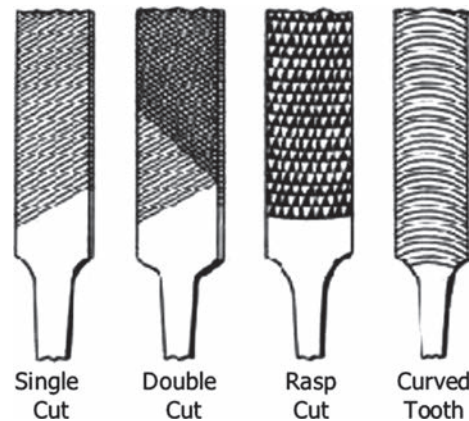


Figure 2.1.1.7(b) Files based on kind of cut

Single Cut File

The teeth of the files are cut in the same way as 60°. It is used to rub the unnecessary metal in soft metals. And it is also used to sharpen the teeth of the saw.

Double Cut File

In the facade, the teeth are cut in both directions. The overcut teeth are cut in 700's and the uppcut teeth are cut in 510. It is used to rub the hard metal, such as iron steel.

Rasp Cut File

This is a file of teeth that are separated by straight and parallel lines. The face of the teeth is slightly upward compared with the file face. It is used to work on smooth materials such as wooden, leather, aluminium.

Curved Cut File

It is capable of cutting deeply. It is used to work on smooth materials such as aluminium, tin, copper and plastic.

2.1.1.8 Drill Bits

Fig 2.1.1.8 shows the different types of Drill Bits. Round shaped rotating drill bit is called as twist drill bit. If a job is drilled from top to bottom is called through hole and if a job is partially drilled for a distance then it is called as blind hole. The drill bit is made up of High-speed steel. It has the polygonal cutting edge. The types of drill bits are given below.



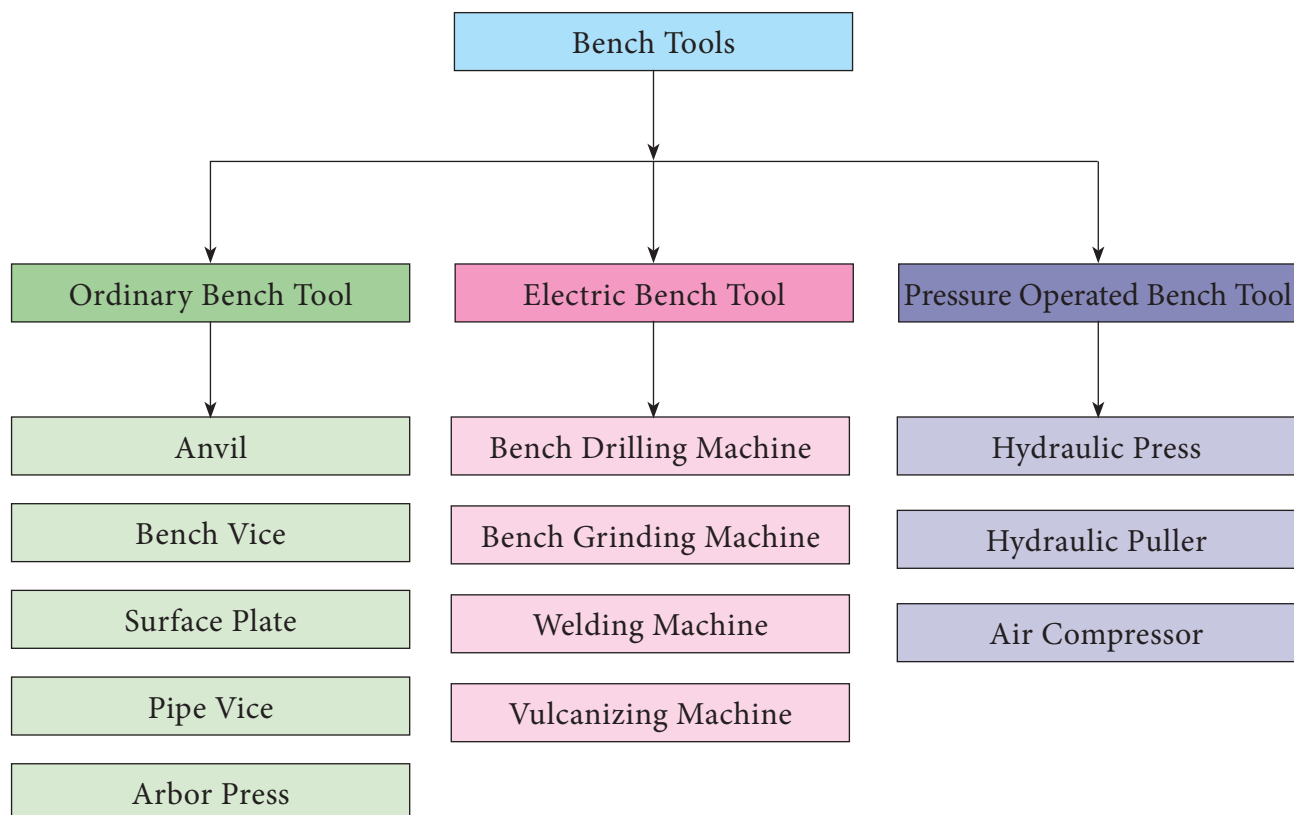
Figure 2.1.1.8 Drill Bits

Types of Drill Bits

- Straight shank twisted drill bit
- Taper shank twisted drill bit

2.1.2 Bench Tools

It is not possible to have all the corrective measures for the damaged vehicle at the particular location itself. Due to this, some defected parts are removed from the vehicle. These parts are then brought back to the



service station and repaired with the tools. This process of repairing is known as bench tools. Bench tools are classified into many types.

2.1.2.1 Ordinary Bench Tools

Tools which are used to repair the defected parts of the vehicle in the service station are known as ordinary bench tools. Tools which are used for this purpose are described below. Fig 2.1.2(a) shows Anvil.

a) Anvil

It is used to repair the Bending, shearing, and rolling of the iron and sheet metal parts in the required manner.

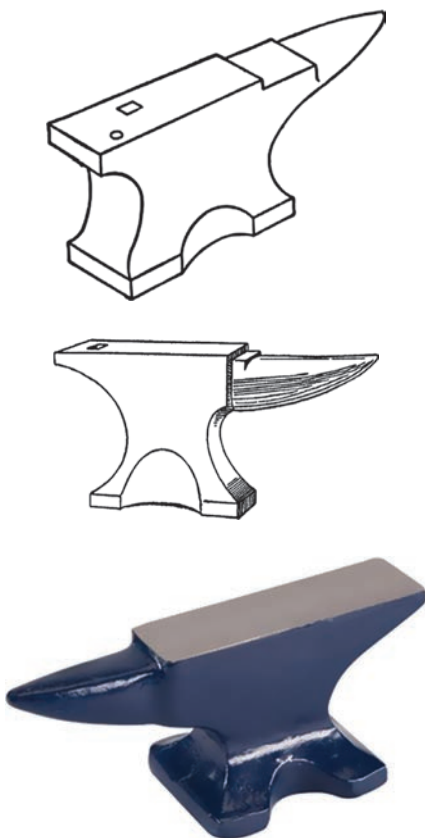


Figure 2.1.2(a) Anvil

b) Bench Vice

A bench vice is a device used for cutting or rubbing portions of the spatial part or

to fold, or to tighten the bolt and nut, to retain the nipple. It is connected to the bench-lob holes in the workshop. The two jaws in it are used to tighten the object to work. Fig 2.1.2(b) shows Bench Vice.

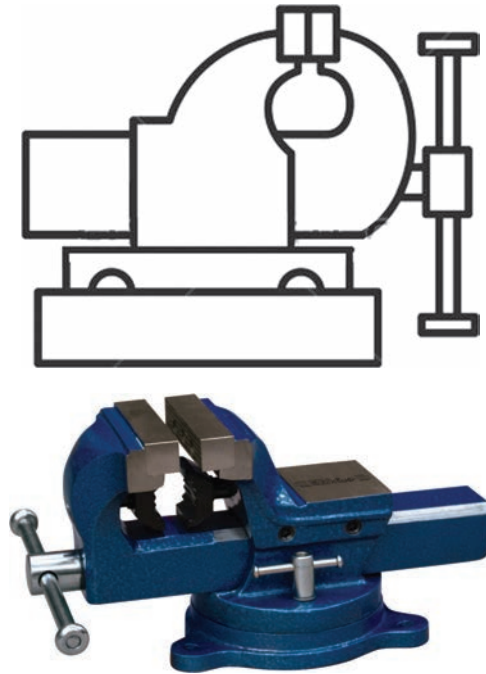


Figure 2.1.2(b) Bench Vice

c) Surface Plate

The surface plate is used to check whether the surface of the repaired part is equal to the surface plate, to adjust the size lines and to verify the corners are in the level. It is made of heavy iron plate. Its surface will be equal and erroneous. Figure 2.1.2(c) shows Surface Plate.

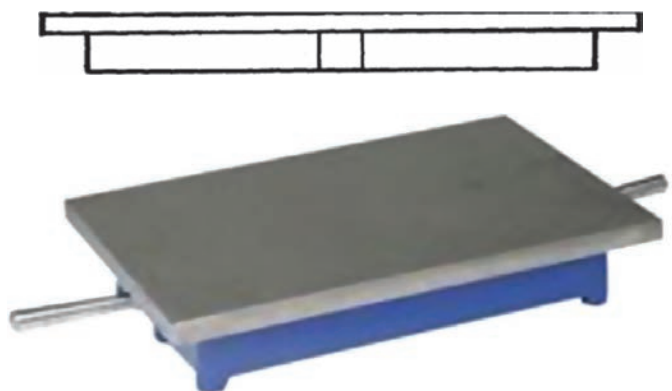


Figure 2.1.2(c) Surface Plate

d) Pipe Vice

This type of pipe vice is used to hold the cylindrical shape parts for to tighten, loosen, tear or cut. This action is similar to bench vice. Fig 2.1.2(d) shows Pipe Vice.

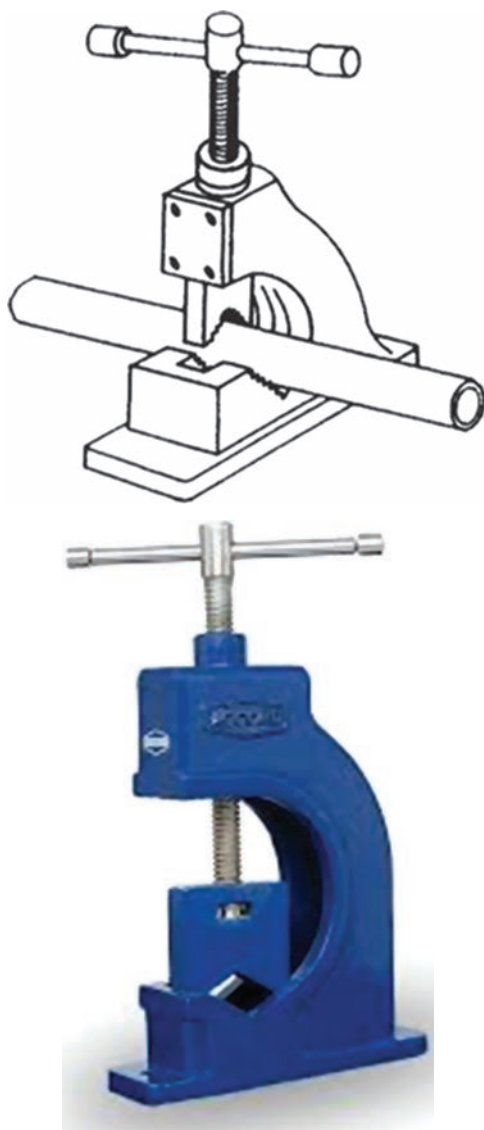


Figure 2.1.2(d) Pipe Vice

e) Arbor press

This type of bench tool is made with our hand-operated system. This type of press is used to tightening and loosening the bearing, gears, pulleys and straightening the shafts. This instrument runs on lever theory. The mechanical press is named as it operated

by hand without operating by electricity, fluid or wind. Fig 2.1.2(e) shows Arbor Press.

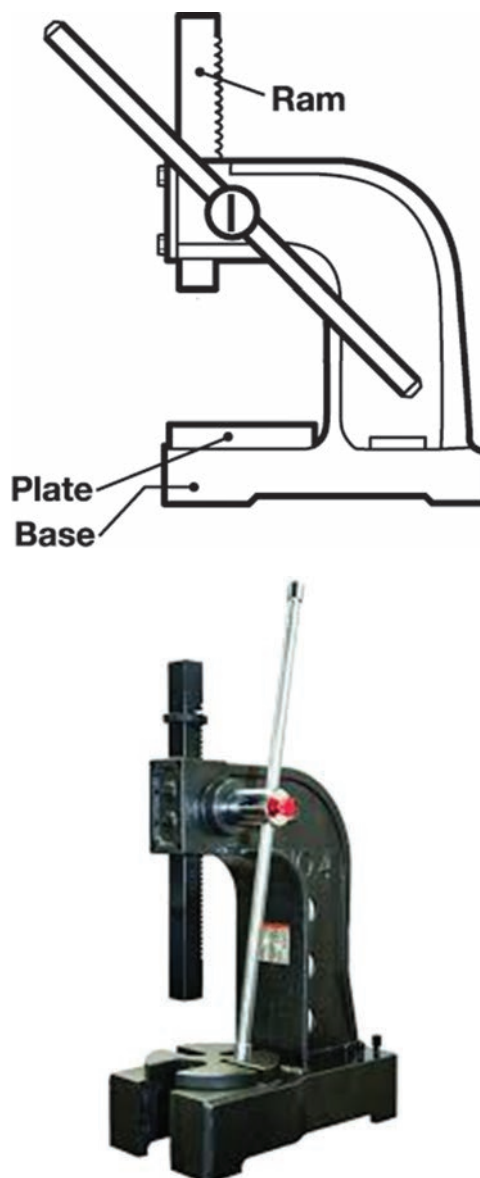


Figure 2.1.2(e) Arbor Press

2.2 POWER TOOLS

With the use of hand tools, tightening and loosening of nut and bolt and drilling is not as simple. It consumes more effort and time. To complete these types of work in an effective and quick manner, electric, hydraulic, pneumatic tools are used. It is named as power tools means. It is classified depends on the nature work. They are

1. Drilling Machine
2. Grinding Machine
3. Welding Machine
4. Vulcanizing Machine
5. Air Compressor
6. Honing Machine
7. Battery Charger
8. Cylinder Boring Machine
9. Spark Plug Tester
10. Front Shaft Grinding Machine
11. Cell Tester

2.2.1 Drilling Machine

Instead of drilling a hole by hand, drilling is made by means of an electric motor. This is done with the use of drill bit which is operated by electric motor. The to and fro motion of drill bit is controlled by a wheel. It requires minimum effort and time compared to hand drilling. Drilling machines are again classified into many types. They are,

- a. Hand Drilling Machine
- b. Flexible Drilling Machine

a. Hand Drilling Machine

These drilling machines are used to drill the hole in the wall and various portions of vehicles. It is also called as a Portable drilling machine. Fig 2.2.1(a) shows Hand Drilling Machine.

b. Flexible Drilling Machine:

These types of drilling machines are used to drill in the parts like crankshaft journals and in the connecting rod oil bath. These are mainly used to drill in the curved region. Fig 2.2.1(b) shows Flexible drilling machine.



Figure -2.2.1 (b) Flexible Drilling Machine



Figure 2.2.1 (a) Hand Drilling Machine



DRILL BIT

Howard Robard Hughes Sr.

Howard Robard Hughes Sr. (September 9, 1869 - January 14, 1924) was an American businessman and inventor. He was the founder of Hughes Tool Company.

He invented the “Sharp-Hughes” rotary tri-cone rock drill bit during the Texas Oil Boom.



He is best known as the father of Howard Hughes, the famous American business tycoon.

2.2.2 GRINDING MACHINE

Whenever the iron piece is subjected to cut and drill, the surface of the portion gets roughness. It is not possible to remove the roughness of the piece in hand. Instead of this, grinding machine is used to soften the iron piece and it requires minimum time and effort to do the process. It is named grinding machine because of grinding operation is done by electric means. If the grinding machine is located on the bench then it is known as bench grinding machine. If it is carried to the work-place then it is known as a portable grinding machine. Fig 2.2.2 shows Grinding Machine.

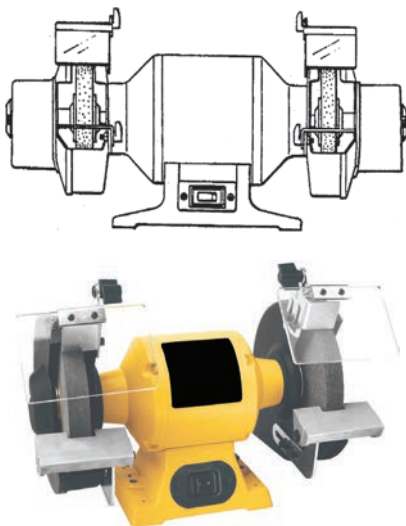


Figure 2.2.2 Grinding Machine

2.2.3 WELDING MACHINE

Two metal pieces can be joined by the use of nuts and bolts. But strength at their joined portions is in a weak manner. By joining the two metal pieces by means of welding, the strength of the material becomes strong. The machine which is used to join two metal pieces is called as welding machine. Fig 2.2.3 shows Welding Machine.

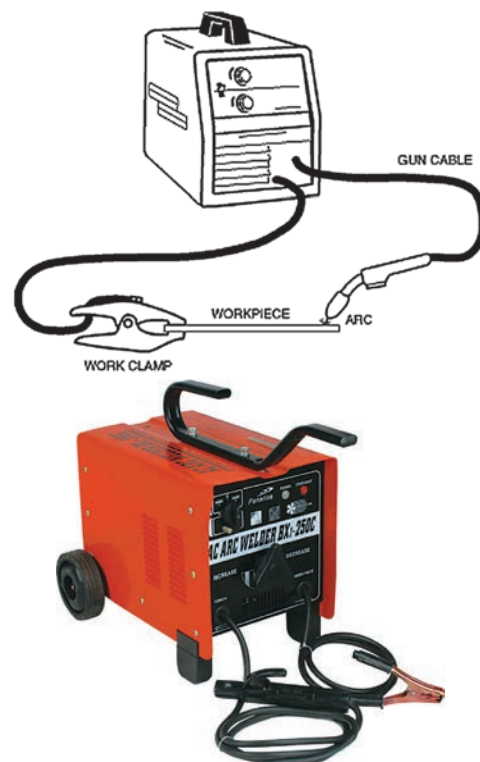


Figure 2.2.3 Welding Machine

2.2.4 VULCANIZING MACHINE

Vehicle tire and tubes should maintain in a proper manner. Otherwise severe effects may be taken place. While the vehicle is traveling on road, if a sharp object in the road gets perforated in the tire, the air in the tire tube gets deflated and due to this vehicle driving motion gets affected. If it continues its motion then the tube gets to tear off. This is known as a puncture. This type of puncture cannot be cured by the cooling method. Curing this puncture with raw rubber is called as Vulcanizing. High pressure and temperature are required to vulcanize the rubber material. The machine which is used to do this vulcanizing process is named as a vulcanizing machine. Shown in Fig 2.2.4.



Figure 2.2.4 Vulcanizing Machine

2.3 GARAGE TOOLS

Measuring tools required for automobiles service station and garage are classified broadly two types

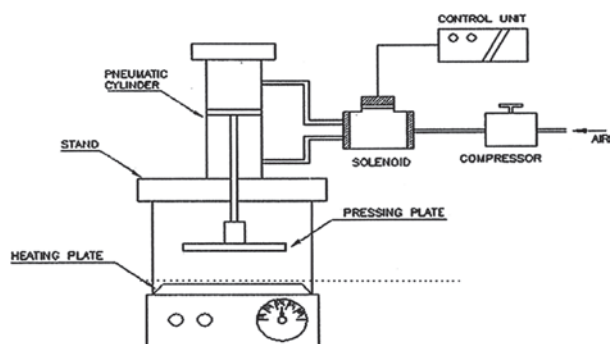
1. Direct tools
2. Indirect tools

2.3.1 DIRECT TOOLS

- a) Steel Rule
- b) Outside Micrometer
- c) Vernier Caliper
- d) Wire Gauge
- e) Voltmeter
- f) Ammeter
- g) Hydrometer
- h) Radius Gauge
- i) R.P.M. Gauge
- j) Pressure Gauge
- k) Speedometer
- l) Oddo Meter

a) Steel Rule

It is a metal steel rule which has both metric and British units. It is a direct measuring instrument. It is made up of spring steel





International Organization for Standardization



The International Organization for Standardization (ISO) is an international standard-setting body composed of representatives from various national standards organizations.

Founded on 23 February 1947, the organization promotes worldwide proprietary, industrial and commercial standards. It is headquartered in Geneva, Switzerland and works in 162 countries.

Use of the standards aids in the creation of products and services that are safe, reliable and of good quality. The standards help businesses increase productivity while minimizing errors and waste.

By enabling products from different markets to be directly compared, they facilitate companies in entering new markets and assist in the development of global trade on a fair basis.

The standards also serve to safeguard consumers and the end-users of products and services, ensuring that certified products conform to the minimum standards set internationally.

or stainless steel. Surface finish was done over the steel rule in order to avoid corrosion. Satin chrome is used for surface finish process. It is available in following measurements, Steel Rule shown in Fig 2.3.1(a).

- 150 mm
- 300 mm
- 600 mm

b) Outside Micrometer

It is used to measure the external diameter of a work as simple, quick, straight and accurate manner. It can be used to measure accurately 0.0001 inches or 0.01mm diameter of a screw. Besides these, micrometres are available in many formats, sizes as needed. Fig 2.3.1(b) shows Outside Micrometer.



Figure 2.3.1(a) Steel Rule

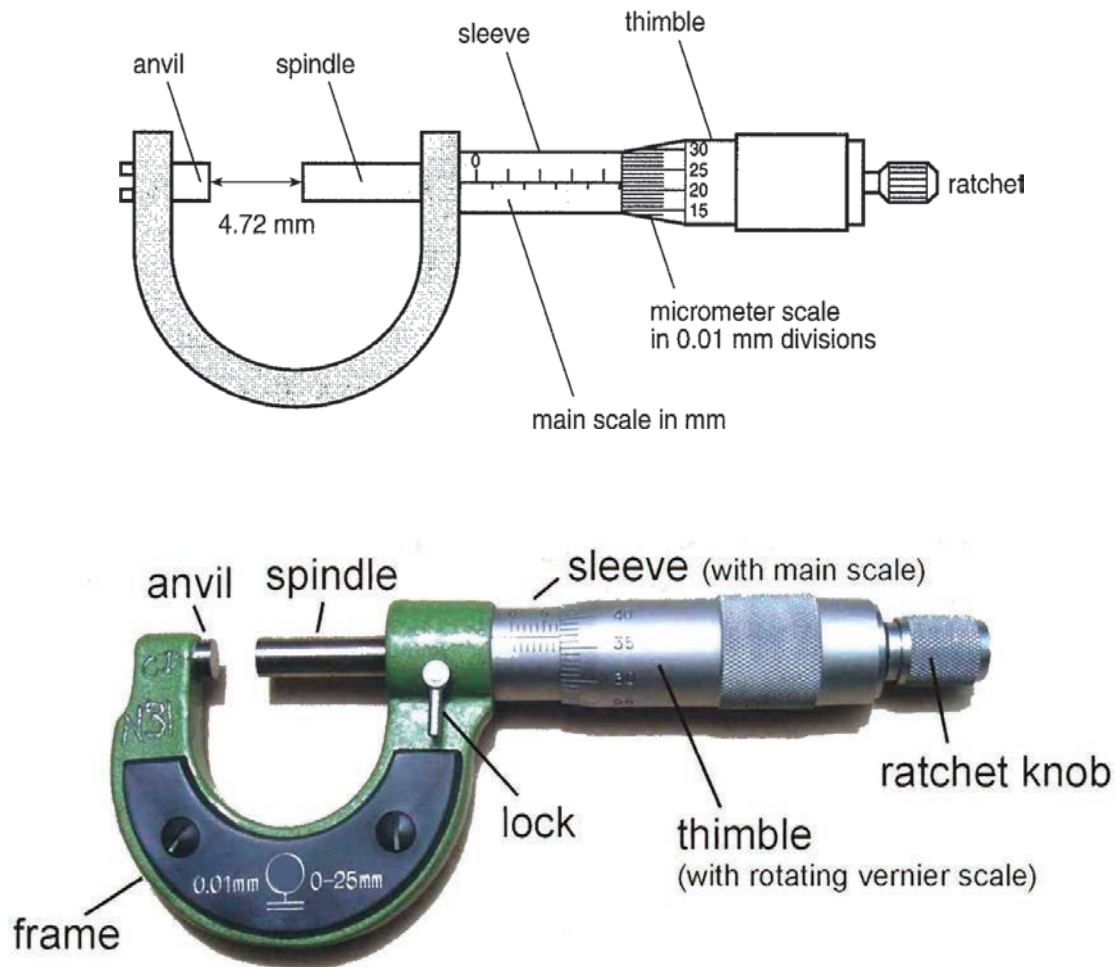


Figure 2.3.1(b) Outside Micrometer

c) Vernier Caliper

Vernier calliper is often used in factories as it is easy and convenient to measure metal components than micrometers. It helps to measure external and internal levels. It is a direct measuring instrument. Vernier Caliper is shown in Fig 2.3.1(c).

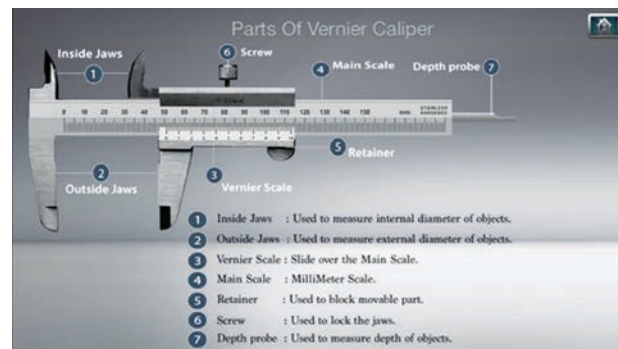
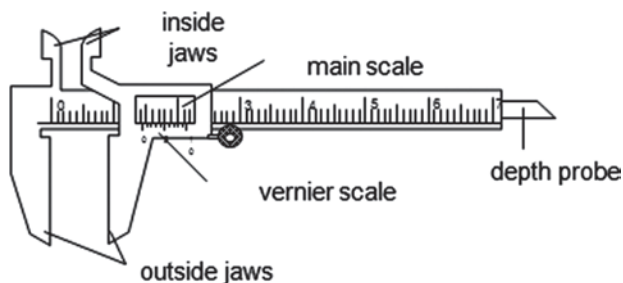


Figure 2.3.1(c) Vernier Caliper



d) Wire Gauge

The thickness of the thin wire or the plate is represented by the gauge number. If the gauge number is higher, the thickness



GAUGE BLOCK

Carl Edvard Johansson:



Gauge blocks were invented in 1896 by Swedish machinist Carl Edvard Johansson. They are used as a reference for the

calibration of measuring equipment used in machine shops, such as micrometers, sine bars, calipers, and dial indicators (when used in an inspection role).

Gauge blocks are the main means of length standardization used by industry.

Gauge blocks (also known as gage blocks, Johansson gauges, slip gauges, or Jo blocks) are a system for producing precision lengths.

The individual gauge block is a metal or ceramic block that has been precision ground and lapped to a specific thickness.

Gauge blocks come in sets of blocks with a range of standard lengths. In use, the blocks are stacked to make up a desired length.

is lower and if the gauge number is lower, the thickness will be higher. Wire gauge is a rounded plate which has holes of various sizes and has a provision to insert the rounded plates at the edge. Gauge numbers are marked on the gauge plate. Shown in Fig 2.3.1(d).

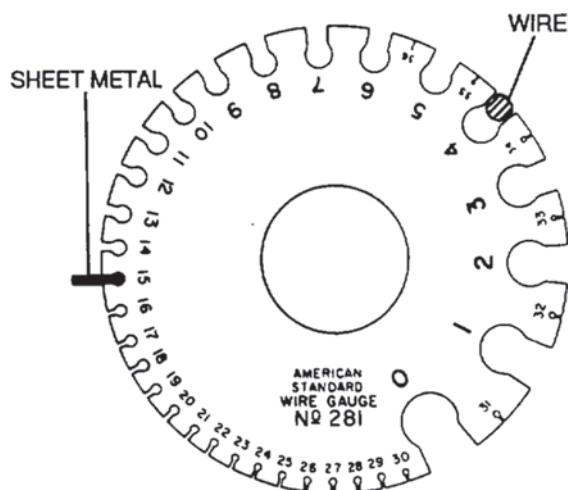


Figure 2.3.1(d) Wire Gauge

e) Voltmeter

The voltmeter is an instrument which is used to measure the voltage across the electrical circuit. The unit of voltage is “volt”. It is used as 240 volts in homes and 440 volts at workstations. Fig 2.3.1(e) shows Voltmeter.



Figure 2.3.1(e) Voltmeter

f) Ammeter

It is used to measure the amount of current passing through the circuit. It is used to verify the faults of the industry and household devices. It helps to check the amount of electricity. The unit of the ammeter is “Ampere”. Fig 2.3.1(f) shows Ammeter.



Figure 2.3.1(f) Ammeter

g) Hydrometer

Hydrometer is used to calculate the density of the insulating fluid (diluted sulfuric acid) in the battery. The amount of liquid in the hydrometer is used to calculate the density of the liquid. While pressing the rubber bulb in the hydrometer, the liquid come inside the cylinder from the cell. Fig 2.3.1(g) shows Hydrometer.



Figure 2.3.1(g) Hydrometer

h) Radius Gauge

Radius gauge is used to measure the specific radius of the projected surface area of the job or the corners of the job. Radius gauge is also used to measure and test the circumference of the curve in the corner or corners. Radius Gauge is shown in Fig 2.3.1(h).



Figure 2.3.1(h) Radius Gauge

i) RPM Gauge

It is used measure the speed of the engine. RPM gauge is used to show the number of cycles per minute for each minute. The red pin is used to show the cycle of 6000 rpm to 7000 rpm. But nowadays digital displays are used. Fig 2.3.1(i) shows RPM Gauge.



Figure 2.3.1(i) RPM Gauge

j) Pressure Gauge

It is used to measure air pressure and pressure of lubricating oil in the engine cylinder. It is set on the vehicle's dashboard. Fig 2.3.1(j) shows Pressure Gauge.



Figure 2.3.1(j) Pressure Gauge

k) Speedometer

It helps to calculate the speed of the vehicles. This calculation helps the driver to increase or decrease the driving speed of the vehicle based on the situation. Figure 2.3.1(k) shows Speedometer.



Figure 2.3.1(k) Speedometer

l) Odometer

This helps to show, how much the vehicle has been running. (Eg., 15000 km). Fig 2.3.1(l) shows Odometer.



Figure 2.3.1(l) Odometer

2.3.2 INDIRECT TOOLS

- a) Feeler Gauge
- b) Outside Caliper
- c) Inside Caliper

a) Feeler Gauge

The set of thin steel plates which are used to measure the size of the shortest spacing is called the feeler gauge. These are placed in a heat treated shell in order to separate them easily. It is very useful for measuring gaps in valve tape bed, sparkplug cape. Fig 2.3.2(a) shows Feeler Gauge.

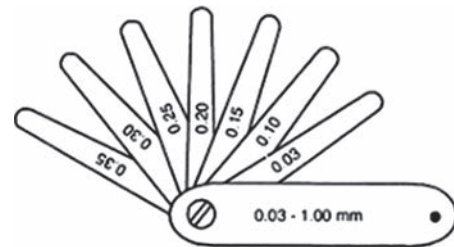


Figure 2.3.2(a) Feeler Gauge

b) Outside Caliper and Inside Caliper

This setting can be found in the picture. It is used to measure the outer diameters of the pipe and the engine cylinder. This can measure the external diameter very accurately.

Inside calliper is used to measure the inner diameter of the engine cylinder holes, pipes and the inner dimensions of the canal. It is an indirect measuring instrument. Fig 2.3.2(b) shows Outside and Inside Calipers.

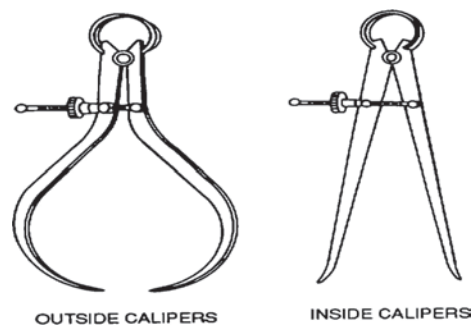


Figure 2.3.2 (b) Outside and Inside Calipers

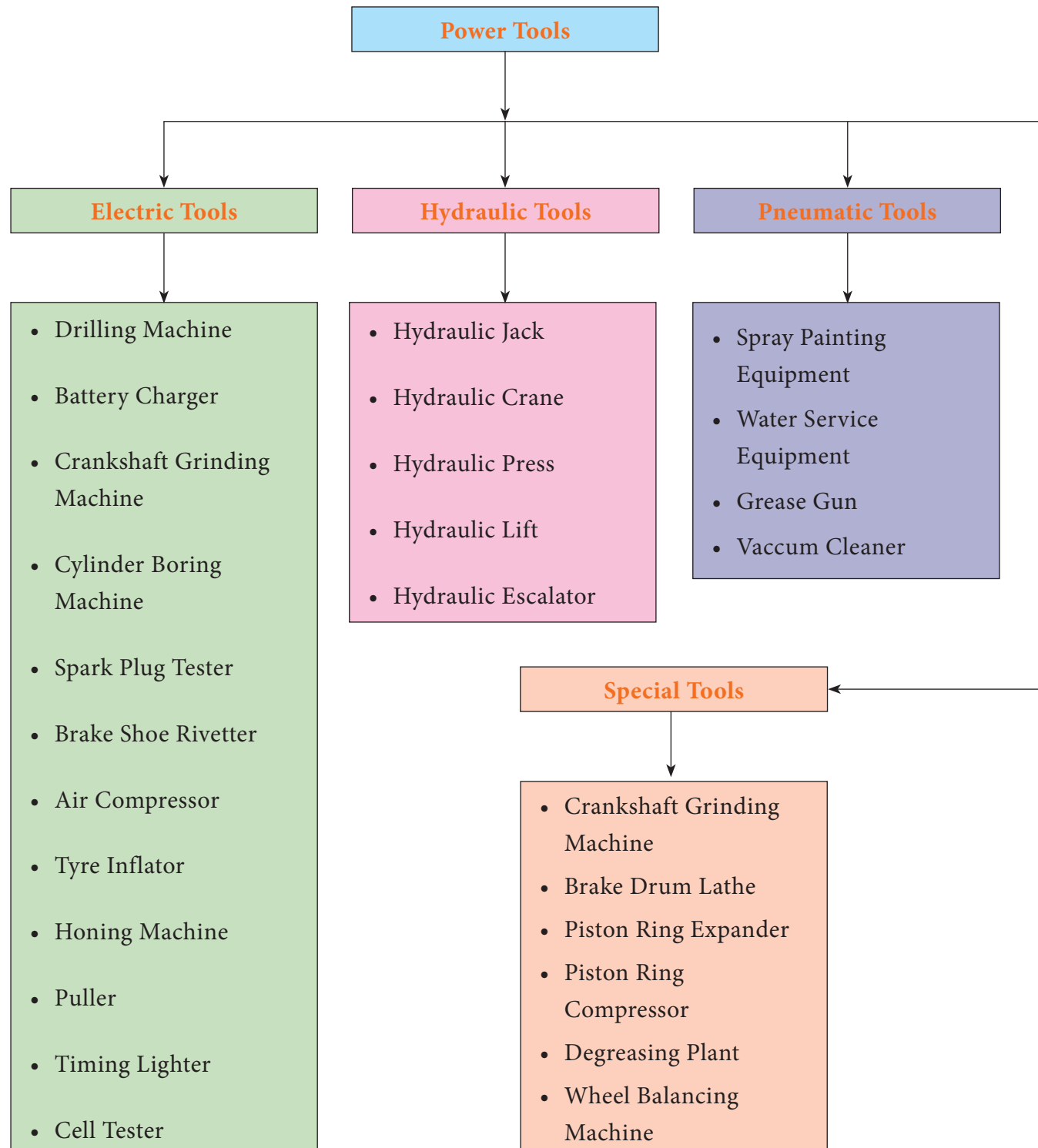
2.3.3 Machinery and Special Tools

Power tools used in automobile vehicles are classified as below,

2.3.4 Electric Tools

2.3.4(a) Drilling Machine

It helps to drill wood and metal parts. These are usually two types. i) Bench Drilling



Machine ii) Portable Drilling Machine. Fig 2.3.4(a) shows the Drilling Machine.

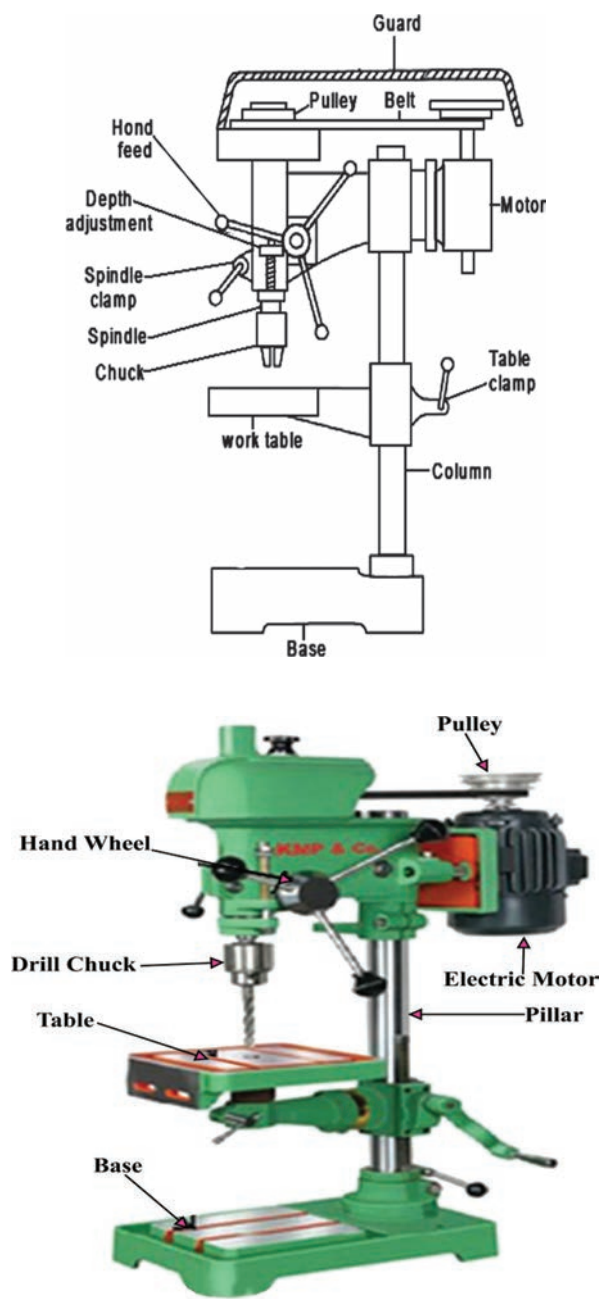


Figure 2.3.4(a) Pillar Type Drilling Machine

2.3.4(b) Battery Charger

The battery charger is used to charge the batteries. It converts the alternating current into a direct current and makes the battery to be charged. Because the battery cannot be directly charged with alternating current. Figure 2.3.4(b) shows Battery Charger.



Figure 2.3.4(b) Battery Charger

2.3.4(c) Cylinder Boring Machine

Continues operation engine leads to wear on the cylinder walls. The energy of the engine is wasted by such wearing. Therefore, Cylinder Boring Machine is used to adjust the cylinder's inner diameter. Refer Figure 2.3.4(c).



Figure 2.3.4(c) Cylinder Boring Machine

2.3.4(d) Spark Plug Tester

In petrol engine at the end of the compression stroke, spark is ignited to burn the

compressed fuel. This is done with the help of spark plug. The equipment which is used to check the spark level is in required manner is known as SPARK PLUG TESTER. Shown in Fig 2.3.4(d).



Figure 2.3.4(d) Spark Plug Tester

2.3.4(e) Caster Camber Gauge

It is used to check the wheel alignment in four wheeled vehicles.

2.3.4(f) Brake Shoe Rivetter

In the top portion of the brake shoe, the new lining is designed to fit the rivets in the hole to tighten the brake shoe parts.

2.3.4(g) Air Compressor

The machine which is used to compress and store the atmospheric air to the required pressure level is named as air compressor. Shown in Fig 2.3.4(g).



Figure 2.3.4(g) Air Compressor

Usages

1. It is used to refill the air in the tire tube.
2. It is used to clean the spark plug, carburetor and nozzle.

2.3.4(h) Tyre Inflator Gauge

It is used to measure the air pressure which is present inside the tire tube at the time of air filling by without having air leakage. Tyre Inflator Gauge is shown in the Fig 2.3.4(h).



Figure 2.3.4(h) Tyre Inflator Gauge

2.3.4(i) Honing Machine

Honing machine is used to regulate the depreciation in the IC engine cylinder, when the cylinder depreciation level is below 0.01mm. Cylinder wall which is made with the use of cylinder bearing is smoothened by cylinder honing. Fig 2.3.4(i) shows Honing Machine.



Figure 2.3.4(i) Honing Machine

2.3.4(j) Timing Lighter

This equipment is used to check whether the spark plug is producing the spark in proper firing order in the engine cylinder. Figure 2.3.4(j) shows Timing Lighter.



Figure 2.3.4(j) Timing Lighter

2.3.4(k) Cell Tester

It is used to check the life cycle of battery cell and is used to check the amount of

electric charge. This is checked by connecting the positive and negative poles of the battery by wire and by doing this if it is lighted up then it is understood that battery is having charge. Fig 2.3.4(k) shows Cell Tester.

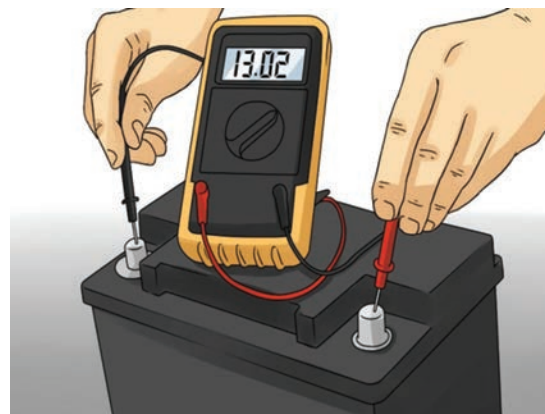


Figure 2.3.4(k) Cell Tester

2.3.5 Pneumatic Tools

2.3.5(a) Spray Painting Equipment

Spray painting equipment is used to paint the vehicle in an uniform manner with the help of air compressor. Air compressor is used in service station to clean the vehicle, by blowing the water in pressurized way. Fig 2.3.5(a) shows Spray Painting Equipment.



Figure 2.3.5(a) Spray Painting Equipment

2.3.5(b) Grease Gun

Grease gun is used in automotive vehicle to reduce the friction in the moving parts by applying the pressurized grease. This is done with the aid of air compressor. It is also used to fix a new lining in the top portion of the brake shoe. Fig 2.3.5(b) shows Grease Gun.



Figure 2.3.5(b) Grease Gun

2.3.5(c) Air Compressor

It is used in automatic machines where air pressure is required. This means by using this amount of air pressure required to restrict the passage is done. In added to this, it is used for to refill the air in the tire, paint, clean and water wash the vehicle. The amount of air which has been used for all this purpose is generated from the equipment which is named as an air compressor. Fig 2.3.5(c) shows Air Compressor.

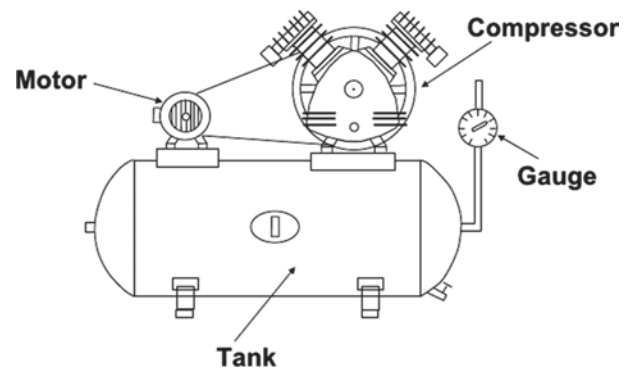


Figure 2.3.5(c) Air Compressor

2.3.5(d) Vaccum Cleaner

The vaccum cleaner is a device which is used to wipe off the dusts deposited in the vehicle parts where the cleaning process is difficult to carried out manually. Fig 2.3.5(d) shows Vaccum Cleaner.



Figure 2.3.5(d) Vacuum Cleaner



Figure 2.3.6(b) Piston Ring Expander

2.3.6 Special Tools

2.3.6(a) Puller

The equipment which is used to remove the components like gear shaft and bearing which are closely fitted to the shafts in an easy manner is named as puller. Shown in Fig 2.3.6(a).



Figure 2.3.6(a) Puller

2.3.6(b) Piston Ring Expander

It is used to remove the piston rings which are fitted in the piston. Fig 2.3.6(b) shows Piston Ring Expander.

2.3.6(c) Piston Ring Compressor

The piston ring compressor is a special tool that is specifically designed for compressing the piston rings when a piston is re-installed. This is accomplished by opening the piston ring compressor enough so that the piston will slide into the opening. Then the rings compress by tightening the tool so that it is snug around the piston. Fig 2.3.6(c) shows Piston Ring Compressor.



Figure 2.3.6(c) Piston Ring Compressor

2.3.6(d) De-Greasing Plant

Mixture of steam and hydrochloric acid is act as a degreasing agent. With the use

of this agent, grease which is deposited in the metal parts can be wiped off.

2.3.6(e) Wheel Balancing Machine

Wheel balancing machine is used to balance the unbalanced weighted wheels which are located in the front and rear axle.

2.3.6(f) Spring Tester

Sometimes tensile strength of the spring is reduced at that time by using this spring tester, spring tensile strength is improved. Fig 2.3.6(f) shows Spring Tester.



Figure 2.3.6(f) Spring Tester

2.3.6(g) Nozzle Tester

It is used to measure the diesel particle size, diesel quantity and leakages of the diesel which is coming out from the nozzle while blowing the diesel in high pressure at the end of the compression stroke inside the engine. Fig 2.3.6(g) shows Nozzle Tester.



Figure 2.3.6(g) Nozzle Tester

2.3.7 Screw Jack and Horses

Jack is used to lifting the heavyweight components which are not possible to lift with the use of hands. Fig 2.3.7(a) shows the diagram of Screw Jack.

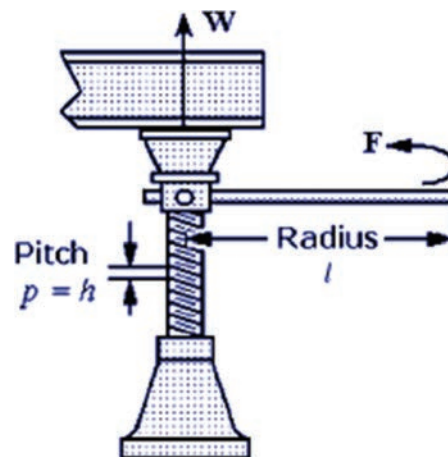


Figure 2.3.7(a) Screw Jack



Bureau of Indian Standards



The Bureau of Indian Standards (BIS) is the national Standards Body of India working under the aegis of Ministry of Consumer Affairs, Food & Public Distribution, Government of India.

It is established by the Bureau of Indian Standards Act, 1986 which came into effect on 23 December 1986.

The Minister in charge of the Ministry or Department having administrative control of the BIS is the ex-officio President of the BIS.

The organisation was formerly the Indian Standards Institution (ISI), set up under the Resolution of the then Department of Industries and Supplies No. 1 Std.(4)/45, dated 3 September 1946. The ISI was registered under the Societies Registration Act, 1860.

As a corporate body, it has 25 members drawn from Central or State Governments, industry, scientific and research institutions, and consumer organisations.

Its headquarters are in New Delhi, with regional offices in Kolkata, Chennai, Mumbai, Chandigarh and Delhi and 20 branch offices. It also works as WTO-TBT enquiry point for India.

Construction

Its shaft is made of with cast iron material. By keeping the gravitational nature in mind, the jack basement is designed. The top portion of the main shell fixed with rotating block. Rotating block consists of with holes through which the handles are fixed and we can rotate it freely. A support is attached to the square thread rod.

Function

At first, screw jack has to be placed below the lifted component. Depends on the nature of the soil and the requirement of height to be lifted, it has been supported by

the wooden sleeper. Then by fixing the handle on the holes in the rotating block and rotating the handle, the vehicle will be lifted to the required height and work under the vehicle will be carried out. After finishing the work, again by rotating the handle in anti-clockwise direction vehicle will be grounded.

Capacity

Screw jack capacity is mentioned by maximum weight it can withstand. It is specified in terms of tonnage. It has to be lifted based on the given specification. If it is operated to lift more load than the specification, then severe damages will occur. Lubrication should be properly done to the moving and rotating parts.

- It is used to lift the four-wheeler to a certain height.
- The vehicle is lifted and supported by the use of this screw jack.
- With the help of this, damages on the bottom side of the vehicle are cleared and it is available in many sizes depends on the weight of the vehicle.

Horses

After lifting the screw jack to a certain height, horses have to be lifted to the same level and then the cotter pin has to be inserted. With the use of this horse, the screw jack has been removed.

It has been used depends on the weight of the vehicle. For to support the vehicle with high load, low load capacity horse should not be used. Fig 2.3.7(b) shows the diagram of Horse.



Figure 2.3.7(b) Horses

2.3.8 HYDRAULIC POWER TOOLS

In automobile industries, the work should be carried out in careful and in an unmistakable manner. In doing that, small

defects in the vehicles are repaired by using hand tools. In sometimes, large defects are repaired by removing the particular defected components from the vehicle and moving down the removed components to the ground or to the bench and then repaired. Similarly, sometimes the parts located below the chassis have to be repaired, that time the vehicle is lifted to a particular height and then repaired. For this purpose, power tools are used in the automotive industries. This is due to that weight of the vehicle is high and repairing the components underneath the vehicle is complicated and too risky. Power tools are utilized depends on the nature of work. The following are some classification of power tools.

2.3.8(a) Hydraulic Crane

It is used to lift and unlift the heavy weight components like engine in an automotive vehicle and to shift the heavy weight components from one place to another place. Fig 2.3.8(a) shows Hydraulic Crane.



Figure 2.3.8(a) Hydraulic Crane

2.3.8(b) Hydraulic Jack

It works on the basic principle of Pascal's law. It is used to hold the heavyweight components in particular height and to move

the heavyweight objects from one place to another place. Components with low load can be lifted easily in hand. But it is not possible to repair the tire of the heavy load carrying capacity vehicle by lifting the vehicle in hand. For this hydraulic jack is used. It works on the hydraulic pressure. Based on this principle, some vehicles are used (eg. JCP, Crane, Bull Dozer). The hydraulic jack is used to lift the vehicle while water washes the vehicle. Hydraulic jack working is explained in the schematic diagram. Fig 2.3.8(b) shows the diagram of Hydraulic Jack.



Figure 2.3.8(b) Hydraulic Jack

2.3.8(c) Hydraulic Press

It is used to straightening the bent portion in the flat, round and tube components. It works on the principle of Pascal’s law. It used in

automation industries, for repairing the mis-aligned curved portion in the chassis, steering, and in-vehicle fork. It is used to fix the bearings which have been used on the automatic machines. Fig 2.3.8(c) shows Hydraulic Press.

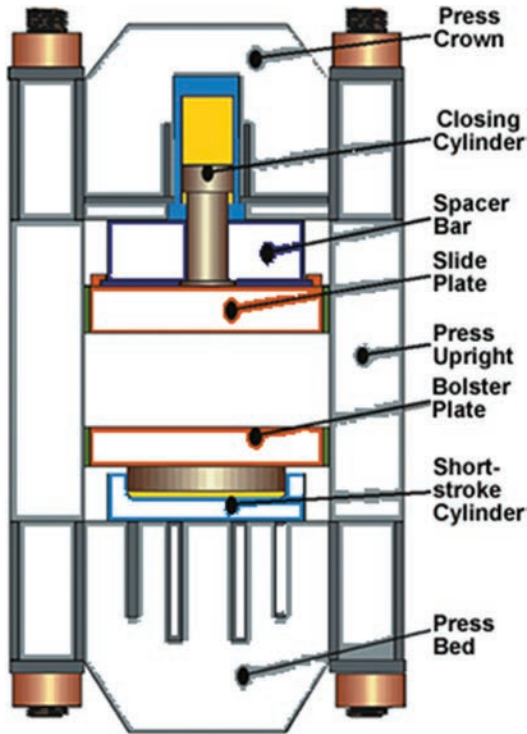


Figure 2.3.8(c) Hydraulic Press

2.3.8(d) Hydraulic jack puller

This equipment is used in the automation industries for to remove the closely fitted bearing by without having any damage in the bearing. Figure 2.3.8(d) shows the diagram of Hydraulic Jack Puller.

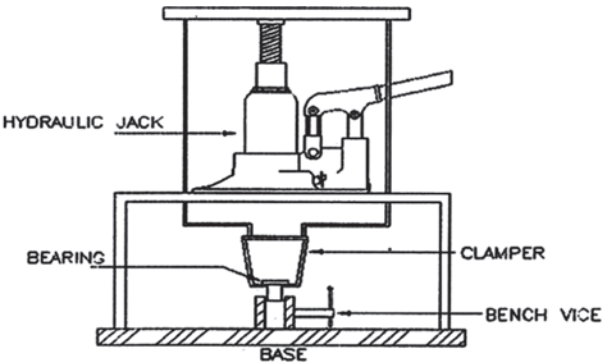


Figure 2.3.8(d) Hydraulic Jack Puller



1. Students should be taken to the nearby service station to learn the handling of mechanical instruments and industrial tools.
2. Students should visit any Government authorised central workshops to learn the process of drilling, overhead crane transport of materials as per the planned schedule of flow and should submit a report on it.



Glossary

Instruments	-	உபகரணங்கள்
Temperature	-	தட்பவெப்பநிலை
Measurements	-	அளவிடுதல்
Adjustable	-	சரிசெய்தல்
Tubular	-	குழாய்
Grinding	-	அரைத்தல்
Vulcanizing	-	துளை அடைத்தல்
Hydraulic	-	திரவ நிலை
International	-	சர்வ தேசம்
Standardisations	-	தர நிர்ணயம்



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SAMPLE QUESTIONS

Choose the correct answer:

1. Which principle is used in the Hydraulic Jack?
 - a) Pascal law
 - b) Newton law
 - c) Lever principle
2. Which one is measured by Hydro meter?
 - a) Voltage
 - b) Density of Electrolyte
 - c) Current
3. Honing machine is used to
 - a) to drill the cylinder
 - b) to enlarge the hole in cylinder
 - c) to finish the cylinder bore accurately
4. Which device is used to check the spark intensity in petrol engine?
 - a) Spark plug tester
 - b) Cell tester
 - c) Battery tester
5. R.P.M.gauge is used to
 - a) to measure the speed of engine
 - b) to measure the speed of vehicle
 - c) to calculate the milage

Answer the following questions:

1. What are the Simple or Ordinary Hand Tools?
2. Name the various types of Power Tools.
3. Explain about the Bench Tools.
4. What are the types of Files?
5. What are the types of Hammers?
6. What are the different types of Punches?
7. Mention any five sizes of Double Ended Spanners.
8. Mention any five sizes of Ring Spanners.
9. Mention any five sizes of Box Spanners.
10. Name the different types of Pliers.
11. What is meant by Volt Meter?
12. What is the use of Ammeter?
13. What is the use of Hydro Meter?
14. What are the uses of Wire Gauge?
15. Explain about R.P.M.Gauge.
16. Explain about Oddo Meter.
17. What is meant by Pressure Gauge?
18. Explain the uses of Timing Light.
19. Explain the uses of Puller.
20. What are the uses of Screw Jack?
21. What are the uses of Air Compressor?