

History

Chemical Engineering

STAMP MILL PROCESS

c. 1900

**Stamp
Rock
from
Mine**

Allis Steam Stamp
Height: 37 feet
Capacity: 650 tons/day
Size of Discharge: 54" in diameter or less
Weight of mill: 10,000 lbs.
Energy of Drive: 30,000 ft-lbs
Steam Use: 1,800 lbs/hr at 100 psi
Motor Use: 400 hp/motor

Rotating Duplex Trommel
Two Trommels per Stamp head
3 ft long, 3 ft in diameter
Speed: 45-50 rpm
Size of discharge: 18" in diameter or less
Classified material by size undersized goes to roughing jigs oversized to triple rolls

Triplex Rolls
Crushes oversize trommel discharge in 0.06" diameter counter-rotating outer rolls smaller rolls fixed spring-mounted outer rolls maintained at constant pressure
Discharge goes to Roughing Jigs

Settling Tank
3 to 5 ft in diameter
1 to 2 ft deep
For fines settle out and are sent to Flagging Mill
Overflow water goes to waste

Trent Rebinding Mill
6 ft in diameter
60 mesh screens mounted on bottom
Use of discharge as an agitator
Flubber rollers revolve around shaft at 25-30 rpm

Waffle Table
Concentrate

Waffle Table
Tailings

Waffle Table
Copper

General Information
The milling process had one objective: to liberate copper from the surrounding waste rock. This drawing (not to scale) is a schematic treatment of the Quincy process; it does not show laundries, hydraulic separators, or the power train system. Quincy's milling technique was similar to that used by other modern mills in the Lake Superior region. Yield averaged 30 lbs. of copper per ton of rock stamped.

Illustrated by: Eric M. Sparney 1978

QUINCY MINING COMPANY: QUINCY STAMP MILL: MILLING PROCESS - c. 1900
ON TONGUE LAKE, APPROX. 5.6 MILES EAST OF HIGHTOWER-BECKHOFF BRIDGE ON STATE ROUTE 26
HIGHLIGHTED QUINCY

SH-1
27-34

HISTORIC AMERICAN
ENGINEERING RECORDS
MIL 2

developed the concept of "unit operations" to explain industrial chemistry processes in 1916.^[1] In 1923, William H. Walker, Warren K. Lewis and William H. McAdams wrote the book *The Principles of Chemical Engineering* and explained that the variety of chemical industries have processes which follow the same physical laws.^[2] They summed up these similar processes into unit operations. Each unit operation follows the same physical laws and may be used in all relevant chemical industries. For instance, the same engineering is required to design a mixer for either napalm or porridge, even if the use, market or manufacturers are very different. The unit operations form the fundamental principles of chemical engineering.

1. Fluid flow processes, including fluids transportation, filtration, and solids fluidization.
2. Heat transfer processes, including evaporation and heat exchange.
3. Mass transfer processes, including gas absorption, distillation, extraction, adsorption, and drying.
4. Thermodynamic processes, including gas liquefaction, and refrigeration.
5. Mechanical processes, including solids transportation, crushing and pulverization, and screening and sieving.

Chemical engineering unit operations also fall in the following categories which involve elements from more than one class:

- Combination (mixing)
- Separation (distillation, crystallization)
- Reaction (chemical reaction)

Furthermore, there are some unit operations which combine even these categories, such as reactive distillation and stirred tank reactors. A "pure" unit operation is a physical transport process, while a mixed chemical/physical process requires modeling both the physical transport, such as diffusion, and the chemical reaction. This is usually necessary for designing catalytic reactions, and is considered a separate discipline, termed chemical reaction engineering.

Chemical engineering unit operations and chemical engineering unit processing form the main principles of all kinds of chemical industries and are the foundation of designs of chemical plants, factories, and equipment used.

In general, unit operations are designed by writing down the balances for the transported quantity for each elementary component (which may be infinitesimal) in the form of equations, and solving the equations for the design parameters, then selecting an optimal solution out of the several possible and then designing the physical equipment. For instance, distillation in a plate column is analyzed by writing down the mass balances for each plate, wherein the known vapor-liquid equilibrium and efficiency, drip out and drip in comprise the total mass flows, with a sub-flow for each component. Combining a stack of these gives the system of equations for the whole column. There is a range of solutions, because a higher reflux ratio enables fewer plates, and vice versa. The engineer must then find the optimal solution with respect to acceptable volume holdup, column height and cost of construction.

See also

- Distillation Design
- Extrusion
- Process simulation
- Separation process
- Unit Operations of Chemical Engineering
- Unit process

References

1. "Arther Dehon Little" (<http://libraries.mit.edu/archives/exhibits/adlittle/mit-connection.html>). *Scatter Acorns That Oaks May Grow*. MIT Libraries. Retrieved 13 November 2013.
2. "Arthur D. Little, William H. Walker, and Warren K. Lewis" (<https://www.sciencehistory.org/historical-profile/arthur-d-little-william-h-walker-and-warren-k-lewis>). *Science History Institute*. Retrieved 20 March 2018.

External links

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