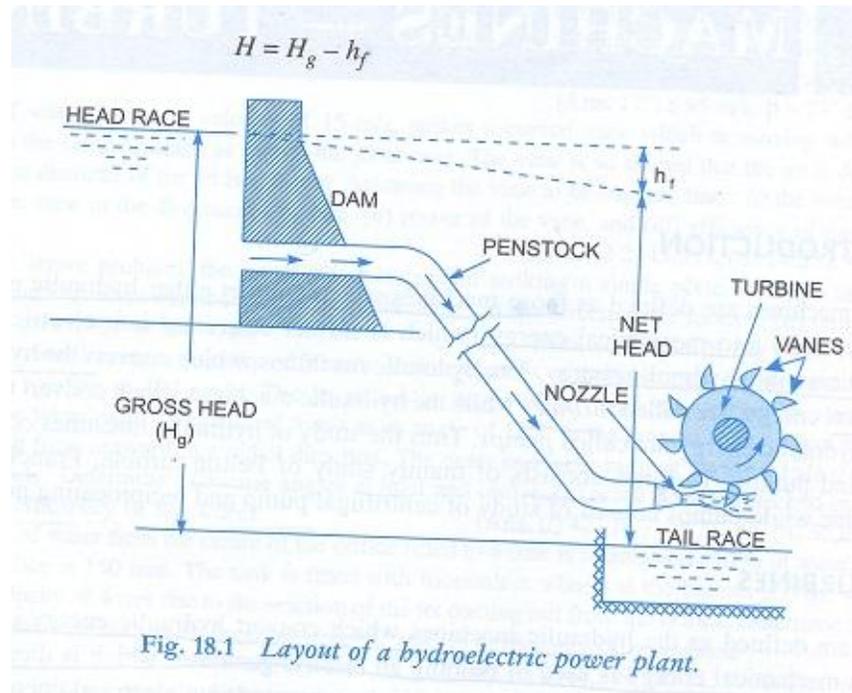


EXPERIMENT NO 1

AIM:-

TO STUDY THE MODEL OF HYDROELECTRIC POWER PLANT AND DRAW ITS LAYOUT.



APPARATUS:-

Model of hydroelectric power plant.

THEORY AND WORKING:-

The purpose of hydroelectric power plant is to provide power from water flowing under pressure. It has two forms of energy, kinetic energy and potential energy. Kinetic energy depends upon the mass velocity of flow while the potential energy exists as a result of difference in water level below two points. The turbine converts potential and kinetic energy possessed by water in to mechanical energy. Thus the turbine is a prime mover which when coupled to a generator produces electricity.

ELECTRIC POWER:-

Hydroelectric power can be developed when water continuously flowing under pressure is available. Dam is constructed to restrict the river water flow. Essential components of a hydroelectric power plant are as follows:-

(1) STORAGE RESERVOIR:-

The water available from an attachment area is stored in a reservoir so that it can be utilized to run the turbine for producing power according to requirement.

(2) DAM WITH CONTROL WORKS:-

Dam is a structure ejected on a suitable site to provide for the storage of water and create head. Dam may be built to make an artificial reservoir from valley or it may be created in a river to control the flowing water.

(3) WATER WAYS:-

Water way is a passage through which the water carried from the storage reservoir to the power house. It may consist of tunnel control, force pipe and penstock. Tunnel is water passage made by cutting the mountain to save the distance for bay in an enlarged section of a canal spread out to accommodate the required width of intake. Its function is to store temporarily water ejected by plant.

(4) PENSTOCK:-

It is a pipe of large diameter caring water under pressure from storage to turbine.

(5) POWER HOUSE:-

It is a building to house the turbine, penstock and other for operating the machines.

RATED QUANTITIES:-

The rated quantities refer to the parameter for which the turbine is designed.

EFFICIENCY OF HYDROELECTRIC POWER PLANT:-

An appraisal of the performance of a hydraulic turbine is made by its overall efficiency.

$$\text{Overall efficiency} = \frac{\text{power available at the shaft}}{\text{power available at the water jet}}$$

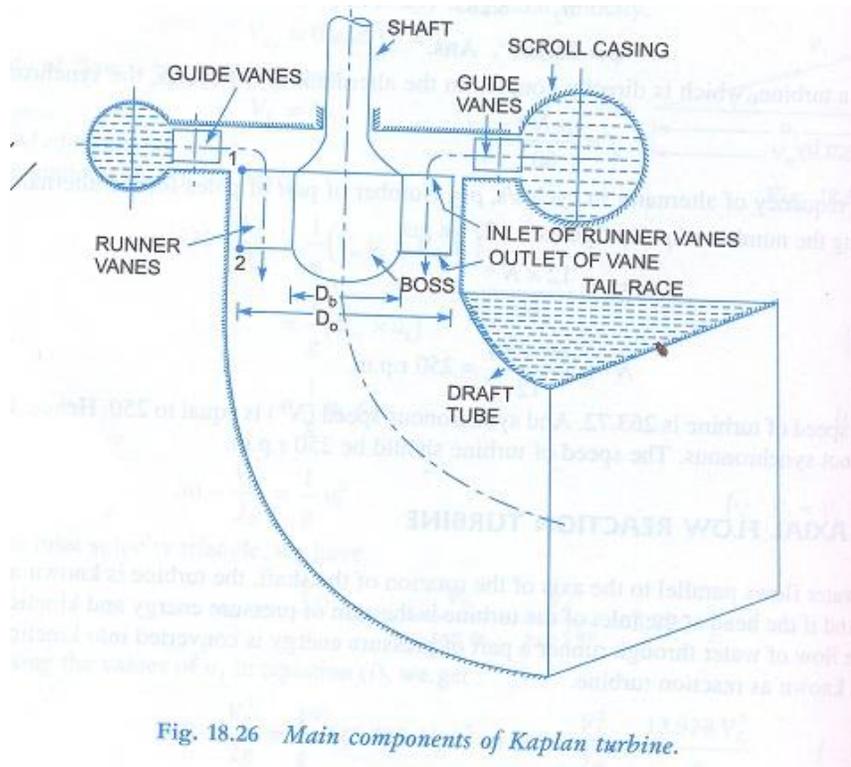
$$\begin{aligned} \eta_o &= \frac{\text{shaft power}}{\text{water power}} \\ &= \frac{P}{WQH} \end{aligned}$$

Where H – is the net or efficiency head in meters and Q – is the total discharge in m³/s.

EXPERIMENT NO 2

AIM:-

TO STUDY THE CONSTRUCTIONAL DETAILS OF KAPLAN TURBINE AND DRAW ITS FLUID FLOW CHART.



APPARATUS:-

Model of Kaplan turbine.

THEORY:-

Kaplan turbine is a reaction turbine which is particularly suited for low heads (up to 30 m) and high flow rate installations. In a Kaplan turbine water flow is purely axial.

CONSTRUCTIONAL DETAILS AND OPERATION:-

- (1) **PENSTOCK:** - it is large sized conduit which conveys water from upstream of the dam to the turbine runner. It is made of steel. Tamaracks are provided at inlet of penstock to obstruct entry of any foreign matter.
- (2) **SCROLL CASING:** - it constitutes of a closed passage whose cross section area gradually decreases along the flow direction. Area is maximum at inlet

and nearly zero at outlet. The decrease in area is in proportion to decreasing volume of water to handle and that velocity of water is constant along its path. The casing is made of cast steel and plate steel and concrete depending upon the pressure head.

(3) GUIDE VANES OR WICKET GATES: - a series of air foil shaped vanes called guide vanes are arranged inside the casing to form a no of flow passages between casing and runner blades. Guide vanes direct the water on to runner at an angle appropriate to design. These are fixed in position, however they can swing around their own axis and that helps to bring about a change in the flow area between two consecutive runner blades.

(4) RUNNER AND RUNNER BLADES: - the runner is in the form of a boss which is nothing but extension of bottom end of shaft into bigger diameter. On the periphery of the boss are mounted equidistantly 3 to 6 vanes made of stainless steel. The runner blades are directly attached to the hub and this feature eliminates the frictional losses with proper adjustment of the blades during its running. The Kaplan turbine is capable of giving a high efficiency for a wide range of load conditions.

(5) REGULATION: - Kaplan turbine has double regulation which comprises movement of guide vanes and rotation of runner blades. The mechanism employs two servomotors, one control guide vanes and the other operates the runner vanes. The governing is done by governors (servomotors). From the inside of the hollow shaft of turbine runner and the movement of piston is employed to twist the blades through suitable linkage. The double regulation ensures a balanced and most satisfactory relationship between relative position of guide and working vanes.

(6) DRAFT TUBE: - after passing through the runner the water is discharged to tail race through a gradually expending tube called draft tube. The free end of draft tube is submerged deep into tailrace. Because of its gradually increasing cross section, the discharge velocity from turbine runner is not all wasted, it is partially converted into a useful pressure head and water discharges at a relatively low velocity to the tail race.

SALIENT POINTS:-

- (1) Purely axial flow turbine
- (2) Only vertical shaft disposition
- (3) Runner blades are adjustable
- (4) Smaller no of vanes, 3 to 8
- (5) Low head turbine(30 m)
- (6) Specific speed ranges from 250-850
- (7) Heavy duty governor is essential for speed control due to smaller sizes of the servomotors.

EXPERIMENT NO 3

AIM:-

TO STUDY THE CONSTRUCTIONAL DETAILS OF FRANCIS TURBINE AND DRAW ITS FLUID FLOW CHART.

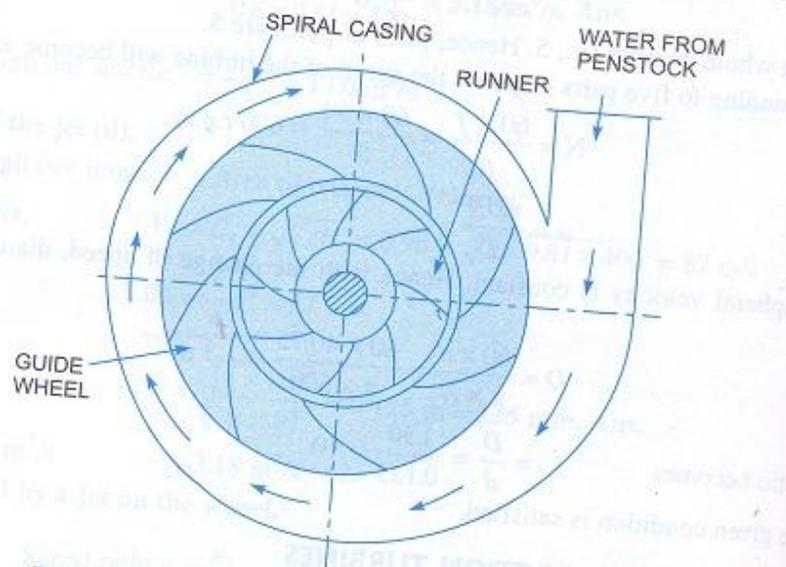


Fig. 18.10 Main parts of a radial reaction turbines.
The presence of

APPARATUS:-

Model of Francis turbine.

THEORY:-

Francis turbine is an inward flow reaction turbine which was designed and developed by American engineer James B Francis. The modern Francis turbine is however a mixed flow unit in which water enters the radial at its outer periphery and leaves axially at its center.

CONSTRUCTIONAL DETAILS AND OPERATION:-

PENSTOCK:-

It is large sized conduit which conveys water from upstream of the dam to the turbine runner. It is made of steel. Tamaracks are provided at inlet of penstock to obstruct entry of any foreign matter.

SCROLL CASING:-

It constitutes of a closed passage whose cross section area gradually decreases along the flow direction. Area is maximum at inlet and nearly zero at outlet. The

decrease in area is in proportion to decreasing volume of water to handle and that velocity of water is constant along its path. The casing is made of cast steel and plate steel and concrete depending upon the pressure head.

GUIDE VANES OR WICKET GATES: -

A series of air foil shaped vanes called guide vanes are arranged inside the casing to form a no of flow passages between casing and runner blades. Guide vanes direct the water on to runner at an angle appropriate to design. These are fixed in position, however they can swing around their own axis and that helps to bring about a change in the flow area between two consecutive runner blades.

RUNNER AND RUNNER BLACES:-

Runner of Francis turbine is a rotor which has passage formed between crown and shroud in one direction and two consecutive blades on the other. These passages take water in at outer periphery in radial inward direction and discharge parallel to axis of rotor. The driving force on runner is both due to impulse and reaction effects. The no of runner blades usually varies between 16 to 24. Runner is made up of cast iron, stainless steel and bronze etc.

DRAFT TUBE:-

After passing through the runner the water is discharged to tail race through a gradually expending tube called draft tube. The free end of draft tube is submerged deep into tailrace. Because of its gradually increasing cross section, the discharge velocity from turbine runner is not all wasted, it is partially converted into a useful pressure head and water discharges at a relatively low velocity to the tail race.

GUIDE WHEEL AND GOVERNING MECHANISM:-

The governing mechanism changes the position of guide blades to effect a variation in water flow rate in the wake of changing load conditions on the turbine. The system consists of a centrifugal governing mechanism. When the load changes the governing mechanism rotates all the guide blades so that water flow rate and its direction remains same at all passages.

SALLIENT POINTS:-

- (1) Radial inward or mixed flow turbine.
- (2) Horizontal or vertical disposition of shaft
- (3) Runner vanes are not adjustable
- (4) Large number of vanes 16 to 24
- (5) Medium head turbine (60 to 250 m) and works under medium flow rate
- (6) Specific speed ranges from 50 to 250.
- (7) Ordinary governor is sufficient for speed control.

EXPERIMENT NO 4

AIM:-

TO STUDY THE CONSTRUCTIONAL DETAILS OF PELTON TURBINE AND DRAW ITS FLUID FLOW CHART.

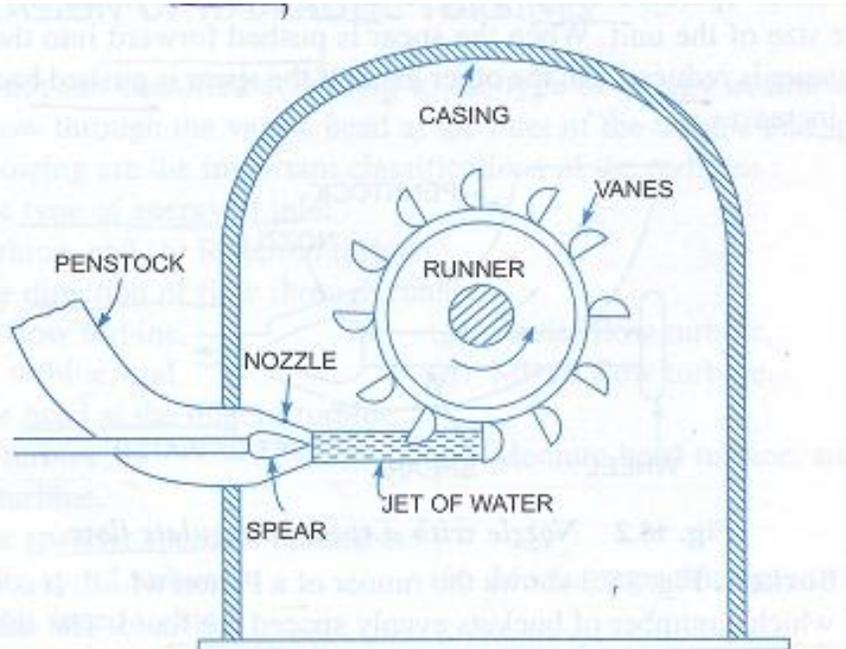


Fig. 18.4 Pelton turbine.

APPARATUS:-

Model of Pelton turbine.

THEORY:-

The Pelton wheel is a free jet impulse turbine named after American engineer Lesteo Pelton. It is simple, robust and only hydraulic turbine which operates efficiently and is used for heads in excess of 450 m. smooth running and good performance are other common features of this unit.

CONSTRUCTIONAL DETAILS AND OPERATION:-

PENSTOCK:-

It is large sized conduit which conveys water from upstream of the dam to the turbine runner. It is made of steel. Tamaracks are provided at inlet of penstock to obstruct entry of any foreign matter.

NOZZLE AND SPEAR:-

At its down stream end the penstock is fitted with an efficient nozzle that converts the whole of hydraulic energy into a high speed jet. To regulate the water flow through the nozzle and to obtain a good jet of water at all loads, a spear or needle is so arranged that it can be moved forward or backward thereby decreasing or increasing the angular area of nozzle flow passage. The movement of spear is controlled either manually by a hand wheel or automatically by governing mechanism.

RUNNER WITH BUCKETS:-

The turbine rotor called as the runner is a circular disc carrying a no of cup shaped buckets which are arranged equidistantly around the periphery of the disc. The runner is generally mounted on a horizontal shaft supported in small thrust bearings and the buckets are either cast integrally with disc or fastened separately. For low heads the buckets are made of cast iron, but for higher heads they are made of bronze, cast steel or stainless steel. Further in surface of buckets are polished to reduce frictional resistance to water jet. Each bucket has a splitter which distributes the striking jet equally into two halves of the hemispherical bucket.

CASING:-

Out flow from the runner buckets is in the form of a strong splash which scatters in all directions. To prevent this and to guide the water to tail race, a casing is provided all around the runner. The casing also acts as a safe guard against accidents. Evidentially the casing has no hydraulic function to perform. A baffle is arranged in the casing to prevent the discharged water being carried along runner direction.

GOVERNING MECHANISM:-

The speed of turbine runner is required to be maintained constant so that the electric generator coupled directly to turbine shaft runs at constant speed under varying load conditions. The task is accomplished by a governing mechanism that automatically regulates the quantity of water flowing through the runner in accordance with any variations in the load.

EXPERIMENT NO 5

AIM:-

TO STUDY THE CONSTRUCTIONAL DETAILS OF HYDRAULIC RAM AND DETERMINE IT'S VARIOUS EFFICIENCIES.

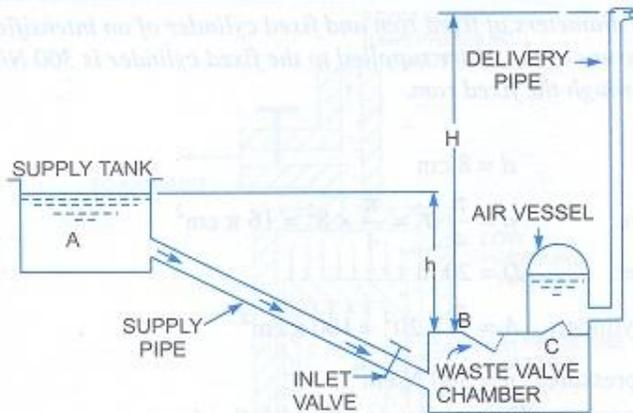


Fig. 21.7 The hydraulic ram.

APPARATUS:-

Hydraulic ram, supply tank, supply pipe, gate valve, delivery valve, pressure gauge, V-notch weir, collection tank and stop watch.

THEORY:-

Hydraulic ram a contrivance to raise a part of large amount of water available at some height. This is employed when some natural source of water like a spring or a stream is available at some altitude. This is also known as impulse pump. The impulse is developed at the expense of dynamic inertia possessed by a moving column of water; the momentum of a long column of water flowing through the supply pipe is made to force a part of water to a level higher than that of the supply source itself.

Let,

H_s = supply head above waste valve

H_d = delivery head above waste valve

Q = the quantity of waste water

q = the quantity of water pumped by ram

$$\text{Rankin efficiency} = \frac{q(H_s - H_d)}{QH_s}$$

$$\text{Submission efficiency} = \frac{qH_d}{(q + Q)H_s}$$

EXPERIMENTAL SETUP:-

The experiment set up for the hydraulic ram is shown in fig. it consists of a water supply tank. Delivery valve A is connected to a supply pipe having a gate valve G. water flows through the supply pipe to a waste valve W. when the waste valve closes, the water hammer forces upon the delivery valve and the delivery valve gets opened. The delivery head is measured by a pressure gauge. The quantity of useful water is measured in a collecting tank and waste water is measured by a 60° V-notch weir.

PROCEDURE:-

- (1) admit water into the supply tank and keep the supply head constant by using an over flow pipe.
- (2) Keep the delivery valve closed.
- (3) Start the hydraulic ram by reciprocating the waste valve twice or thrice.
- (4) Adjust the delivery valve so that pressure gauge read about 20 m of water head.
- (5) Calculate the waste water rate Q by measuring the head over the V notch and taking $c_d = 0.62$
- (6) Determine the useful water rate q being pumped by the ram from the collecting tank.
- (7) Note the time for 50 beats and calculate the number of beats per minute.
- (8) Repeat the experiment for 6 different values of delivery head at an interval of 3 to 4 m of water.
- (9) Calculate the Rankin efficiency.

RESULT:-

The delivery head will be found to increase with the increase in number of beats.

EXPERIMENT NO 6

AIM:-

TO STUDY THE CONSTRUCTIONAL DETAILS OF CENTRIFUGAL PUMP AND DRAW ITS CHARACTERISTIC CURVE.

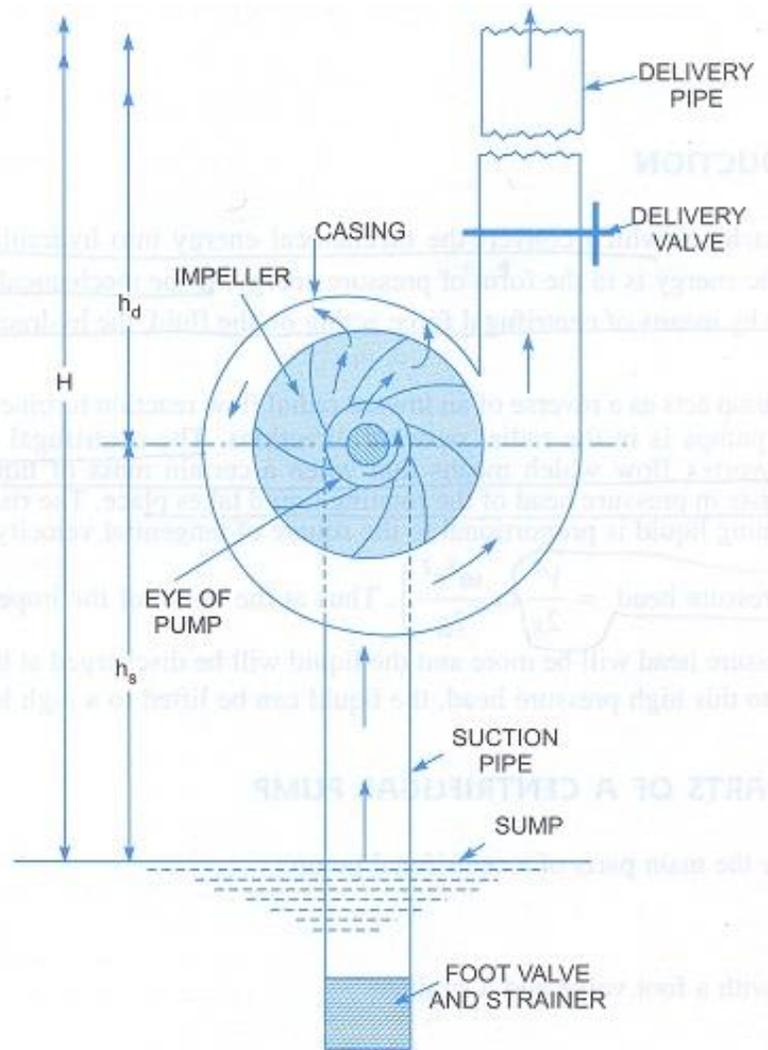


Fig. 19.1 Main parts of a centrifugal pump.

APPARATUS:-

Centrifugal pump, stop watch, scale, collecting tank.

THEORY:-

Centrifugal pump belongs to the category of dynamic pressure pumps where in the pumping of liquid or generation of head is affected by rotary motion of one or more rotating wheels called the impellers.

CONSTRUCTIONAL DETAILS AND OPERATION:-

A centrifugal pump consists essentially of the following elements:-

(1) ROTATING ELEMENT:-

It consists of shaft and a vane rotor called impeller. The vanes are curved, cylindrical or have more complex surfaces. The unit has a finite number of vanes. The number is selected to assure motion of the liquid in the desired direction and varies with diameter of the impeller eye and radial depth of the vanes. The number usually ranges 6 to 12.

The impeller is mounted on a shaft coupled to the driving unit which may be internal combustion engine or an electric motor. By virtue of force interaction between the vanes and the liquid the mechanical energy of the driver is transformed into the energy of flow.

(2) STATIONARY ELEMENT:-

It consists of casing, stuffing box and bearings. The casing is an airtight chamber surrounding the pump impeller. It collects liquid from the impeller and leads it away under high pressure to the delivery side. Packing and glands are needed to reduce the shaft leakage, both internal and external.

(3) SUCTION PIPE, STRAINER AND FOOT VALVE:-

Suction pipe connects the center (eye) of the impeller to the sump from which the liquid to be lifted. The pipe is load airtight so that there is no possibility of formation of air packets. Strainer is used in pipe to prevent the entry of solid particles into the pump. Foot valve is used to fill up the pipe with water before it starts its work.

(4) DELIVERY PIPE AND DELIVERY VALVE:-

Delivery pipe leads the liquid from the pump outlet to the point of use. A regulating valve provided just near the pump outlet serves to control the flow of liquid into the delivery pipe.

The pump is initially primed where in the suction pipe, casing and portion of the delivery pipe up to the delivery valve are completely filled with the liquid to be pumped. Rapid motion imparted to the impeller then builds up centrifugal force which throws the liquid towards the impeller periphery. This cause's pressure gradients in the suction pipe i.e. partial vacuum exist at the impeller eye. While the liquid in the sump is at atmospheric pressure. The process is continuous as long as motion is given to the impeller and there is supply of liquid to draw upon.

EXPERIMENT NO 7

AIM:-

TO STUDY THE CONSTRUCTIONAL DETAILS OF GEAR OIL PUMP AND DRAW ITS CHARACTERISTIC CURVE.

APPARATUS:-

Gear oil pump coupled to an electric motor, pressure gauge, water collecting tank, stop watch, energy meter.

THEORY:-

The unit consists of two identical intermeshing spur gears involutes teeth. One of the gears is kept to driving shaft to the motor and the other gear revolves ideally. These gears rotate in the opposite direction in a closed fitting stationary mounting. The oil coming in from a suction part fills the space between the teeth is carried around periphery of revolving gear and is finally pushed out to discharge port. The teeth of the gears have a perfect meshing and that serves both to transmit the drive and to maintain a seal between the suction and discharge side. It is taken to ensure that the oil is trapped between the successive lines of contact does not build pressure. A change in the flow direction can be effected by sensing the direction of gear assembly both the spur pump assembly.

Volume of oil discharge in one revolution (q) = 2Lh

$$V_{th} = \text{displacement by pump perform} = 2aln \times \frac{N}{60}$$

Where

a = area enclosed between adjacent teeth

l = axial length of teeth

n = no of teeth in each gear wheel

N = rpm

GEAR PUMP TEST RIG:-

A single stage external type gear pump consists of two identical intermeshing spur wheels working with a fine clearance inside a suitable shape casing. One gear is keyed to the driving shaft of a motor and other revolves ideally. Oil is entrained in spaces between the teeth and the casing and carried around between the gears from the suction pipe to the discharge port. It can not slip back into the inlet side due to meshing of gears.

Volume of liquid pumped in one revolution = 2aln

$$\text{Total discharge} = \frac{2a \ln N}{60}$$

$$\text{Volumetric efficiency } (\theta) = \frac{2a \ln N}{60} \times n\theta$$

If “a” is difficult to find, then use the empirical relation:-
 $q = 0.95 nc (1-c)$

OBSERVATION TABLE:-

Input kwhr	Gauge pressure P kg/cm ²	Suction pressure p mm ⁴	ΔP (N/m ²)	h_1 (mm)	h_2 (mm)	Δh (mm)	t (sec)	V (m/s)	Θ A×V (m ³ /s)	I/P	$\dot{\eta}$

PROCEDURE:-

- (1) fill the supply tank to the required height.
- (2) Open the gate valve in the delivery pipe fully.
- (3) Start the motor.
- (4) Throttle the gate valve to get required head.
- (5) Note the pressure and vacuum gauge readings.
- (6) Note the time for 10 revolutions of the energy meter.
- (7) Note the time for a specified water level into collecting tank.
- (8) Measure the vertical height of pressure gauge above vacuum gauge.
- (9) Repeat the experiment at various heads by throttling the gate valve.

EXPERIMENT NO 8

AIM:-

TO DRAW THE FOLLOWING PERFORMANCE CHARACTERISTICS OF PELTON TURBINE CONSTANT HEAD, CONSTANT SPEED AND CONSTANT EFFICIENCY CURVE.

APPARATUS:-

Pelton wheel, stop watch, tachometer, pressure gauge, spring weight, brake dynamometer, venturimeter and centrifugal pump.

THEORY:-

Pelton turbine is an impulse turbine which is used to utilize high head for generation of power by converting it into kinetic energy by means of a spear and nozzle arrangement.

EXPERIMENTAL SETUP:-

The experimental set up consists of a Pelton turbine supplied with water under high pressure by a centrifugal pump. The water is conveyed through a venturimeter having manometer connected to determine the flow rate of water. The nozzle spinning can be increased or decreased by operating the spear wheel. The spear can be positioned 8 places of the nozzle opening. The turbine shaft is coupled to a brake dynamometer to measure its output.

FLOW MEASUREMENT:-

In the experiment set up the discharge is measured by the venturimeter. If a_1 and a_2 are the areas respectively and c is the coefficient of venturimeter, then it can be shown that

$$Q = \frac{c a_1 a_2 \sqrt{2gh}}{\sqrt{a_1 - a_2}}$$

SPECIFICATIONS:-

- (a) PUMP SIZE:- 80mm × 65mm
DISCHARGE: - 10 lps
HEAD: - 23.5 m
- (b) MOTOR:- 5 H.P., 440 volt, 3 phase, 2870 rpm induction motor
- (c) PELTON WHEEL:-
 - No of buckets = 12
 - Pitch circle dia = 190 mm
 - Outer dia of wheel = 250 mm
 - Angle of outer tip = 10°
 - Bucket width and height = 50mm × 50mm
 - Material of the bucket = gun metal with powder coating
- (d) NOZZLE: - with spear head streamer lined type.
Outer size = 15mm, made of brass material

(e) VENTURIMETER:-

Material = cast iron
Dia of inlet of venturimeter = 50mm
Dia of throat of venturimeter = 25mm

(f) BRAKE DRUM:-

Material = cast iron
Drum dia = 300mm
Rope dia = 12mm

(g) SUMP TANK:-

Material = MS steel lined with fiber glass
Size of tank = $1250 \times 60 \times 100 \text{ mm}^3$
Manometer = mercury filled glass tube, V type.

OBSERVATION TABLE:-

Given,

Rpm = 600
 $a_1 = 50 \text{ mm}$
 $a_2 = 25 \text{ mm}$
Drum diameter = 300mm

S.N.	P kg/c m^2	Net head H (m)	Manom eter differen ce (m)	Sp wt Net	Q disch arge m^3/s	I/P	Torqu e	O/P	η	Q_4	N_4
1											
2											
3											

PROCEDURE:-

- (1) Keep the nozzle opening at 75% of full opening.
- (2) Start the centrifugal pump.
- (3) Allow the water to flow into the turbine.
- (4) Note the speed of the turbine.
- (5) Note the reading of manometer.
- (6) Note the pressure of water in pressure gauge to determine the head generated by the pump.
- (7) In order to plot the main characteristic keep the head constant and to plot the operating characteristic keep the speed constant.
- (8) Load the turbine by weight on brakes and note the spring constant.
- (9) Repeat the experiment for different loads, speed and spring constant.
- (10) Stop the pump motor.
- (11) Calculate the power input, power output and efficiency.
- (12) Plot the main and operating characteristics.

RESULT:-

The main characteristics are obtained by keeping the head constant and varying the speed by allowing a variable quantity of water to flow through the inlet opening. Thus a source of flow rate and speed values is obtained. For each value power output is calculated. The value of Q , N and power output which are reduced to unit head is plotted. A typical plot is shown in figure for the operating characteristics. Speed is constant and Q and H are varied.

EXPERIMENT NO 9

AIM:-

TO DRAW THE FOLLOWING PERFORMANCE CHARACTERISTICS OF FRANCIS TURBINE CONSTANT HEAD, CONSTANT SPEED AND CONSTANT EFFICIENCY CURVE.

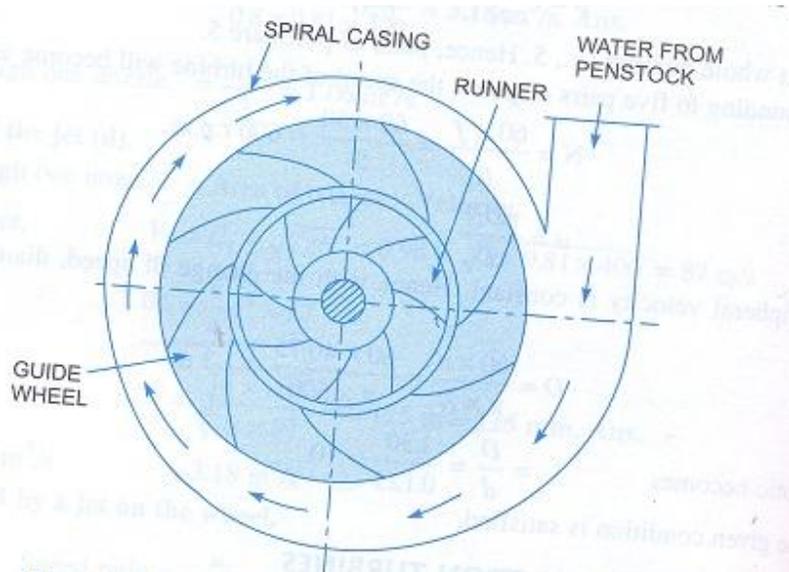


Fig. 18.10 Main parts of a radial reaction turbines.
The pressure at

APPARATUS:-

Francis turbine, tachometer, brake dynamometer, venturimeter, centrifugal pump, pressure gauge, vacuum gauge, weights and manometer.

EXPERIMENTAL SETUP:-

The turbine consists essentially of a runner a ring of adjustable guide vanes, a volute casing and a draft tube. The runner consists of two shrouds with a number of fixed curved vanes in between. The guide vanes can be rotated about their axis by means of a hand wheel and their position is indicated by a pair of dummy guide vanes fixed outside the turbine casing. A centrifugal pump supplies water under pressure to the turbine and the flow can be controlled by means of the gate valve fitted in the pipe line. The discharge in the pipe line and above through the turbine can be measured with pressure gauge and vacuum gauge. The output of turbine is determined by means of a rope brake dynamometer.

SPECIFICATIONS:-

(1) Francis turbine:-

Rated supply head = 15.0m

Discharge = 2000 l/m

Rated speed = 1250 rpm

Power output = 1250 rpm
Unit speed = 3.75 KW (5HP)
Specific speed = 955 rpm
Runway speed = 2750 rpm
Runner diameter = 160mm
No of guide vanes = 10
Thickness of vanes = 12mm
PCD of guide vanes = 230mm
Brake drum diameter = 15mm

(2) Supply pump set:-

Rated head = 15 m
Discharge = 2000 l/m
Normal speed = 2880 rpm
Power required = 11.2 KW (15 HP)
Size of pump = 100mm × 100mm
Type = high speed, centrifugal
Impeller diameter = 250mm

(3) Flow measuring unit :-

Inlet diameter of orifice meter = 100mm
Orifice meter area ratio = 0.45
Throat dia for orifice meter = 67.06 mm
Meter constant for orifice meter = $k = 0.010511$, $Q = k(h)^{1/2}$

(4) Ball bearing used :-

In the casing = 6308 (or its equivalent)
In the pedestal = 1308 (or its equivalent)

(5) oil seals used:-

In the casing = 6308-1 no
In the pedestal = 1308-1 no

STARTING UP:-

Make sure before starting that the pipe lines are free from foreign matter. Also that all the joints should be water tight and leak proof. Prime the pump and start it. The guide vanes in the turbine should also be in the closed position while starting the pump. Then slowly open the gate valve situated above the turbine and open the pressure gauge and see the pump develops the required head. Slowly open the turbine guide vanes by rotating the hand wheel. Operate the guide vanes through suitable link mechanism until the turbine attains the rated speed for about ten minutes and then carefully note down the observations.

OBSERVATION TABLE:-

Given,

Rpm = 2100

Brake drum diameter = 300mm

S.N.	P kg/cm ²	Net head H (m)	Manometer difference (m)	Sp wt Net	Q discharge m ³ /s	I/P $\rho gQH(N)$	Torque	O/P	η
1									
2									
3									

PROCEDURE:-

- (1) Keep the guide vanes fully opened.
- (2) Prime the pump and start it.
- (3) Vent the manometer.
- (4) Note the pressure gauge Hg and vacuum gauge Hv reading.
- (5) Adjust the gate valve so that $H_g + H_v = 15m$.
- (6) Note the reading at manometer.
- (7) Measure the speed of turbine by a tachometer.
- (8) Load the turbine by putting weights in weight hanger of brake dynamometer.
Also note the spring balance reading.
- (9) Repeat the experiment for various loads and guide vane setting.
- (10) Stop the pump motor.
- (11) Calculate the power input, power output, efficiency, specific and unit quantities.
- (12) Plot the characteristics curve.

TESTING:-

Turbine shall be first tested at constant net supply head at the rated value of 15m.
By varying the load