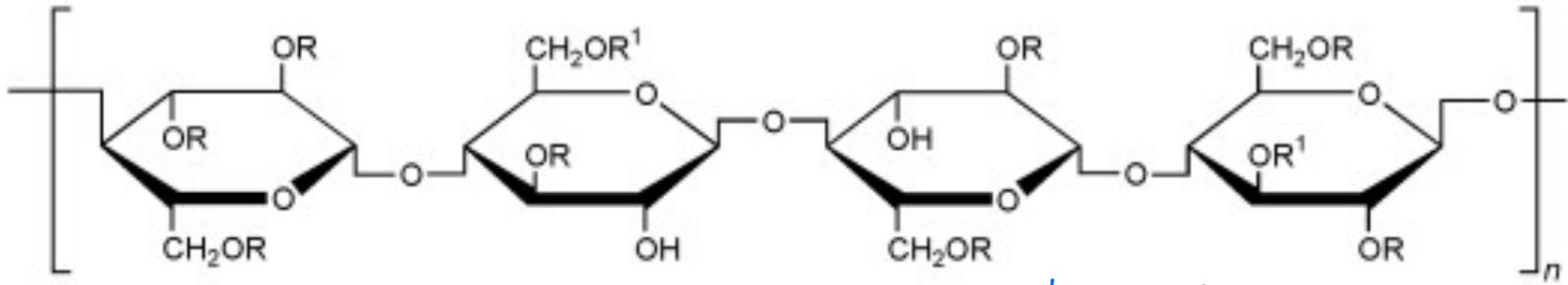


Types of film forming polymers

Enteric materials → all of them soluble in ↓ high pH. water at

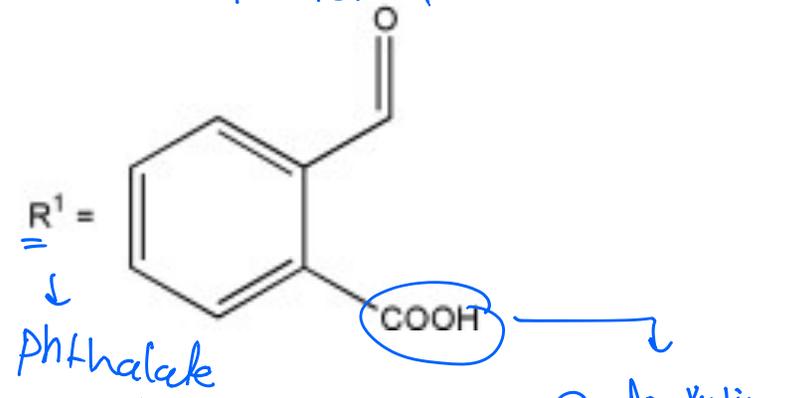
- ① • Phthalate esters
 - Cellulose acetate phthalate (CAP)
 - Polyvinyl acetate phthalate (PVAP)
 - Hydroxypropyl methycellulose phthalate
- ② • Cellulose acetate trimellitate (CAT)
- ③ • Methacrylic acid copolymers (Eudragit L[®], Eudragit S[®])
- ④ • Carboxymethyl ethylcellulose (CMEC)
- ⑤ • Hydroxypropyl methycellulose acetate succinate (HPMCAS)



pack bone as cellulose → بول ال اتي عندي
R and R₁

(Cellulose)

(احد تكون وتبقة مع ال)
 ester ionization about
 R = CH₃C(=O)
 ↓
 acetate



Cellulose acetate phthalate

dicarboxylic acid
 واحد قسم يكون free
 impermeable + polymer
 insoluble at low pH

at high pH
 COOH
 ↓
 ionized
 ↓
 soluble in water

at low pH
 COOH
 ↓
 unionized
 ↓
 not soluble in water

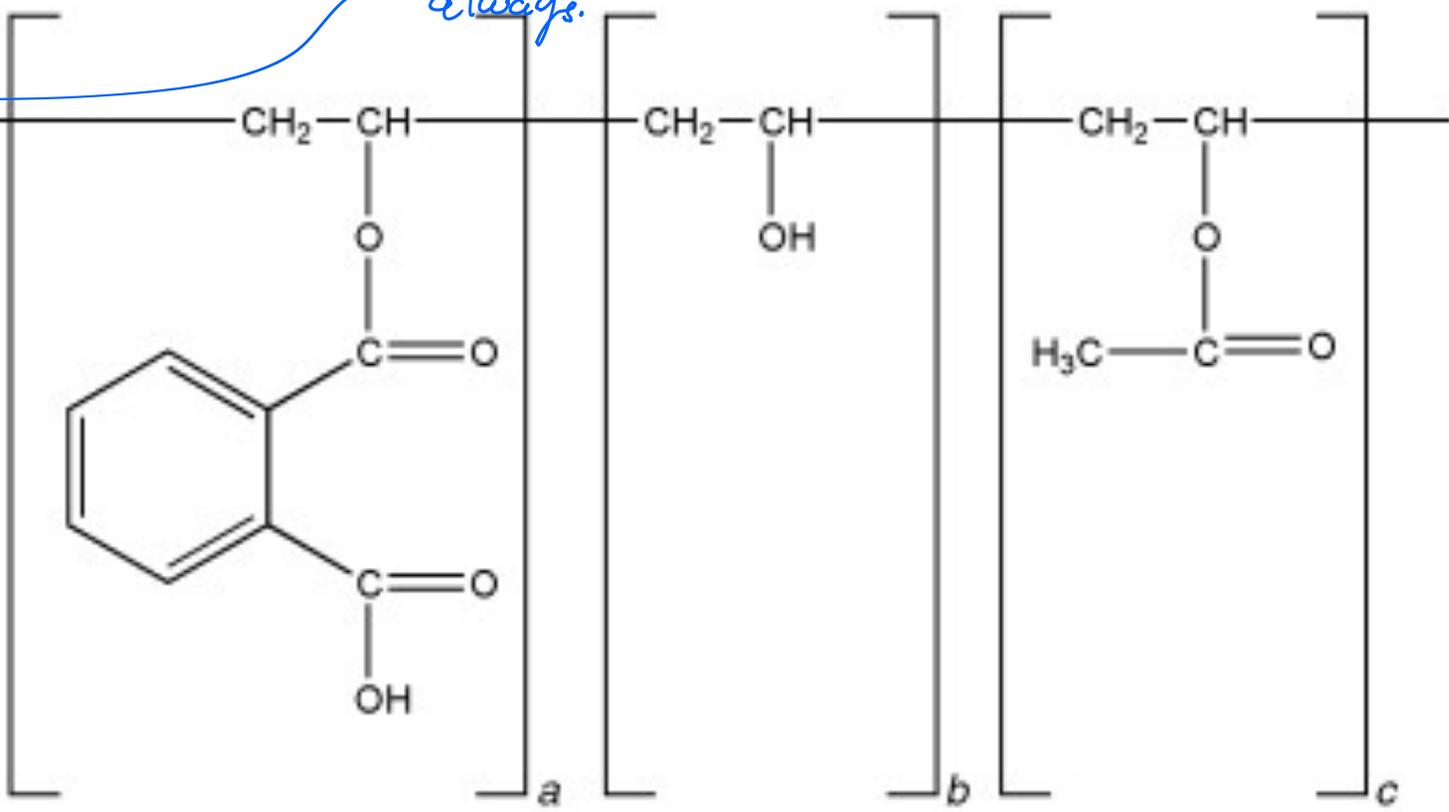
Carboxylic acid
 هي باي خلت
 المركب يذوب في ال water only at high pH

الفرق بين ال enteric and sustaine

always insoluble but permeable to water

← Sustaine خواصه دار solubility تبينه و بتغير ال pH
 ← enteric ال solubility تبينه على ال pH + impermeable always.

قابلية لیس
 release of Drug
 لا في ال intestine
 لیس في ال stomach
 ال drug قس في ال stomach
 و تبين على ال diffusion
 ال diffusion لیس permeable
 لیس ال permeable



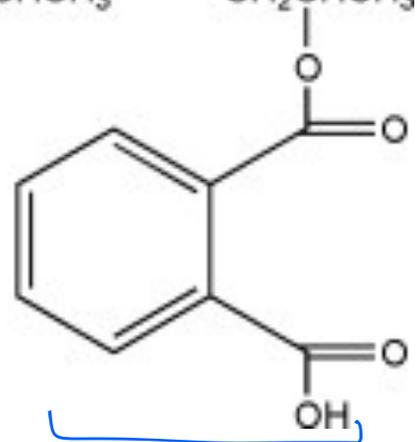
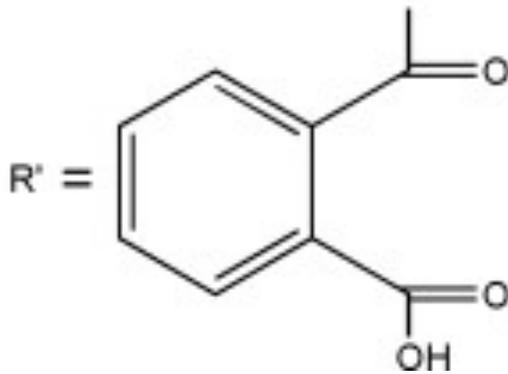
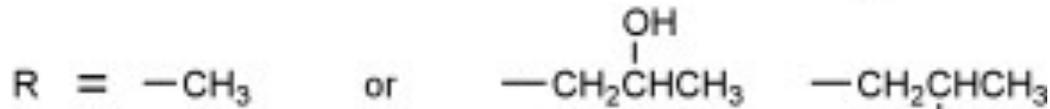
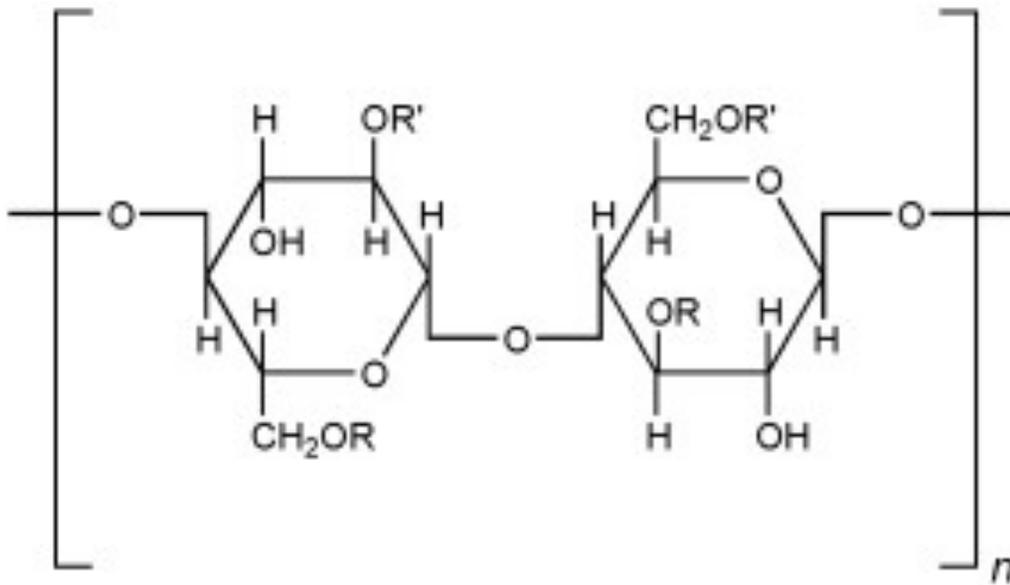
poly(vinyl)

← backbone

صون اختلف ال

Polyvinyl acetate phthalate

Depending on the phthalyl content, *a* will vary with *b* in mole percent. The acetyl content *c* remains constant depending on the starting material.



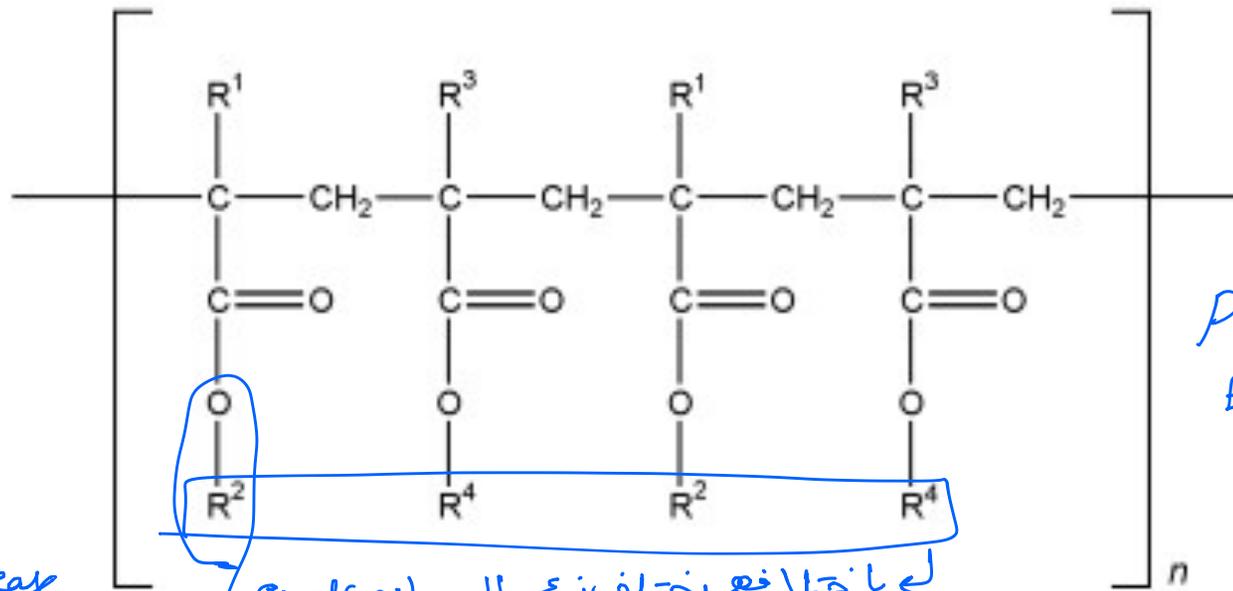
Phthalate

Hydroxypropyl methylcellulose phthalate

Phthalate is added by chemical addition enteric release.

← immediate release

ليس Phthalate في الـ n → immediate release



backbone of Eudragit

له باختلافه مختلف نوع ال eudragit

بزرگ پی ← immediate release
low pH only

For Eudragit E:

- R1, R3 = CH3
- R2 = CH2CH2N(CH3)2
- R4 = CH3, C4H9

Nitrogen will ionized at low pH.

→ sustaine release.

For Eudragit RL and Eudragit RS:

- R1 = H, CH3
- R2 = CH3, C2H5
- R3 = CH3
- R4 = CH2CH2N(CH3)3+Cl-

وظیفہ
فی ال
membrane permeable to water.

مربوط علیہا
4 C
always have positive charge

← Enteric coated
structure

For Eudragit L and Eudragit S:

- R1, R3 = CH3
- R2 = H
- R4 = CH3

Carboxylic acid group

in small intestine
in large intestine

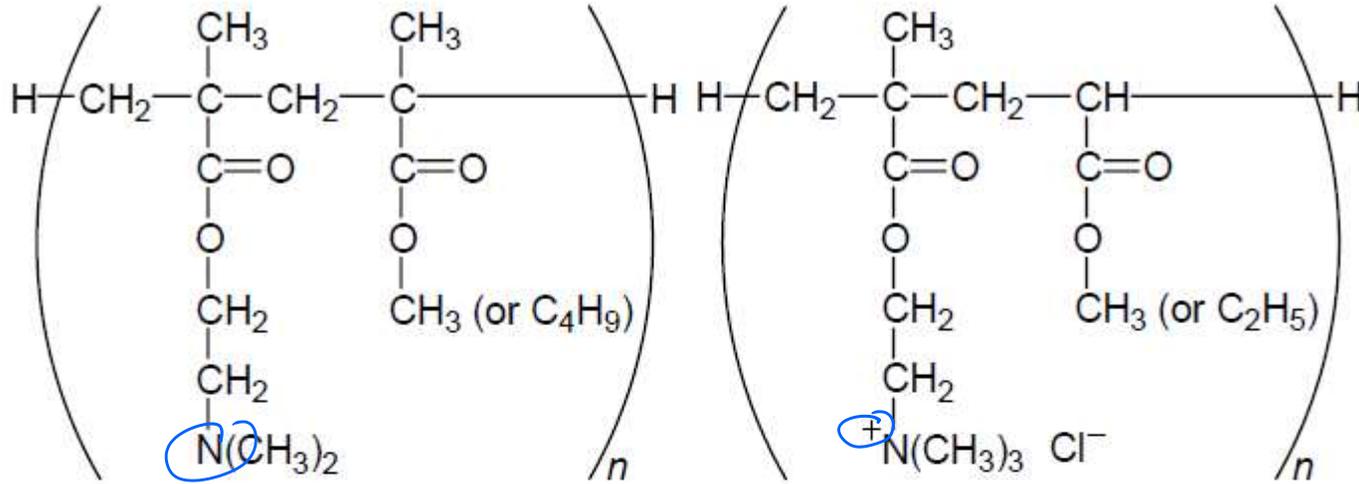
soluble at high pH.

← لیسے گا جس لہ
← فائبر سٹریچ
← کان پروتون.
ionized in stomach

immediate \rightarrow hydrophilic groups
 \rightarrow ionized N

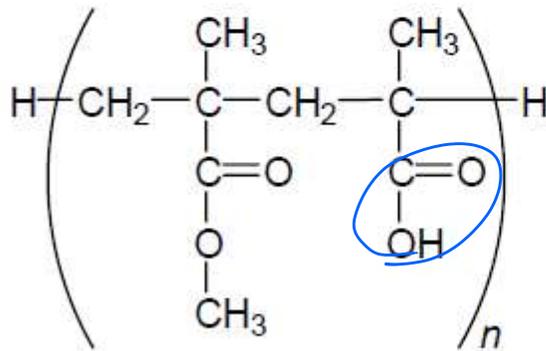
enteric coated \rightarrow carboxylic groups

Structure ال \leftarrow سبب الدكتور كما لا يمر من خلال ال
 immediate, enteric or sustaine. \rightarrow نعين شونوع ال polymer هو
 Structure ال \leftarrow عر حفظ

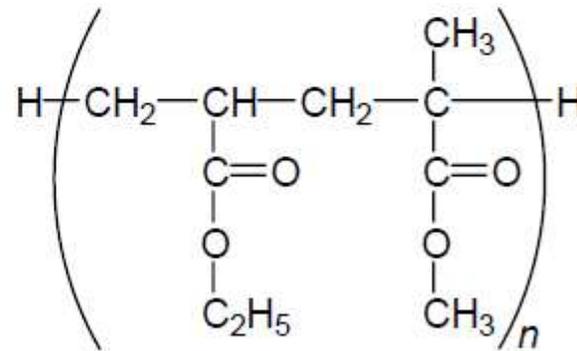


Eudragit[®] E

Eudragit[®] RL & RS



Eudragit[®] S



Eudragit[®] NE 30 D

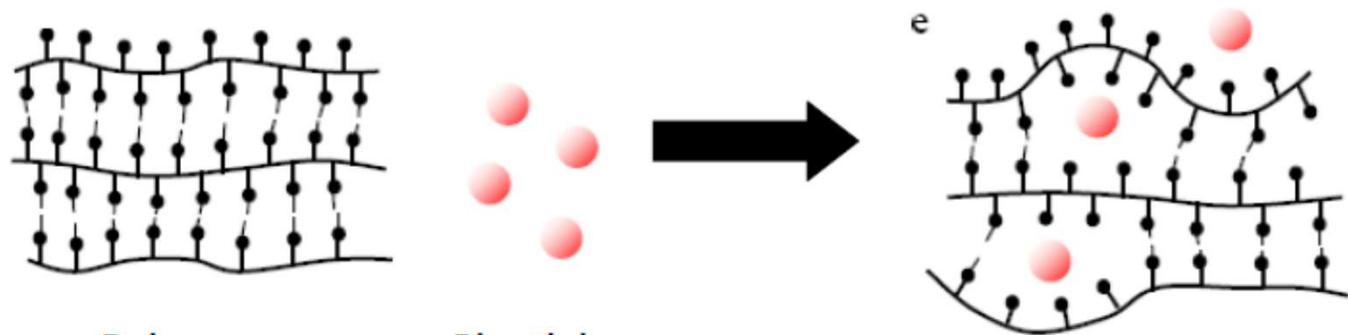
\downarrow
 sustaine release
 polymer.

Figure 4.3 Structures of selected Eudragits[®].

Plasticizer

- These are agents used to improve the quality (flexibility, ^①adhesion) of film.
- They decrease film brittleness.
- They should be soluble in the solvent used to dissolve the polymer.
- Mechanism: They interpose themselves on a molecular scale between the polymer strands thus permit them to move more freely.

↪ between polymer chain → make chain more flexible.



flexible

اللياقة تكون

Polymer

فوقها

brittel

Plasticizer

درجة الحرارة يـ
ونقصا تكون

decrease

glass trans temperature.

Plasticizer → should be soluble in the solvent used in polymer

- Examples

1 – Polyhydric alcohols: Polyethylene glycols, Propylene glycol, Glycerin → all of them soluble in water

2 – Oils: Castor oil, coconut oil, mineral oil → soluble in organic solvent

3 – Surfactants: Polysorbates (Tweens), Sorbitan esters (Spans) → soluble more in water

4 – Organic esters: Diethyl phthalate, Glyceryl triacetate (Triacetin), Triethylcitrate, acetyltriethylcitrate.
soluble in water

Colorants

- Pharmaceutically acceptable colors are available in both water soluble forms (dyes) and water insoluble forms (pigments)
- Pigments have advantages over water soluble colors:
 - 1 – More stable towards light صعتم
 - 2 – Provide better opacity and covering power
 - 3 – Optimize the impermeability of the film to vapor
- Examples: iron oxide pigments, titanium dioxide and aluminum lakes.
① ②
③ له نفا
آ بفر

Solvent

- In the past, polymers were dissolved in organic solvents (methanol, ethanol, chloroform, isopropanol, acetone, methylethylketone and methylene chloride).
- Modern techniques now rely on water as a solvent because of the disadvantages of organic solvents which include:

- 1 – Environmental side effects
- 2 – Safety (toxicity, explosion)
- 3 – Financial
- 4 – Solvent residues in the film (impurities)

قابلية
للانفجار

ما عذبي مشكلة
استخدم ال
water in
immediate
release

soluble لأنه يدي الدواء
بإستثناء ال
Eudragit

إستخدماً يال بعدد نوع ال
solvent ال
ال polymer ال
بي استخرصها .

Aqueous polymeric dispersions

- Industrially, specialized dispersions of water insoluble polymers are frequently used.
colloidal dispersion of insoluble polymers in water.
- They permit aqueous processing of water-insoluble polymers.
*↓
Enteric and sustain release*

Aqueous polymeric dispersions

Examples

Material trade name	Polymer	Use
<u>Aquacoat ECD[®]</u> , <u>Surelease[®]</u>	Ethylcellulose	<u>Sustained</u> release coating
<u>Eudragit[®] RS 30 D</u> , <u>Eudragit[®] RL 30 D</u> , <u>Eudragit[®] NE 30 D</u>	Methylmethacrylate copolymers	<u>Sustained</u> <u>release coating</u>
<u>Kollocoat[®] SR 30 D</u> <i>sustained release</i>	<u>Polyvinylacetate</u>	<u>Sustained</u> <u>release coating</u>
<u>Eudragit L 30 D-55</u> <u>Eudragit FS 30D</u>	Methacrylic acid copolymers	<u>Enteric coating</u>
<u>Aquacoat[®] cPD</u>	Cellulose acetate phthalate	<u>Enteric coating</u>

aqueous dispersion ←

لبنية دهان السيارت

Film coating process

- Fundamental requirements of tablet coating system include:

spraying
الرش

1) Adequate means of atomizing the spray liquid for application to the tablet cores

كل الرش عرضة لل coating
الرش المادة

2) Adequate mixing and agitation of the tablet bed.

3) Sufficient heat input in the form of drying air for solvent evaporation

لإدخال هواء ساخن لعملية ال drying

4) Good exhaust facilities to remove dust and evaporated solvent.

Si bien
extra
material

Film coating process

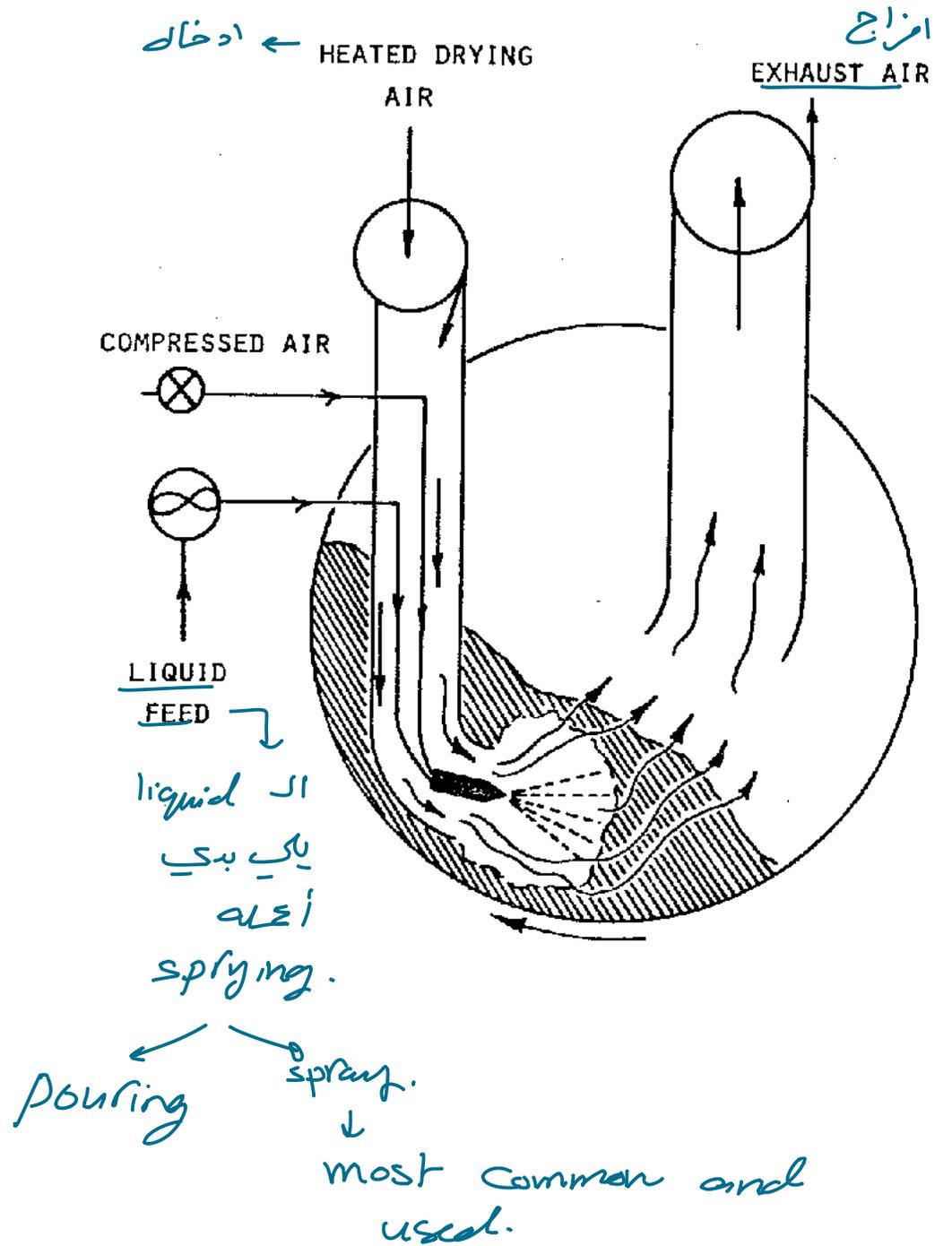
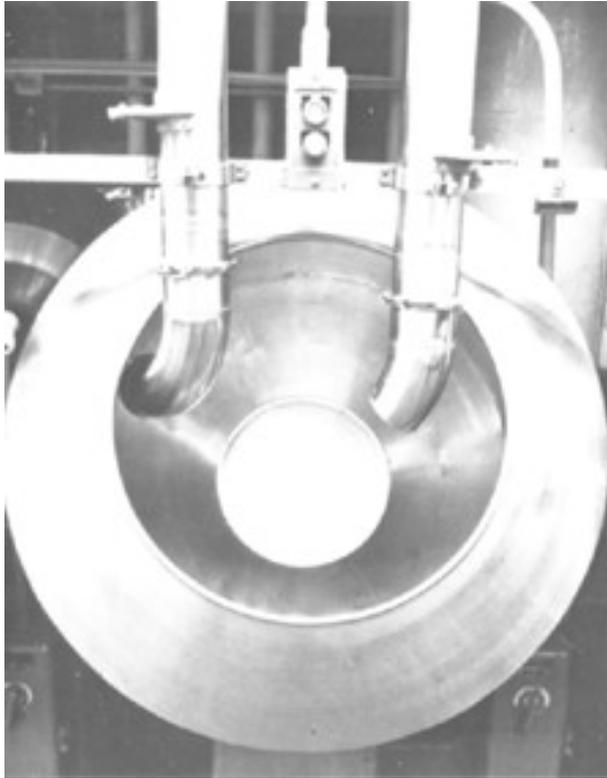
Film is usually applied by:

- ① • Pan coating
 - 1 – Standard coating pan
 - 2 – Perforated coating pan
- ② • Fluidized bed (Air suspension) coating

Film coating process

Conventional pan system

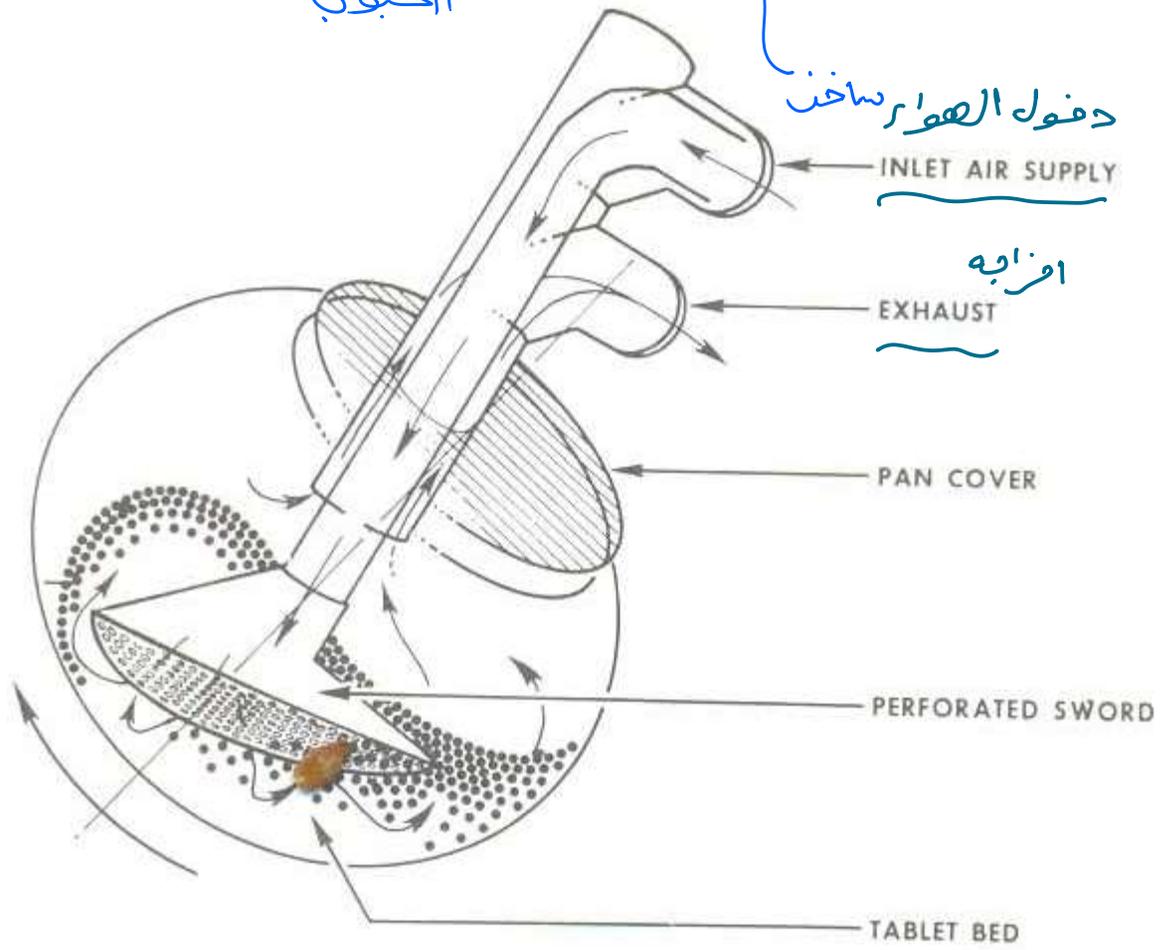
- The standard coating pan consists of a circular metal pan mounted angularly on a stand.
- Heated air is directed into the pan and onto the tablet bed surface and is exhausted by means of ducts positioned through the front of the pan.
- The coating formula is added either by ^①pouring or by ^②spraying (Nowadays spraying is the most commonly used method).
- Spraying system is used to spray the liquid coating materials, which produce faster, and more even distribution of the solution or suspension. ^① ②



Film coating process

- A significant improvement in the drying efficiency of the standard coating pan is achieved by:
 - 1 – The immersion sword
 - 2 – The immersion tube system
 - 3 – The Pellegrini pan

الفكرة الهواء يتوزع بالتساوي على
الحبوب



دفع الهواء ساخن

افزاجه



FIG. 12-7. Simplified diagram of Glatt immersion-sword system.

لبشبه فرش الحديدية

في جزء يدخل هواء ساخن وجزء يخرج على شفاط.

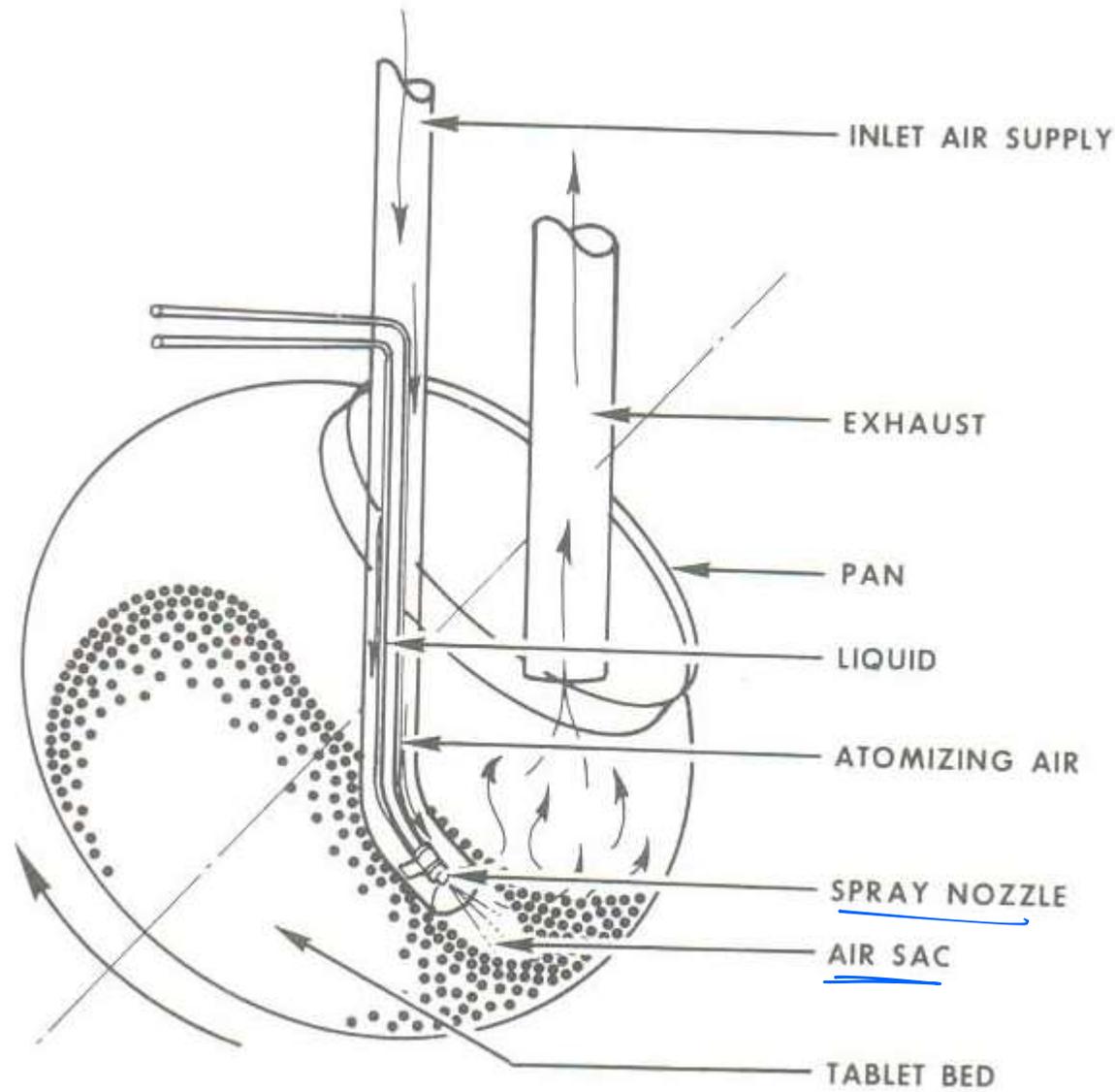
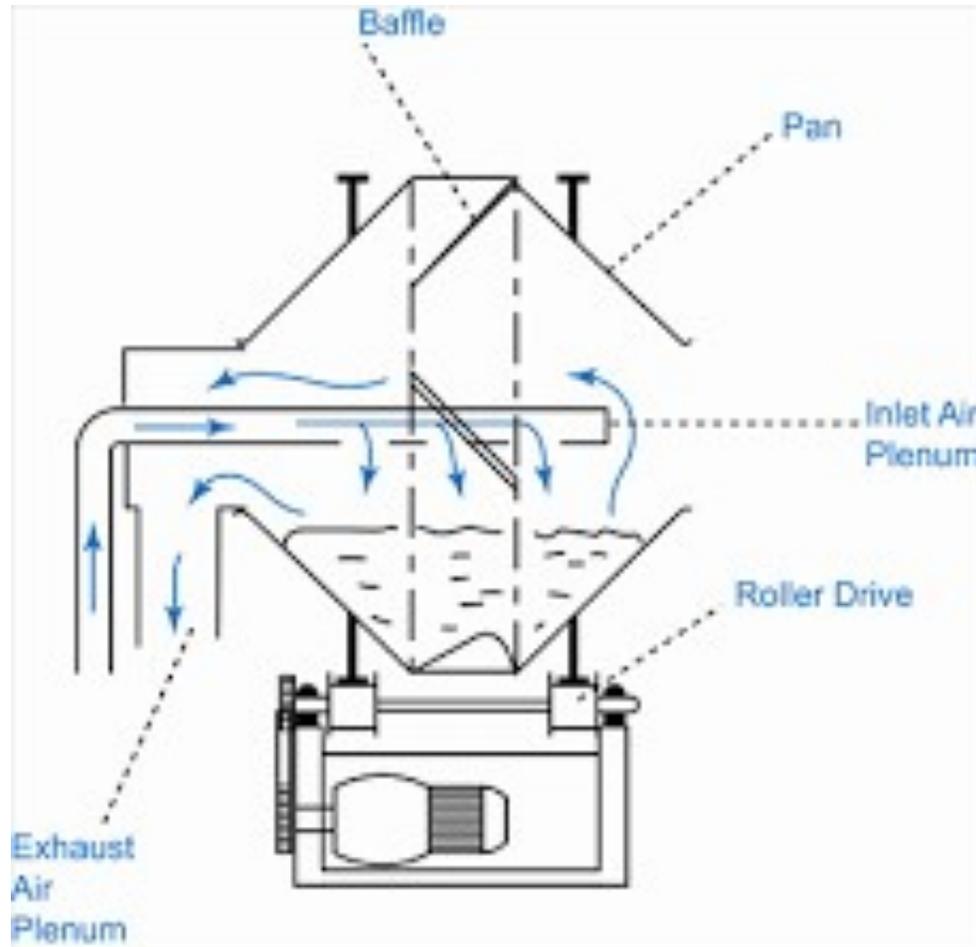


FIG. 12-8. Diagram of immersion-tube system. (From Demmer et al.⁵)

ار sprayer
 داخل ال tube
 يلى نفوت الهواء الساخن
 الى الرش لتسييف في نفس المكان



Pellegrini coating pan →

الصواني خلية
من خلال تقوية



Pelligrini pan coater (enclosed)

Film coating process

لا يمكن ان يكون عليه العيوب
و تكون تدجرك لها فيه
ثقوب

السمه = فيفا ثقوب يا يدخل منها الهواء و يطلع من الوسط
او يكون في مكان يدخل الهواء و يطلع من خلال
ثقوب الثقوب

Perforated Pan Systems

- In general, all equipment of this type consists of a perforated or partially perforated drum that is rotated onto its horizontal axis in an enclosed housing. Examples on this type are

- Accela Cota** and **Hi-coater**. In these coaters, the drying air is directed into the drum is passed through the tablet bed and exhausted through perforations in the drum

تدخل
من
الوسط
الهواء
و يطلع

- Driacoater** the drying air can be directed from inside the drum through the tablet bed and out an exhaust duct. The coating system is applied to the surface of the rotating beds of tablets through spraying nozzles or by pouring via distribution pipes.

من خلال
الثقوب

هون
العكس
الهواء

لنوع

من
الثقوب



۱۲ paffels سے عبارتہ عن حواجز تقساعد لتقليب الحوي

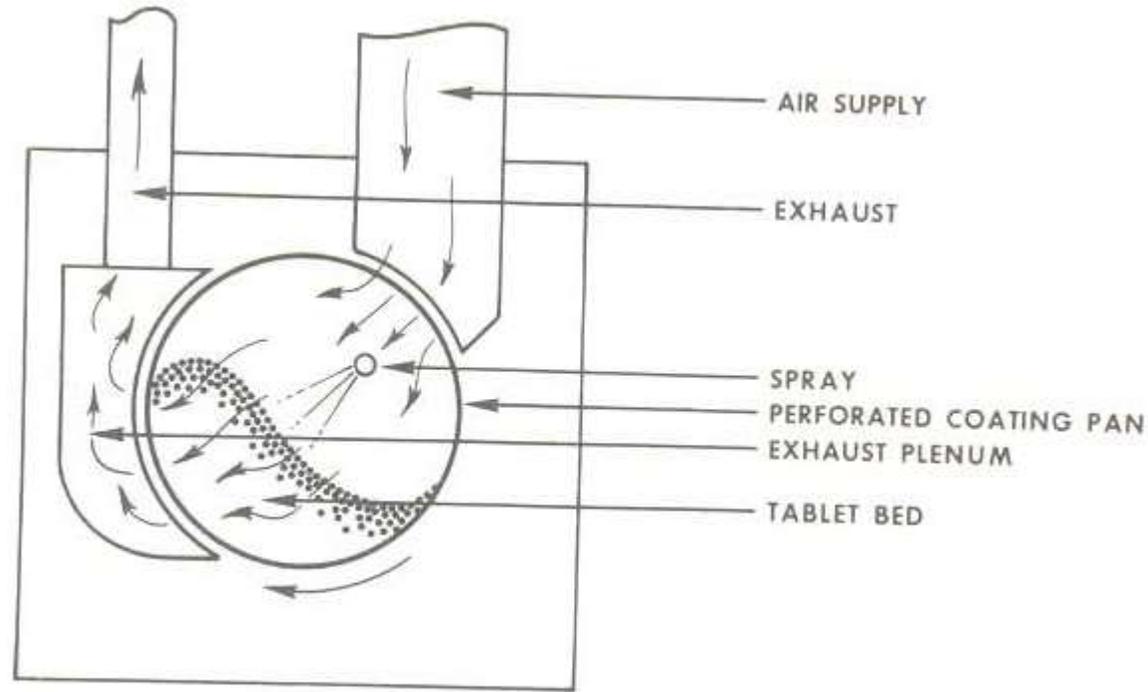
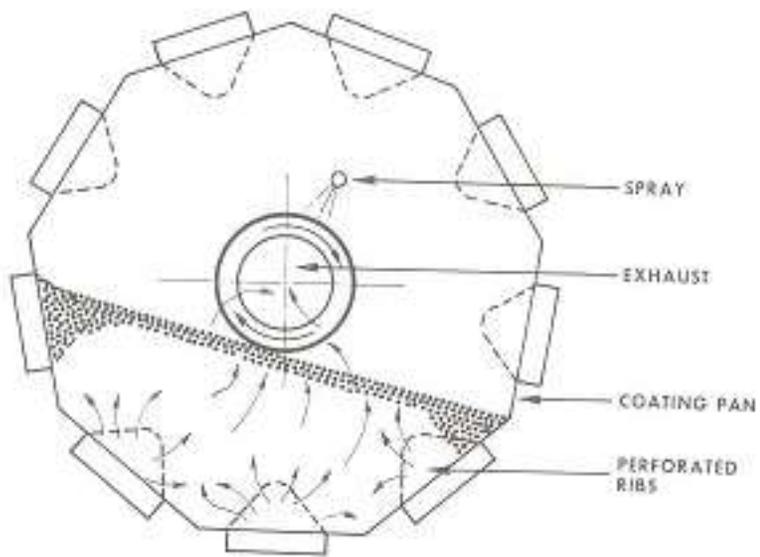
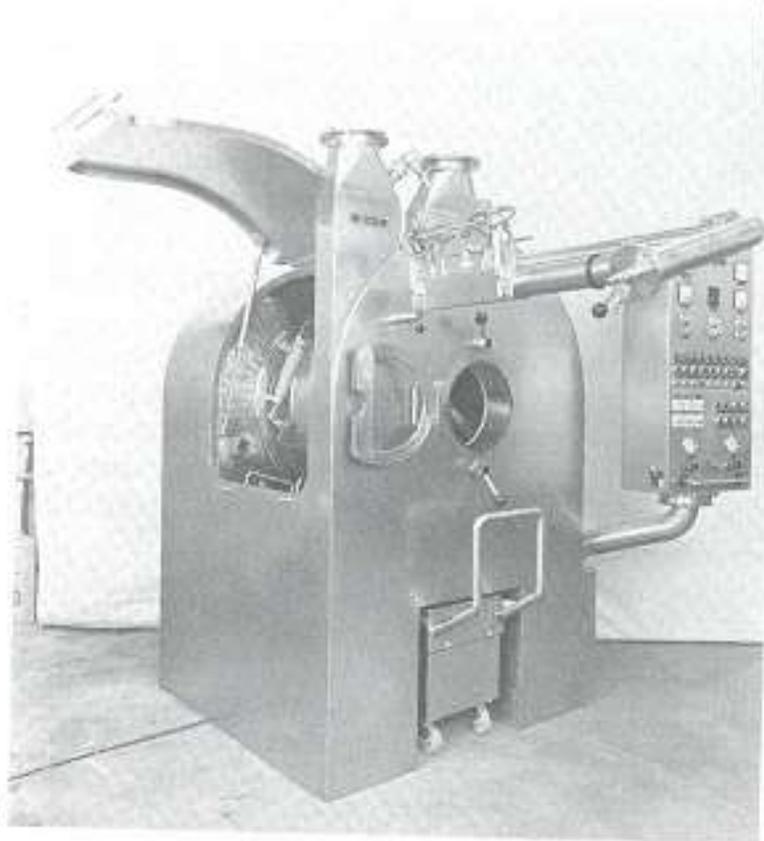


FIG. 12-9. Simplified diagram of Accela-Cota system.



A



B

FIG. 12-11. A, Diagram of Driacoater pan. B, Glatt coater. (Courtesy of Glatt Air Techniques Inc., Ramsey, NJ.)