The transition to EC motors and the opportunity for Wellington

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October 2010

Company Overview

WT7310

Contents

- The market context
- Wellington's technology
  - High efficiency electric motors that cut electricity bills
- Commercial significance
- Questions

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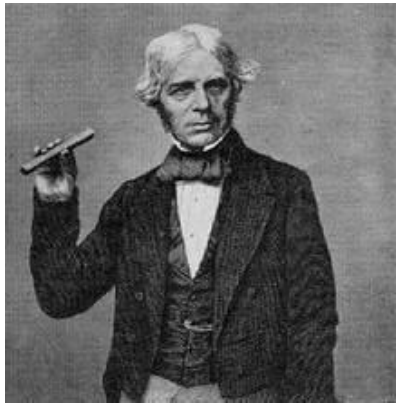
Electric Motors – Why?

- Movement
  - Energy
- Old (old) tech
  - 19th century origins
- Everywhere
  - Fundamental to the growth and continued existence of modern society



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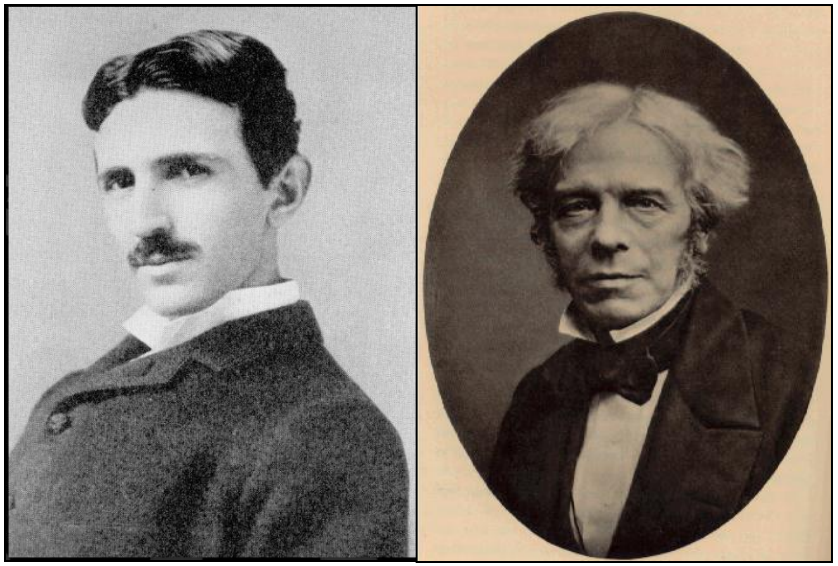
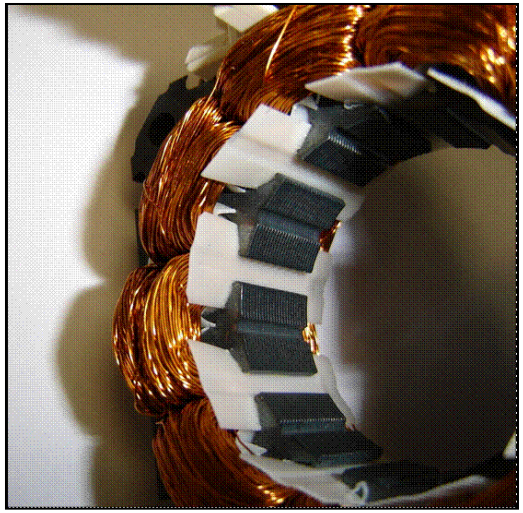
Electric motors are moving from 19th Century…

Electric motors…
…from 19th century genius





Steel, copper

Casting, stamping

Metalworking

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..to 21st Century technologies

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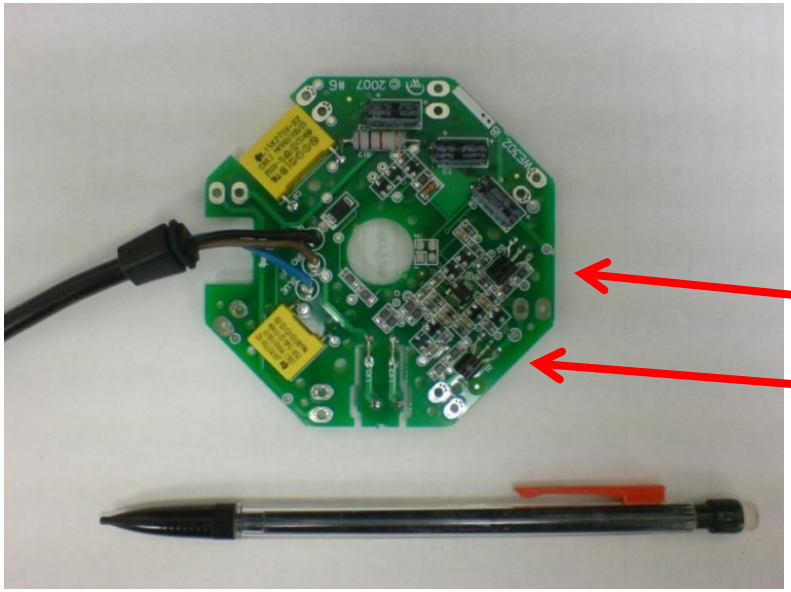

Embedded intelligence

Power electronics

Advanced materials

Information Technology

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The motor industry is not the first …

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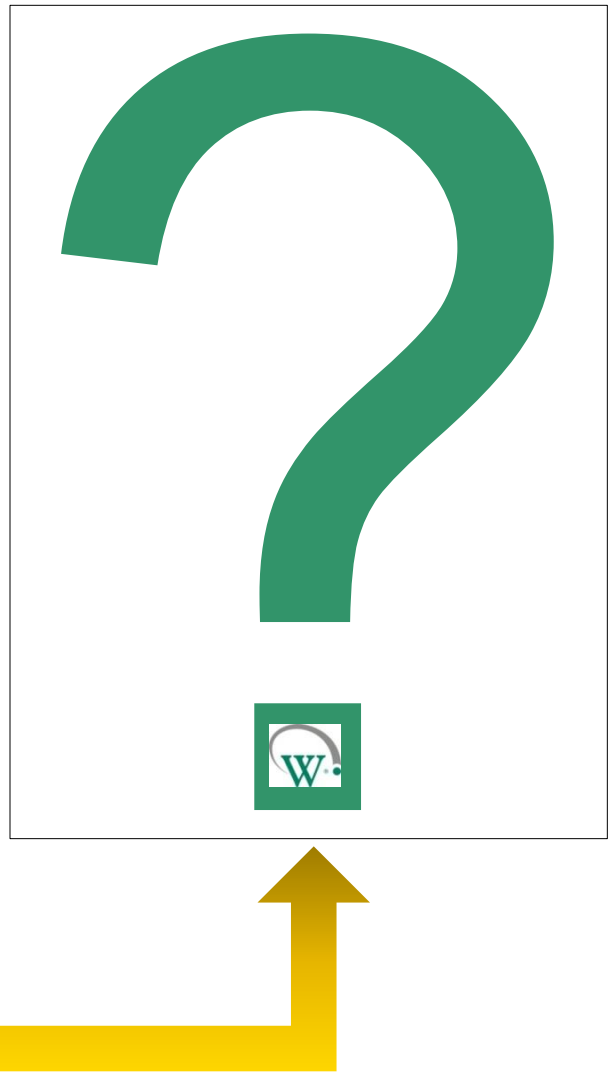

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Wellington's opportunity

- The transition to 'EC' motors provides Wellington's market entry opportunity
  - Incumbent motor manufacturers lack electronics and software skills
  - Rustbelt: those with appropriate skills can find [far] more attractive places to work
- Wellington has a broad technology base of 'formal' IP and deep experience with EC motor/controller/software design
  - Wellington's focuses on fractional horsepower motors for air moving applications e.g. commercial refrigerators & air conditioning

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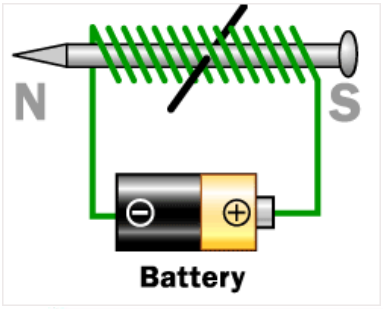
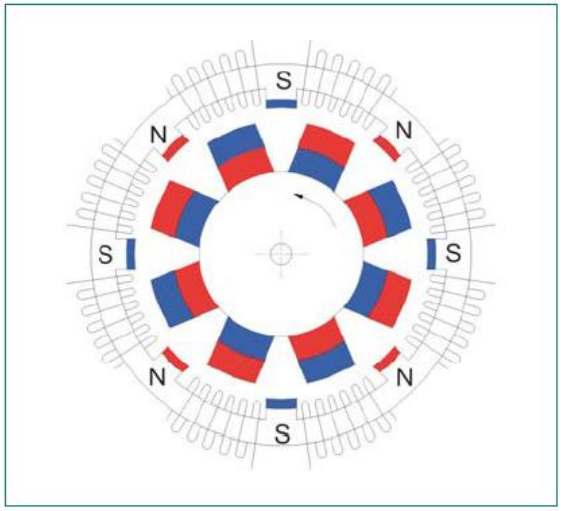
Electric motors 101…

- Opposites Attract – Likes Repel
- Rotating magnetic fields are what make electric motors ‘turn’
- The main difference amongst electric motors is how the rotation of the magnetic fields is achieved



….developed as a motor – the coils are software controlled electromagnets



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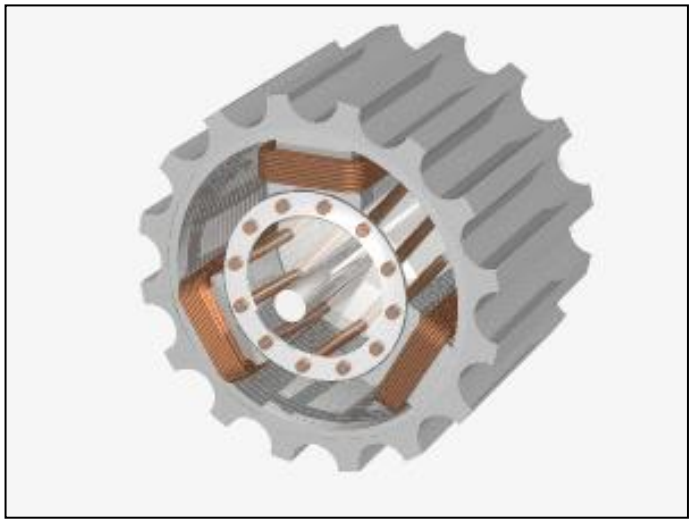
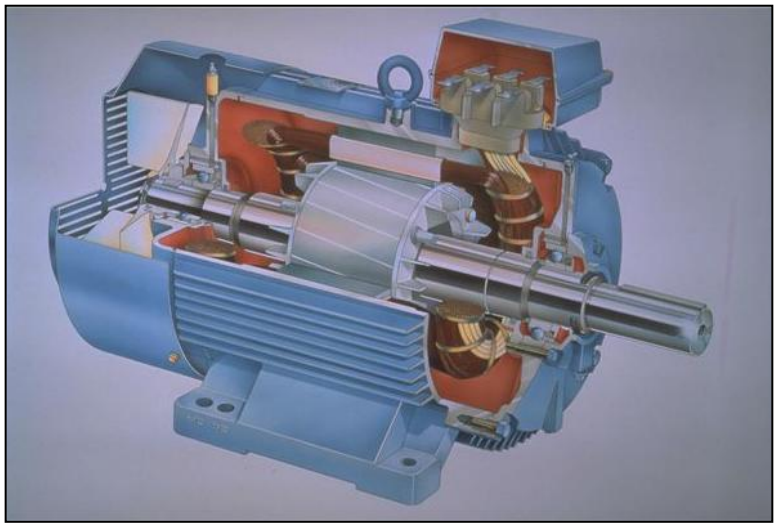
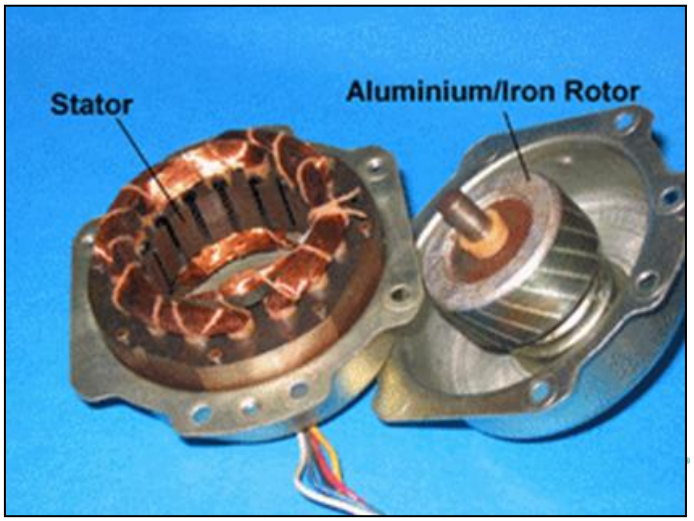
The Induction Motor

- No electronics or magnets
  - Stator connects directly to AC supply
  - “Induced” rotor magnetic field
- Simple (in concept)

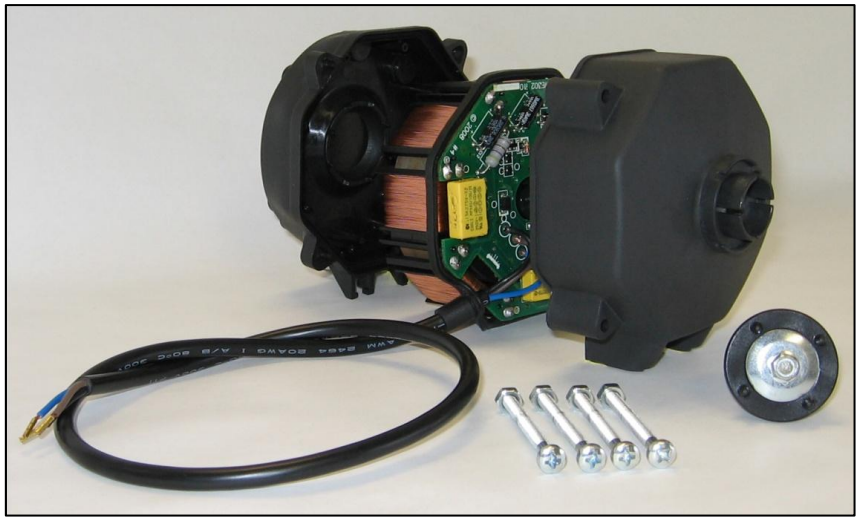


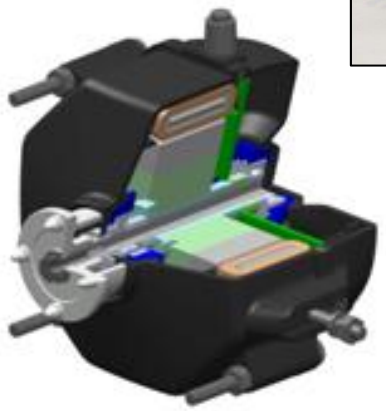




An ‘EC’ motor

- Stator magnetic field under electronic [software] control
  - Power electronics
- Magnets on the rotor
- Cost challenges





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After 100+ years, time for a change

- Energy efficiency in small sizes
  - Induction designs do not ‘scale down’ well and are inefficient at small sizes
- Material wastage
- Demand for variable speed and the improved application performance it brings
- Pervasive connectivity
  - Data
  - “Internet of Things”

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Wellington's technology

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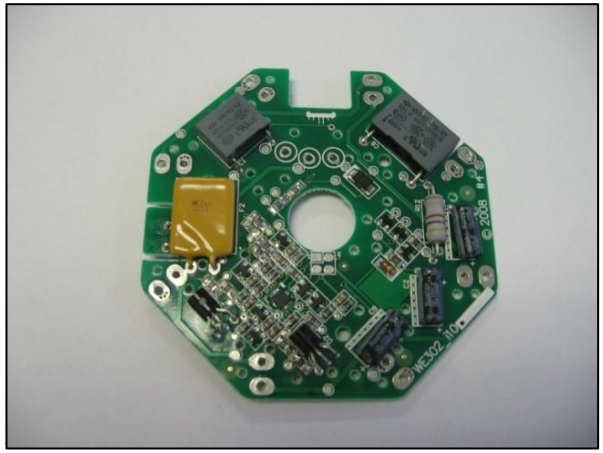
Formal intellectual property

- Slotless, plastic motor designs
- Low part count, electronic controllers
  - Related software
- Manufacturing techniques



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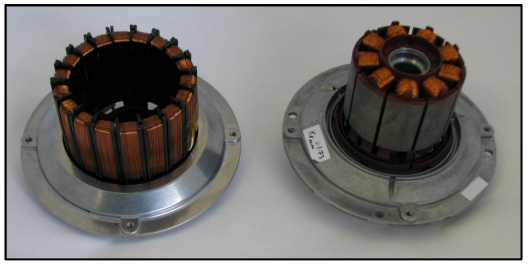
What is Slotless?

- Conventional motors have windings in steel “slots” of various formats:
  - Many (good) reasons for this
  - Manufacturing process is complicated
    - But there is 100+ years experience
- Wellington has a new, simple (& patented) way of making “slotless” motors



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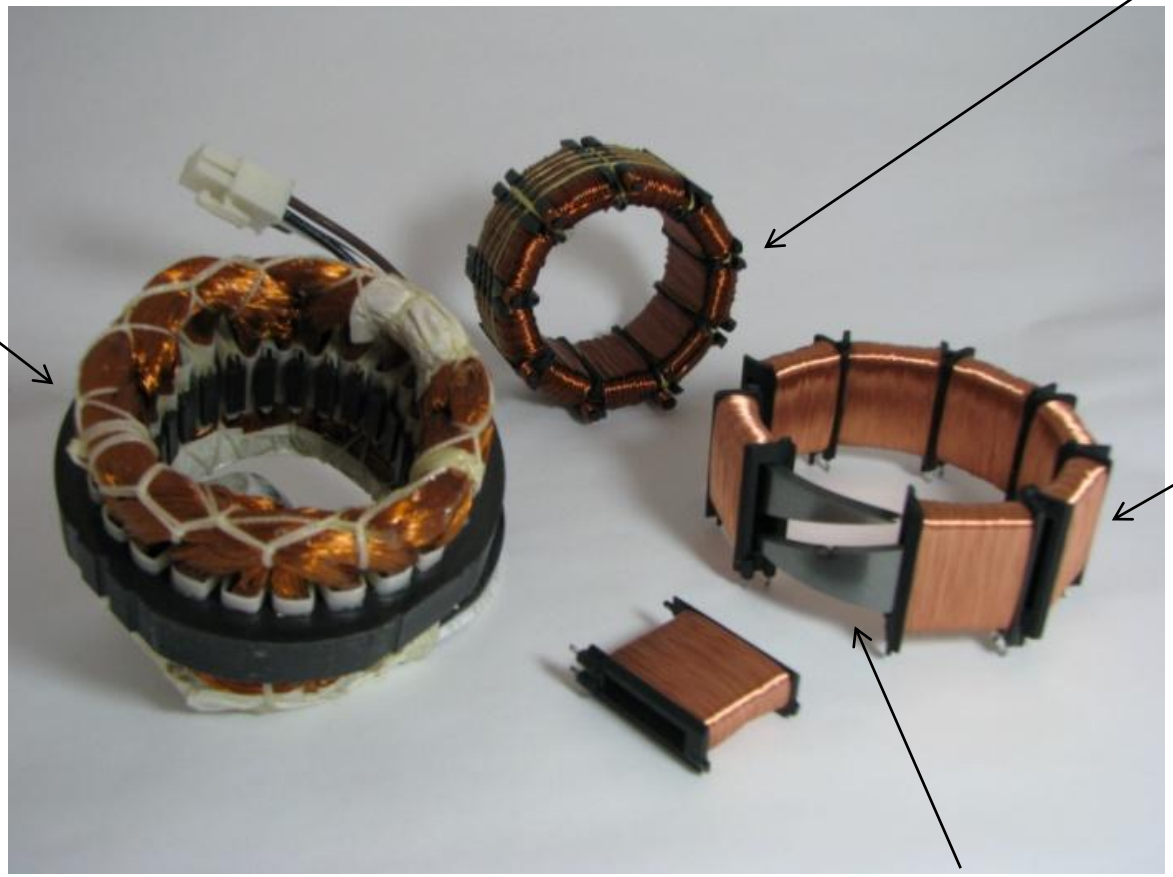
“string” motor
[60W - DD]

Induction motor
[7W rating]



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“bobbin”
Motor
[20W – ECR]

Patented Wellington
Split core

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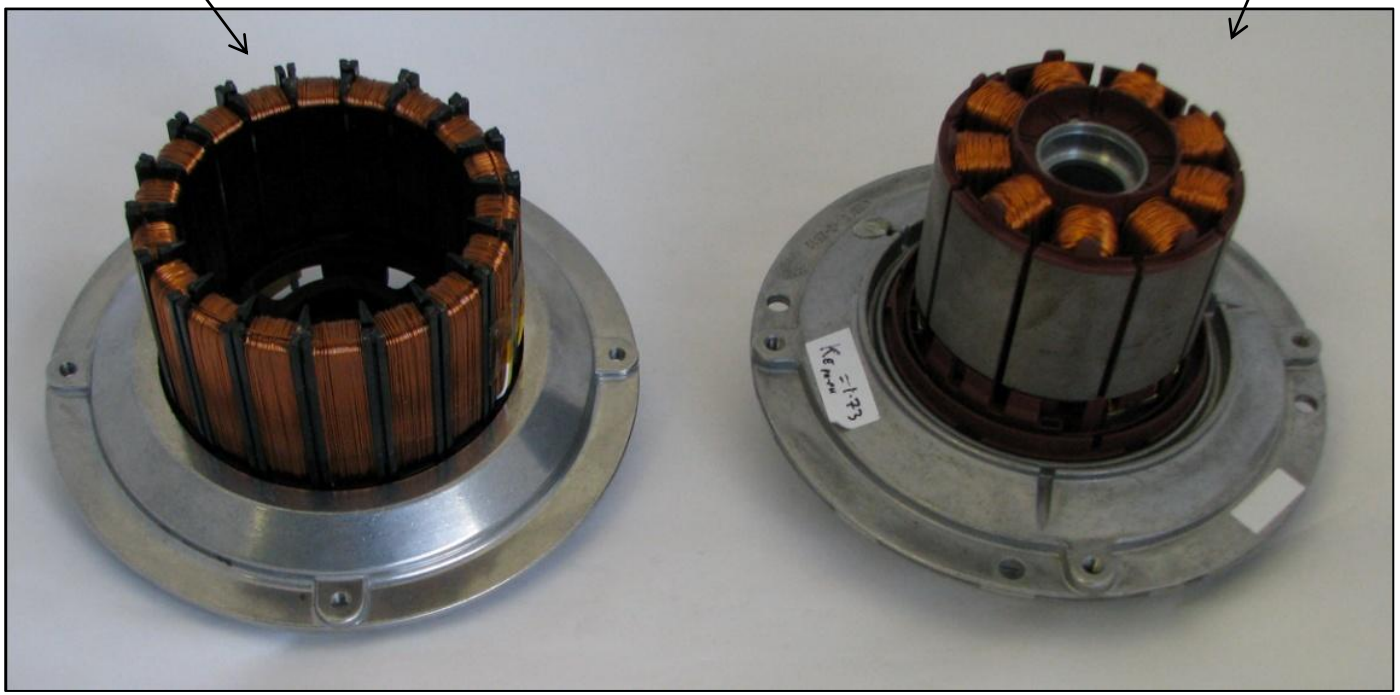
Wellington DB110 motor
[500W]

Salient pole EC motor
[500W]



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Slotless motors: pros and cons

Advantages of slotless motors include:

- zero cogging,
- high efficiency at part load or high speed,
- Low capital cost & manufacturing complexity
- low-profile form factor
- Hollow
- design freedom

Disadvantages include:

- poor low-speed high-load efficiency,
- cost penalties for high power density,
- less well suited to “standard” frame sizes

Slotless is not the universal answer, but it offers significant advantages in many situations

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China - Motor Production Line - Changzhou

Electronic Controls

- Wellington's electronics approach focuses on simplicity, and on mechanical/hardware/software integration.
- Wellington has a 'platform' approach to controllers, including variants for different power ratings and which meet different cost/performance points
  - Includes the very low cost, patented, 'Monsoon' split-phase synchronous controller
- Wellington has also focussed on application-specific platform variants which integrate customers' other system electronics
  - *Duplication of support systems (power supply, filters, PCB etc) is wasteful*
  - *A motor control microprocessor is very busy occasionally, but the rest of the time it has plenty of scope to address other tasks. Extra pins are cheaper than another microprocessor*
  - *Much can be deduced about load conditions from info available to the controller (e.g. foam detection in pumps, or model-based constant airflow algorithms)*

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Wellington's toolbox

- In practice, more important than formal IP is accumulated experience and expertise at motor, controller and software design and execution
  - "Total problem solving capability"
  - Formal IP gives "right to exploit"
- Application knowledge is increasingly significant
- Wellington's technology base is deepening all the time
  - New controller platforms currently under development
  - Will likely develop 'normal' or 'salient pole' motor design capability for areas where slotless is not preferred solution

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Applicable market is wide

Current own-brand products

1/50hp 1/12 1/8 1/4 1/3 1 3hp

Customer projects

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A cautionary note….

- Technology in the real world…
  - Customers are resistant to change, fearful & lack transition skills
    - A barrier....and an opportunity
  - Customers want drop in replacements for old technology
    - Easy adoption....and an escape route
  - A ‘high tech’, ‘electronic’ product has negative connotations
  - ‘Software’ is even more frightening

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A successful product

- Looks like an ‘old style’ motor
- Is able to be used like an ‘old style’ motor
- Is reliable – ‘fit and forget’
- Only has basic features
  - But with a path to more features
- Does not have to be cheap
  - Must be seen as cost effective
  - Graded feature set [i.e. product range] & staggered pricing important
  - Reliability is the “must have”
  - Product roadmap is vital

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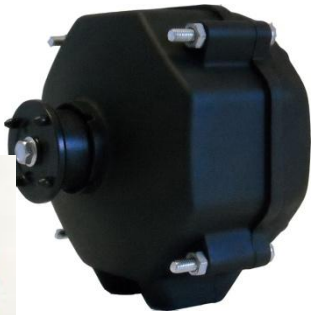
Evolution of the ECR line

Induction Motor

ECR

- “Retro” styling
- Metal parts (cosmetic)
- Comprehensive mounting options



ECR P

- Polymer case
- Additional mounting options
- Better performance
- Reduced costs

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Our market segment

(one fan per meter of chilled space)

ENERGY SAVING
www.wdtl.com

(400 fans in a large US supermarket)

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Our motors are used here

Supermarket cabinets: ECR80/90, ECR82/92, ECR01

Bottle coolers: ECR80/90, ECR82/92, ECR01

Walk-in coolers: ECR85/95

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...and here (ventilation & A/C)

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Questions

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