HERE IS THE DATA ON THE TORQUE METERS THAT I AM USING.

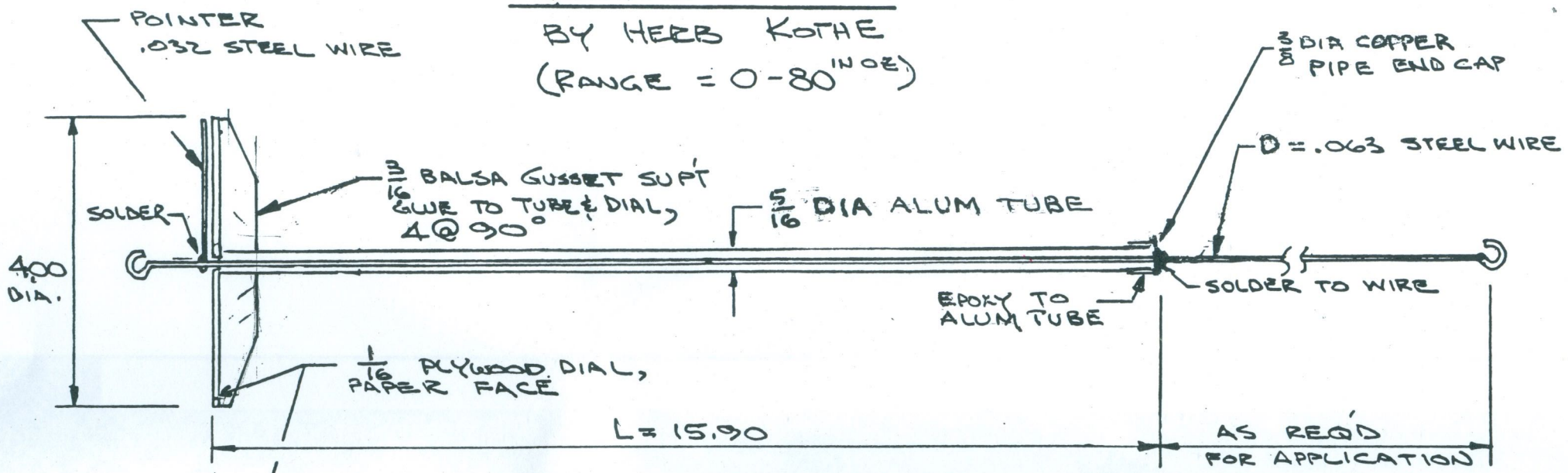
I HAVE INCLUDED THE MATH REQUIRED TO CALCULATE THE TWIST ANGLES FOR VARIOUS TORQUE RANGES. IT IS IMPORTANT TO NOTE THAT THE EQUATION FOR TWIST ANGLE ONLY APPLIES IF THE ELASTIC STRENGTH OF THE STEEL WIRE IS NOT EXCEEDED. ALL EXAMPLES SHOWN ARE WITHIN THE ELASTIC SHEAR STRESS ALLOWABLE FOR STEEL MUSIC WIRE. THE TWIST ANGLE VS. TORQUE CALCULATIONS WERE VARIFIED USING A GRAM BALANCE TO MEASURE TORQUE WITH VERY FAVORABLE RESULTS.

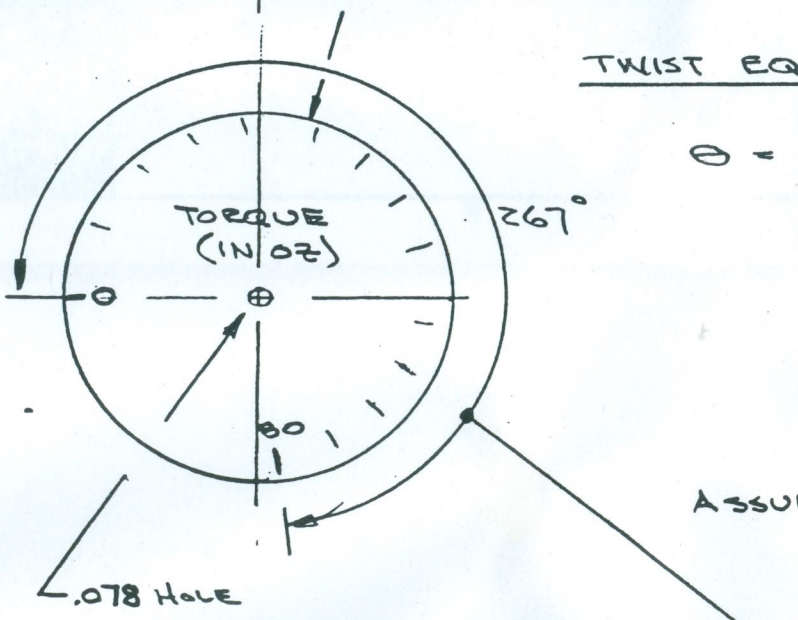
11-2-93

TORQUE METER

BY HERB KOTHE

(RANGE = 0-80 IN OZ)





TWIST EQUATION FOR STEEL WIRE

$$\theta = \frac{TL}{GJ}$$

θ = ANGLE OF TWIST, (RADIANS)

T = TORQUE, (IN #)

L = LENGTH, (IN)

G = TORSIONAL MODULUS OF ELASTISITY, (PSI)

J = TORSIONAL MOMENT OF INERTIA, (IN^4)

ASSUME:

$T = 80^{IN\ OZ} = 5.00^{IN\ \#}$

$L = 15.90^{IN}$

$G = 11.0 \times 10^6$ PSI

$$J = \frac{\pi D^4}{32} = \frac{\pi (.063)^4}{32}$$

$$= 155 \times 10^{-8}\ IN^4$$

FOR 80 IN OZ TORQUE

$$\theta = \frac{TL}{GJ}$$

$$= \frac{(5.00)(15.90)}{(11 \times 10^6)(155 \times 10^{-8})}$$

$$= 4.666 \text{ RADIANS}$$

$$= (4.66)(57.3)$$

$$= 267°$$

FOR 1 IN OZ TORQUE

$$\theta = \frac{267}{80} = 3.34°$$

SIMPLIFIED TWIST EQUATION

(USING STEEL MUSIC WIRE)

$$\theta = 3.32 \times 10^{-6} \frac{TL}{D^4}$$

T = TORQUE (IN OZ)
L = LENGTH WIRE (IN)
D = DIA WIRE (IN)
θ = TWIST ANGLE (DEG)

EXAMPLE:

$T = 80$ IN OZ
$L = 15.9$ IN
$D = .063$ IN

$$\theta = \frac{(3.32 \times 10^{-6})(80)(15.9)}{(.063)^4}$$

$$= 267 \text{ DEG}$$

SOME OF THE TORQUE METERS THAT I HAVE MADE HAVE THE FOLLOWING SPECIFICATIONS —

T (IN OZ)	L (IN)	D (IN)	θ (DEG)
120	25.2	.078	270
80	15.9	.063	267
40	18.7	.055	270
20	19.8	.047	270
4	8.0	.025	270