



## Modelling Pantographs

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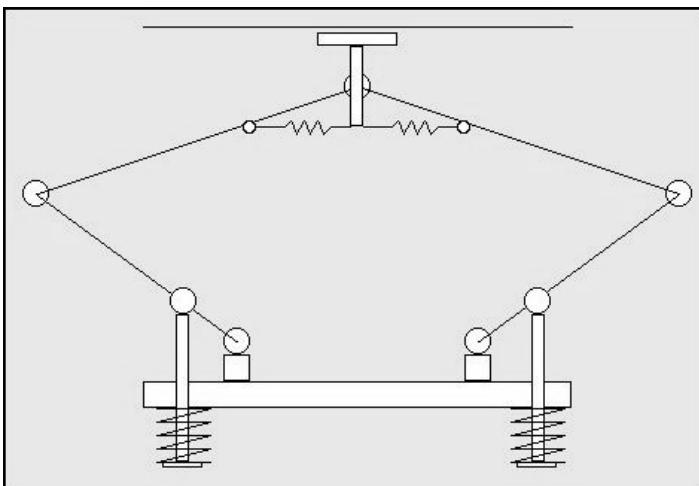
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All of my Gauge 3 models so far have been “Sparkies” and I have a love of early electric locomotives due to the fact that their designers never really understood what it was that they were designing... The (then) “Bleeding Edge” of Railway Technology showed its roots in steam technique and when you start out to build one there is always the one problem with any “Sparkie” - the Pantograph.

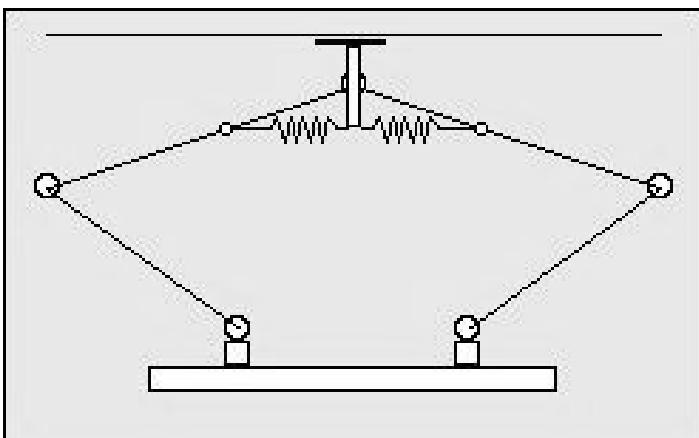
It is actually quite easy to “date” a locomotive from the type of pantograph that it was fitted with, and early builders of model electric locomotives slavishly copied the designs and found -they didn't work!!! Even the time honoured model locomotive designers still got it wrong.

So what is the problem?

I believe that if you have an electric locomotive then it should run with the pantographs raised. The main problem is that in reality the Bow Collector is in tension from the wire above it and unless everything is held in tension -the whole thing simply flops around... Over the years there have been several attempts to produce a model pantograph and they devolve into the two “themes”.



**The Greenly Pantograph**



**The Kerr Pantograph**

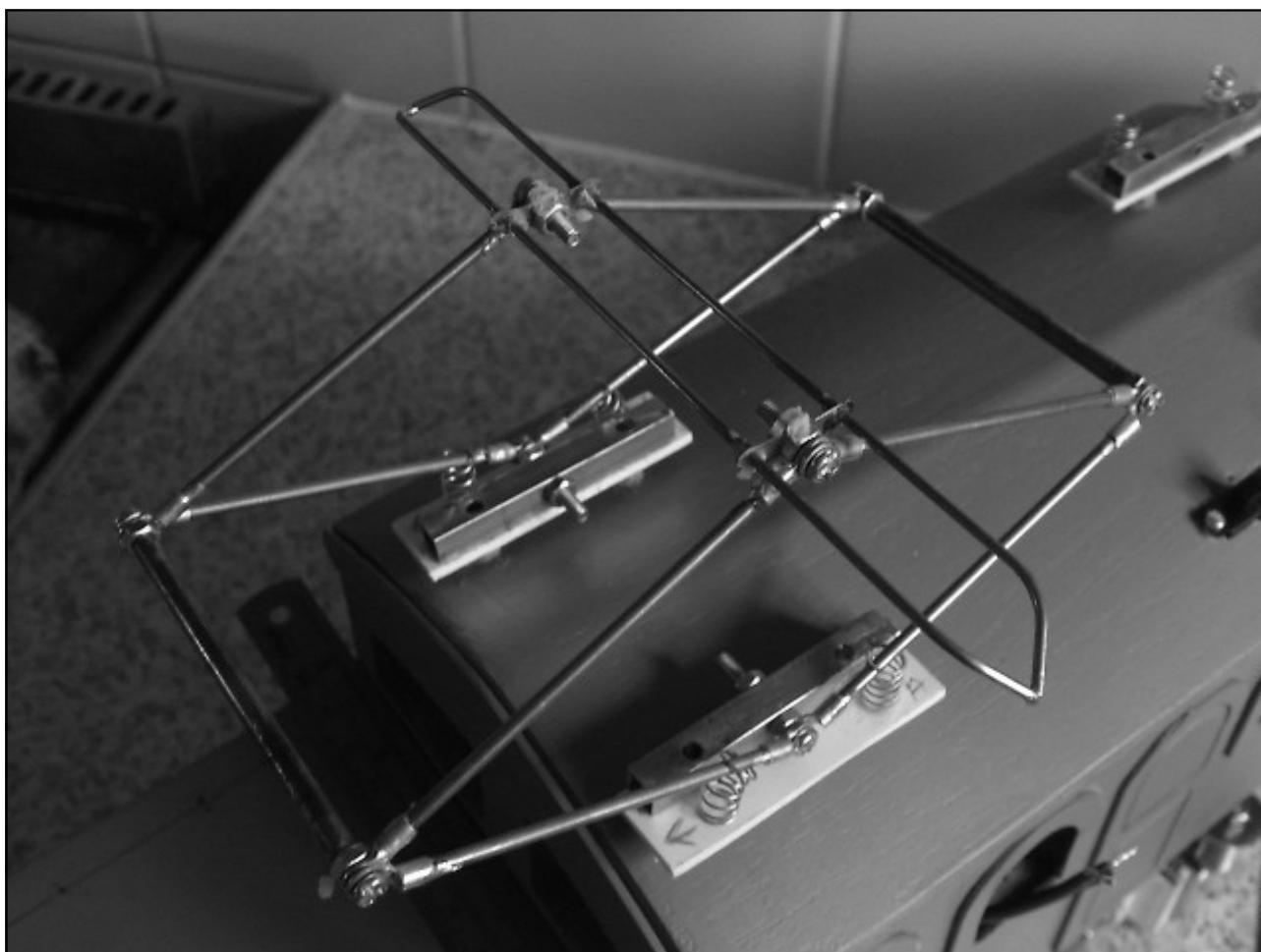
At first sight -they look pretty similar. However their modes of operation are very different. The Greenly Pantograph pushes the lower arms up via springs with two lateral springs to centre the Collector Bow. The Kerr Pantograph uses the collector Bow as the spring mount and it is the tension on the two (or three!) pairs of springs that raises the pantograph.

Needless to say neither of these types is very good at picking up current...

This is due to the fact that the Collector Bow is held in place rigidly and the higher mass at the end of the arms tends to make the assembly "skip" along the overhead wire. In real life the pantograph arms were raised by compressed air, (or a hook on a long length of varnished bamboo), this provided a flexible damped assembly.

While I was contemplating my first loco I had already decided that it should have fully working pantograph system... I looked at the two "classic" designs and voted for the Greenly one -but I altered it to fit my requirements. There are two methods of springing -compression and torsion. I opted for torsion. But, in order to achieve the damped effect, I knew that I couldn't simply use push rods to lift the pantograph arms. So, I elected to BEND the spring... If you take a spring and hold one end then push the top from side to side -then you will notice something strange. The spring is initially very hard to move, but, the more you move it -the easier it becomes...

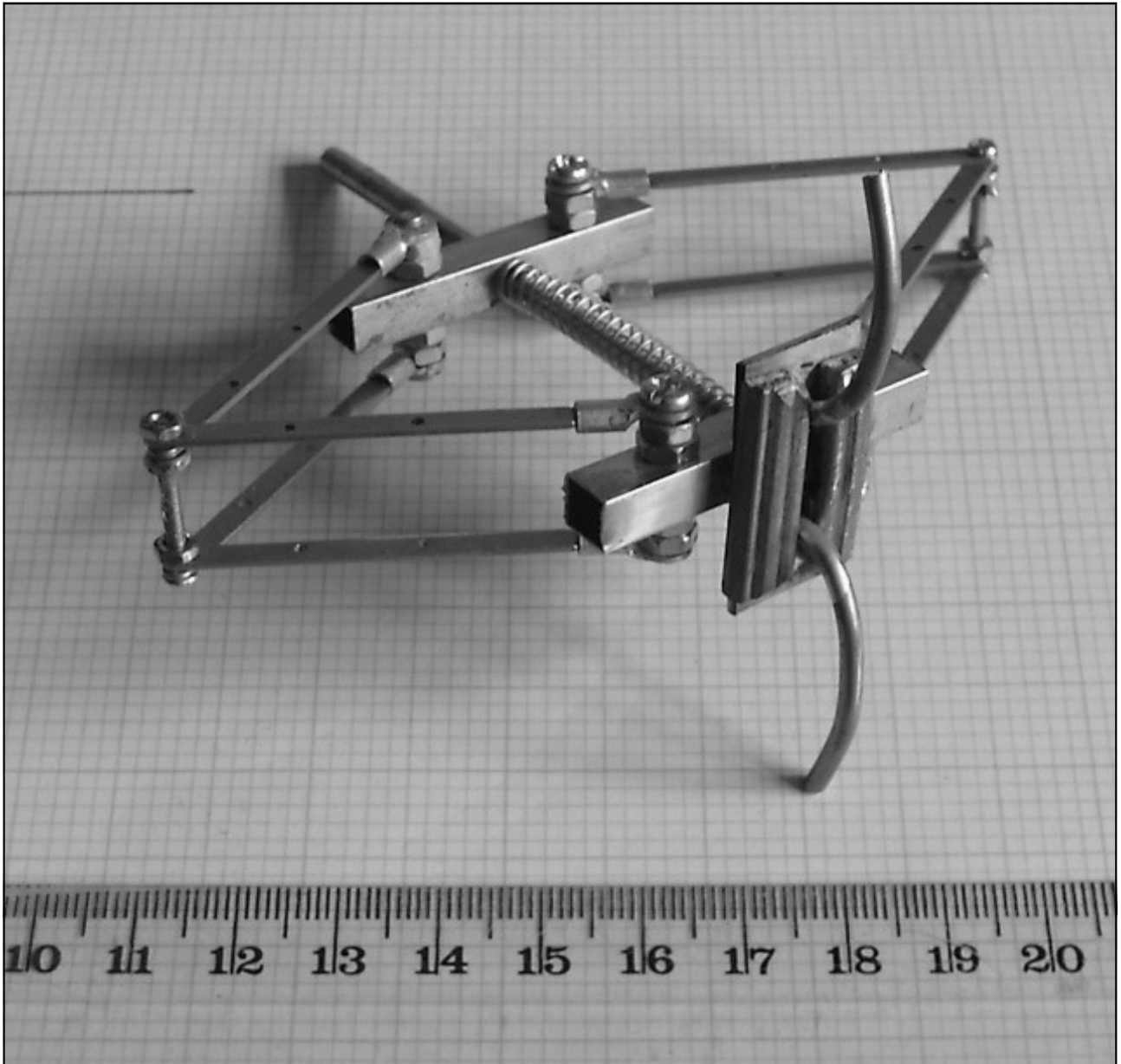
This is how the variable spring loading for my pantograph arms is performed.



The other "problem" with either of the two designs is the fact that the Collector Bow is held rigidly vertical -rather than being allowed to move in contact with the wire. The simplest way out of this problem is to allow the Bow to pivot at the top of the "Diamond". It has to be "self seeking", so in order to do that I bend the ends of the bow together and weight, (with solder), the fused ends. Thus although the pivot point of the Bow is higher than the ends the weight at the ends holds the Bow vertical.

The pantograph shown above is made from 1/16th and 1/8th inch K&S brass tubing, 3mm crimp connectors, plus 3mm nuts and bolts. It has been "drop tested" at 6 Amperes and is capable of plus / minus 10mm.

However not all pantographs are designed to use overhead wire -some were designed to use overhead rail... An example in point was used by the New York Central for their electric locomotives designed to haul the carriages into Grand Central Station through the tunnels under the river. These were not "little shunting engines" -but rather high speed electric locomotives hauling 12 to 15 carriages at 70mph. The pantograph used was extremely robust!!!



The one above is made from K&S sections, 2.5mm and 3mm nuts and bolts. The carbon greasers are made from old graphite motor brushes scraped with a clay scraper.