

FILTRATION

Main Processes for Separation of Food

- **Filtration**
- **Settling and sedimentation**
- **Centrifugation**
- **Expression**

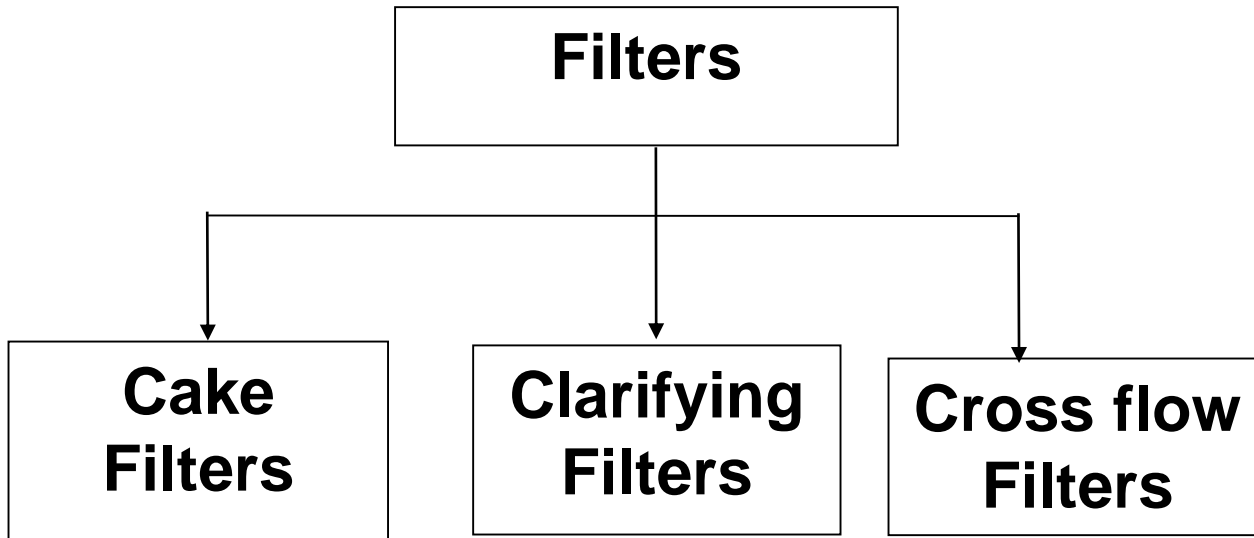
Principles of separation

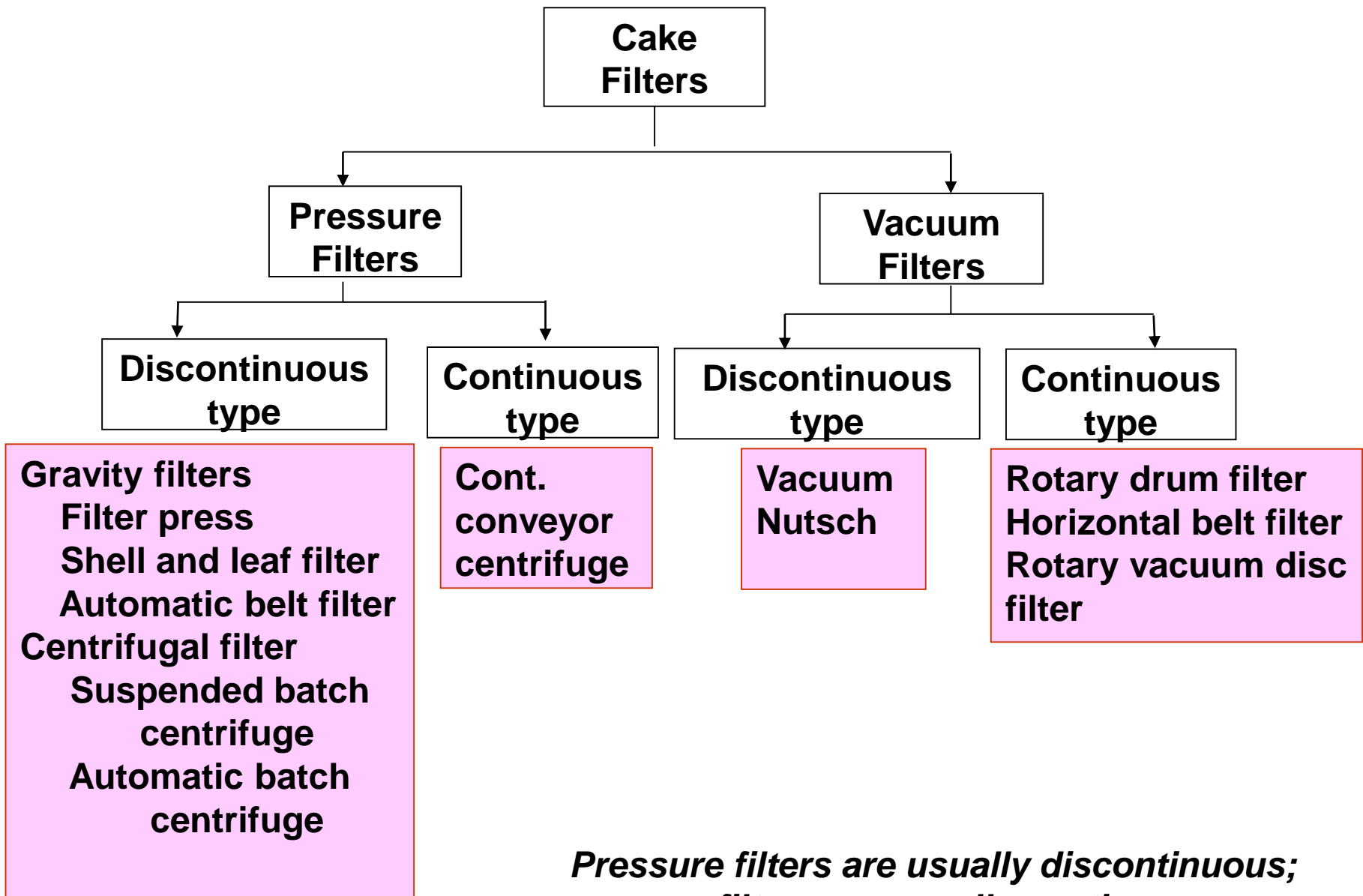
- **Filter medium**
- **Gravity**
- **Centrifugal force**
- **Pressure**

Filtration is the **removal of solid** particles **from a fluid** by passing the fluid through a **filtering medium** (or septum) on which the solids are deposited.

The fluid may be a liquid or a gas.

Modification of feed to increase the filtration rate (by heating, recrystallising, or adding a filter aid)





Pressure filters are usually discontinuous; vacuum filters are usually continuous.

Commercial filters

Plate and frame filter press

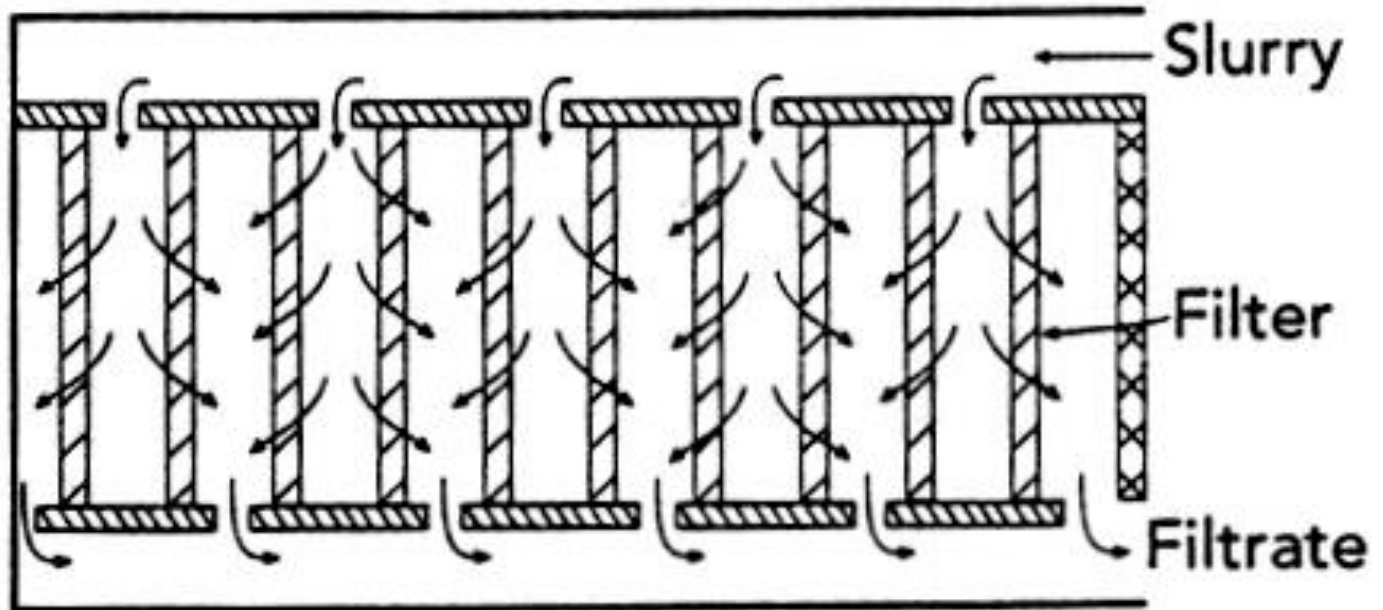


Plate and frame filter press

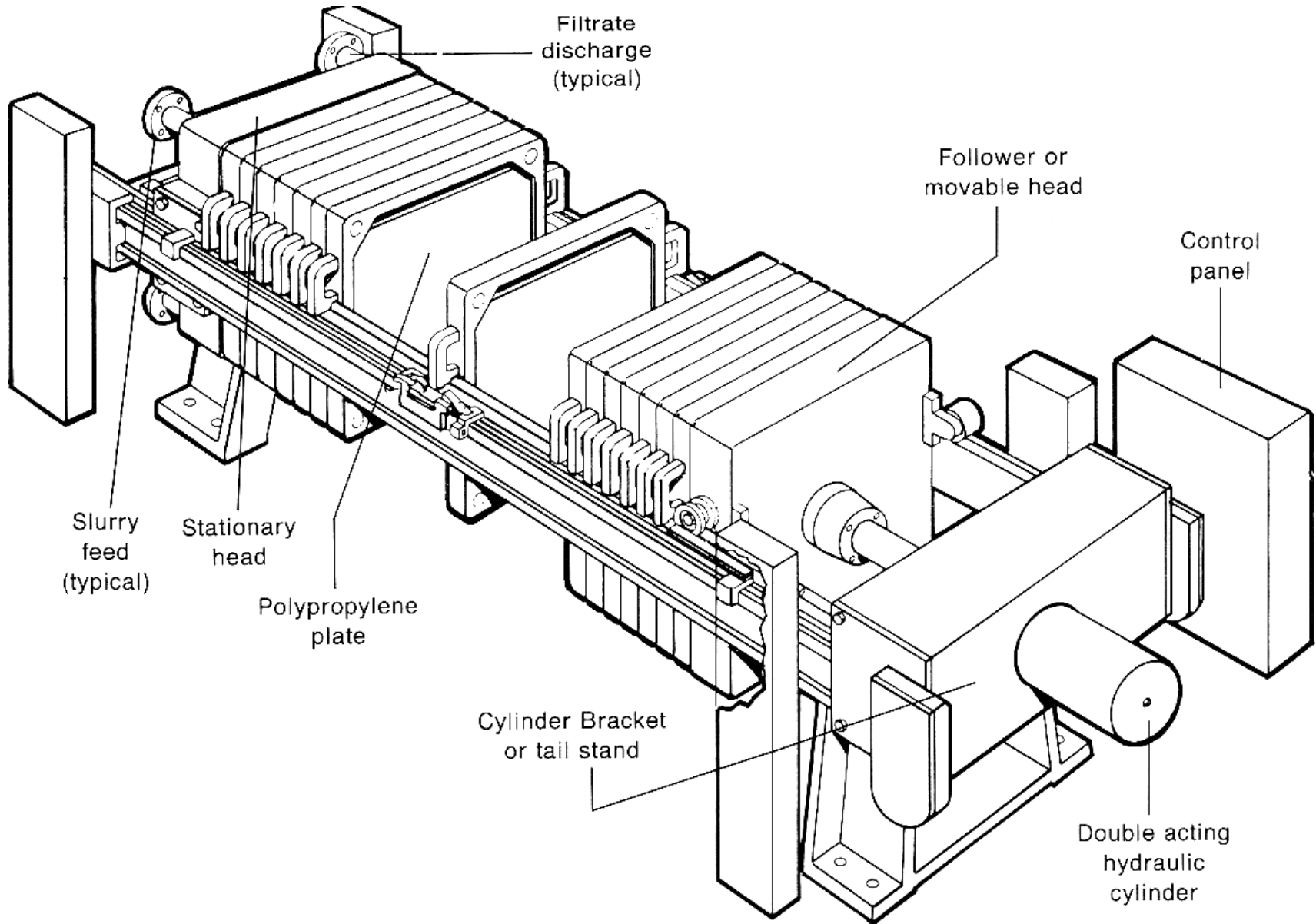


Plate and frame filter press

- Plates and frames arranged alternatively and supported on a pair of rails
(Filter clothes separate the hollow frames from the plates)

Plates

- Set of plates make a series of chambers to collect solids
- Ribbed surfaces
- may be square or circular, vertical or horizontal
(Usually square : 0.15 m x 0.15 m to 2 m x 2 m)
- Thickness : 6 to 50 mm
- Hand screw or hydraulic press to close the plates

Plate and frame filter press

- Slurry channel
- Openings from this channel in each frame
- Outlet at the bottom of each plate
- Liquor passes through the cloth, down grooves or corrugations in each faces
- A thick cake is formed
- Low pressure (1.5-3.2 kg/cm² gauge pressure)
- Slurry is admitted to each compartment under pressure; liquor passes through the canvas and out a discharge pipe, leaving the wet cake of solids behind.
- Filtration continues till the frames are completely filled (no filtrate at the bottom) → known as **solid filling** or **jamming**.

Plate and frame filter press

Removal of solid filling

First blow of air

Usually no displacement of cake as the cell is completely filled with solids.

**Wash solution/
water under
pressure**

**2nd blow of air
behind filter cloth**

Air blow removes the wash and obtain as dry cake as possible.

**Opening of Press
to remove cake**

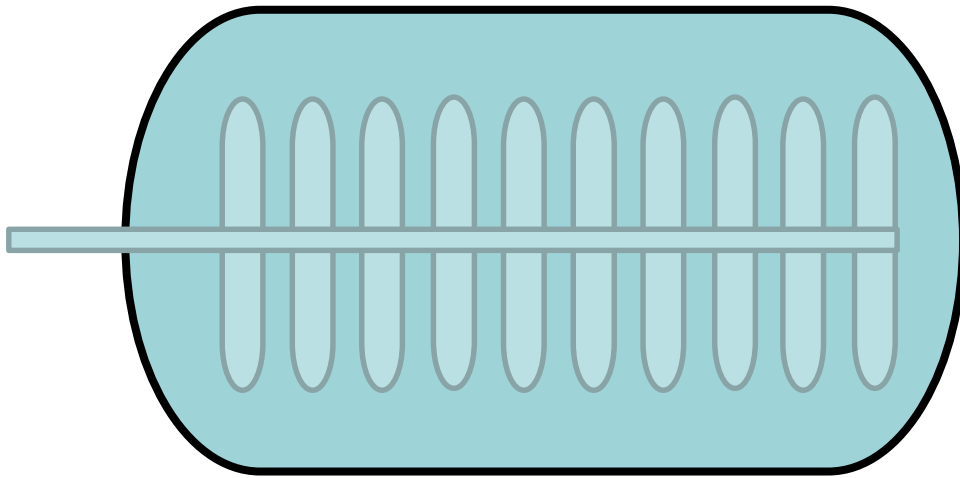
Cake dropped onto a conveyor or storage bin.

The dryness of the cake is one major advantage with the plate and frame press.

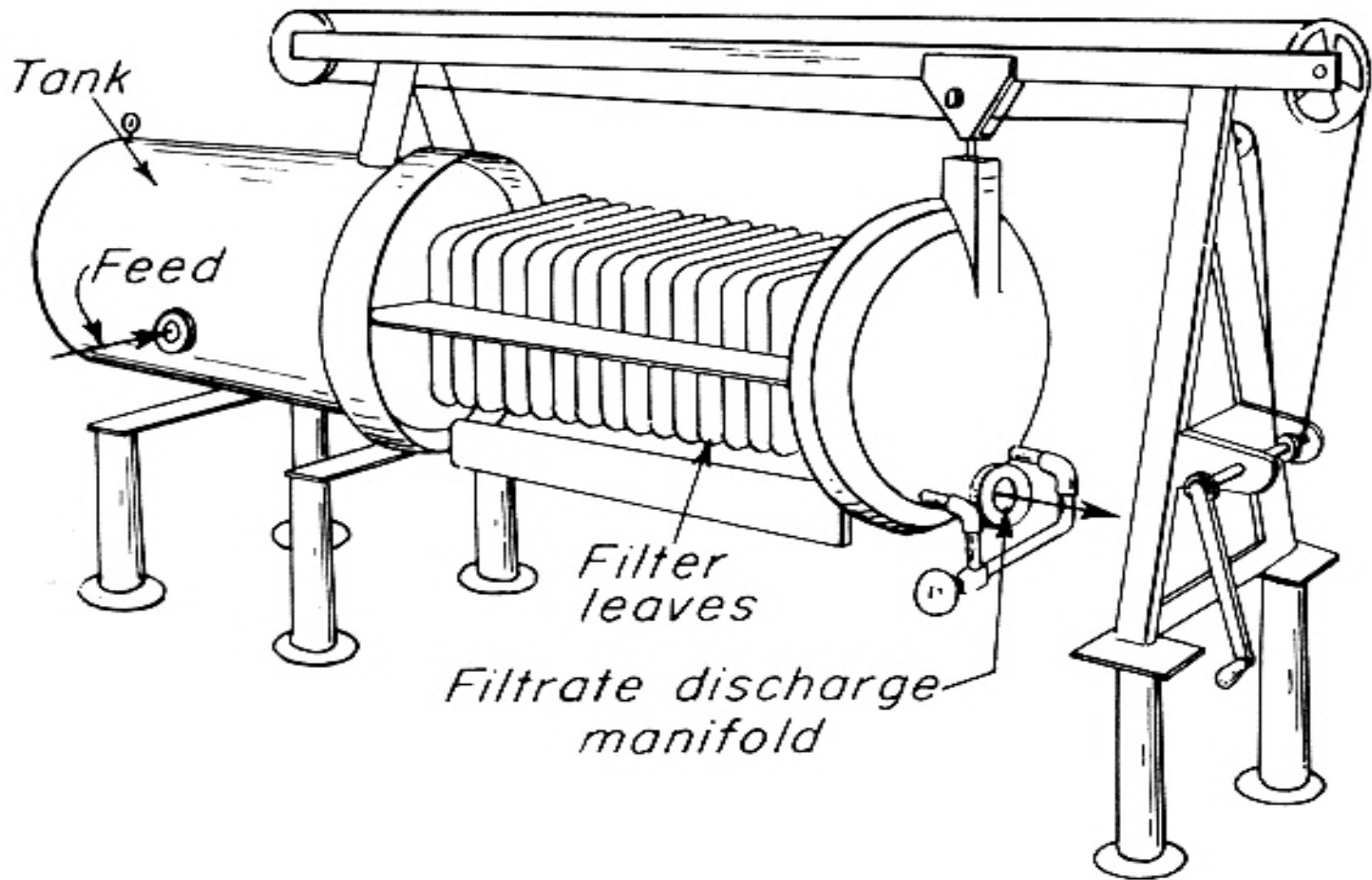
Plate and frame filter press

- **Low capital cost**
- **Highly flexible for different types of products**
- **Easy maintenance**
- **Intermittent operation**
- **Used for production of apple juice and cider, other juices, and filtration of oil.**

Shell and leaf filters



Shell and leaf filters



Shell and leaf filters

- A set of mesh leaves held on a retractable tract inside a pressure vessel.
- Vertical or horizontal
- Leaves coated with filter medium and supported on a hollow frame, which forms the outlet channel for the filtrate.
- During operation, the leaves are inside the closed tank; feed enters through the side of the tank; feed liquor is pumped into the shell at a pressure of approx. 400×10^3 Pa.
- Filtrate passes through the leaves into a discharge manifold.
- The cake is blown or washed from the leaves after completion of the filtration operation.
- In some designs the set of leaves rotate at 1-2 rev/min to improve the uniformity of cake build up.

Shell and leaf filters

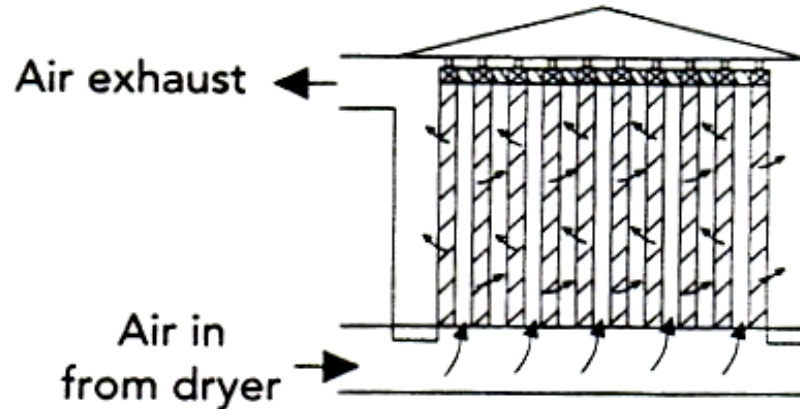
- Involves **higher cost** than the plate filters and less labour.
- Widely used for filtration involving the **filter aids**.
- Used for filtration under higher pressures than are possible in a plate and frame filter.
- Used **when more effective washing of the cake** is necessary.

Filters for gas

- *Pad filters* for atmospheric dust
- Granular beds and *bag filters* for process dust

In all of these filters most of the separation is by impingement.

Filters for gas- Pad filter



- Air is cleaned by passing it through pads of cellulose pulp, cotton, felt, glass fibre, or metal screening.
- The pad material may be dry or coated with a viscous oil to act as a dust holder.
- For light duty the pads are disposable, but in large-scale gas cleaning they are frequently rinsed and recoated with oil.

Granular bed filters

Contain stationary or moving beds of granules ranging from 30 mesh to 8-mesh in size in some designs, to 12 to 40 mm in others.

Bag filter

- A bag filter contains one or more large bags of felt or thin woven fabric, mounted inside a metal housing.
- Dust-laden gas usually enters the bag at the bottom and passes outward, leaving the dust behind, although sometimes the flow is inward.
- Efficiencies are typically 99% even with extremely fine particles- far finer than openings in the bag material.
- Periodically the flow is automatically cut off and clean gas is blown back or the bag is mechanically shaken to dislodge the dust for recovery or disposal.
- In most cases, bag filters act as clarifiers with particles trapped within the fabric of the bag, but with heavy dust loadings a thin but definite cake of dust is allowed to build up before it is discharged.

Thank You