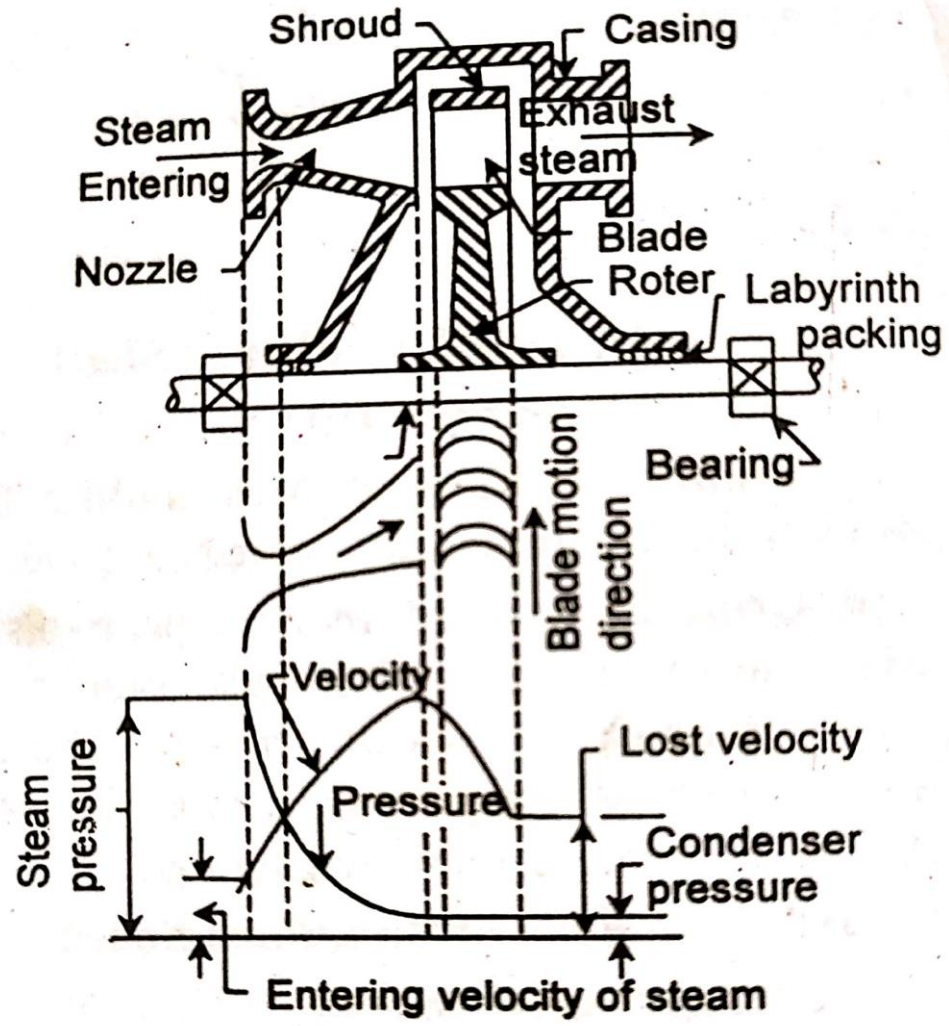

# A presentation on **Steam Turbines**

**Presented by:**
**Prof. Prabha Chand**
**NIT Jamshedpur**
**Department of mechanical engineering**

# The Simple Impulse Turbine

- The blade speed should be one half of the steam speed so blade velocity is about 500m/s and the rotational speed 30,000 r.p.m.
- The leaving velocity of steam is also quit appreciable resulting in an energy loss called “carry over loss” or “leaving velocity loss”
- This type of turbine generally employed where relatively small power is needed and where the rotor diameter is kept fairly small



# Compounding of Steam Turbines

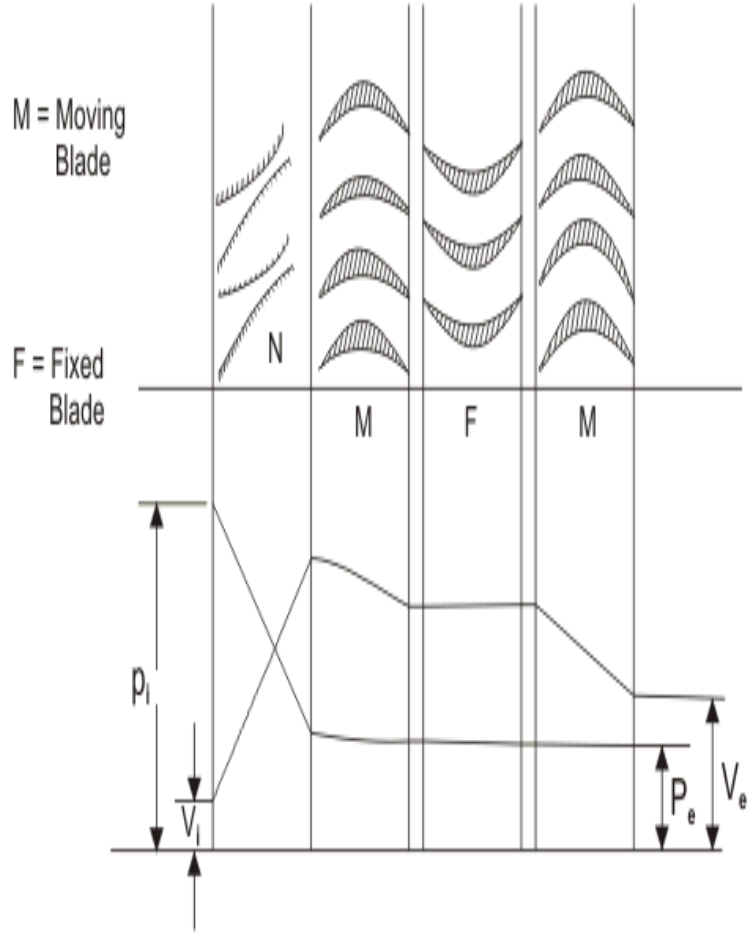
- This is done to reduce the rotational speed of the impulse turbine to Compounding of Steam Turbines practical limits.
- Compounding is achieved by using more than one set of nozzles, blades rotors in a series keyed to a common shaft; so that either the steam pressure or the jet velocity is absorbed by the turbine in stages.

# Compounding in Impulse Turbine

- If high velocity of steam is allowed to flow through one row of moving blades, it produces a rotor speed of about 30000 rpm which is too high for practical use.
- It is therefore essential to incorporate some improvements for practical use and also to achieve high performance. This is possible by making use of more than one set of nozzles, and rotors, in a series, keyed to the shaft so that either the steam pressure or the jet velocity is absorbed by the turbine in stages. This is called compounding.

Three main types of compounded impulse turbines are:

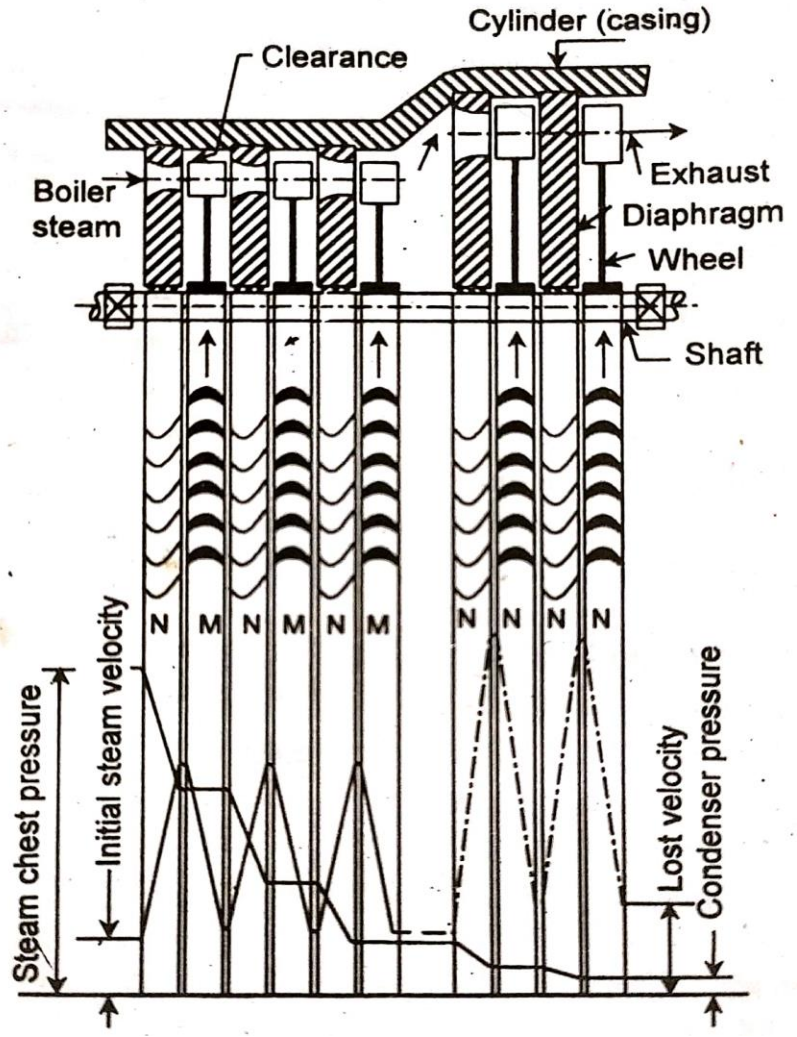
- Pressure compounded Impulse turbine
- Velocity compounded impulse turbine
- Pressure and velocity compounded impulse turbines.



# Pressure compounding impulse turbine

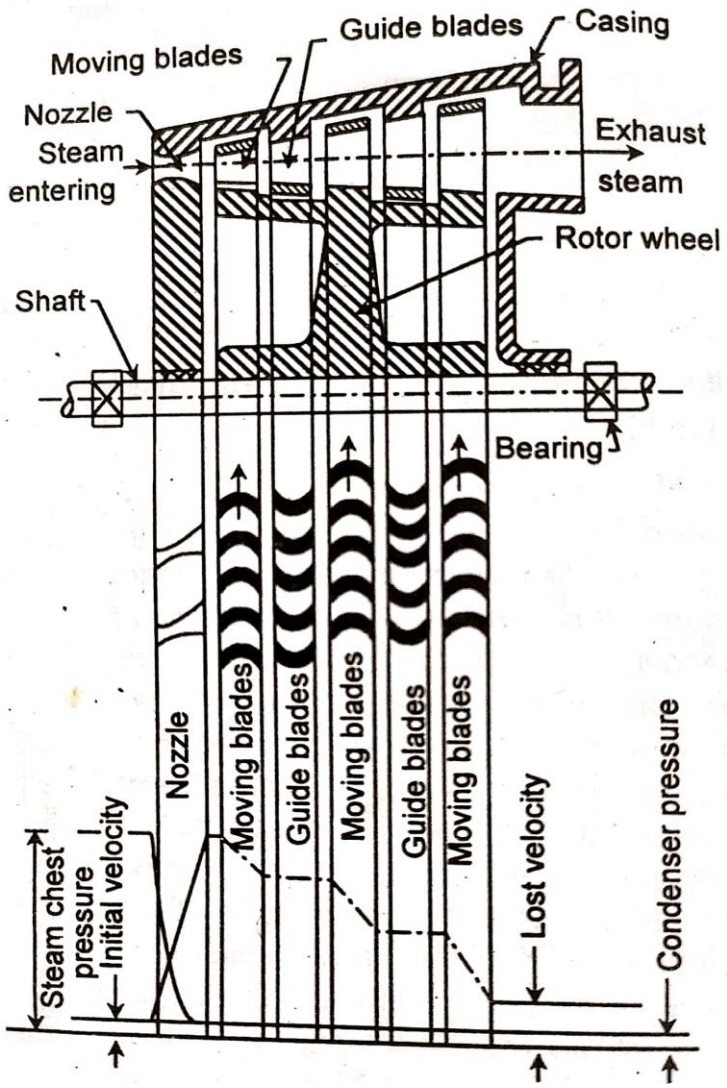
Involves splitting up of the whole pressure drop into a series of smaller pressure drops across several stages of impulse turbine.

The nozzles are fitted into a diaphragm locked in separates one wheel chamber from the casing that another. All rotors are mounted on the same shaft.



# Velocity compounded impulse turbine

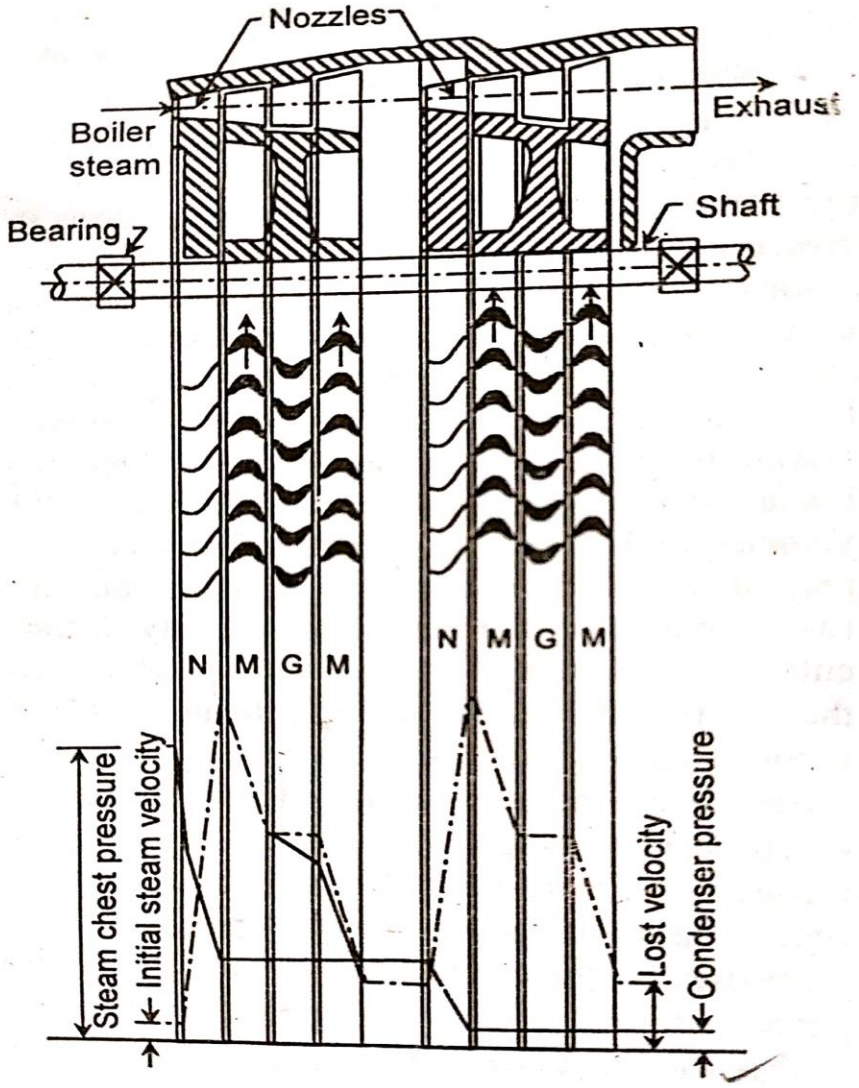
Velocity drop is achieved through many moving rows of blades instead of a single row of moving blades. It consists of a nozzle or a set of nozzles and rows of moving blades attached to the rotor or the wheel and rows of fixed blades attached to the casing



# Pressure and velocity compounded impulse turbines

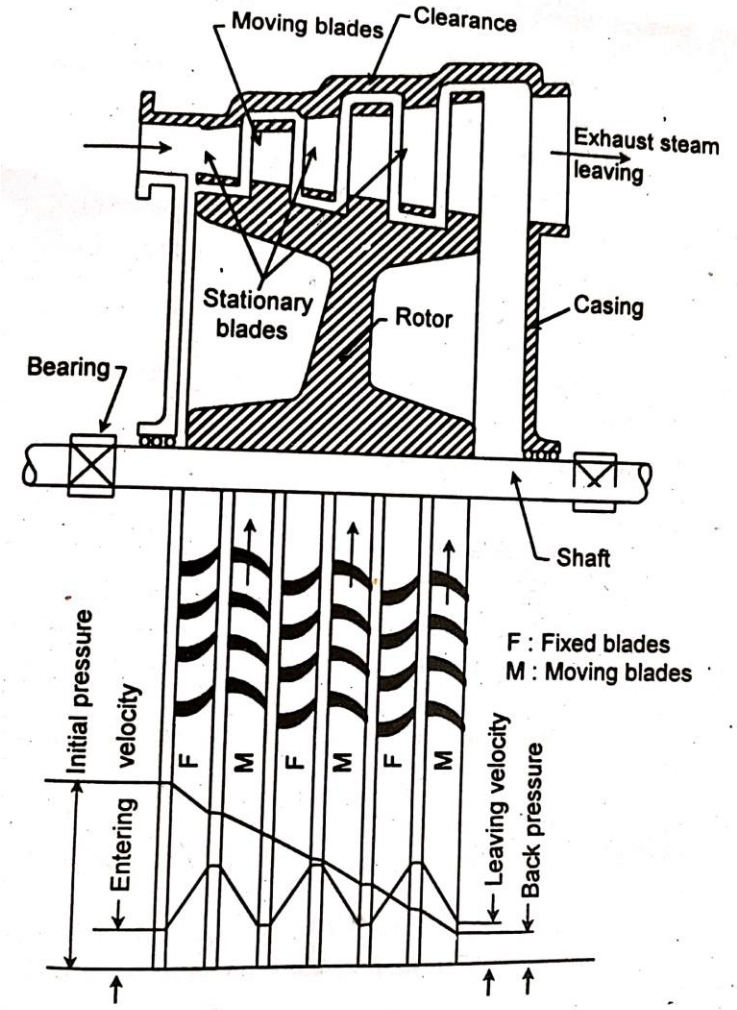
Pressure velocity compounding gives the advantage of producing a shortened rotor compared to pure velocity compounding.

In this design steam velocity at exit to the nozzles is kept reasonable and thus the blade speed (hence rotor rpm) reduced.



# Impulse reaction turbine

- The steam velocities are comparatively moderate and its maximum value is about equal to blade velocity.
- Reduce the number of stages, the steam velocity is arranged greater than the blade velocity
- This type turbine is used mostly in all power plants
- The power plants 30 MW and above are all impulse-reaction type



# Comparison between Impulse & Reaction Turbine

## Impulse turbine

- An impulse turbine has fixed nozzles that orient the steam flow into high speed jets.
- Blade profile is symmetrical as no pressure drop takes place in the rotor blades
- Suitable for efficiently absorbing the high velocity and high pressure
- Steam pressure is constant across the blades and therefore fine tip clearances are not necessary
- Efficiency is not maintained in the lower pressure stages (high velocity cannot be achieved in steam for the lower pressure stages)

## Reaction turbine

- Reaction turbine makes use of the reaction force produced as the steam accelerates through the nozzles formed by the rotor
- Blades have aerofoil profile (convergent p drop occurs partly in the rotor Blades passage) since pressure
- Efficient at the lower pressure stages
- Fine blade tip clearances are necessary due to the pressure leakages
- Inefficient at the high pressure stages due to the pressure leakages around the blade tips
- Fine tip clearances can cause damage to the tips of the blades

THANK YOU