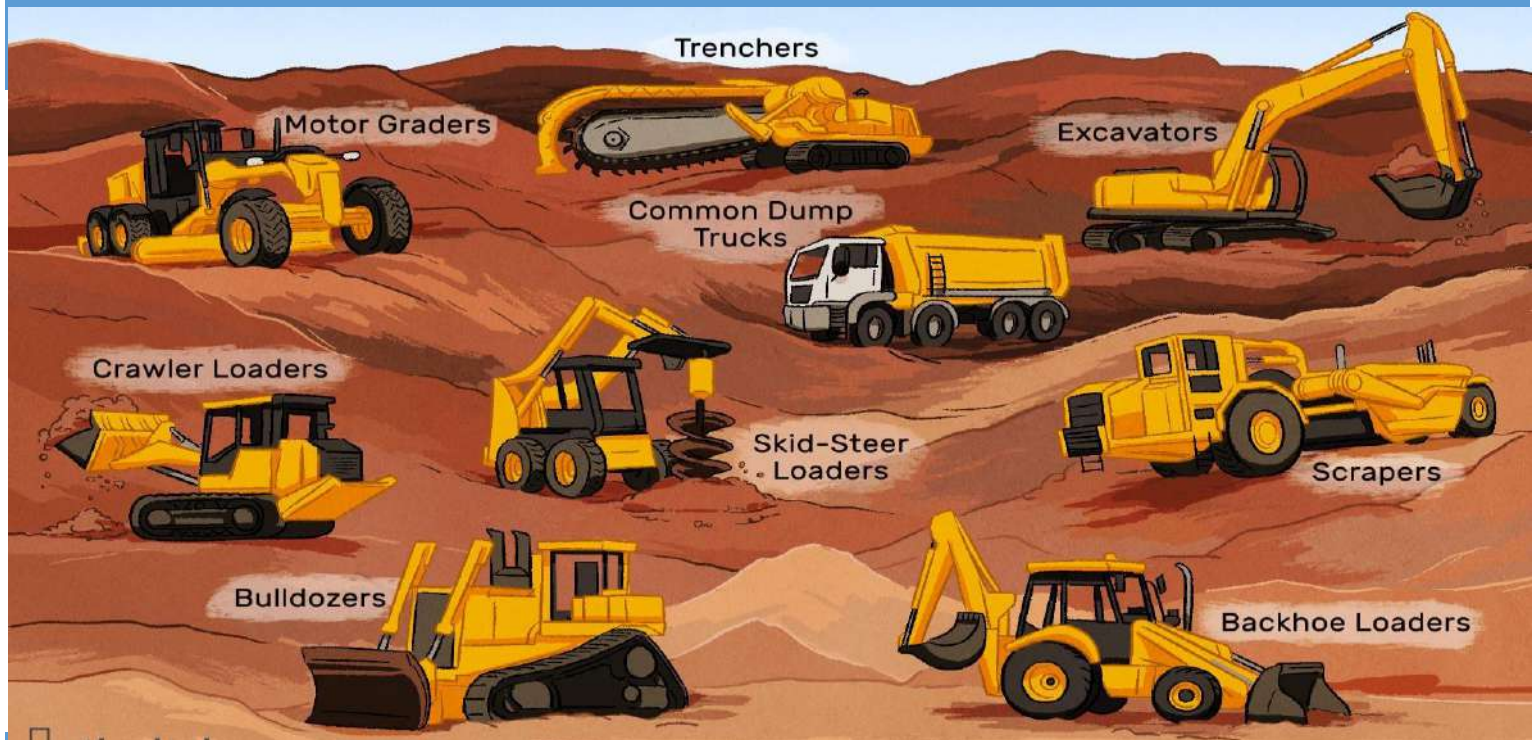


LAB MANUAL

MINE MACHINERY-2



LAB MANUAL

FOR

MINE MACHINERY-2 LAB

FOR MINING ENGINEERING 6th SEMESTER

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Aim of the experiment- To study of centrifugal pump.

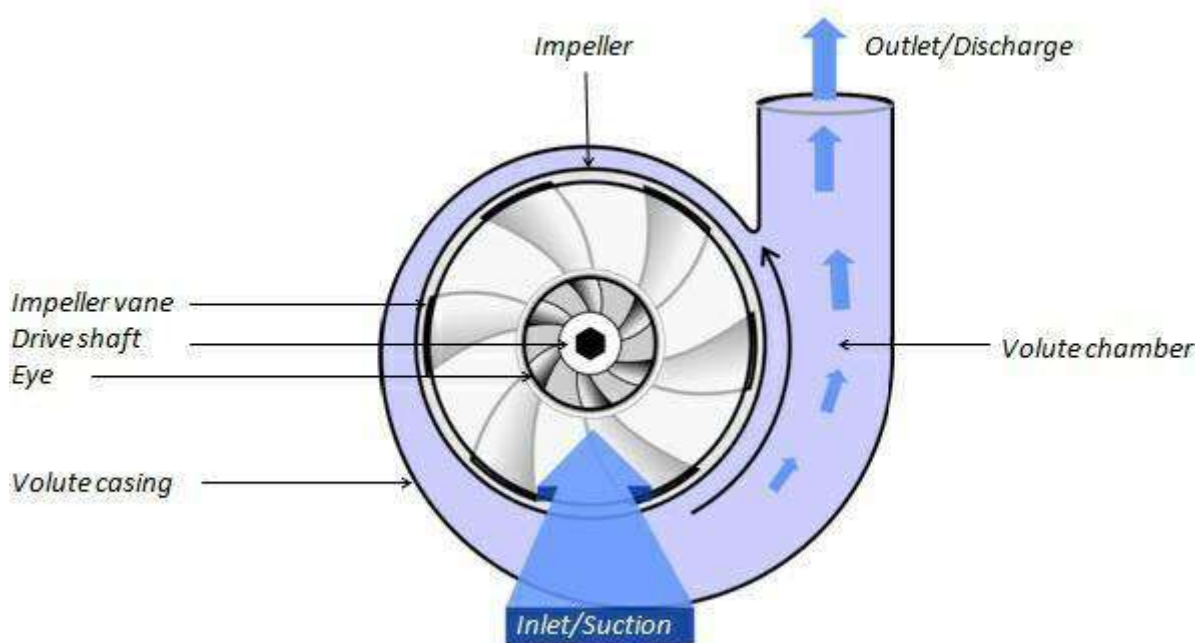
Theory/Description-

A pump comprises basically a casing and an impeller and shaft, together with stuffing boxes where the shaft enters the casing. Renewable wearing surfaces are provided at all points of close contact between stationary and moving parts.

Component of Centrifugal pump:

1. Casing: Cast iron or bronze materials are used for casing.
2. Impeller: Impeller are made up of bronze. Monel metals are used for corrosive and salty water.
3. Wearing ring: It is made up of bronze, cast iron, cast steel, stainless steel.
4. Pump shaft: It is made up of forged steel or phosphorous bronze.
5. Shaft sleeves: It is made of bronze. Stainless steel shaft sleeves are used when liquid is abrasive.
6. Pump glands: It is made up of bronze cast iron or steel.

Diagram-



Constructional features of centrifugal pump :

1. It consists of a close type of impeller mounted on a steel shaft which passes through the pump casing having water sealed stopping box at its end.
2. The bearing are carried on the extension of the end cover. The other end of casing is being supported by bearing in a water tight cap.
3. The impeller rotates with in an expanding casing having a form like spiral.
4. The liquid is drawn from the centre of impeller & called as eye and the liquid passes round the casing & being driven out tangentially by the veins blades of the impeller in to the main delivery.

Principle of operation of Centrifugal pump :

1. A centrifugal pump can't create its own vacuum therefore it needs priming.
2. As the impeller rotates the liquid gains kinetic energy due to centrifugal force imported to it.
3. When the liquid passes round the volute casing losses the kinetic energy & converted to pressure energy.
4. As the one of reduced pressure is created inside the impeller fresh liquid enter into it & this process is continued.
5. If „v“ is the velocity of the liquid attained in a pump the head develop will be $H=v^2/2g$.
6. The single inlet impeller causes axial inlet thrust towards the suction because of water leakage from the delivery side to behind the impeller eye, thus causing a resultant back.
7. This unbalancing is set by right means of a thrust bearing usually of double ball type & placed on the shaft.

Conclusion- From the above experiment we study about the constructional features and operation of centrifugal pump.

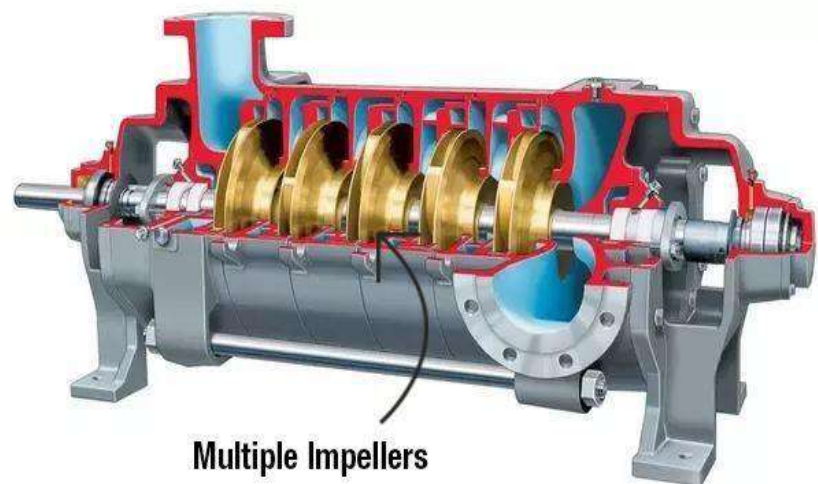
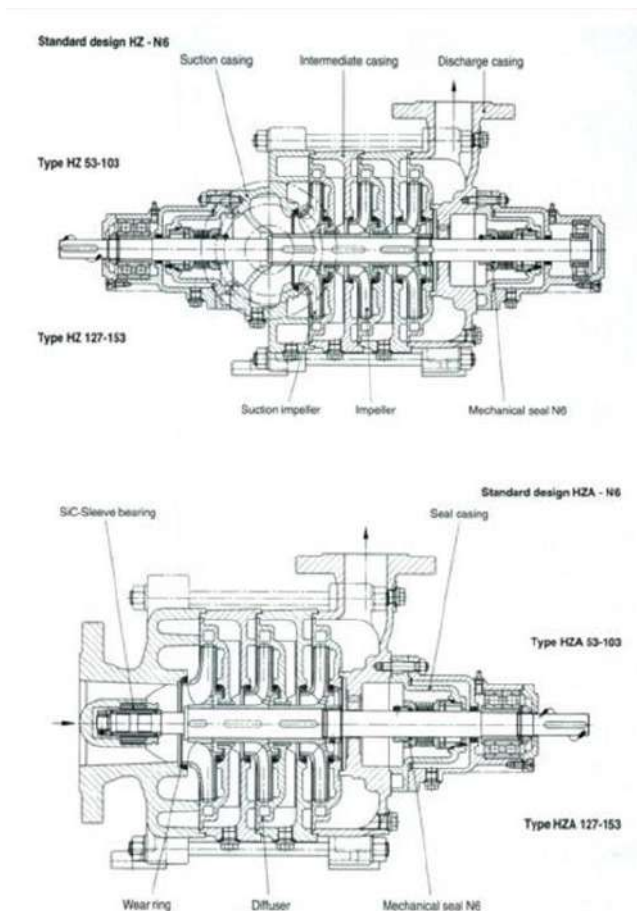
Aim of the experiment- To study of Turbine pump.

Theory/Description-

Main parts of turbine pump:

1. Pump casing: It is made up of cast iron or cast steel. It has got a suction inlet & a delivery outlet.
2. Impeller: Impeller is made up bronze or phosphorous bronze. Each impeller is mounted directly on the driving shaft.
3. Diffusing channels: Diffusing channels are formed by the diaphragm & the inner periphery of the casing.
4. Ring oiled bearing: At each end of the pump the shaft is supported on white metal bearing.
5. Staffing box: Staffing box provided at the end to seal the pump & to prevent the leakage of air, water.

Diagram-



Constructional features of turbine pump :

1. The turbine pump consists of one or more impeller diffused combination. The no. of Combination signifying the no. of stages.
2. Impellers are mounted on a shaft & revolve with in a casing.
3. An impeller has an inlet opening eye through which water is entering in to the pump.
4. It has a no. of guide vanes along which water rotates and comes out entering the diffuser passage. In this way the water finally lead to the delivery column.
5. The pump is commonly associated with a balancing disc mounted on the main shaft to w\counter act the axial thrust.

Principle of action of turbine pump:

1. The pump is works on the principle of Bernoulli theorem. According to which “the sum of them kinetic energy & pressure energy of flow of water for each unit weight of water is constant at any point.
2. The rotating impeller gives an increased head & velocity while in the diffusing channels the velocity of water is reduced. In this stage kinetic energy in get converted in to potential energy.
3. This conversation of kinetic energy to potential energy is governed by the velocity of water thrown off by the impeller.
4. The net effect of head is a sum of heads developed at each stages.

Conclusion- From the above experiment we study about the constructional features and operation of Turbine pump.

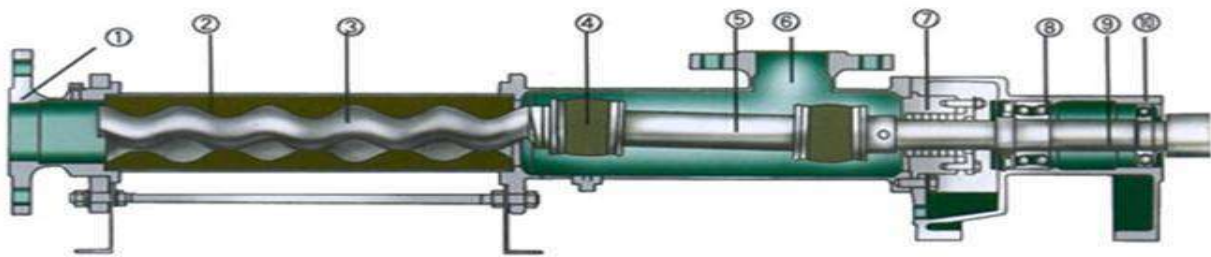
Aim of the experiment- To Study of Roto Pump.

Theory/Description

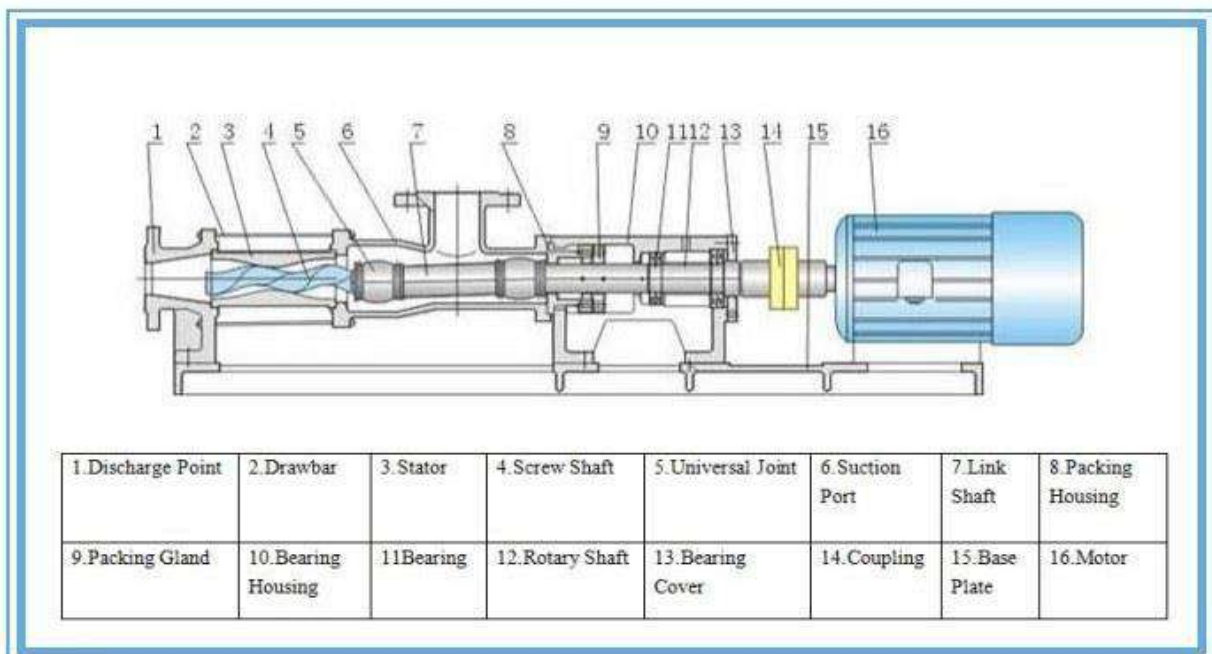
Roto pump is generally used for small capacity & low heads. It is especially used in muddy water in advancing deep headings. In coal washers, the radial cross section is circular & eccentric into the axis.

Diagram-

Helical Rotor Pump



- ① Outlet ② Stator ③ Rotor ④ Cardan Joint ⑤ Intermediate Shaft ⑥ Inlet
 ⑦ Shaft Seal ⑧ Bearing ⑨ Transmission Shaft ⑩ Bearing Body



Constructional features of roto (screw) pump :

This type of pump differs from the reciprocating and turbine pumps in its construction and working principle. It is a special type of electrically driven valve less, rotative pump which is inherently self priming with a lift (suction head) of up to 8m of water. It consists of essentially.

1. A rubber starter which has the form of a double internal helix and is a push fit in the machined cast iron barrel. The starter may be of natural or synthetic rubber or of hypalon, viton or other plastic material.
2. A single helical rotor of special abrasion resisting or non corroding steel (Monel metal or stainless steel).
3. Suction and delivery branches, ranging from 19mm to 75mm diameter.
4. Hollow driving shaft, running in ball bearing and transmitting an eccentric motion to the rotor by a coupling rod of high tensile steel.

Working principle of roto (screw) pump :

It is an eccentric screw pump. The radial cross section of the rotor is circular and is at all points eccentric to the axis, the centers of the sections lying along a helix whose axis forms the axis of the rotor. The pitch of the starter is twice that of the rotor and the two engage in such a fashion that the rotor section travels back and forth across the starter passage. The rotor maintains a constant seal across the starter. Whilst the rotor rotates in the starter, cavity formed between the two progresses from suction to delivery side resulting in uniform metered flow of water.

The rotary motion creates an exceptionally high suction which exhausts all air from intake line resulting in immediate lift of water without need for priming.

Water which enters the suction branch is thus caught up in the space between the rotor and starter and is forced through the pump as the rotor revolves. A positive pressure is developed on the delivery side and there must be a free passage for the water before the pump is started up. The rotor pump is normally direct driven by a three phase. A.C. squirrel cage induction motor running at 580, 720, 960 or 1450 revs. per minute. The motor is switched direct on to the line. The pumps are available as single stage pumps (0.33 to 10 H.P. of motor) or double stage pumps (10 to 20 H.P. of motor).

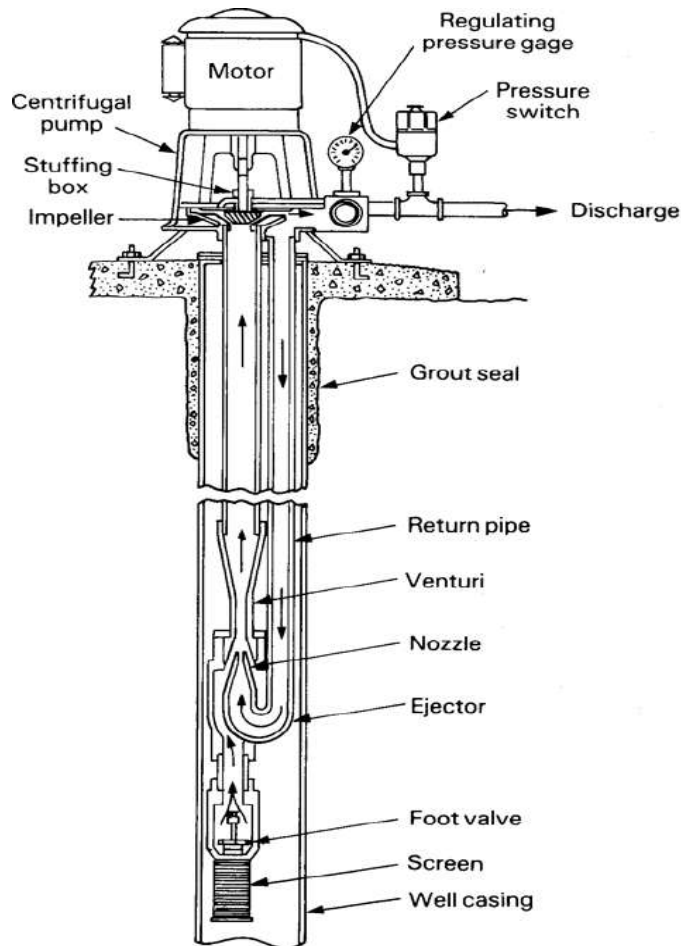
Conclusion- From the above experiment we study about the constructional features and operation of Roto pump.

Aim of the experiment- To Study of Sinking Pump.

Theory/Description

A pump which is used in a borehole of a couple of cm diameter is called as borehole pump. It is nothing but a multi stage turbine pump having with non over loading characteristics.

Diagram-



Construction/Operation-

Essentially it consist of 2 parts, one at the surface and the other inside the borehole.

1. The motor is placed in the surface & driving the pump through along driving shaft and lower the pump unit is placed.
2. In the top part the motor is spindle connected through a thrust bearing to the shaft.
3. This also contains first discharge bend of rising men where the driving shaft inters the rising man.

The lower part along with suction pipe with strainer is suspended from the rising men the rising column.

- The rising column is supported by intermediate guide bearing.
- Impellers diffusers of pump are usually bronze.
- In this pump a strainer is attached at the end and there is no foot valve.

Conclusion- From the above experiment we study about the constructional features and operation of sinking pump.

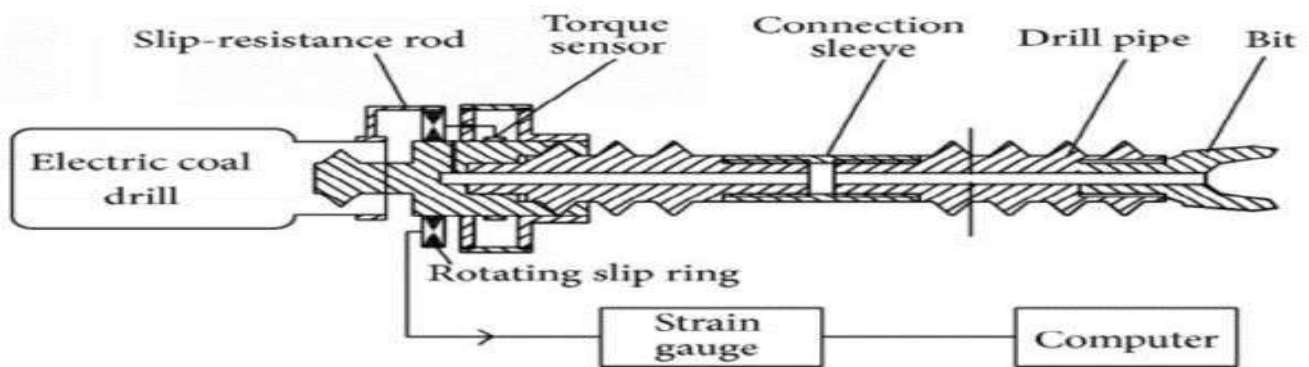
Aim of the experiment- To Study of electric coal drills & its accessories.

Theory/Description-

This drill used for drilling holes in coal and similar soft rock is electrically operated and is of rotary type. Such drills are manufactured by a few companies like MAMC, Voltas, Chanda & co and others. Coal drills manufactured are of 2 types.

1. Type CD-1 (with steel body)
2. Type CD-2 (with aluminum body)

Diagram-



(Drill rod)



(Drill bit)

1. The drill essentially contains a squirrel cage induction motor is a flame proof with two hand grips symmetrically placed on two sides of the machine.
2. The switching device is placed under the right hand grip of the motor casing while the cable entry is but the left handgrip through the plug & socket arrangement.
3. The output power of the motor which has two poles is FKW half hourly rotated & is wound for 125 volts, 3 phage, 50 cycles AC supply.
4. The powers supplied through the 6.5mm 2. 5 core trailing cable of 100 m long from a drill panel which receives power at 550 volt by armoured cable & steps it down to 770 volt.
5. The drill machine comprises of (i) Drill machine. (ii) Drill rod. (iii) Drill bit.

Drill rod :

1. The drill rod is of diamond section for drilling in coal and it fits in the drill chuck by a beyond joint but the bit is attached to the rod by a wire nail.
2. Tungsten carbide typed drill bits are used and of these the eccentric type bit in employed in coal.
3. The rate of penetration of bit in coal is generally 1.5mt / min.
4. The drill is capable of drilling holes each 1.5mt deep in a shaft of 8 hours.

Drill bit :

The different types of drill bits used in the element coal drill are, (i) Eccentric type. (ii) Concentric type. (iii) VEE type.

In coal mine of western coal fields Ltd. the drill was used in galleries 4.5m in wide 42.6m high the coal yield per blasting was nearly 25te.

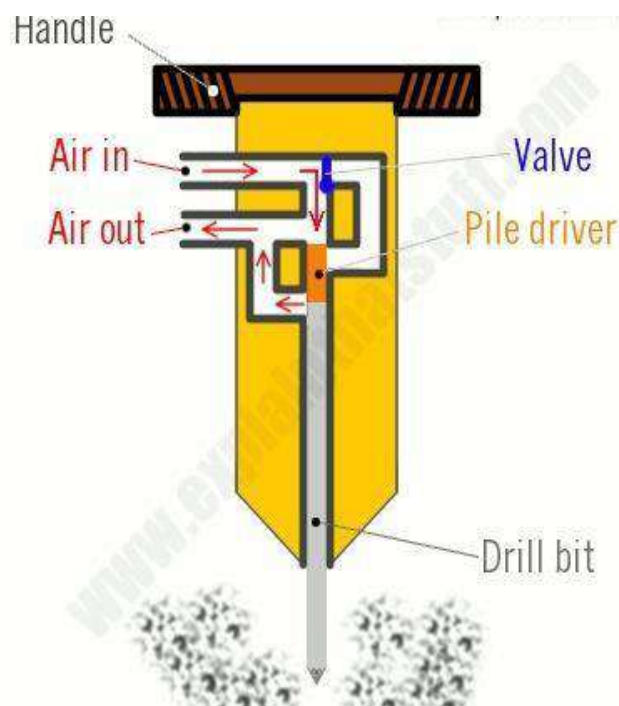
Conclusion- From the above experiment we study about the constructional features and operation of electric coal drills & its accessories.

Aim of the experiment- To Study of Jack Hammer Drill with air leg

Theory/Description-

1. It is a compressed air operated drill to which air is supplied from external compressors through hose pipes at a pressure of about 6kgf/cm².
2. It is a hand held drill used for vertically downward drilling.
3. The drill weight 15 to 25kgf and drill holes of dia 30mm to 38mm up to 3m depth.
4. The drill rod is hexagonal in cross section. Suitably shaped it one end of the to form the shank & the other end so shaped as to form a non-detachable single chisel bit with a tungsten carbide insert.
5. Drill rod may also be equipped with detachable x-type tungsten carbide drill bit.
6. When handheld the machine drills vertically downward holes only but it mounted on air legs, it may be used for drilling inclined holes.
7. An oil bottle (lubricant) placed between the drill and the air receiver & connected by hose pipes to both, provides lubrication to the drill when working.
8. For dust suppression a jackhammer can be adopted to wet drilling by some modifications, so that the drill cuttings mixed with water come out of the hole in the form of sludge.
9. The air consumption is generally 2-2.5m³ of free air/min.

Diagram-

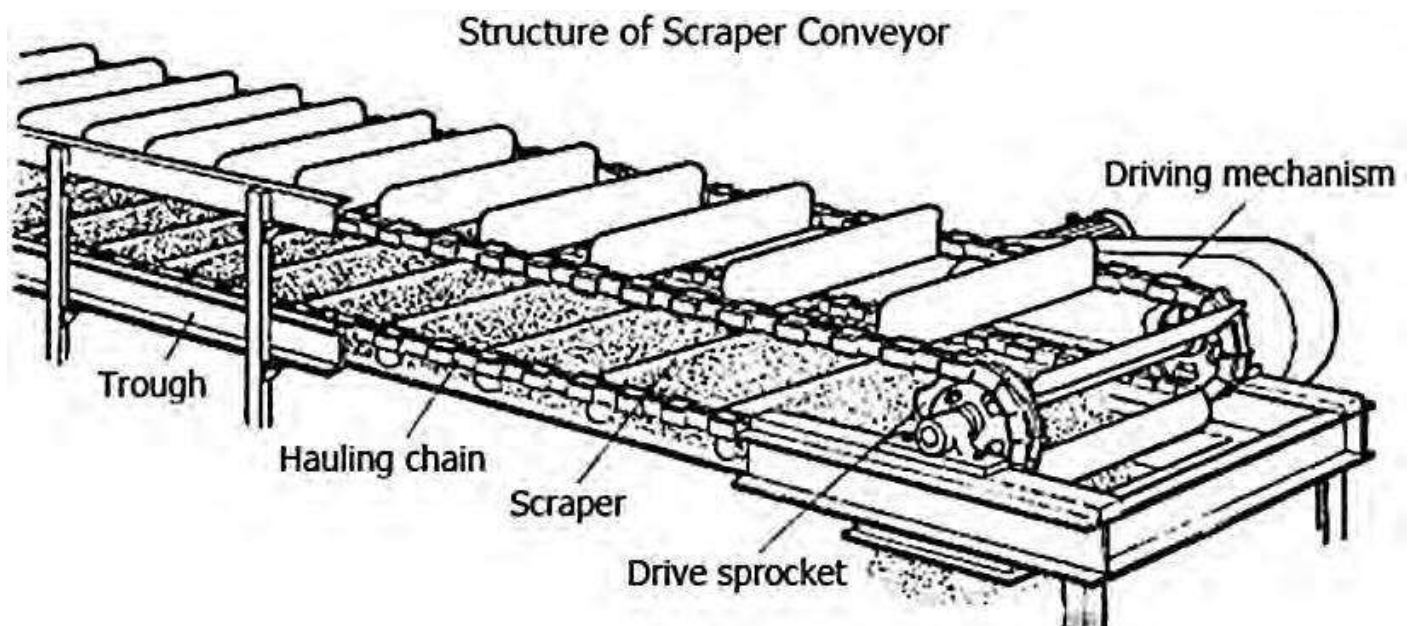




Conclusion- From the above experiment we study about the constructional features and operation of Jack Hammer Drill with air leg.

Aim of the experiment- To Study of scrapper & shaker conveyor**Theory/Description-****Scraper Conveyors**

- (1) Scraper conveyor is a type of flight conveyor. It consists of a trough in which a continuous driven chain with flights is running. The flights are scraping the material over the bottom of the casing. The material is moving forward to the discharge point
- (2) The design is ideal for slower transportation speeds over short distances, on moderate inclines, or even under water.
- (3) We use forked chains, round link chains as well as box scraper chains as a chain type. According to the product and load, we use single as well as double strand versions.
- (4) A mechanical device for conveying coal, rock, ashes, culm, etc., in a metal trough by means of scrapers attached to a rope or chain.
- (5) A conveyor consisting of chain-drawn scrapers or flights running in a trough through which they push the material to be transported. Also called drag-link conveyor; flight conveyor; chain conveyor.

Diagram-

Shaker conveyor-

(1) A conveyor consisting of a length of metal troughs, with suitable supports, to which a reciprocating motion is imparted by drives. In the case of a downhill conveyor, a simple to-and-fro motion is sufficient to cause the coal to slide. With a level or a slight uphill gradient, a differential motion is necessary; i.e., a quick backward and slower forward strokes. The quick backward stroke causes the trough to slide under the coal, while the slower forward stroke moves the coal along to a new position.

(2) A type of oscillating conveyor

(3) Material is moved by means of vibration;

(4) Significant time saving in the transfer of materials from one process step to another;

(5) Minimum use of staff, who can therefore be engaged in other activities within the company and will no longer have to manually move heavy loads;

(6) Transporting of mixed materials with uneven sizes and different specific gravities;

(7) Transport of materials with high specific gravity;

(8) Easy installation and maintenance.

Diagram-



Conclusion- From the above experiment we study about the constructional features and operation of scraper conveyor and shaker conveyor.

Aim of the experiment- To Study of scrapper loader

Theory/Description-

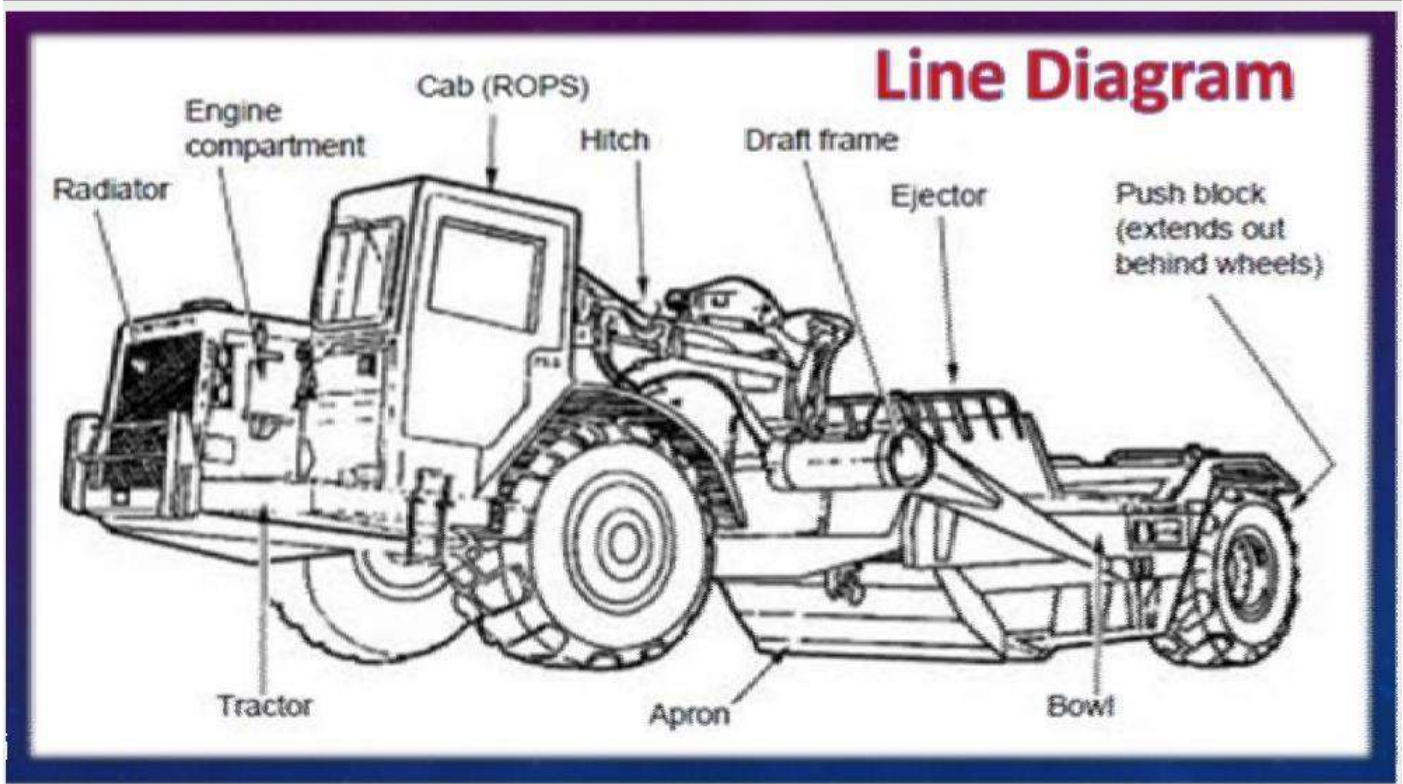
This machine is diesel-operated with pneumatic tyre wheels and has the centre a bowl fitted with a cutting blade at bottom. The blade is reversible and can be replaced when blunt. Its working may be compared to that of a lawn power. As a scraper is pushed forward by a dozer, its blade cuts a thin slice of earth usually between 75mm and 225mm thick over a distance of nearly 30m. The earth is automatically collected in a central bowl whose capacity ranges from 3m³ to 22m³ and it takes nearly one minute for loading.

When the scraper is fully loaded its bottom opening is closed by the operator through manipulation of a cable (rope) and the loaded scraper, with the bowl lifted, travels to the dumping yard on its own power. At the dumping yard, as the scraper moves, the bottom opening of the bowl is opened and the contents are unloaded in a layer 150mm to 250mm thick, over a distance of 30 to 70m. The bowl is always bottom discharging. Scrapers are unsuitable in soils with stumps, large boulders and hard rocks.

When the ground is hard, it is necessary to rip the surface with the help of a ripper before loading by a scraper. Sandy soil is best for a scraper which has to be stopped during rains, if engaged in aluminium.

Diagram-





Scrapers are used in coal mines for cutting and transporting weathered sandstone as well as coal. The coal excavated by it is however smaller in size. A scraper may take 5 to 6 minutes for a complete cycle of loading and unloading if the total up-and-down distance of a trip is nearly 300m. One-way traffic of loaded and empty scrapers is desirable for good results. One dozer is normally sufficient for every two scrapers used.

Conclusion- From the above experiment we study about the constructional features and operation of scraper loader.

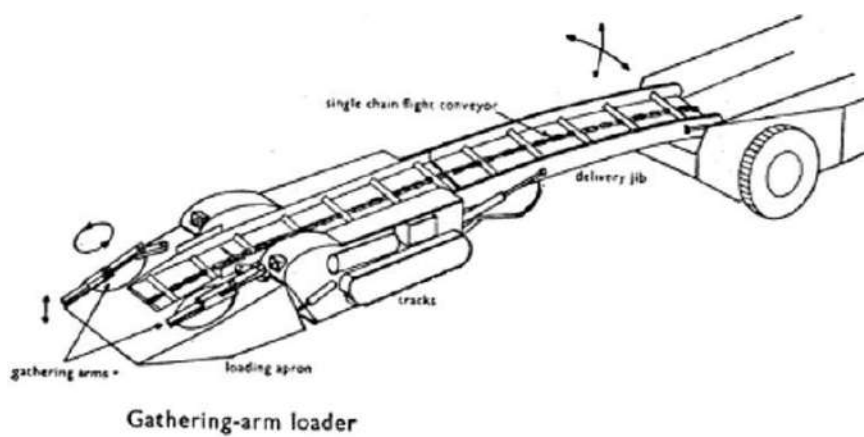
Aim of the experiment- To Study and Model Development of Gathering arm loader.

Theory/Description-

Gathering Arm loader consists of 3 principle units.

- (i). A gathering head.
- (ii) A central crawler mounted chassis.
- (iii) A rear boom or jib.

Diagram-



1. A chain conveyor extending from the gathering head up to the boom end is transporting medium, conveying coal gathered from the face to the receiving mine car, tub, conveyor or shuttle car.
2. The gathering arms are operated by twin crank discs. This discs are, flush with the working surface of the head.
3. There is a separate driving motor for each of the arm.
4. The rate of loading depends upon the no of the strokes/men and the conveyor speed is also related to the rate of loading of the gathering arms.
5. There variable speeds are available on the loader for gathering speed of the arms.
6. The ramp of gathering head can be raised or lowered usually through 0.5m.
7. Hydraulic jacks are used for elevation of the gathering head and they are controlled by the operator form this position at the controls.
8. At the face as the loader loads cowl it has to move forward to be close to coal heap and in a gallery width of 4 to 4.8 m to and for movement of the machine are frequent for cleaning up the gallery.

Conclusion- From the above experiment we study and know model development of Gathering arm loader

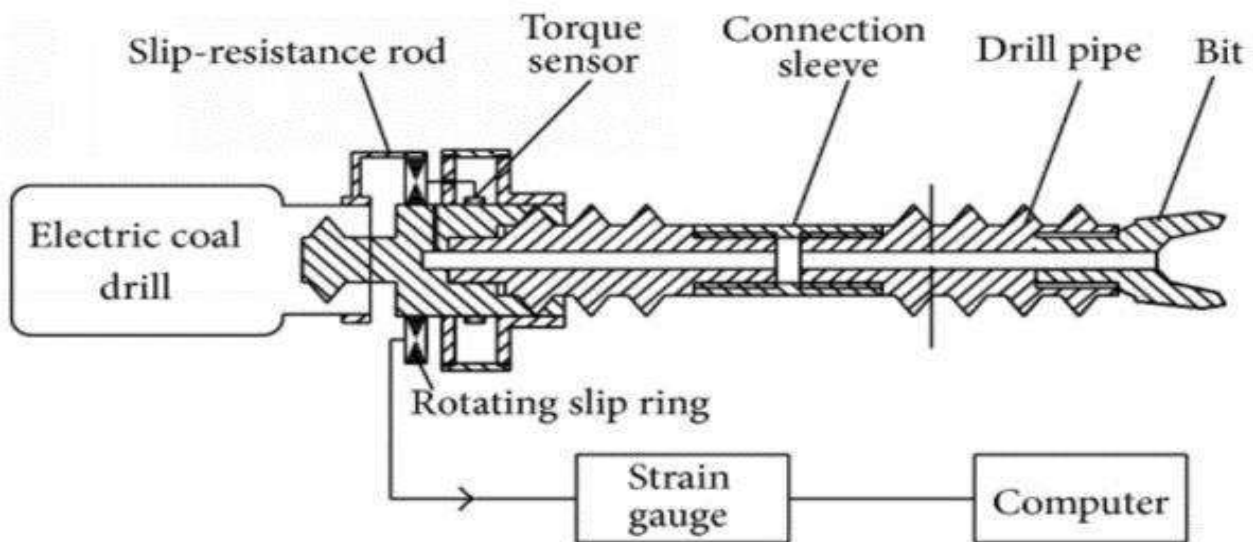
Aim of the experiment- To Study of Electric Coal Drill

Theory/Description-

An electric motor-driven drill designed for drilling holes in coal for placing blasting charges,

Electric drill - a rotating power drill powered by an electric motor. Chuck - a holding device consisting of adjustable jaws that centre a workpiece in a lathe or centre a tool in a drill.

Diagram-



1. The drill essentially contains a squirrel cage induction motor is a flame proof with two hand grips symmetrically placed on two sides of the machine.
2. The switching device is placed under the right hand grip of the motor casing while the cable entry is but the left handgrip through the plug & socket arrangement.
3. The output power of the motor which has two poles is FKW half hourly rotated & is wound for 125 volts, 3 phage, 50 cycles AC supply.

4. The powers supplied through the 6.5mm 2. 5 core trailing cable of 100 m long from a drill panel which receives power at 550 volt by armoured cable & steps it down to 770 volt.

5. The drill machine comprises of (i) Drill machine. (ii) Drill rod. (iii) Drill bit

Conclusion- From the above experiment we study about the electric coal drill.
