301429 Torque Testing

Purpose:

The purpose of this test is to measure the torque required to move the trigger pull adjustment screw (301429) in the X-Mark Pro Externally Adjustable trigger (301463) for normal adjustments. The data will be used to determine the torque limits for the hex bit to knob for the adjustment wrench supplied with the gun to the consumer. Torque will also be measured for informational purposes when the locking element on the adjustment screw is initially engraved to establish the torque level for installation. This engraving will normally be done at assembly.

BARBER - RE 0004765

The trigger assembly used for testing will be mounted in the test fixture using two 1/8" dowel pins through the mounting holes. The adjustment screw will be started into the threads in the trigger. A 1/16" hex key will be inserted into the socket in the adjustment screw. A Chatillon digital force gage is to be set up such that it contacts the hex key at a right angle 1" from the centerline of the adjustment screw (distance verified with a machinist's scale). With the force gage zeroed for force (both instantaneous and peak), the trigger assembly will be rotated slowly through 180 degrees. The peak torque for this rotation will be recorded, the gage re-zeroed, and the wrench reset to measure torque for the next 180 degreee arc. This procedure is to be repeated until the adjustment screw bottoms out in the trigger.

Procedure:

Data:

TA #1
7SS

	Engraving Angle	Force	Normal Angle	Force
1	180	0.475	180	0.145
	360	0.425	360	0.215
2	540	1.300	540	0.320
	720	1.215	720	0.250
3	900	1.750	900	0.565

TA #5 700SS	Engraving Angle	Force	Normal Angle	Force
1	180	0.185	180	0.110
	360	0.585	360	0.180
2	540	0.940	540	0.355
	720	0.770	720	0.265
3	900	0.830	900	0.275

TA #7 700SS	Engraving Angle	Force	Normal Angle
1	180	0.110	180
	360	0.105	360
2	540	0.170	540
	720	0.115	720
3	900	0.580	900

BARBER - RE 0004766

Force	TA #2 7SS	Engraving Angle	Force	Normal Angle	Force	TA #3 7SS	Engraving Angle	Force	Normal Angle	Force	TA #6 700SS	Engraving Angle	Force	Normal Angle	Force	TA #4 7SS	Engraving Angle	Force	Normal Angle	Force
0.100	1	180	0.270	180	0.105	1	180	0.565	180	0.145	1	180	0.350	180	0.070	1	180	0.845	180	0.270
0.105		360	0.260	360	0.175		360	0.455	360	0.150		360	0.450	360	0.140		360	0.350	360	0.160
0.090	2	540	0.330	540	0.180	2	540	0.965	540	0.260	2	540	0.740	540	0.165	2	540	0.490	540	0.135
0.090		720	1.110	720	0.165		720	1.115	720	0.350		720	0.975	720	0.200		720	1.075	720	0.115
0.235	3	900	0.865	900	0.260	3	900	1.910	900	0.420	3	900	1.115	900	0.445	3	900	0.995	900	0.270

BARBER - RE 0004767

TA #10 700SS	Engraving Angle	Force	Normal Angle	Force	TA #8 700SS	Engraving Angle	Force	Normal Angle	Force	TA #9 700SS	Engraving Angle	Force	Normal Angle	Force
1	180	0.410	180	0.275	1	180	0.635	180	0.340	1	180	0.560	180	0.090
	360	0.965	360	0.260		360	0.490	360	0.250		360	0.435	360	0.120
2	540	1.160	540	0.265	2	540	0.795	540	0.295	2	540	0.550	540	0.170
	720	2.290	720	0.370		720	1.235	720	0.100		720	1.115	720	0.255
3	900	2.075	900	0.420	3	900	2.255	900	0.560	3	900	1.085	900	0.275

BARBER - RE 0004768

	1080	1.740	1080	0.485		1080	1.135	1080	0.635		1080	0.890	1080
4	1260	1.990	1260	0.480	4	1260	1.010	1260	0.455	4	1260	1.485	1260
	1440	1.730	1440	0.465		1440	0.995	1440	0.530		1440	1.620	1440
5	1620	1.130	1620	0.365	5	1620	1.010	1620	0.495	5	1620	1.545	1620
	1800	1.025	1800	0.385		1800	0.680	1800	0.395		1800	1.430	1800
6	1980	1.455	1980	0.430	6	1980	0.975	1980	0.195	6	1980	1.130	1980
	2160		2160			2160		2160			2160	0.680	2160
7	2340		2340		7	2340		2340		7	2340	1.385	2340
	2520		2520			2520		2520			2520		2520

Maximum mesured torque for the sample tested was 1.295 lbs. If the hex bit to knob interface is capable of supporting 5 in-lbs, there will be sufficient safety margin with the wrench design to ensure that the hex bit does not turn inside the knob during any forseeable operating conditions.

Conclusion:

BARBER - RE 0004769

0.275		1080	1.445	1080	0.355		1080	2.245	1080	0.460		1080	1.795	1080	0.280		1080	1.255	1080	0.385
0.430	4	1260	1.105	1260	0.445	4	1260	1.850	1260	0.470	4	1260	1.655	1260	0.420	4	1260	1.475	1260	0.525
0.585		1440	1.740	1440	0.555		1440	2.075	1440	0.685		1440	2.115	1440	0.575		1440	1.385	1440	0.505
0.715	5	1620	1.335	1620	0.615	5	1620	1.605	1620	0.810	5	1620	2.490	1620	0.695	5	1620	1.695	1620	0.680
0.915		1800	1.525	1800	0.635		1800	1.260	1800	0.530		1800	2.210	1800	0.985		1800	1.255	1800	0.625
0.775	6	1980	0.860	1980	0.615	6	1980	0.970	1980	0.335	6	1980	1.165	1980	0.845	6	1980	1.090	1980	0.615
0.485		2160	0.465	2160	0.325		2160	1.990	2160	0.580		2160	0.965	2160	0.630		2160	0.645	2160	0.410
1.595	7	2340	0.870	2340	0.720	7	2340		2340		7	2340	2.340	2340	0.405	7	2340	1.160	2340	1.090
		2520		2520			2520		2520			2520		2520			2520		2520	

BARBER - RE 0004770

	1080	2.590	1080	0.670		1080	1.930	1080	0.495		1080	1.725	1080	0.655
4	1260	2.515	1260	0.760	4	1260	2.575	1260	0.540	4	1260	1.660	1260	0.585
	1440	2.630	1440	0.975		1440	1.900	1440	0.810		1440	2.120	1440	0.890
5	1620	2.690	1620	1.250	5	1620	3.460	1620	0.885	5	1620	1.740	1620	0.790
	1800	1.635	1800	0.920		1800	3.060	1800	1.295		1800	1.730	1800	0.910
6	1980	1.140	1980	0.715	6	1980	2.250	1980	1.160	6	1980	1.085	1980	0.530
	2160	1.770	2160	0.895		2160	1.120	2160	0.455		2160	0.920	2160	0.410
7	2340		2340		7	2340	1.510	2340	0.655	7	2340		2340	
	2520		2520			2520		2520			2520		2520	

BARBER - RE 0004771

Cell: O21
Comment: ronkainejw:
original screw was only partially engraved, giving lower torque for first part of engraving measurements

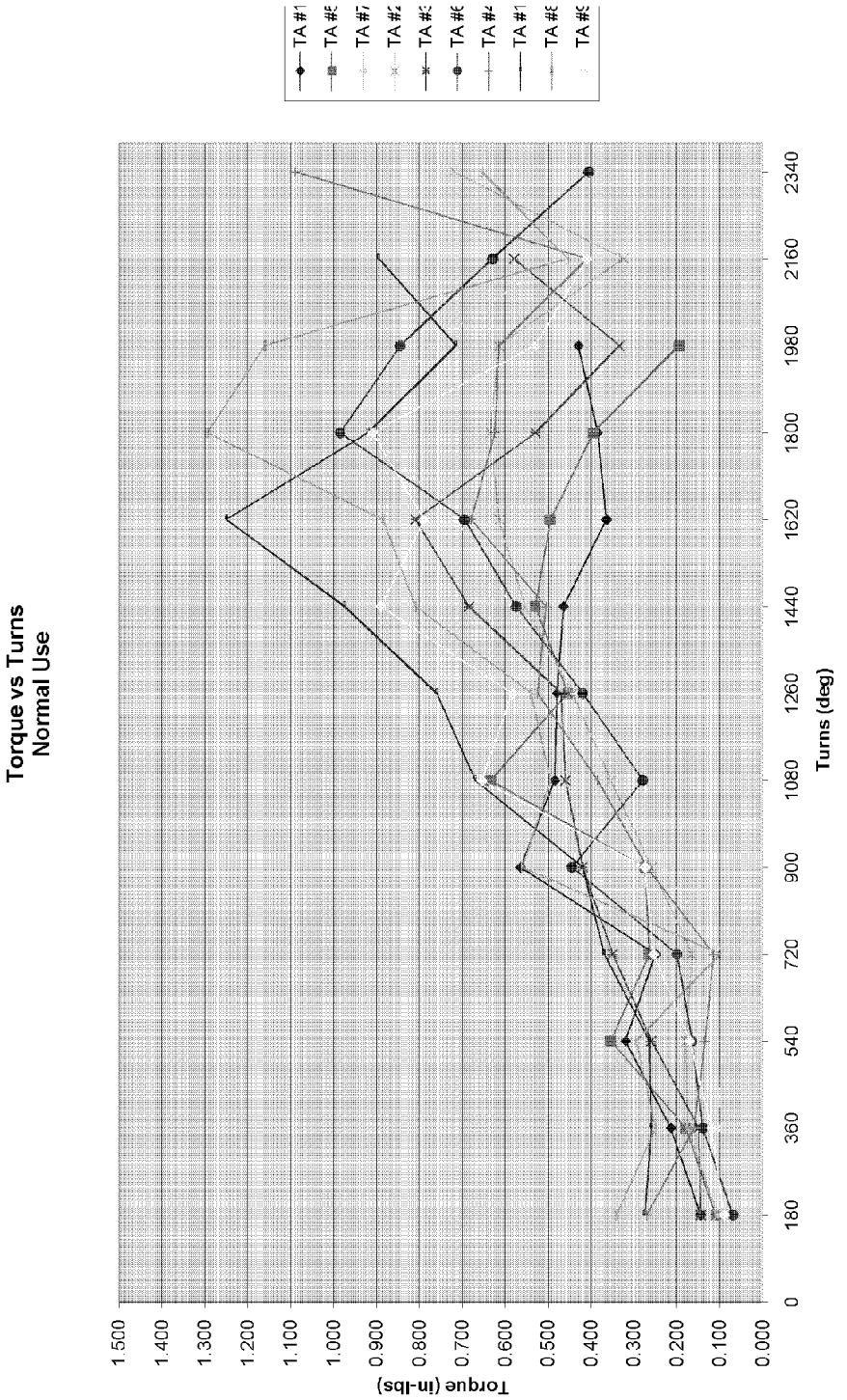
Cell: C32
Comment: ronkainejw:
it was hard to tell where the screw bottomed out, so I may have overshot the point of contact

Cell: AC33
Comment: ronkainejw:
stopped after 90 degrees of rotation.

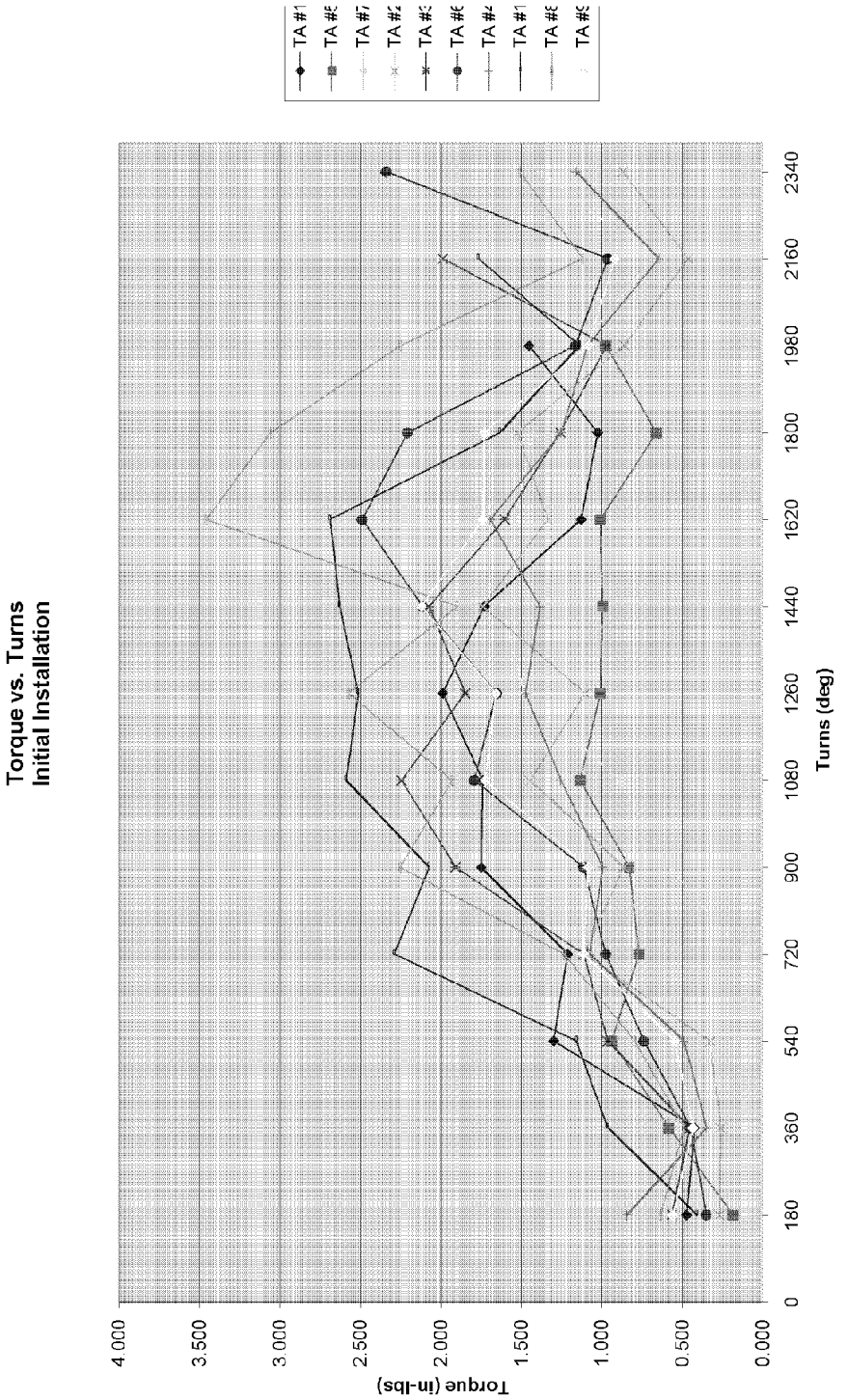
Cell: AM34
Comment: ronkainejw:
stopped after 90 degrees of rotation - felt screw bottom out

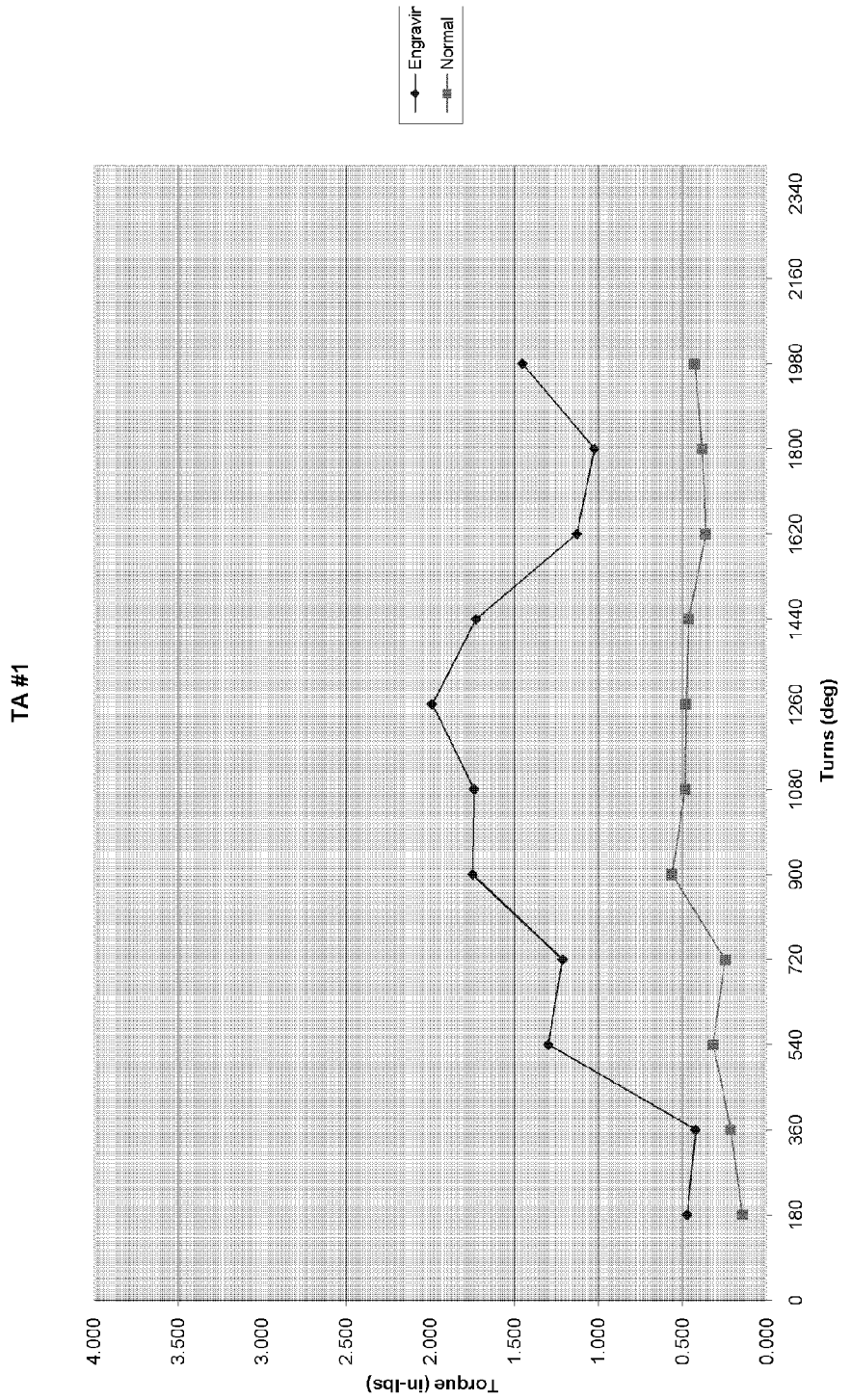
Cell: AY34
Comment: ronkainejw:
stopped after 90 degrees

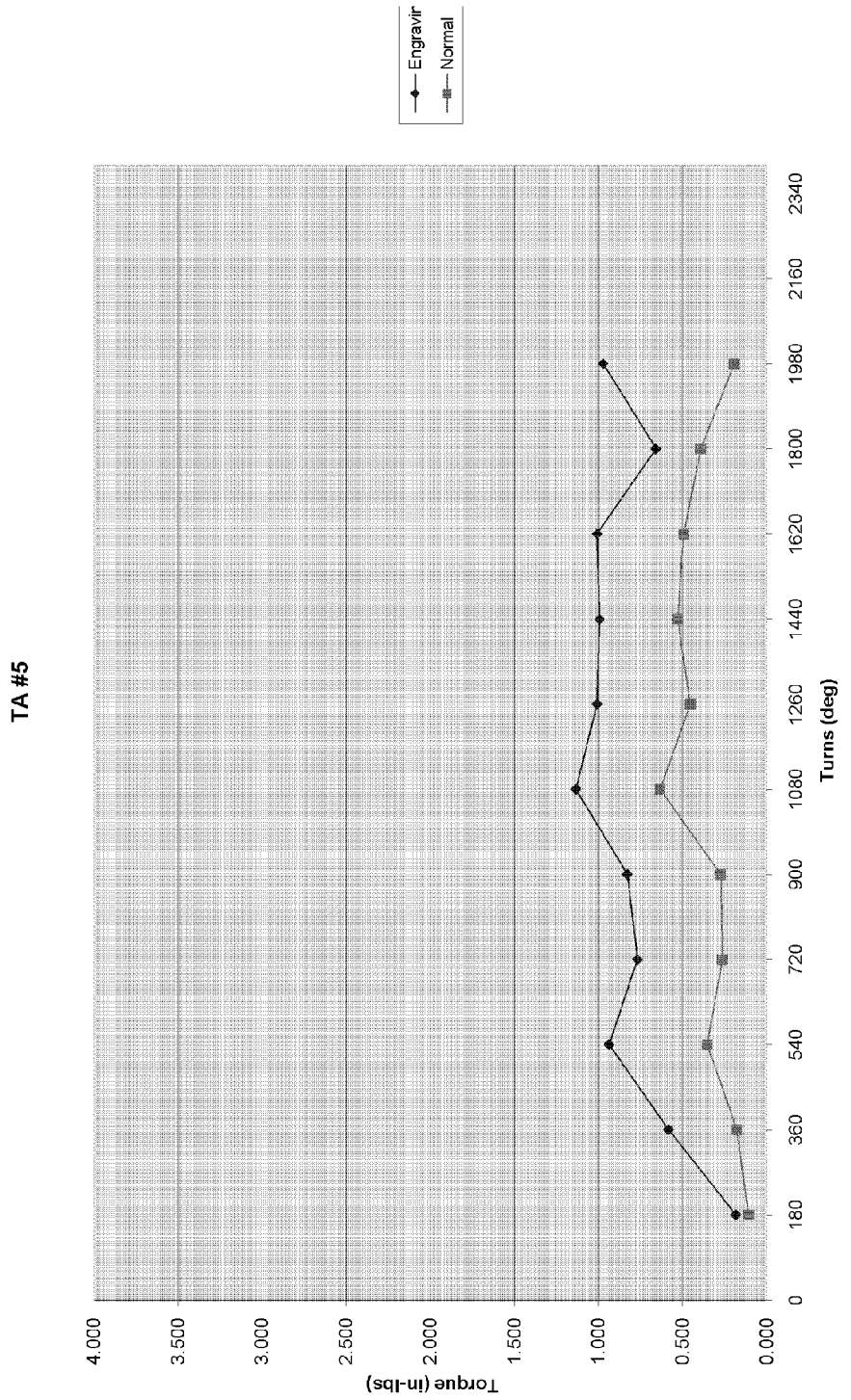
BARBER - RE 0004772

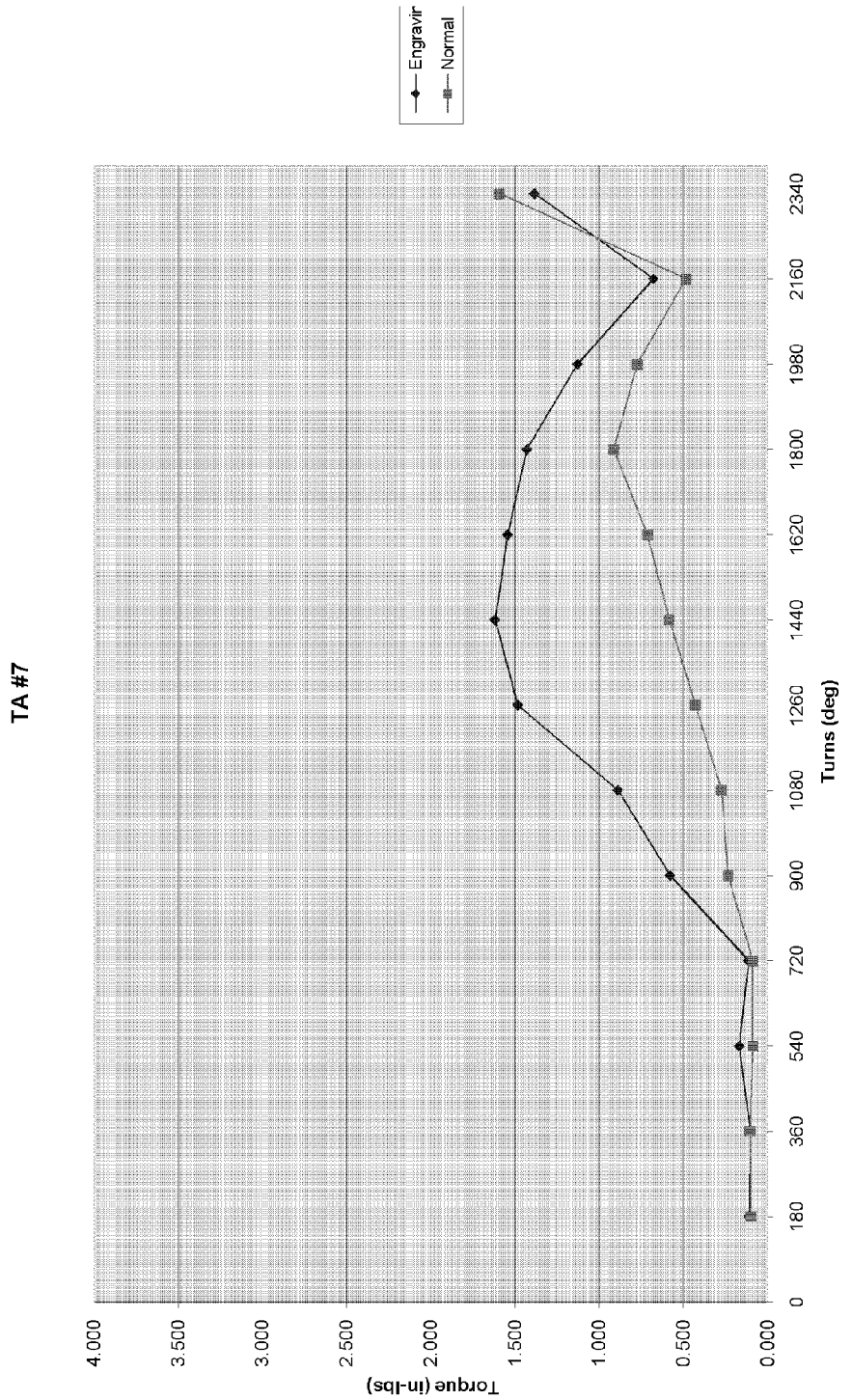


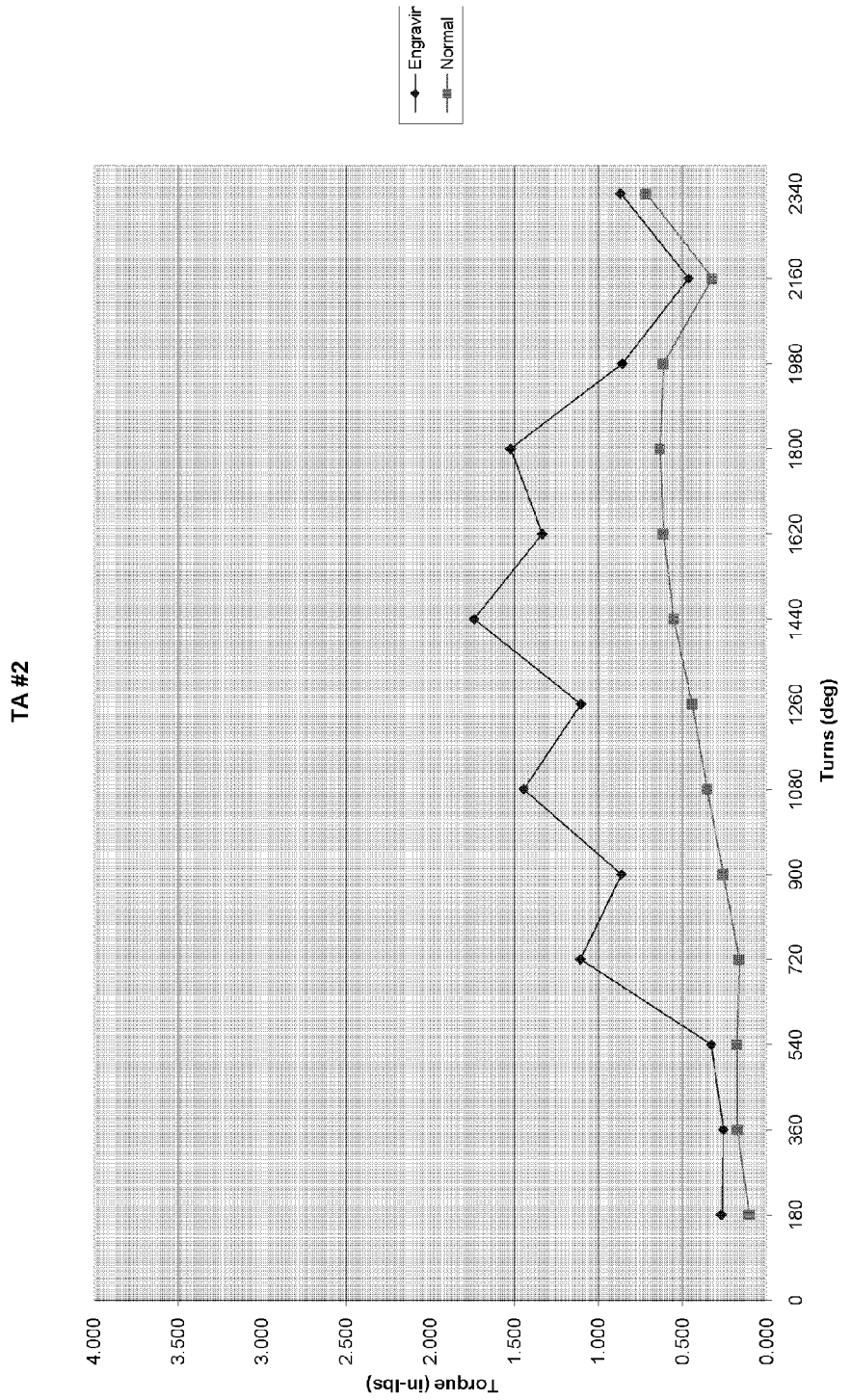
BARBER - RE 0004773

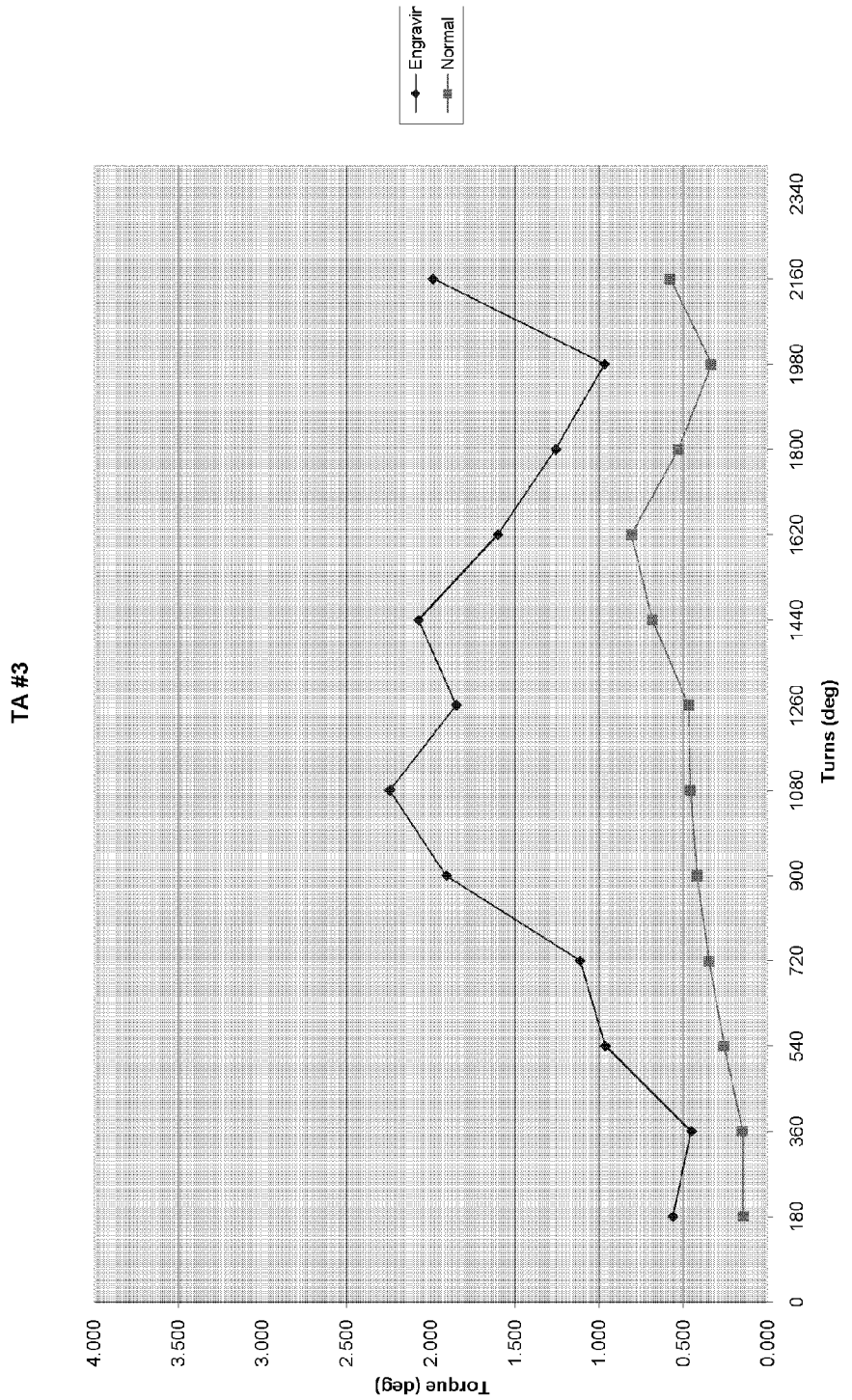

Torque vs. Turns
Initial Installation
Torque (in-lbs)
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
0
180
360
540
720
900
1080
1260
1440
1620
1800
1980
2160
2340
Turns (deg)
TA #1
TA #8
TA #7
TA #6
TA #5
TA #4
TA #3
TA #2
TA #1
TA #8
TA #9

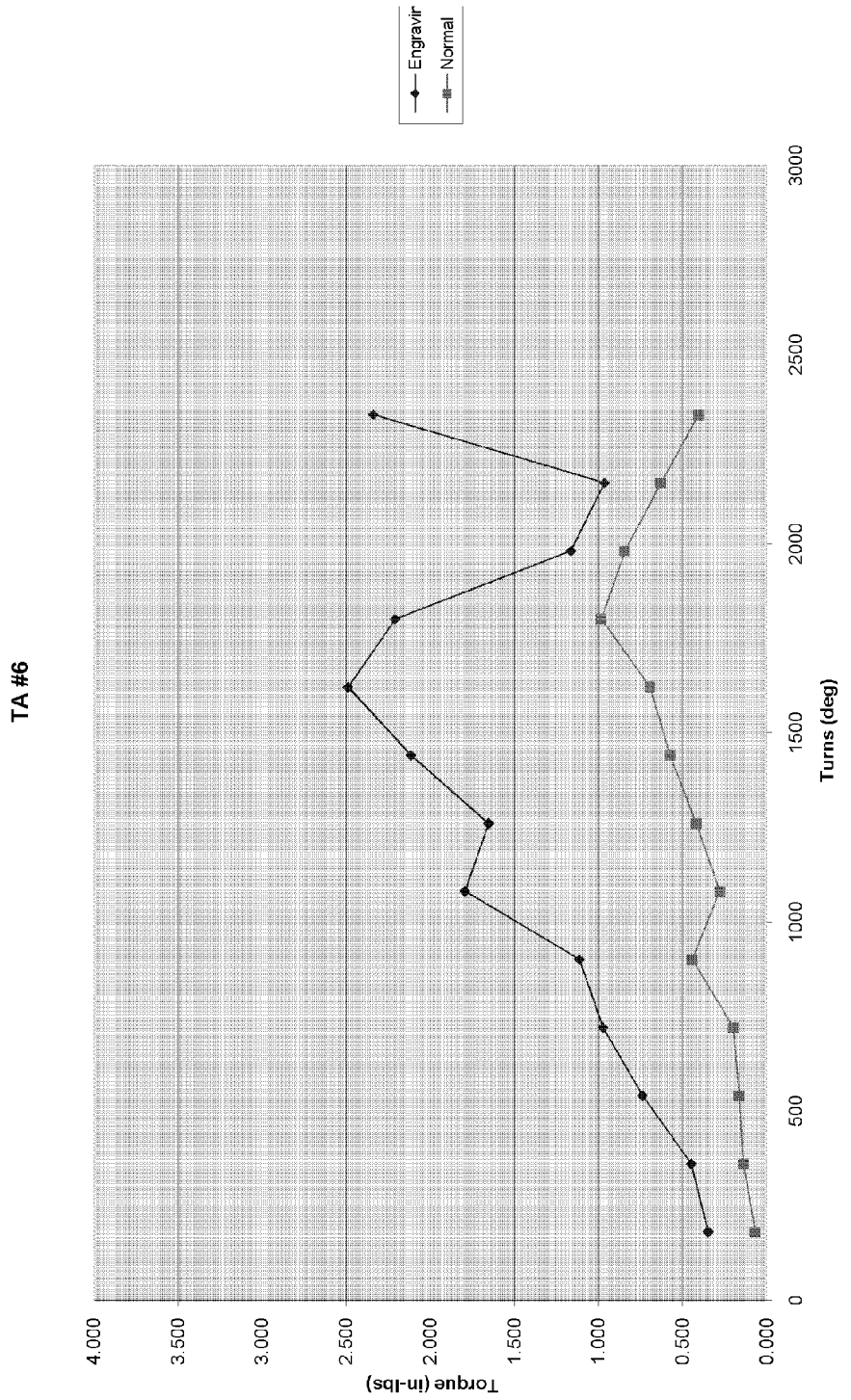

TA #1
Engravir
Normal
Torque (in-lbs)
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
0
180
360
540
720
900
1080
1260
1440
1620
1800
1980
2160
2340
Turns (deg)

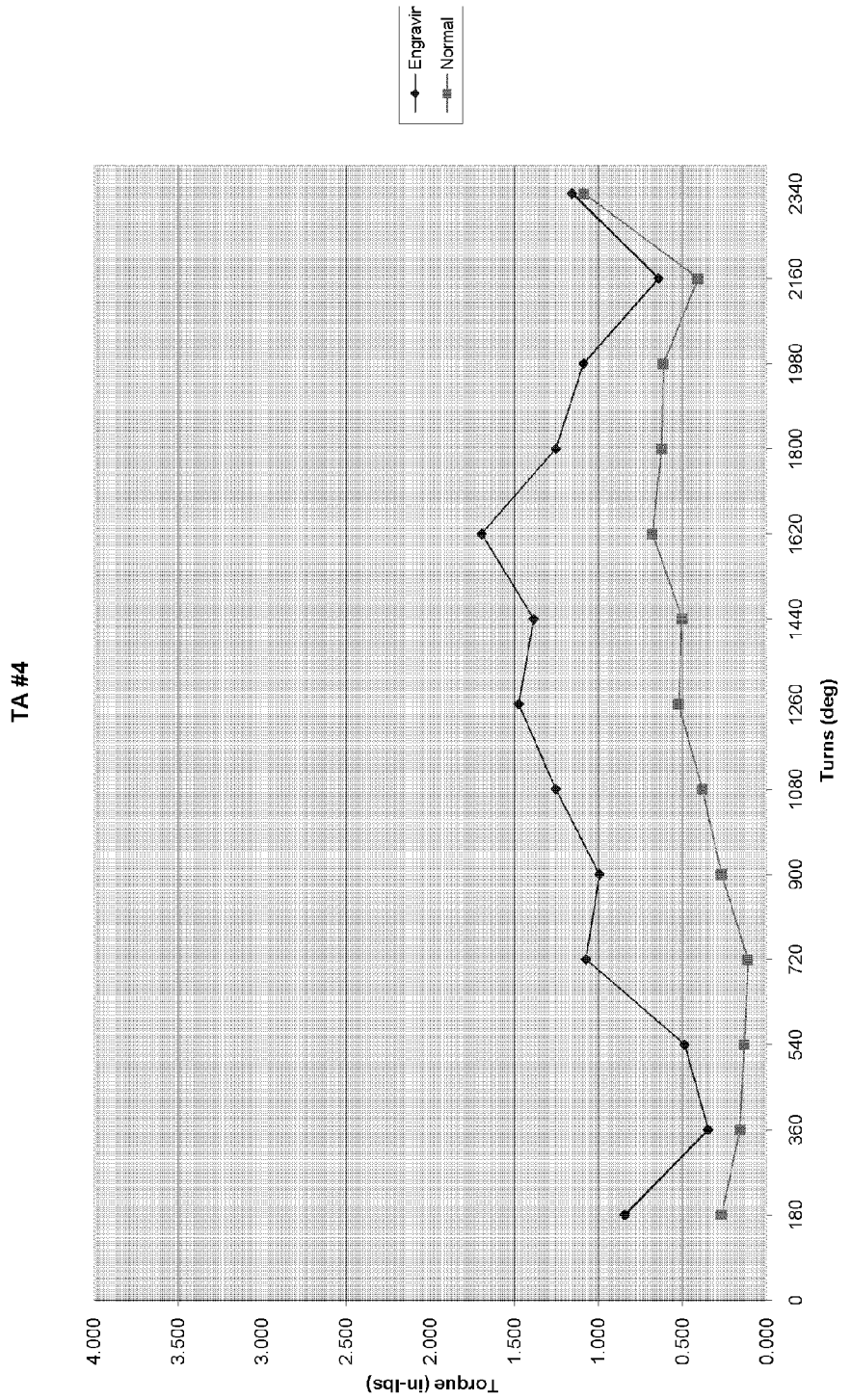

TA #5
Engravir
Normal
Torque (in-lbs)
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
0
180
360
540
720
900
1080
1260
1440
1620
1800
1980
2160
2340
Turns (deg)

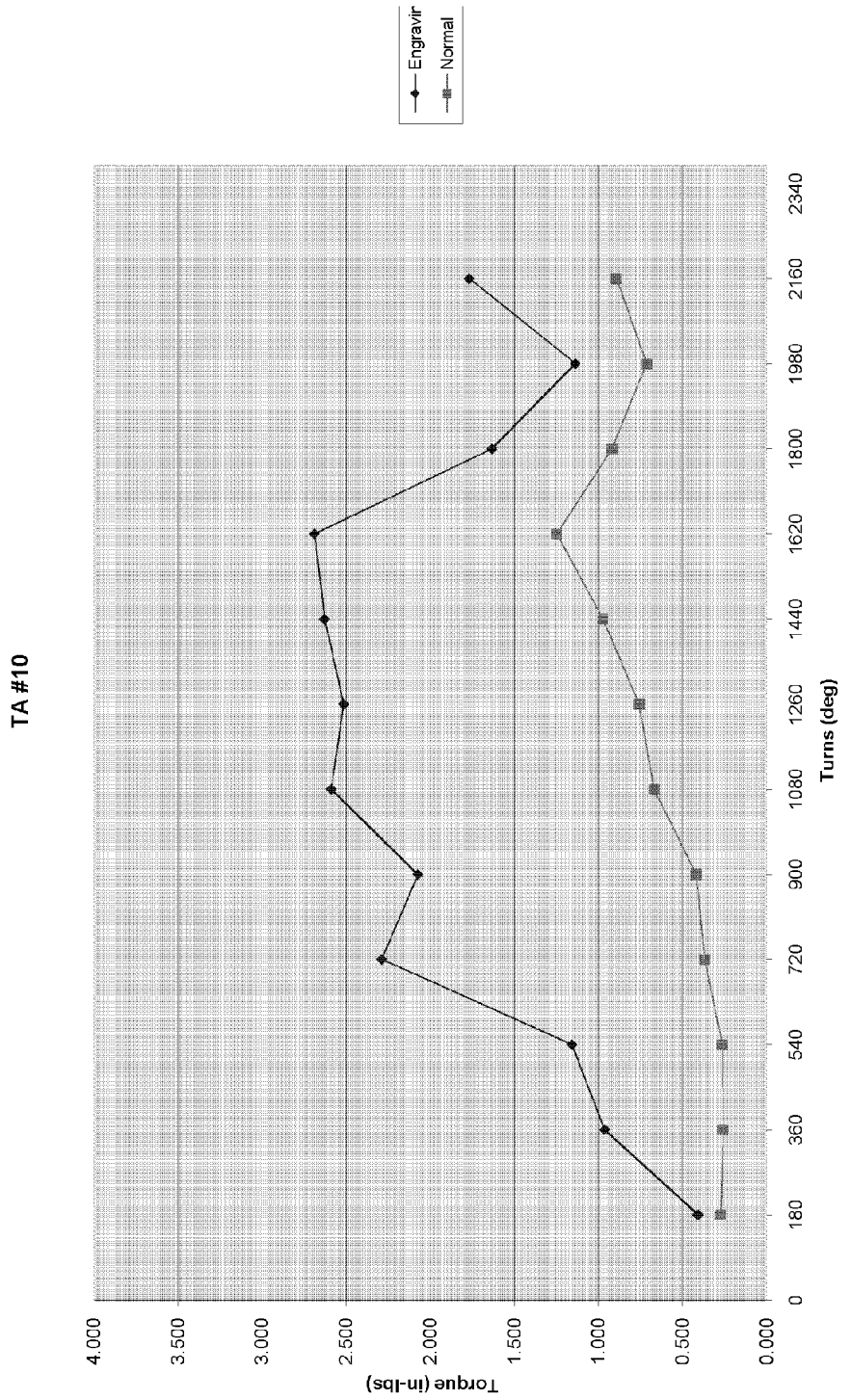

TA #7
Engravir
Normal
Torque (in-lbs)
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
0
180
360
540
720
900
1080
1260
1440
1620
1800
1980
2160
2340
Turns (deg)

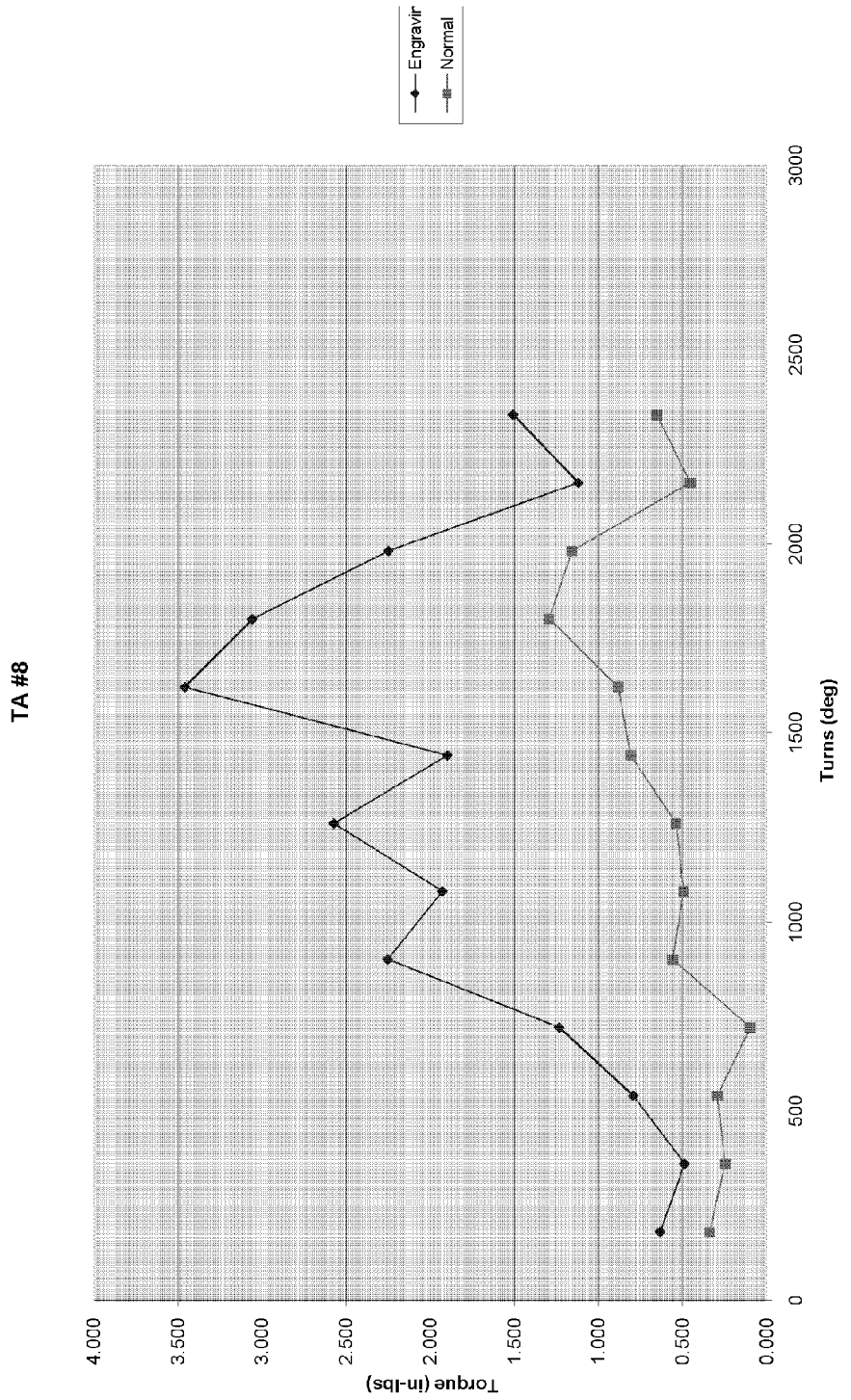

TA #2
Engravir
Normal
Torque (in-lbs)
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
0
180
360
540
720
900
1080
1260
1440
1620
1800
1980
2160
2340
Turns (deg)

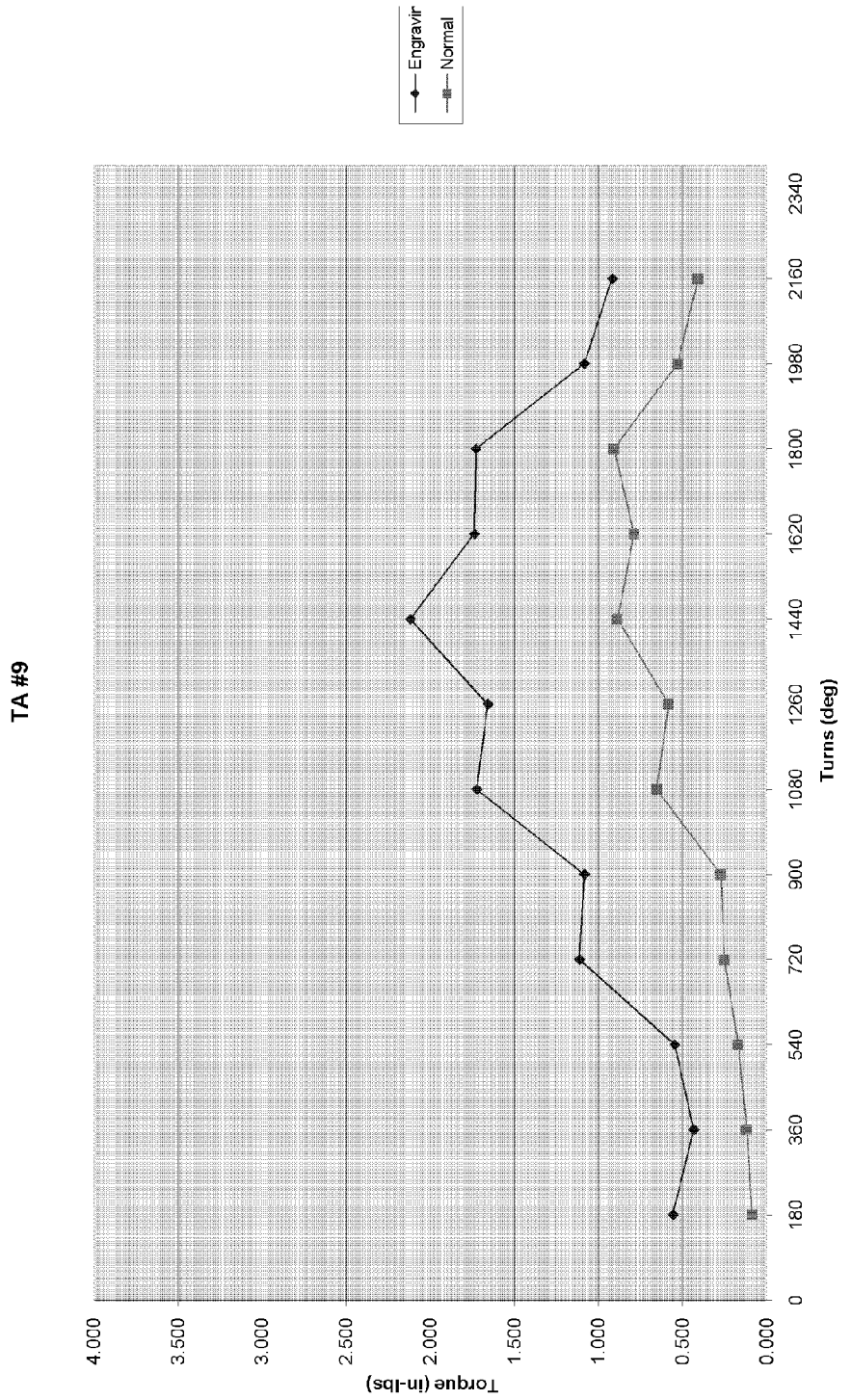

TA #3
Engravir
Normal
Torque (deg)
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
0
180
360
540
720
900
1080
1260
1440
1620
1800
1980
2160
2340
Turns (deg)


TA #6
Engravir
Normal
Torque (in-lbs)
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
0
500
1000
1500
2000
2500
3000
Turns (deg)


Engravir
Normal
TA #4
Torque (in-lbs)
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
0
180
360
540
720
900
1080
1260
1440
1620
1800
1980
2160
2340
Turns (deg)


TA #10
Engravir
Normal
Torque (in-lbs)
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
0
180
360
540
720
900
1080
1260
1440
1620
1800
1980
2160
2340
Turns (deg)


TA #8
Engravir
Normal
Torque (in-lbs)
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
0
500
1000
1500
2000
2500
3000
Turns (deg)


TA #9
Engravir
Normal
Torque (in-lbs)
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
0
180
360
540
720
900
1080
1260
1440
1620
1800
1980
2160
2340
Turns (deg)