Possible Solution: Motor in wheel to reduce transmission losses

Primary Objectives:

- High Efficiency
- Low Weight

Secondary Objectives:

- High Reliability
- Low Cost

Problem with this Concept:

Rotational speed of wheel is low ≈ 360rpm

- Electric motors most efficient at higher frequencies ≈ 15,000rpm
- Low rpm, high torque motors are heavy

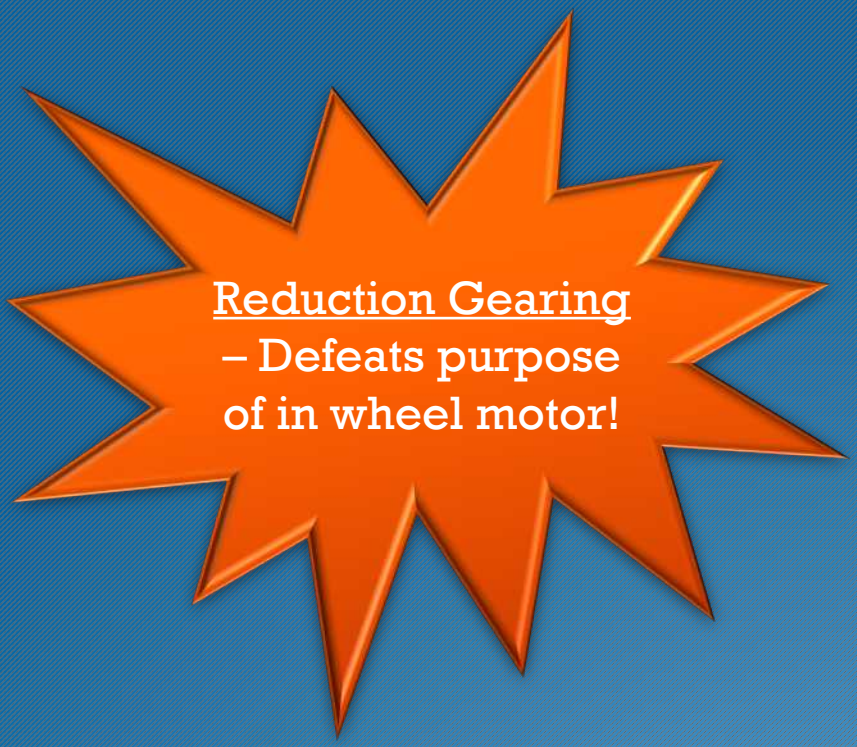
Why?

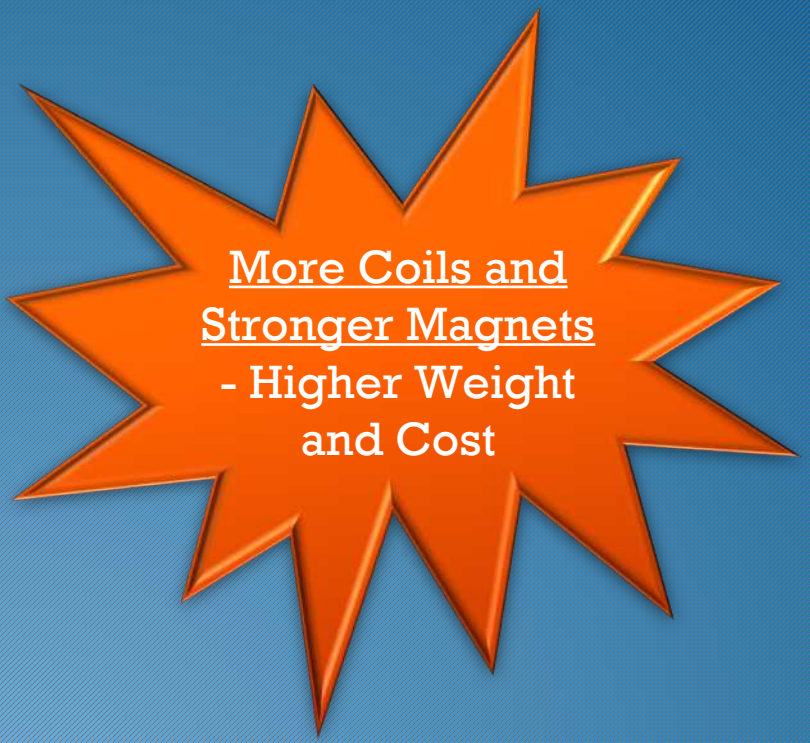
Low RPM

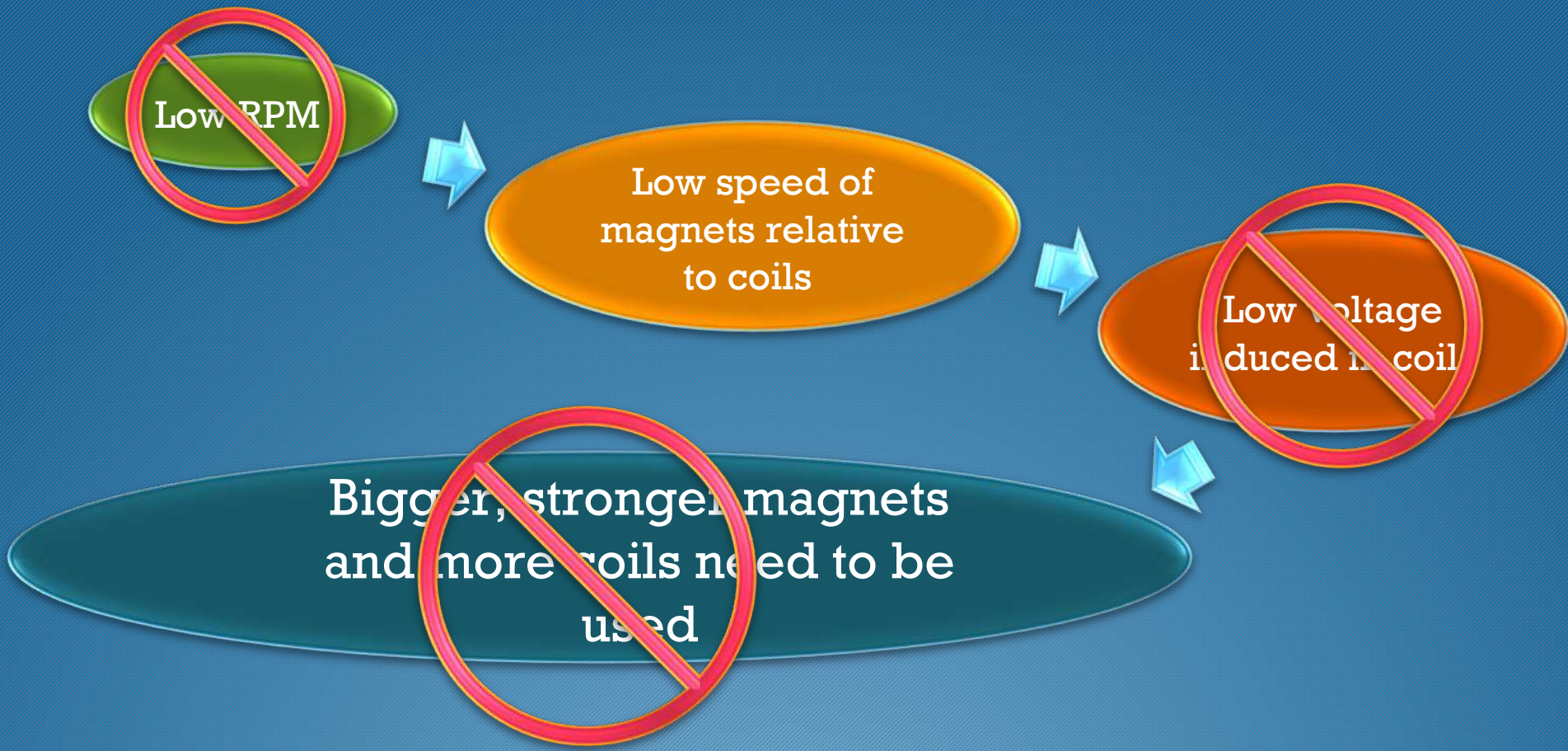
Low speed of magnets relative to coils

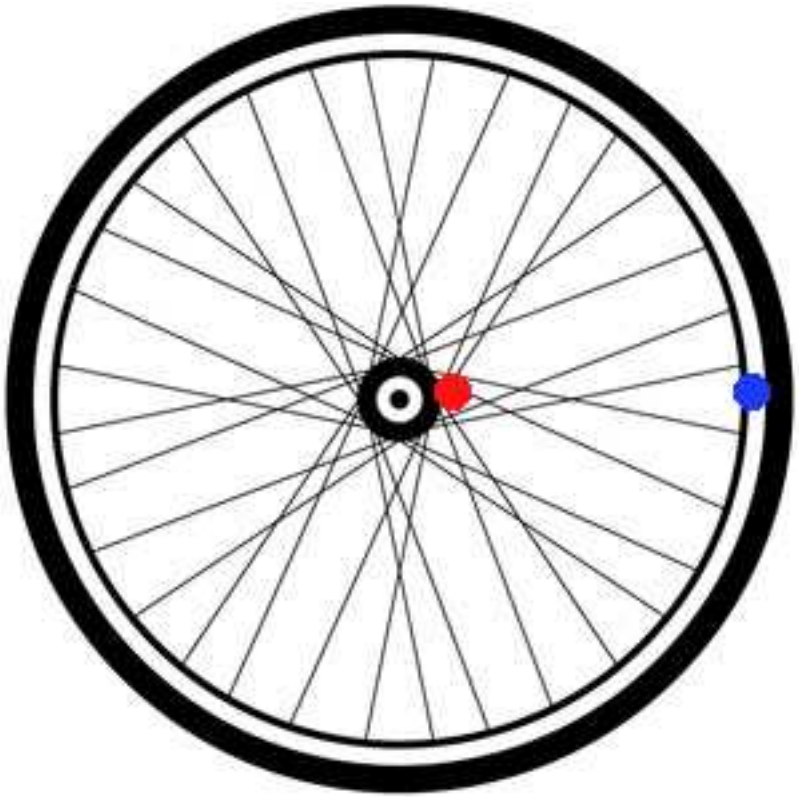
Low voltage induced in coils

Stronger magnets and more coils need to be used


Reduction Gearing
– Defeats purpose
of in wheel motor!


More Coils and
Stronger Magnets
- Higher Weight
and Cost

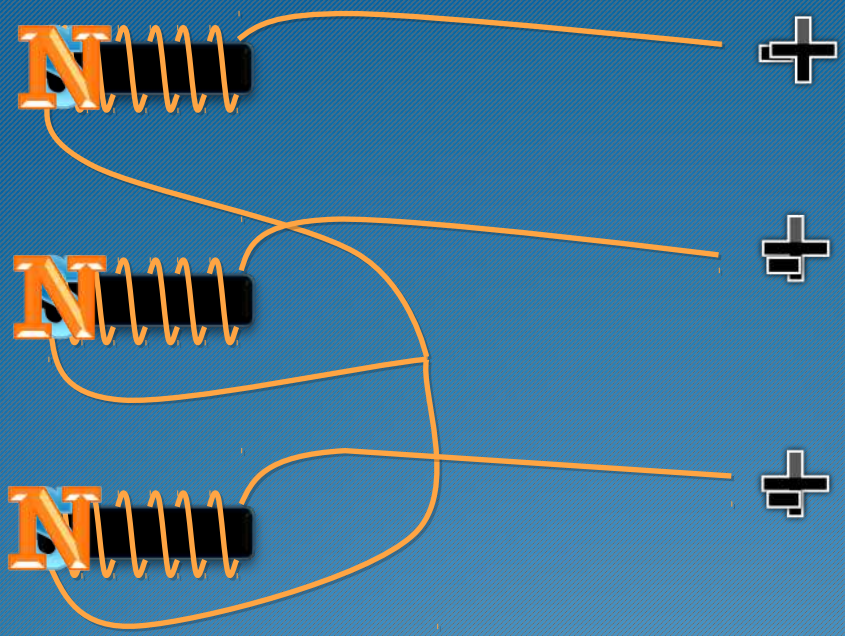

Low RPM
Low speed of magnets relative to coils
Low voltage induced in coil
Bigger, stronger magnets and more coils need to be used



Idea:
Place magnets close to the rim where their speed will be highest

Concept Sketch:

What's happening?!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Prototype

- Concept Shell Eco-Marathon Car wheel modeled on a bicycle

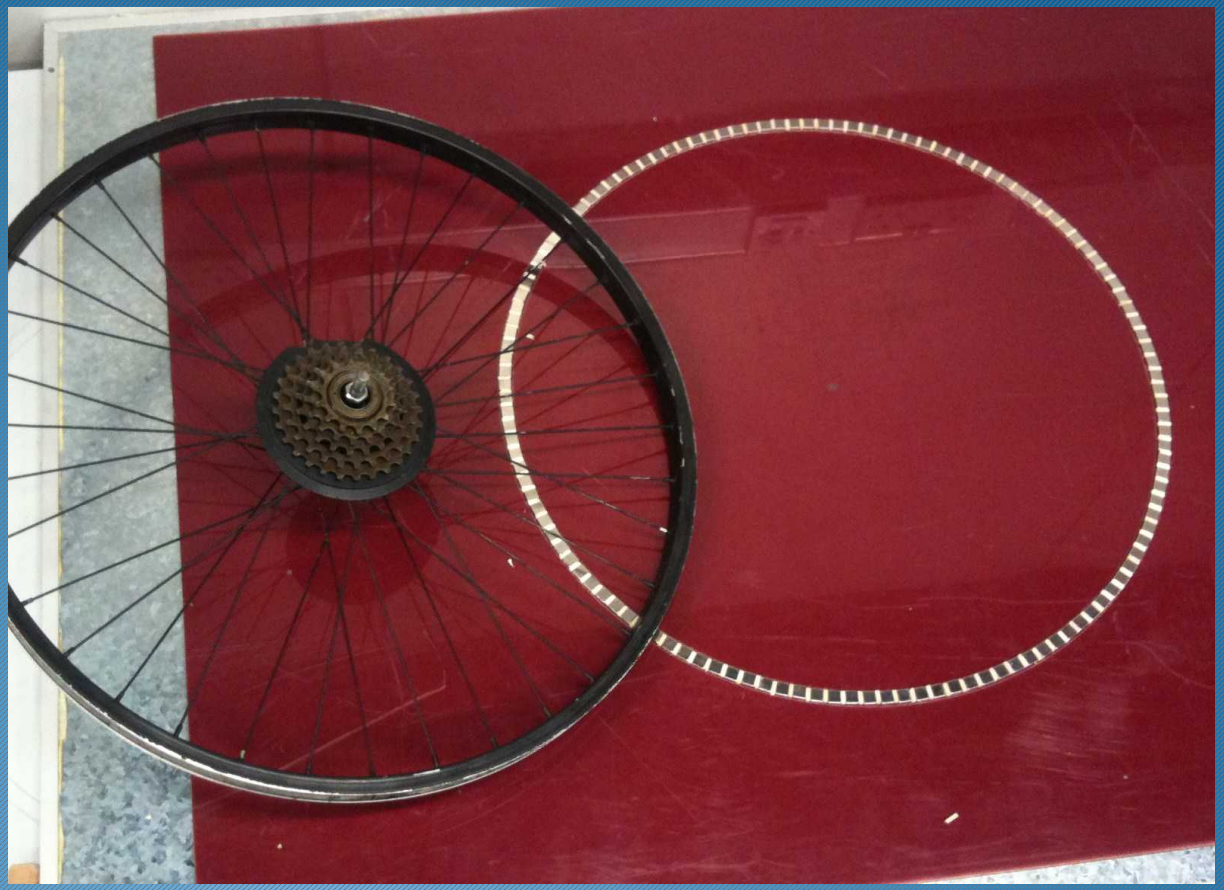
Steps Taken:

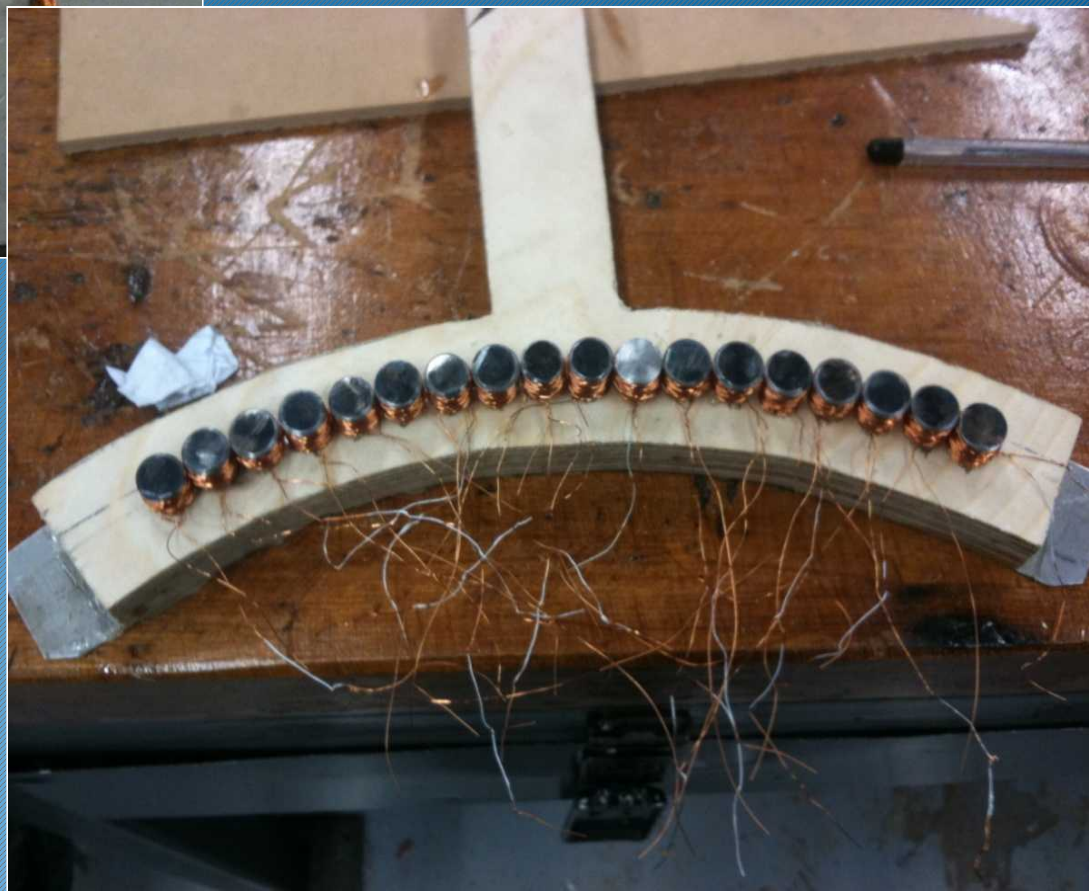
- Attached Magnets to the Wheel
- Constructed Multiple Cores
- Fitted Equipment to the Bicycle

Spacing of Magnets

Attaching Magnets to the Wheel

132 Magnets – Must be a multiple of 2





Concept Generation

Prototyping

Testing & Analysis

Tested Maximum Efficiency:

35%

Testing Procedure: Power In

Volts × Amps = Power In

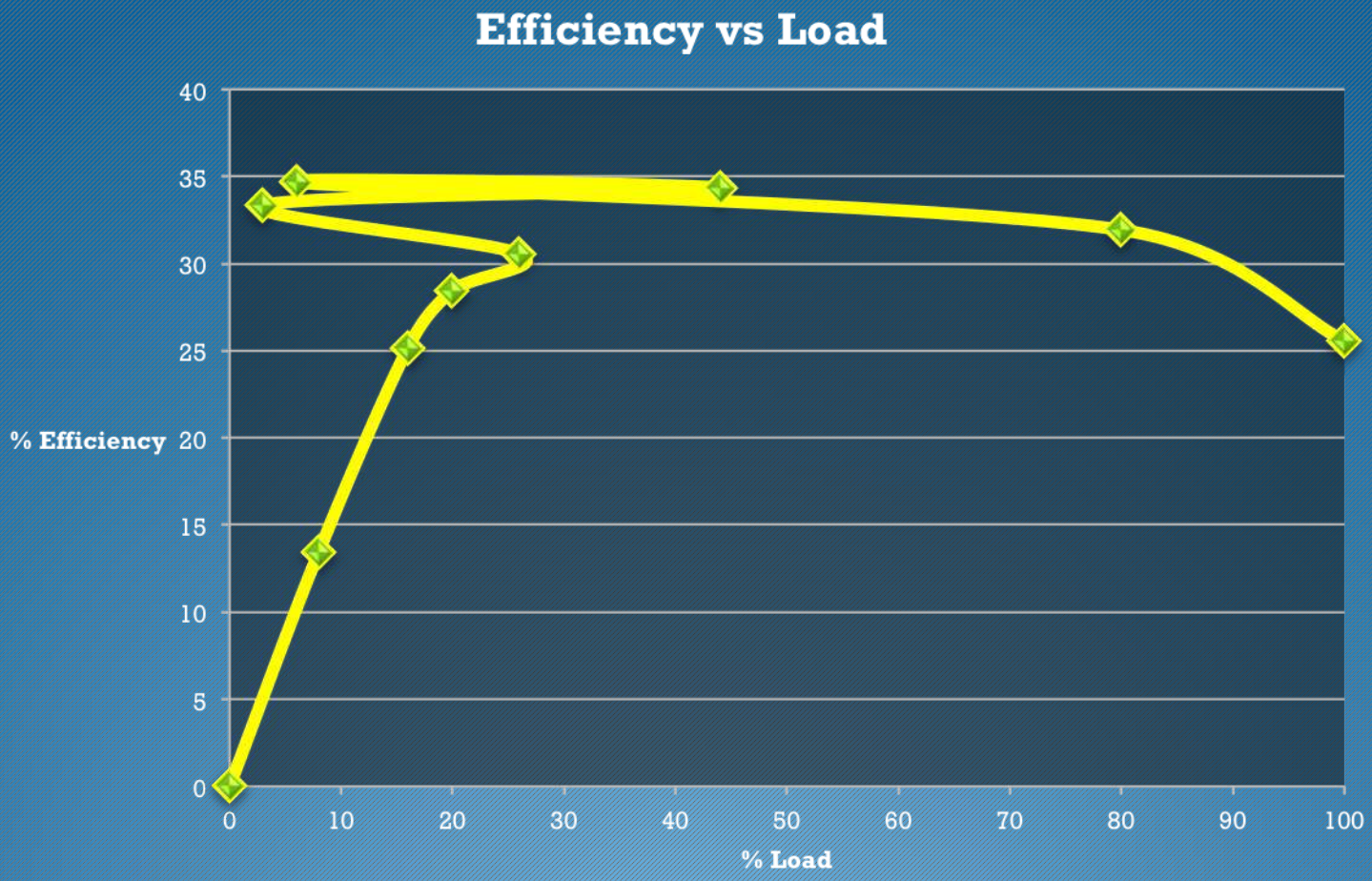
Testing Procedure: Power Out

Friction Brake

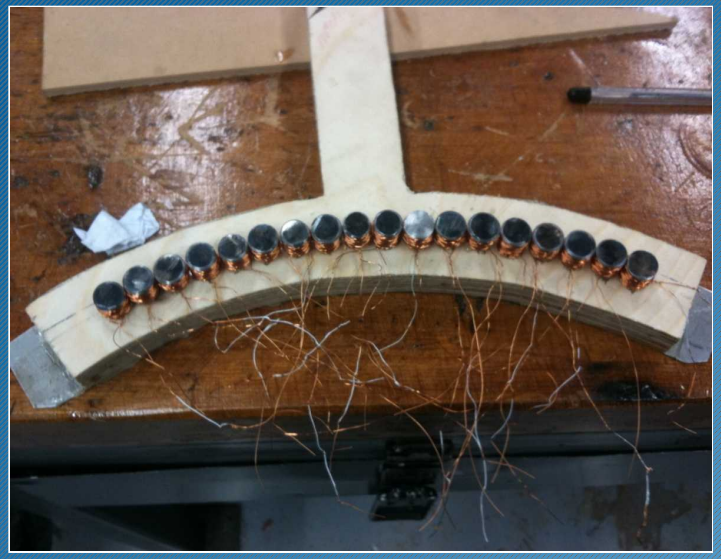
Can work out torque and RPM

Power Out

$$Efficiency = \frac{Power\ Out}{Power\ In}$$



Why was the efficiency so low?



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