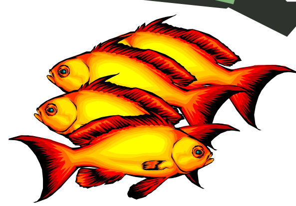
Gone Fishing !



A CRACKER STORY

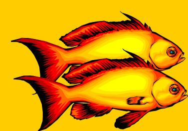
GARY ISRAEL
PROCESS SOLUTIONS OF NY LLC
SEPTEMBER 19, 2008

1995

7 CRACKER PRODUCTION LINES – 3 PLANTS

20 + SHIFTS /LINE / WEEK

ROOM FOR ONE ADD'TL LINE – $18MM

MAX OUT - PRE PACKAGING 

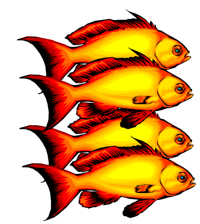
COMPANIES LARGEST SALES SKU'S

'INTERNAL ONLY' PROTECTION – NO CO-MNFG

EXPERTS - " ***LINE SPEED MAXED OUT***! "

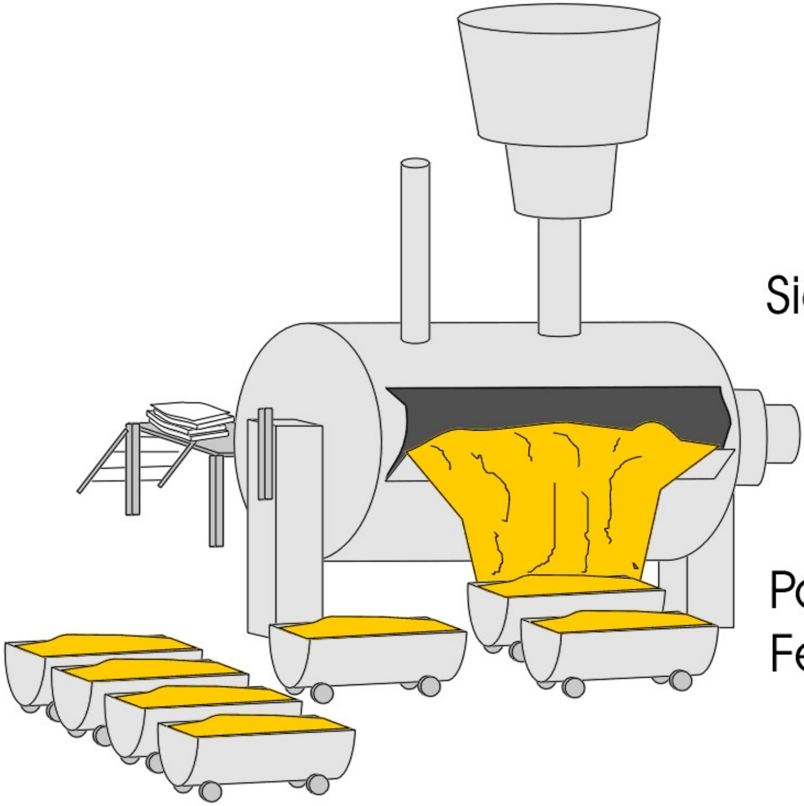
BUSINESS & TECHNICAL CHALLENGE

DOUBLE BUSINESS BY 2000



GO BACK TO FISH CRACKER SCHOOL

SNACK CRACKER PRODUCTION



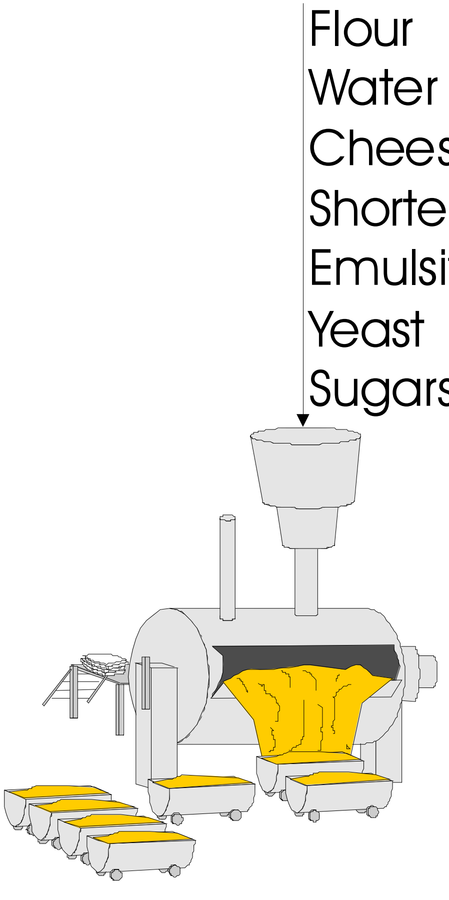
Flour / Starch & Sugar + Yeast ⟶ Ethanol, Sugar Alcohols, CO_2

GARY ISRAEL
PROCESS SOLUTIONS OF NY LLC
SEPTEMBER 19, 2008

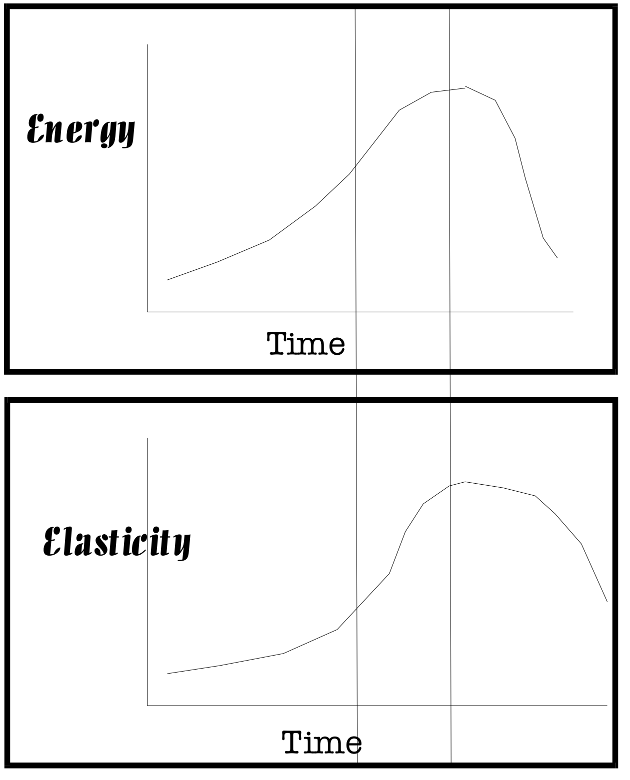
Mixing

Stage 1: Incorporation
Stage 2: Uniformity
Stage 3: Development

Flour
Water
Cheese
Shortening
Emulsifiers
Yeast
Sugars



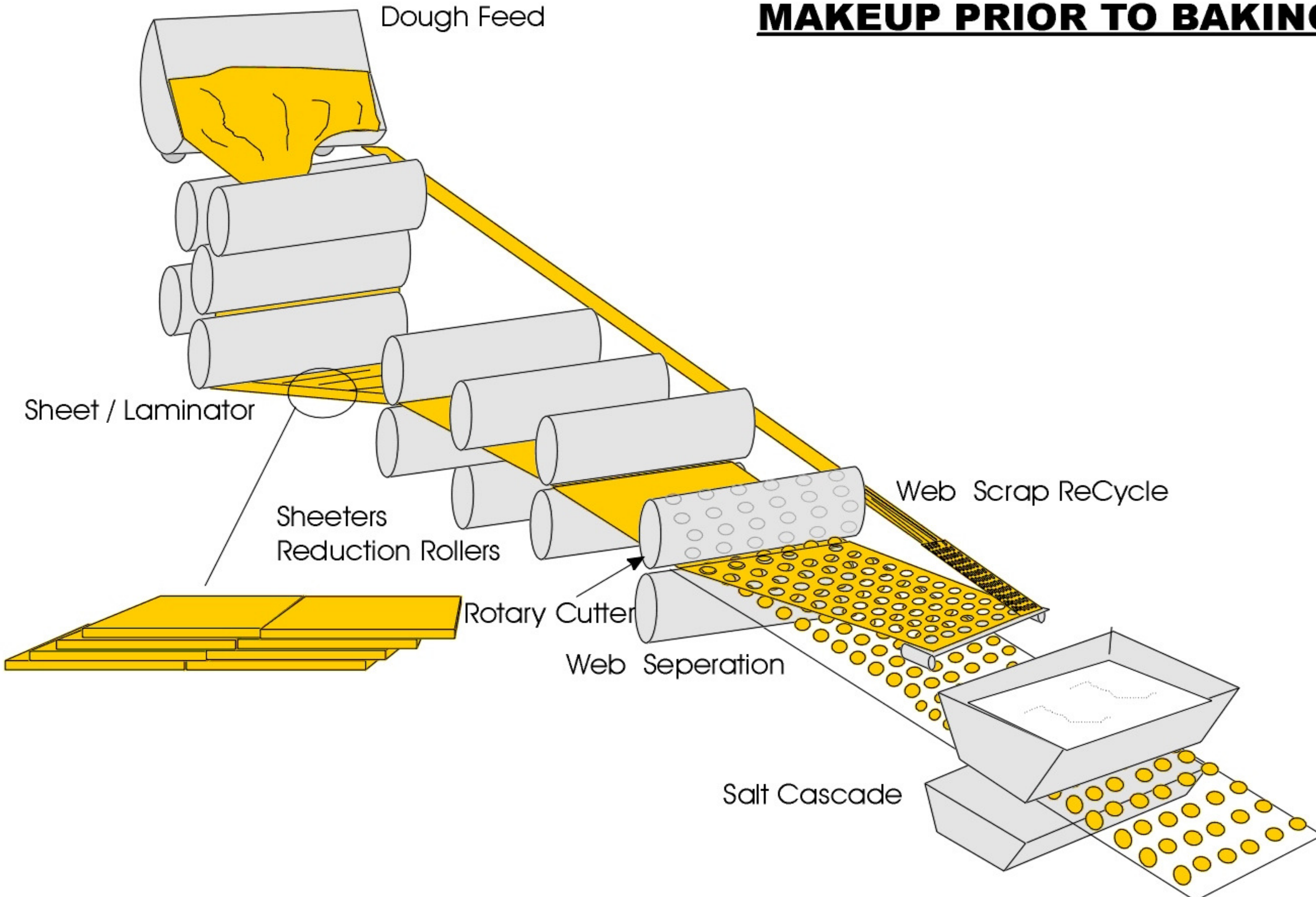
Mixing - Development



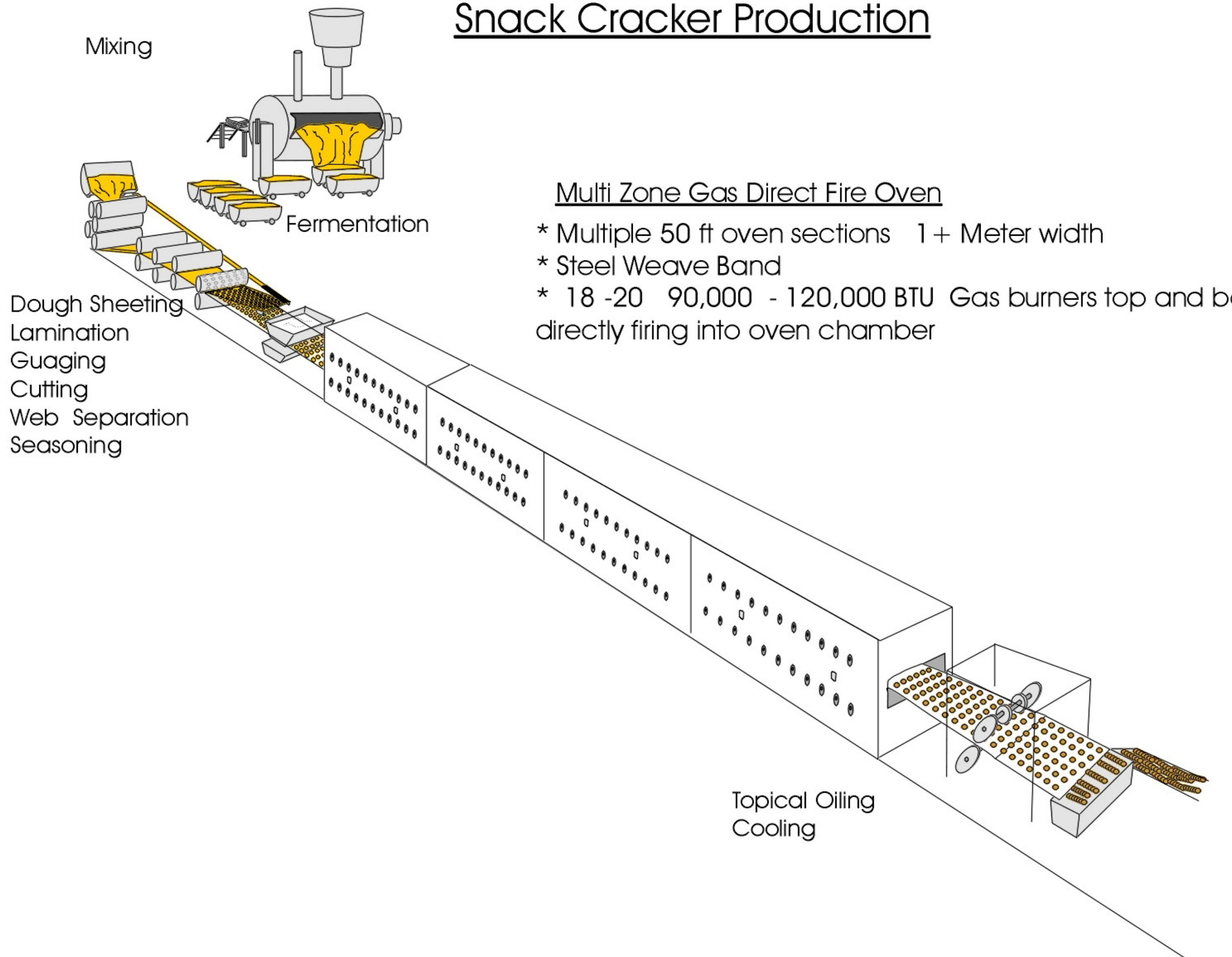
Crackers

SNACK CRACKER PRODUCTION

MAKEUP PRIOR TO BAKING



Snack Cracker Production



Multi Zone Gas Direct Fire Oven

* Multiple 50 ft oven sections 1+ Meter width
* Steel Weave Band
* 18 -20 90,000 - 120,000 BTU Gas burners top and bottom directly firing into oven chamber

CONVENTIONAL CRACKER BAKING

GDF: GAS DIRECT FIRE

Ribbon Burners in Product Chamber - Individual Control

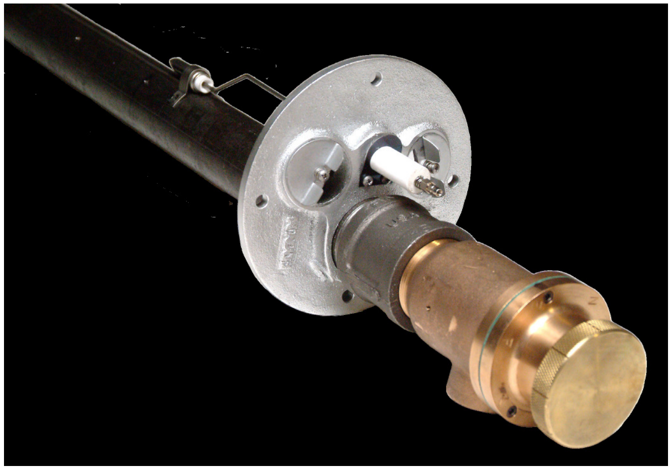
Dense Steel Weave Oven Band

Multiple Baking Zones

Humidity Control Exhaust Stacks (fan & damper)

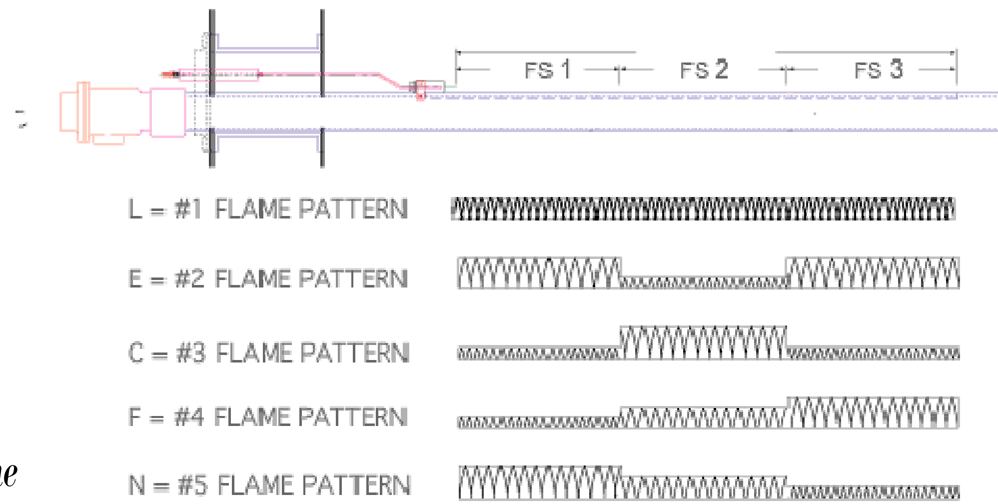
CONVENTIONAL CRACKER BAKING

Tri Zone Gas Mixture Burners



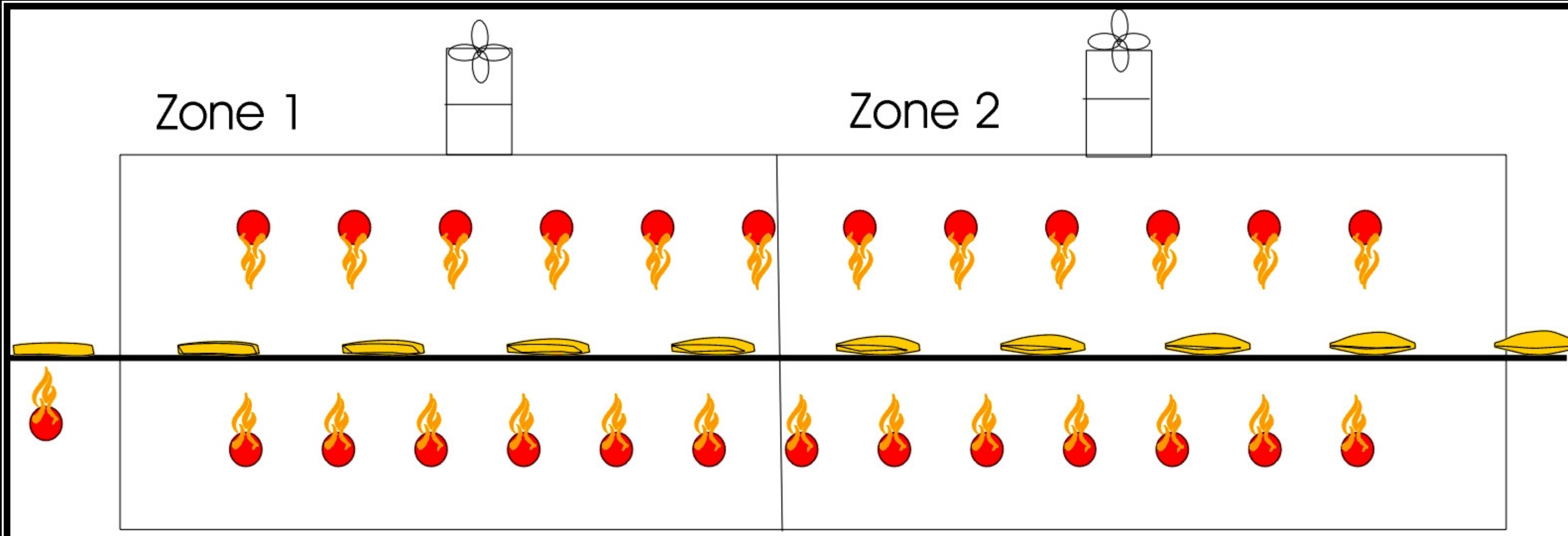
Description

The Flynn Distributor Pipe burner provides lateral flame adjustment to equalize product color and moisture across the band.



Capacity to 4,000 BTU/inch of flame space.
Turn down to 200 BTU/inch of flame space.
Flame space 16 to 215 inches.

Suitable for use with natural gas, propane and butane



Product

* Internal Temperature and heat Increase
* Partial Pressure of Water in dough increases
* Evaporation at Top Surface
* Defusion Reduction at Surface (Skinning)

Oven

* Band Heating
* Humidity Increase - Closed Exhust Damper

Product

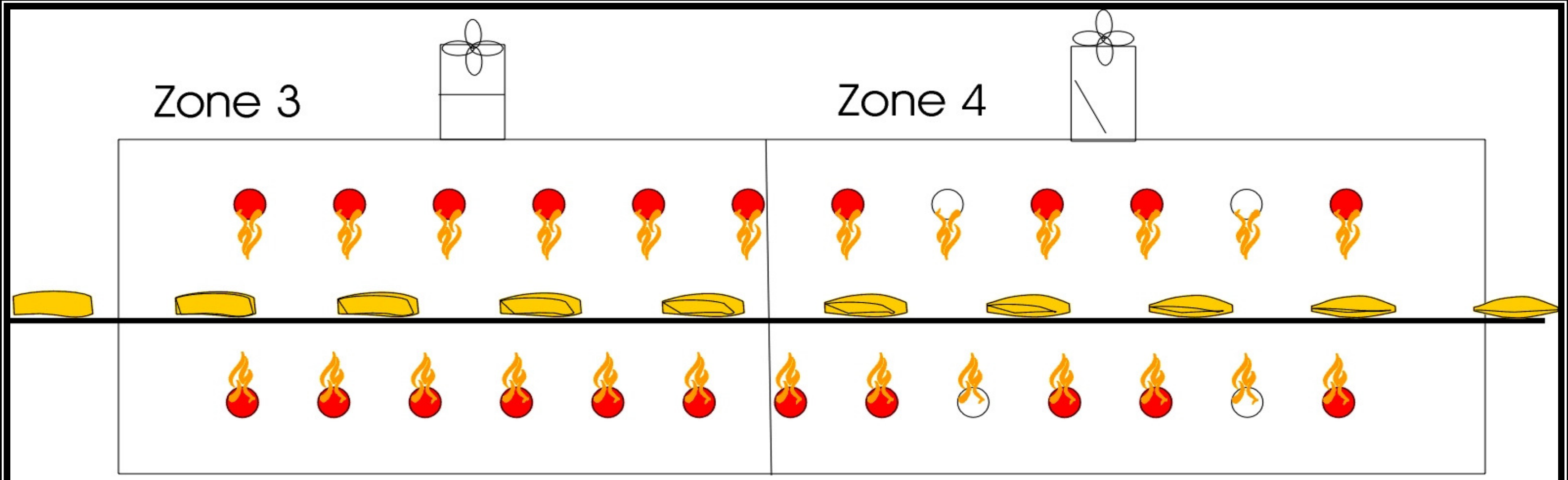
* Internal Temperature and heat Increase
* Defusion Reduction at Surface (Skinning) + Trapped steam starts layer separation
* Evaporation continues at Top Surface Product bows off band, Evaporation from bottom and sides. Puff begins at Z2.

Oven

* Band Heating - Band Temp increases
* Humidity Increase - Closed Exhust Damper

Zone 3

Zone 4



Product

* Primary purpose - Moisture redux (17% to 12%)

* Important to assure that product does not fully skin, and that scorching does not occur.

* Puff levels at maximum by end of Zone

Oven

* Band Heating
  Heat carried into top of Zone 3 from Band heat in Zone #2.
* Top and Bottom Heat influx at Maximum

* Humidity Increase - Closed Exhaust Damper

Product

** Primary purpose - Moisture redux (127% to 6%)

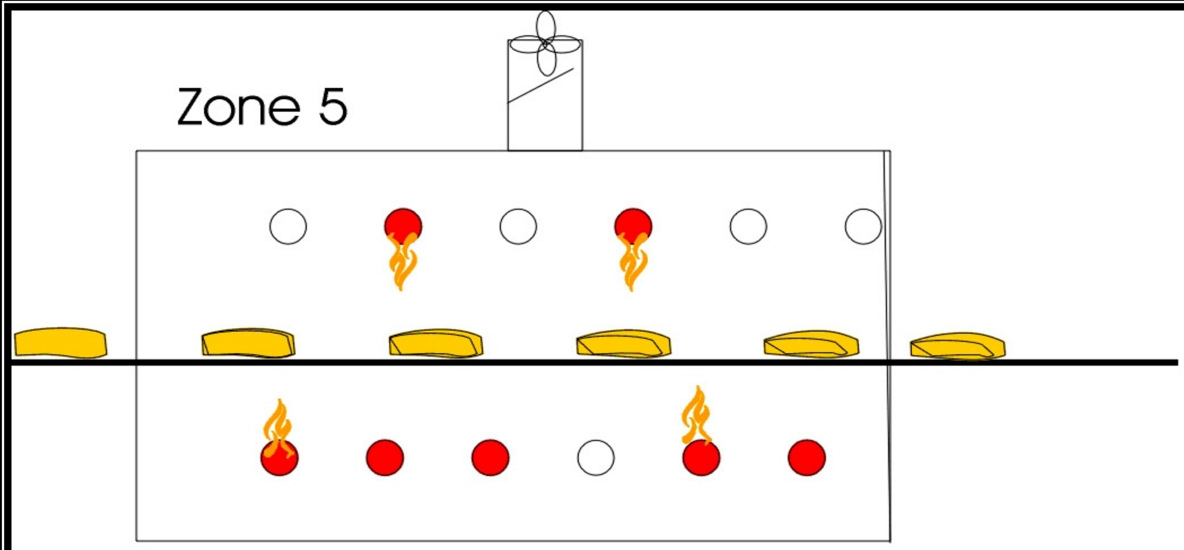
* Product Structure set by mid Zone.

* Evaporation continues at Top Surface
  Product bows off band, Evaporation from bottom and sides.

Oven

* Band Heating - Band Temp increased 75 deg

* Humidity decrease - Open Exhaust Damper Pull heat from Z 3, and reduce heat flow into Z5

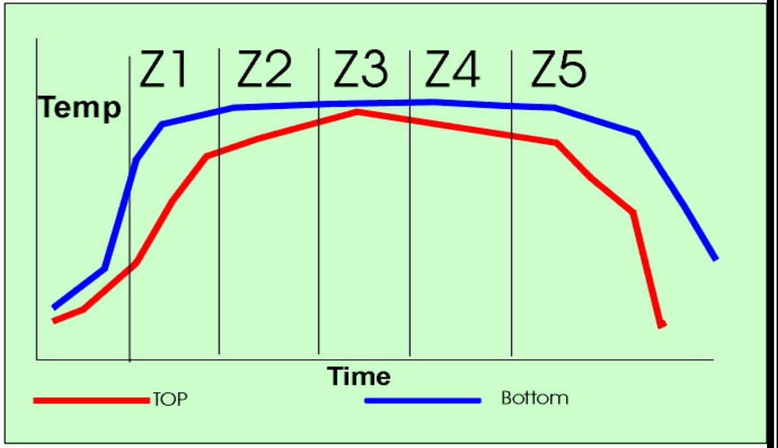


Product

* Primary purpose - Final Moisture redux (6% to 3%)

* Final Toast Flavor and color

* Important to assure that product does not scorch..



Oven

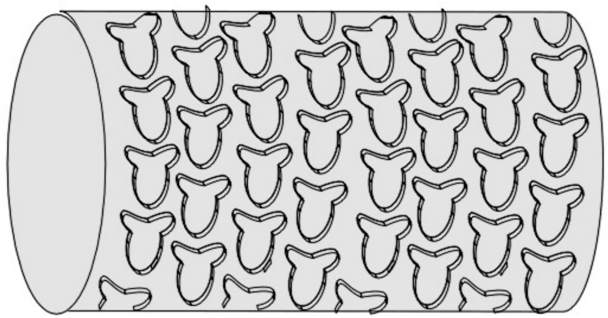
* Band Heating
  Heat carried into top of Zone 3 from Band
  heat in Zone #4.

* Humidity Decrease - Open Exhaust Damper

GARY ISRAEL
PROCESS SOLUTIONS OF NY LLC

Snack Cracker Production

Step #1: Cutter Ring Optimizations

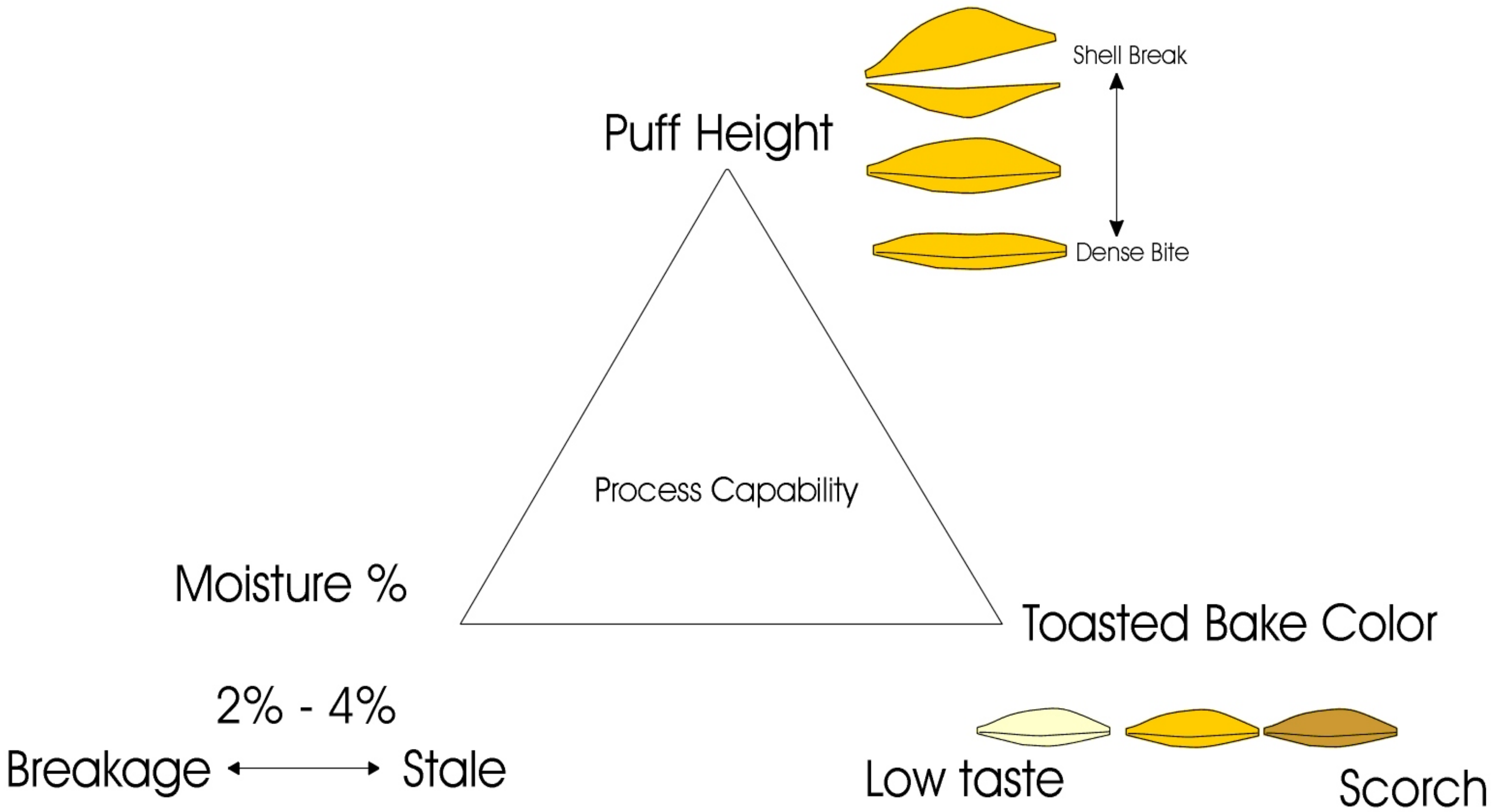


		#/Shaft	#/200' Oven @ 30RPM Crackers / Min	
Project Start	Plastic Cutters	490	14,700	
Stage 1	Brass Cutters	670	20, 100	+37%
Stage 2	Brass Cutters	873	26,190	+78%
Stage 3	Brass Cutters	912	27,360	+86%

Same 4.2 min Bake

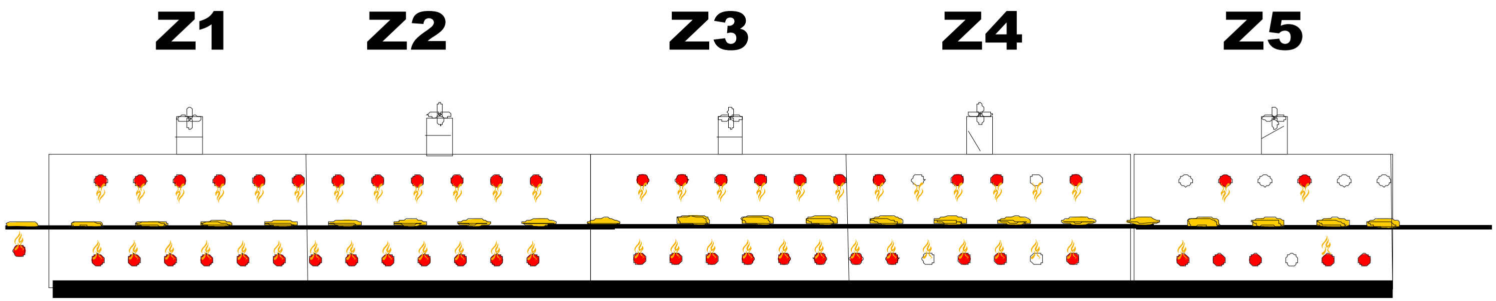
Snack Cracker Production

Step #2: Bake Optimizations



A CRACKER STORY

CHALLENGES TO DOUBLE



ORIGINAL 5 MIN. BAKE

- FULL PUFF ON 2.2 MIN
- MOISTURE EXIT

Z3	12%
Z4	6%
Z5	3%

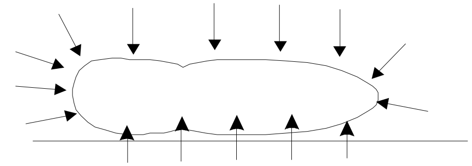
ORIGINAL TARGET 2.5 MIN. BAKE

- FULL PUFF ON 1.2 MIN
- MOISTURE EXIT

Z3	12%
Z4	6%
Z5	3%

2 x HEAT TRANSFER

ALL HEATING VIA THERMAL GRADIENTS

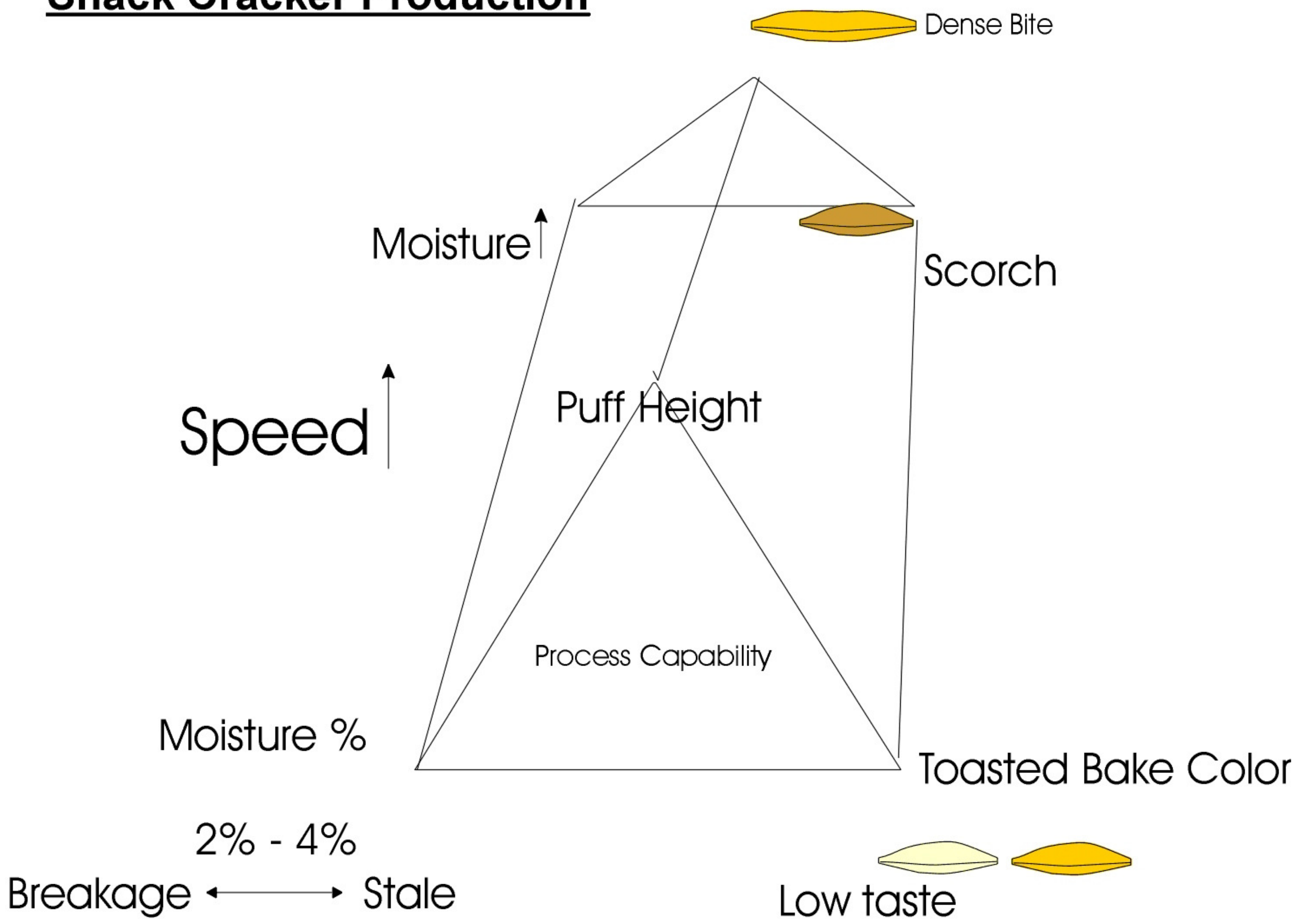


GREATER HEAT TRANSFER RATES REQ. HIGHER TEMP &/OR HIGHER HUMIDITY

SCORCH + HIGH MOISTURE

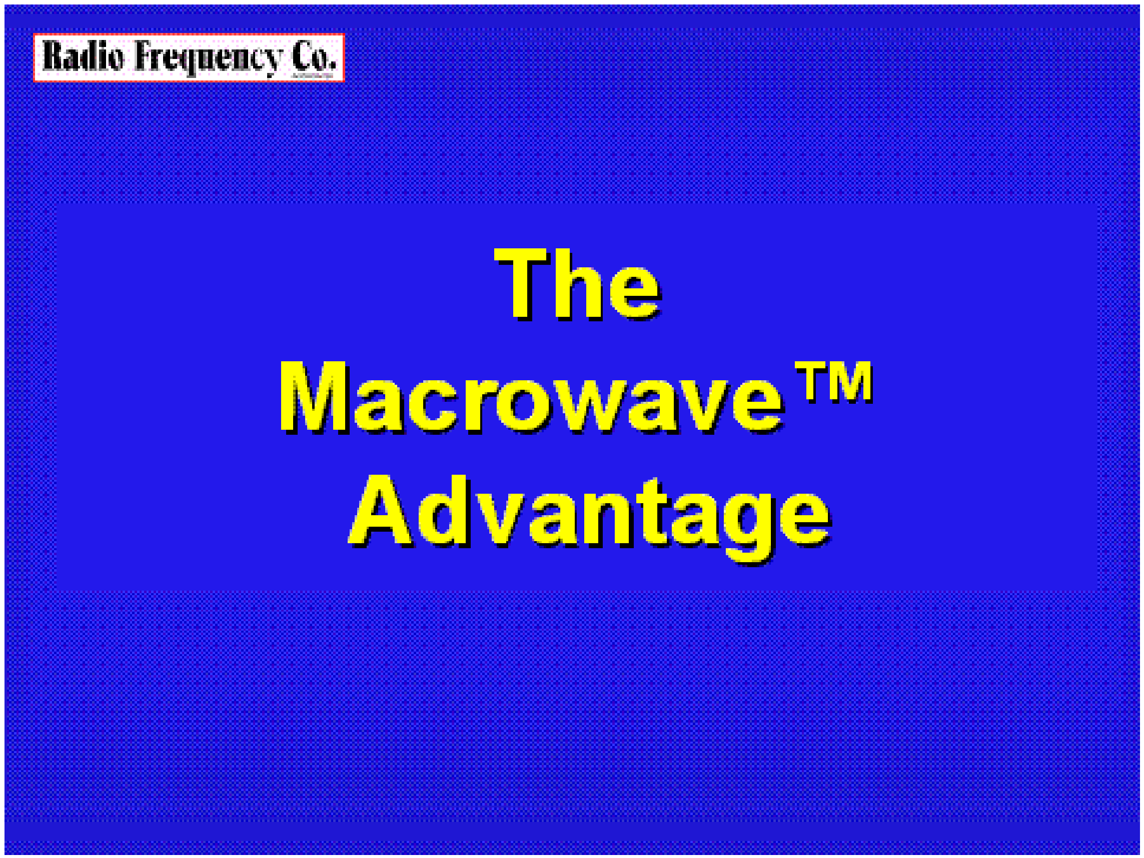
GARY ISRAEL
PROCESS SOLUTIONS OF NY LLC
SEPTEMBER 19, 2008

Snack Cracker Production

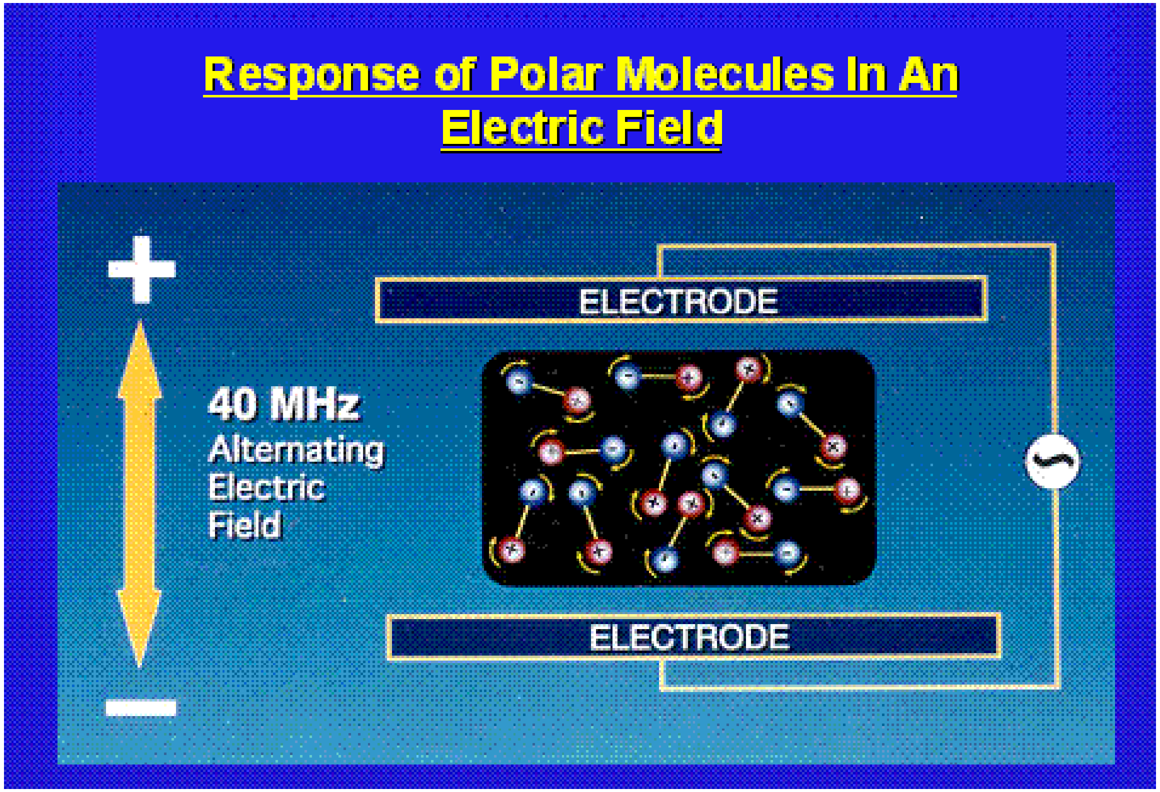


GARY ISRAEL
PROCESS SOLUTIONS OF NY LLC
SEPTEMBER 19, 2008

RADIO FREQUENCY DRYING



RADIO FREQUENCY DRYING



TARGETING POLAR (H_2O) MOLECULES

RADIO FREQUENCY DRYING

Dielectric Materials + Electromagnetic Field HEAT

Some portion of the electromagnetic energy will go through a change of state and be dissipated as heat with the dielectric.

Conversion of energy = F (atomic and molecular structure of the material, frequency, field strength)

Alternating electromagnetic field

•Displacement of the polarized components as re-alignment with the positive and negative oscillations occurs.

•Friction on an atomic or molecular level = Heat generated in the dielectric.

Heat generated in a dielectric

$$P = .555\ f\ E2\ e' \ (\tan \delta \ x\ 10\text{-}6)$$

P = Heat generated in watts/cm3
f = Frequency of the electromagnetic field MHz/sec
E = Field strength in Volts/cm
e' = Dielectric constant of the material
$\tan \delta$ = Loss tangent, Ie/Ic

RADIO FREQUENCY DRYING

Heat generated in a dielectric

$$P = .555\ f\ E2\ e'\ (\tan\delta \times 10\text{-}6)$$

P = Heat generated in watts/cm3
f = Frequency of the electromagnetic field MHz/sec
E = Field strength in Volts/cm
e' = Dielectric constant of the material
tan δ= Loss tangent, Ie/Ic

Materials with higher "loss tangents" and higher "dielectric constants" heat more readily
(Multiply the (loss tangent) by the (dielectric constant) we obtain by definition the "loss factor",

The higher the loss factor of any specific material, the more efficiently it will heat in an alternating RF field.

Materials with loss factors of

- .3 or greater are considered excellent candidates for RF heating,
- between .2 and .3 good candidates,
- <.2 but> .1 fair to poor.

Raw Dough - Bound Water ------ Poor
Dough > 180 F Good !

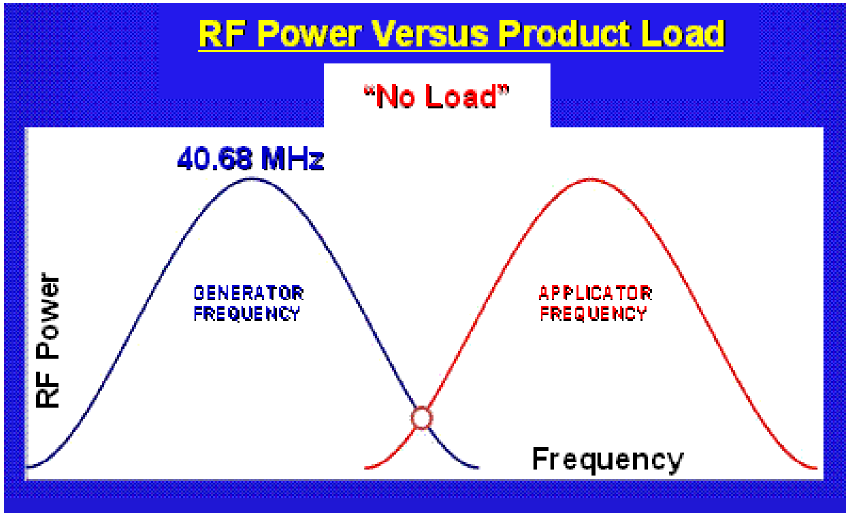
GARY ISRAEL
PROCESS SOLUTIONS OF NY LLC
SEPTEMBER 19, 2008

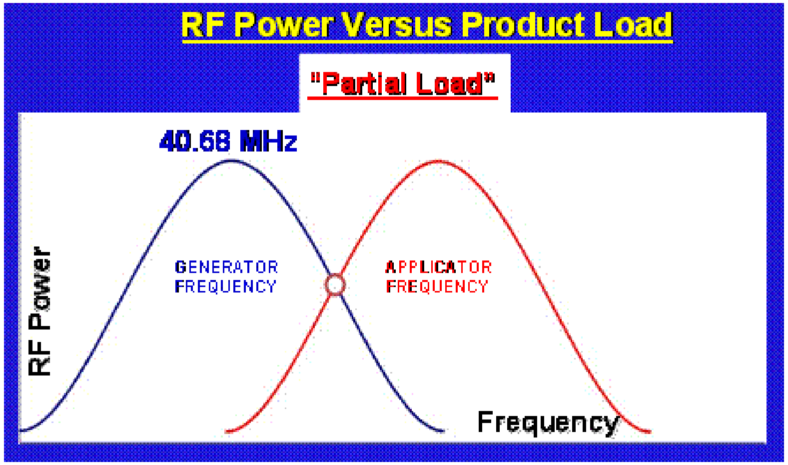
RADIO FREQUENCY DRYING

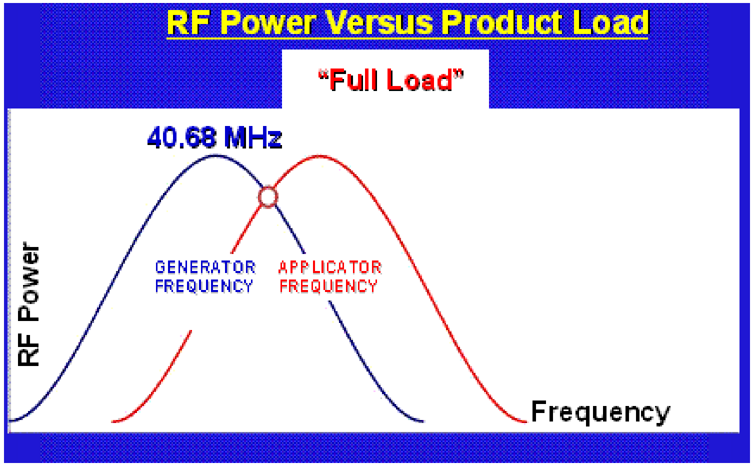
Typical Dielectric Heating Frequencies Reserved For Industrial Use (ISM)

- 13.56MHz + 0.05%
- 27.12MHz + 0.50%
- 40.68MHz + 0.05%

RADIO FREQUENCY DRYING







RADIO FREQUENCY DRYING

Radio Frequency Co.

Advantages of Macrowave™ Heating

- Automatic Response to Product Load
  - Power Consumed Proportionate to Product Load
  - Unlike Microwave, there is no need for Energy Wasting Dummy Loads to Accommodate Gaps in Production
  - Inherent Versatility for Multiple Product Lines
- Uniform Application of Heat to the Product Load
  - Longer Wavelength Eliminates Preferential Surface Heating
  - Energy is Applied Uniformly Across Product Width

$$ CAPITOL ADVANTAGES

RADIO FREQUENCY DRYING

Radio Frequency Co.

Macrowave

75kW Continuous Wet Granulation Drying System

Radio Frequency Co.

Macrowave

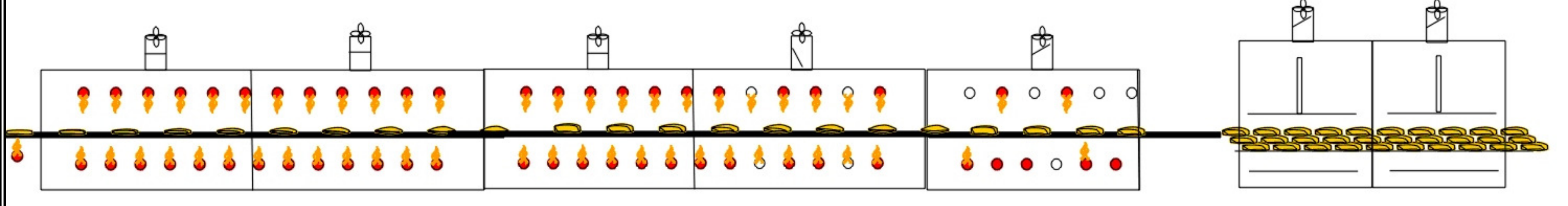
300kW Catalytic Converter Substrate Drying System

ALTERNATE BAKING OPPORTUNITIES

STANDARD: GDF THERMAL — EXTERNAL HEAT

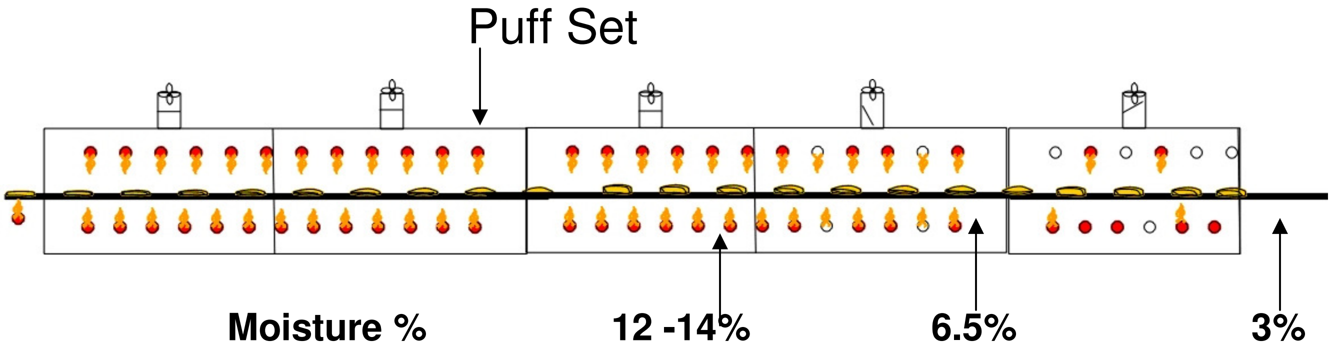
RADIO FREQUENCY — INTERNAL HEAT

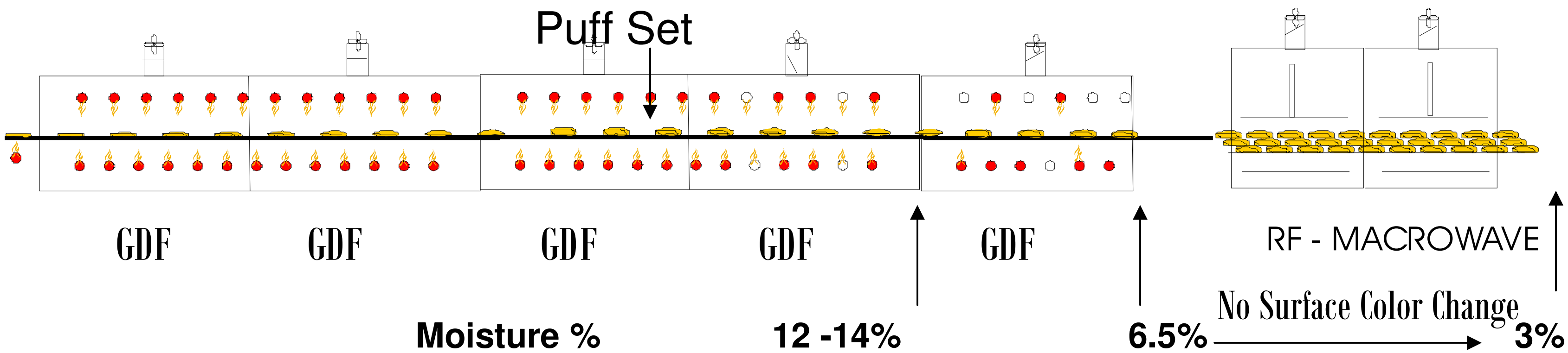
HYBRID OVEN BAKE



NO SCORCH + MOISTURE CONTROL

GARY ISRAEL
PROCESS SOLUTIONS OF NY LLC
SEPTEMBER 19, 2008





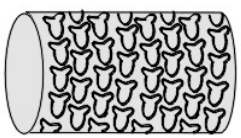
INCREASE SPEED WITH

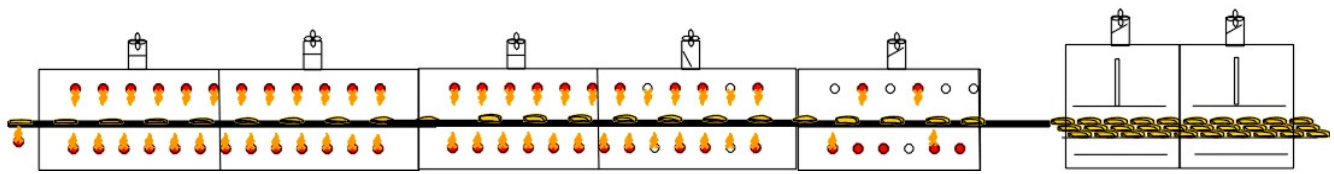
NO SCORCH + MOISTURE CONTROL

DOUBLE THE OUTPUT

2+ YRS

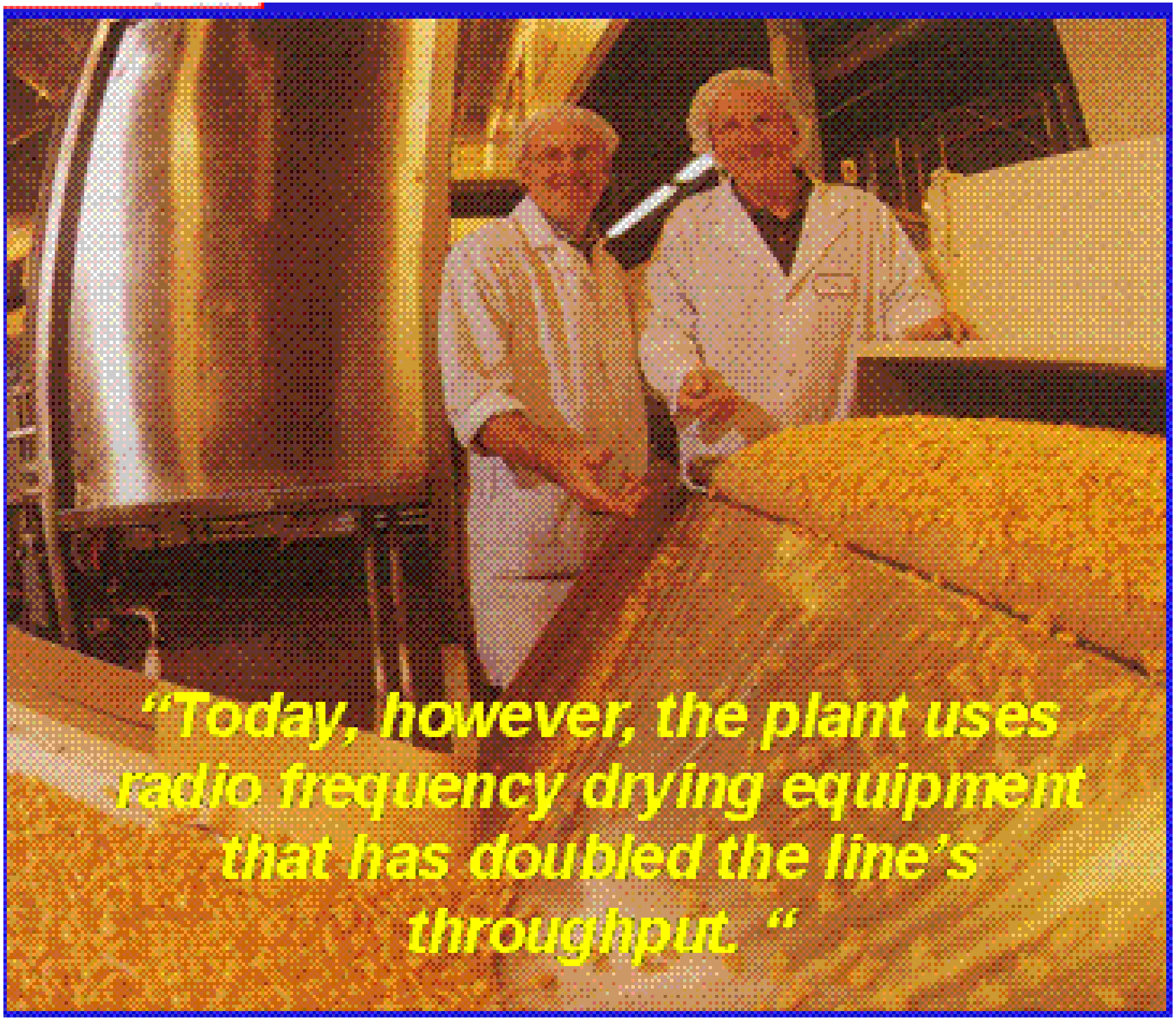
CUTTER OPTIMIZATIONS + HYBRID OVEN BAKE





		#/Shaft	RPM	Bake-Min	Crackers / min.	
Project Start	Plastic Cutters	490	30	4.25	14,700	
Stage 1	Brass Cutters	670	30	4.25	20, 100	+37%
Stage 2	Brass Cutters	873	30	4.25	26,190	+78%
Stage 3	Brass Cutters	912	30	4.25	27,360	+86%
Stage 4	Hybrid Bake	912	37	3.44	33,744	+129.%
Stage 5	Hybrid Bake	912	41	3.11	37,392	+154 %
Stage 6	Hybrid Bake	912	49	2.6	44,688	+ 204 %

GARY ISRAEL
PROCESS SOLUTIONS OF NY LLC
SEPTEMBER 19, 2008



GARY ISRAEL
PROCESS SOLUTIONS OF NY LLC