

ELEMENT ONE: An electro-mechanical reactor environment (EMRE) which provides an effective “Phase Space” environment to: 1) unpack the GTRP, re-set the vulcanization pre-cursor for 2) subsequent sulfidic bridge realignment, 3) with minimal alteration to the native, elastomer-filler matrix.

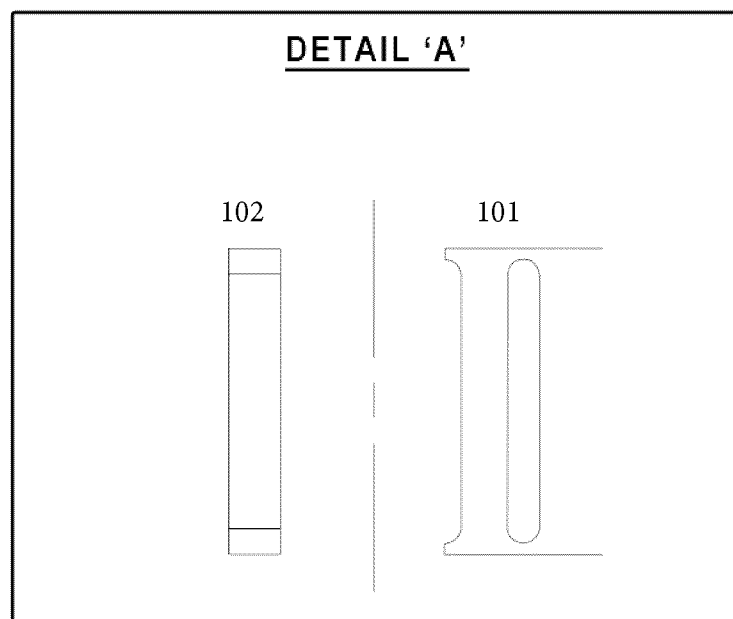
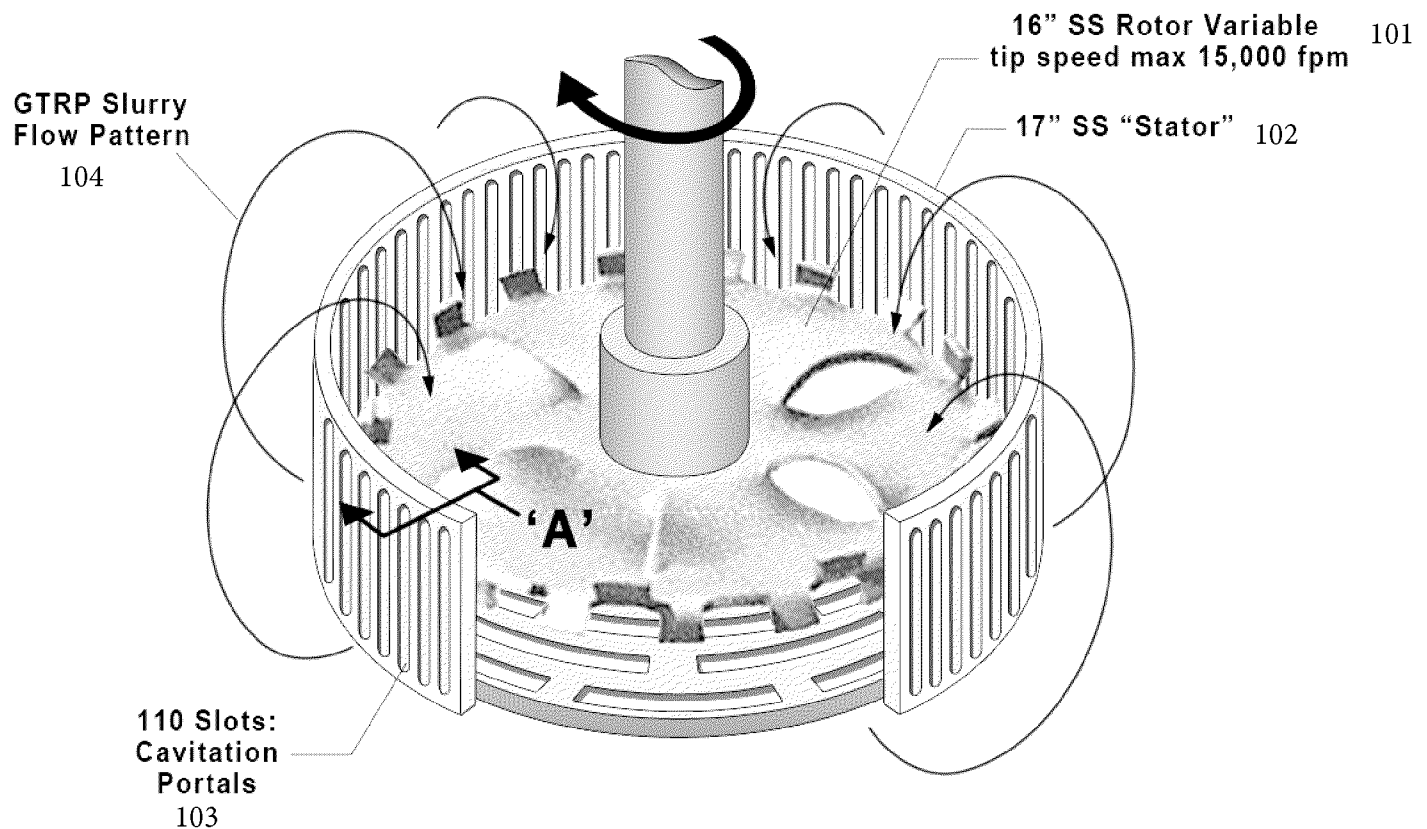


FIG. 1

ELEMENT TWO: Prepare GTRP Slurry for EMRE

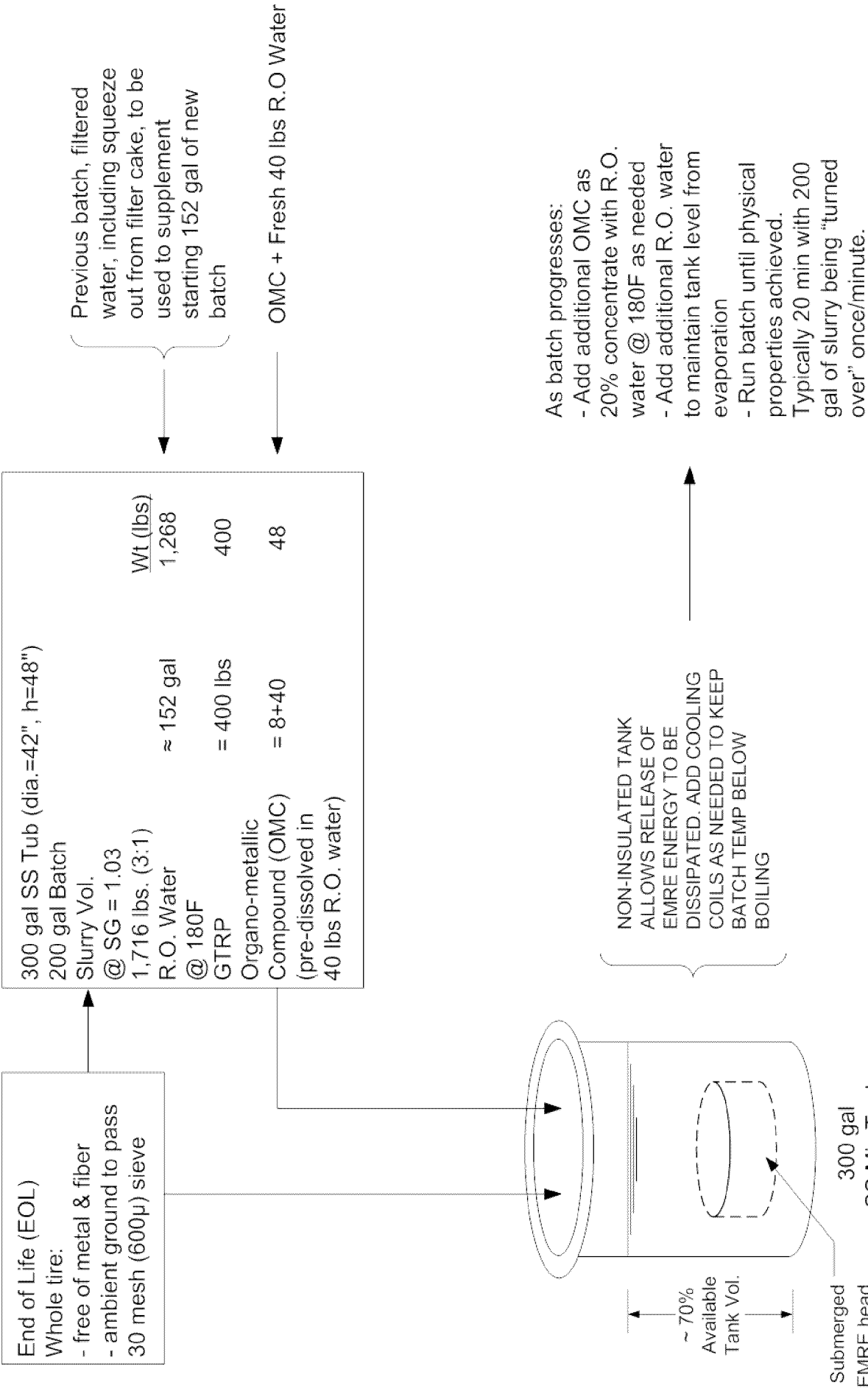


FIG. 2

ELEMENT THREE: GTRP Traverses ‘Phase Space Tunnel’; differential-cyclical, mechanical stress and steric field-polarization.

TIMELINE	0.000 sec 0.0007 sec +0.0012 sec																							
LINEAR DISTANCE	0.50" → STATOR COMPRESSION → 0.25" → EXIT STATOR → ≤ 20' → RECIRCULATION PATTERN*																							
GTRP GEOMETRY	$d \leq 600\mu$ $w/l \approx 3.1$ $w/l \approx 6.1$ $w/l \approx 3.1$ $d \leq [600\mu] - \left[(600) \left[\frac{1}{20} \right] N \right]$																							
VELOCITY	GTRP Recirculation Speed 0.25 MPH Tip Speed ~ 90 MPH GTRP Enters Compression Gate ~ 90 MPH Cavitation Range ~ 90 MPH ~ 400 MPH Average Increase ~ 245 MPH																							
ACCELERATION PROFILE	~ 5,800 G's 0 – 52,700 G's																							

* 600μ particle with ~1200 transverse sulfidic-crosslinks; 60 regenerated vulcanized pre-cursor sites/pass.

FIG. 3A

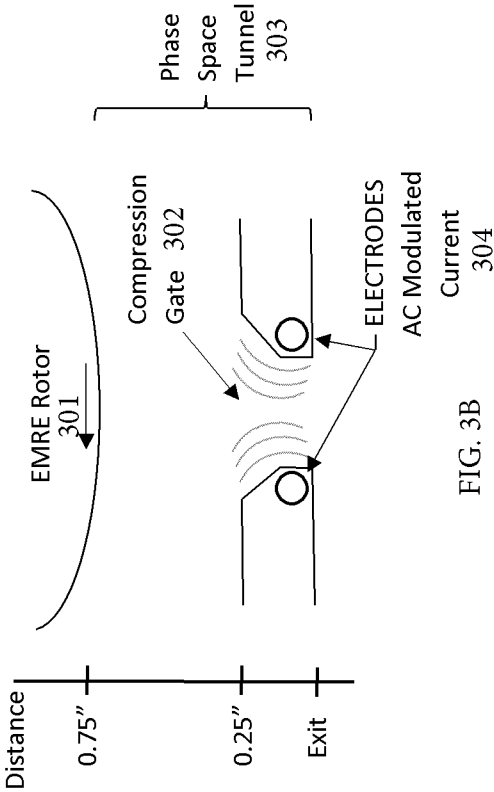
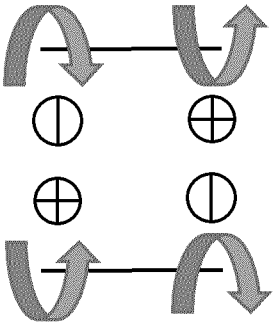


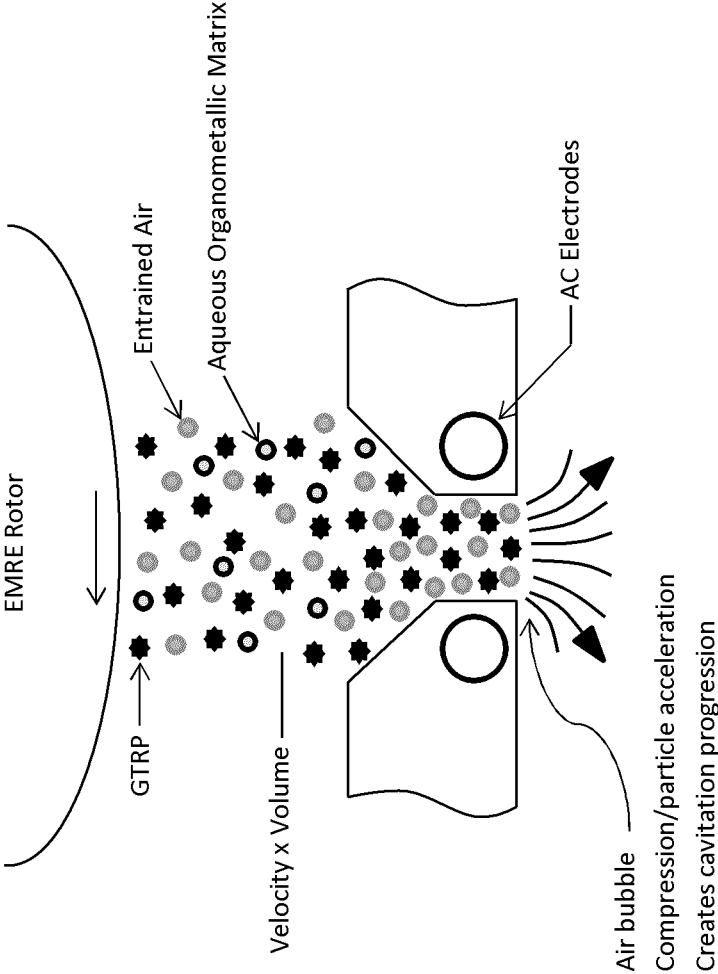
FIG. 3B



Trampoline effect of rapid compression-stretching-decompression; and/or oscillating AC current, enhances steric effect of repulsion between overlapping electron clouds with subsequent accelerated delamination of GTRP bound matrix.

FIG. 3C

ELEMENT FOUR: Engineered, Cavitation-Induced, Acoustic Shockwave.



As slurry exits, lower pressure completes cavitation cycle with implosion of air cavity.

Extreme temperature and pressure differential excursion within cavitation cone in range of:

Temperature: $10^2 - 10^{15}$ °F

Acoustic Wave Velocity: 60 – 180 m/sec

Time Interval: $10^3 - 10^8$ (sec⁻¹)

Changing rotation speed of EMRE Rotor and/or slurry viscosity and/or stator gap allows manipulation of energy “leverage” within “Phase Space” .

FIG. 4A

GTRP SLURRY & EMRE PROCESS
CONTROL VARIABLES

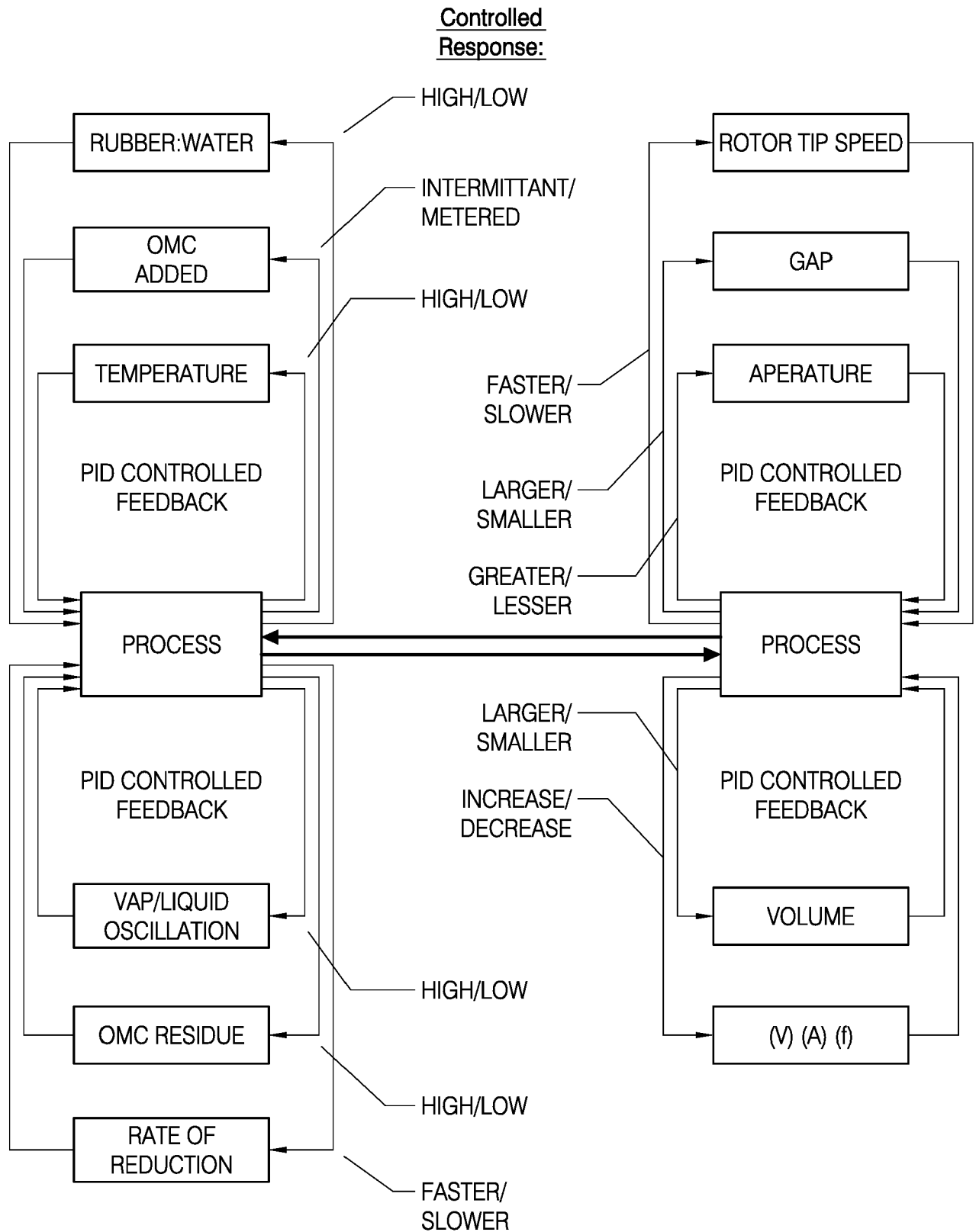


FIG. 4B

COMPONENT	METHOD OF CONTROL	ABBREV.	FIRST ORDER RESULT		DATA GATHERING HARDWARE
RUBBER-TO-WATER DENSITY	PRE-BATCH RECIRCULATION RESERVOIR MIX	R:W	HIGHER: LOWER:	INCREASE PHASE SPACE TUNNEL PARTICLE COLLISION LOWER REACTOR YIELD; MORE PRECISE END PRODUCT/ENERGY FASTER BATCH TIMES W/LARGER FINAL PARTICLE SIZE EFFICIENT-TARGETED OMC METATHESIS	BATCH MASS; VOL PROGRAMMABLE ELEMENT VISCOSITY DELTA OUTPUT
CHEMICAL (OMC) SEQUENCE	INTERMITTANT BULK 'DROPS' OR METERED	OMC ADDED	INTER-MITTANT; METERED:		METERING PUMP CONTROLLED BY APP
SLURRY TEMPERATURE	RECIRCULATION RESERVOIR JACKET TO HEAT &/or COOL	TEMP.	HIGHER: LOWER:	INCREASE OMC COORDINATION COMPLEX FUNCTION; PLUS PENETRATION OF AQUEOUS MEDIUM TO PARTICLE CORE DEFER PHASE SPACE PARTICLE MANIPULATION TO CAVITATION EFFECT & PHOTON BLOCKADE	MULTI-POINT SENSORS TO CORRELATE W/ OTHER SENSOR INPUT FOR INTEGRATED OPTIMIZATION
SLURRY PRESSURE ACHIEVED WHERE SLURRY PUMPED THROUGH (PCMR) IN-SERIES	PARALLEL CONTINUOUS FLOW MICRO-SYNTHESIS REACTOR 2ND STAGE SERPENTINE PIPE MODULE WHERE SLURRY TEMPERATURE: PRESSURE MANIPULATE VAPOR/LIQUID PHASE OSCILLATIONS	VAPOR LIQUID OSCILLATION	HIGHER: LOWER:	AUGMENTS PHOTON BLOCKADE PRESERVES ENTROPY LOSS W/ MORE PARTICLE SIZE REDUCTION/UNIT OF INPUT ENERGY DEFERS PHASE SPACE PARTICLE MANIPULATION TO ELECTROMAGNETICS OF DUAL ELECTRODE ELEMENT IN STATOR SLOT	TEMPERATURE & PRESSURE SENSORS PLUS IRIS VALVE CONTROLS TO SET NUMBER OF PRESSURE GRADIENT CHANGES DURING PCMR PASSAGE TIED TO MASTER PROGRAM
POST REACTOR PARTICLE DE-WATERING SELECTION	FILTER-PRESS THEN DEHYDRATE OR FULL DEHYDRATION	OMC RESIDUE	HIGHER: LOWER:	REMAINING REACTIVE OMC ASSISTS IN HIGH SHEAR COMPOUNDING INTO MACRO-STRUCTURE BY DRY METATHESIS OF 'ORPHAN' BONDS REDUCES OMC DEMAND IN SUBSEQUENT BATCH; FASTER POST REACTOR PROCESS TIME	MONITOR X LINK DENSITY; TENSILE STRENGTH AND RESILIENCE PROPERTIES OF COMPOUNDED RUBBER MACRO-STRUCTURE THEN CORRELATE FOR EFFICACY
PARTICLE SIZE REDUCTION; AND RATE OF REDUCTION	USE ALL OTHER SYSTEM VARIABLES IN BOTH SLURRY CONTROL AND EMRE CONTROLS	RATE OF REDUCTION	FASTER: SLOWER:	SHORTER BATCH INTERVALS WITH ENERGY ECONOMIES W/O LOSS OF FINAL PURPOSE OF PROCESS REDUCED POST-PROCESSING OF DRY, REACTOR MODIFIED GTRP	SAME AS V. SAMPLING, DURING BATCH W/ PARTICLE SIZE ANALYZER AND PHYSICAL SMEAR TEST OVER 5μ GRATING TO DETERMINE OUTER DIMENSION AVERAGE AND PARTICLE CORE RESILIENCY

FIG. 4C.

COMPONENT	METHOD OF CONTROL	ABBREV.	FIRST ORDER RESULT		DATA GATHERING HARDWARE
SPEED ROTOR TIP RPM	VARIABLE FREQUENCY DRIVE	ROTOR TIP SPEED	FASTER: SLOWER:	MORE DISTORTION REDUCED CAVITATION EFFECT	HARD WIRED, PROGRAM FREQ, RPM, AMP, VOLT: TO MOTOR
ROTOR TIP-TO- STATOR DISTANCE	MECHANICALLY ESTABLISHED PRIOR TO RUNNING	GAP	LARGER: SMALLER:	INCREASE MIXING INGREDIENT & REACTION TIME MAINTAIN PARTICLE VELOCITY & MAXIMIZE CAVITATION EFFECT	CHART RESULT FOR DIFFERENT GAPS VS FINISHED PRODUCT AS DATA ENTRY POINT - PRGM
STATOR GAP APERATURE SHAPE & AREA	ADJUSTABLE, CONCENTRIC DUAL SHELL PLATES SET-UP BEFORE RUNNING OR ADJUSTABLE ON-THE- FLY	APERATURE	GREATER: LESSER:	ACCOMMODATE SMOOTH FLOW OF LARGE PARTICLE AT START OF REACTOR RUN IMPROVE CAVITATION EFFECT OF SMALLER PARTICLE LATE IN RUN	PRE-BATCH FUNCTION TO BE DETERMINED AND ENTERED AS A PROGRAMMABLE ELEMENT/APP
RECIRCULATION RESEVOIR VOLUME	PRE-SET VOLUME FOR SINGLE OR MULTI- STAGE PROCESS TARGET(S)	VOLUME	LARGER: SMALLER:	IMPROVED DIELECTRIC RELAXATION; UNIFORM GROUND STATE HIGHER PHASE SPACE TUNNEL ENERGY RETENTION	PRE-BATCH FUNCTION; CALCULATE AS PROGRAM ELEMENT APP
STATOR APERATURE PASSAGE WAY EMBEDDED, OVAL ELECTRODE GATE WIRED TO HIGH VOLTAGE AC SOURCE	POWER CONTROL MODULE WITH VARIABLE: FREQUENCY, VOLTAGE, AMPERAGE CONTROLS (V) (A) (f) = 3 VARIABLES	(V) (A) (f)	VARIABLE INCREASE: VARIABLE DECREASE:	RAPID PHOTON BLOCKADE INFILL & CAPACITY TO TRIGGER PHASE CHANGE(S) ENHANCE PARTICLE CORE ELECTRON CLOUD REPLUSION; INNER DELAMINATION	VOLT AMP FREQUENCY METERS; TO BE INTEGRATED INTO PROGRAMMABLE APP

FIG. 4D

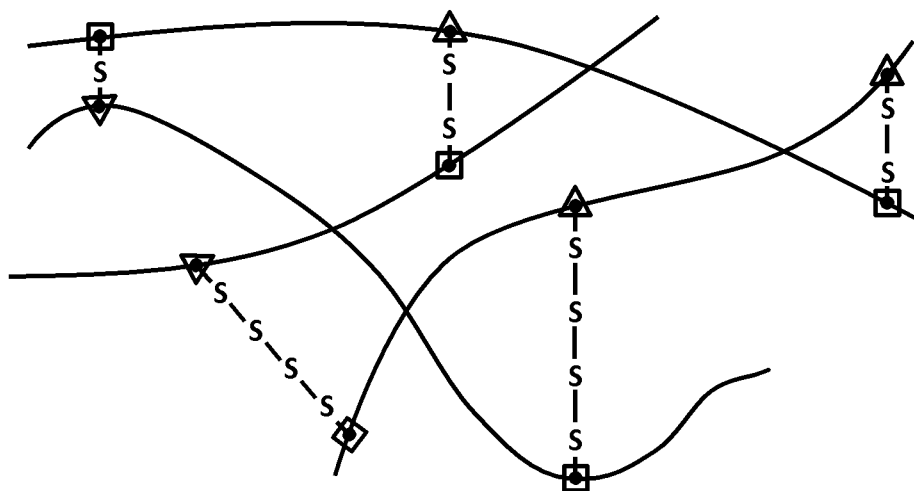
ELEMENT FIVE. Chemotactic sulfidic-bridge-tether-effect (SBTE)

FIG. 5A

- Pendant vulcanizate precursor @ predominant methyl carbocation (originally forms @ ~140°C)
 Completed vulcanization @ allylic carbocation (subsequently forms @ ~160°C)

CARBOCATION STABILITY

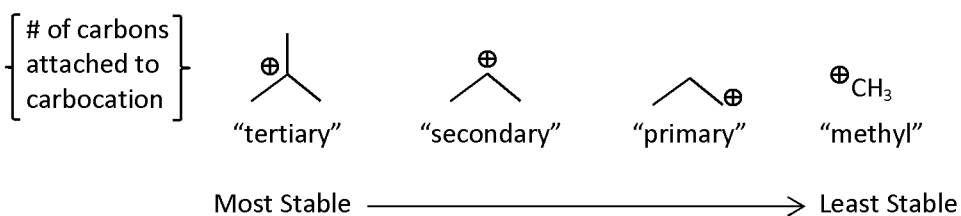


FIG. 5B

ELEMENT SIX: Chemical Reaction Products and Timeline

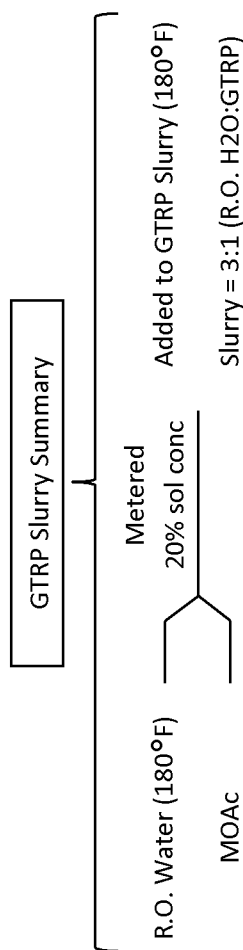


FIG. 6A

Organometallic compound dissolved in water develops ligands, including transient, aquo metal formations.

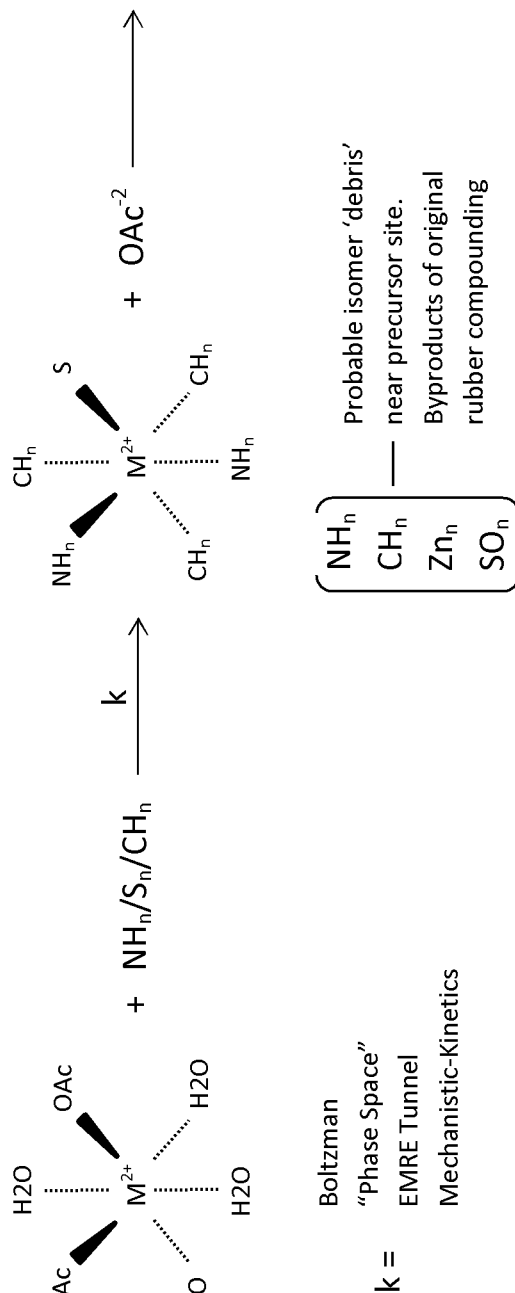


FIG. 6B

- Metal-Acetate Ion
- Dissociative Substitution @ methyl carbocation/
- 1. disrupts vulcanization precursor
- 2. insertion forms new functional site at elastomer pendent structure for subsequent sulfidic bridge realignment
- 3. $\text{O}_2^+ \rightarrow \text{CO}_2$ with "Phase Space" particle charged carbon aggregate
- 4. strong $\text{M}^{2+} - \text{S}^{-2}$ interaction forms a precipitate
- 5. liberates rigid sulfidic bridge to 'tether' state bound only at original allylic carbocation

$k =$ Boltzman
 "Phase Space"
 EMRE Tunnel
 Mechanistic-Kinetics

ELEMENT 7: Fabricate Monolithic, Rubber Macro-Structure

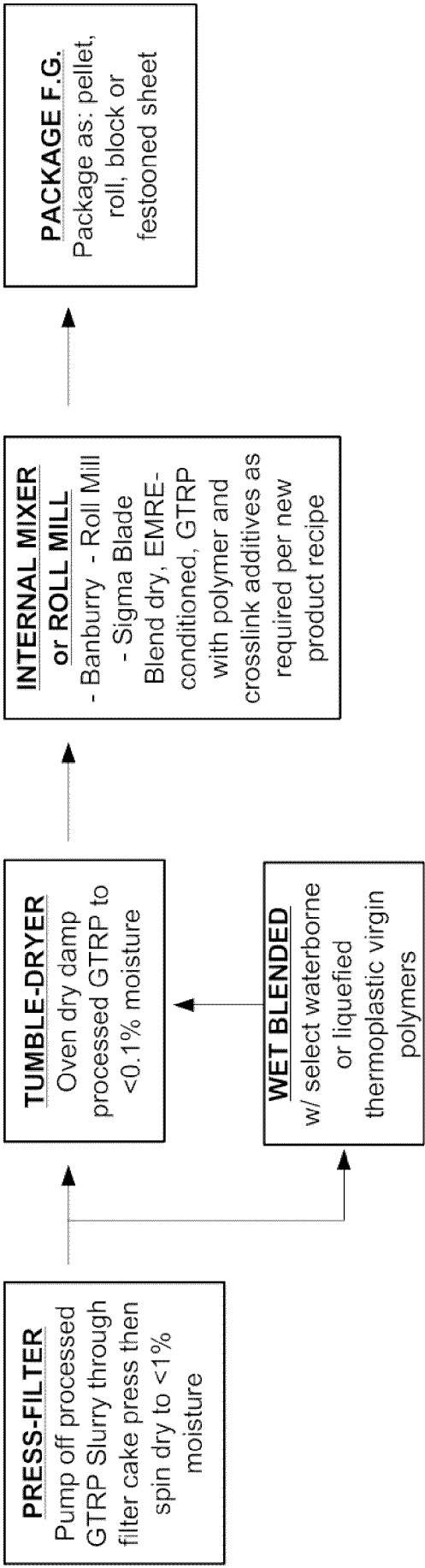


FIG. 7A

STAGE 1: Ground State Vulcanized GTRP
STAGE 2: EMRE-Conditioned GTRP
STAGE 3: Regenerated Interpenetrating Elastomer Network

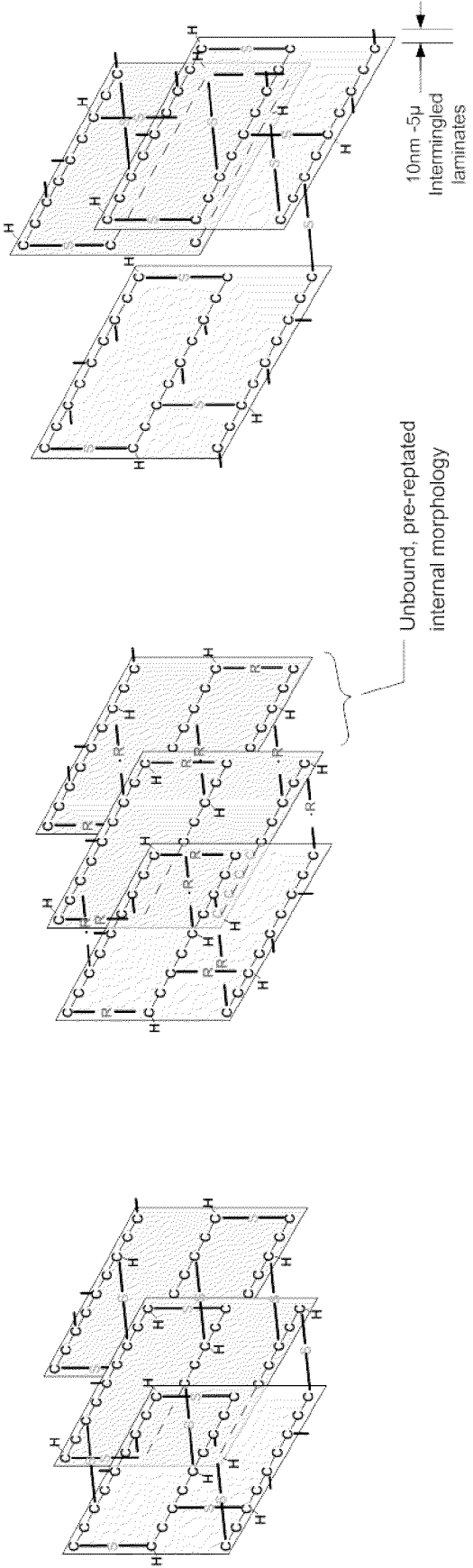


FIG. 7B

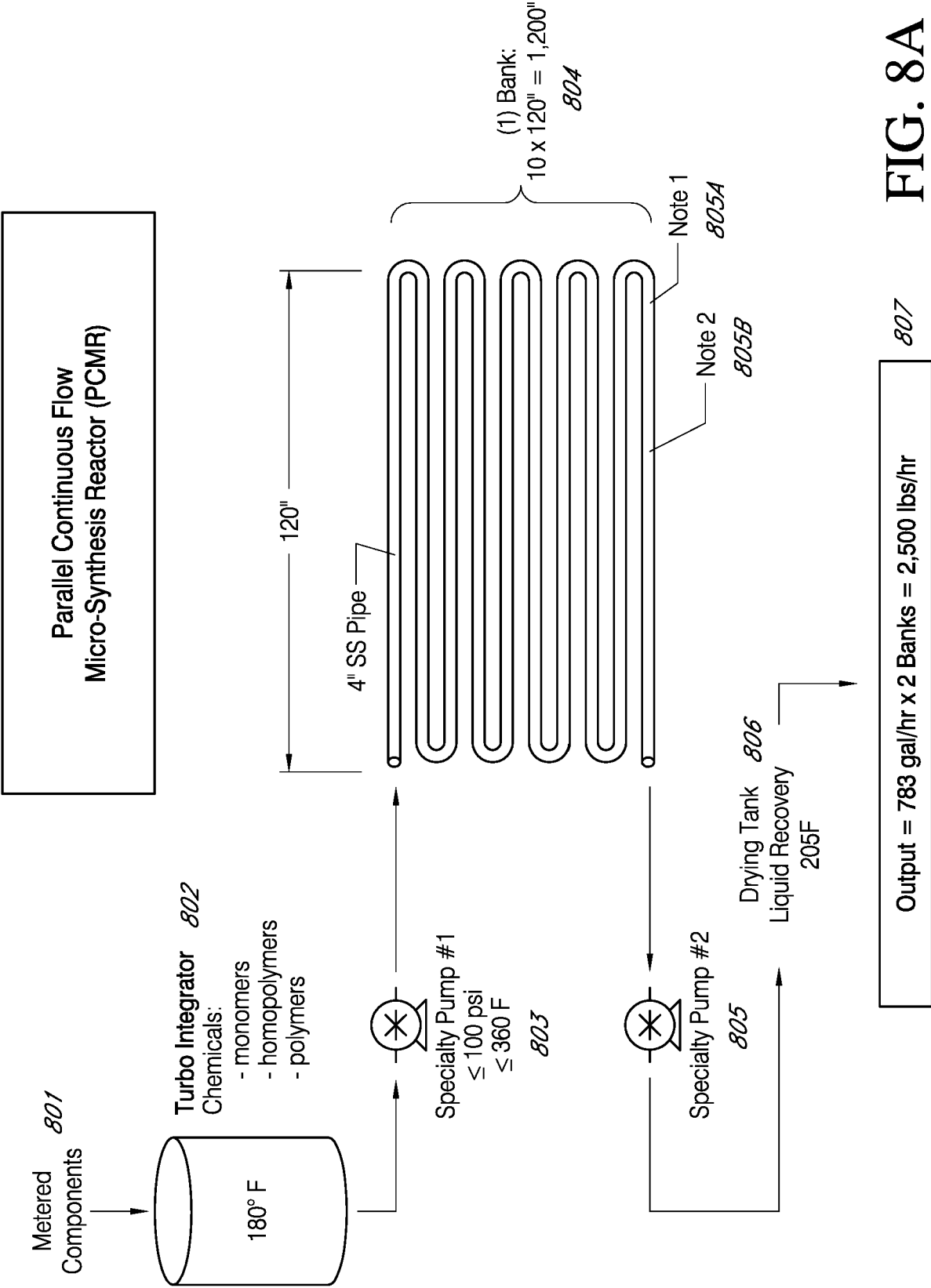


FIG. 8A

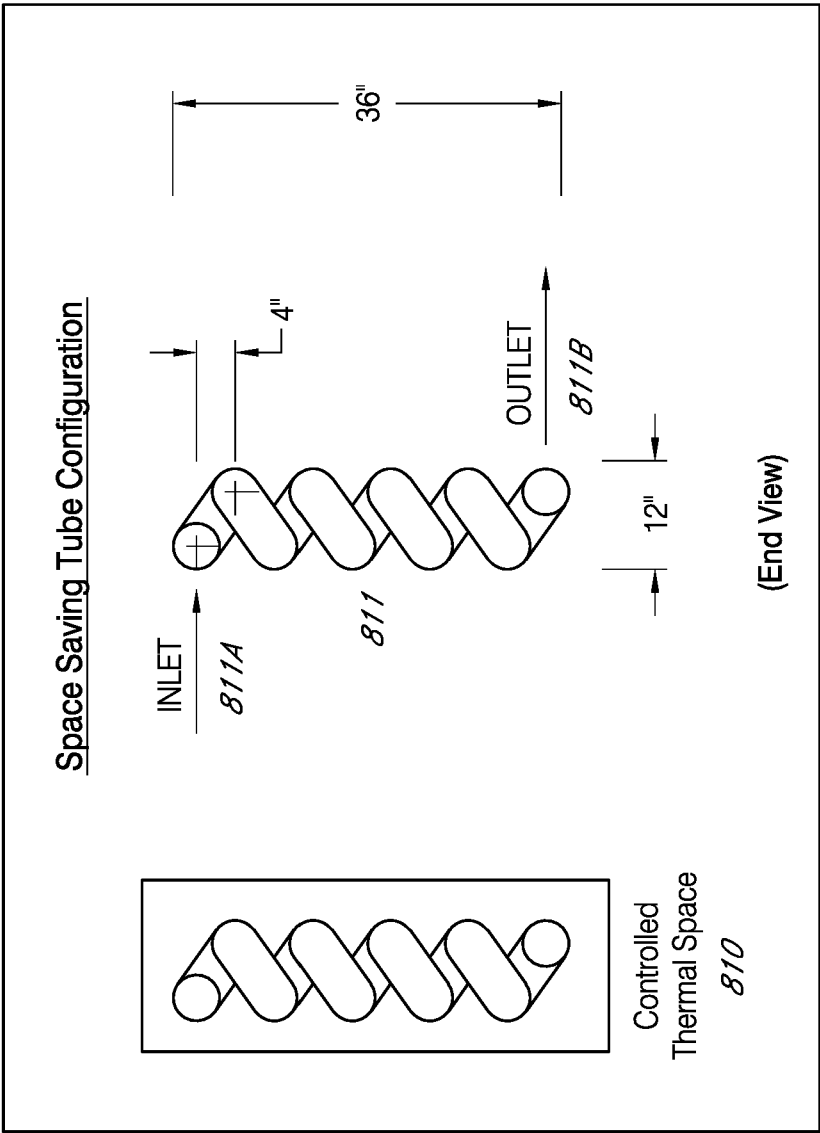


FIG. 8B

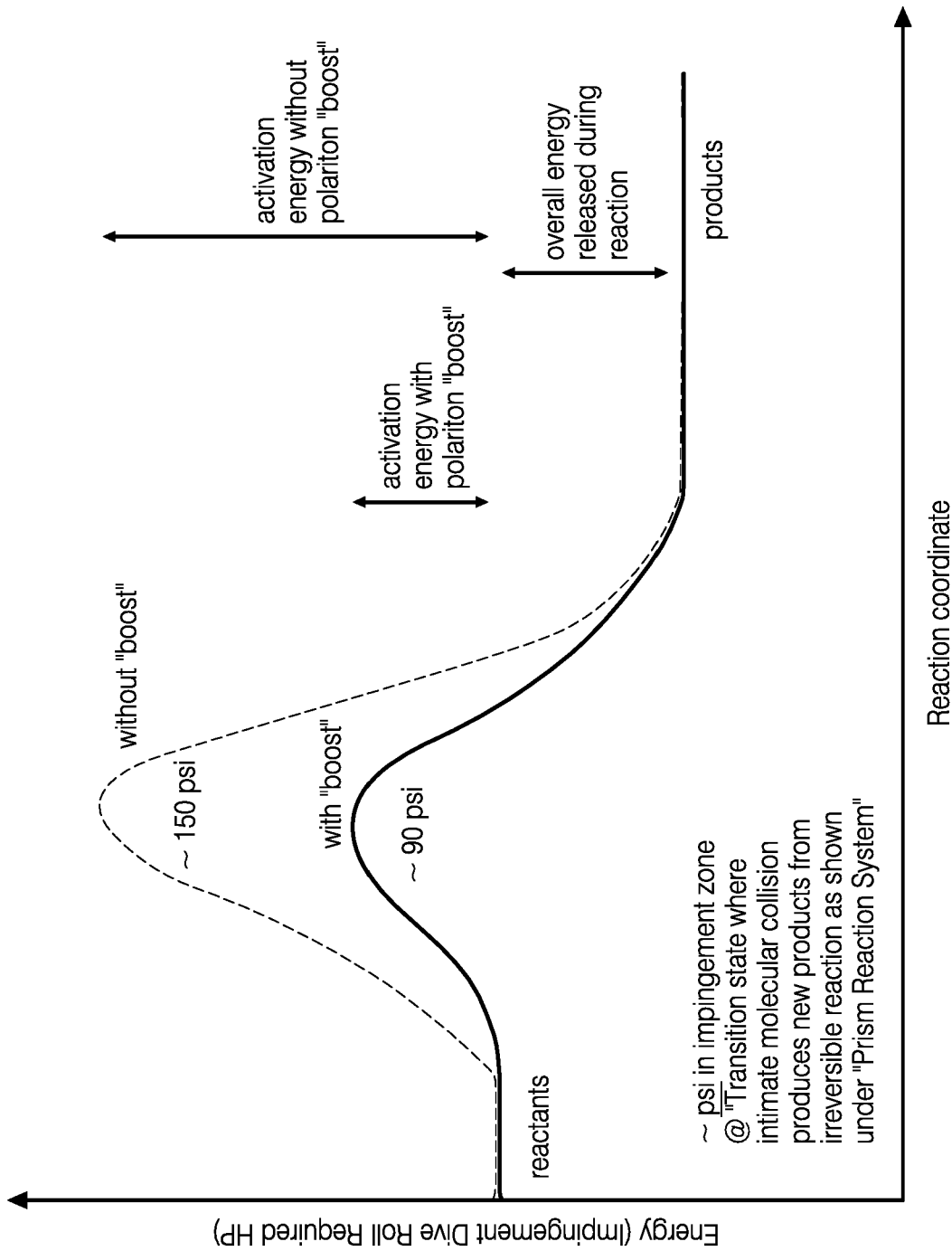


FIG. 9

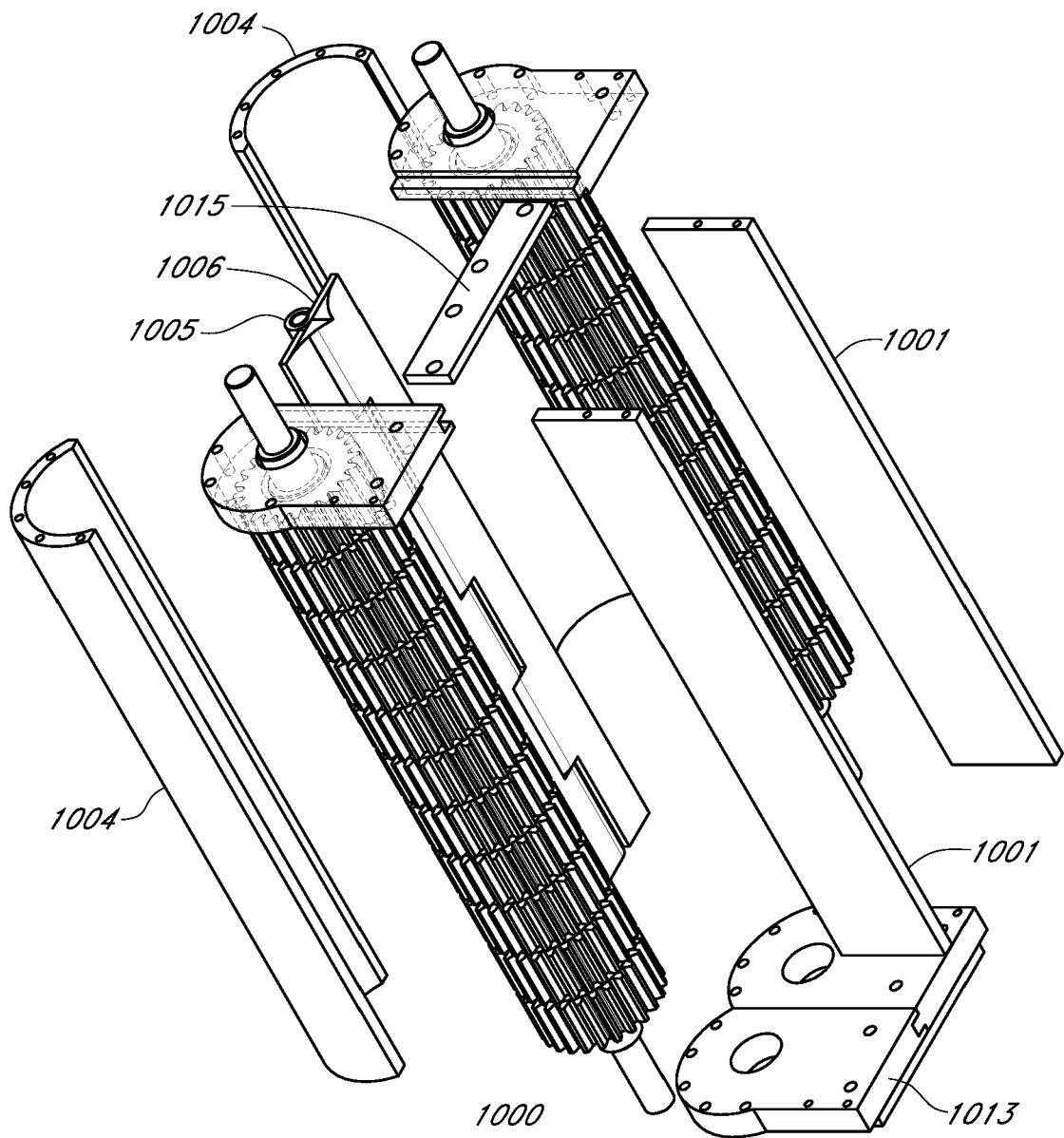


FIG. 10B

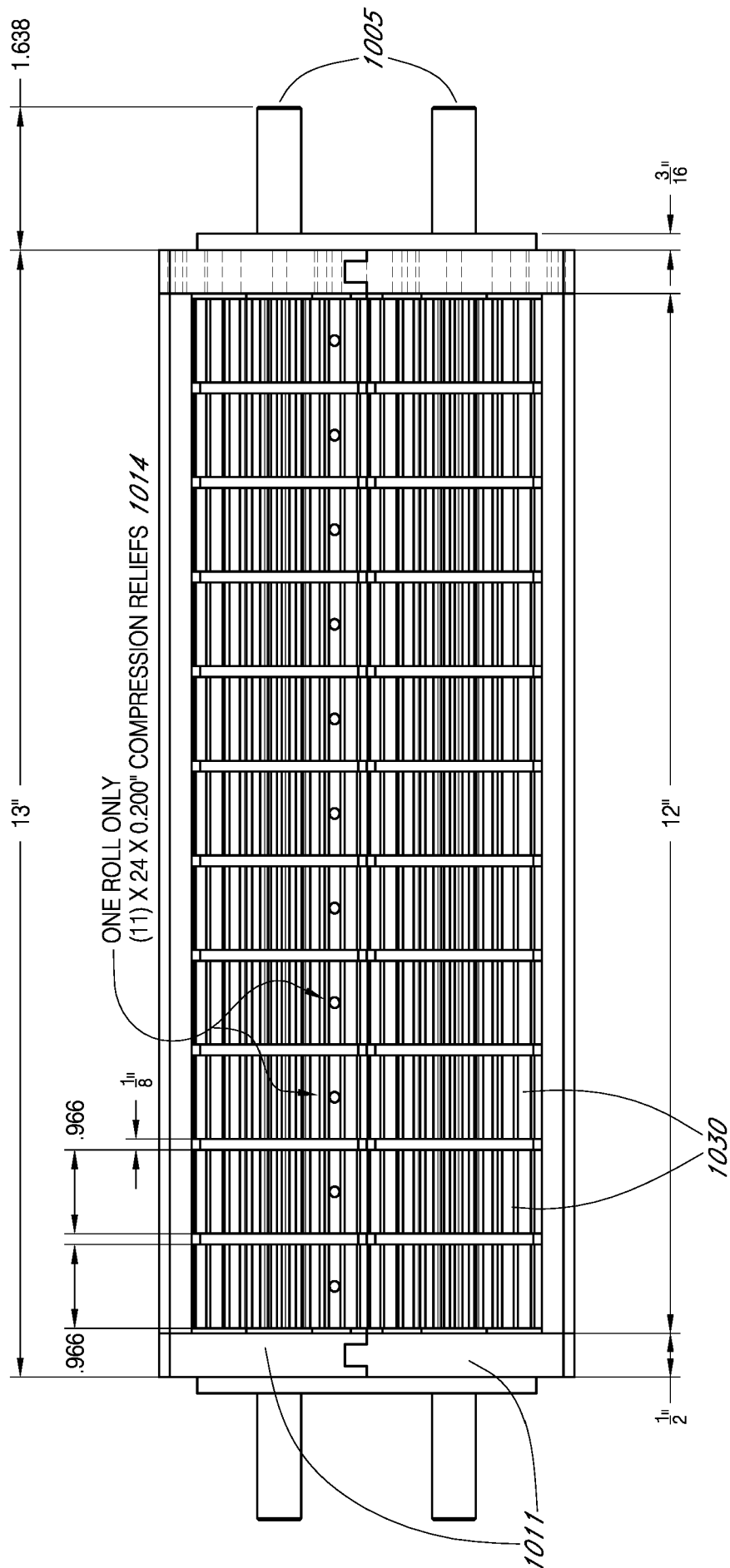
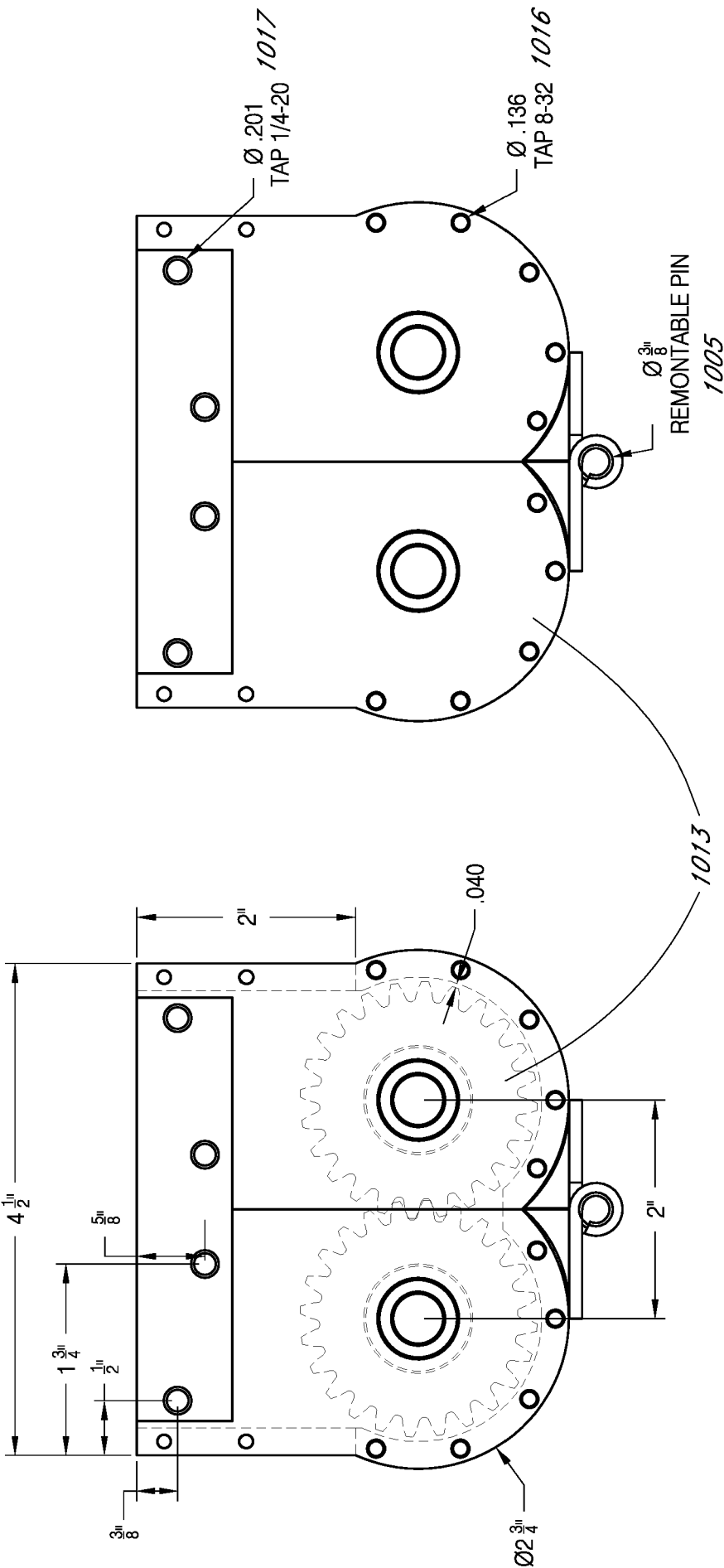


FIG. 10C



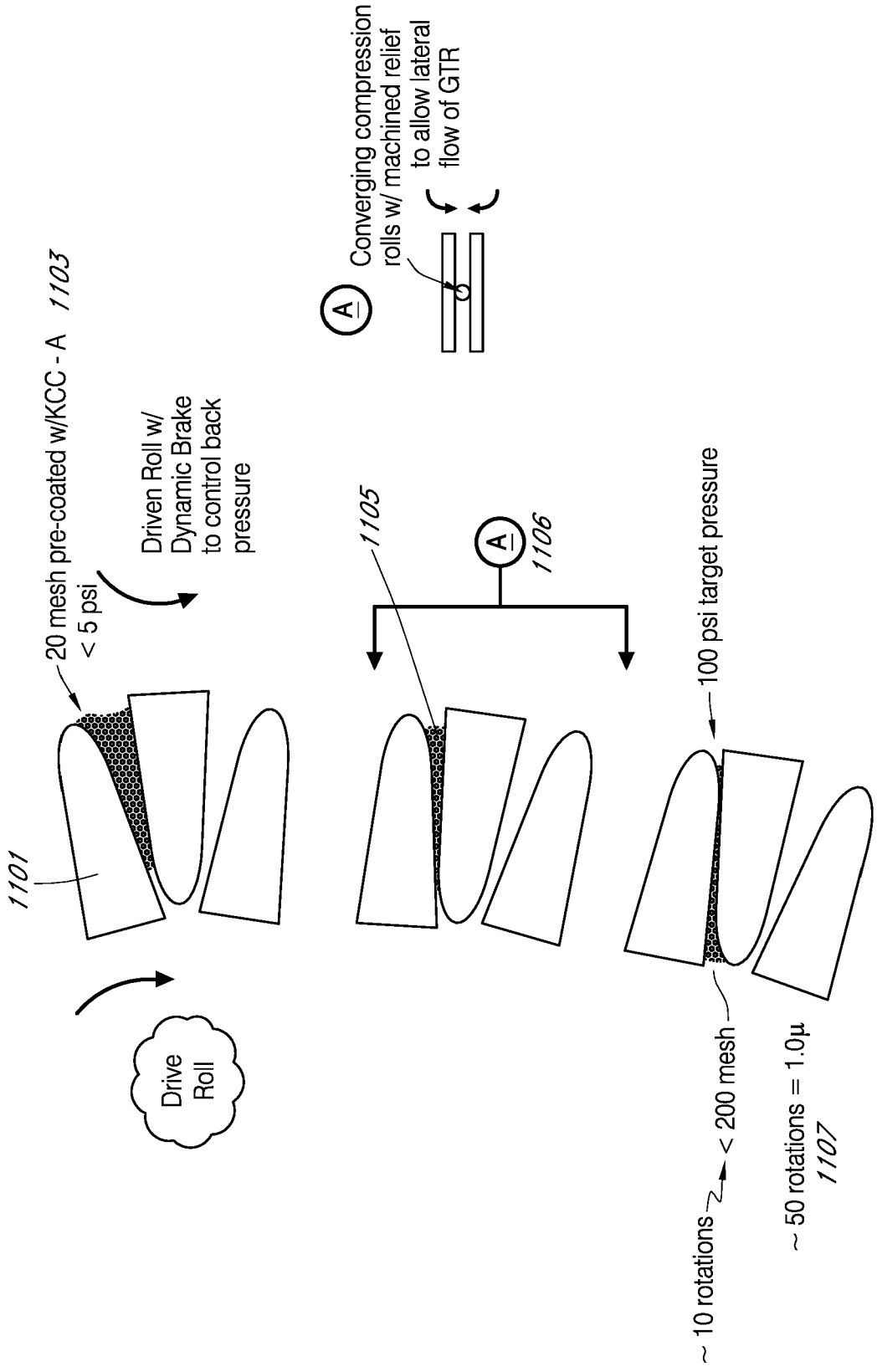
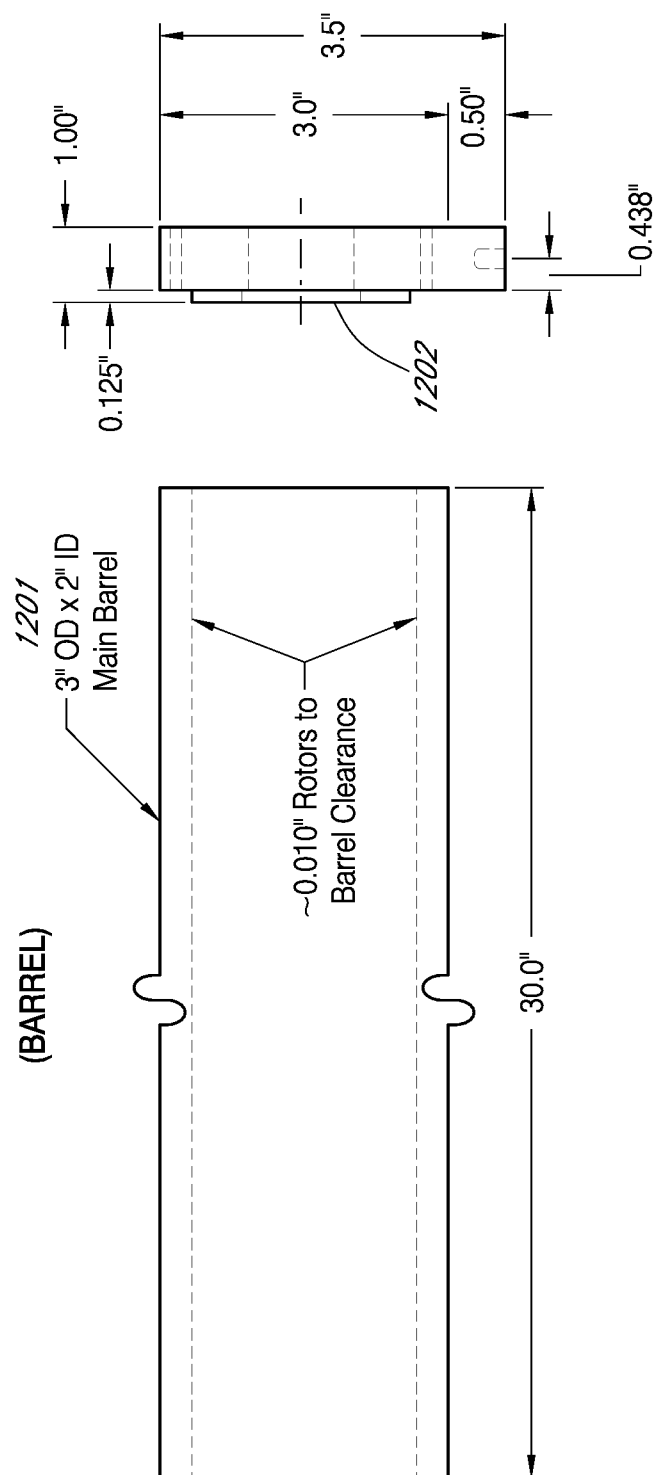


FIG. 11



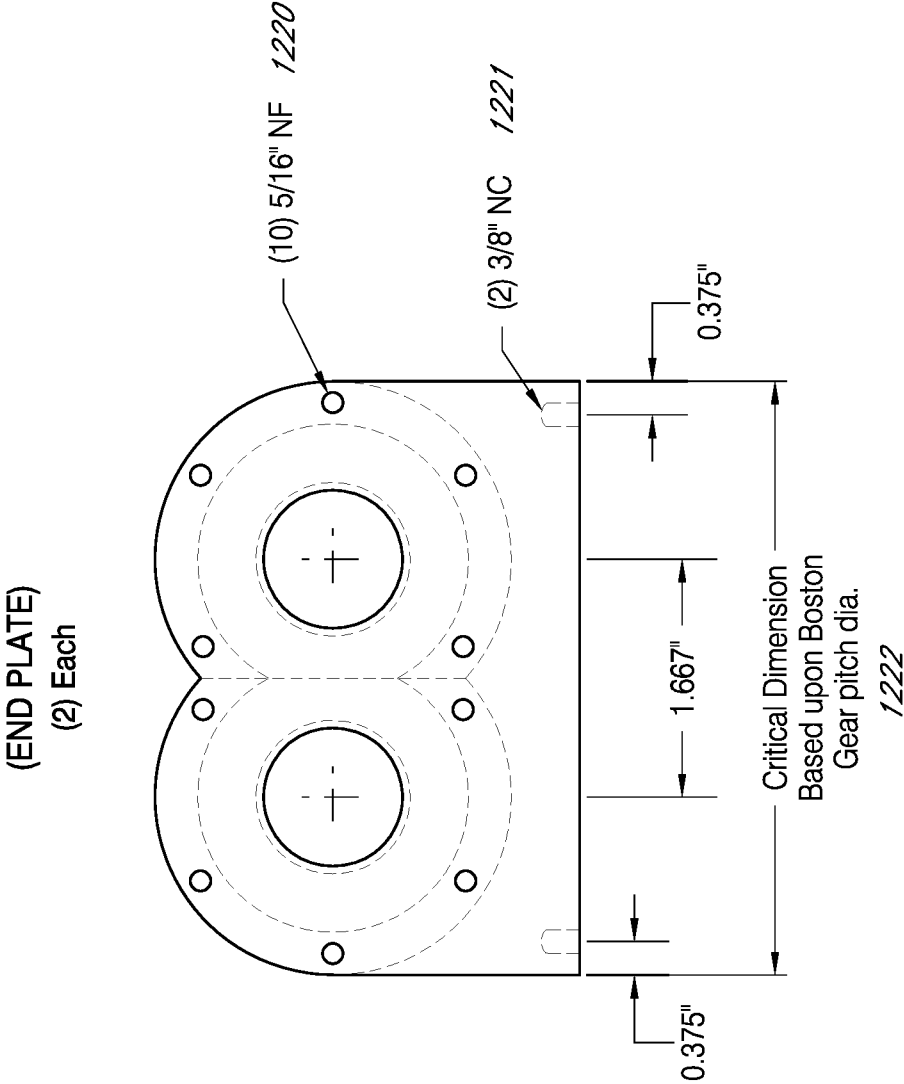
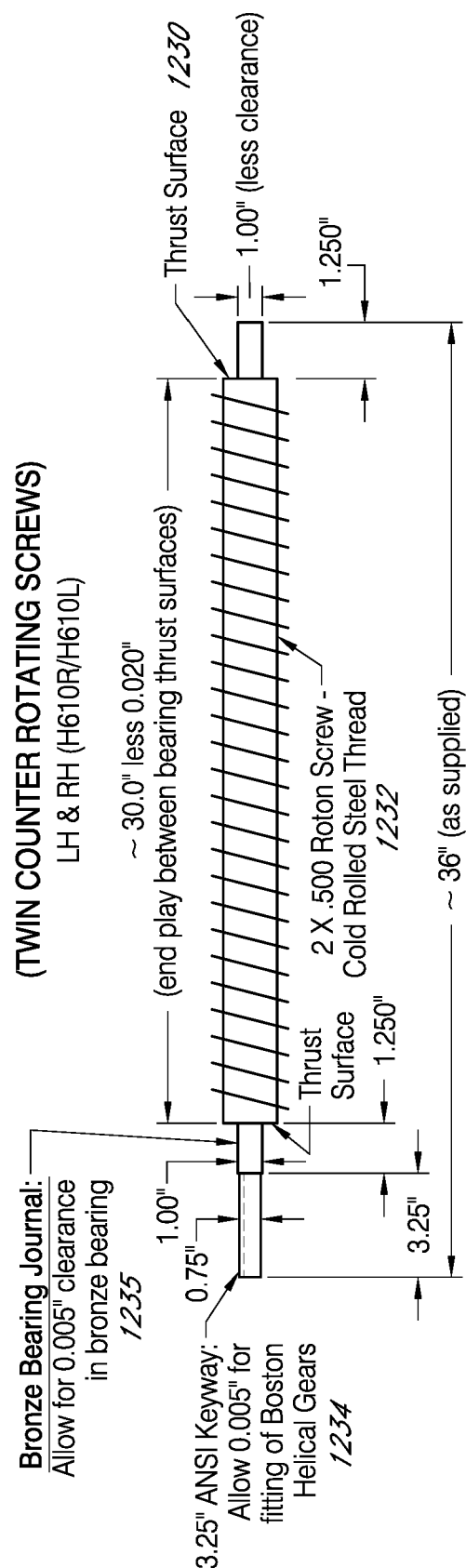


FIG. 12B



Notes:

- 1. Final screw close-intermesh to be timed w/ key placement on one shaft
- 2. Screw pitch diameter(s) machined (touch-up) for crown to trough clearance.

FIG. 12C

SAN JOAQUIN REFINING CO., INC

CERTIFICATE OF ANALYSIS
LABORATORY REPORT - ASPHALT PRODUCTS

Performance Graded Asphalt Binder per CALTRANS Specification

PRODUCT: PAVING ASPHALT PG 64-10 PRODUCT: 2185

AASHTO SPECIFICATION GRADE

PROPERTY	Test Method	PG 64-10	PG 64-10
		SPEC	TEST
ORIGINAL BINDER			
Flash Point, Minimum C	T-48	230	296
VOC's, %	ASTM D402	<0.5%v	0.0
Solubility, Minimum %	T-44	99	99.8
Viscosity at 135 C, Maximum, Pa's	T-316	3.0	0.256
Dynamic Shear, Test Temp. at 10 rad/s, C	T-315	64	64
Minimum G*/sin(delta), kPa		1.00	1.406
Phase Angle, δ (*)			89.5
RTFO Test Aged Binder			
RTFO Test	T-240		
Mass Loss, Maximum, %		1.00	-0.214
Dynamic Shear, Test Temp. at 10 rad/s, C	T-315	64	64
Minimum G*/sin(delta), kPa		2.2	2.399
Phase Angle, δ (*)			88.6
Ductility at 25 C Minimum, cm	T-51	75	150
PAV Aging, Temperature, C	R-28	100	100
RTFO Test and PAV Aged Binder			
Dynamic Shear, Test Temp. at 10 rad/s, C	T-315	31	31
Maximum, G*/sin(delta), kPa		5000	3440
Phase Angle, δ (*)			66.5
Bending Beam, Creep Stiffness, Test Temperature, C	T-313	0	0
Maximum S-value, Mpa		Max 300	138
Minimum M-value		Min 0.300	0.468

Tank No.: 20004 Carrier: _____ Quantity: (Gal) _____ (Tons) _____
 Batch No.: 170523 Truck No.: _____ API Gravity @ 60F: 6.3 Specific Gravity @ 60 F: 1.0268
 Buyer: _____ Loading Temp, F: _____ Shipment Date: _____

We hereby certify that the above determinations were performed in accordance with AASHTO, ASTM or other applicable test methods and that the product designated hereon conforms to the Caltrans specification for the product indicated: PG 64-10

DATE: 5/23/2017

TESTER:

Don Conner

FIG. 13

	AASHTO Test Method	SJR PG 64-10 Base	PTR PG 64-10		Specification
Specific Gravity, 60°F (15.6°C)	T228	1.026	1.022		Report
Rotational Viscosity, 135°C Pa*s	T316	0.244	0.378		3.0 Max.
Flash, COC, °C	T48	294	290		230 Min.
Solubility in Trichloroethylene, %	T44	99.9	99.2		99.0 Min.
Dynamic Shear Rheometer, °C	T315	64	58	64	
G*, kPa		1.38	1.44	0.75	
Phase Angle, δ , °		89.6	74.4	71.0	
G*/Sin δ , kPa		1.38	1.50	0.79	1.00-2.00
Pass/Fail Temperature, °C		-	61.8		
RTFO-Aged	T240				
Mass Loss, w%	T240	0.196	0.254		1.0 Max.
Dynamic Shear Rheometer, °C	T315	64	58	64	
G*, kPa		2.22	2.26	1.02	
Phase Angle, δ , °		89.0	79.3	79.8	
G*/Sin δ , kPa		2.22	2.30	1.04	2.20 Min.
Pass/Fail Temperature, °C		-	58.5		
Ductility, 25°C, cm	T51	150+	150+		75 Min.
Elastic Recovery, 25°C, %	T301	-	65.0		75.0 Min.
PAV-Aged, °C	R28	100	100		
Dynamic Shear Rheometer, °C	T315	31	22	19	
G*, kPa		4492	3974	6994	
Phase Angle, δ , °		65.9	62.8	58.7	
G*Sin δ , kPa		4100	3535	5976	5000 Max.
Pass/Fail Temperature, °C		-	20.0		
Bending Beam Rheometer, °C	T313	0	-12	-18	
Stiffness, MPa		151	233	505	300 Max.
Pass/Fail Temperature, °C		-	-13.5		
m-value		0.474	0.383	0.271	0.300 Min.
Pass/Fail Temperature, °C		-	-16.4		
PG Grade		-	58-22		

FIG. 14A

	AASHTO Test Method	SJR PG 64-10 Base	PTR PG 64-10	
Multiple Stress Creep Recovery, °C	T350	64	58	64
Recovery @ 0.1 kPa, %		-0.068	84.59	91.29
Recovery @ 3.2 kPa, %		-1.274	35.69	19.97
Difference in Recovery, %		-1782.9	57.80	78.13
Jnr @ 0.1 kPa, 1/kPa		4.689	0.542	0.577
Jnr @ 3.2 kPa, 1/kPa		4.842	2.478	6.334
Difference in Jnr, %		3.256	357.5	997.9

FIG. 14B

	AASHTO Test Method	Prism PG 64-10	
		Top	Bottom
Dynamic Shear Rheometer, °C	T315	58	58
G*, kPa		1.50	1.87
Phase Angle, δ , °		74.3	75.8
G*/Sin δ , kPa		1.56	1.93

FIG. 14C

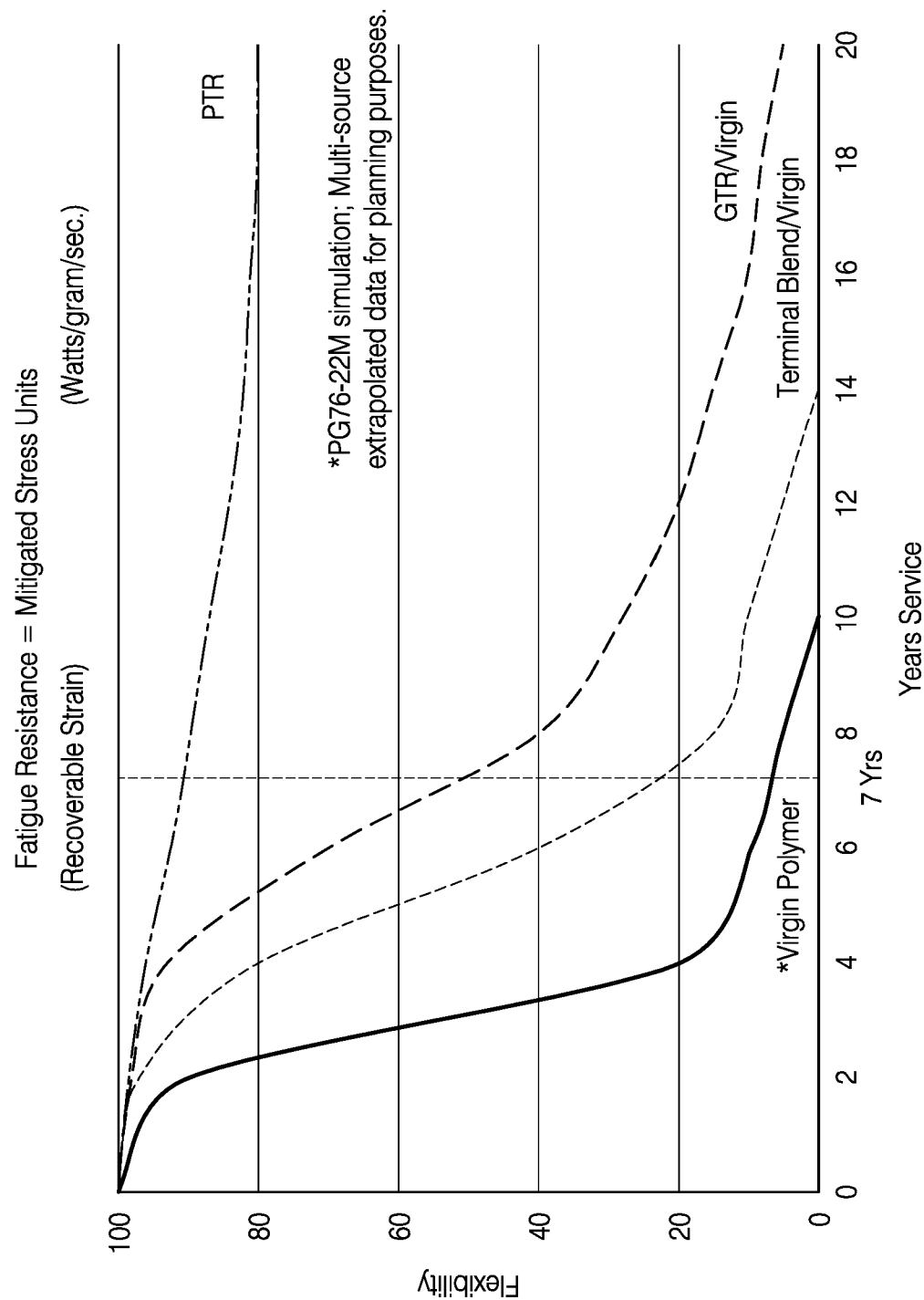


FIG. 15

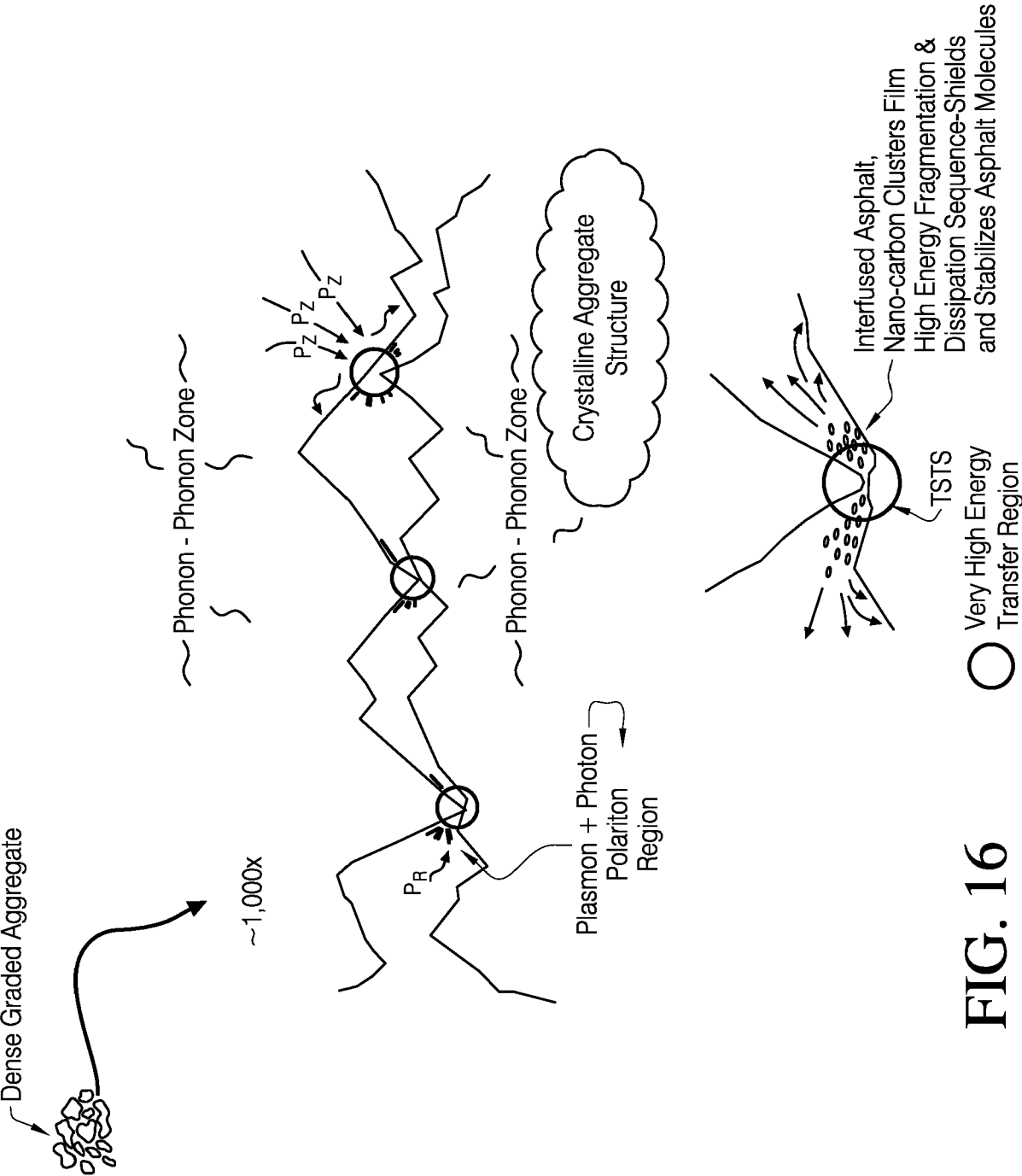


FIG. 16

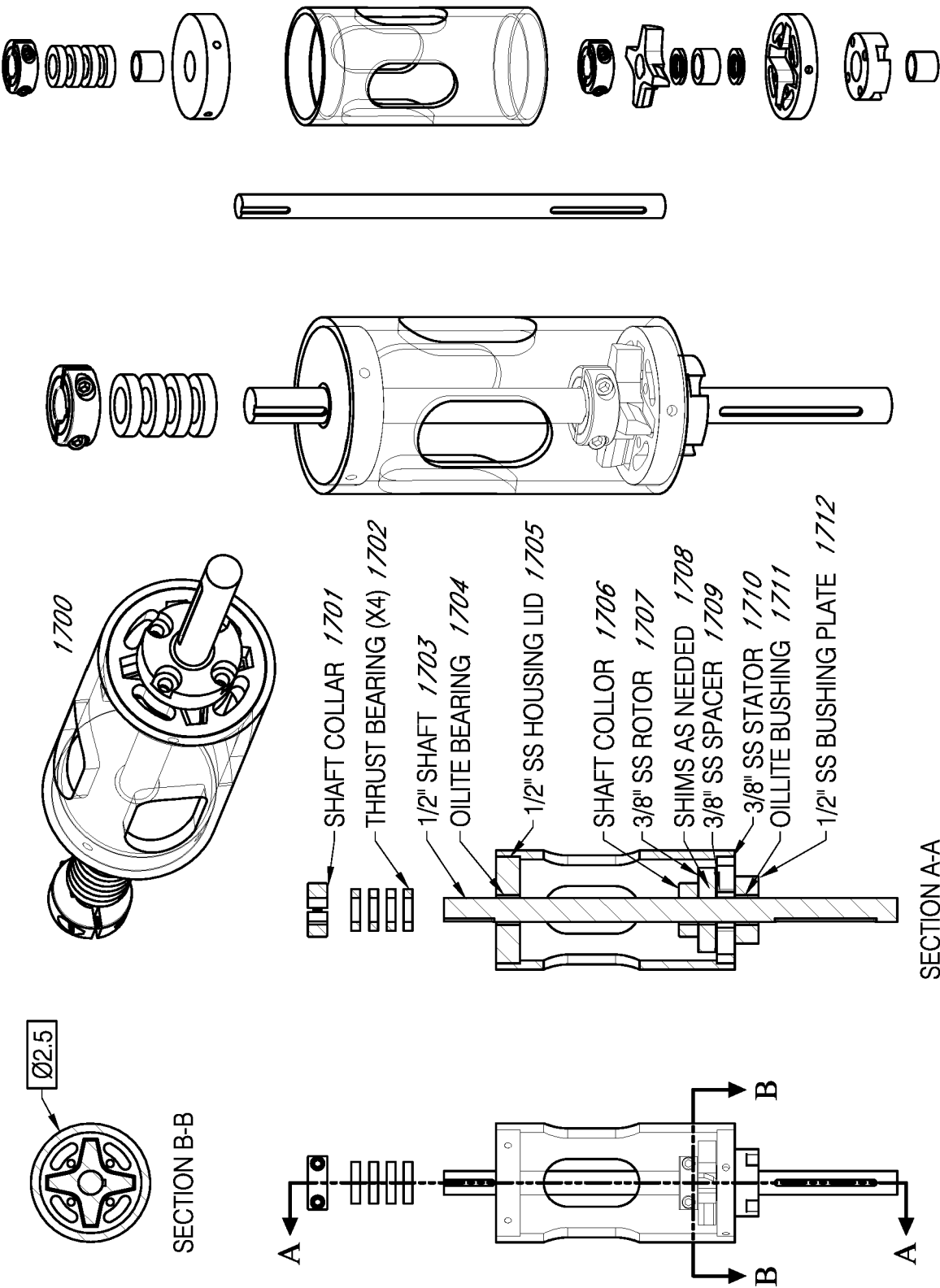


FIG. 17A

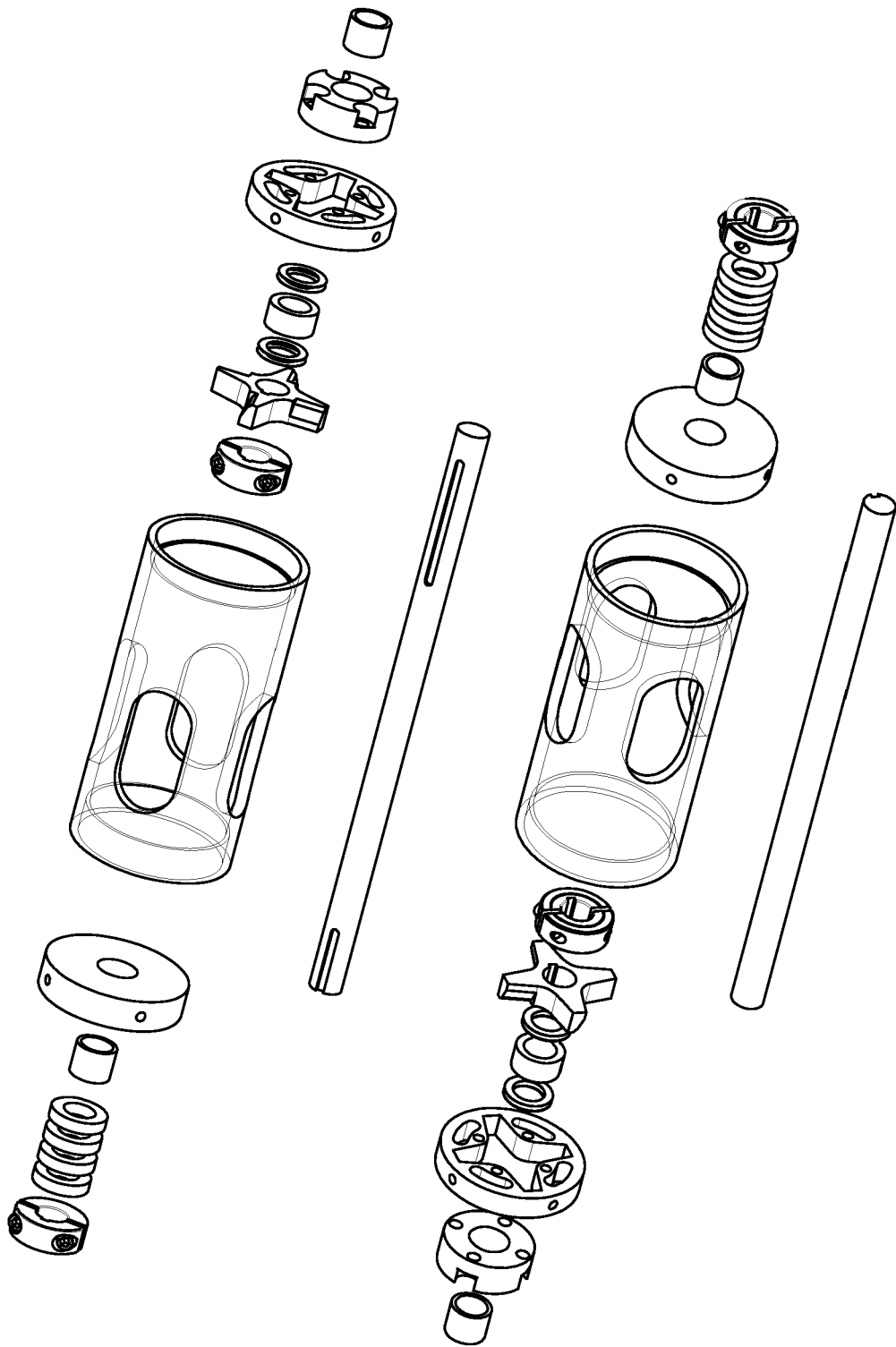


FIG. 17B