## INTRODUCTION & OPERATIONS OF DIFFERENT PAPER MACHINES

### **R.B.LAKSHMIPATHI SAKTHI**

Deputy Manager (Paper Machine Production) TNPL - Karur





### **SAKTHI** Production)



## PAPER MACHINE

### WHAT IS PAPER?

A thin & flat material made from fibrous substances used for writing, printing, drawing, wrapping, etc

### WHAT IS PAPER MACHINE ?

**Industrial machines which transforms pulp into a continuous sheet of** paper in large quantities.









### REELING









Paper, Board, Tissue, Kraft & **Specialty paper** 

**Slow Speed & High Speed** 

Single Wire, Twin Wire & **Hybrid Formers Single tier, Double Tier & Yankee Dryer Cylinders** 



## **TYPES OF PAPER MACHINES**



• Fourdrinier Machine

- Cylinder Mould Machine
- Twin-wire Paper Machine
- Corrugated Board Machine





### • Multi-layer Machine

### • Tissue Paper Machine

### Coated Board Machine

### • Pulp sheet Drying Machine









### **FUNCTION** To transform the pulp from pipeline flow into an even rectangular discharge, equal in width to the paper machine at uniform velocity











Parts of Head Box	Operation
Manifold Distributors	To convert the pipe line flow into a rewidth of the wire section. To maintain a constant static pressure direction.
Flow Stabilization Elements	To prevent the fibers from flocculatin turbulence. To improve the paper formation by e plates with even holes which depends





### IS

ectangular flow across the

re along the cross machine

ng and settling through

elements like rolls, tubes or s on the design



Parts of Head Box	Operation
Top lip	To deliver the stock velocity & volum and down in vertical direction
Bottom Lip	To adjust the angle of impingement of moving towards forward and reverse





### IS

### e by moving towards up

### of stock on the wire by e in horizontal direction



### JET LANDING

The point at which the jet from Head box hits the moving forming fabric is called Jet landing point

The angle, speed, and location of jet landing affects fiber orientation, sheet formation quality, and basis weight distribution.











### **FUNCTIONS**

1. To transport the fiber 2. To permit drainage 3. To produce maximum dewatering with minimum fiber losses and good formation









Parts of Wire Part	Operation
Wire	The wire is an endless finely wove plastic which runs between the brace coarse wire allows faster drainage, brace
Rolls	To drive, guide & hold the wire throu
Showers	To lubricate the wire loop circuit generation due to friction



0

### lS

en belt made from wire or east roll and couch roll. A ut gives coarser paper.

ugh out the loop length.

with water to avoid heat



Parts of Wire Part	Operation
Forming Board	Placed after the breast roll to sup meets the wire.
Drainage Elements	Removing water between the brea These are table rolls, foils, wet suc boxes. Vacuum is applied in suction k draw water from the sheet
Doctor Blades	To make the surface of the rolls cle excess water in Rolls



0





### port the wire as the stock

### ast roll and the couch roll. tion boxes, and dry suction boxes to provide the force to

### ean by doctoring the fines &





### 1 layer



2 and half layer





0



### 2 layer





### **TYPES OF WIRE PART**

**TYPES OF** WIRE PART

### SINGLE WIRE

GAP **FORMERS** 

ROLL

**FORMERS** 

BLADE FORMERS

### FOURDRINIER



0



### TWIN WIRE









The twin wire formers use a jet of stock imparted on to the gap between two converging wires

Depending on the design, the initial drainage can take place in one direction or in another direction or in both directions.





## **TWIN WIRE BLADE FORMERS**



- requirement



 Deflectors are used on either side of the wires to control the rate of water removal

• Requires high level of precision in design and setting up of the blades Better sheet formation but have lower retention and higher drive

## **TWIN WIRE ROLL FORMERS**



- mechanism.
- **Retention is better, but grainy** formation is a dominant weakness.





### • Convergence of two wires as they wrap one or more rolls which is the primary water removal



## **TWIN WIRE ROLL / BLADE FORMERS**



- Developed to combine the advantage of roll & blade formers and this approach has yielded the desired result
- The blades on one side are fixed, while those on opposite sides are adjustable to provide better control of formation of sheet and improve quality









## **HYBRID FORMERS**

The hybrid former has become a popular low-cost alternative to a gap former, for increasing speed, improving formation and reducing twosidedness.



## **HYBRID FORMERS**

### • A "Pre forming zone" is referred to the open wire paper making before the onset of twin wire forming.



• In the twin wire forming section, the slurry is subjected to drain by pressures generated by the wire tension over the rolls covered surfaces, or blades or by vacuum





## Many hybrid formers are modifications of Fourdrinier and for this reason they are referred as <u>"RETROFIT FORMERS"</u> Hybrid Formers have exceeded expectations and provided new life to old fourdriniers.

## HYBRID FORMERS







### **PRESS PART**

### **FUNCTIONS**

To remove water from wet web formed at wire part through the nip of two rolls running under pressure & to make the web compact





## **REQUIREMENTS OF PRESS PART**

- Determines economy of a paper machine in terms of dryness
- High dryness after the press part is required to reduce steam consumption
- The dewatering capacity of a press section, paper properties & risk of web breaks depend on the design, the number of nips & the arrangement of open draws







## **OPERATIONS OF PRESS PART**

- roll.
- box



• The web is squeezed between a nip of solid roll and a felt supported by a perforated

• The water is expelled into the felt and then into the holes of the perforated roll The absorbed water in felt will be removed by vacuum during felt run through uhle



### **TYPES OF PRESS PART**







### DOUBLE FELTED PRESS

### **SUCTION** PRESS

### GROOVED **ROLL PRESS**



### EXTENED **NIP PRESS OR SHOE** PRESS





## **DOUBLE FELTED PRESS**



- Double felting a nip allows water removal in both directions and can greatly increase the capacity. The greatest advantage is for heavier weight sheets and higher nip
- - pressures
- They are mostly used at first presses where the greatest quantity of water is being handled



## **SUCTION PRESS**

- It is composed of a bronze stainless steel shell covered with rubber
- Both the shell and cover have approximately 3.2mm diameter holes or drilled on about 8mm centers over the entire roll surface
- Liquid ring type vacuum pumps or centrifugal exhausters, located in the machine room basement or outside provide the vacuum.



## **GROOVED ROLL PRESS**

- Grooves are provided in the roll covers to provide easily acceptable receptacles for the squeezed out water from the paper web.
- The grooved roll is solid and therefore higher pressure can be applied to squeeze out the water. • The water caught in the grooves is removed by centrifugal force generated
- at high roll surface speeds.



## EXTENDED NIP / SHOE PRESS



- dryness
- achieve higher dryness
- shoe

• To reduce the energy costs involved in drying section of paper machine it was required that the sheet leaving the press section should have a higher

• Long nip presses were the answer to • These extended nip presses use a long nip that is formed against a stationary



## EXTENDED NIP / SHOE PRESS



- With the increased dwell time of these presses a dryness of around 55% can be reached.
  - When used as the last nip the press gave not only a much drier sheet but also significantly stronger sheet due to improved consolidation of the web structure.





## TRI NIP PRESS

- ١

1<sup>st</sup> Nip is with the suction roll and granite roll
2<sup>nd</sup> Nip is with another suction roll on the same granite roll.
3<sup>rd</sup> Nip with the granite roll and suction roll.



## FACTS ABOUT PRESS PART



- Water removal in dryer section is 7-10 times costlier than on presses • Water removal in dryer section is 60-70 times costlier than on wire part
- By higher Nip pressure & longer nip time, it is theoretically possible to get up to a dryness of 65% only





## FACTS ABOUT PRESS PART





 Practical limit of dryness on the press section is 35-55% • This is the limit of dryness on the presses because it is not possible to remove this water by pressing without damaging the structure of the fibres.



## **DRYER SECTION**

### **FUNCTIONS**

To remove the remaining water in the wet web that cannot be removed by vacuum or pressing during wet end operations. To facilitate fiber to bond together by hydrogen bonding.













The dryer cylinders are grouped in sections having 8-10 dryer cylinders. Each section is independently driven and has a fabric to press the paper on to the hot cylinders.



- Drying of wet web is carried out by passing around series of steamheated cylinders
- There are about 40 to 70 dryer
  - cylinders on a typical paper
- This is the largest part of a paper

## **DRYER SECTION**



0











- The paper web is threaded around two row of dryers i.e. bottom & top side cylinders
- The un supported paper web due to open draw limits the higher machine speed. However, both side of the paper is heated results in curl free product





## SINGLE TIER DRYER SECTION



- The paper web is threaded around one row of dryers with a bottom row of turning rolls.
- Thus, the web is continuously supported by a fabric; there are no free draws which enables higher machine speed. However, only one side of the paper is heated in this configuration



## SINGLE & DOUBLE **TIER DRYER SECTION**

High speed enabled configuration at starting stages of drying & **Double side heating enabled configuration at later stage of drying** results better option in modern paper machines. Quality & Productivity can be achieved in this configuration





## MG CYLINDER / YANKEE DRYER



- Used to produce soft products such as facial tissues, toilet tissues, and kitchen towels.
- It is pressurized inside with steam, which helps to heat the surface of the cylinder.
- Also used for producing paper grades imparts a high-gloss finish to one side of the paper products like chart paper & Wrappers







## FLAKT / AIR FLOATATION DRYER

- machines
- than used for paper
- slurred





• The web passes through a number of tiers in which hot air is blown • This gives lower temperature drying • This in turn darkening, embrittlement and bonding which are important when the pulp is re-



## FOURDRINIER PAPER MACHINE



### It is named after the Fourdrinier brothers, who invented it in the early 19th century. Products like Newsprint, Writing, printing & **Photo Copying paper**



0



## • CYLINDER MOULD PAPER MACHINE



### As the cylinder rotates and picks up the pulp, which is then transferred to a continuous fabric to form the paper. Products: Laid paper, filter paper, and artistic paper.





Press roller

Wire mesh

## TWIN-WIRE PAPER MACHINE



It has two forming wires that control the drainage more efficiently than Fourdrinier. This machine is used for higher-quality and higher-speed production than the Fourdrinier machine. Products: Fine paper, packaging paper and board grades.









A multi-layer paper machine is designed to produce paper with multiple layers, offering unique properties like strength, texture, and surface smoothness. **Products:** Premium quality papers such as coated paper and specific packaging materials.



### Top-Former



Tissue paper requires higher levels of moisture removal and a softer, bulkier product. These machines usually have a Yankee dryer to dry the paper quickly while giving it a soft texture. Products: Toilet paper, napkins, facial tissues, paper towels.

1211.6	LOUI MINUT
1513	128mme (# [31)
6.8.8	05/07/88
1.8	ALTE (200000, 12ph), (00x001) NTE (200000, 12ph), (00x000)
5464	2225.9458
1225	ADERT



This machine uses a similar process to Fourdrinier machine but involves multiple layers of Coatings to create smoother board. **Products: Corrugated board, container board & packaging materials.** 









## **PULP SHEET DRYING MACHINE**

A pulp sheet drying machine is used for producing thick sheets of pulp, which are then dried and processed into paper. Products: All varieties of Pulp sheets







## **CALENDER SECTION**

### **FUNCTIONS**

**1.** To improve smoothness and gloss in paper ensure consistent thickness & enhance printability by compressing the paper



# 2. **To**





- Compressing the paper web between one or more rolling nips under pressure is called Calendering • Nip pressure reduces the web thickness & the flat rolls
  - surface imposes smoothness on the paper.









 Achieves better smoothness and retains the thickness • Enables higher machine speed Inversion & Tandem design makes the process simple compared to conventional Hard **Nip Calendering** 



### **REELER SECTION**

### **FUNCTIONS** To make final paper product in a convenient form mostly as a jumbo roll for subsequent processing it off machine







## **RELLER SECTION**



- Most pay equipped collects 1
  specified
  The reel
  Reel" why
  with suff
  winding
- Most paper machines are equipped with a drum roll which collects the paper & winded to a specified diameter.
- The reel drum is called as "Pope Reel" which is motor driven with sufficient load for a tight





## **ANY QUESTIONS** 222

### **R.B.LAKSHMIPATHI SAKTHI**

### **DEPUTY MANAGER (PRODUCTION)**

### CONTACT: 999 4 688 652