

FOSTER

Biomedical Polymer Solutions™

Polymer Compounding Basics

Continuous Process Melt Extrusion Polymer Compounding

Definition

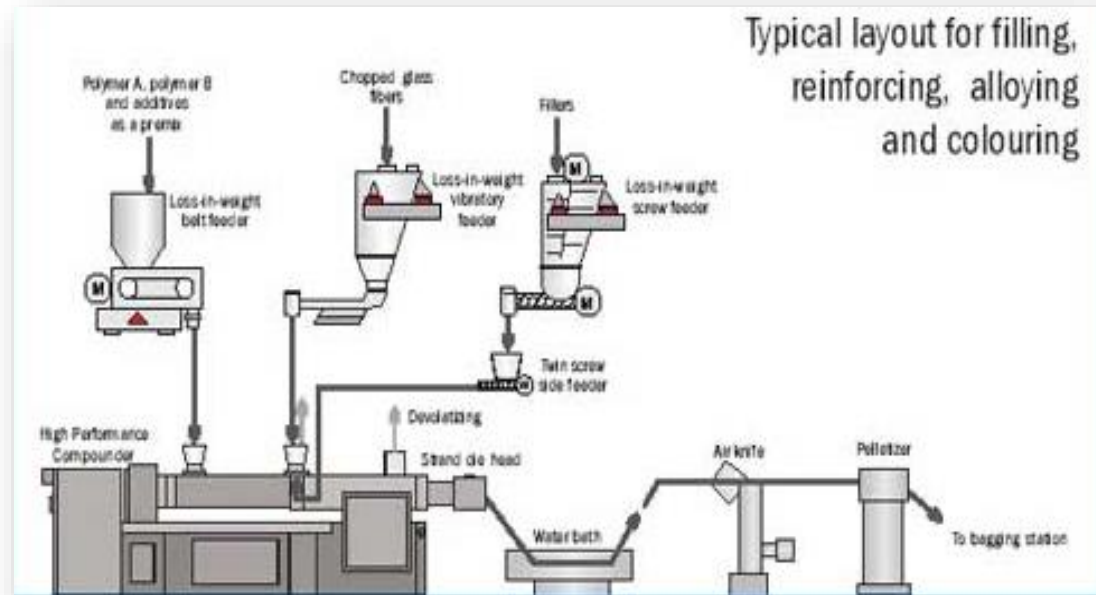
Upgrading or adding value of polymers or polymer systems through melt blending & mixing of additives into a polymer matrix or melt mixing two or more polymers together to make an alloy

Purpose

Tailor properties to satisfy a specific applications requirements

Compounding Line

drying
feeding system(s)
extruder
Screw(s)
barrel
motor
die
cooling
size reduction and segregation



Traditional Process Sequence



Pellets



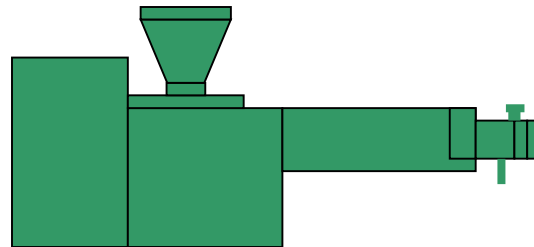
Powders/Fillers



Fibers



Liquids

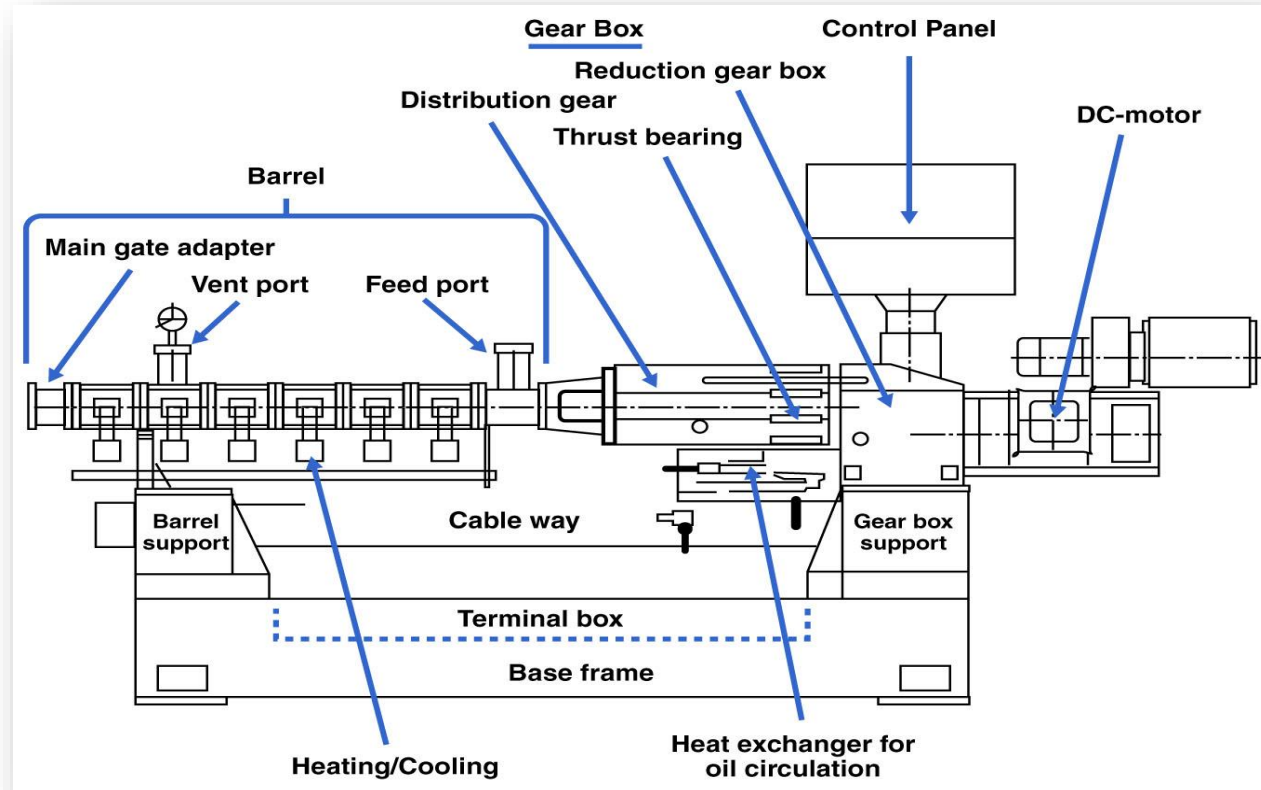


Twin Screw Extruder



Pellets

Twin Screw Extruder



Controls: screw rpm, temp's, vacuum

Readouts: melt pressure, melt temp., motor amps/torque, vacuum level

What Happens in a Hot Melt Extrusion Compounding Operation

Preparation of inputs

Feeding of inputs

Compounding

Conveying

Plasticizing/melting

Mixing

Homogenizing

Dispersing

Devolitizing

Reacting

Heating/cooling

Viscosity breakdown

Cooking/pressurizing

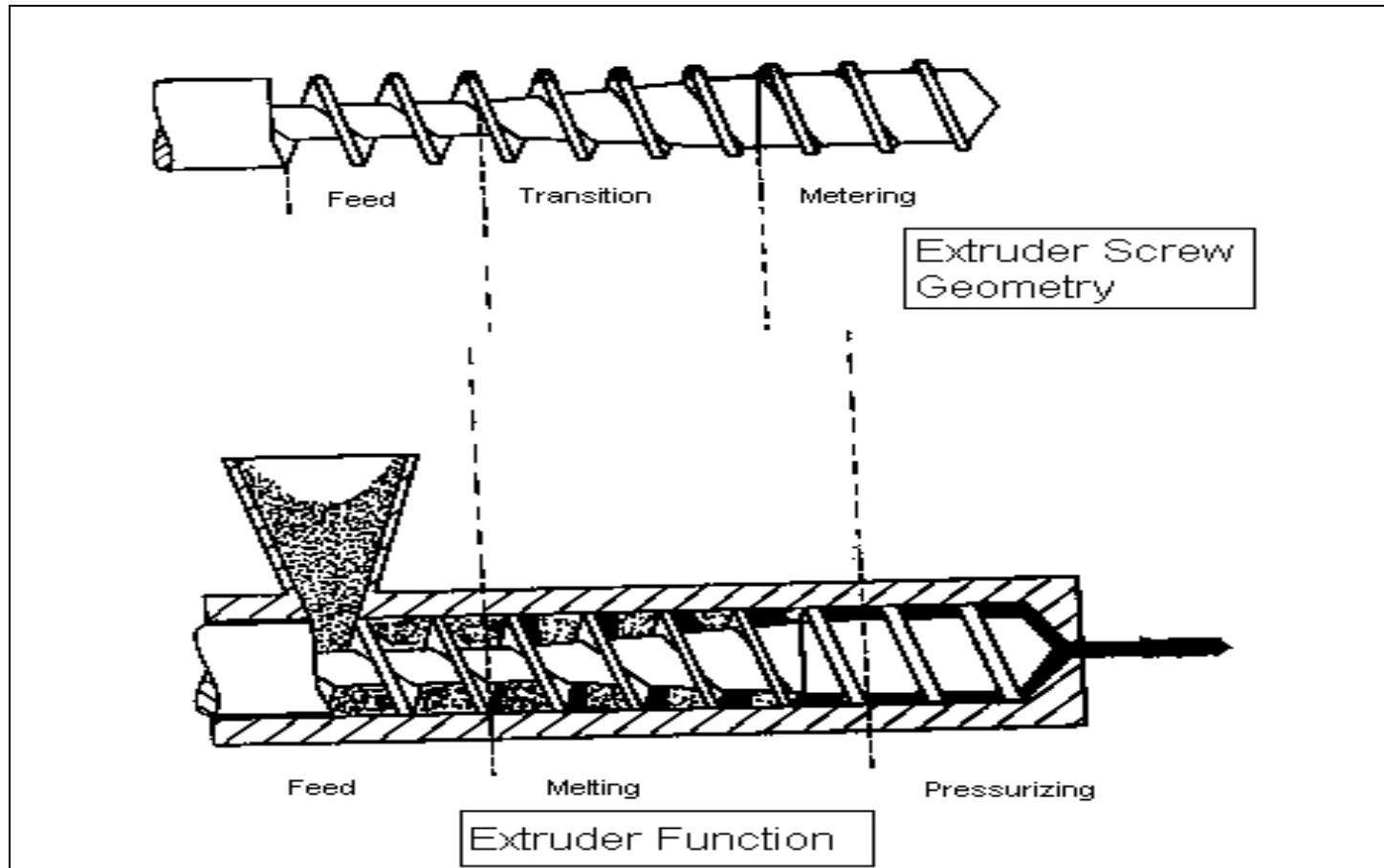
Cooling

Size reduction and packaging

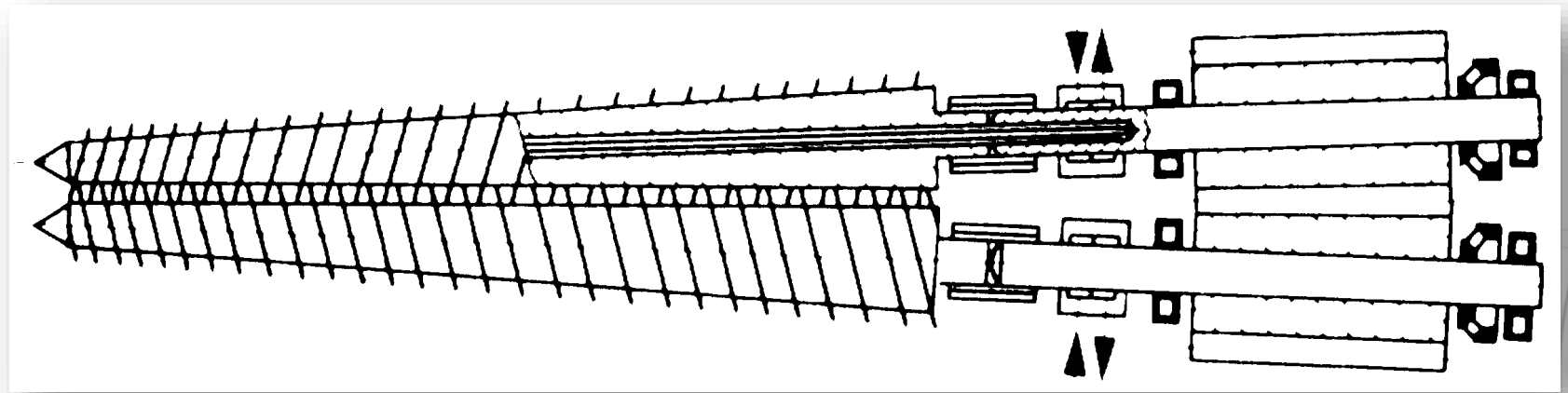


Inside Extruder

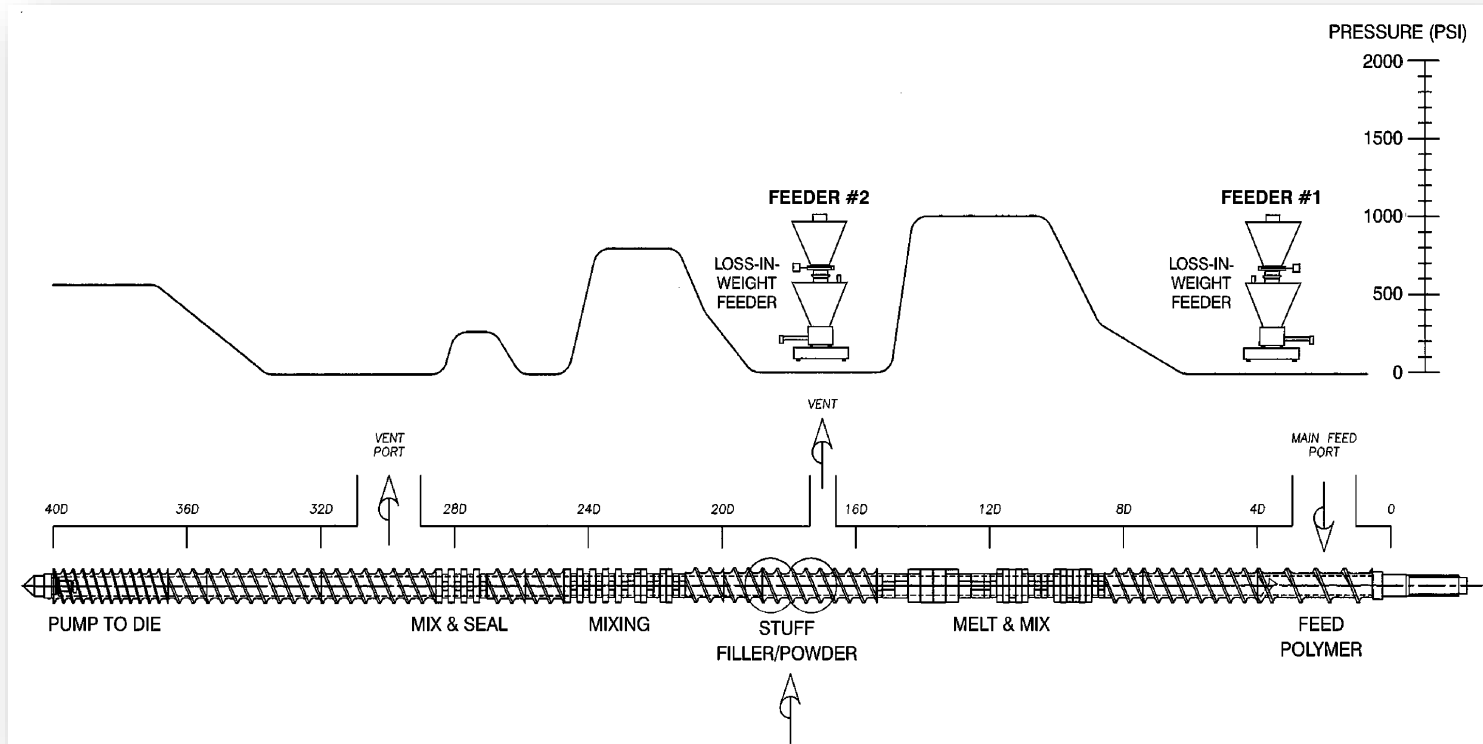
Screw Geometry v Function



Conical Twin Screw Extruder

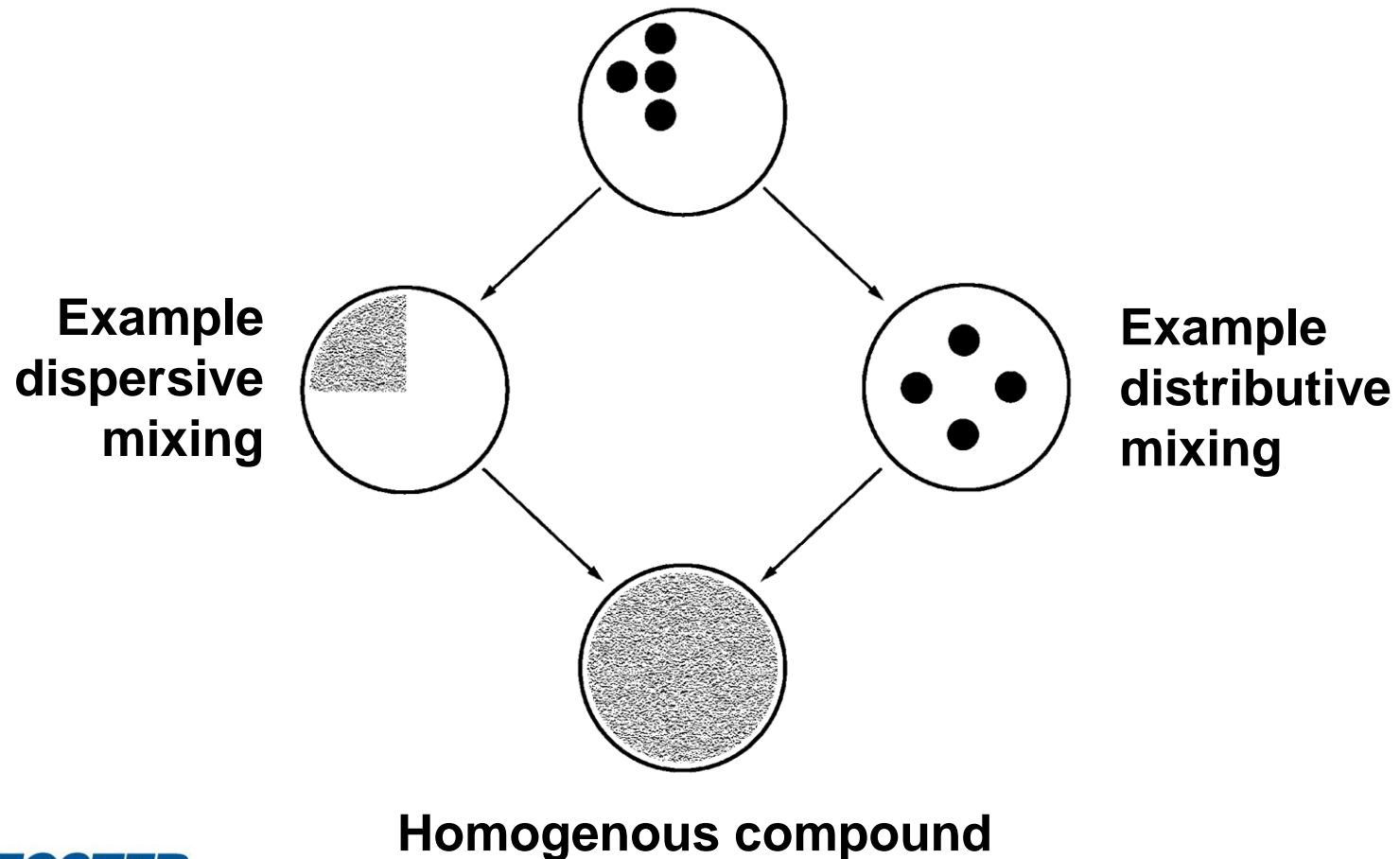


Pressure Profile in Twin Screw Extruder



Example of Compounding

Conceptual representation
of components prior to compounding



Mixing

Distributive

uniformly distributes ingredients without using high-shear stresses

Dispersive

intense process that employs high stress techniques to break up cohesive agglomerated solids

Twin Screw Extrusion Achieves Both

Screws and Barrels are Modular

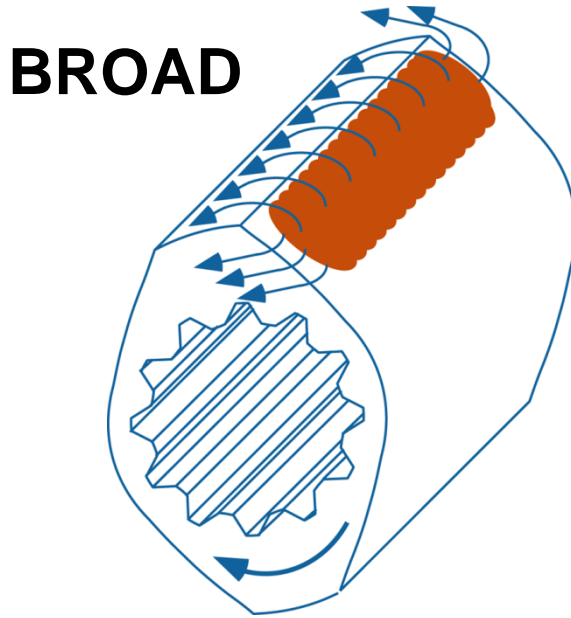


Screws are assembled on high-torque splined shafts

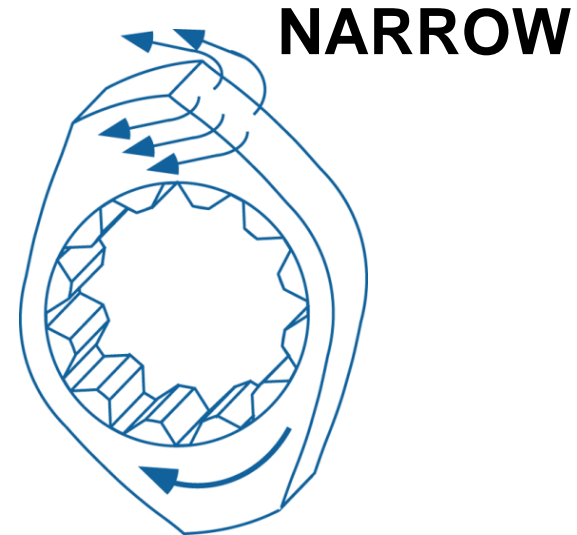


Flanged barrels, electrically heated and liquid cooled

Single Kneading Element



**LOBAL POOL CAPTURE
(DISPERSIVE)**

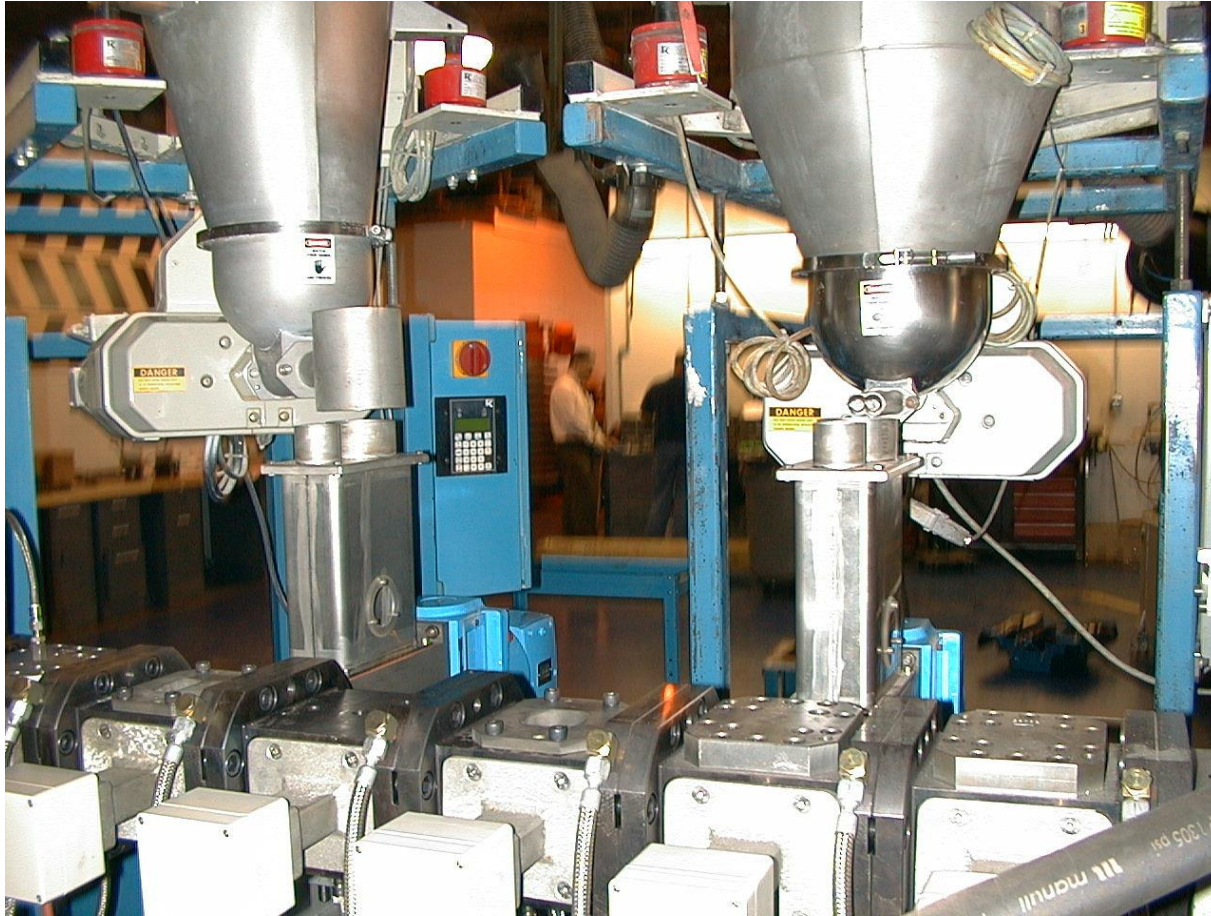


**MELT DIVISION
(DISTRIBUTIVE)**

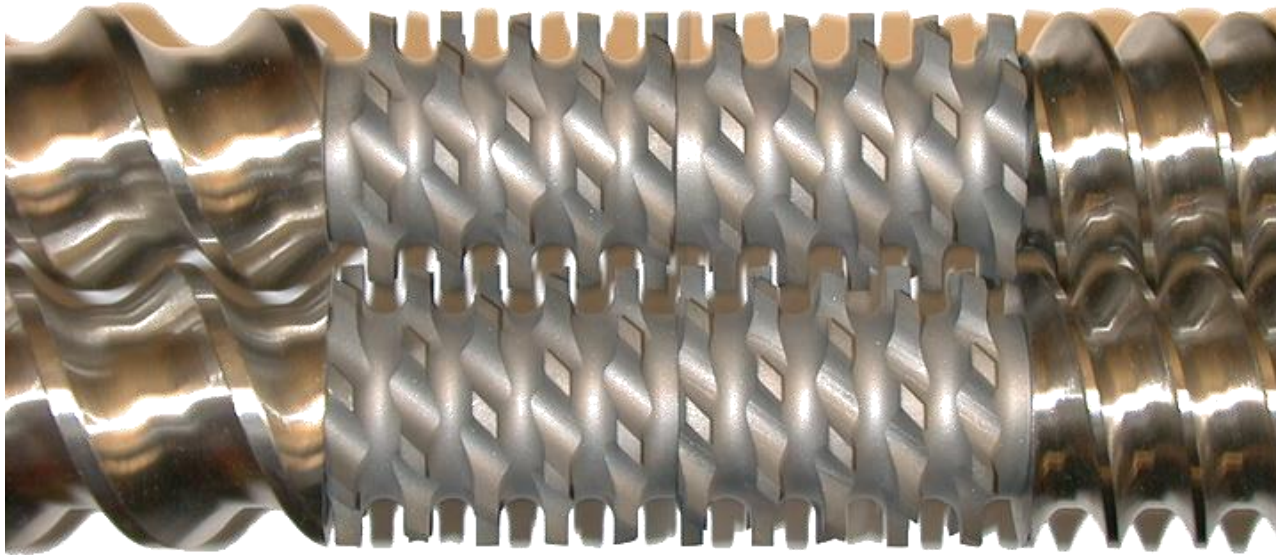
Wider disk = increased elongational acceleration/dispersive mixing

Narrower disk = melt divisions/distributive mixing

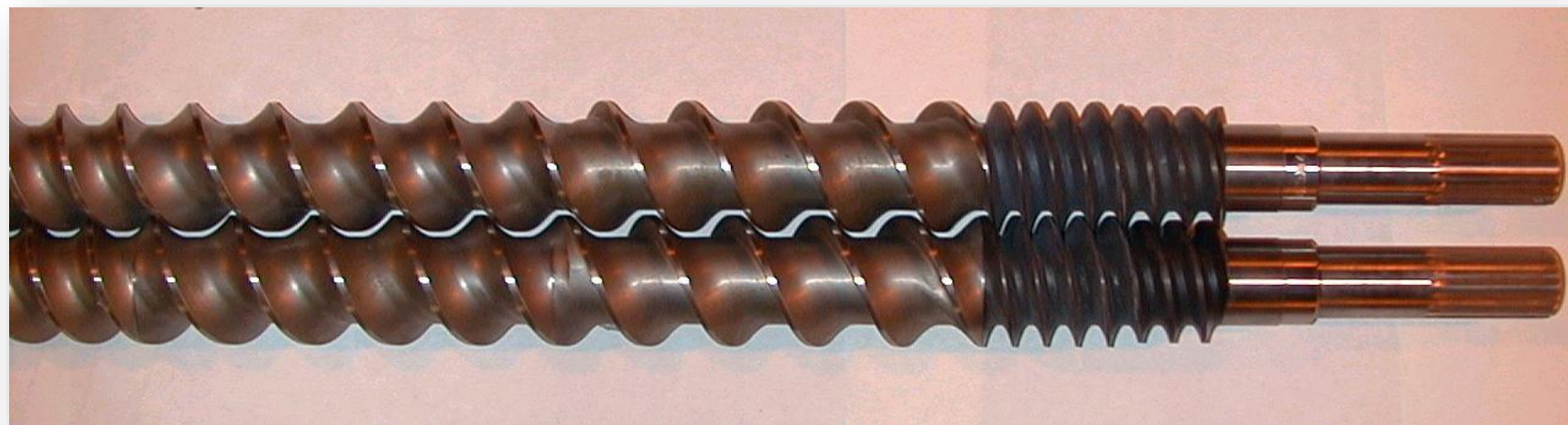
Multiple Downstream Feeding



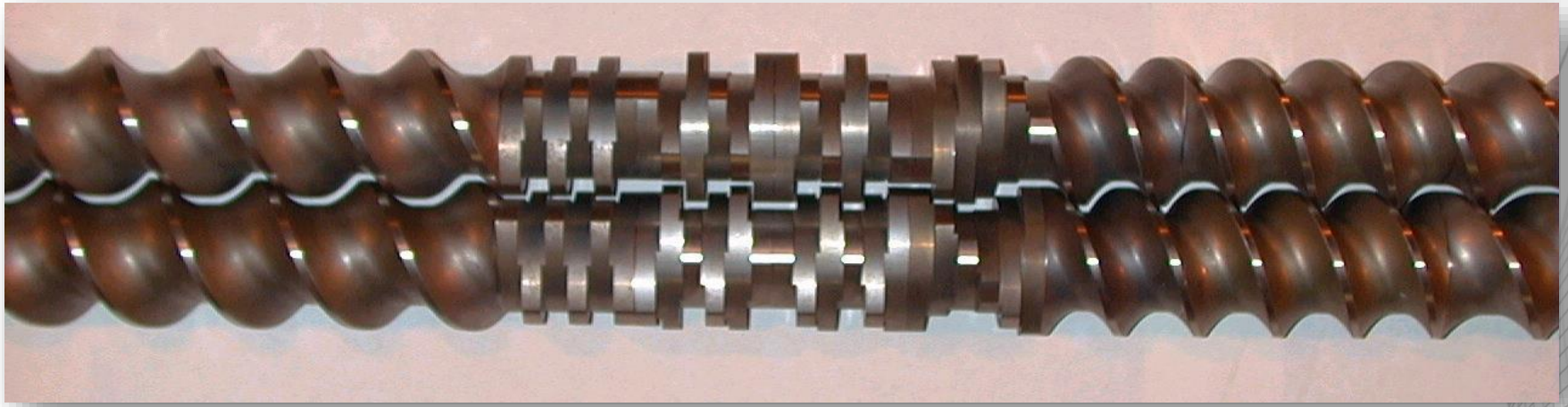
High Distributive “Combing” Elements



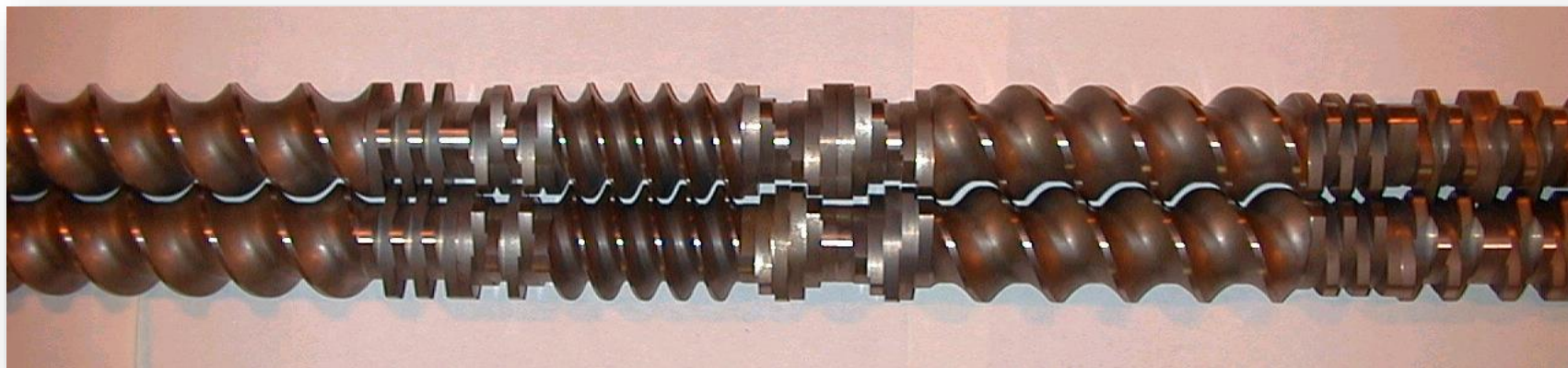
Feeding Section



Melt/Mix Section



Section for Adding Filler/Mixing



Foster Compounding Lines

Production Machines

27mm – 53mm

all co-rotating twin screws

dry and liquid feed capabilities

side stuffers on some machines

R & D

Counter-rotating conical twin screw

Screw Technology

distributive and dispersive mixing

programmable screw configurations

Feeders

volumetric

loss-in-weight

ability to feed powder, pellet, and some liquids

Foster Compounding Lines

Pre & Post Blending

- high intensity mixers
- deagglomerating V-blender
- cross-tumbler

Size Reduction

- strand and underwater pelletizers
- sifters/classifiers
- die face cutting

Driers

- dehumidifying hopper
- dehumidifying tray
- non-dehumidifying tray

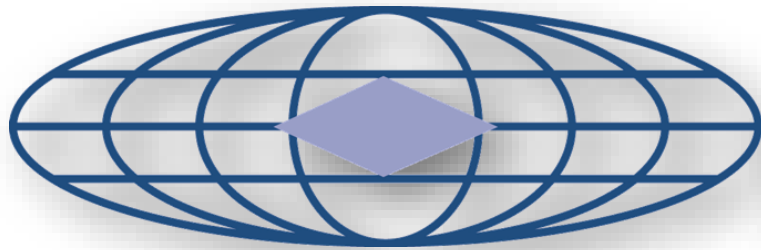
Cooling

- water bath
- air
- none

Other

- melt filtering





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