



DRYING

Presented by:

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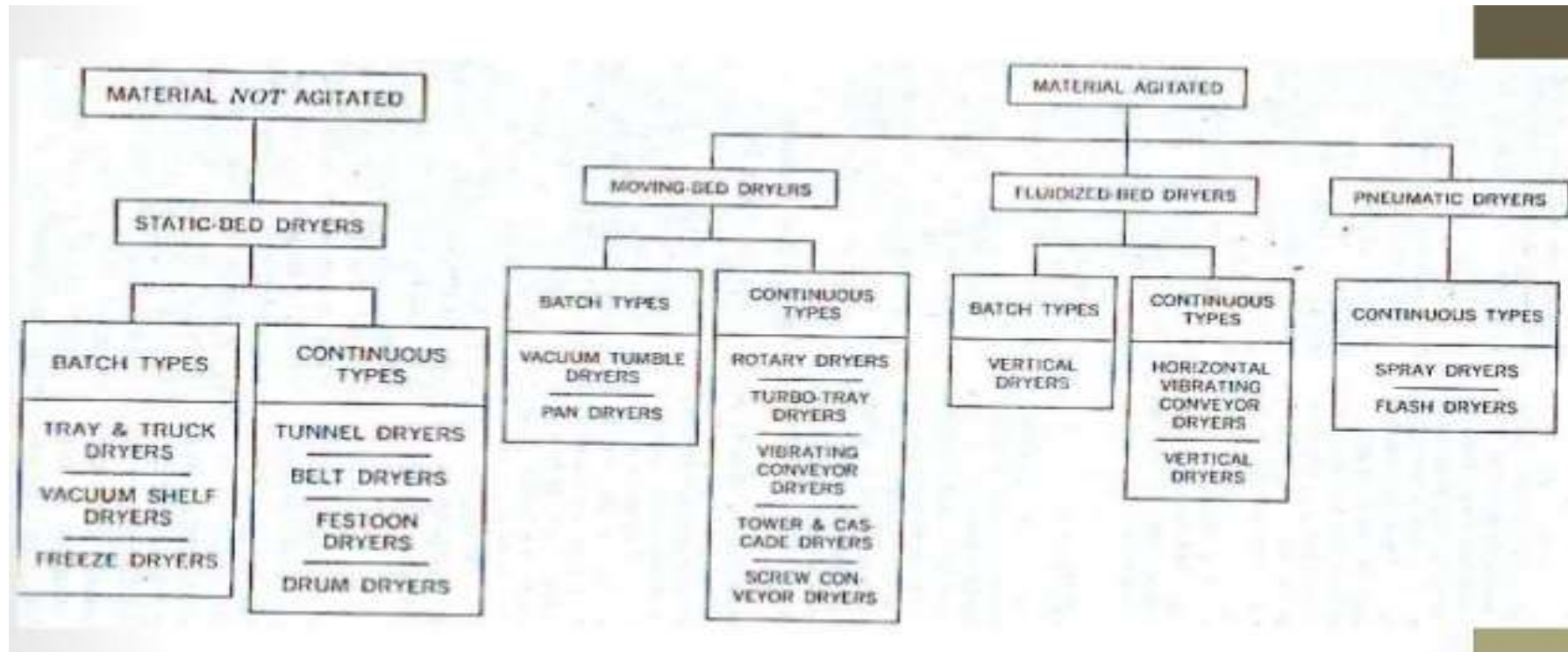
DRYING

Classification of dryers

Based on heat transfer

- ▶ Drying of wet solids
 - Convective drying :e.g. tray dryer, tunnel dryer, rotary dryer.
 - Conductive drying: e.g. vacuum dryer
 - Radiation drying: e.g. microwave dryer.
- ▶ Drying of dilute solutions & suspensions -Drum dryer.
- ▶ Freeze drying

Based on methods of solids handling



Factors affecting selecting of dryers

1. Properties of material being handled

Physical characteristics when dry

Physical characteristics when wet

Corrosiveness

Toxicity

Flammability

Particle size

Abrasiveness

2. Drying characteristics of material:

Type of moisture (bound/unbound/both)

Initial moisture content

Final moisture content

Permissible drying temperature

Probable drying time for different dryer

3. Flow of material to and from dryer:

Quantity to be handled per hour

Type of operation (batch/continuous)

Process prior to drying

Process subsequent to drying

4. Product qualities

Shrinkage

Contamination

Uniformity of final moisture content

Decomposition of product

Rate of subdivision

Product temperature

Bulk density

5. Recovery problems:

Dust recovery

Solvent recovery

6. Facilities available at site of installation

Space

Temperature

Humidity

Cleanliness of air

Available fuels

Available electric power

Source of wet feed

Permissible noise, vibration, dust or heat losses

Exhaust-gas outlets

List of equipment used for drying

- ▶ Drum dryer,
- ▶ Spray dryer,
- ▶ Fluidised bed dryer,
- ▶ Tray dryer,
- ▶ Tunnel dryer,
- ▶ Vacuum dryer,
- ▶ Microwave,
- ▶ Radiant heat dryer (infra red)
- ▶ Rotary dryer
- ▶ Freeze dryer

TRAY DRYER

PRINCIPAL

In tray dryer hot air is continuously passed over wet mass. Heat transfer takes place by forced convection.

CONSTRUCTION

It consists of a rectangular chamber whose walls are insulated. Trays are placed inside the heating chamber. The number of trays may vary with the size of the dryer. Each tray is rectangular or square and about 1.2 to 2.4 metres square in area . Trays are usually loaded from 10.0 to 100 millimetres deep. Dryer is fitted with a fan for circulating air over the trays. Electrically heated elements are provided inside (rather than outside) to heat the air. In the corner of the chamber, direction vanes are placed to direct air in the expected path.

WORKING

- ▶ Wet solid is loaded into trays. Trays are placed in the chamber.
- ▶ Fresh air is introduced through inlet which passes through the heaters and heated up.
- ▶ The hot air is circulated by means of fans at 2 to 5 meter per second.
- ▶ The water is picked up by air and moist air is removed from outlet.
- ▶ During the cycle of drying only 10 to 20 % of fresh air is introduced and 80 to 90% air is circulated back.

MERITS

- ▶ The method is operated batch wise.
- ▶ Attrition is not observed.
- ▶ Loading and unloading can be done without losses.

DEMERITS

- ▶ Only a fraction of the solid particles is directly exposed.
- ▶ The method is costly and time consuming.

USE

- ▶ Sticky materials, plastic substances, granular mass or crystalline materials, precipitates and paste can be dried in a tray dryer.

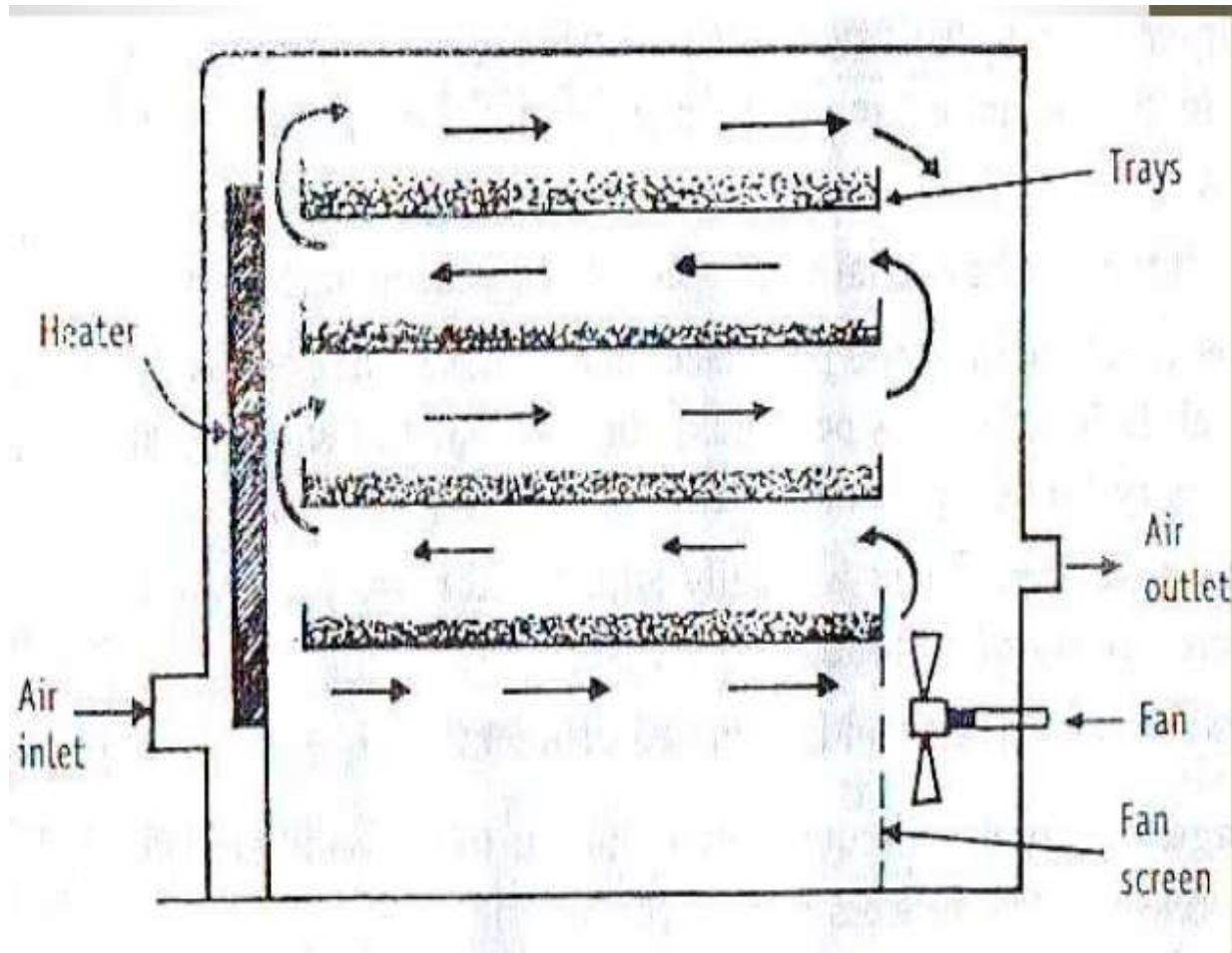


Fig. Tray dryer

DRUM DRYER or ROLLER DRYER

Principle

In drum dryer heated hollow cylindrical drum is rotate on longitudinal axis, which is dipped into the solution to be dried.

The solution is carried as a film on the surface of the dryer and dried to form a layer. Dried material is removed with the help of the knife.

CONSTRUCTION

The drum dryer consists of a horizontally mounted hollow steel drum of 0.6 to 3.0 metres diameter and 0.6 to 4.0 metres length, whose external surface is smoothly polished.

Below the drum, feed pan is placed in such a way that the drum dips partially into the feed. On one side of the drum a spreader is placed and on the other side a doctor's knife is placed to scrap the dried material.

A storage bin (or a conveyor) is placed connecting the knife to collect the material.

WORKING

Steam is passed inside the drum. Heat transfer coefficient of the drum metal is high. Heat is transferred by conduction to the material.

Simultaneously drum is rotated at the rate of 1-10 revolutions per minute. The liquid material present in the feed pan adheres as a thin layer to the external surface of the drum during its rotation.

The materials are completely dried during its journey in slightly less than one rotation (from one side to another side of the drum). The dried materials are scrapped by the doctor's knife, which then falls into a storage bin.

The time of contact of the material with hot metal is 6 to 15 seconds only. Therefore processing conditions such as film thickness, steam temperature are closely controlled.

MERITS:

The method gives rapid heat drying and mass transfer are higher

The entire material is continuously exposed to heat source.

The equipment is compact.

Heating time is short being only a few seconds.

The product obtained is completely dried and is in the final form.

DEMERITS:

Operating conditions are critical.

Attrition is not possible.

Skilled operators are essential to control feed rate ,film thickness, speed of rotation and temperature.

Maintenance cost of a drum dryer is higher than spray dryer.

It is not suitable for solutions of salts with less solubility.

USE

Drum dryer is used for drying solution, slurries, suspensions etc.

The products dried are milk products, starch products, ferrous salts, suspensions of zinc oxide, suspension of kaolin, yeasts, pigments, malt extracts, antibiotics, DDT, calcium, insecticides and barium carbonates.

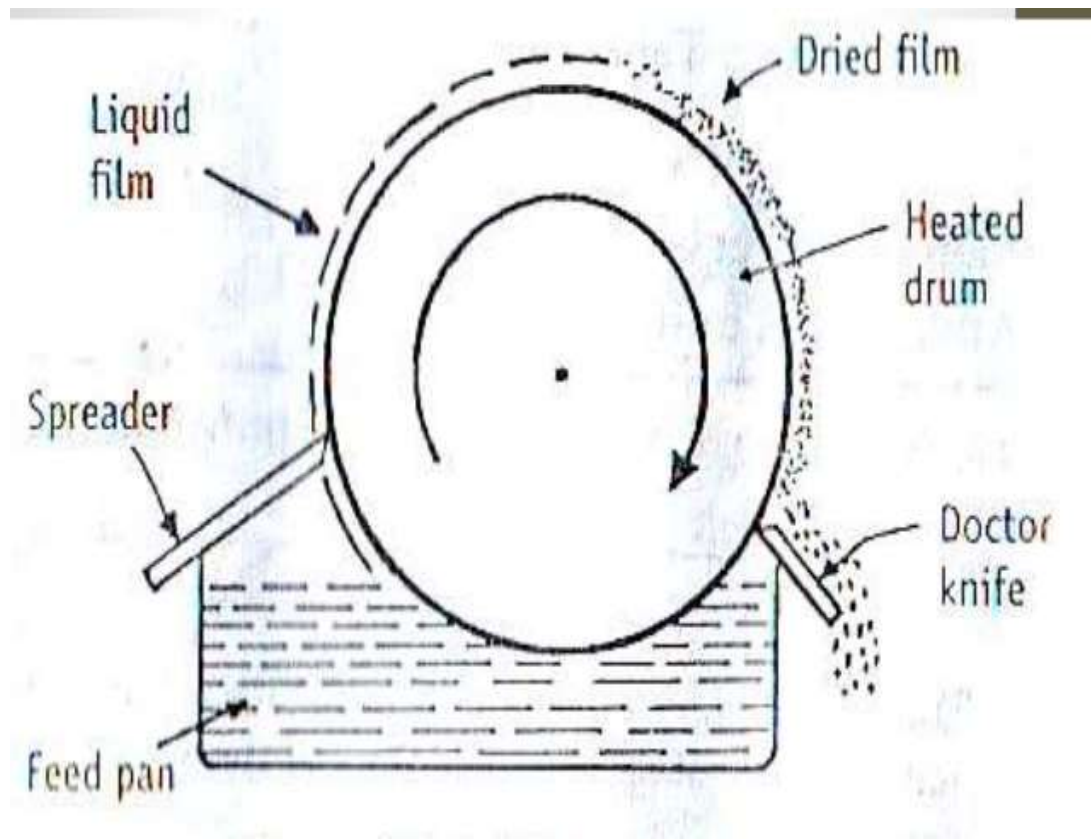


Fig. drum dryer

T H A N K

Y O U