



Electrifying Women: Caroline Haslett and the Long History of Women in Engineering



NAEST 092/07/01 Caroline Haslett papers: WES visit to a power station, c.1938. Portrait of Caroline Haslett when she became director of EAW, c.1925.
Source: Institution of Engineering & Technology (IET) Archives



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@ElectrifyingWmn
#electrifyingwomen

Women's Engineering Society Centenary

- WES founded in UK on June 23rd 1919
- The first women's engineering society in the world
- But why does Britain now have the lowest proportion in Europe (c.12%) of women in engineering?
- Can a more inclusive history of women in engineering enhance recruitment?



Women's Engineering Society conference, 1920s. Courtesy of WES/IET Archives



Arts & Humanities
Research Council

AHRC project: Electrifying Women: Understanding the Long History of Women in Engineering

Public engagement work in partnership with WES, IET,
Wikimedia & Science Museum:

Aims:

- To share stories of women's collaborative participation in engineering from 19th century
- To show where more research is needed, how it can be done & how shared
- To enhance Wikipedia pages on women in engineering history through Wikithons
- To develop inclusive forms of participation in women's engineering heritage e.g. creative writing and drama
- To support recruitment of women into engineering through heightened historical awareness

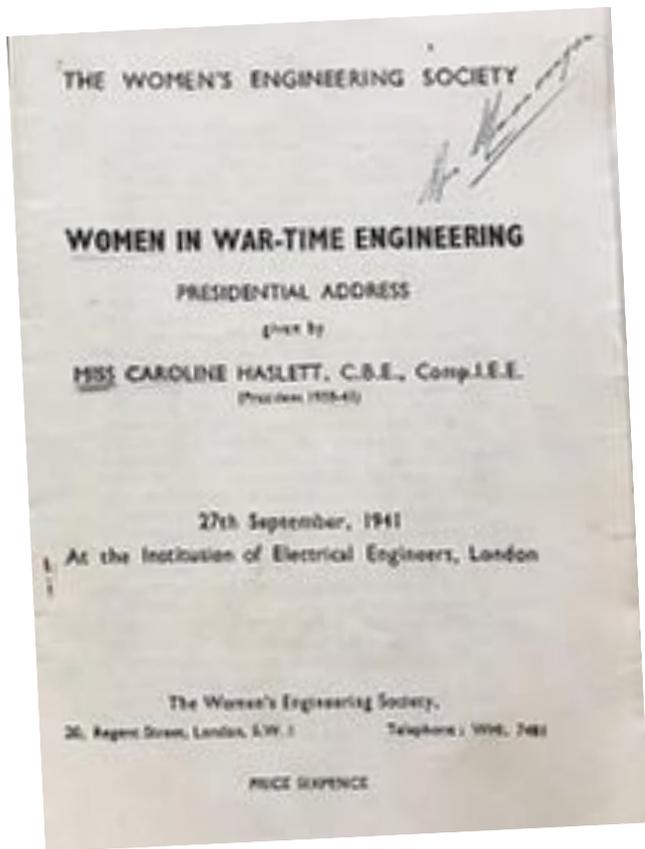
Recovering the missing women in engineering history



- Lots of statues of Victorian engineers – all male
 - Heroic histories of engineers – almost all about men
 - Engineering Trade Unions – women only fully included by 1945
 - Engineering institutional membership – difficult to secure work opportunities
- BUT...
- Census data
 - Patent records
 - Biography/autobiography
 - *The Woman Engineer* (1919-)
 - Archival papers of WES/Caroline Haslett in archives of Institution of Engineering & Technology (IET), Savoy Place, London.

Caroline Haslett, first Secretary of WES, first Director of WEA. Source: IET Archives

Women engineers in the 1841 Census



Caroline Haslett's WES
Presidential Address
in September 1941

Haslett quoting
appendix on 1841
census data in:
*Ivy Pinchbeck,
Women Workers
and the Industrial
Revolution (1930)*

employment long before the years of so-called emancipation. The following are for England alone :

	No. of women engaged
Agricultural Implement Maker ..	58
Anchor Smith and Chain Maker ..	103
Blacksmith	469
Boat and Barge Builder ..	19
Brass Founder and Moulder ..	43
Brazier, Brass Finisher and Tinker	110
Buckle Maker	43
Burnisher	216
Button Maker	1,628
Carpenter and Joiner	389
Chair Maker	280
Clock and Watch Maker ..	185
Coach Maker	116
Cooper	119
Cutler	139
Die Engraver and Sinker ..	8
Engine and Machine Maker ..	53
Engineer and Engine Worker ..	102
File Maker	123
Fork Maker	42
Gas Fitter	2
Gun Maker and Gun Smith ..	79
Hook and Eye Maker	67
Jeweller, Goldsmith and Silversmith	265
Lamp and Lantern Maker ..	10
Locksmith and Bell-Hanger ..	42
Mason, Paviser and Statuary ..	150
Mathematical Instrument Maker	2
Metal Manufacturer	163
Millwright	28
Moulder	17
Musical Instrument Maker ..	23
Nail Manufacturer	4,039
Needle Manufacturer	748

Patent specifications as documentary evidence of women's inventiveness

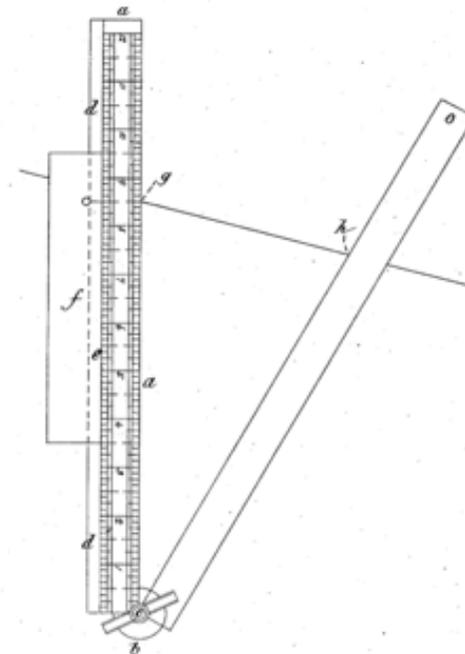
P. [Phoebe] S. Marks, 'Draftsman's Dividing Instrument'

UK patent 5443, patented on 23 March 1884 and US Patent 310,450, patented on 6 January 1885

Total of 26 patents: five on mathematical dividers, thirteen on arc lamps & electrodes, and eight on the propulsion of air.

But who was Phoebe S. Marks?

(No Model.)
P. S. MARKS.
DRAFTSMAN'S DIVIDING INSTRUMENT.
No. 310,450. Patented Jan. 6, 1885.



Witnesses.
George W. Rice
Abel Conitt

Inventor,
Phoebe S. Marks.
By James L. Norris,
Att'y.

Hertha Ayrton (1854-1923)

- Feminist, mathematician, inventor, patent holder physicist, electrical engineer, and suffragist.
- **1854:** Phoebe Sarah Marks born to an impoverished Jewish-Polish migrant family in Portsmouth
- **1876-1881:** Studied Mathematics at University of Cambridge and University London (BSc). Acquires name 'Hertha'
- **1884:** Granted first patent for line divider
- **1885:** takes name Ayrton as spouse of engineer William Ayrton.
- **1899:** Hertha Ayrton elected first female member of Institution of Electrical Engineers (now IET)

Right: Portrait of Hertha Ayrton, painted by H el ena Ars ene Darmesteter, supplied by The Public Catalogue Foundation.



Hertha Ayrton: Physicist & Electrical Engineer

1884: Studies Physics at Finsbury Technical College, meets Professor William Ayrton

Early 1890s: Begins researching electrical arcs – powerful outdoor and indoor lighting

1899: Elected first female member of Institution of Electrical Engineers for her arc light research

1902: *The Electric Arc* wins wide praise and secures her the Royal Society Hughes Medal

1916: Ayrton anti-gas fan used in WW1 trenches – over 100,000 issued to British Army in France



IWM FEQ 492 Ayrton Anti-Gas Fan. Courtesy of Imperial War Museums (IWM)

Hertha Ayrton commemorated today



Blue Plaques: Left: English Heritage blue plaque at 41 Norfolk Square, Paddington, London, W2 1RX; Right: Portsmouth Blue Plaque, Queen Street, Portsea



'Hertha Marks Ayrton' honoured with a Google doodle 28 April 2016 to mark her 162nd birthday.



Hertha Ayrton by Art illustrator George Doutsopoulos for STEM: the game.

Mrs Hertha Ayrton was I think the first member of the fair, but no longer frail sex, to distinguish herself in the engineering world,

...though perhaps the woman engineer would not have arrived yet, had not the war, which upset so many masculine traditions, proved that woman was capable of doing many things which had hitherto been considered strictly within the provenance of the more assertive male...

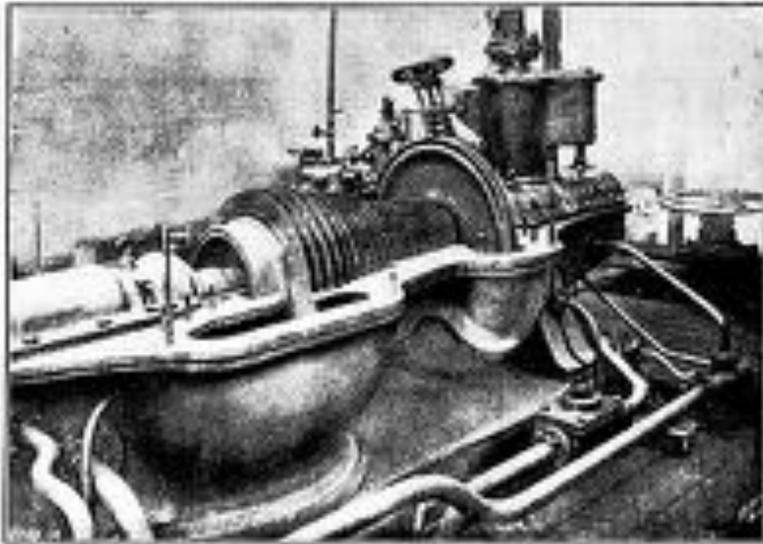
Andrew Stewart, 'On Making the Best of It'
The Woman Engineer 1 (1923) pp 284–286

Individual vs collective work of women

- Individual women in technical professions – routes in via family connections or via higher education. Small in number
- Rise of professional women's organisations: aftermath of World War 1
- Sex Disqualification (Removal) Act, 1919:
- Professional bodies for women in Law, engineering & architecture
- Contrary sense of Restoration of Pre-war Practices act, 1919
- The Launch of the Women's Engineering Society

Hon. Charles Parsons & Katharine Parsons

The steam turbine engine
and 'Turbinia' c.1894



Lady Parsons documented in the *Transactions of the North East Coast Institution of Engineers and Shipbuilders*

Lecture: 'Women's Work in Engineering and Shipbuilding during the War'
July 1919

'It has been a strange perversion of women's sphere – to make them work at producing the implements of war and destruction and to deny them the privilege of fashioning the munitions of peace'

Obituary 'The Hon. Lady Parsons (Hon.Fellow)' published in 1933

'She was always at [Sir Charles Parson's] side, always there to help him when he needed her, always supporting him with her really powerful mind and ready tact, and perfect understanding.

'Lady Parsons was the possessor of a remarkable character, she was almost fiercely independent... She had in many ways a very masculine brain - and a love of business organization and leadership.'

The Women's Engineering Society 1919

- Founded on 23rd June 1919 by seven eminent/wealthy women:

Lady Eleanor Shelley-Rolls, Monmouth;

Rachel Parsons, London;

Lady Katharine Parsons, Newcastle;

Janetta Mary Ormsby, Newcastle;

Margaret Rowbotham, Kirkcudbright;

Margaret Moir, SW London;

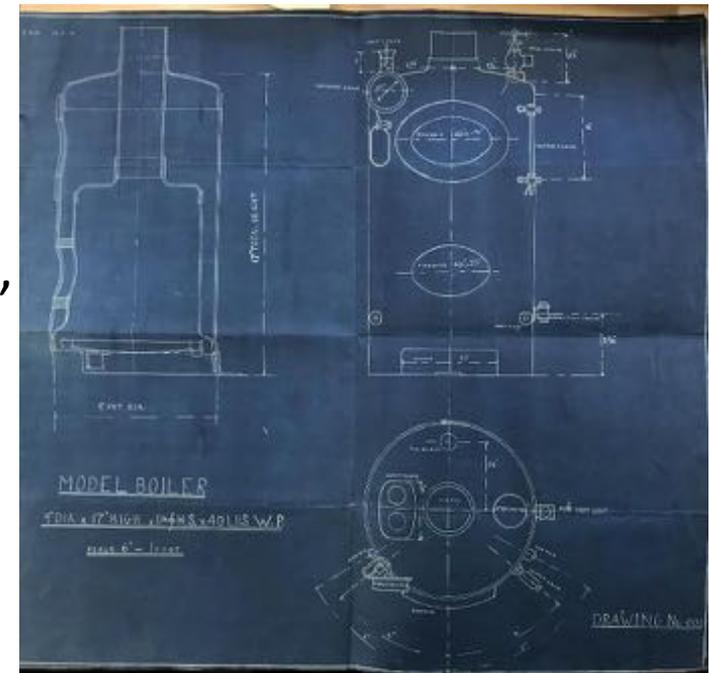
Laura Annie Willson, Halifax

WES Aims:

- To promote the study and practice of engineering among women
- To enable technical women to meet and exchange ideas

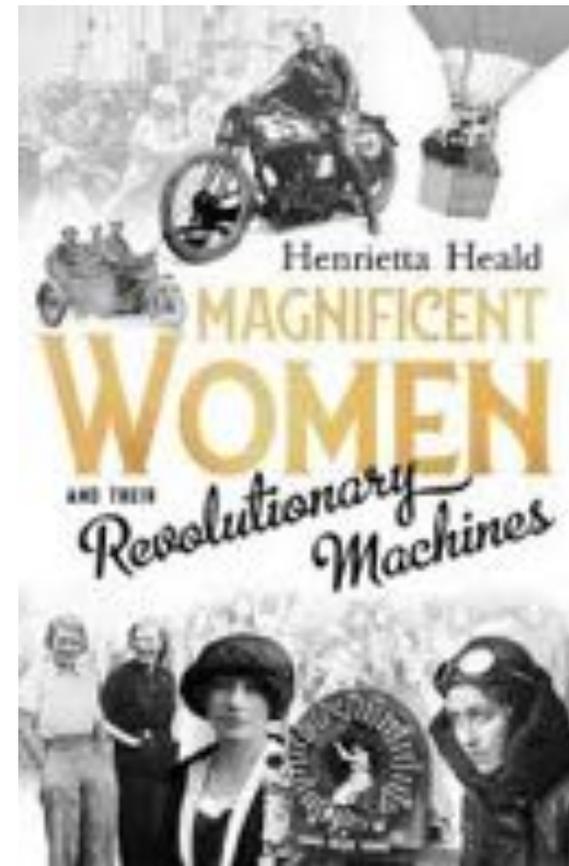
Caroline Haslett: from suffragette to boiler engineer

- Suffragette in 1913, in WW1 Haslett trains for secretarial work
- Join Cochran Boiler Co. as junior clerk drawing up specifications
- Manages Cochran London office in 1918, supplies boilers to the UK War Office
- Learns boiler making at Cochran's Scots HQ - designs & sells bespoke boiler as 'C.Haslett'
- After WW1 Cochran's keep Haslett on, but almost all women forced out of war work



Early Days of the Women's Engineering Society

- British Engineering journals advertise thus in February 1919:
- 'Required: Lady with some experience in Engineering Works an Organizing Secretary for a Women's Engineering Society'
- Lady Parsons hires Haslett: unique experience of shorthand & running an engineering works
- Lady Parsons W.E.S.'s chief financial sponsor, paying Secretary's wages to Haslett
- Caroline Haslett as Secretary 1919-1929, and first editor of *The Woman Engineer*



The Women's Engineering Society

President—MISS R. M. PARSONS.

Secretary—MISS C. HASLETT.

The Women's Engineering Society is established in the Interests of Women engaged in Engineering and Allied Trades. The Aims and Objects of the Society are as follows :—

1. To promote the training and employment of women in Engineering and Allied Trades.
2. To work for the admission of women to all Schools of Engineering and Technical Colleges.
3. To give special attention to the future of women who have attained some degree of skill in the Engineering and Allied Trades and Professions, and who wish to continue their work.
4. To work for the admission of women :
To membership of all suitable Institutes of Engineers.
5. To enable technical women to meet and to correspond, and to facilitate the interchange of ideas respecting openings in the various branches of technical and mechanical science by the circulating of information on such subjects.

The Woman Engineer

Volume 1
1919-24

First issue
December
1919

Third issue
June 1920

course she will need a great deal of determination and perseverance and must not mind how dirty she gets.

In spite of all this the work is most fascinating and absorbing and one becomes so interested in everything that one forgets to be tired and the time goes extraordinarily quickly and happily.

I see no reason at all why girls should not be so successful in Engineering as they have been in other trades which have hitherto been considered unsuitable for them.

After all, pioneers always meet with difficulties and discouragement and we cannot hope to be an exception to the rule, but I firmly believe that we shall succeed in the end.

The Direct Current Machine.

NOTES ON ITS CONSTRUCTION AND HABITS.

By MARGARET M. PARKINSON, B.Sc.,
Graduate I.E.E.

THE standard Direct Current Machine consists of a rotating armature, described by some genius as "a bundle of wires tied up with tape" mounted in a stationary magnetic yoke, or field. Electric current runs through the wires of the armature, and through the coils of wire wound round the poles of the field.

It is easy to run a current through stationary coils, like the field coils; but how send a current through a wire which is racing round the main shaft at the rate of 500 or 3,000 times a minute?

At one end of the armature is the commutator, a ring of copper bars or strips—each insulated from the main shaft, and from its neighbour by mica. Every wire is soldered at each end to one of these bars. Pressing on to the commutator are two or more brushes which sweep over it as it revolves, and pick up or distribute the electric current. These brushes are usually composed of some preparation of carbon.

This is, very roughly, the construction of every Direct Current Machine, though its individual characteristics vary according to the different systems of winding the coils.

If we put an electric current through the armature and the field coils, we get mechanical energy from the reaction of the armature. The machine is then called a motor. Inversely, if we input mechanical energy to the same machine

we get electrical energy generated. We then call the machine a dynamo.

The theory of the Direct Current Machine is very simple, and when it is properly and conscientiously treated, it is an honest and straightforward creature, but no machine rewards ill-treatment, either in construction or use, more quickly and violently.

Suppose you take an inspection tour round our test bed.

The first apparatus we come to, a girl, wears a worried look, and a pair of alterations for we are perfect ladies we do not call them trousers! She is running two machines coupled together, and is providing current for the motor from the main supply, and is using up the current produced by the dynamo to heat a radiator—at least that is what she wants to do—but as soon as she starts the motor the commutator becomes a ring of sparks. This will not do. First she tests the field circuit. Yes. Current there all right.—Then she tests the separate coils with a compass needle to see if the polarity of the magnetic poles is correct. Nothing wrong there.—She examines the commutator. Blackened, but otherwise O.K.—The winding of the armature appears all right and all the connections to the brushes.—What about the spacing of the brushes round the commutator? No trouble there.—Oh! now we are hotter—the spring, which should hold the brush firmly on the commutator, has moved out of place. She adjusts that and all is well.

It is no fault-finder that the slightest fault takes the longest to find.

Next we come to two boys who are giving a break lead to a series motor. They have made the break themselves. It is a long wooden lever covered with ferrous break compound, which one presses down on to the pulley of the machine, while the other takes readings of the speed and electric pressure and current (volts and amps). One boy thinks he is being as strong as two horses because the motor shows that it is doing 2 h.p. Yes, but he forgets that his break lever is a long one, though he would remember quickly enough if you were to suggest that he should shorten it.

Here is another girl, very busy. Her machine appears to be running perfectly—pleasant hum—not too hot—everything in the garden is beautiful. "Please, my machine is running ever so much faster than it ought to." What's fault is that? It may be that you have some extra unwanted resistance in the field circuit, or the voltage of



Laura Willson
Halifax house builder

Caroline Haslett
W.E.S. Secretary

Margaret Partridge
Consulting engineer

Caroline Haslett with WES co-founder Laura Willson and early WES member, London mathematics graduate Margaret Partridge.



Early patrons and Presidents: Rachel Parsons (above)

Lady Margaret Moir
'engineer by marriage'

Common themes
WW1, suffrage, cars...



Why did the UK have the first Women's Engineering Society?

- Compare UK – WES founded 1919
- Germany - Verein Deutsche Ingenieure (1856) women's section 1933
- USA - Society of Women Engineers, founded 1950

- Germany & USA: formal professional education requirements in engineering
- UK: unlike Medicine, no legally-required engineering qualifications

- WES Focus on engineering (vs. engineers)
- More inclusive of experience (vs. training)
- Finance from philanthropic women when membership recruitment stagnant

Caroline Haslett writes to Lady Parsons 23rd May 1919

- It seems a great difficulty now to get new members
- Most the people who come to the office now say they feel that engineering for women is practically hopeless and have in most cases decided to take up some other sort of work
- I endeavour to make the situation look as hopeful as possible, but evidently not hopeful enough to induce them to join

23rd May 1919.

Dear Lady Parsons,

I thank you for your letter of the 21st inst. enclosing two advertisements. I have written to the "Upable Lady", and also to the Secretary Officer at Malvern.

I note what you say about the Honorary Members. When I first started up here it seemed necessary to make some distinction, and I decided at the time it would be best to make the distinction according to the subscription paid.

Col. Craig I thank you for the suggestion you make re shorter technical training for girls rather than a long apprenticeship, and will remember to bring this point up when we interview Col. Craig. Lady Blair rang up this morning to say that it was still very undecided when the Bill would come up in Committee. I told her of your offer to draw up a short memorandum of the work done by Newcastle women, and she said it would be very useful if you could do this, as Col. Craig desires to have as much information as possible. Lady Blair called at the office this week to help to draft a letter to Sir Percy Stothert.

Mrs. Wilson has not yet sent me the particulars re the Women's Society, and until I receive these particulars I do not think I see very clearly what it is she has in mind.

Thank you for the "Electrician" received this morning. The article by Mr. Wyle is a brief summary of the points discussed at the meeting. I think perhaps a point which needs consideration is how far women will be allowed to work in the shops if they are not members of some trade union.

It seems a great difficulty now to get new members. Most of the people who come to the office now say they feel that engineering for women is practically hopeless and have in most cases decided to take up some other sort of work. I endeavour to make the situation look as hopeful as possible, but evidently not hopeful enough to induce them to join.

As you requested, I telephoned Miss Walker asking her to send me the two copies of engineering.

Miss Edwards who worked at the Gun Carriage Dept. at Woolwich called this morning and left a short description of her work there. I will send you a copy of this as soon as possible.

Will you please let me know as soon as possible whether you approve of the draft form which I sent you, and also kindly let me know how I should answer the letter from Miss Green of the N.G.W.

Yours truly,

Secretary

24

Spring 1919: 'a paragraph appeared in *The Times* telling of a Woman's Engineering Society...

'My mother and I went to a modest top-floor office, to find a young secretary, Caroline Haslett, no less...

She described a technical college at Loughborough... which had trained women in the war... it was still prepared to hold a few places open for women in their diploma courses starting in the autumn.'

A life-long WES member and writer for the *Woman Engineer*

Claudia Parsons, 1900-1998), Century Story, (1995)



Parson as expert driver & mechanic traveling in Iraq, Afghanistan etc in 1938 with 'Baker', her Studebaker.

Haslett's move to domestic technologies 1924

- Recruiting new members to WES proves difficult given economic climate
- WES members focus on domestic technology e.g. vote on the most important engineering initiative in home efficiency: a dishwasher
- Haslett meets influential US time & motion specialist, Dr Lillian Gilbreth
- Paper on domestic uses of electricity offered by Mrs M.L. Matthews:
- 'the thrift of one's energies is often more important than thrift of money. It is by this form of thrift that electricity is going to help women'
- Proposed an Electrical Association for Women to reduce domestic drudgery
- Haslett enthusiastic for an E.A.W. – but Lady Parsons is not

The First International Conference of Women in Science, Industry and Commerce, Wembley, 1925



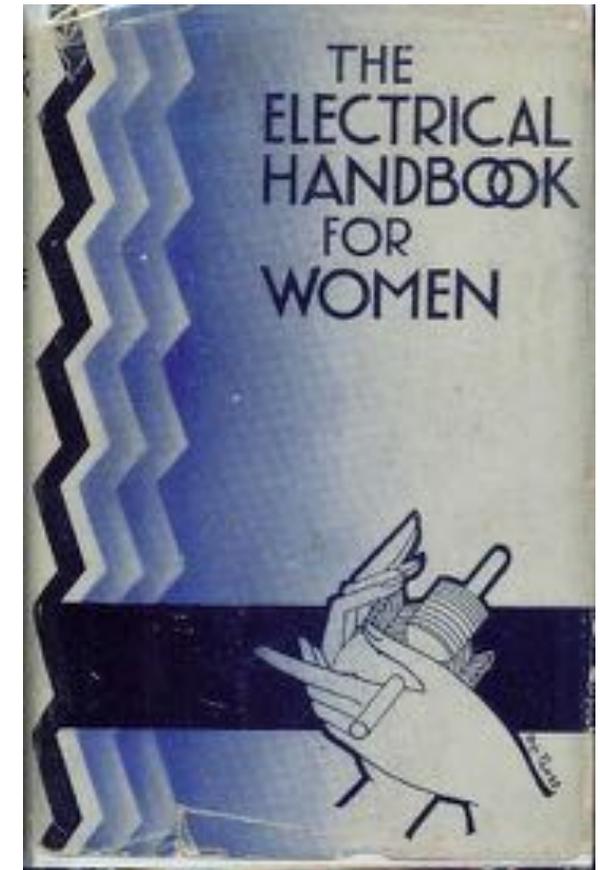
Electrical Association for Women grows - with trade-offs

- After Haslett's 1925 lecture, EAW lectures and visits invited by electrical industry
- Rapid EAW expansion with branches opening in Glasgow and Manchester
- Haslett secures funding for EAW from the electrical industry which needed her to bring them more female customers - winning hearts & minds
- She (initially) promises the WES membership emancipation by participation:
 'I do not think that the women's world has yet realised that the machine has really given women complete emancipation. With the touch of a switch she can have five or six horsepower at her disposal; in an aeroplane she has the same power as a man'.

But the ideal of equity with men proves harder to fulfil in the domestic domain...

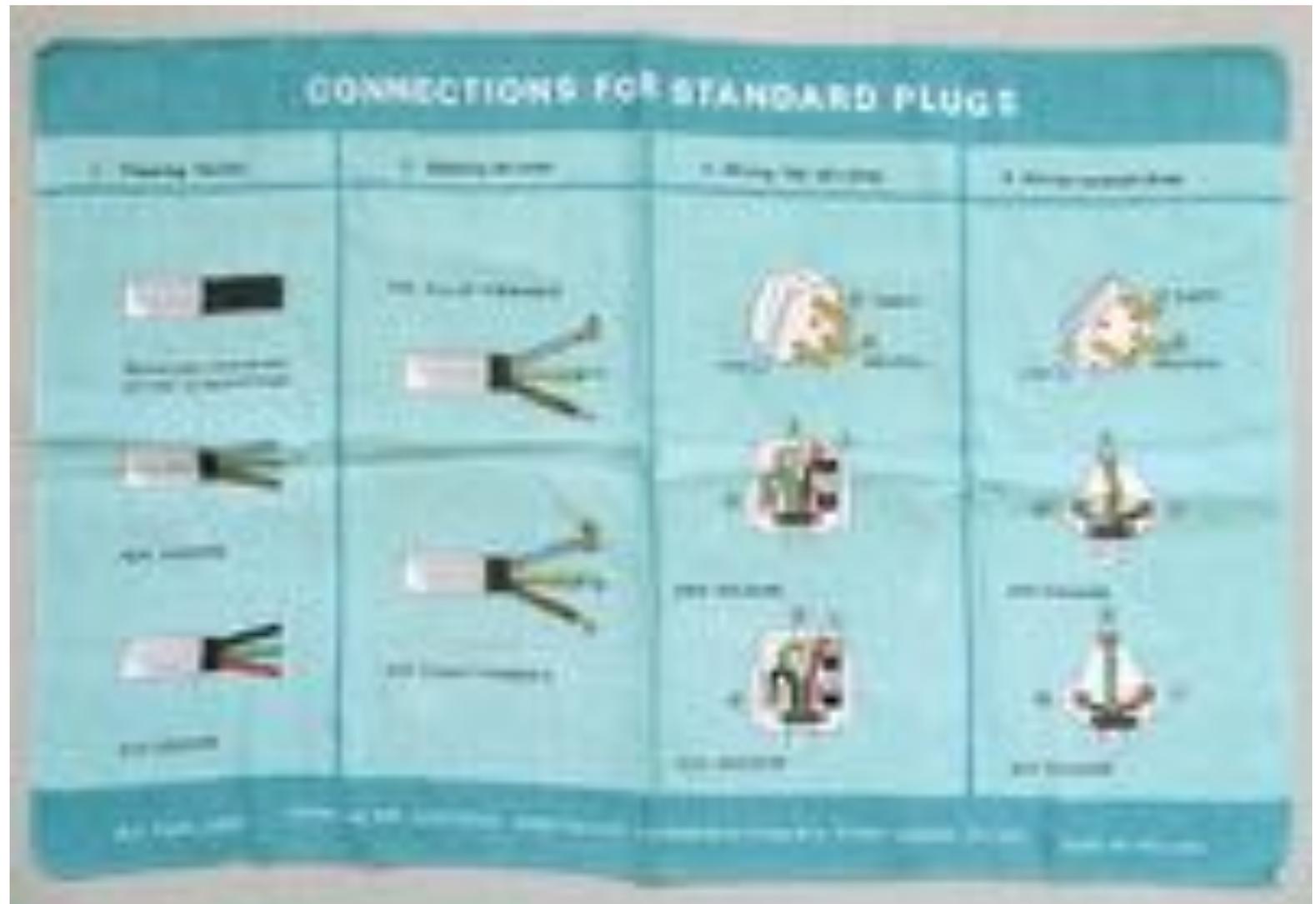
E.A.W. growth - training schemes 1925-34

- EAW branches discuss design efficiency of electric cookers, etc
- What of emancipation? Career structure for EAW women to become professional trainers of 'housewives'
- EAW Electrical Housecraft School - lecture courses for 'housewives', teachers, and for 'Junior Demonstrators'.
- The Electrical Development Association and Electrical Lamp Manufacturers Association sponsor training courses
- EAW's Certificate Examinations as professional qualifications
- 1934: *The Electrical Handbook for Women* – 9 editions to 1983



An E.A.W
tea towel,
early 1970s

Indicating
plug wiring
techniques

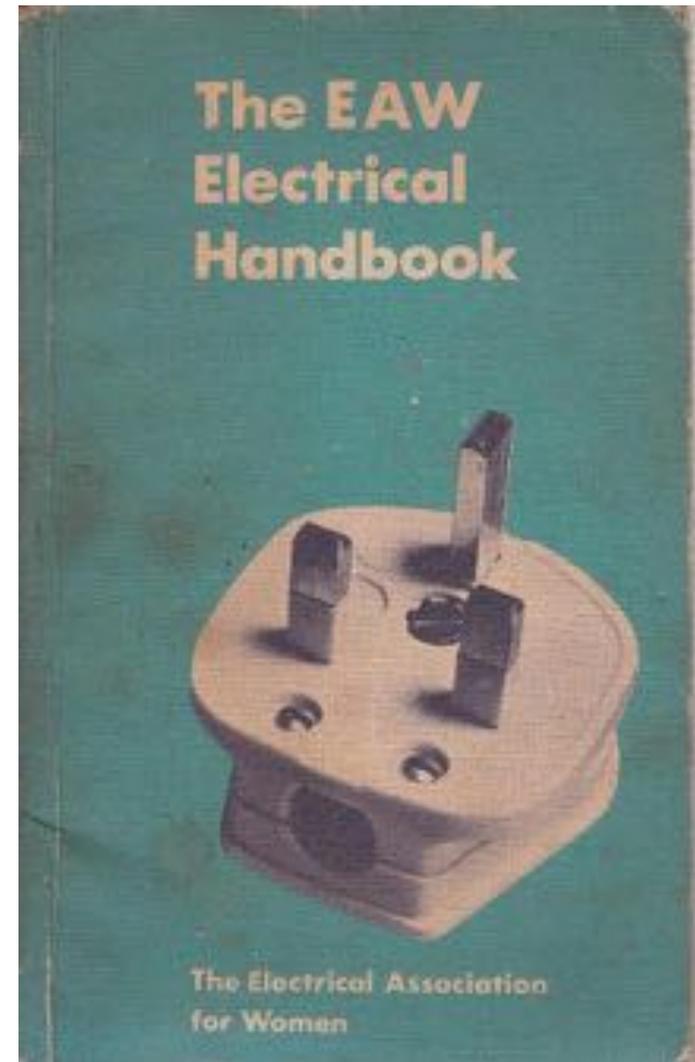


The E.A.W after Haslett

Caroline Haslett not mentioned in editions of the EAW Handbook published after her death in 1957.

But her legacy remains in focus on safety in the three-pin plug and standard BS 1363 in all editions up to the last *Essential Electricity - A User's Guide* (1983)

In 1986 the Electrical Association for Women closes down: its membership had dwindled as had industrial sponsorship.



But what of the Women's Engineering Society?

- Caroline Haslett remained as Secretary until 1929
- Then served as Honorary Secretary
- In 1930 Haslett is the only woman to attend the World Power Conference (later the World Energy Council)
- Other women emerged as leading figures to keep WES flourishing

Laura Annie Willson, WES President 1926-28

From Halifax textile worker to suffragette and union activist
From engineering spouse to independent builder
First woman member of the Federation of House Builders
EAW supporter, committed to building electrified houses

**WORKMEN'S
HOUSES.**

*Modern.
Attractive.
Durable.*

Can be built in
quantities of 48.



Price £400 each (Freehold).

ENQUIRIES SOLICITED.

LAURA A. WILLSON, M.B.E., Jumpsles, Halifax.



Amy Johnson/Mrs Mollison WES President, 1935-37

- Sheffield Economics graduate
- Successful qualified pilot and ground mechanic by 1929
- Won many flight competitions
- Promoted aeronautics to women
- Opportunities for women in a new growing industry
- Elected President WES 1935
- Marital status as 'Mrs James Mollison' - divorced in 1938
- As Amy Johnson dies on ATA service 1941 transporting planes
- Legacy supports women's scholarship



Statue of Amy Johnson at Herne Bay, Kent – and copied in Hull. Installed 2016.

Presidential Address given at the Institution of Electrical Engineers
on 27th September, 1941

I have chosen for my Presidential Address what I regard as a subject of the greatest importance at the moment. This second year of my office has witnessed more outstanding developments in women's part in engineering than have ever occurred before. The registration of women, and the demands that are being made on them from every department of national service will make this a period of greatest interest in the history of women. The response to these demands and the capacity that women have shown are worthy of the occasion.

One or two preliminary remarks may be useful in outlining the scope of this Address. I hope to make a brief reference to the work of women in engineering up to the present time, though the interest of this Society is primarily in *the woman engineer*, that is the woman within the industry who is not a labourer or an automaton, but who understands what is being aimed at, or being achieved and who undertakes a responsible part of the work. I have been careful not to say "important" part, for every bit of an engineering job is important,—not all of it can be regarded as responsible.

One reason for extending the scope of the paper beyond the direct interest of the Society is that it is difficult to find an exact line of demarcation between work that is skilled, semi-skilled and unskilled, and often it exists, not in the character of the work done, but in the ability, natural or acquired, of the worker.

Another reason is that there is topical interest in the work of women in engineering for the numbers of women in the industry and the variety of work on which they are engaged are greater than at any time.

The prime reason however is neither of these, but because the line of demarcation between the

woman in engineering and the woman engineer is not really clear, and in the mind of this Society it should not exist at all; but should be replaced by a series of stepping stones providing direct access from labour of an unskilled nature to employment of the most responsible kind where ability is shown, although apprenticeship is the ideal for peacetime. It is the first aim of this Society that a woman should be able to reach the highest rank in the engineering profession by way of the workshop and not be restricted, as she is in normal times, to an academic approach.

It will be clear from this introduction that the scope of the address is extensive rather than intensive.

Early this year I was honoured by an invitation from the Royal Society of Arts to read a paper on *Women in Industry. I regret that it will be difficult to avoid some measure of repetition, but perhaps it will serve to add emphasis to any point I then made.

WOMEN'S ENTRY INTO ENGINEERING

In passing I should like to mention that it is not clear when women first practised as engineers. We are inclined to imagine that women were introduced to many crafts during the period of the Great War, but a cursory glance at books connected with these pursuits reveal otherwise and one book, *Women Workers and the Industrial Revolution*, by Ivy Pinchbeck, which quotes the census of 1841, shows clearly how varied was women's industrial employment long before the years of so-called emancipation. The following are for England alone :

	<i>No. of women engaged</i>
Agricultural Implement Maker . .	58
Anchor Smith and Chain Maker . .	103
Blacksmith	469

Caroline Haslett
as WES
President
(1940-41)

Second World
War and lessons
from the First
World War

Longer term view of Haslett and W.E.S.

- World War 2 brings only short-term opportunities for women in engineering
- Secrecy over Bletchley Park decryption obscures much women's work
- Post World war 2 Britain gave less prestige to engineers than scientists

- Several famous WES figures die young - notably Amy Johnson
- Caroline Haslett drawn into many other roles, away from engineering

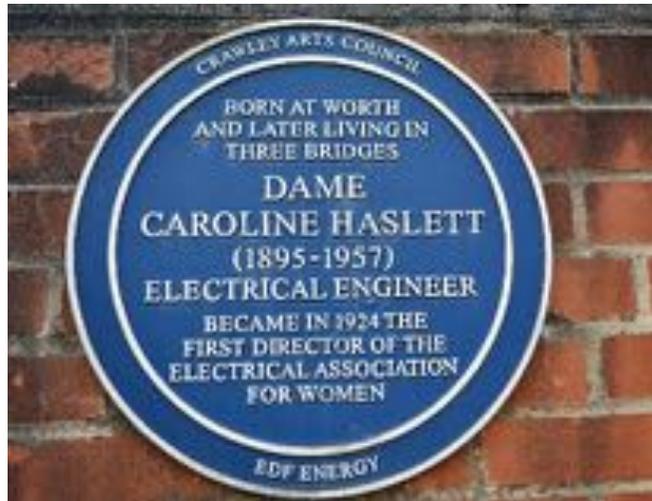
- Yet unlike the defunct EAW, WES continues to exist as a professional body of women recognizing Caroline Haslett's early leadership and building of collegial networks

Hertha Ayrton and Caroline Haslett compared

- Independent women in engineering – through family connections
- Great leaders, inspiring many women and enabling new technical roles
- Multi-talented, but drawn away from engineering in later years

- Ayrton remembered for inventions and links to suffrage movement
- An iconic national and international figure as woman engineer

- Haslett an engineer not inventor – although worked on the 3-pin safety plug
- But a transformative 20th century figure deserving national recognition!



Thank you!



Caroline Haslett c1924. Picture courtesy of the IET Archives

Web: Electrifyingwomen.org Email: electrifyingwomen@gmail.com