Overhead Contact System Constant Tensioning With Spring Devices

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Key Presentation Take-Aways

- Origin of the Constant Tension Spring
- Variable tension/constant tension difference
- Types of tensioning equipment
- Constant Tension Springs (CTS)
- CTS operating principles
- Advantage of CTS
- CTS at Toronto Transit Commission

Variable Tension/Constant Tension

- All wires in tension have sag
- Sag is pronounced with variable tension (VT)
- Radial load increases with VT
- Constant tension controls sag and radial load

Sag in Contact Wire

$$D = \frac{WS^2}{8T}$$

$D = Sag\ in\ Feet$

$W = Weight\ of\ wire\ in\ lb/ft$

$S = Span\ length\ in\ ft$

$T = Tension\ in\ lbs$

Radial Load in Contact Wire Variable/Constant Tension

Contact Wire Tension

0° F = 3,512 lbs

104° F = 1,109 lbs

Radial Load for 16°

0° F = 977 lbs

104° F = 318 lbs

Constant Contact Wire Tension

0° F = 2,000 lbs

104° F = 2,000 lbs

Radial Load for 16°

0° F = 556 lbs

Tensioning Equipment

- Hydraulic tensioners
- Gas tensioners
- Balance weights
- Springs-variable
- Springs-Constant

Tensioning Equipment

Hydraulic

Long Spring

Balance Weight

Short Spring

Cam/Spiral-Constant Tension

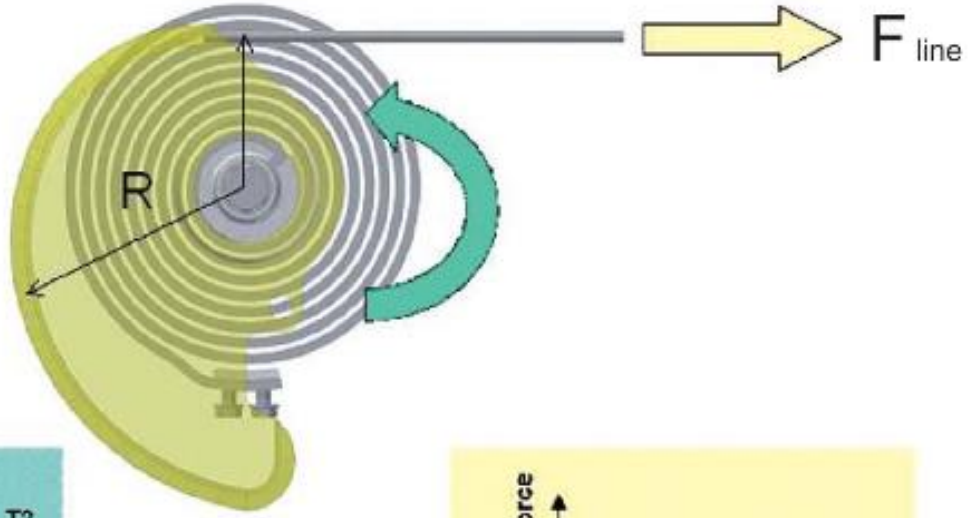
Gas

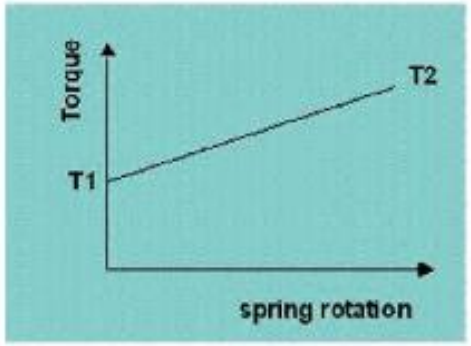
Constant Tension Springs

Origin of Constant Tension Spring

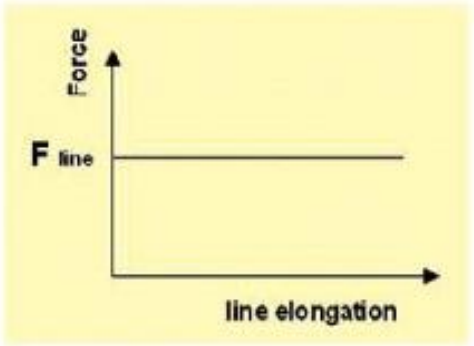
- Designed by Matti Insco Williams student at UMass
- Developed at MBTA, Boston
- Two units Installed 1991 on line B of the Green Line
- Still in service today

Constant Tension Spring Operating Principle

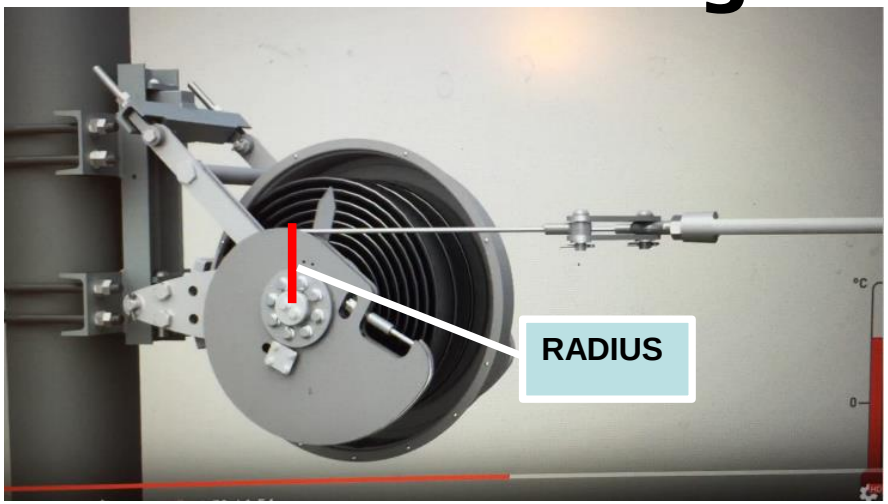




$$F_{line} = \frac{T}{R}$$

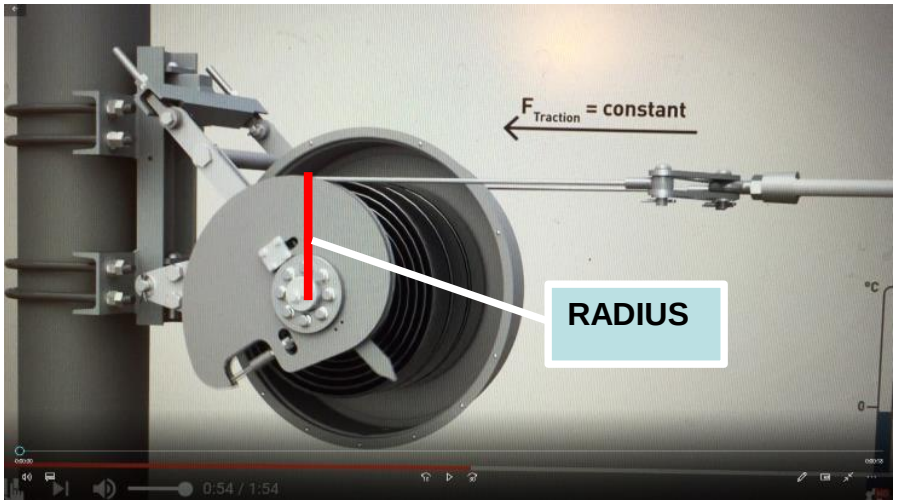


Cam Movement Over Temperature Range Hot to Cold



Expanded wire at hot temperatures

Contracted wire at low temperatures



Advantage of Constant Tension Springs

- Less Costly
- Easy Installation
- Aesthetically Pleasing
- Simple mounting
- Reduced tension losses

Constant Tension Springs
Toronto Transit Commission

Overlap Transition Clamp

Joint Use Pole-Route
514-Cherry Street

QUESTIONS