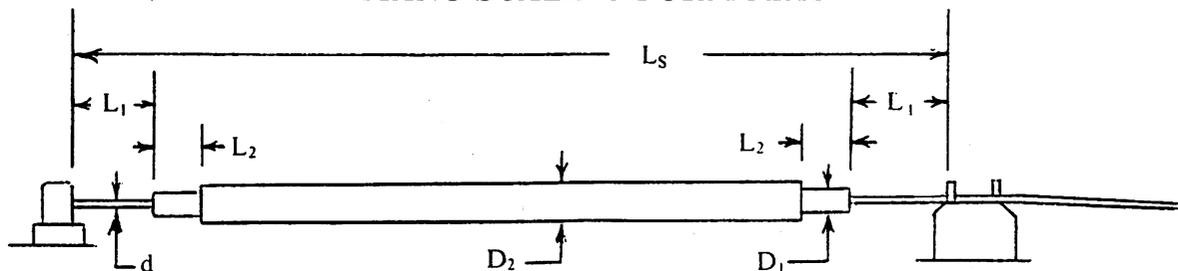


PIANO TECHNOLOGY TOPICS

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Topic #5 PIANO SCALING FORMULAS



TENSION

1. Plain Wire

$$T = \frac{f^2 L_s^2 d^2}{434} \quad \text{or} \quad T = 1.55 d^2 L_s^2 2^{(N/6)} \quad (\text{Alternate Forms})$$

Where T = tension, lbs; f = freq., Hz.; L_s = speaking length, in.; d = dia., in; N = note number.

2. Wound Strings

$$T = \frac{f^2 L_s^2 (.89 D_2^2 + .11 d^2)}{434} \quad \text{or} \quad T = 1.55 (.89 D_2^2 + .11 d^2) L_s^2 2^{(N/6)}$$

INHARMONICITY CONSTANT

(I = Bn^2 where I = inharmonicity of partial n, cents)

1. Plain Wire

$$B = \frac{(330d)^4}{TL_s^2} \quad \text{or} \quad B = \frac{(87400d)^2}{L_s^4 2^{(N/6)}} \quad B \text{ is inharmonicity constant, cents.}$$

2. Single-Wound Bass Strings.

$$B = B_{\text{core}} + B_{\text{end}_1} + B_{\text{end}_2} \quad B_{\text{core}} = \frac{(330d)^4}{TL_s^2}$$

$$B_{\text{end}} = .287 \left(\frac{D_2^2 - d^2}{D_2^2 + .12d^2} \right) \left(4 \sin \frac{4\pi L_1}{L_s} - \sin \frac{16\pi L_1}{L_s} \right)$$

Note: L_1 on tenor bridge, use more than .75 to get B up to required values if necessary.

3. Double-Wound Bass Strings.

$$B = B_{\text{core}} + B_{\text{end}_1} + B_{\text{end}_2} + B_{\text{step}_1} + B_{\text{step}_2} \quad B_{\text{core}} = \frac{(330d)^4}{TL_s^2}$$

Bend = same as above

$$B_{\text{step}} = .287 \left(\frac{D_2^2 - D_1^2}{D_2^2 + .12d^2} \right) \left(4 \sin \frac{4\pi (L_1 + L_2)}{L_s} - \sin \frac{16\pi (L_1 + L_2)}{L_s} - 4 \sin \frac{4\pi L_1}{L_s} + \sin \frac{16\pi L_1}{L_s} \right)$$

BREAKING POINT PERCENTAGE

$$P = \frac{T}{2528 d^2} \quad \text{where } P = \% \text{ of breaking point (not to exceed 66)}$$

ELONGATION

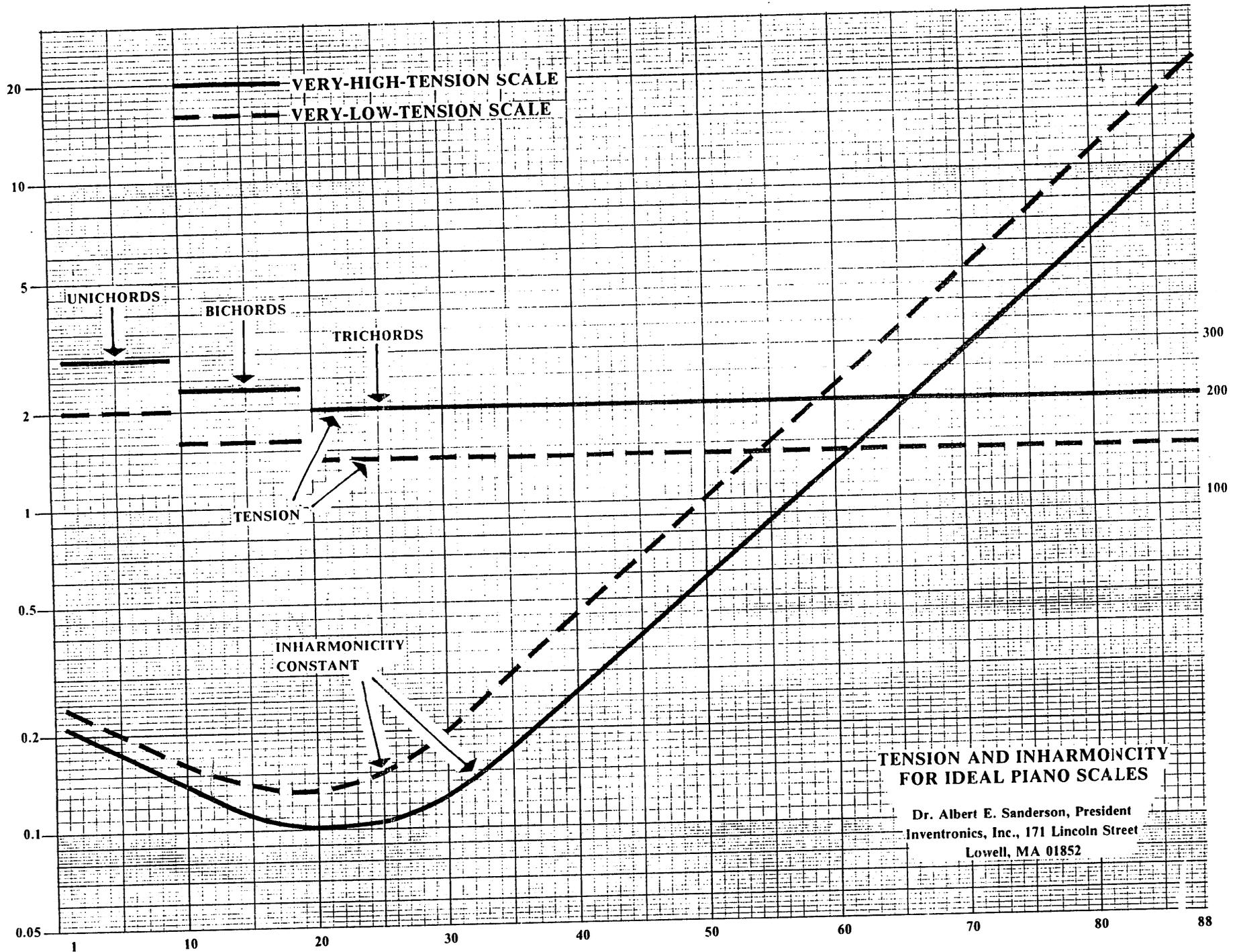
$$e = \frac{PL}{8792} \quad \text{where } e = \text{elongation, in inches.}$$

LIMITATIONS

$$P < 66 \quad \frac{D_2}{d} < 3, \text{ single wound} \quad \frac{D_2}{d} < 5, \text{ double wound. } L_2 \text{ as short as possible.}$$

$$D > d + .019 \quad .5 < L_1 < .75 \text{ on bass bridge. See note above for tenor bridge.}$$

INHARMONICITY CONSTANT, B. CENTS.



**TENSION AND INHARMONICITY
FOR IDEAL PIANO SCALES**

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