Production of Tablets (Methods and equipment)

- **Powders intended for compression into tablets must possess two essential properties:**
  - **<u>Powder fluidity</u>**
    - **The material can be uniformly transported through the hopper into the die (no segreagtion)**
    - **To produce tablets of a consistent weight**
    - **Powder flow can be improved mechanically by the use of vibrators, incorporate the glidant and/ or lubricant.**

- **Granulation can enhance powder flow properties by increase sphericity and density.**
- **Spray drying and microencapsulation can be used for the same purpose.**

– **Powder compressibility**

- The property of forming a stable, intact compact mass when pressure is applied.

Q/ How can you increase compressibility?

Additionally:

- Non sticking of the powder blend to walls of dies and surfaces of punches,

- Adequate cohesion of the powder blend to form a strong tablet.

General Tableting procedure

- Filling (of powders or granules)
- Compression
- Ejection of compressed tablets

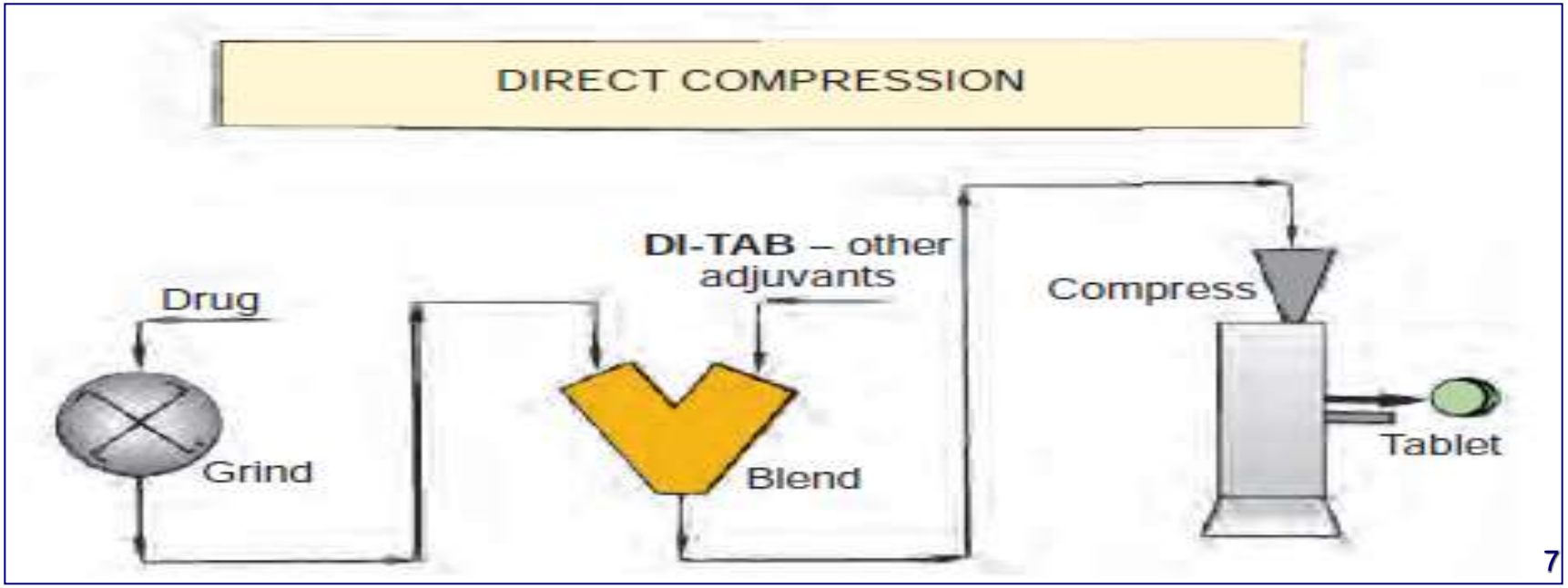
Tableting methods

- **Dry methods**
  - **Direct compression**
  - **Dry granulation**
- **Wet methods**
  - **Wet granulation**

Q/ What are the factors affecting the choice of a suitable tabletting method?

Direct compression

- **Tablets are compressed directly from powder blends of the active ingredient and suitable excipients**
- **No pretreatment of the powder blends by wet or dry granulation procedures is necessary**

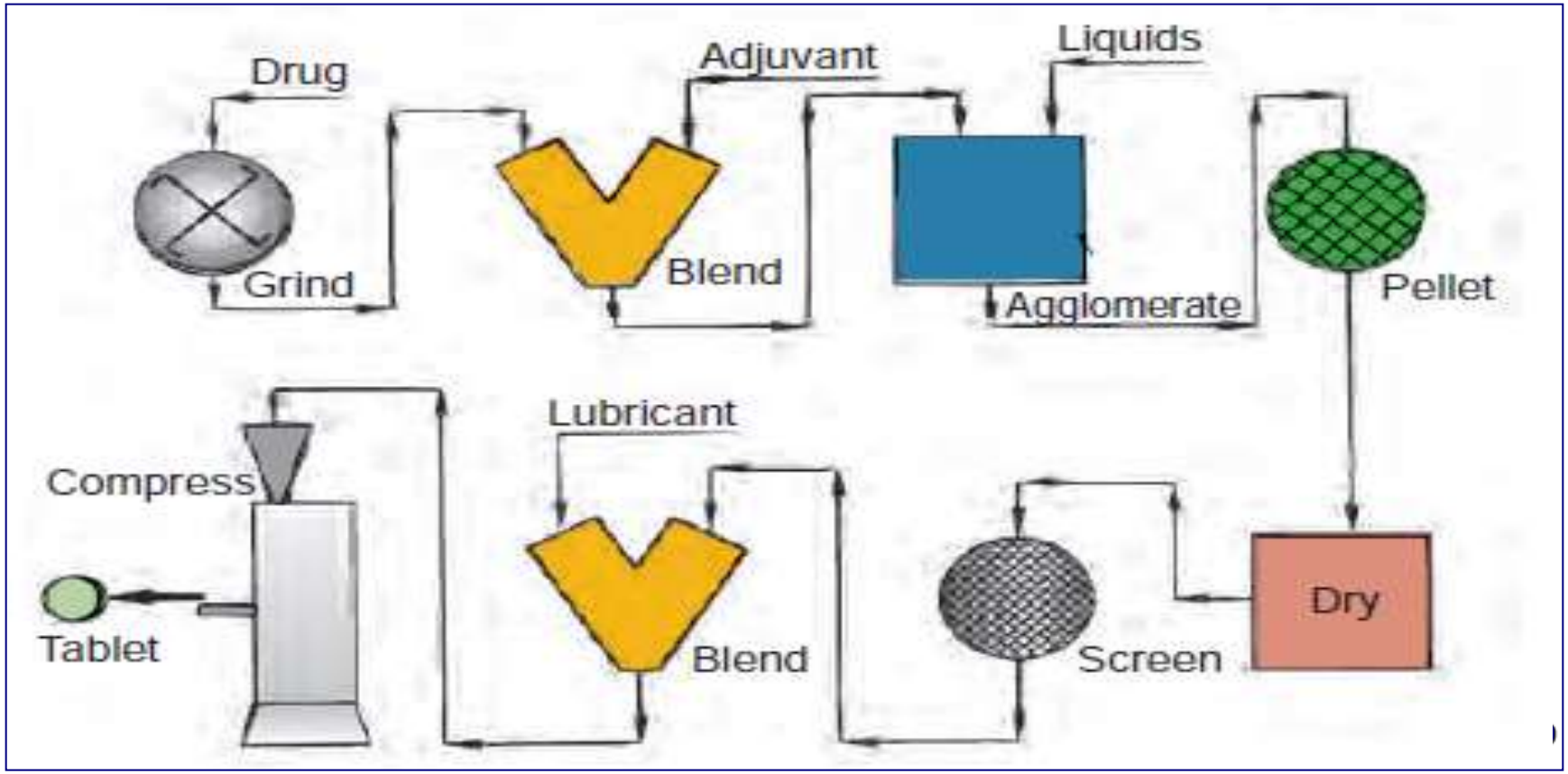


- **Advantages**
  - **Economic (time, cost, materials and equipment)**
  - **Elimination of variabilities in wet granulation processing (binder conditions, process conditions) or dry granulation processing (heat of compaction).**

Disadvantages??? H.w.

Wet granulation

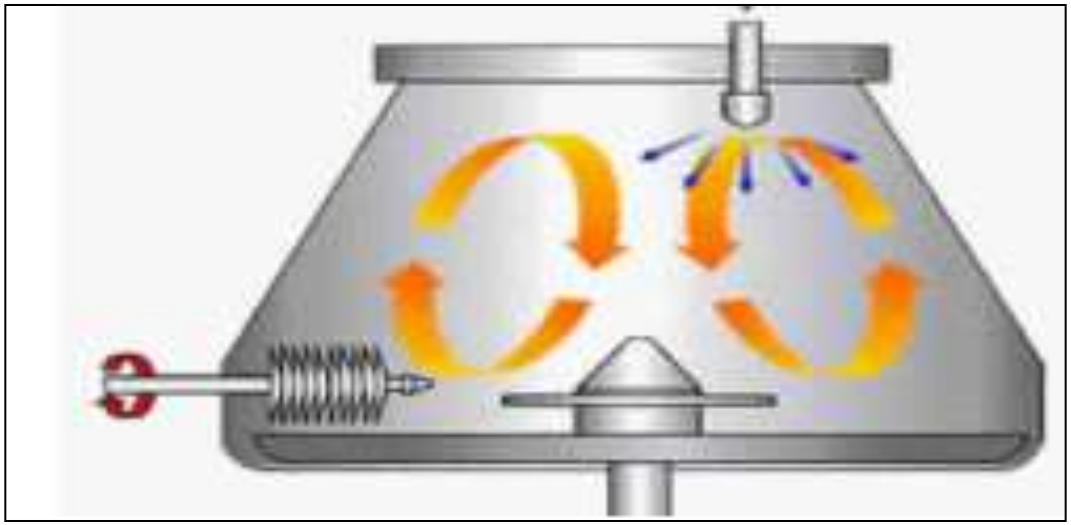
- **Granulation may be defined as a size enlargement process which converts small particles into physically stronger & larger agglomerates.**



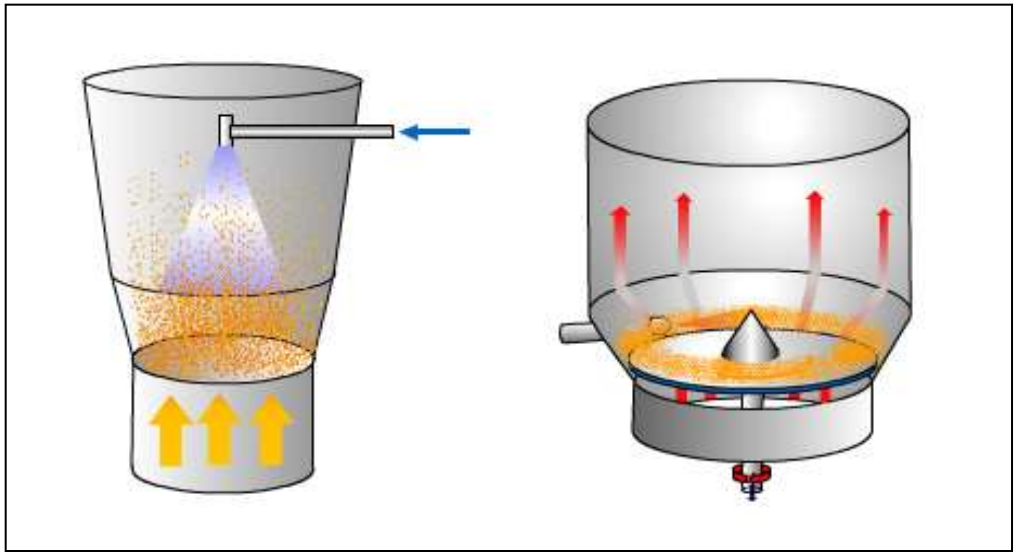
- What are advantages and disadvantages?

Notes:

1. Preferred for low compactability and flowability powders
2. Mixing here solid- solid and liquid-solid types
3. The binding forces are related to the binder used
4. Granules obtained manually (by sieving) or industrially (by granulators) (like???)



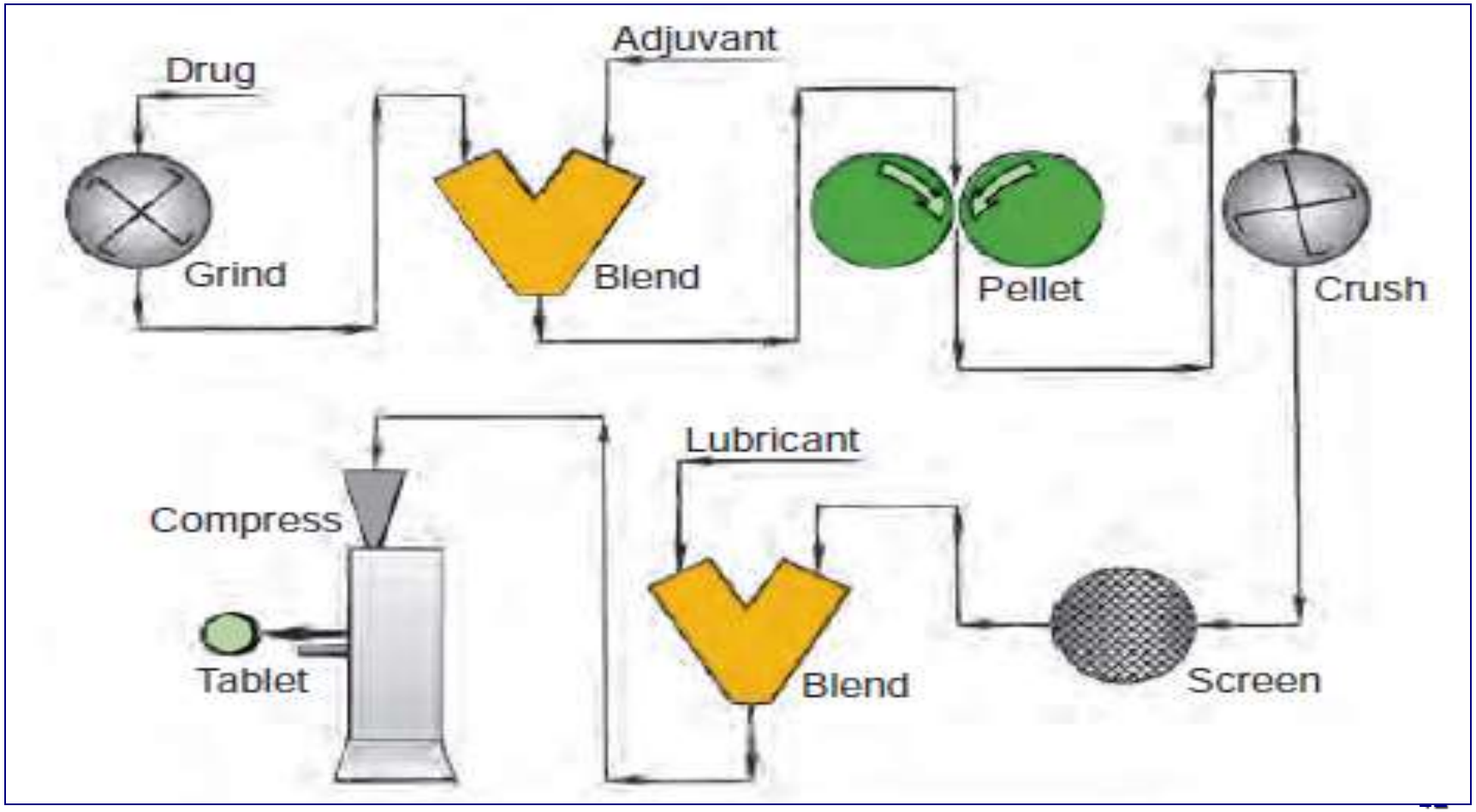
High speed mixer granulator



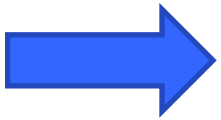
Fluidized bed system

Dry granulation (Double compression)

- Preferred for powders with adequate compactability and bad flow properties

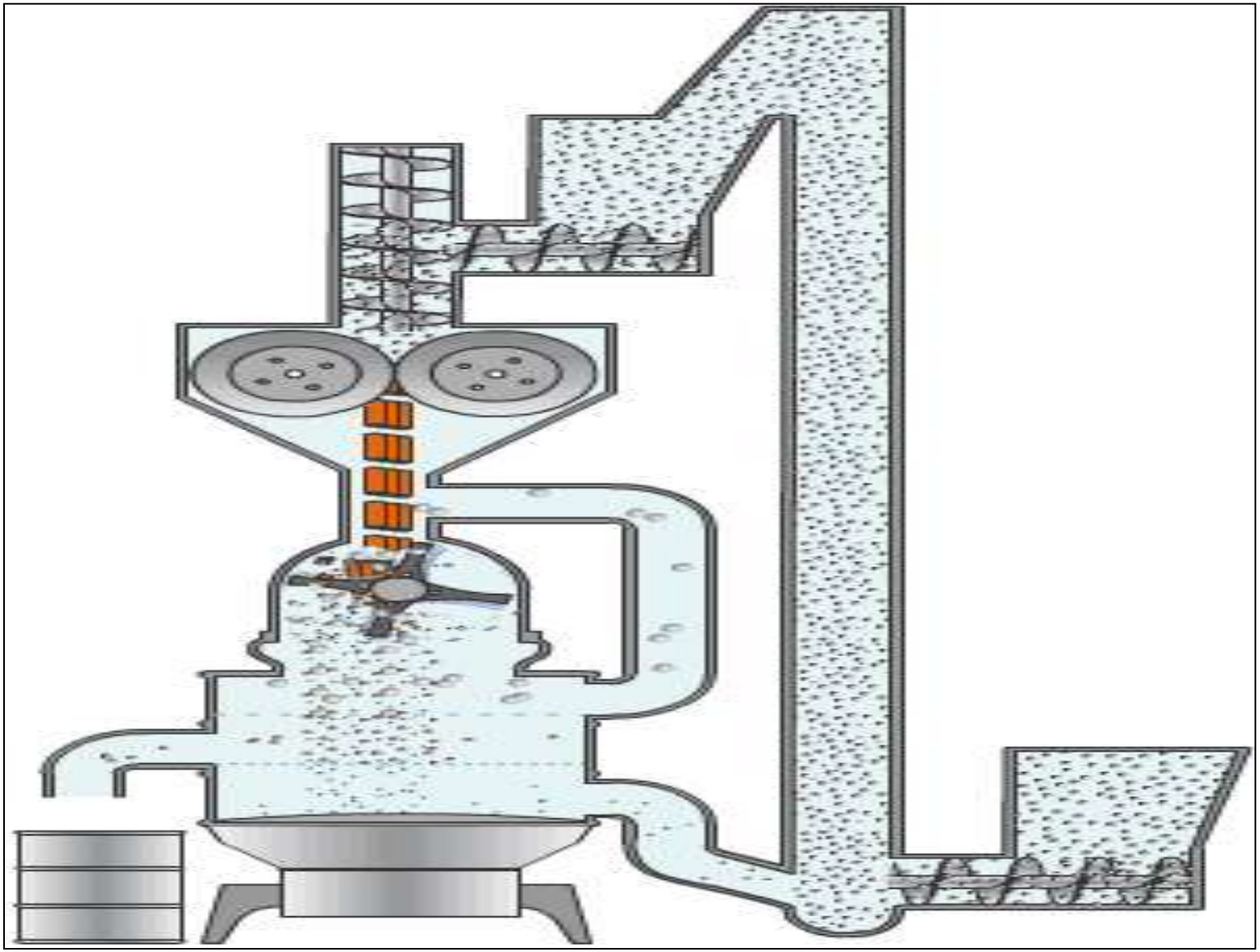


- **The binding forces obtained by compaction ,here different forces are involved that increased by decrease distance between (powder within die) and upper punch.**
- **Slugging (machine?) or Roller compaction (machine?) is used for that.**

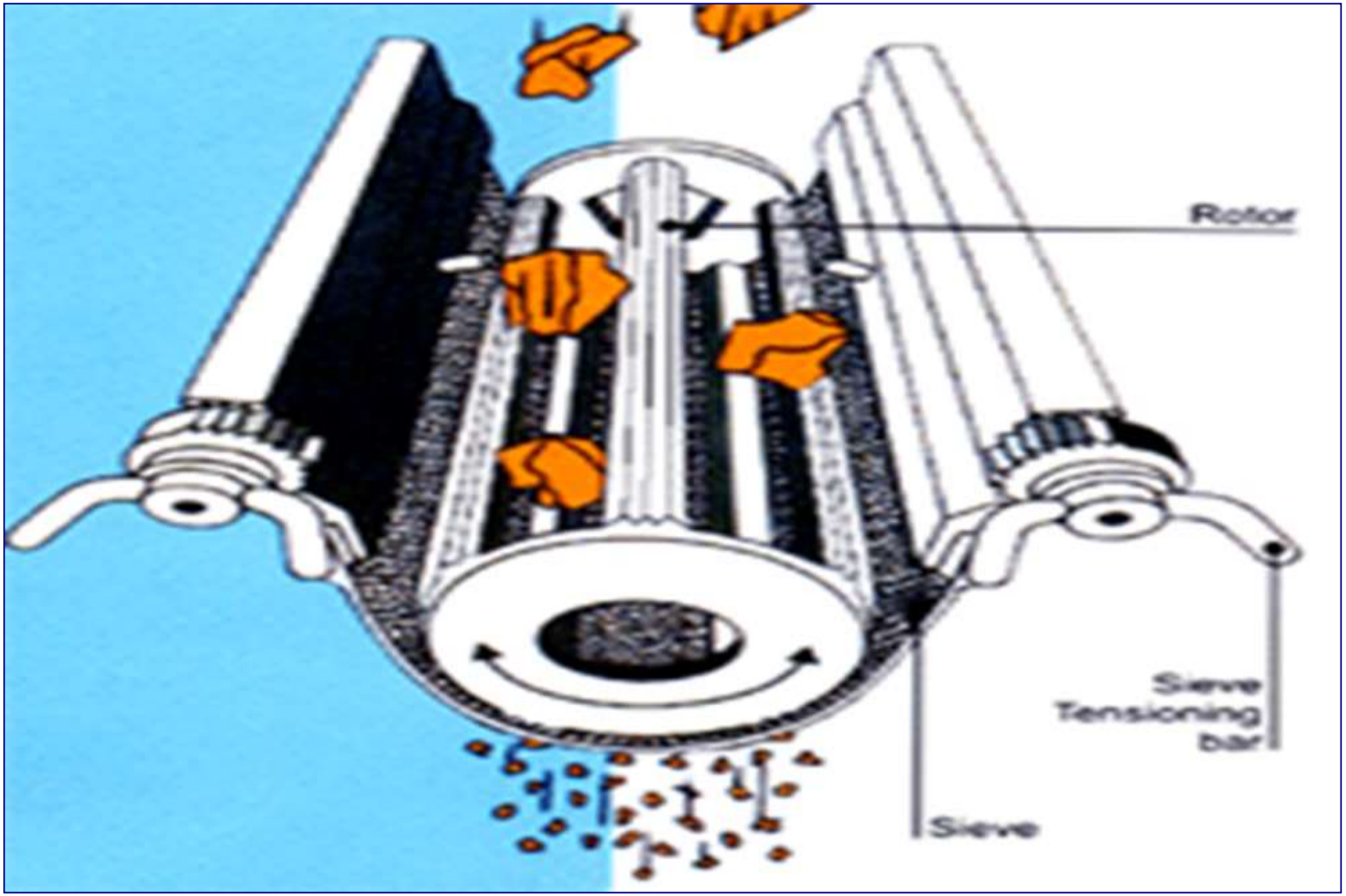
Powder mix.  **Oversized tablet (slug)**

Milling

Granules



Roll compactor (Chilsonator)



Oscillating granulator

Advancement in Granulations

- **Steam Granulation**

It is modification of wet granulation. Here steam is used as a binder instead of water.

With advantages like:

- Higher distribution uniformity.
- With more spherical granules with larger surface area.
- More environmentally friendly

Foam Granulation

Here liquid binders are added as aqueous foam.

It has several benefits over spray(wet) granulation such as:

- It requires less binder with greater rate of addition.
- Useful for granulating water sensitive formulations.
- Less drying time.
- Uniform distribution of binder throughout the powder bed.

Melt Granulation / Thermoplastic Granulation

Here granulation is achieved by the addition of meltable binder. That is binder is in solid state at room temperature but melts in the temperature range of 50 – 80˚C.

- Melted binder then acts like a binding liquid.
-There is no need of drying phase.

Tablet compression machines

- Hopper for holding and feeding granulation to be compressed
- Dies that define the size and shape of the tablet
- Punches for compressing the granulation within the dies
- Cam tracks for guiding the movement of the punches
- Feeding mechanisms for moving granulation from the hopper into the dies

Single punch machine

- The compression is applied by the upper punch
- Stamping press
- During compression, hammer motion for upper punch, moved feeder and constant lower punch and die.

Single Punch Machine (Tablets)

top punch

bottom punch

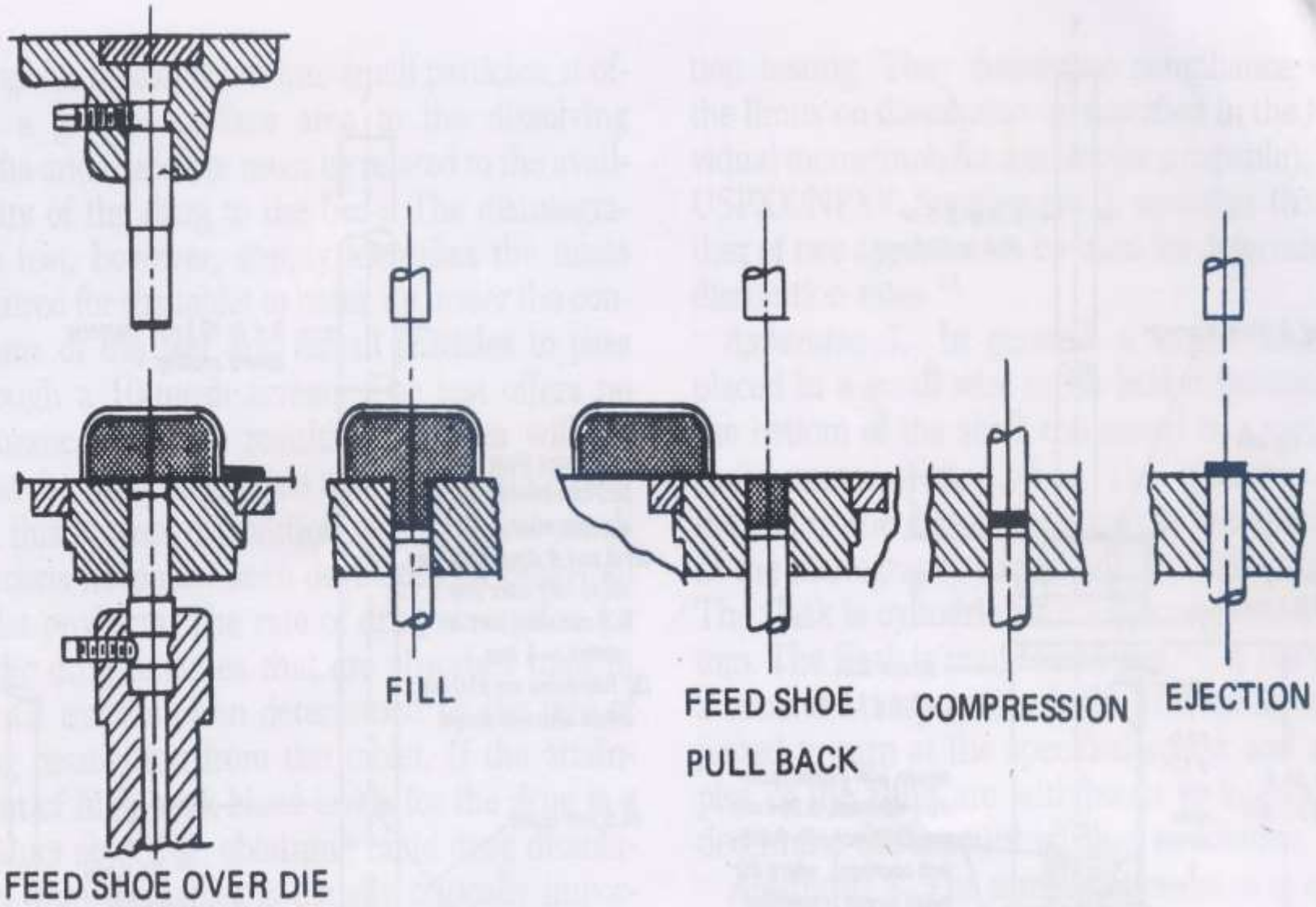
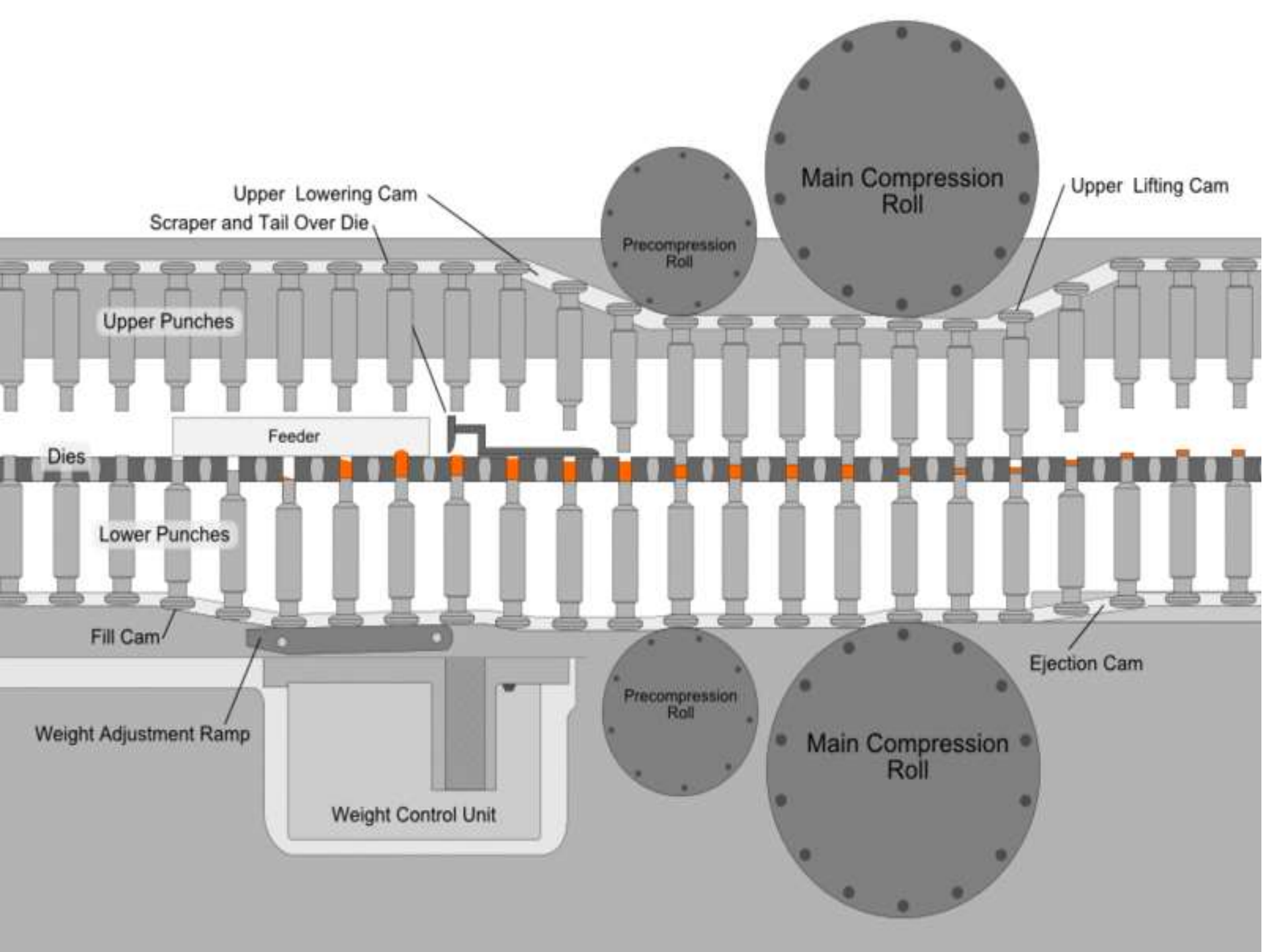


FIG. 11-5. *The compression cycle of a single-punch tablet press. (Courtesy of Vector Corporation, Marion, IA.)*

Multi-station rotary presses

- **The head of the tablet machine that holds the upper punches, dies and lower punches in place rotates (Constant feeder and rotating punches and die) .**
- **As the head rotates, the punches are guided up and down by fixed cam tracks, which control the sequence of filling, compression and ejection.**


Upper Lowering Cam
Scraper and Tail Over Die
Precompression Roll
Main Compression Roll
Upper Lifting Cam
Upper Punches
Feeder
Dies
Lower Punches
Fill Cam
Ejection Cam
Weight Adjustment Ramp
Precompression Roll
Main Compression Roll
Weight Control Unit

- **The portion holding the dies is called the die table**
- **The lower punches are moved to the bottom, allowing the dies to overfill**
- **The punches then pass over a weight-control device (why)?**
- **Scraper for removing excess powder**

As modifications for machine:

- An increase in production rate is obtained by increasing :
  - Number of tooling sets
  - Number of compression stations
  - Rotational speed of the press

- **Special adaptations of tablet machines allow for the compression of layered tablets and coated tablets**
- **Chillers within the compression machine for allowing compression of low-melting point substances such as waxes.**

Questions

- **Differentiate between single and rotary press.**
- **What is the meaning of pelletization?**
- **The binding forces of tablets are varied with variation of tabletting method, T or F (explain?)**