Arts & Humanities Research Council

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# Meters, Patents and Expertise(s): Knowledge Networks in the Electric Meters Industry, 1880-1914

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**Managing Knowledge in Techno-sciences, 1850-2000**
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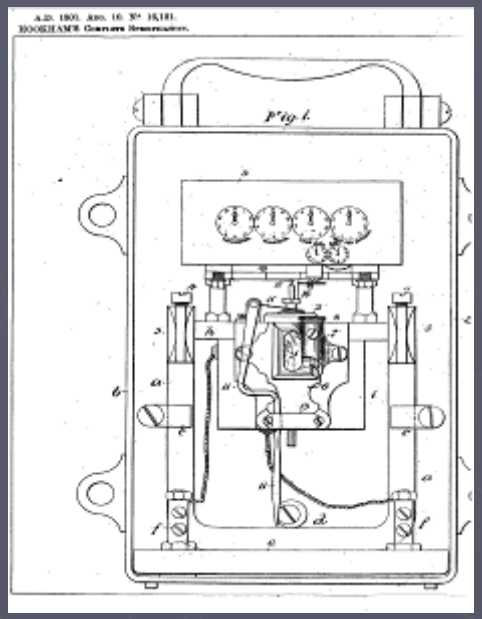
# OVERVIEW

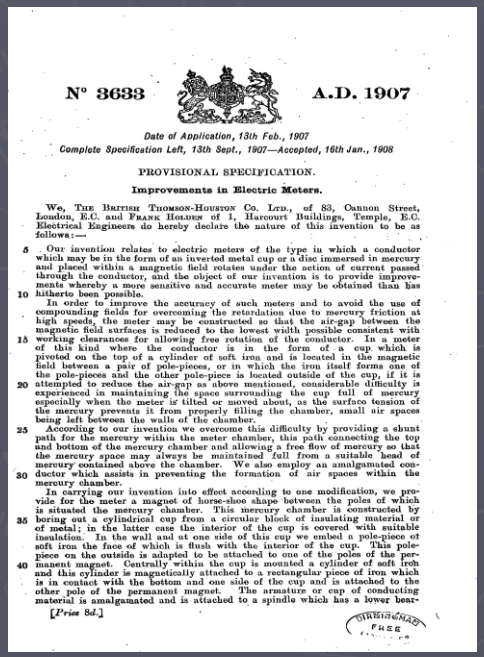
- 1. Introduction
- 2. Shared Knowledge, Patents and the Making of the Industry
- 3. Infringements, Rights and the Making of Patents
  - 3.1 Authorship, Inventorship and Patent Agents
  - 3.2 'Hoist with his own petard': Discovery vs Invention
  - 3.3 Scientific Authority and/or Legal Reasoning
- 4. Conclusion

# Introduction

- Supplement or go beyond existing historiography
  - Business histories which focus on the business strategies, development and economics of manufacture (Wilson, 1987;2000)
  - Histories of meters which focus on the role of users in the process of design (Gooday, 2004)
- IP as the entry point
  - IP strategies (corporations and individuals)
  - Actors in *socio-technical regimes* (Johan Schot et. 2009; Geels, 2004; Hughes, 1984; Nelson and Winter, 1982; Rip and Kemp, 1988)
  - Management of expertise and authorities: Trust and Credibility topics of concern.
- Courts as 'public theatres of contestation': Dynamics, contingencies and the practical considerations in the legal procedures without neglecting the structures of jurisprudence and communication systems that had impact on the court cases.

# Shared Knowledge, Patents and the Making of the Industry



N° 3633 A.D. 1907

*Date of Application, 13th Feb., 1907*
*Complete Specification Left, 13th Sept., 1907—Accepted, 16th Jan., 1908*

PROVISIONAL SPECIFICATION.

**Improvements in Electric Meters.**

We, The British Thomson-Houston Co. Ltd., of 83, Cannon Street, London, E.C. and Frank Holden of 1, Harcourt Buildings, Temple, E.C. Electrical Engineers do hereby declare the nature of this invention to be as follows:—

Our invention relates to electric meters of the type in which a conductor which may be in the form of an inverted metal cup or a disc immersed in mercury and placed within a magnetic field rotates under the action of current passed through the conductor, and the object of our invention is to provide improvements whereby a more sensitive and accurate meter may be obtained than has hitherto been possible.

In order to improve the accuracy of such meters and to avoid the use of compounding fields for overcoming the retardation due to mercury friction at high speeds, the meter may be constructed so that the air-gap between the magnetic field surfaces is reduced to the lowest width possible consistent with working clearances for allowing free rotation of the conductor. In a meter of this kind where the conductor is in the form of a cup which is pivoted on the top of a cylinder of soft iron and is located in the magnetic field between a pair of pole-pieces, or in which the iron itself forms one of the pole-pieces and the other pole-piece is located outside of the cup, if it is attempted to reduce the air-gap as above mentioned, considerable difficulty is experienced in maintaining the space surrounding the cup full of mercury especially when the meter is tilted or moved about, as the surface tension of the mercury prevents it from properly filling the chamber, small air spaces being left between the walls of the chamber.

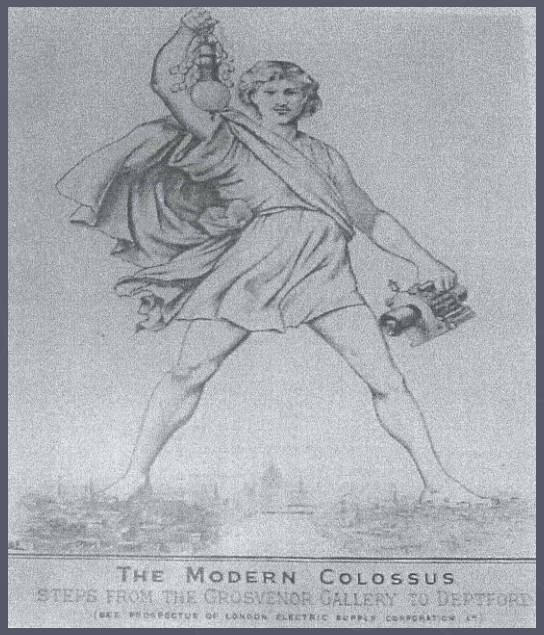
According to our invention we overcome this difficulty by providing a shunt path for the mercury within the meter chamber, this path connecting the top and bottom of the mercury chamber and allowing a free flow of mercury so that the mercury space may always be maintained full from a suitable head of mercury contained above the chamber. We also employ an amalgamated conductor which assists in preventing the formation of air spaces within the mercury chamber.

In carrying our invention into effect according to one modification, we provide for the meter a magnet of horse-shoe shape between the poles of which is situated the mercury chamber. This mercury chamber is constructed by boring out a cylindrical cup from a circular block of insulating material or of metal; in the latter case the interior of the cup is covered with suitable insulation. In the wall and at one side of this cup we embed a pole-piece of soft iron the face of which is flush with the interior of the cup. This pole-piece on the outside is adapted to be attached to one of the poles of the permanent magnet. Centrally within the cup is mounted a cylinder of soft iron and this cylinder is magnetically attached to a rectangular piece of iron which is in contact with the bottom and one side of the cup and is attached to the other pole of the permanent magnet. The armature or cup of conducting material is amalgamated and is attached to a spindle which has a lower bear-

[*Price 8d.*]

- Electricity meters industry: A heavily patented sector
- Heterogeneity of inventorship:
  - Practice oriented engineers- 'manufacturing engineers': Hookham, Ferranti etc.
  - Scientist-engineers: Ayrton & Perry, Forbes, Hopkinson etc.
  - Large Foreign Manufacturers (British Thomson Houston, Siemens, British Westinghouse)
    - IP management that promoted technology transfer from abroad: British Thomson Houston, British Westinghouse, Siemens
    - British Thomson Houston: After 1900 followed a hybrid IP management with technology transfer and investment in in-house inventing activities

# Shared Knowledge, Patents and the Making of the Industry



- Through the participation of practitioners like Ayrton and Perry – who bridged the academic and the industrial worlds – and the contributions of technologists like Ferranti or Hookham – who fashioned the roles of manufacturing engineers and professional inventors, the identity of electrical engineers was hybridised combining 'science' and 'engineering' either at the cognitive and epistemological or at the social and cultural level.

- Through processes of *bricolage*, where social activities and models were merged and hybridized, electrical engineering was not only institutionalized but also socially legitimized as a scientific discipline.

## Shared Knowledge, Patents and the Making of the Industry

- Inventing and patenting canonical 'scientific' practices in the emergent 'electrical science'.
- Already patented meters were included in the articles in the technical journals of the period – the Electrician and the Electrical Review – the papers presented in institutions and associations like that of Electrical Engineers or in the Society of Arts.
- These papers were considered as contributions to knowledge but they contributed mostly to the development of a literary genre, 'analytical engineering' (Pickstone, 2000): lacking thorough mathematical or experimental treatment of engineering phenomena.
- IEE, ICE, IMechE, Society of Arts: forums of 'patently shared knowledge' rather than of collective invention

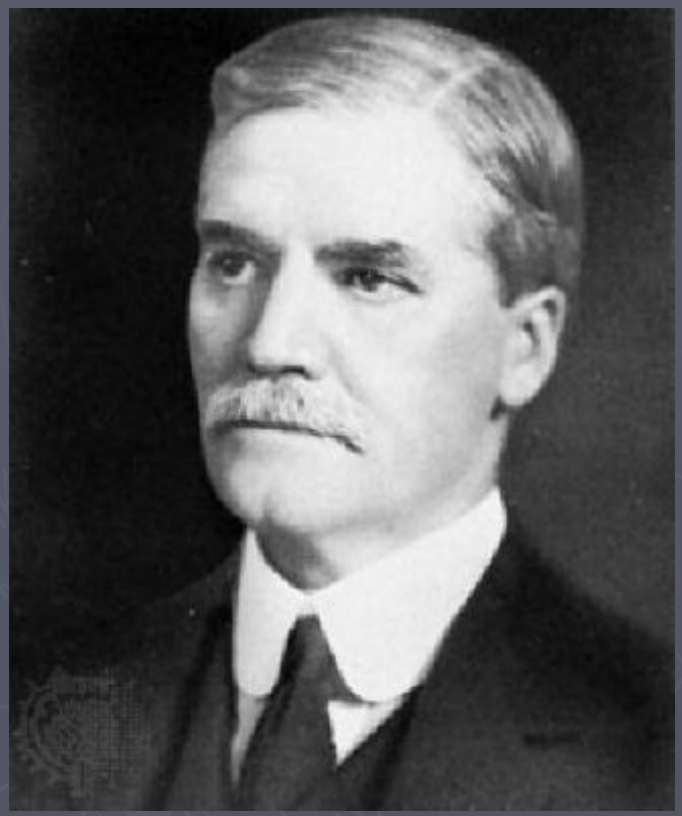
# IP and Shared Knowledge in Public

# Infringements, Rights and the Making of Patents

# Authorship, Inventorship and Patent Agents

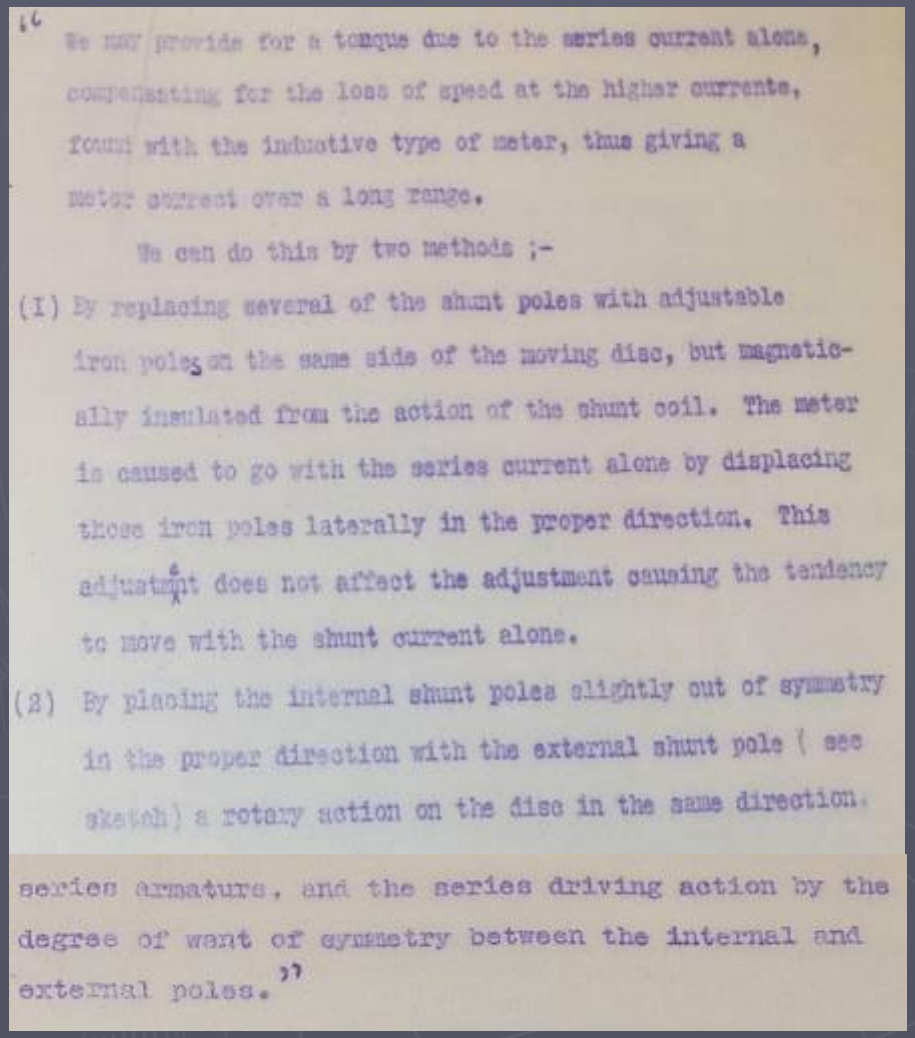
- Patent Agencies as loci where patent specifications were textually constructed. (Guagnini, 2002; 2009)
- The role of patent agencies as hubs of confidential information flows about inventions, technologies and experimental activities
- Large manufacturers established a relation of trust with their patent agents.

# Marks and Clerk



- 1888 Marks and Clerk patent agency was established in Birmingham
- Founders: Dugald Clerk (later Sir) (1854-1932) with George Croydon Marks (later Baron) (1858-1938).
- 1910: Birmingham, Manchester, London and New York
- Customers: Hookham & Chamberlain (meters), Parsons Co. (turbines), Ferranti Ltd. (meters, generators, alternators, engines)

# Marks and Clerk and the Ferranti Co.



"We may provide for a torque due to the series current alone, compensating for the loss of speed at the higher currents, found with the inductive type of meter, thus giving a meter correct over a long range.

We can do this by two methods :-

(1) By replacing several of the shunt poles with adjustable iron poles on the same side of the moving disc, but magnetically insulated from the action of the shunt coil. The meter is caused to go with the series current alone by displacing these iron poles laterally in the proper direction. This adjustment does not affect the adjustment causing the tendency to move with the shunt current alone.

(2) By placing the internal shunt poles slightly out of symmetry in the proper direction with the external shunt pole ( see sketch) a rotary action on the disc in the same direction.

series armature, and the series driving action by the degree of want of symmetry between the internal and external poles."

- Inventors & patent agents : co-authors
- Information about Ferranti's research activities
- Updates for possibly patentable devices
- Advice about possible infringements
- Patent agents: as drafters of specifications and expert witnesses

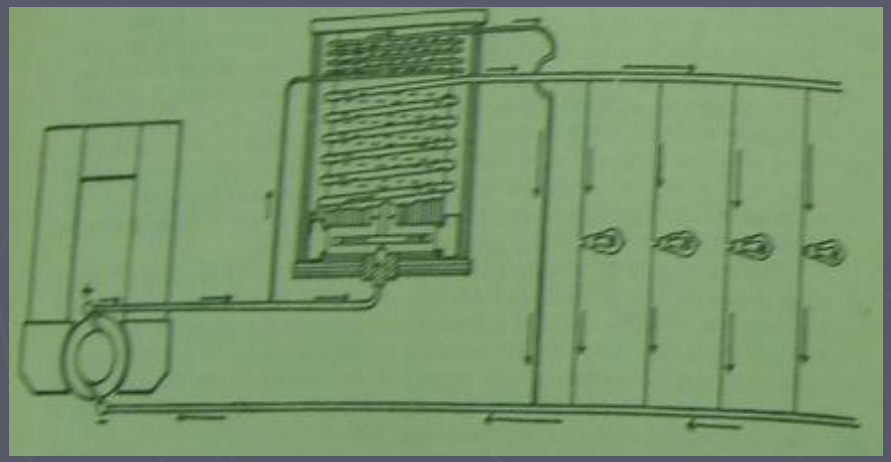
# Discovery v Invention?: Managing expertise at the Bar

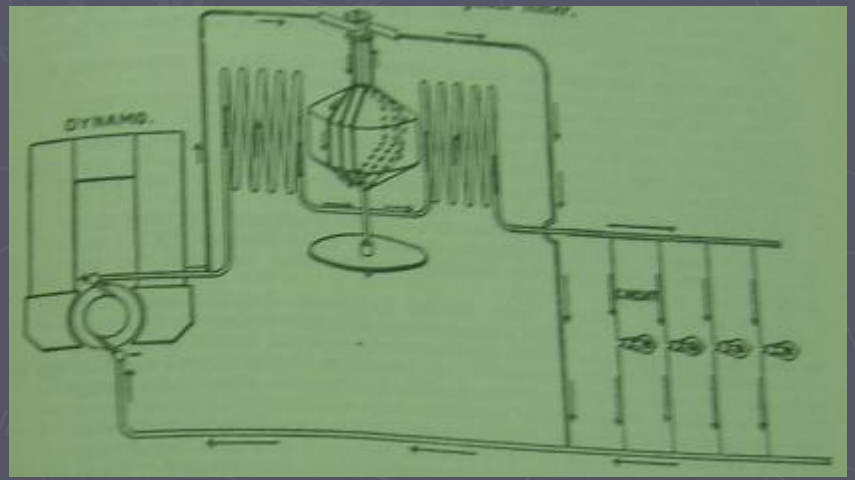
- Hookham & Chamberlain Co. v Johnson and Phillips Co. (1897)
- G. Hookham: electricity meters patent No 4225 of 1887, amended 1895
- William Ayrton & John Perry: motor meter patent No 2642 1882
- John Perry : Patent 1178 of 1880

# A Good Lawyer matters more than a scientific theory and discovery

- Fletcher Moulton: The principles and the theory behind Hookham's invention was known
- Hookham meter was original in the sense that it was a synthesis of engineering practices and design techniques that nobody before had put together providing a workable measuring device.
- Hookham and Chamberlain had the moral and legal right to pursue the monopolistic regimes provided by the patent law

# Scientific Authority & Legal Reasoning






- Ferranti Ltd v British Thomson Houston (1900)
- Ferranti patent No 701 of January 1887, on the 'Improvements of Electrical Meters'. The British Thomson Houston company was accused of importing from France and trading in Britain electric meters with the Ferranti innovation introduced in his 1887 patent.
- Ferranti's expert witnesses: Ferranti, Dugald Clerk and Wordingham
- British Thomson Houston camp:
  - Legal team: Fletcher Moulton
  - Expert Witnesses: James Swinburne & James Alfred Ewing

# Scientific Authority & Legal Reasoning

- Plaintiffs
  - The plaintiffs' strategy: Ferranti's invention as definitive electrical contrivance that overcame existing practical problems with alternating current meters.
  - Dugald Clerk: 'There were many proposed, and the theory was quite well understood, but his was the only motor meter on the market'
  - Wordigham: 'Most Valuable'
  - Wordigham in the witness box: 'Q.1050. But you know of no meter prior to the date of the Plaintiff's patent which was accurate at low loads? – No motor meter. Q.1051. And it was the introduction of this invention which made that practicable? – Yes.'
- Defendants
  - Ferranti was not the 'true and first inventor of the said alleged invention'
  - There were relevant patents and publications by Brush, Siemens, Faure and Philips before Ferranti's specification
  - Incomplete specification: What exactly Ferranti aimed? What exactly did Ferranti meter measure?

# Scientific Authority & Legal Reasoning

**Charles Swinfen Eady, 1st Baron Swinfen**
(31 July 1851-15 November 1919

- Validity; Infringement; Classification
- Semantic Ambivalence:
  - What kind of meter? 'Current' or 'Energy' meter?
  - 'Current to be measured' in the Plaintiff's specification means the lamp current which is made to pass through the additional coil. In other words it extends only to a current meter and does not include the case of an energy meter which measures and records the product of two variants the quantity and the potential, without measuring separately either variant'. (Judge Eady)

# Conclusion

- The meters industry was dominated by the culture of patenting and the field was structured through patentable techniques and technologies and their management in the legal and market worlds.
- Inventors and patent agents: 'co-authors' of patents and intellectual property claims.
- No 'open knowledge' innovation pattern, but 'patently shared knowledge' innovation pattern. The domination of patents determined the industry as well as the making of the practitioners' identities.
- The emergent type of scientist-engineer was compatible with the patterns of innovation through 'propertization' (Nowotny, 2005)
- 'Scientification' of industry: 'science' as socio-cultural category more dominant than 'invention' since 1890s
- Diversity/Heterogeneity of trust relations in authority**:** Practical expertise was represented as equally 'authoritative' with 'scientific' and 'theoretical' authorities.
- The networks of experts and expertise contributed in the formation and evolution of the industrial sector of the manufacture of electricity meters.

# THANK YOU