Industrial Pharmacy II

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Tablet Coating

Coating Process

Tablet coating is the application of a coating composition to a moving bed of tablets with the concurrent use of heated air to facilitate evaporation of the solvent.

The distribution of the coating is accomplished by the movement of the tablets either perpendicular (coating pan) or vertical (air suspension coater) to the application of the coating composition.

Tablets Coating Principles

1. To mask the taste, odor, or color of the drug.
2. To provide physical and chemical protection for the drug.
3. To control the release of the drug from the tablet.

4. To protect the drug from the gastric environment of the stomach with an acid-resistant enteric coating.

5. To incorporate another drug or formula adjuvant in the coating to avoid chemical incompatibilities or to provide sequential drug release.

6. To improve the pharmaceutical elegance by use of special colors and contrasting printing.

There are three primary components involved in tablet coating:

1. Tablet properties.
2. Coating process.
   - -Coating equipment.
   - -Parameters of the coating process.
   - -Facility and ancillary equipment.
   - -Automation in coating processes.
3. Coating compositions.

Tablet Properties

Tablets that are to be coated must possess the proper physical characteristics. In the coating process, the tablets roll in a coating pan or cascade in the air stream of an air suspension coater as the coating composition is applied.

To tolerate the intense attrition of tablets striking other tablets or walls of the coating equipment, the tablets must be resistant to abrasion and chipping.

Tablet surfaces that are brittle, that soften in the presence of heat, or that are affected by the coating composition tend to become rough in the early phase of the coating process and are unacceptable for film coating.

The quality of thin film coatings applied to compressed tablets usually depends much more on the quality of the starting tablet than on the time at which sugar coatings are applied.

Sugar coatings, with their high solids content, dry more slowly and can fill many of the minor tablet surface imperfections that may occur in the early phase of the coating process.

In addition to a smooth surface, the physical shape of the tablet is important. When a coating composition is applied to a batch of tablets in a coating pan, the tablet surfaces become covered with a tacky polymeric film.

Before the tablet surface dries, the applied coating changes from a sticky liquid to a tacky semisolid, and eventually to a non-tacky dry surface.

The tablets must be in constant motion during the early drying phase or tablet agglomeration can occur. The ideal tablet shape for coating is a sphere, which allows tablets to roll freely in the coating pan, with minimal tablet-to-tablet contact.

The worst shape is a square flat-faced tablet, in which case coating materials would collect between the surfaces to glue them together, like a stack of dominos or poker chips. For this reason, coated tablets have rounded surfaces; the more convex the surface is, the fewer difficulties will be encountered with tablet agglomeration.

A compressed tablet formulation includes many ingredients besides the active drug to provide a readily compressible, resilient, and rapidly dissolving dosage form. The resulting surface properties of the tablet depend on the **chemical nature** of the ingredients utilized in the formulation.

For the coating to adhere to the tablet, the coating composition must wet the surface. Hydrophobic tablet surfaces are difficult to coat with aqueous-based coatings that do not wet the surface.

The composition of the coating formulation can be adjusted, however, through the addition of appropriate surfactants to reduce the surface tension of the coating composition and improve coating adhesion.

Equipment

Most coating processes use one of three general types of equipment:

(1) The standard coating pan.

(2) The perforated coating pan.

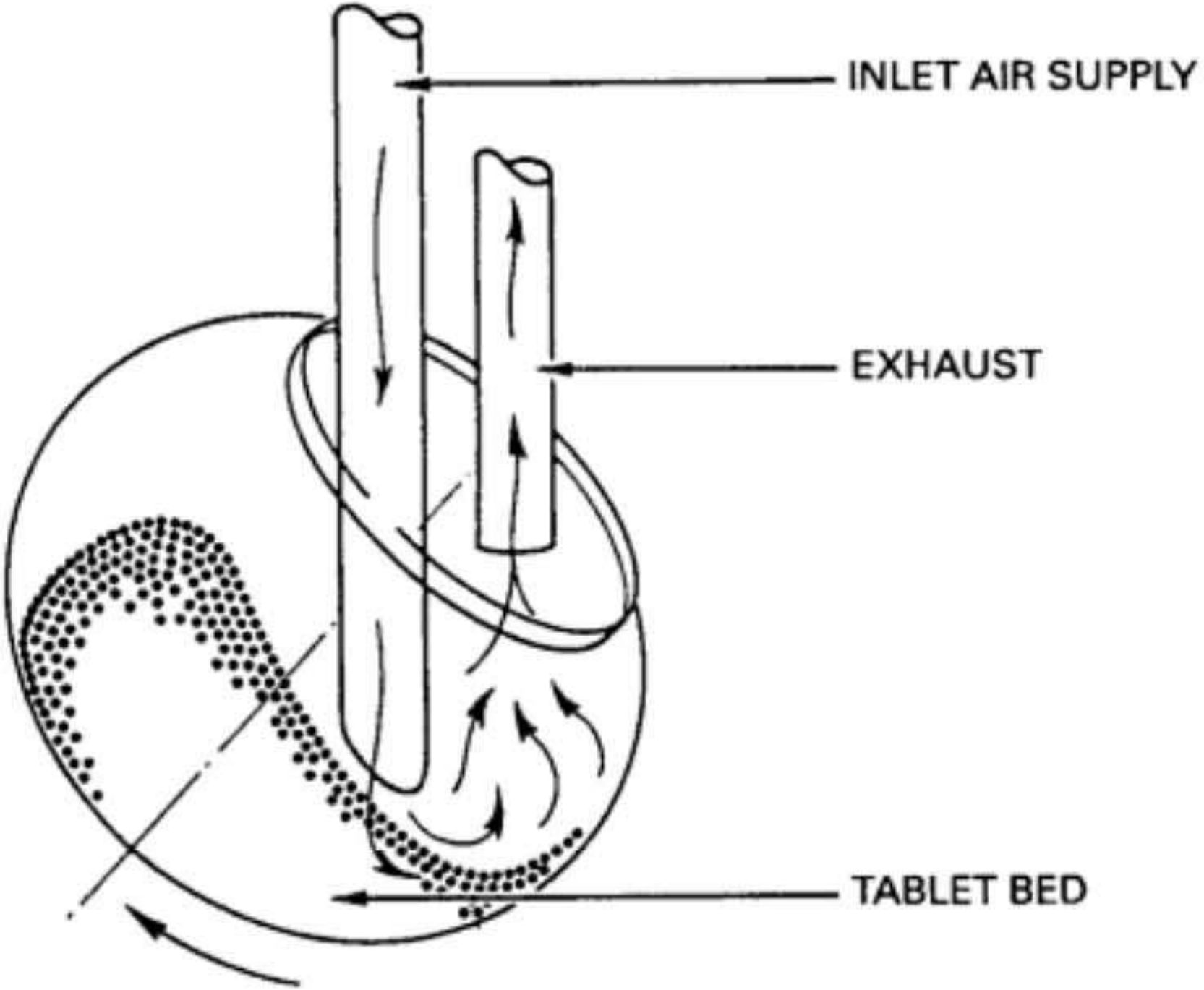
(3) The fluidized bed (air suspension) coater.

The general trend has been toward energy-efficient, automated systems to shorten the total coating time and reduce operator participation in the coating process.

1.Conventional Pan System

The standard coating pan system consists of a circular metal pan mounted somewhat angularly on a stand. The pan is 8 to 60 inches in diameter and is rotated on its horizontal axis by a motor.

Heated air is directed into the pan and onto the tablet bed surface, and is exhausted by means of ducts positioned through the front of the pan.


INLET AIR SUPPLY
EXHAUST
TABLET BED

Coating solutions are applied to the tablets by ladling or spraying the material onto the rotating tablet bed. Use of atomizing systems to spray the liquid coating material onto the tablets produces a faster, more even distribution of the solution or suspension.

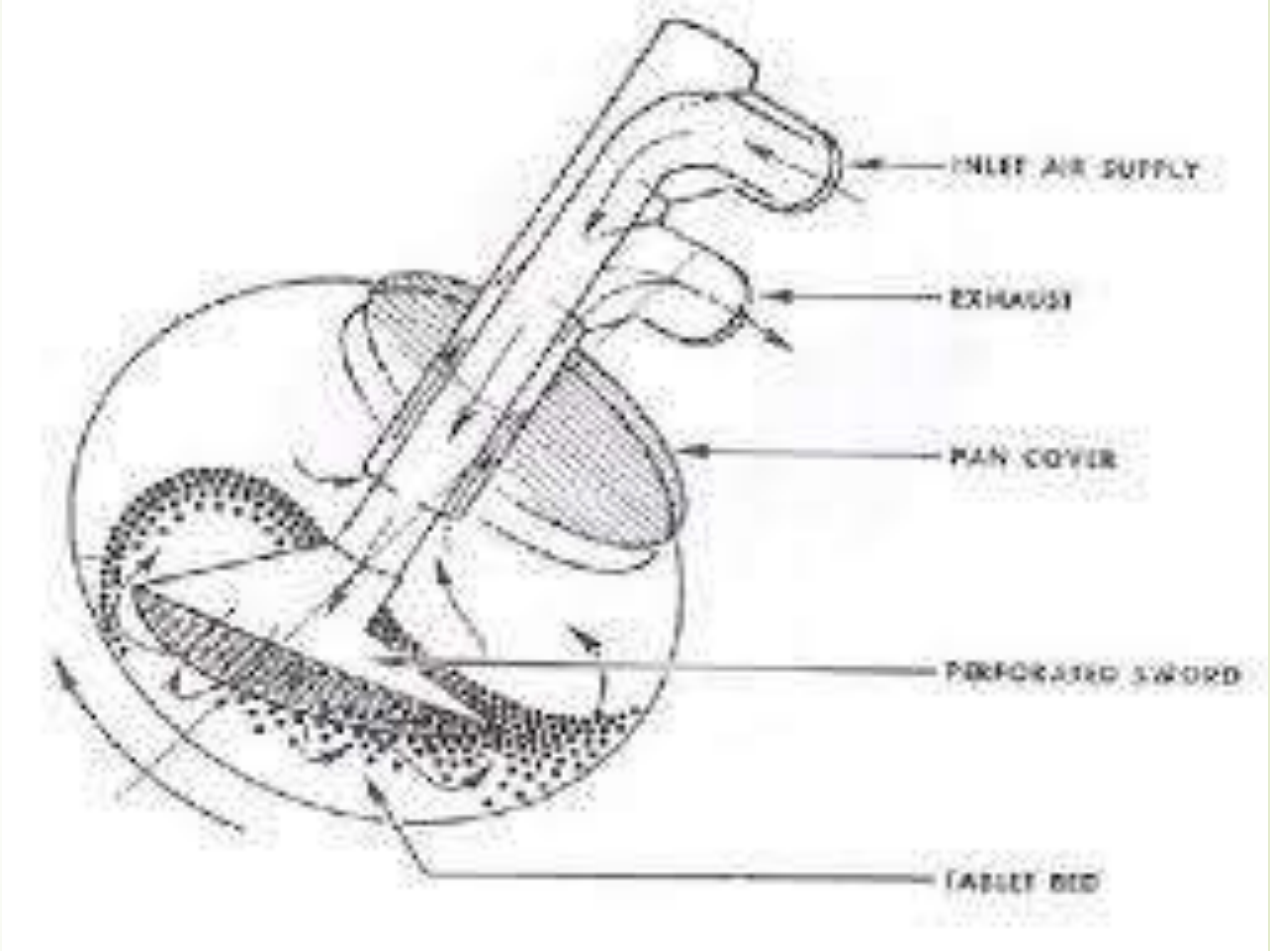
Spraying can significantly reduce drying time between solution applications in sugar coating processes and allows for continuous application of the solution in film coating.

A significant improvement in the drying efficiency of the standard coating pan is achieved by:

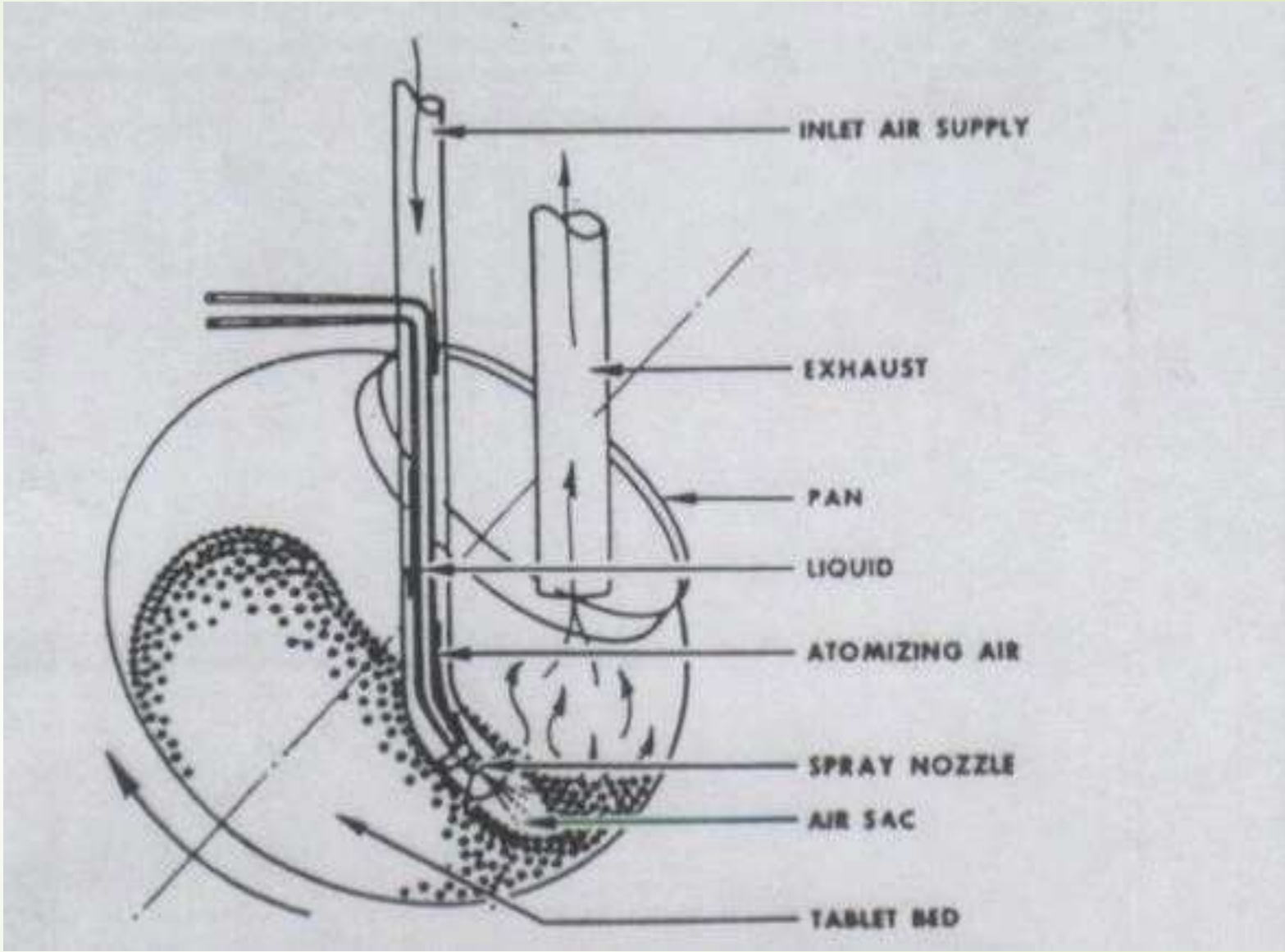
- **The Pellegrini Pan.**
- **The Immersion Sword Pan.**
- **The Immersion-Tube Systems.**

Pellegrini Pan

Immersion Sword Pan



Immersion-Tube Systems

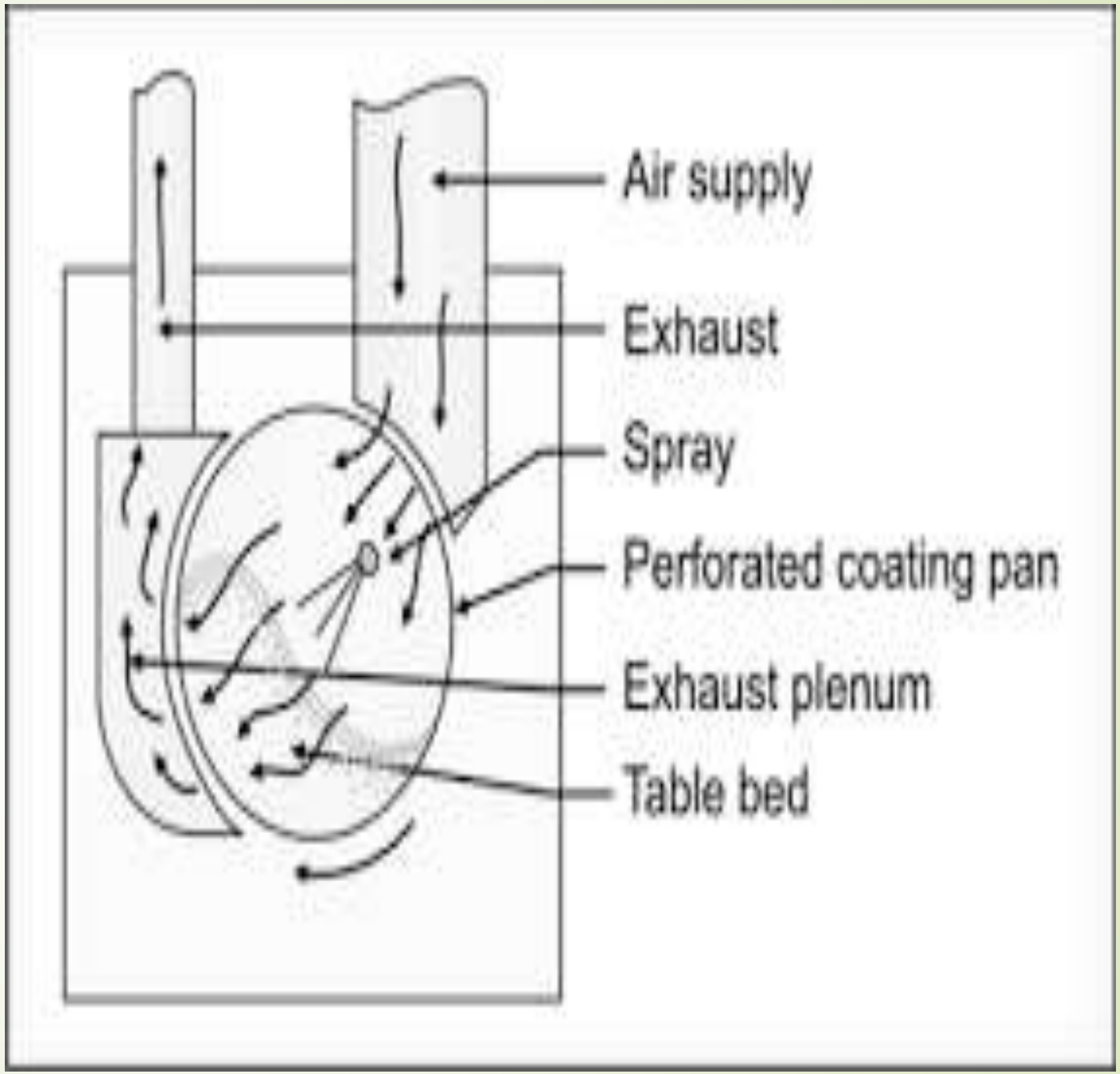


2. Perforated Pan Systems.

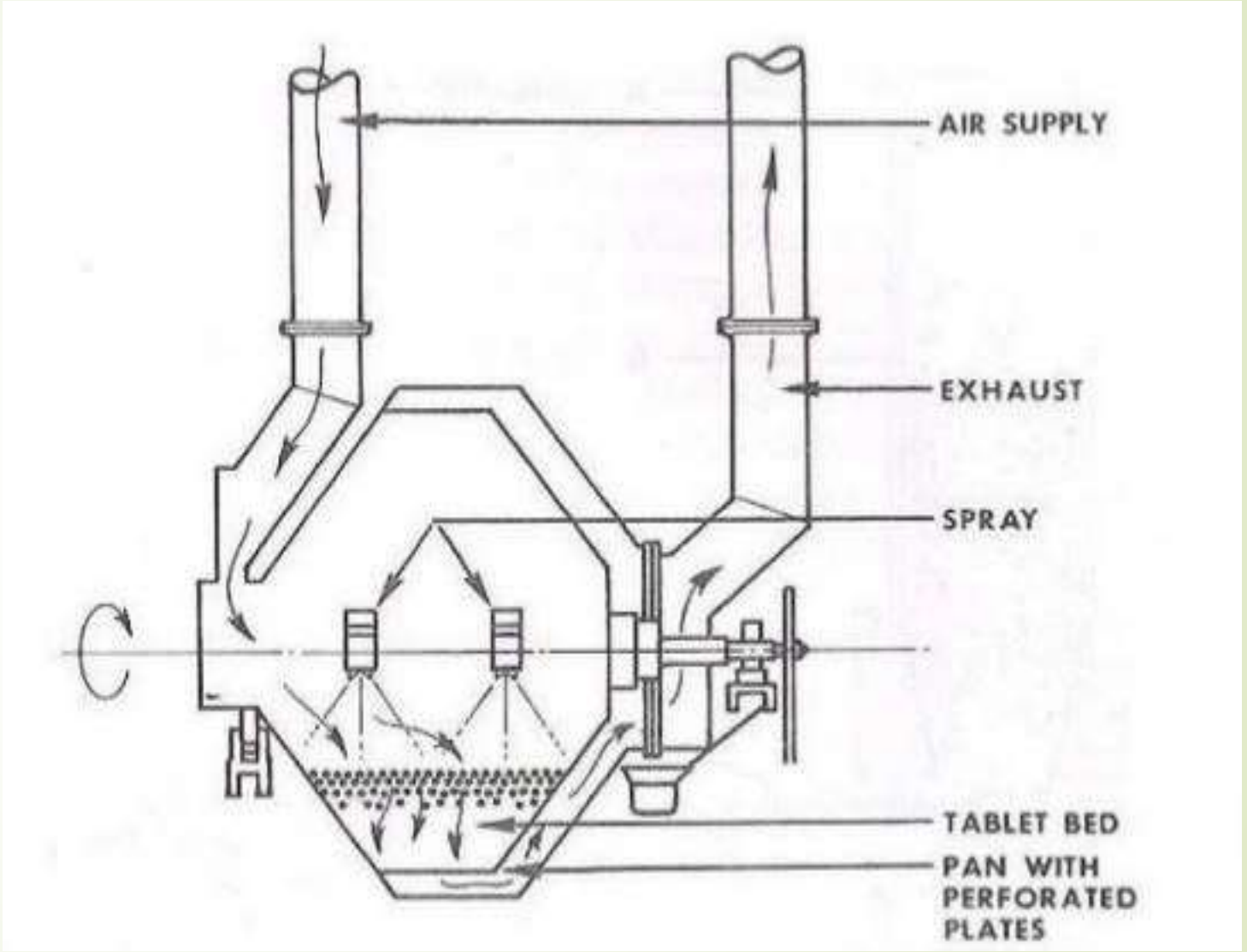
This type consists of a perforated or partially perforated drum that is rotated on its horizontal axis in an enclosed housing.

In the Accela-Cota and Hi-Coater systems, drying air is directed into the drum, is passed through the tablet bed, and is exhausted through perforations in the drum. The Driacoater introduces drying air through hollow perforated ribs located on the inside periphery of the drum.

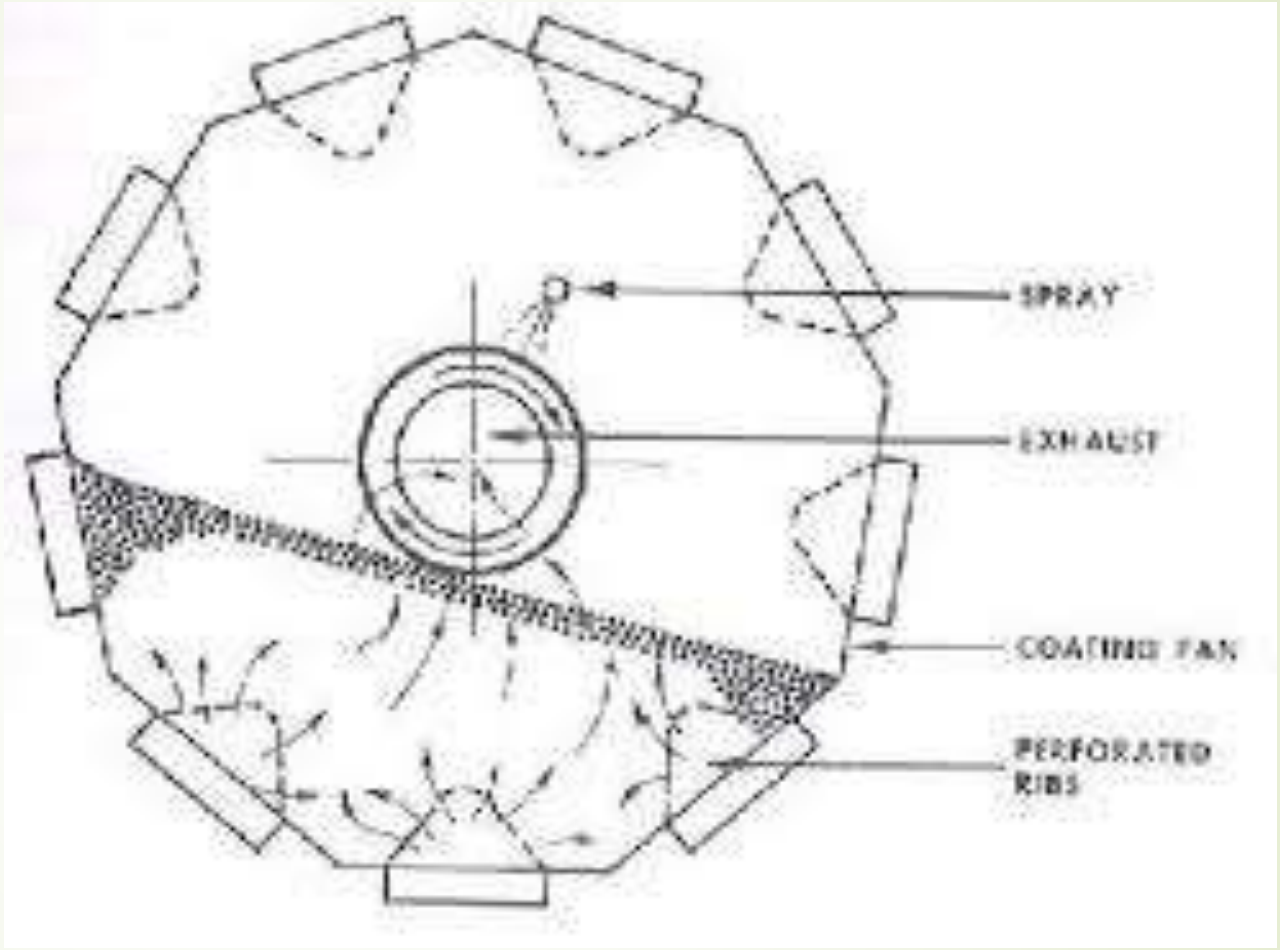
Accela-Cota


Air supply
Exhaust
Spray
Perforated coating pan
Exhaust plenum
Table bed

Hi-Coater


AIR SUPPLY
EXHAUST
SPRAY
TABLET BED
PAN WITH PERFORATED PLATES

Driacoater

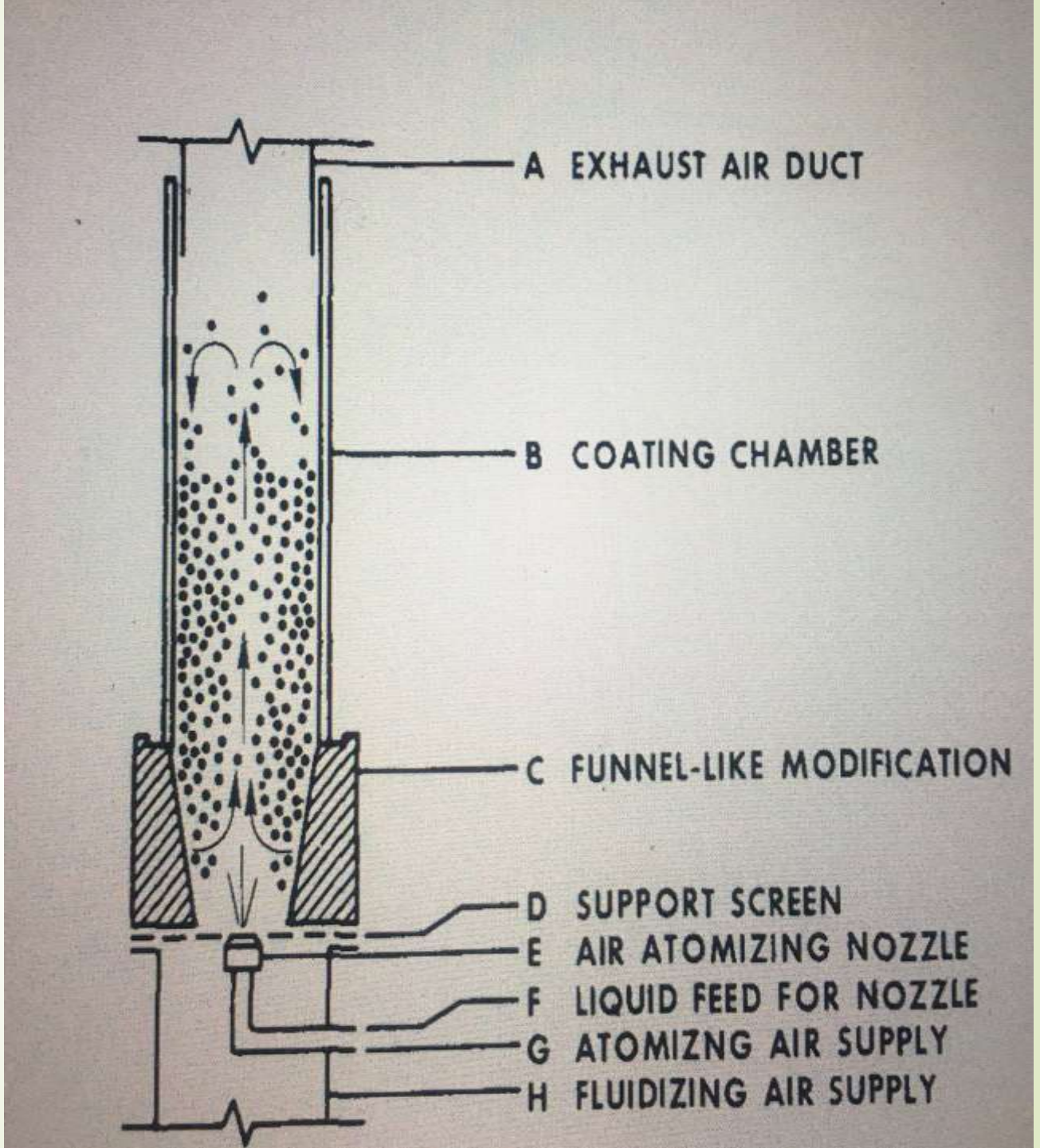


In the Glatt coater, drying air can be directed from inside the drum through the tablet bed and out an exhaust duct.

3. Fluidized Bed Systems (Air Suspension).

Fluidized bed coaters are also highly efficient drying systems. Fluidization of the tablet mass is achieved in a columnar chamber by the upward flow of drying air. The airflow is controlled so that more air enters the center of the column, causing the tablets to rise in the center.

Fluidized Bed Systems



Fluidized Bed Systems

Tablet cores that are friable and prone to chipping and edge abrasion may be difficult to coat even under optimum conditions in the fluidized bed systems, owing to the relatively rough tablet-to-tablet impact and tablet-chamber contact.

Spray Application Systems.

The two basic types of systems used to apply a finely divided (atomized) spray of coating solutions or suspensions onto tablets are

1. High-pressure, airless.

2. Low-pressure, air-atomized.

In the airless spray system, liquid is pumped at high pressure (250 to 3000 pounds per square inch gauge (psig) through a small orifice (0.009 inch to 0.020 inch id) in the fluid nozzle, which results in a finely divided spray.

In the low-pressure air-atomized system, liquid is pumped through a somewhat larger orifice (0.020 inch to 0.060 inch id) at relatively low pressures (5 to 50 psig).

The degree of atomization and the spray rate are controlled by the fluid pressure, orifice size, and viscosity of the liquid. Because of the small orifice, suspended solids in the coating composition must be finely milled or filtered to prevent orifice blockage.