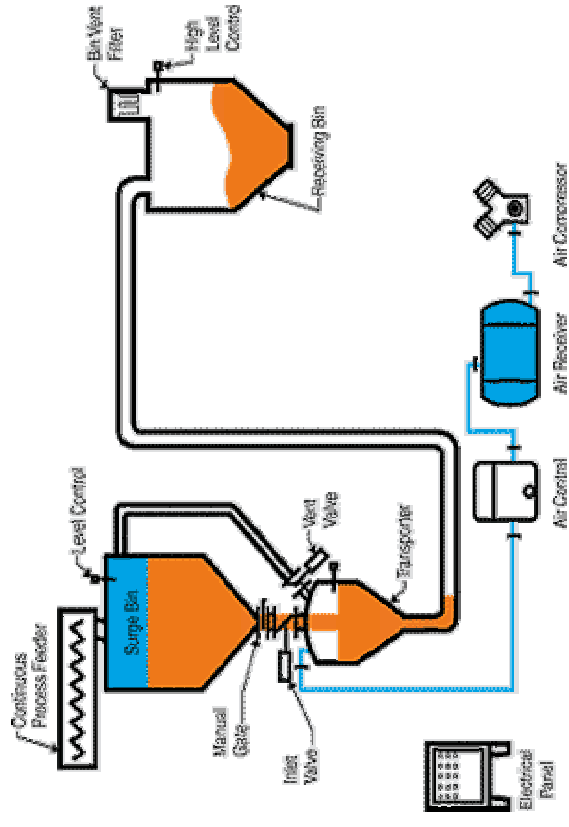


Types of Conveying Systems

- Dense Phase Conveying
- Pressure/Vacuum Systems (push/pull)
- Pressure Conveying Systems
- In Plant Vacuum Conveying
 - Positive Displacement Blowers
 - Ring Compressor Blowers
 - Self Contained Loaders

Dense Phase Conveying - Strengths

- Good for brittle materials
- Lower velocity air
- Less abrasive
- Higher throughputs
- Long convey distances



Dense Phase Conveying - *Weaknesses*

- Very expensive
- Maintenance intensive
- Loud
- Difficult to set-up/balance



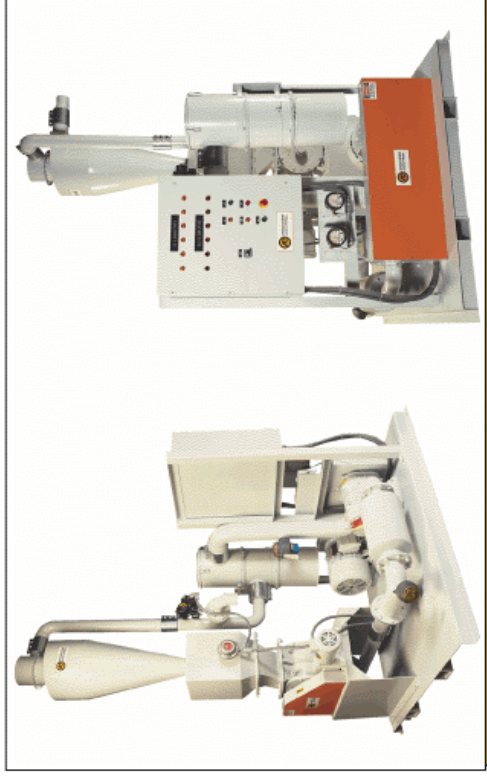
Pressure/Vacuum Systems - *Strengths*

- Rail car or truck unloading
- Highest throughputs
- Long conveying distances



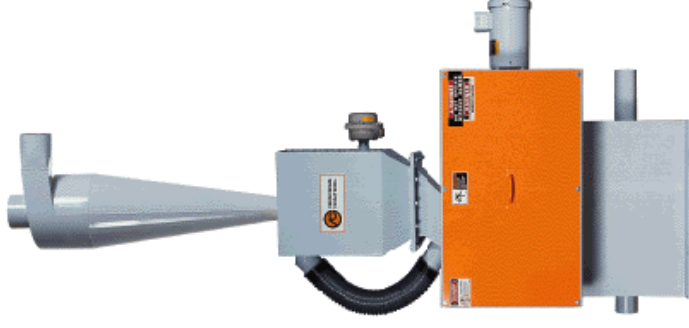
Pressure/Vacuum Systems - *Weaknesses*

- High cost
- High noise and maintenance
- Difficult to balance
- Outdoor installation
- Poor dust management



Pressure Conveying Systems - *Strengths*

- Economical
- High conveying distances
- Simple design
- Bulk truck equipped



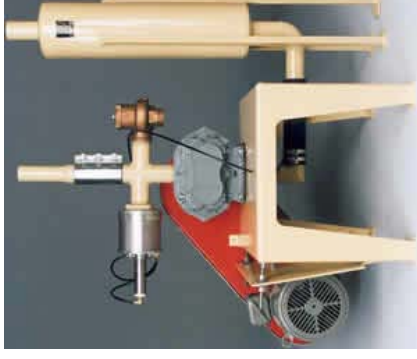
Pressure Conveying Systems - *Weaknesses*

- Dust management
- High noise
- High maintenance
- Difficult to sequence



In-Plant, Positive Displacement - *Strengths*

- Easy to automate
- High throughputs
- Long conveying distances
- Good dust management



In-Plant, Positive Displacement - *Weaknesses*

- Noisy, high maintenance
- Higher capital cost
- Prone to vacuum leaks
- Sophisticated controls



In-Plant, Ring Compressor - *Strengths*

- Lower capital cost
- Less noise/low maintenance
- Compact/simple design
- Easy to work on



In-Plant, Ring Compressor - *Weaknesses*

- Shorter conveying distances
- Lower throughputs
- Less efficient
- Poor dust management



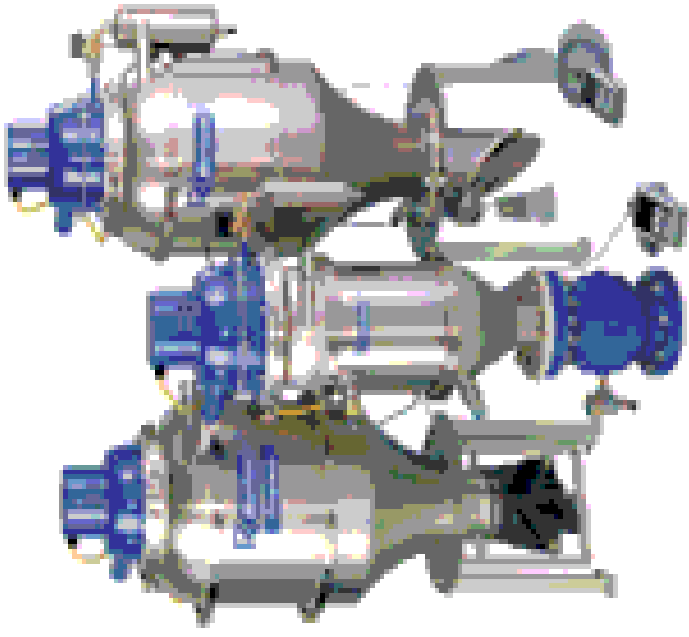
In-Plant, Self Contained - *Strengths*

- Very low cost
- Easy to maintain
- Compact design
- Versatile
- Easy to move or install



In-Plant, Self Contained - *Weaknesses*

- Short conveying distances
- Noisy
- Poor dust control
- Very inefficient



Types of Drying Systems

- Hot Air Dryers
- Vacuum Dryers
- IR Dryers
- Desiccant Dryers
 - Dual Bed
 - Cartridge
- Crystallizing Dryers

Hot Air Dryers - *Strengths*

- Low Cost
- Pre-heat materials
- Higher product quality
- Higher throughputs



Hot Air Dryers - *Weaknesses*

- Surface drying only
- High heating cost
- Large foot print
- Can create dusting



Vacuum Drying Systems - *Strengths*

- Heat sensitive materials
- Crystallizing capabilities
- Low oxygen drying
- De-volitization



Vacuum Drying Systems - *Weaknesses*

- High cost
- Maintenance intensive
- Batch drying
- High energy cost



Infrared Dryers - *Strengths*

- Energy efficient
- Low dust levels
- Crystallizes PET
- Short residence time



Infrared Dryers - *Weaknesses*

- Higher capital cost
- Maintenance intensive
- Requires finish drying belt

100 ppm



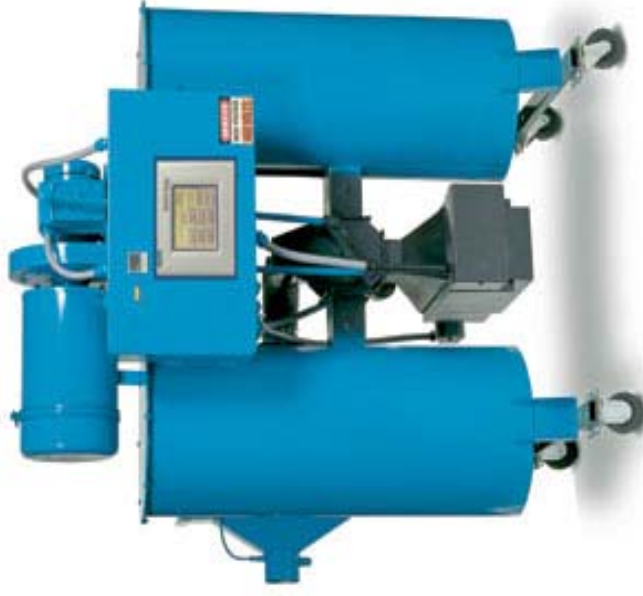
Desiccant Dryers - *Strengths*

- Very low moisture
- Energy efficient heating
- Closed loop system
- Numerous suppliers



Desiccant Dryers - *Weaknesses*

- High capital cost
- Maintenance intensive
- Less than 1% incoming moisture
- Large footprint



Types of Feeding & Blending Systems

- Volumetric Feeders
- Gravimetric Feeders
 - Auger, Vibratory, Belt
- Volumetric Blenders
- Batch Gravimetric Blenders
- Loss-in-Weight Blenders
 - Target Rate & Target Weight
- Special Fluff Feeders & Reclaim Systems

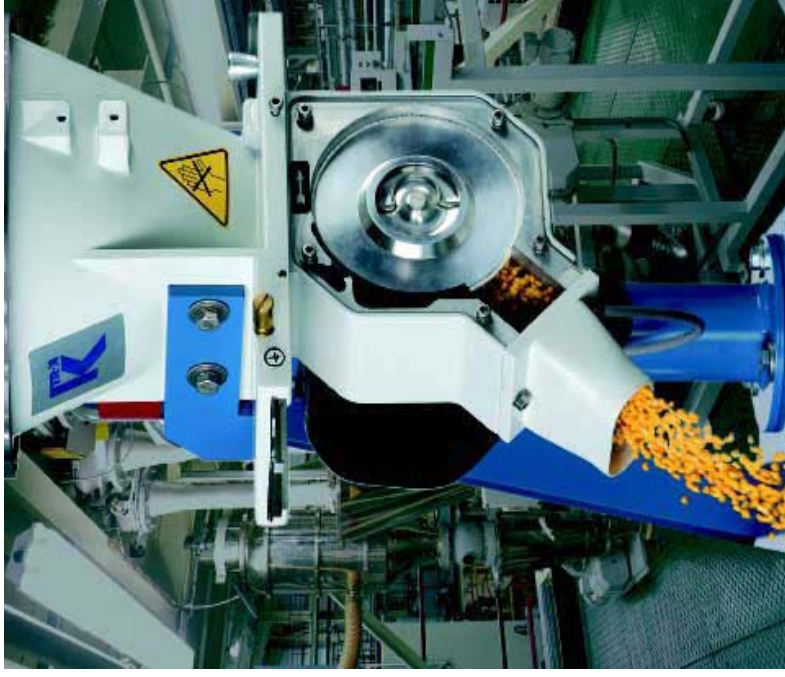
Volumetric Feeders - *Strengths*

- Low Cost
- Simple to use
- Easy to maintain
- Bolt direct to extruder throat



Volumetric Feeders - *Weaknesses*

- Poor Accuracy
- Calibrate for different materials
- No material usage information



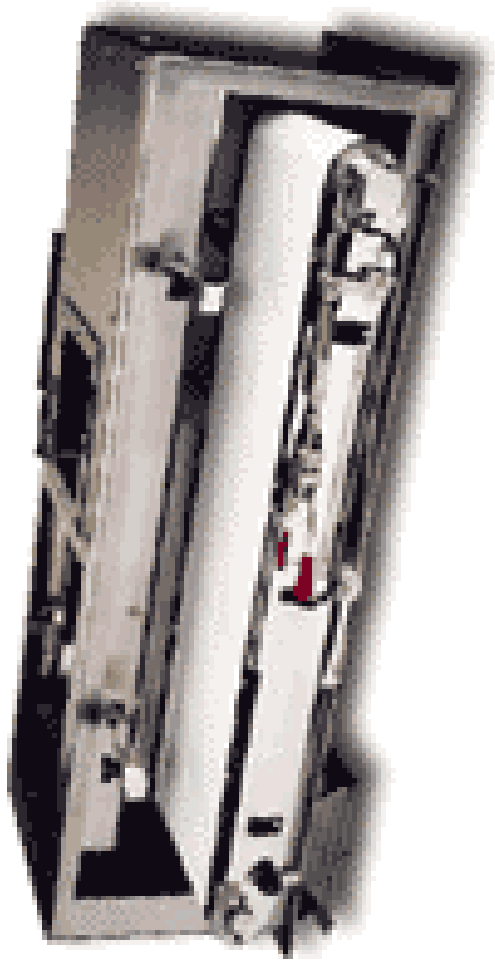
Gravimetric Feeders - *Strengths*

- High Accuracy
- Adjust for changing bulk densities
- Material usage information



Gravimetric Feeders - *Weaknesses*

- High cost
- Maintenance intensive
- Difficult to install
- Sensitive to vibration



Volumetric Blenders - *Strengths*

- Low Cost
- Easy to use & maintain
- Immune to vibration
- Simple to install



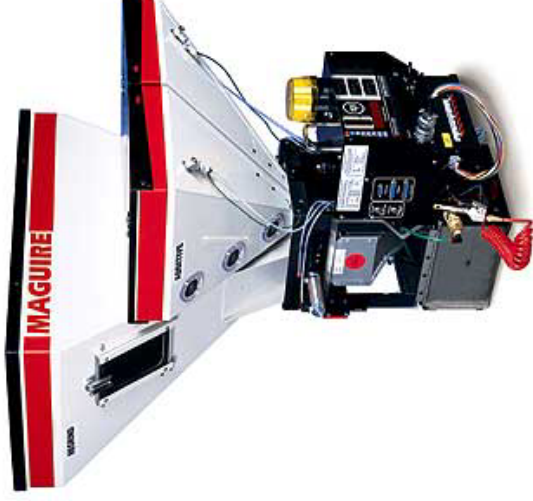
Volumetric Blenders - *Weaknesses*

- Poor Accuracy
- Requires frequent calibration
- No inventory or extrusion control



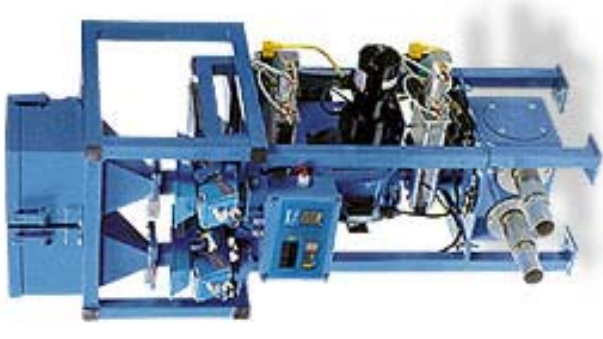
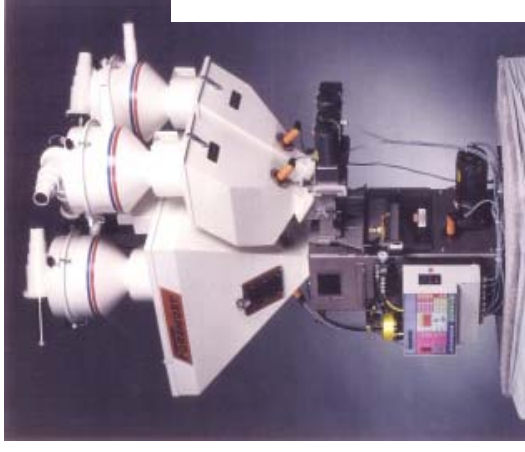
Batch Gravimetric Blenders - *Strengths*

- Lowest cost gravimetric
- Easier to maintain
- Compact designs
- More accurate than volumetric
- Documents material usage



Batch Gravimetric Blenders - *Weaknesses*

- More expensive than volumetric
- Maintenance intensive
- Lower weighing resolution & difficult mixing
- Sensitive to machine vibration



Loss-in-Weight Blenders - *Strengths*

- Highest accuracy
- Loadcell for each material
- Best for mixing
- High output
- 8 ingredients or more
- Extruder output control



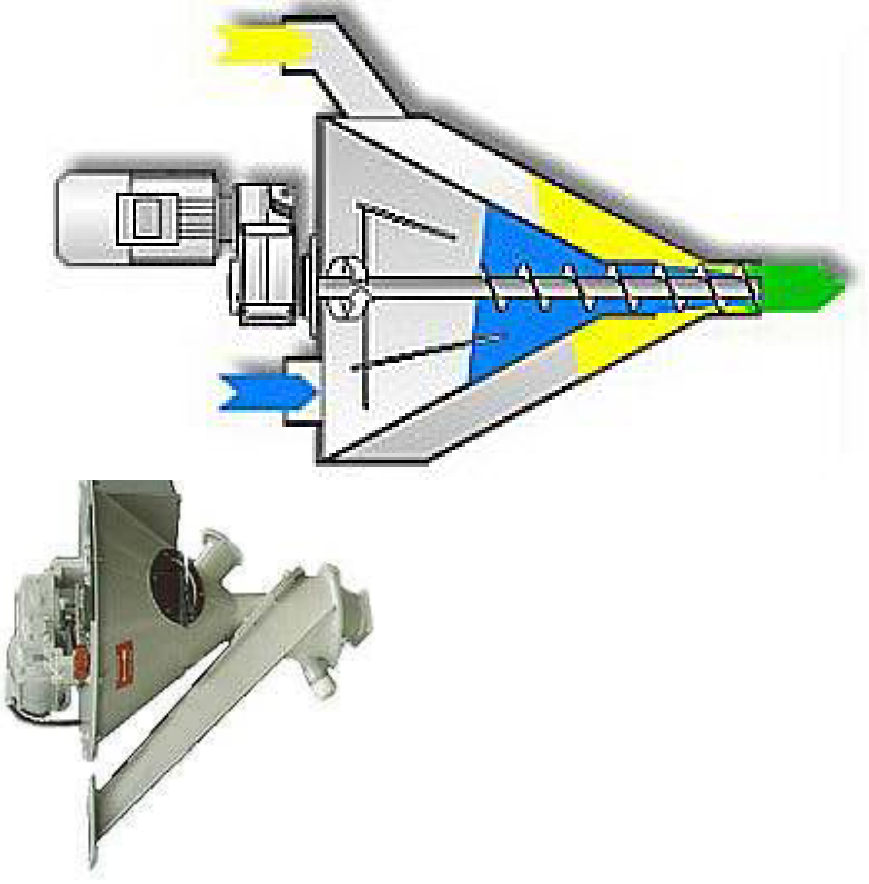
Loss-in-Weight Blenders - *Weaknesses*

- Highest cost system
- Maintenance intensive
- Vibration sensitive
- Difficult to install



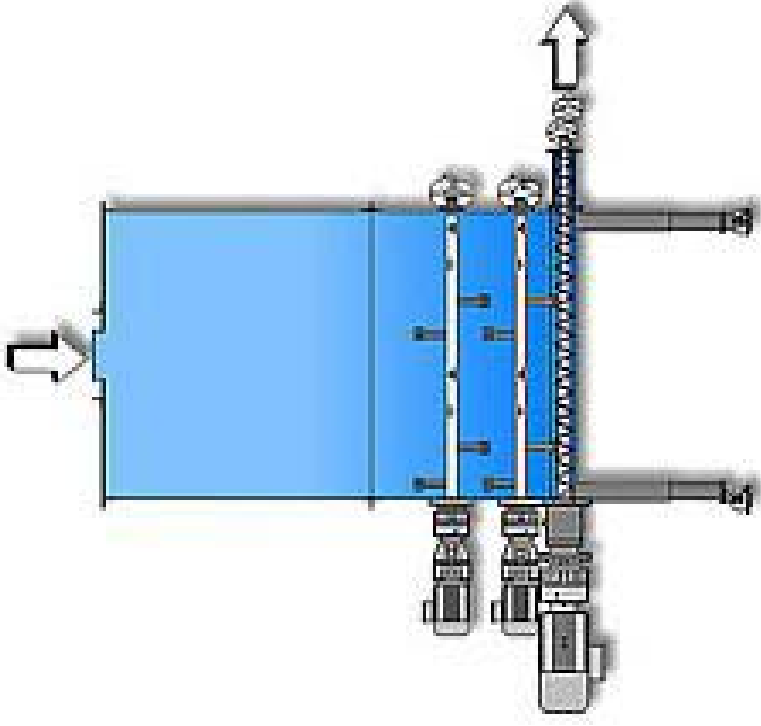
Fluff Reclaim Systems - *Strengths*

- Direct film recycling
- No additional heat history
- Less contamination
- Lower overall energy cost
- Saves personnel cost



Fluff Reclaim Systems - *Weaknesses*

- Limited reclaim percentages
- Dust around extrusion line
- Complicates blending and extrusion control
- Can make extruder more unstable



Types of Dimensional Control Systems

- Gravimetric Extrusion Control
- Gear Pump Systems
- Gauging Systems

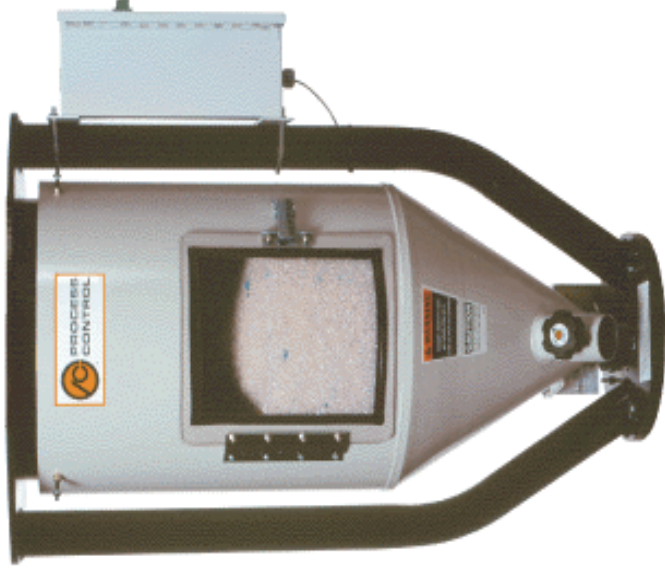
Gravimetric Extrusion Control - *Strengths*

- Average weight and layer control
- Simple to use & easy to maintain
- No material effects



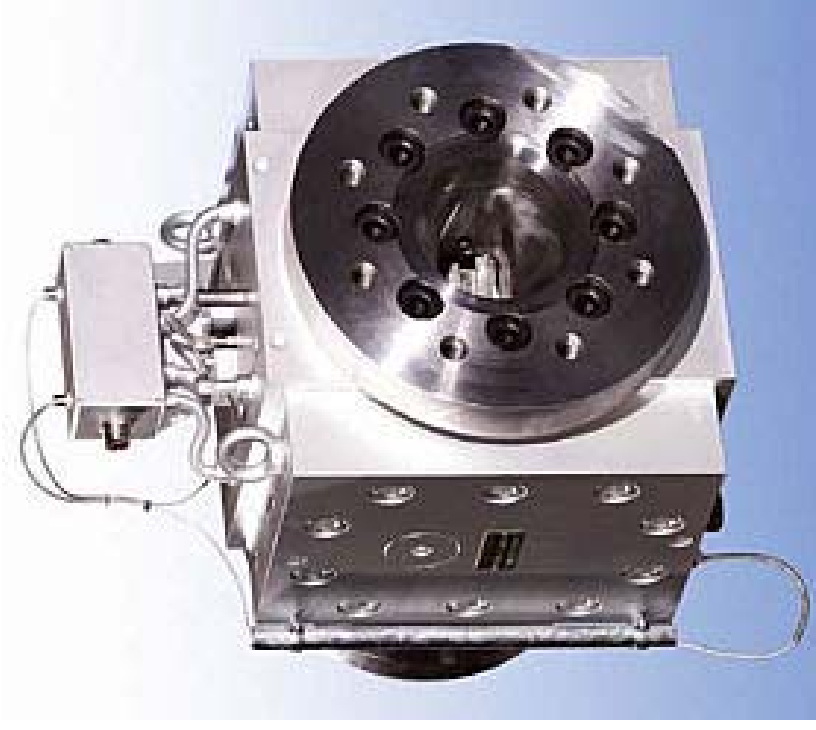
Gravimetric Extrusion Control - *Weaknesses*

- Difficult to install
- Controls product weight, not thickness
- Controls long term drift only, not surging
- Machine direction control only, no traverse



Gear Pump Systems - *Strengths*

- Controls surging
- Reduces backpressure & increases output
- Volumetrically accurate outputs



Gear Pump Systems - *Weaknesses*

- High cost system
- Relatively maintenance intensive
- Difficult to install
- Machine direction only, no traverse



Gauging Systems - *Strengths*

- Measures machine and traverse direction
- Control an automatic die system
- Direct thickness and layer measurement



Gauging Systems - *Weaknesses*

- High cost
- Requires frequent maintenance & calibration
- Controls long term drift, not surging



Types of Pelletizing Systems

- Strand – Water Bath
- Strand – Water Slide
- Hot Die Face – Air Cooled
- Die Face – Water Ring
- Die Face – Under Water
- Drop Pelletizing

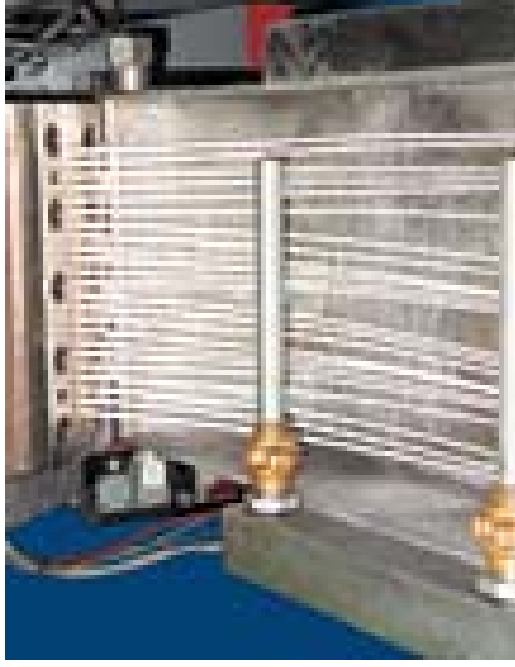
Strand – Water Bath - *Strengths*

- Low cost
- Simple to use
- Easy to clean and changeover



Strand – Water Bath - *Weaknesses*

- Very little automation
- Limited pellet size
- High cutter wear/maintenance
- Sensitive to process variations



Strand – Water Slide - Strengths

- Higher level of automation
- Self stranding
- Variable cooling
- Higher process rates
- More compact



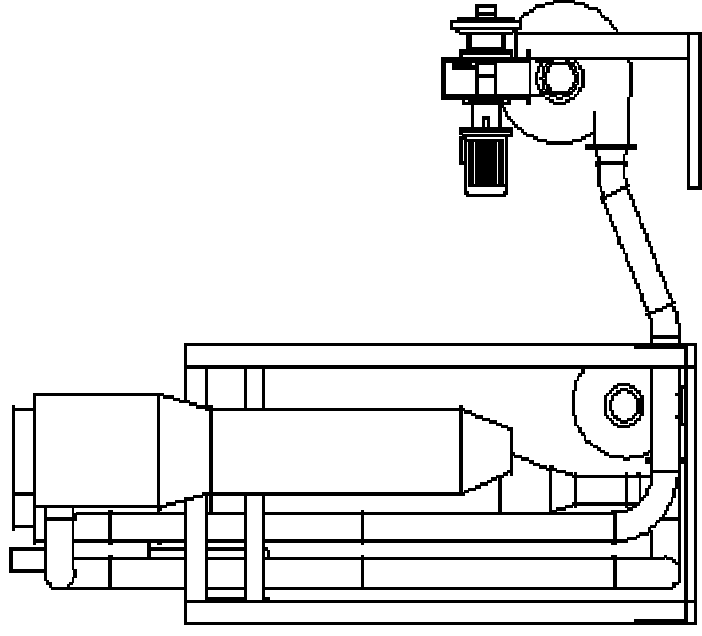
Strand – Water Slide - *Weaknesses*

- Higher cost
- High cutter wear and maintenance, but less than water bath
- Difficult to setup



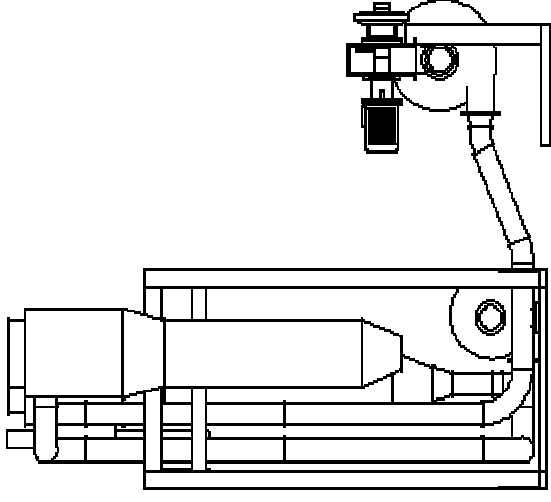
Hot Die Face – Air Cooled - *Strengths*

- Very simple design
- No contact with water
- Compact layout
- Easy to setup and operate



Hot Die Face – Air Cooled - *Weaknesses*

- Very limited cooling capability
- Low outputs
- High blade Wear
- High dust levels



Die Face – Water Ring - *Strengths*

- Relatively low cost
- Compact design
- Better cooling capabilities
- No die freezing



Die Face – Water Ring - *Weaknesses*

- Limited to Olefins
- Poor performance on high heat and sticky materials
- Limited application range



Die Face – Under Water - *Strengths*

- Highest automation
- Very versatile – can process most any polymer
- High blade life
- Production of micro pellets



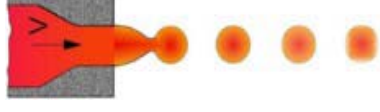
Die Face – Under Water - *Weaknesses*

- Relatively high system cost
- Complicated auxiliary and water/drying systems
- Die freeze issues on high heat products



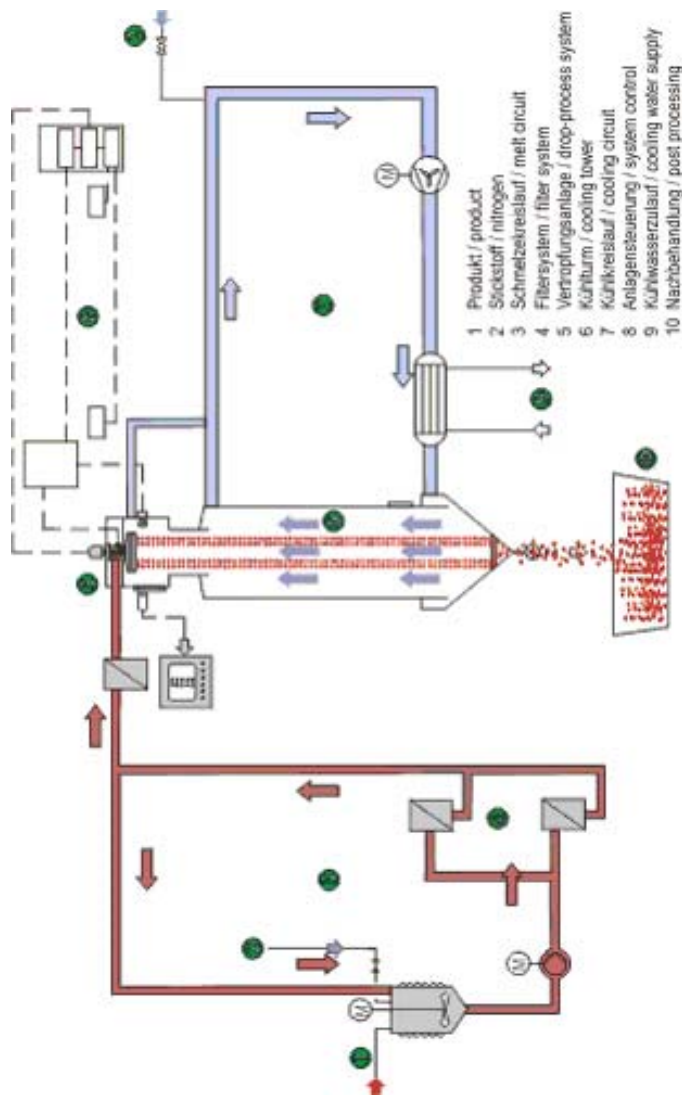
Drop Pelletizing - *Strengths*

- Specialty system for low viscosity polymers and waxes



Drop Pelletizing - Weaknesses

- High cost and complexity



Types of Filtration

- Manual Screen Changer
- Hydraulic Screen Changer
- Continuous Belt Type
- Dual or Single Piston
- Multi-Segment Rotary Disc
- Large Area - Candle Element

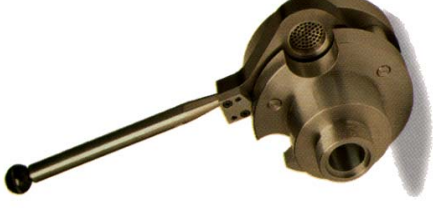
Manual Screen Changer - *Strengths*

- Sizes: 30 mm to 150 mm
- Low capital costs
- Low operating costs
- Streamlined flow paths
- Minimum residence time
- Small in size



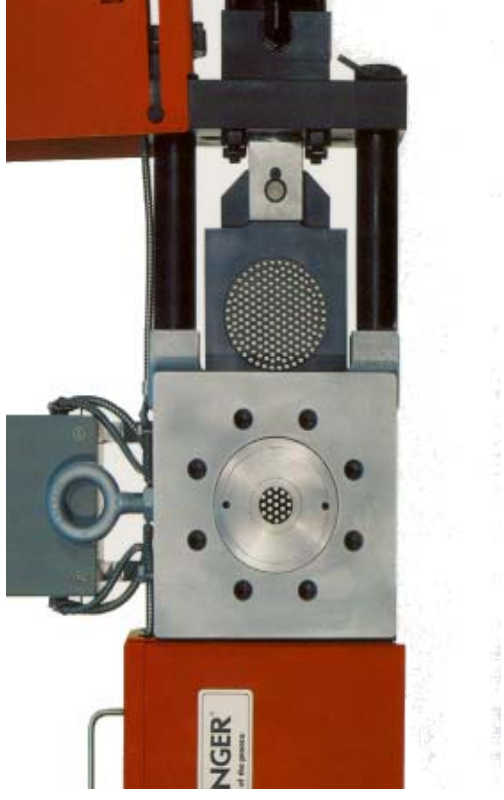
Manual Screen Changers - *Weaknesses*

- Process Interruption
- Line shutdown
- Air entrapment
- Limited open area
- Seal leakage/replacement



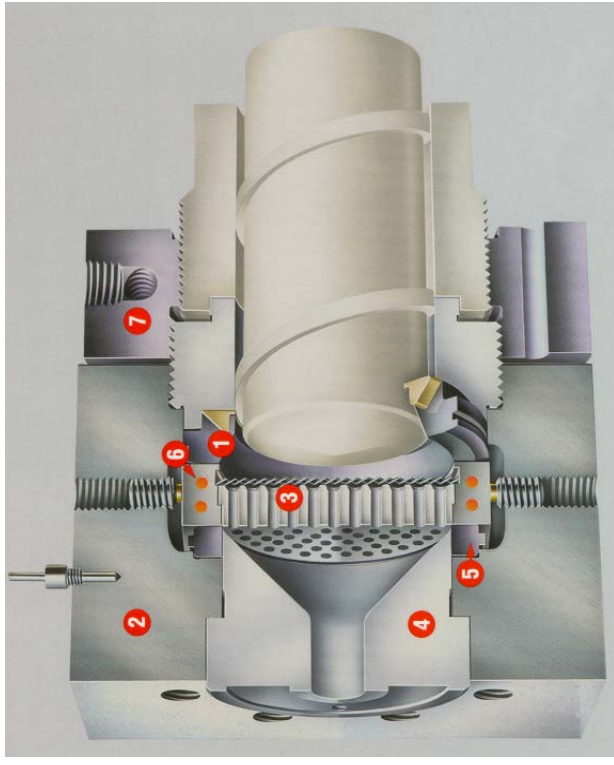
Hydraulic Screen Changer - *Strengths*

- Sizes: 70 mm to 380 mm
- Low operating costs
- Low capital costs
- Streamlined flow paths
- Minimal residence time
- Industry acceptance



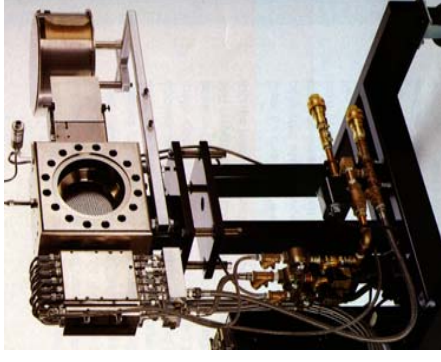
Hydraulic Screen Changer - *Weaknesses*

- Process interruptions
- Air entrapment
- Heated standby screen
- Limited open area
- Complicated hydraulics
- Seal leakage/replacement



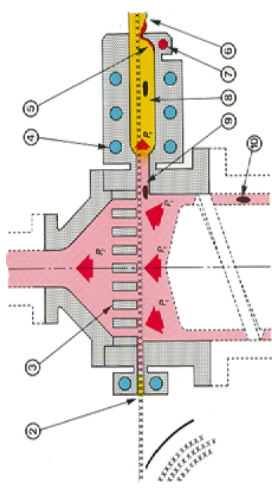
Belt Type Screen Changer - *Strengths*

- Constant differential pressure
- Streamlined flow paths
- Minimal residence time
- Low operator intervention



Belt Type Screen Changer - *Weaknesses*

- Limited size ranges
- Capital costs
- Operating costs
- Sophisticated controls
- High contamination
- Temperature dependent sealing
- Head/differential pressure limitation



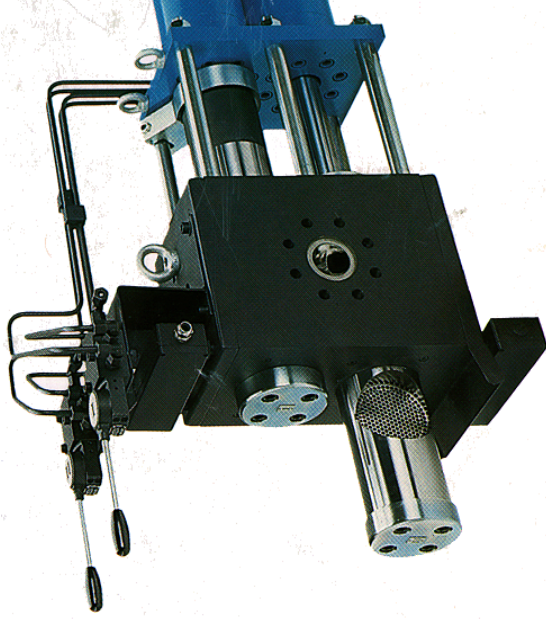
Piston Screen Changer - *Strengths*

- Sizes: 30 to 450 mm
- Continuous filtration
- Sealless design
- High open area
- Uses round screens
- Low capital & operating costs
- Variety of special applications



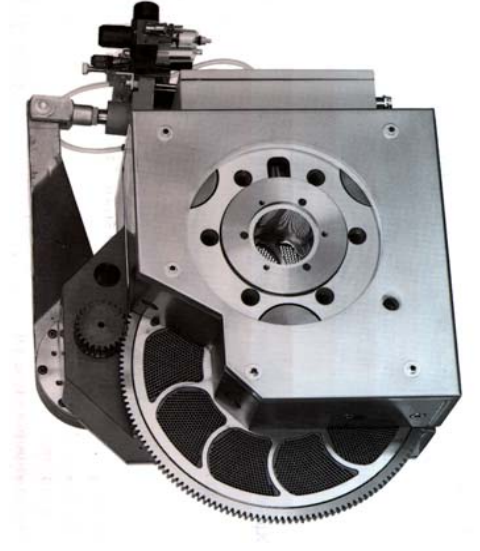
Piston Screen Changer - *Weaknesses*

- Cost relative to hydraulic
- Some pressure variations
- Operator skill level
- Size and installation
- Increased residence time



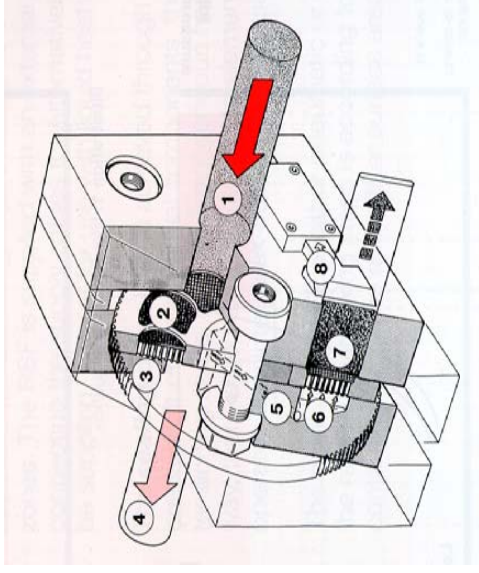
Rotary Screen Changer - *Strengths*

- Sizes: 30 mm to 250 mm
- Very constant pressure
- Streamlined flow paths
- Minimum residence time
- High automation
- Low operator intervention



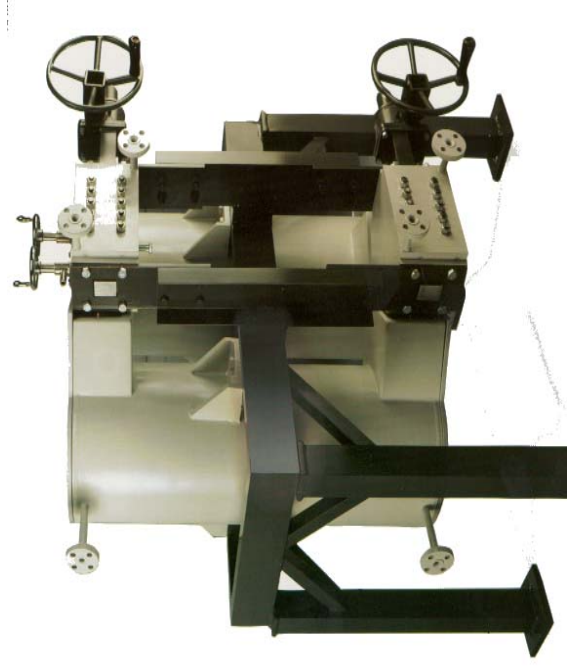
Rotary Screen Changer - *Weaknesses*

- Too loose - leakage
- Too tight - lockup/galling
- High capital cost
- Sophisticated controls
- High differential pressure
- Pressure/viscosity dependent bolt torque



Large Area Filtration - *Strengths*

- Sizes: 5,000 PPH and up
- 5 microns at 90% efficient
- Difficult applications
- Single and dual vessel
- Depth filtration - gels



Large Area Filtration - *Weaknesses*

- Capital cost
- Operating cost
- Safety
- Large installation area

