Module 10. Continuous Rotary (Agitating) Retorts

Thermal Processing for Meat and Poultry Products Training

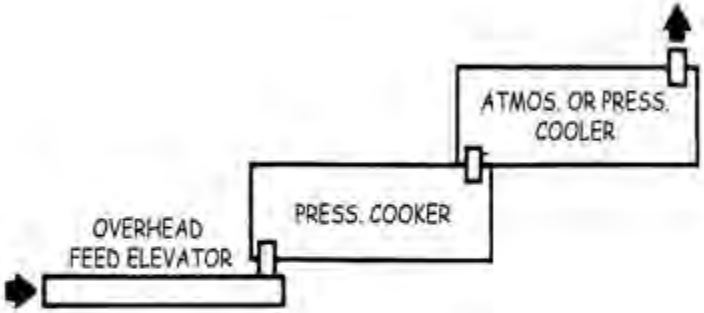
USDA

Introduction

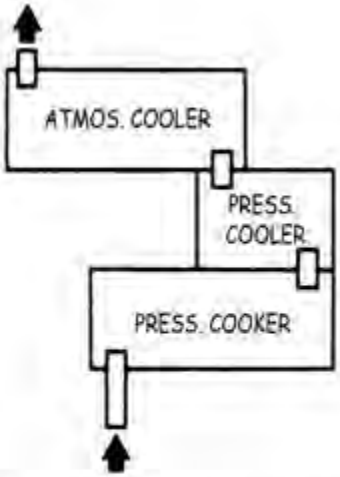
- Uses steam as the heating medium
- Continuous container handling
- Intermittent product agitation
- At least two shells
- Configuration will vary

Typical Arrangements of Continuous Rotary Retorts

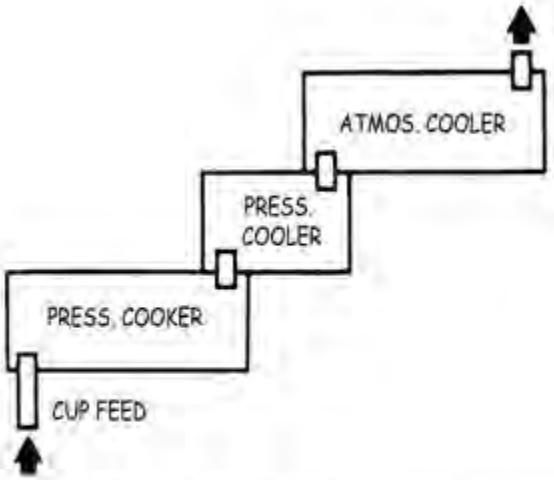
THERMAL PROCESSING TRAINING



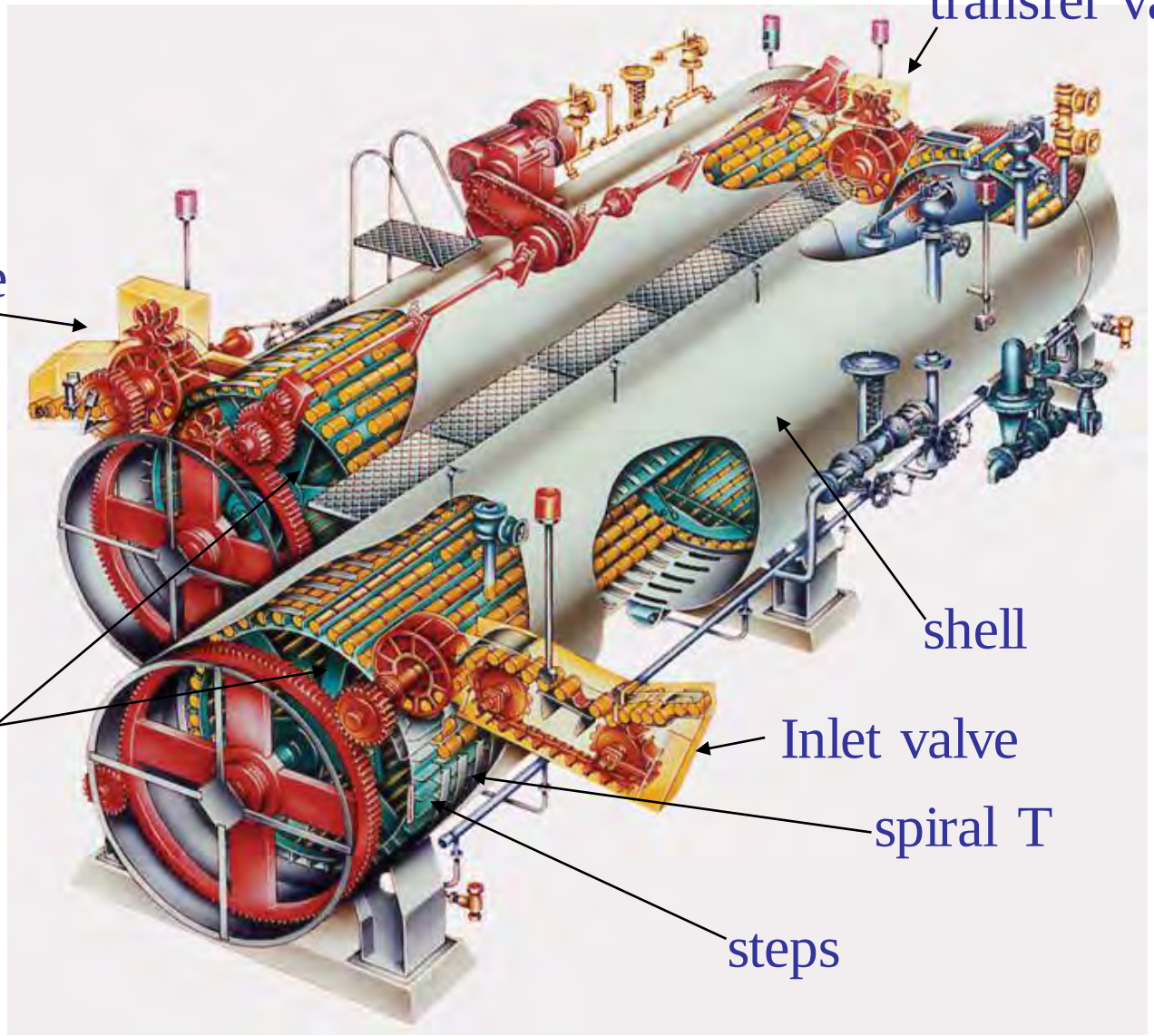
TWO SHELL LINE ARRANGEMENT



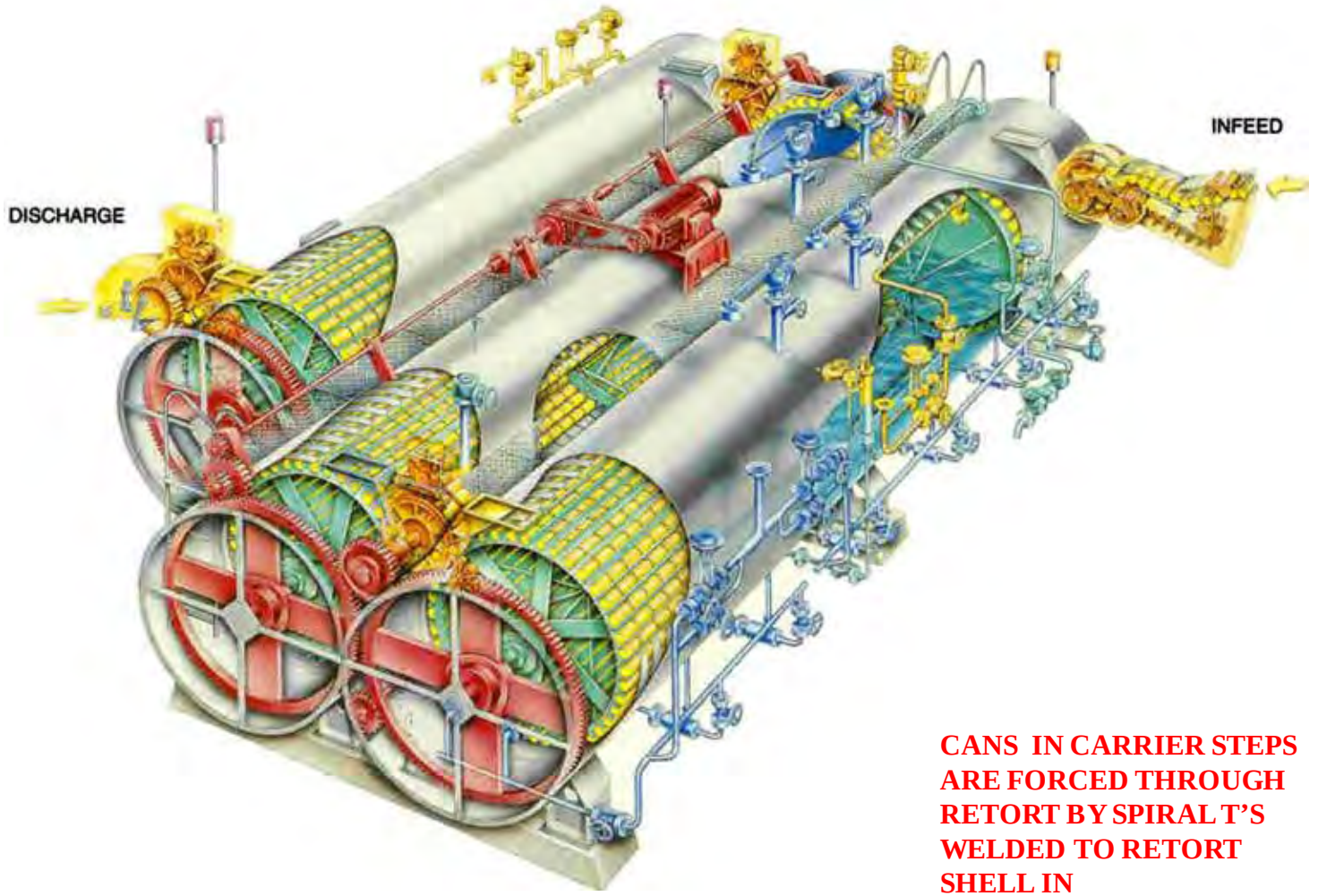
THREE SHELL LINE ARRANGEMENT



THREE SHELL LINE ARRANGEMENT

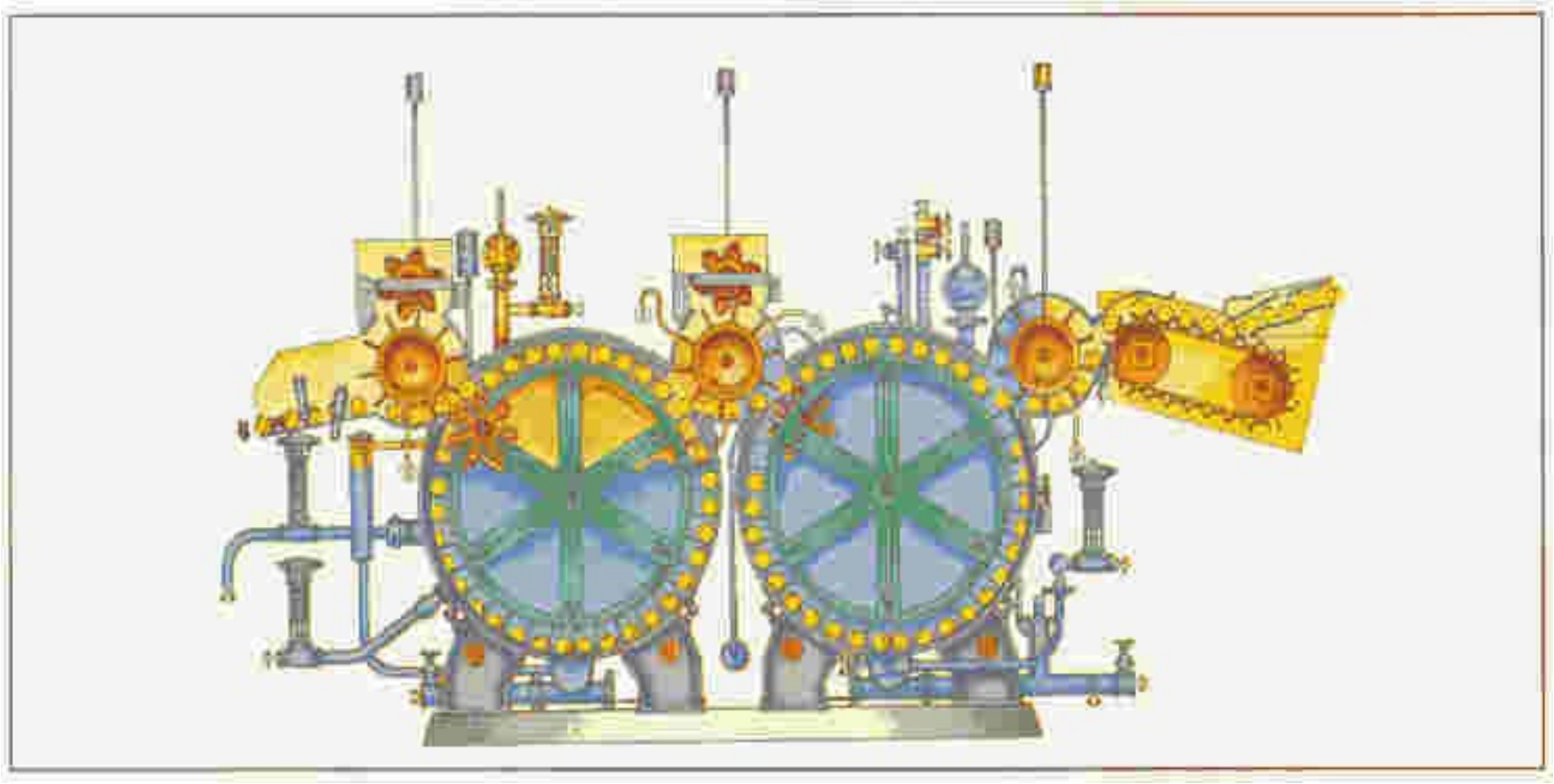

transfer valve
discharge valve
shell
reel
Inlet valve
spiral T
steps

STERILMATIC



CANS IN CARRIER STEPS ARE FORCED THROUGH RETORT BY SPIRAL T'S WELDED TO RETORT SHELL IN

End View of Continuous Rotary Retort



Retort Description

- Rotating reel with steps to hold containers
- Spiral T attached to shell to move containers through

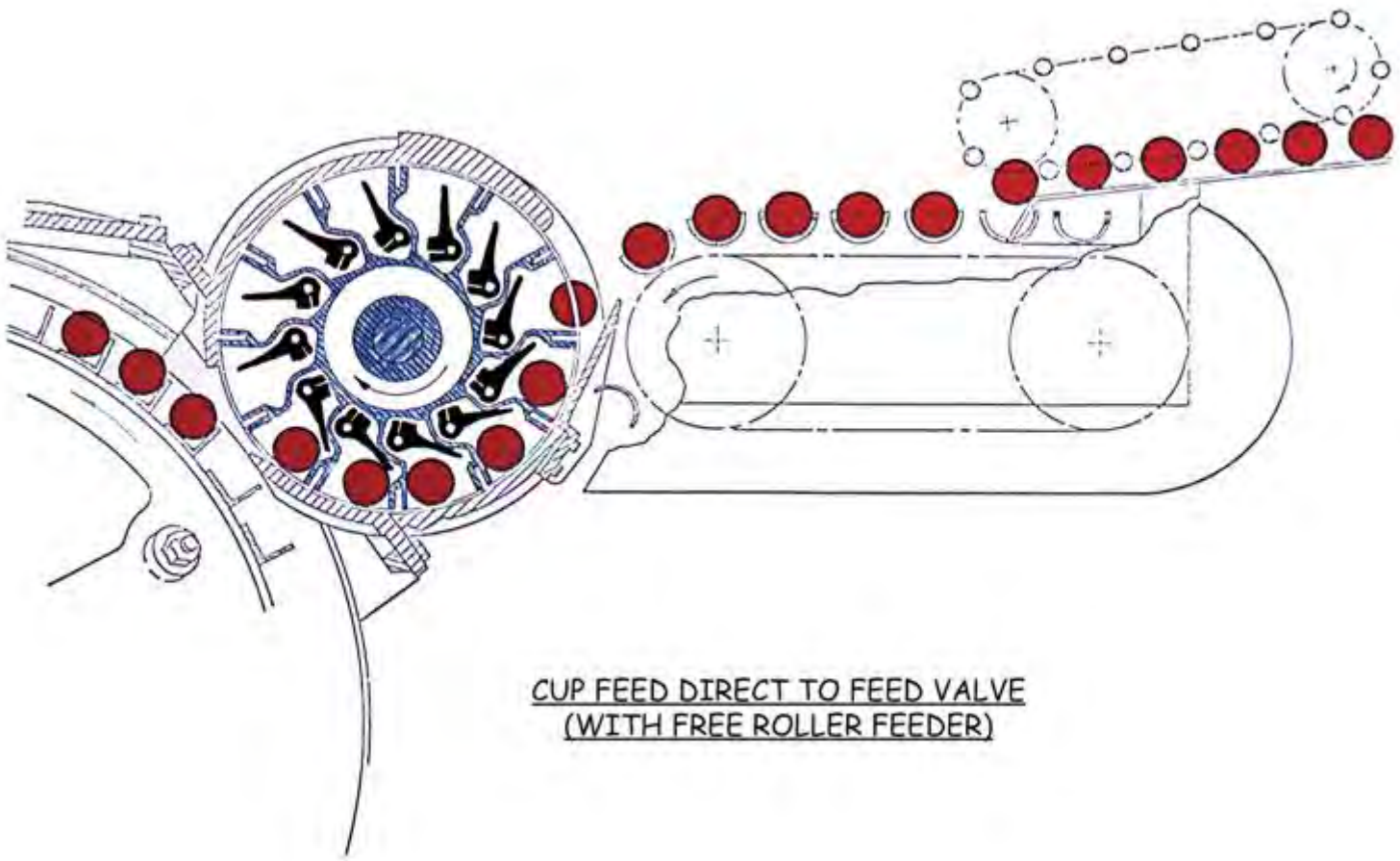
Spiral T

The Reel

Number of Reel Steps for Can Diameters

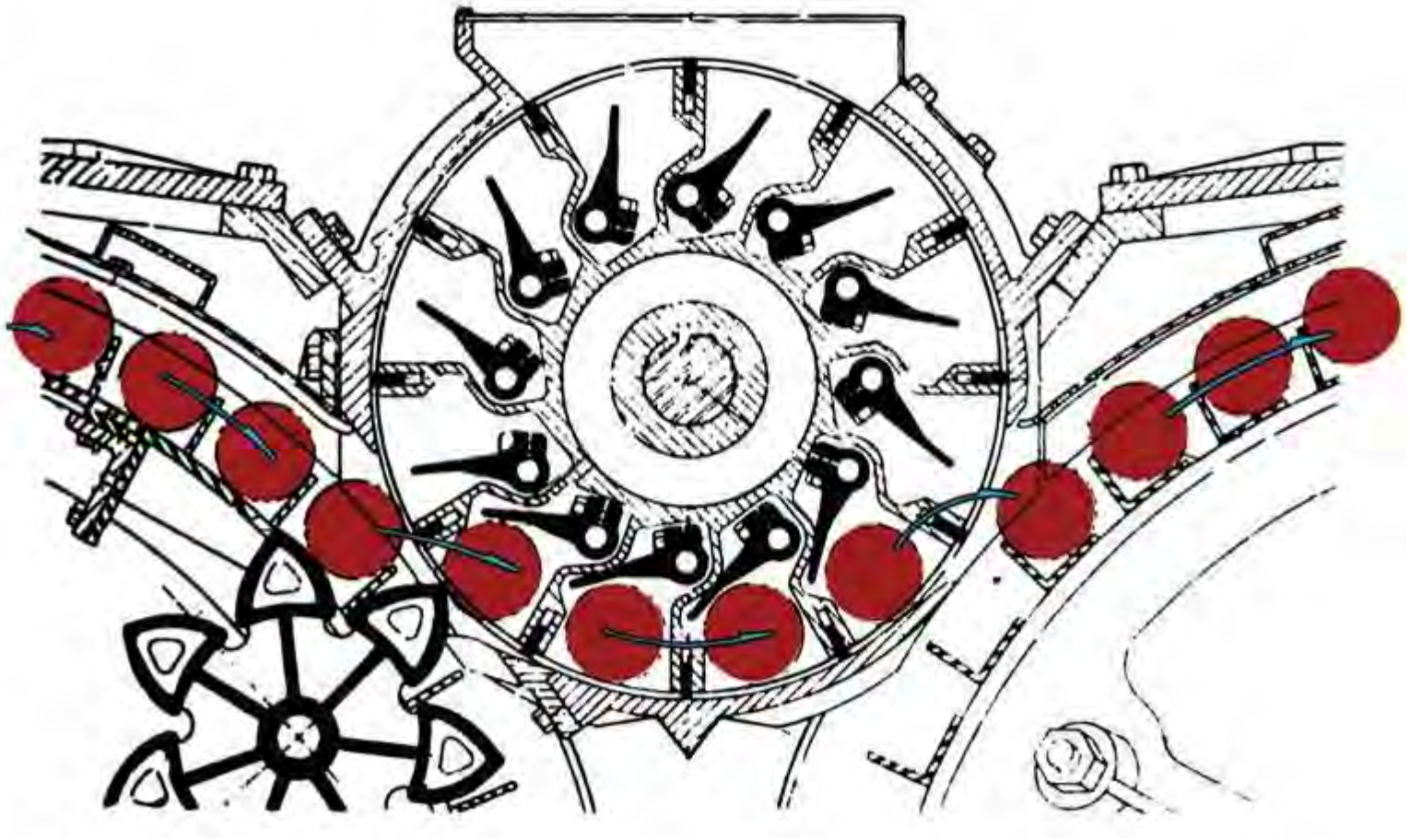
Can Size	Steps Per Turn of Reel
211	56
300-303	47
307-401	42
404	35
603	24

In-Feed



CUP FEED DIRECT TO FEED VALVE
(WITH FREE ROLLER FEEDER)

Transfer Valve



Retort Description

- Advantages:
  - Short process time
  - Continuous input
- Disadvantages:
  - Extra critical factors
  - Container size limits
  - Larger investment than a still steam retort

Retort Installation/Operation - Steam Inlet

- Multiple feeder lines to trough at bottom of shell
- Must be large enough for proper operation

Retort Operation - Condensate Removal

- Required to remove it
- Condensate interferes with container rotation
- May reduce product agitation leading to under processing

Retort Operation - Condensate Removal

Must:

- Open drain for sufficient time during venting
- Provide for continuous or intermittent removal
- Have bleeder arranged for observation
- Be observed and recorded frequently

Retort Operation - Pressure Cooling

- May be needed to prevent container distortion
- Cooler pressure should be slightly below cooker pressure so water does not enter cooker

Rotational Speed and Process Timing

- Reel speed must be set as stated in process schedule before containers enter retort

Rotational Speed

- Determines process time
- Affects product agitation
- Faster than calculated time results in shorter process time
- Slower than required minimum speed reduces agitation

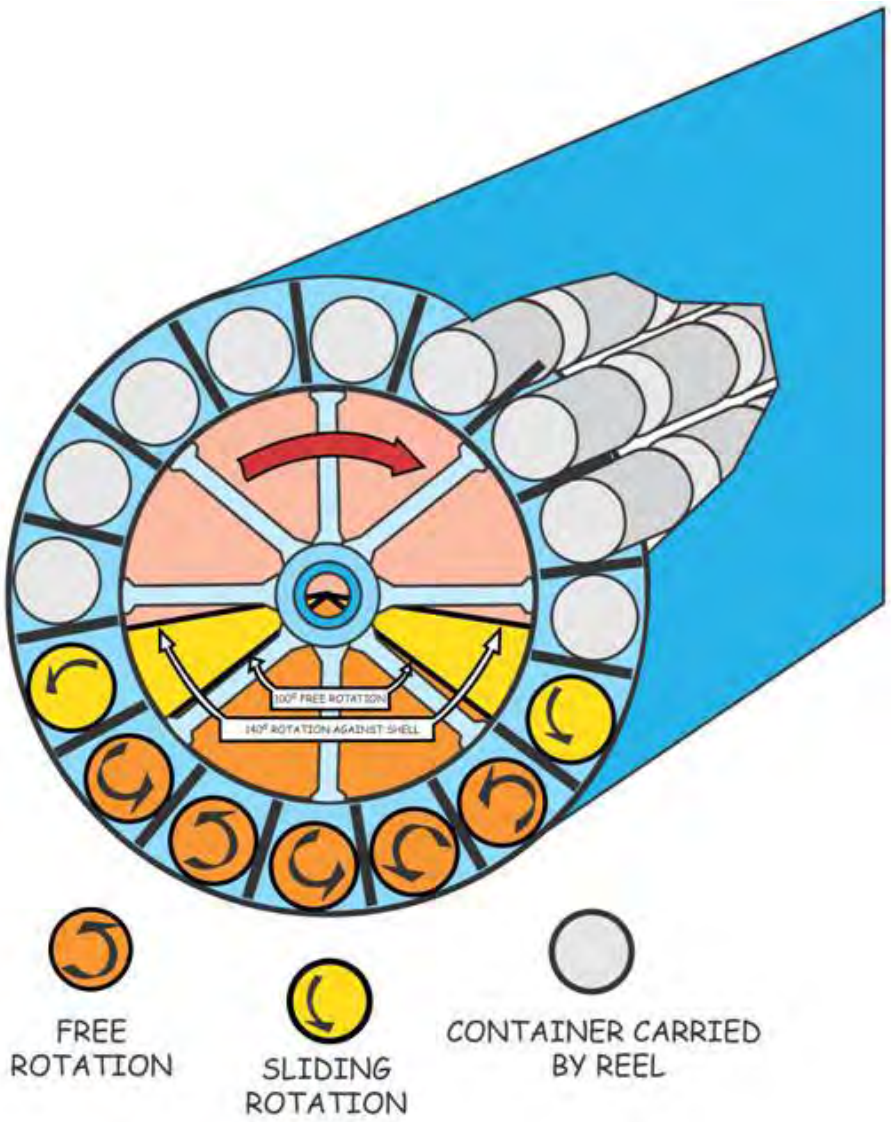
Rotational Speed

The rotational speed must be:

- Specified by process authority in the process schedule
- Checked and adjusted when the retort is brought up to temperature and determined and recorded at intervals not to exceed 4 hours

Notice to prevent unauthorized changes

Rotational Speed



Intermittent Agitation

Process Considerations:

- Intermittent agitation provides more rapid heating and cooling when compared to no agitating
- Container rotation is divided into carried, sliding and free phases

Intermittent Agitation

- Product and headspace bubble mix during rotation
- Solid pack items like beef stew and chili do not benefit from agitation
- Brine-packed items, soups and sauces may benefit by faster heating and shorter processes
- Dependent on headspace, consistency, reel speed and fill-in weight

Important Critical Factors

- Condensate build-up
- Headspace
- Consistency
- Reel speed

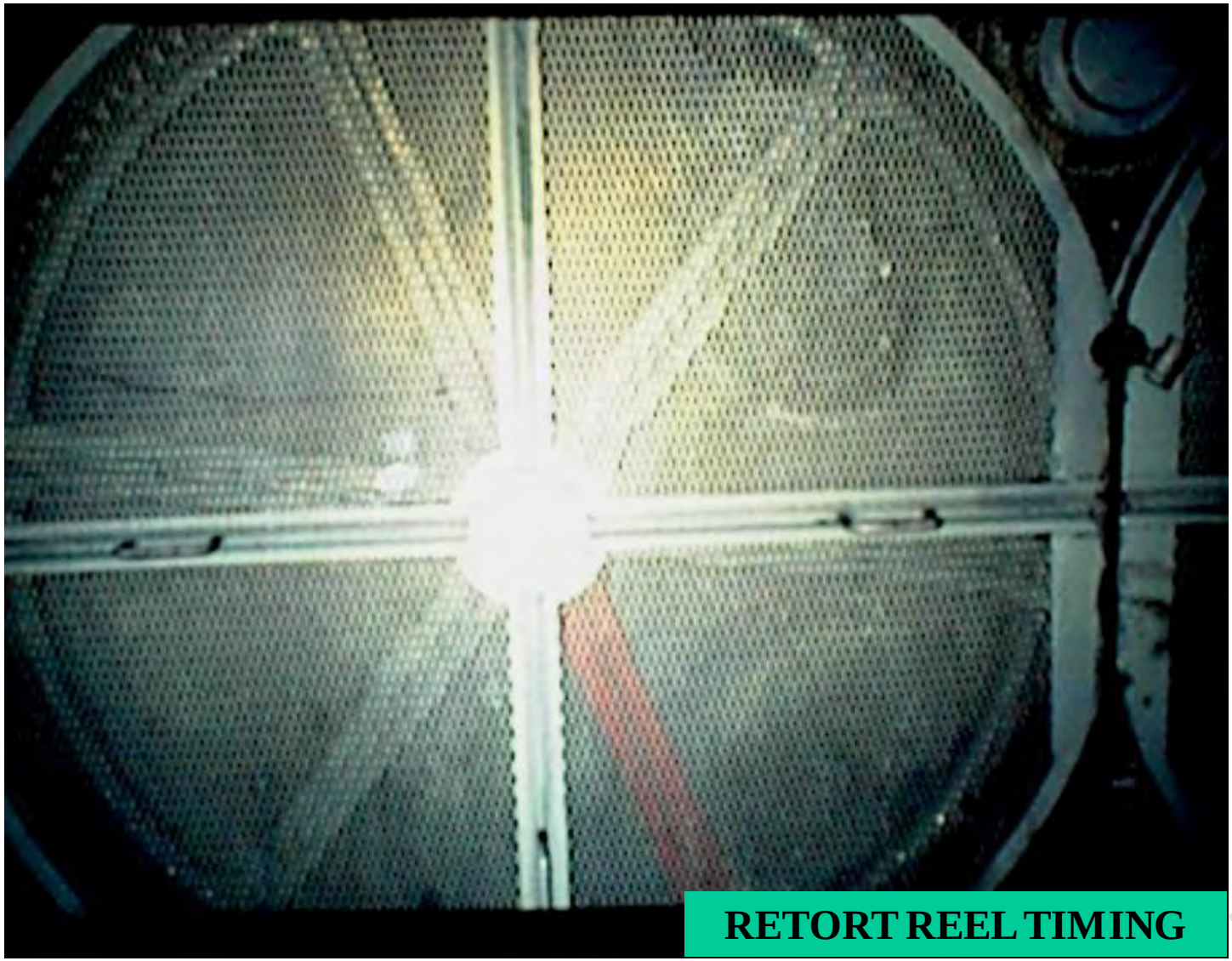
Headspace

- Area not occupied by product
- Critical factor for agitation
- Net or gross headspace

Consistency

- Measure of product thickness
- Thicker product may reduce agitation
- Measure consistency at location specified in the process schedule and in accordance with a written procedure, e.g., at the cooking kettle of filler at 160 F or higher temperature

Reel Speed



Reel Speed

- For reel speed calculation you need:
  - Process time
  - Total container capacity of processing shells
  - Number of reel steps

Reel Speed

Can Size	Steps Per Turn of Reel
211	56
300-303	47
307-401	42
404	35
603	24

Reel Speed

Calculations

- Reel Speed

  RPM = capacity/reel steps x process time

- Cans Per Minute

  CPM = capacity/process time

Reel Speed

Seconds for 10 Revolutions of Reel =

$\frac{\text{10 revs x 60 sec/min x reel steps x process time}}{\text{Shell Capacity}}$

$\frac{\text{10 x 60 sec/min x 47 x 14 min}}{\text{10, 000 (303 diameter)}}$ = 39.48 secs

$\frac{\text{10 x 60 sec/min x 24 x 10 min}}{\text{5,000 (603 diameter)}}$ = 28.8 secs.

Initial Temperature (IT)

- Critical heating parameter specified in the process schedule
- Measured on containers taken from line prior to inlet valve

Recordkeeping Requirements

- Critical factors and IT must be measured and recorded in accordance with the method and frequency in the written procedure
- Must include reel speed checks

Handling Process Deviations

Retort Jam or Reel Breakdown In-Process:

- Must reprocess, repack and reprocess, or destroy all containers
- May use emergency still process before retort is cooled

Handling Process Deviations

Emergency Still Process:

- Obtained from a processing authority, if not process must be reviewed by a processing authority
- Must reprocess, repack and reprocess or destroy containers in inlet and transfer valves
- Records must be kept of actions including the time the retort stopped and the time retort was used for the still process

Handling Process Deviations

Alternative Procedures in Case of Temperature Drop in the Retort:

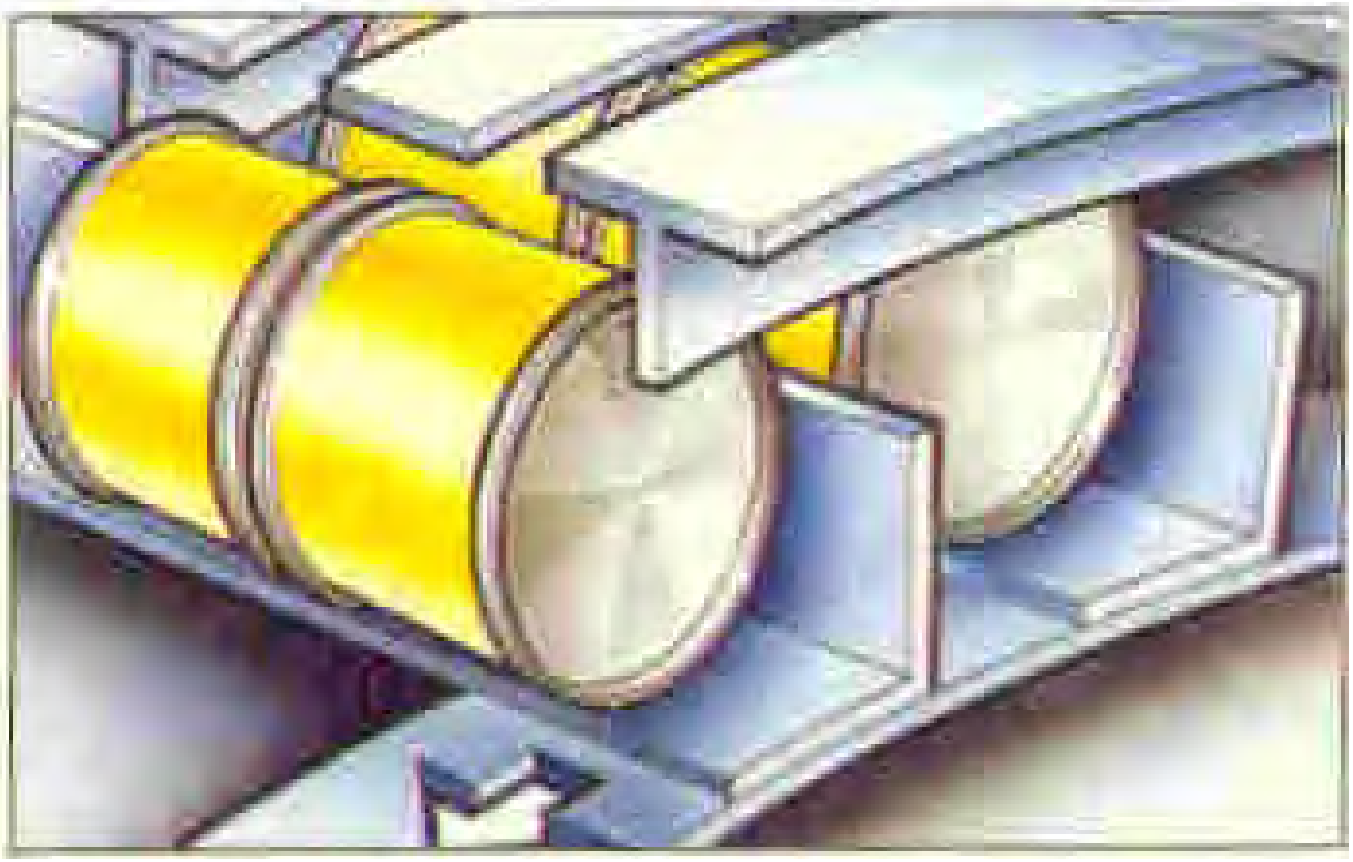
- < 10°F drop
  - Stop reel and use emergency still process on file
  - Stop container entry and use emergency agitating process on file
  - Have process evaluated by processing authority
  - Empty retort and reprocess, repack and reprocess, or destroy all containers

Handling Process Deviations

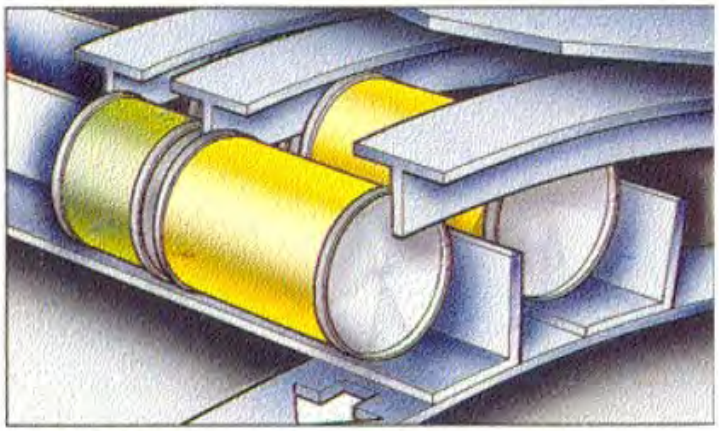
Alternative Procedures in Case of Temperature Drop in the Retort:

- ≥ 10°F drop
  - Stop reel and use emergency still process on file
  - Have process evaluated by processing authority
  - Empty retort and reprocess, repack and reprocess, or destroy all containers
  - Records must be kept of actions

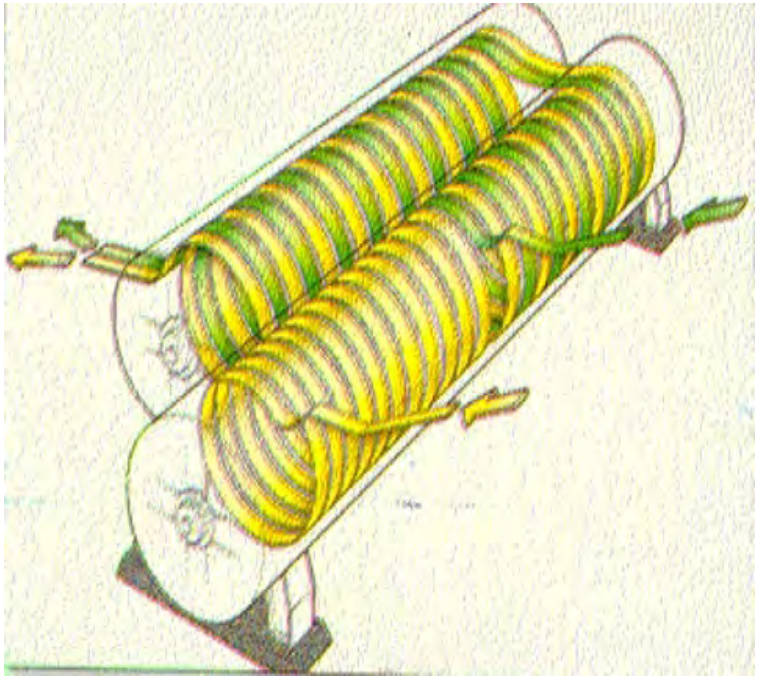
Double can handling system



Twin spirals (Triple available)



Dedicated line system for high speeds, or separated multiple products/can sizes. In addition delicate products can be run at high speed with half the agitation of a single spiral.



Different can sizes or products can be introduced into custom reels. Spirals can be custom designed to handle different length cans or can be designed to provide different thermal process times to different cans.

Questions?

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