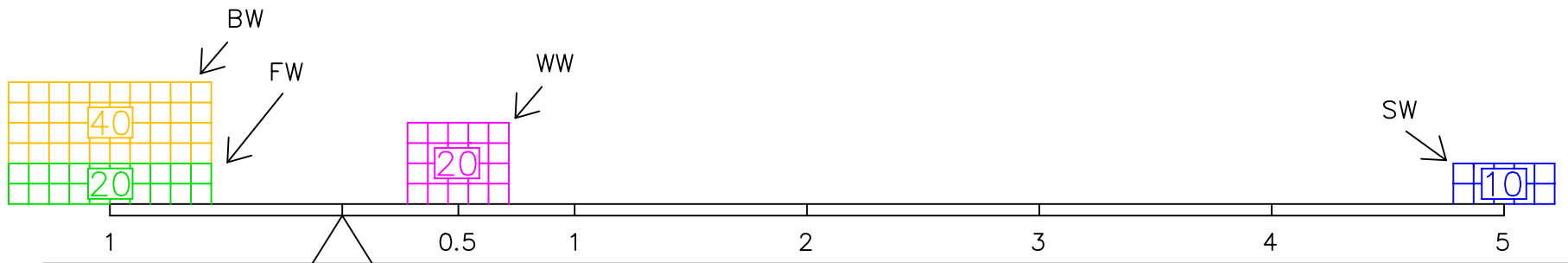
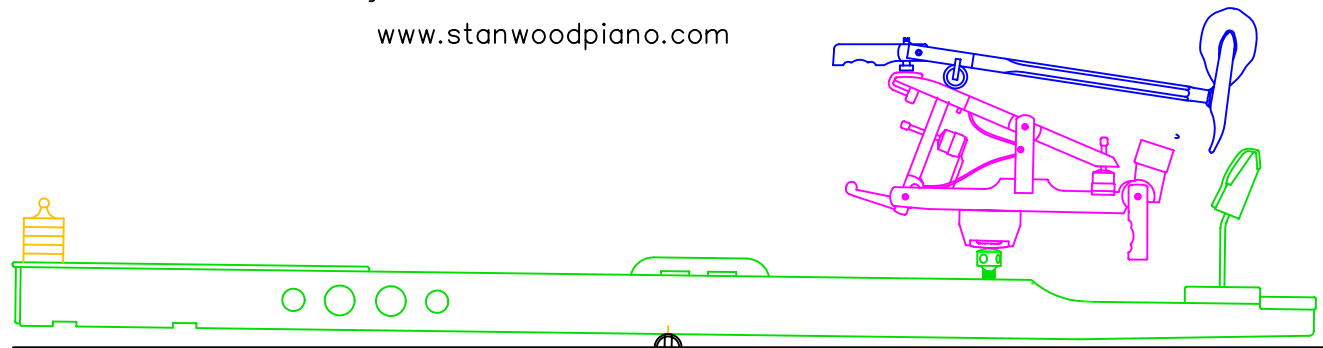


THE NEW TOUCH WEIGHT METROLOGY

AS AN ANALOGY OF THE GRAND PIANO ACTION TO A CATAPULT

By DAVID C. STANWOOD

www.stanwoodpiano.com



THE EQUATION OF BALANCE : $BW + FW = (KR \times WW) + (R \times SW)$

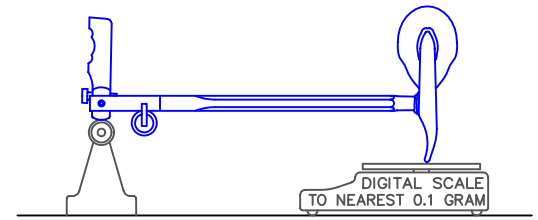
CALCULATION OF STRIKE WEIGHT RATIO: $R = (BW + FW - (KR \times WW)) / SW$

Where:

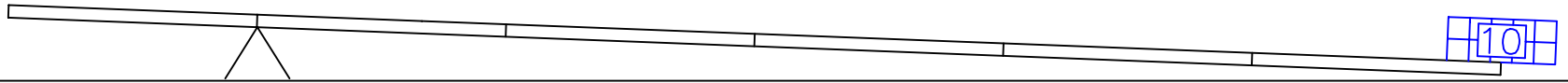
- BW = Balance Weight: The amount of weight placed on the front of the key to put the key in balance.
- FW = Front Weight: The amount of downward balancing force created by installing lead weight in the key.
- WW = Wippen Radius Weight: The amount of weight from the wippen on the capstan.
- KR = Key Weight Ratio: The ratio by which the WW is transformed to an upward force at the front of the key.
- SW = Strike Weight: The weight of the hammer and the radius weight of the shank.
- R = Strike Weight Ratio: The ratio by which the SW is transformed to an upward force at the front of the key.

All the components shown in the equation of balance have direct counterparts in the grand piano action.
In the model the beam is weightless and the pivot frictionless

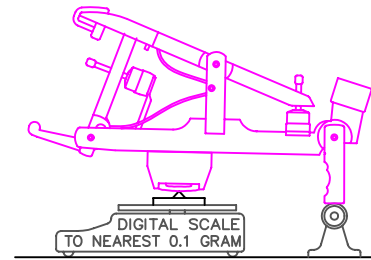
SW = 10
R = 5



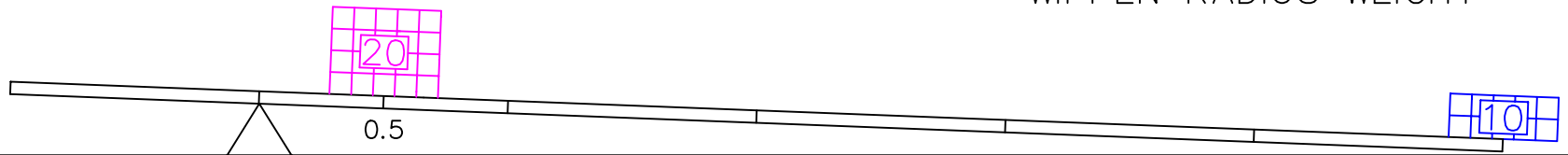
STRIKE WEIGHT



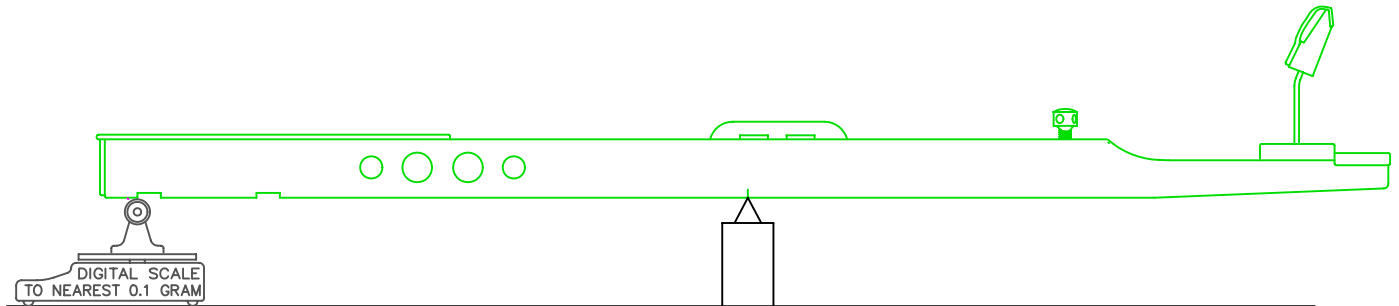
WW = 20
KR = 0.5



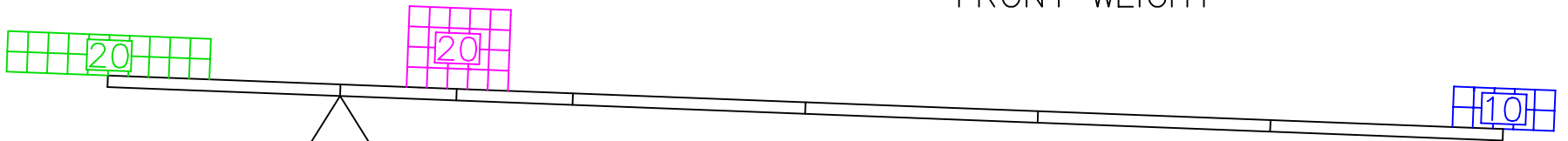
WIPPEN RADIUS WEIGHT



FW = 20



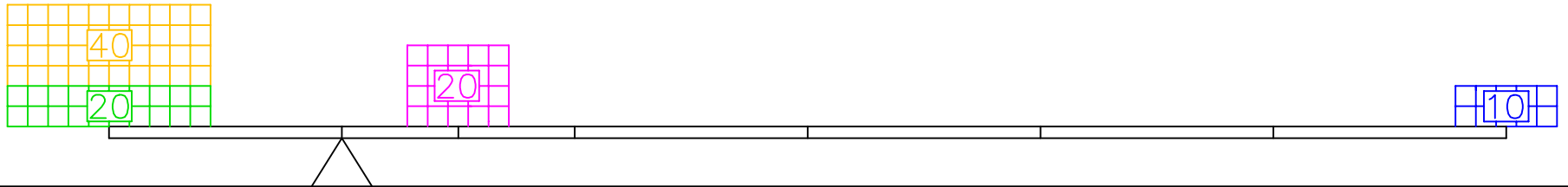
FRONT WEIGHT



$$BW = 40$$

$$BW + FW = (KR \times WW) + (R \times SW)$$

$$40 + 20 = (0.5 \times 20) + (5 \times 10)$$



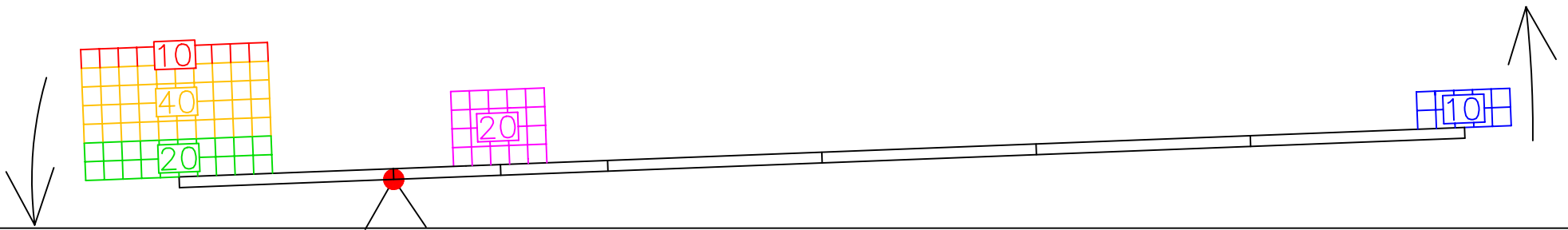
Add 10 grams Friction Weight to the front of the key
Tighten friction brake to make 50 gram Down Weight

$$D = \text{Down Weight}$$

$$F = \text{Friction Weight}$$

$$D = BW + F$$

$$50 = 40 + 10$$



Confirm 30 gram Up Weight

$$U = \text{Up Weight}$$

$$U = BW - F$$

$$30 = 40 - 10$$

$$F = (D - U)/2$$

$$10 = (50 - 30)/2$$

$$BW = (D + U)/2$$

$$40 = (50 + 30)/2$$

