A Working Quill Drive in Gauge '3'

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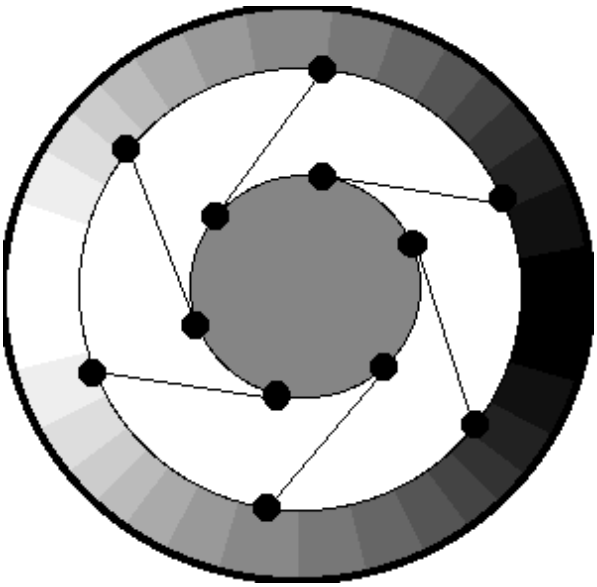
First Published in

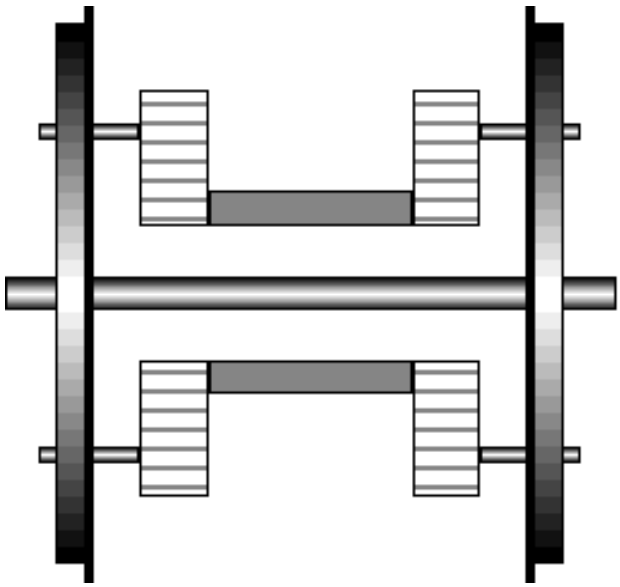
Newsletter 80

March 2010

Most modellers when faced with connecting the motor to the axle normally resort to a spur gear - driven by either a worm gear or another spur gear. I on the other hand am attempting to do something different and get back to the way that it was done in the early part of the 20th century—but at G3 scale. As most people know my G3 locos are all electric—that is they are electric traction with functioning pantographs.

What I am attempting to do in my current model is to produce a working 'Quill Drive'. This uses a large Bull Gear with a tube axle inside which there is the main drive axle. Power is transmitted to the wheel by compression of springs. Normally the 'garland' of springs consists of six facing clockwise and (on the other wheel) six facing anti-clockwise. The axle moves up and down on the horn guides while the Bull Gear is held rigid on the chassis.



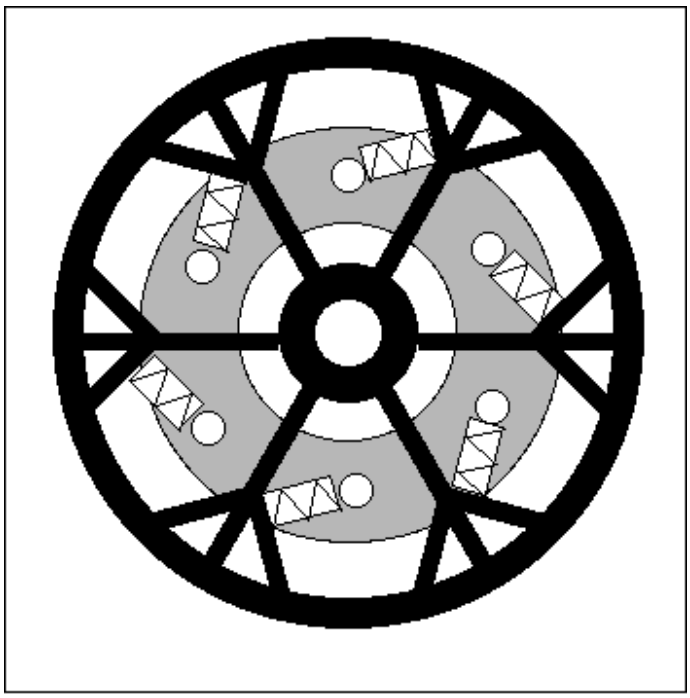


The only sources of information I have been able to garner have been my several books on locomotive engineering and most usefully — the Penn. R.R. archives...

As the system works by compressing springs the least possible number of coils has to be used - however this means that the spring is more rigid. There comes a point at which the compression of the spring limits the amount of movement and you have (in effect) a rigid connection. Too soft a spring and the spring will bind giving the same effect.

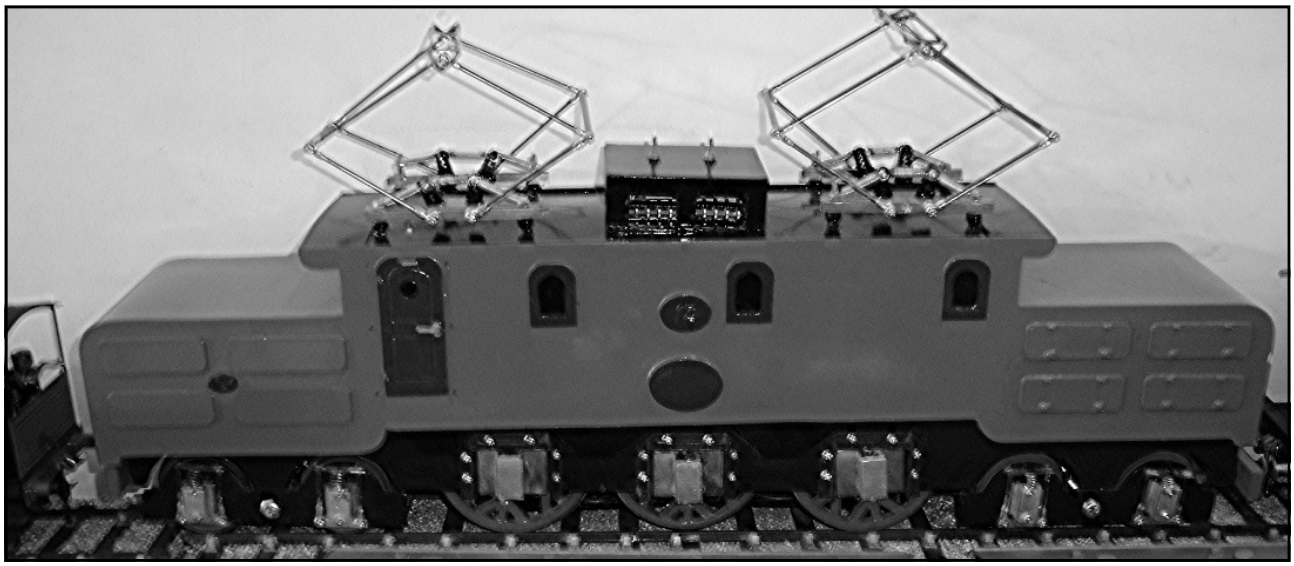
After some leverage calculations I arrived at the amount of force that my motor (through its gearing), would exert on the spring. Next some careful drawing gave me the amount of travel the spring had to be capable of taking before it reached full compression. Because the spring physically changes the angle as it compresses -the effective force taken by the spring is NOT linear...

So I cheated. I took the force at rest, the force at mid point and the force at full compression -and then took the average of the three calculations. This has, (I think), left me with a spring rating that is slightly too strong for my purposes, but the only one I could find in the catalogues that was close was slightly weaker -so I think it evens out!



The main problem with the design of this wheel has actually getting the parts to manufacture a Bull Gear from. The working prototype uses two large spur gears from Moffet Gears with a length of 22mm pipe and a 22mm pipe solder fitting tuned down to 25mm diameter. Yes -Heath Robbinson and Reuben Goldberg are alive and well... Test using weighted tins of nails have shown that the 3mm thick longitudinal bolts through the bosses of the bull gear can take more than 300% of the torque that they would have to take while the loco is in operation. The motor is capable of 223 Grammes per Centimetre of torque and this (after passing through 2 stages of reduction) is multiplied to 2,700 Grammes per Centimetre. So provided my loco does exceed 8,100 Grammes of resistive force— I can get it to move!!!

The drawing above shows how the 'spider' from the Bull Gear interfaces with the drive wheel. This type of drive wheel is normally refered to as a 'Snowflake Wheel'. In the original the six radial spokes split into three at 45 degree intervals and touch the rim at 18 equidistant spaces. The springs from the spider then press against these tridents. According to the drawings from the Penn. R.R. archives the springs from the spider should be at 90 degrees to the trident and the spider should sit centrally. Although I have taken most of my information from the Pennsylvannia Rail Road and a book from 1922 written by the CME of the Great India Peninsular Railway to help build an N.E.R. loco—I have I feel done something that is at least true in spirit to the original.



Ralph's N.E.R. No.13, complete with working quill drives to the 'snowflake' wheels at the AGM