

ADAM HUNTER (1869–1933)

'ENGINEER EXTRAORDINAIRE'

A public lecture at Clydebank Town Hall on

19 August 2013 at 7.30pm

by Professor **ROLAND PAXTON** MBE FICE FRSE

School of the Built Environment Heriot-Watt University

Vice-Chairman ICE Panel for Historical Engineering Works

Admission Free



**IStructE/CHG version,
London, 17 March 2014**



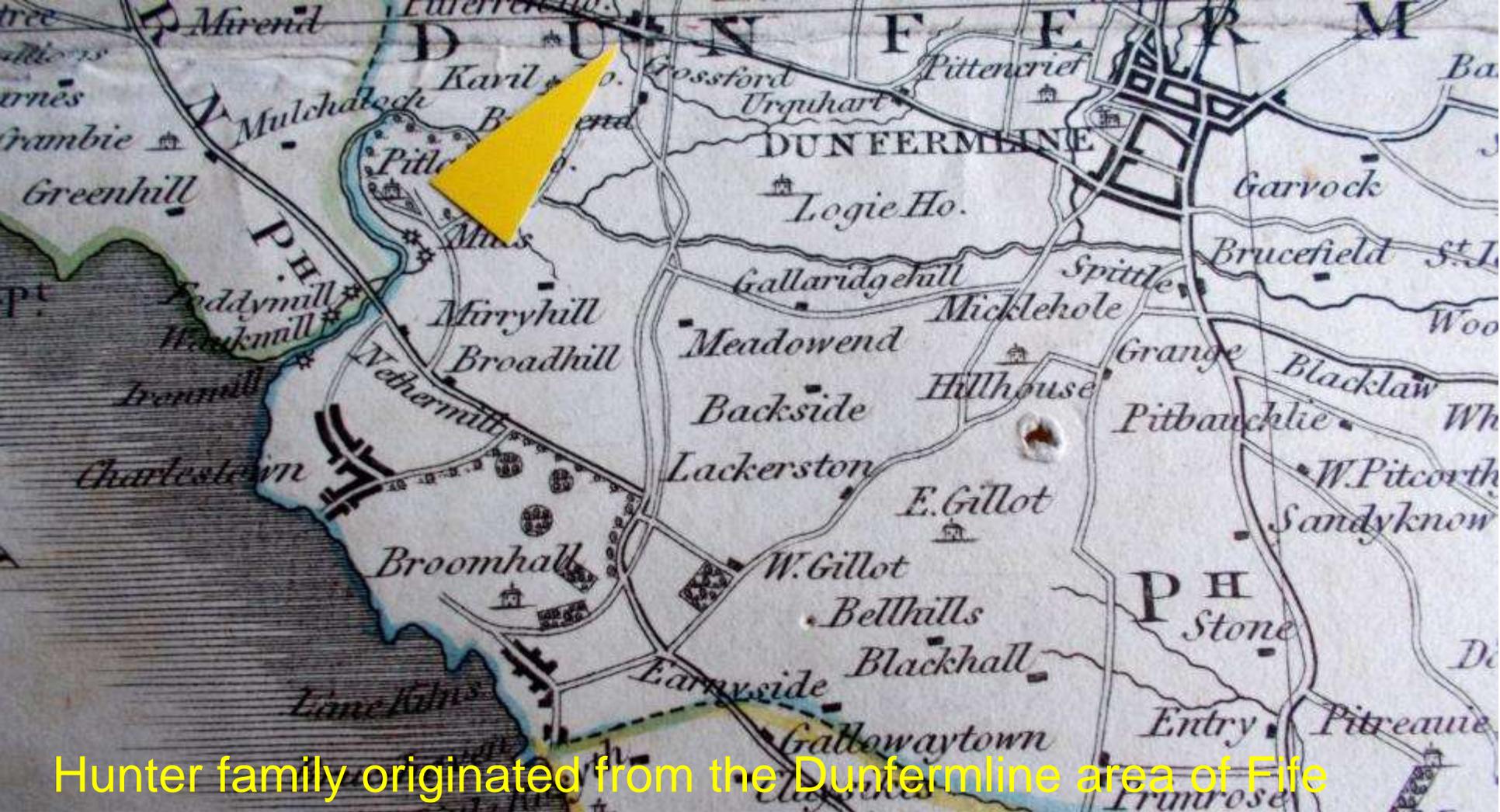
[Hunter: *Glas. Her.*:NLS]



Author's picture taken from the crane on a visit in July 2011



This visit inspired me on behalf of ICE's Panel for Historical Engineering Works (founded 1968, whose mission includes the promotion of such works and encouraging excellence in conservation of the finest examples) **to make a case for international status for the crane and to try and discover details of its unknown designer**



Hunter family originated from the Dunfermline area of Fife

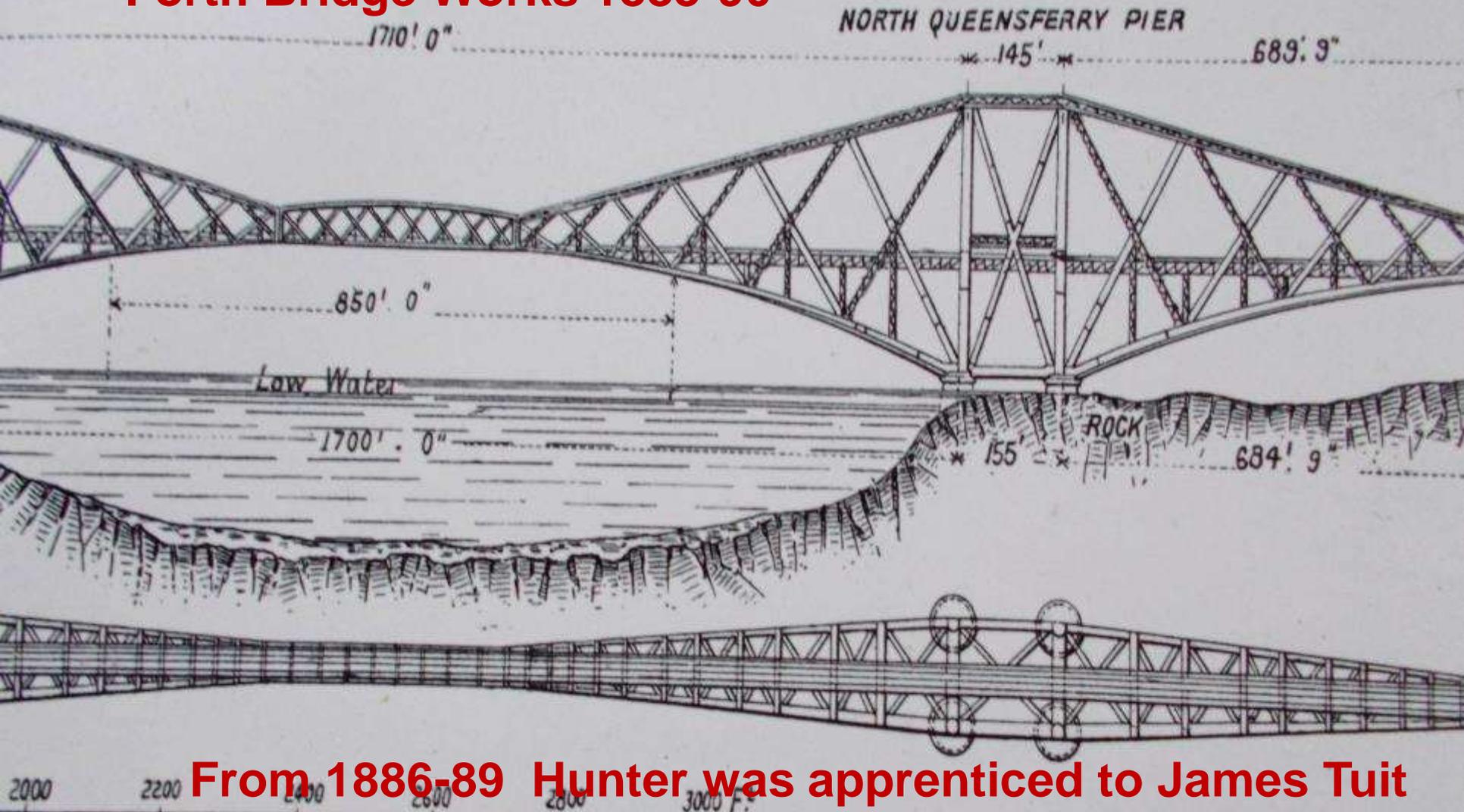
Adam [1] 1814-94 - Elgin Colliery Engineer

Adam [2] 1845-1918, Engineer - i/c Forth Bridge Workshops,
Queensferry [said to have saved 2 years in bridge erection]

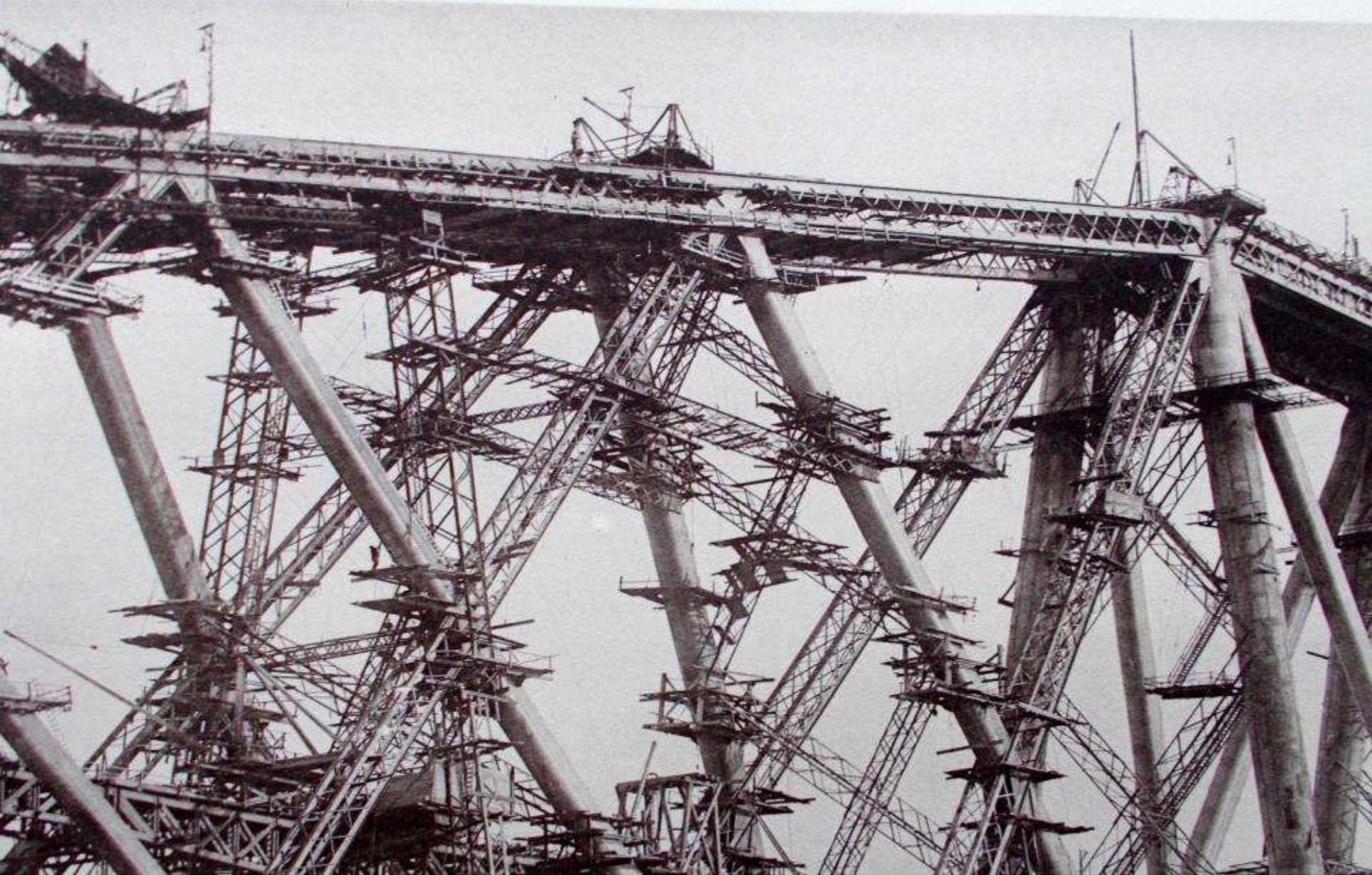
From 1890, the Forth Bridge's permanent Resident Engineer

Adam [3] b. Crossford 28.8.1869, d. Glasgow 1.11.1933

Forth Bridge Works 1883-90

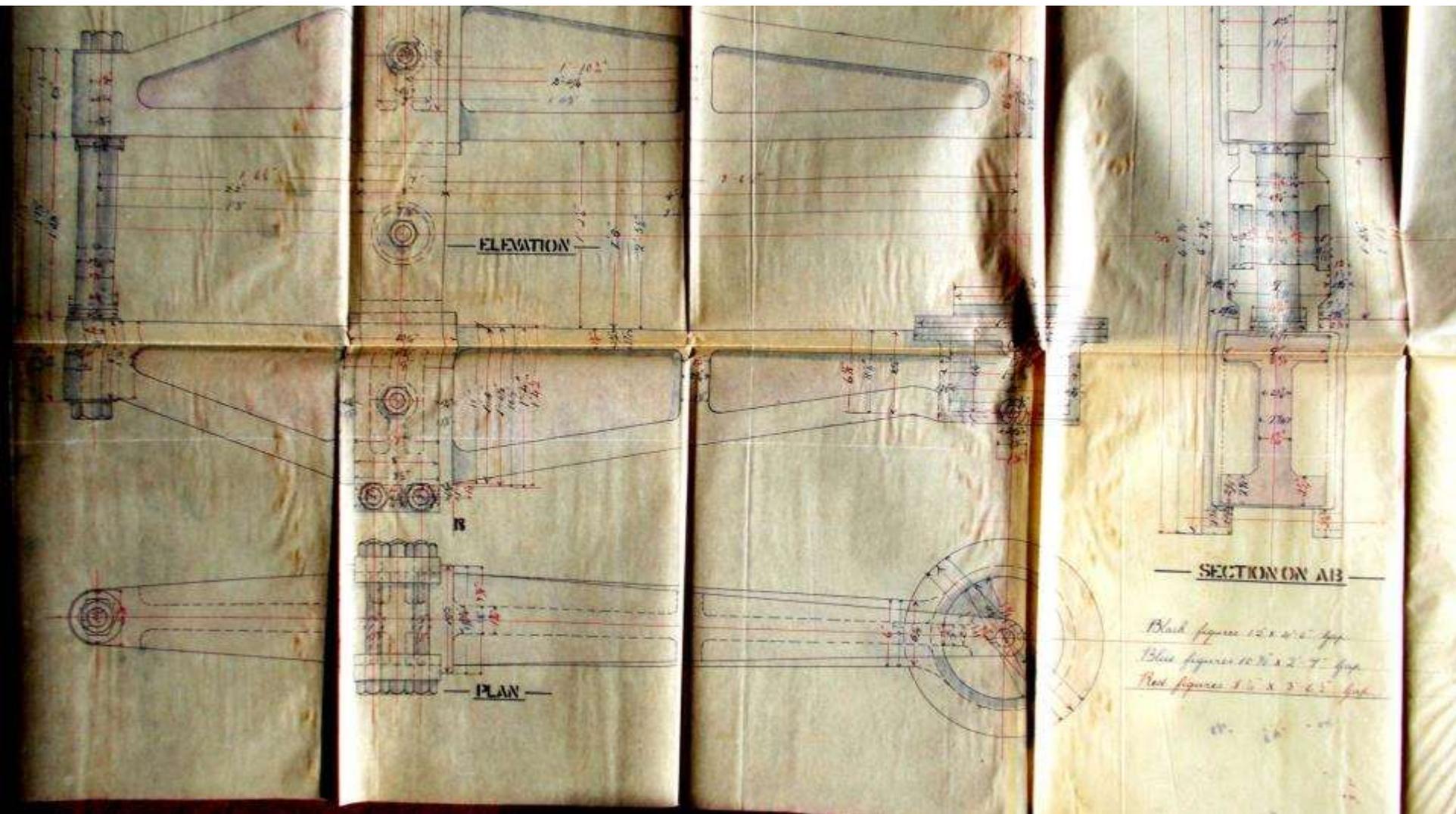


From 1886-89 Hunter was apprenticed to James Tuit MICE of contractor Tancred, Arrol & Co. on the erection of the world's then largest steel bridge [Westhofen, pl.III]

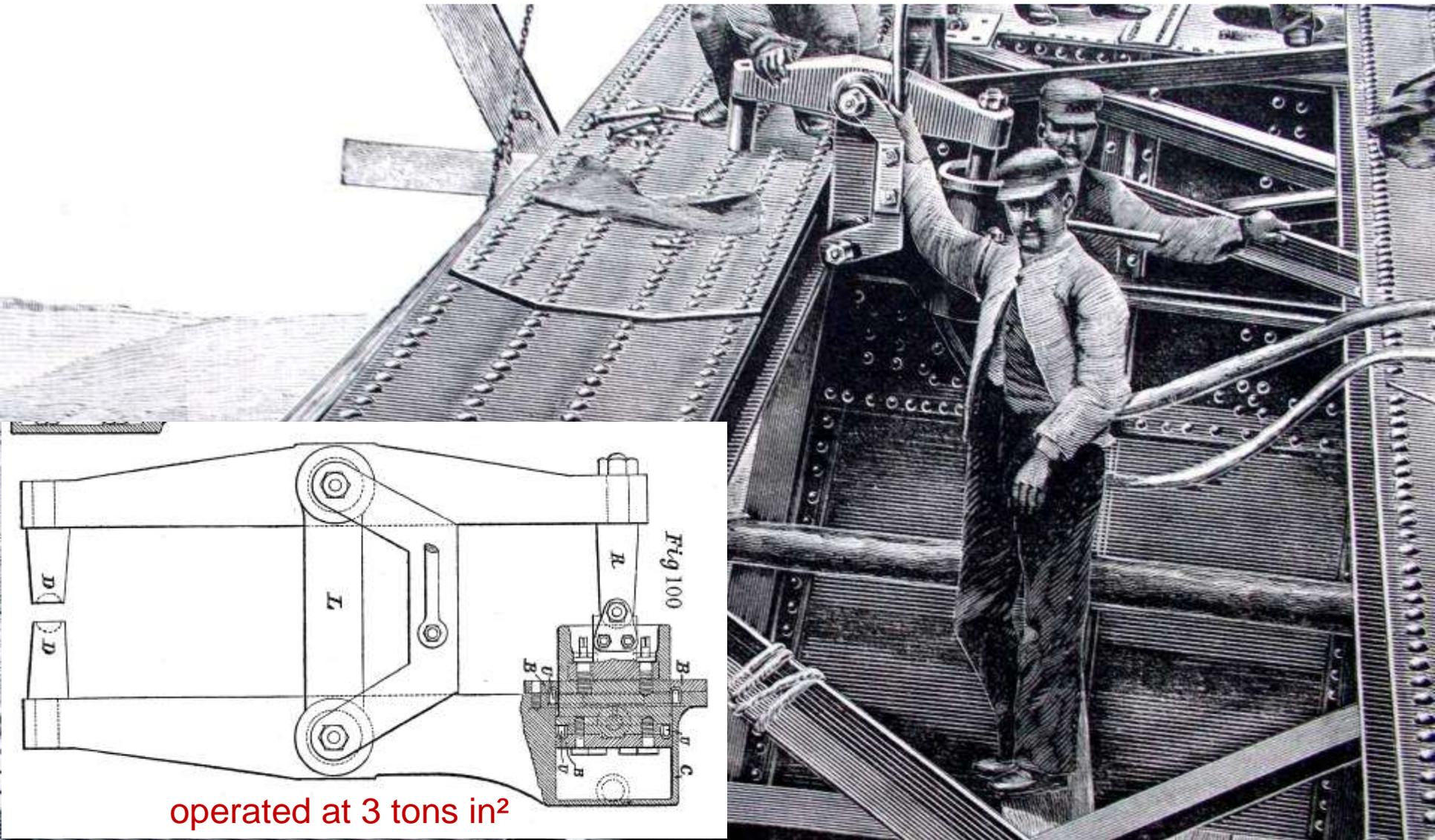


**Forth Bridge balanced cantilever construction in progress
at North Queensferry in 1888**

[Hunter Archive]



Forth Bridge Works – Hunter’s copy of riveter drawing
[Hunter Archive]

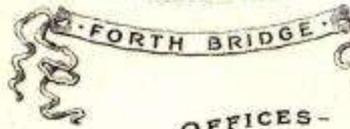


Forth Bridge – jointed hydraulic riveter in use near cantilever top [*The Engineer*, 9 November 1888 - inset Westhofen]

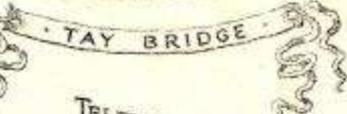
Arrol jointed hydraulic riveter c.1888 @
ICE Scotland Museum Heriot-Watt
University, Edinburgh



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Preston Street, BRIDGETON,

Glasgow. Tuesday, 10th Novr., 1908.

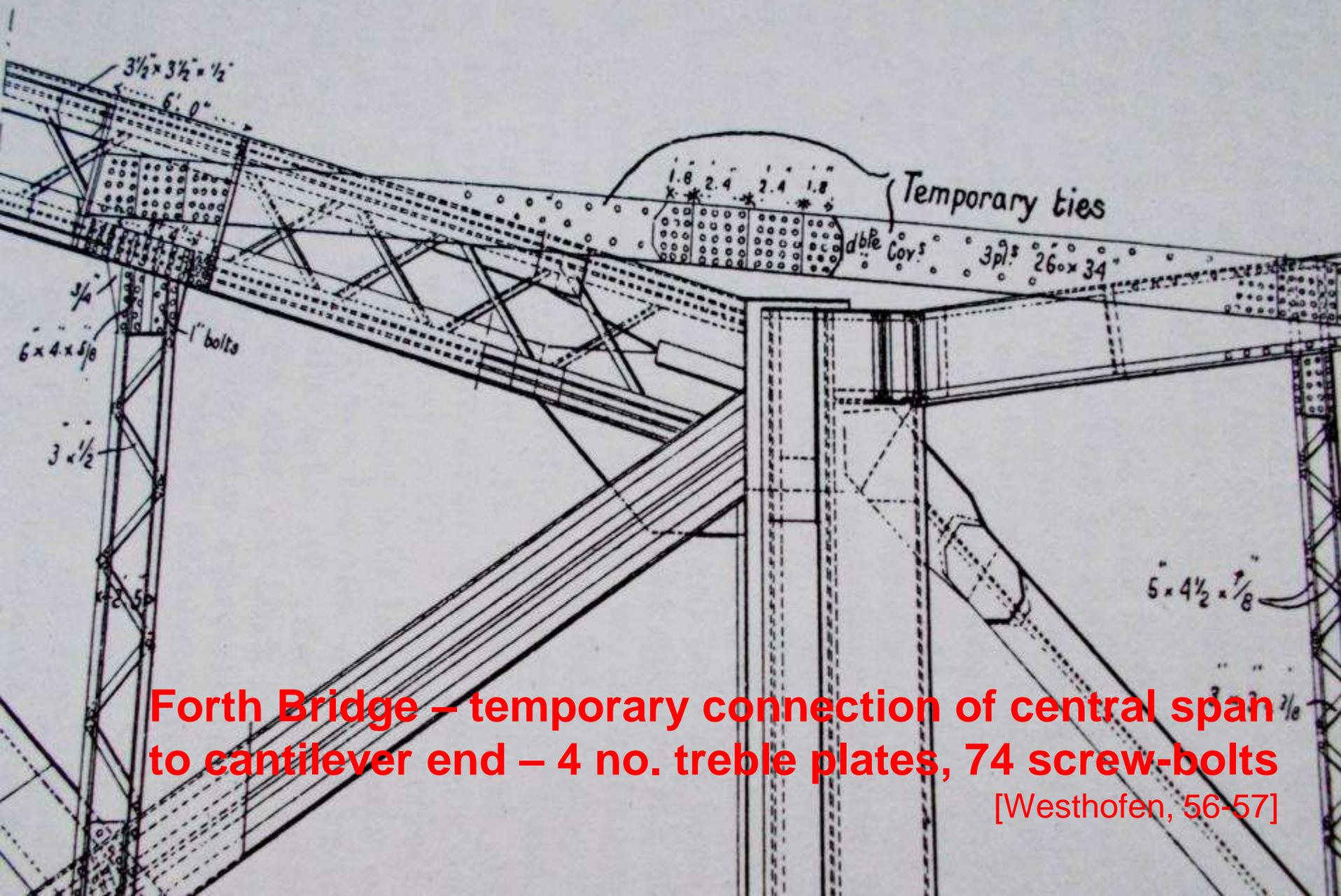
Impressive letter heading of Sir William Arrol & Co. Ltd on a testimonial for C.P. Hogg of Crouch & Hogg [Hunter Archive]



**Forth Bridge suspended span under construction in 1889
Young Hunter was one of many engaged at the work-yard on
the south bank on the bridge's fabrication and erection**

[Phillips, *Forth Bridge* 1890, pl. 34B]

AL GIRDERS AND INTERNAL VIADUCT.

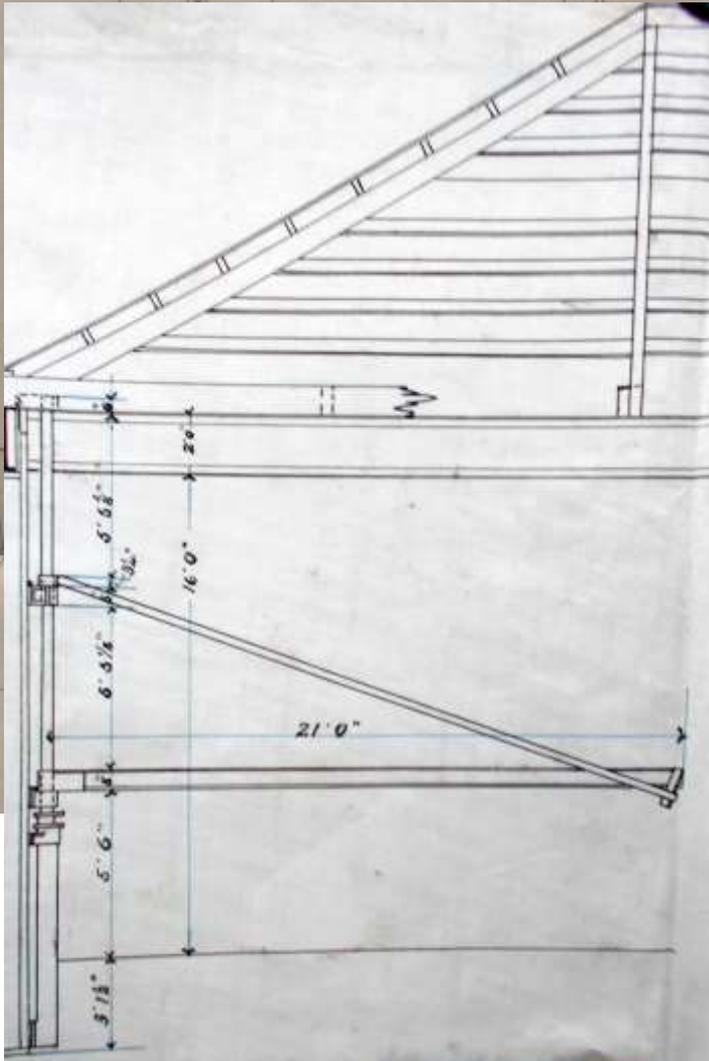


Forth Bridge – temporary connection of central span to cantilever end – 4 no. treble plates, 74 screw-bolts

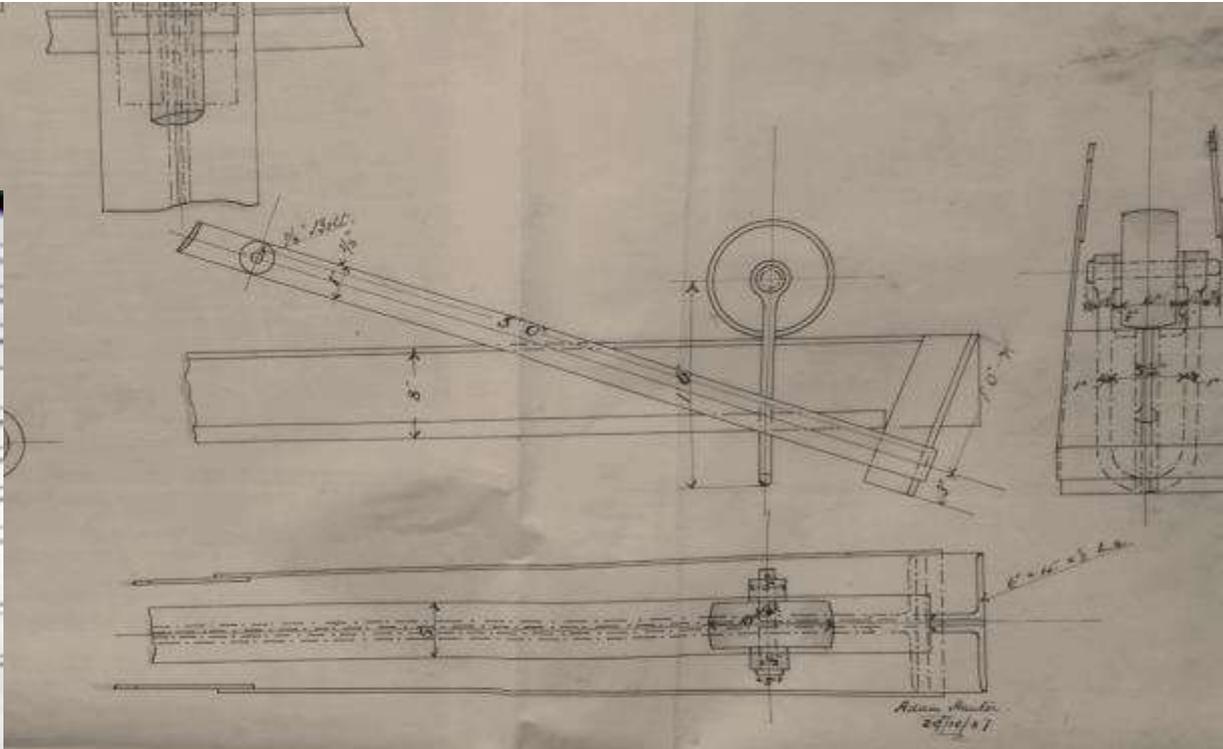
[Westhofen, 56-57]

In 1889 Hunter was working on site when **‘with a bang like a shot from a 38-ton gun’** [Westhofen 59], the last 36 bolts of the temporary ties between the north central span and the cantilever end sheared off before the temperature could be equalised for their unstressed removal. Hunter noted that **‘The huge cantilevers rocked from end to end as they had never rocked before or since, like the beam of weighing scales’**

[Hunter 1929, 43]. [Paxton *BDCE3*]



Hydraulic Crane for Smith's Shop

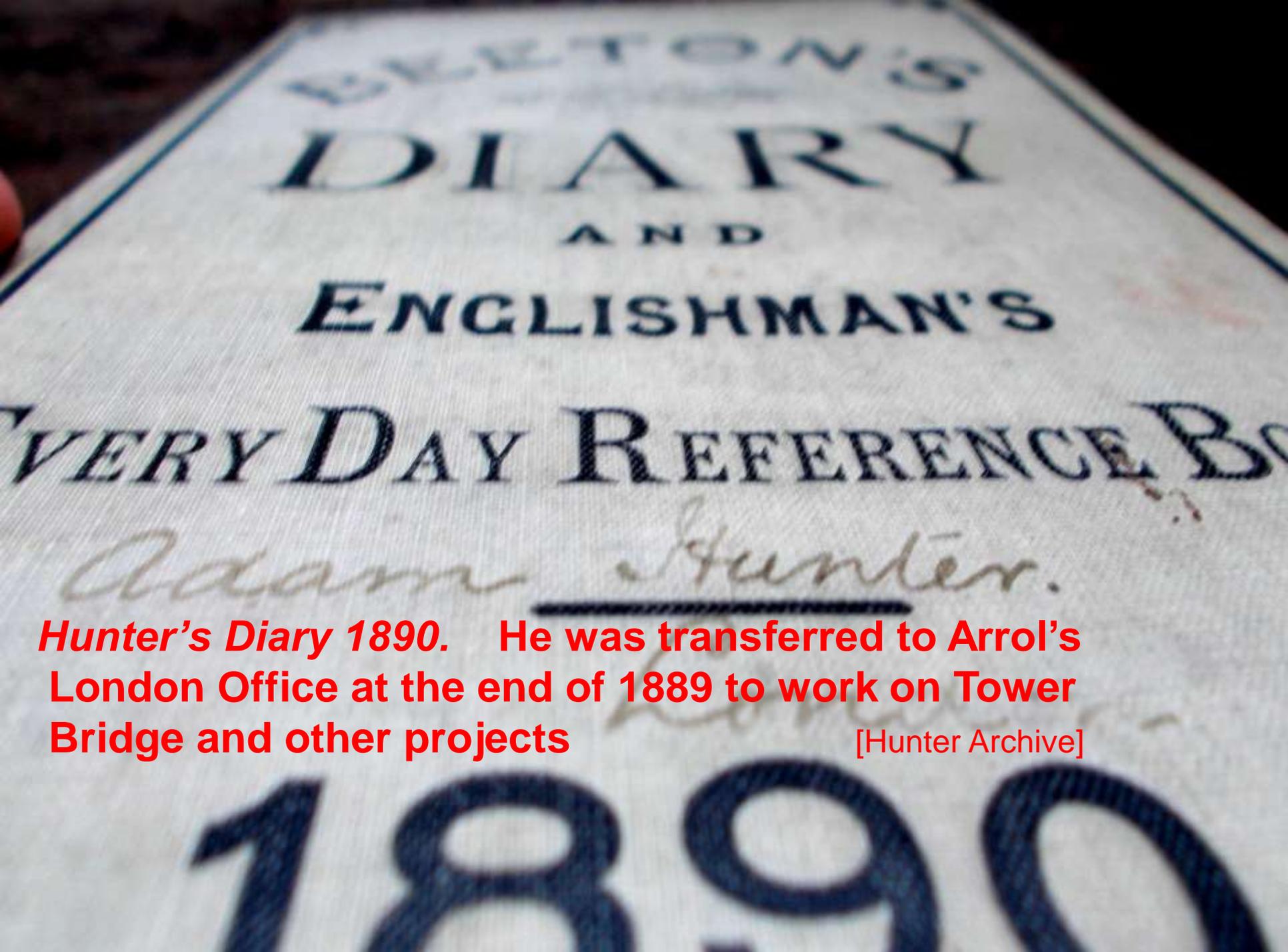


its of Hydraulic Crane.

for N° 2. Shed

Pressure, 1000lbs per sq. in.

Forth Bridge Works – Hunter drawing of a swivel-crane for the Work-yard Smith's Shop in 1887, when aged 18. Within 2 decades he was designing world-class cranes [Hunter Archive]



BLETTON'S
DIARY

AND

ENGLISHMAN'S

EVERY DAY REFERENCE BOOK

Adam Hunter.

Hunter's Diary 1890. He was transferred to Arrol's London Office at the end of 1889 to work on Tower Bridge and other projects

[Hunter Archive]

1890

1 WEDNESDAY.

was down at St. Paul's last
night.

Dinner

Spon's Price book

1 6

8

At work today for the first
time on New Year's day.

Hunter's Diary 1 January 1890. Engineering Assistant at 2 gns a week still working under Tuit [now the firm's Chief Engineer, responsible for erecting Tower Bridge and other projects]

18 TUESDAY.

MARCH.

Dinner			6
Postage for Industries + Blues A. Bridge			7½
Sundries			5
was up at Exeter Hall at			
Lecture by Professor Fowler on			
"How to rise in life"			

Hunter's diary entry for 18 March 1890 when he attended Professor Fowler's lecture on "How to rise in life" - and he certainly did!

[Hunter Archive]

Whitehall laid with new timber
blocks, uncreosoted and kept at
distance by small nails - fixed by
cement grouting, no pitch used
laid on concrete bed.

opened for traffic today

4 THURSDAY SEP

Hunter's diary entry for 3 Sept 1890 describing the laying
of timber blocks in Whitehall, London - note the concise
attention to detail!

[Hunter Archive]

At Crystal Palace
Fare

16



THE TOWER BRIDGE,

ITS HISTORY AND CONSTRUCTION FROM THE DATE OF THE
EARLIEST PROJECT TO THE PRESENT TIME.



BY

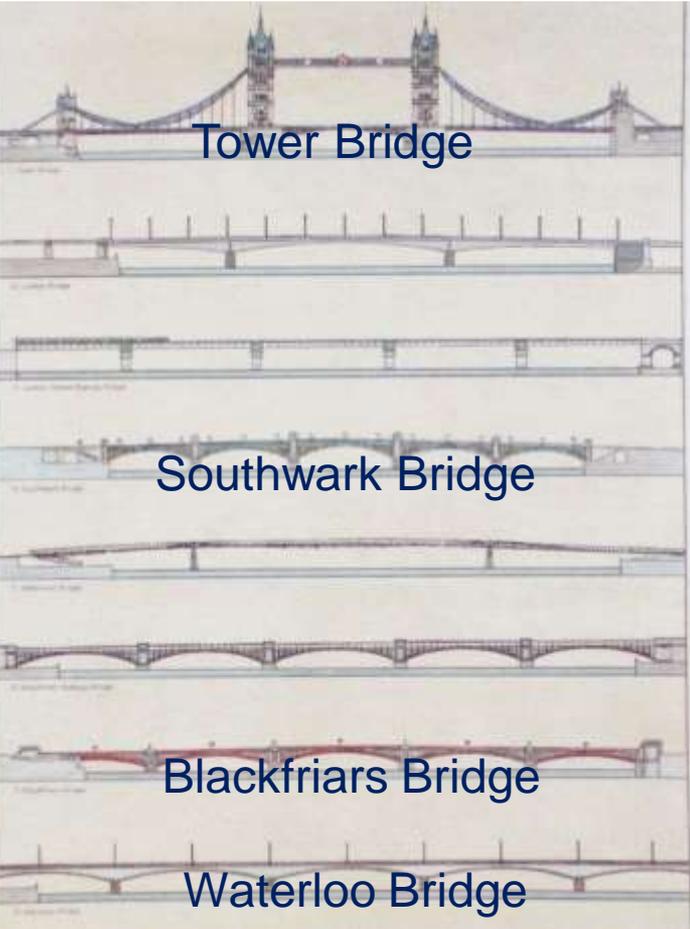
J. E. TUIT, M. INST. C.E.,

ENGINEER TO SIR WILLIAM ARROL AND CO., THE CONTRACTORS.

**Hunter's copy of his chief's
book about the Tower Bridge
published on completion of
the Bridge in 1894 [Hunter Archive]**

LONDON:

OFFICE OF "THE ENGINEER"



**London – Thames bridge sites at which Hunter worked.
Tower Bridge 1890-94. By 1924 he had directed the erection
of Southwark, Blackfriars and Waterloo Bridges as Chief
Engineer**

[old postcard/ICE card, *Errolgraphics* 2005]



**Tower Bridge
c. 1891.**

**The contract for
provision and
erection of steel-
work was let to Sir
William Arrol & Co
Ltd in 1889.**

**The bridge's stone
cladding on
completion belies
its 11,000 tons
of steel and 1,200
tons of cast iron**

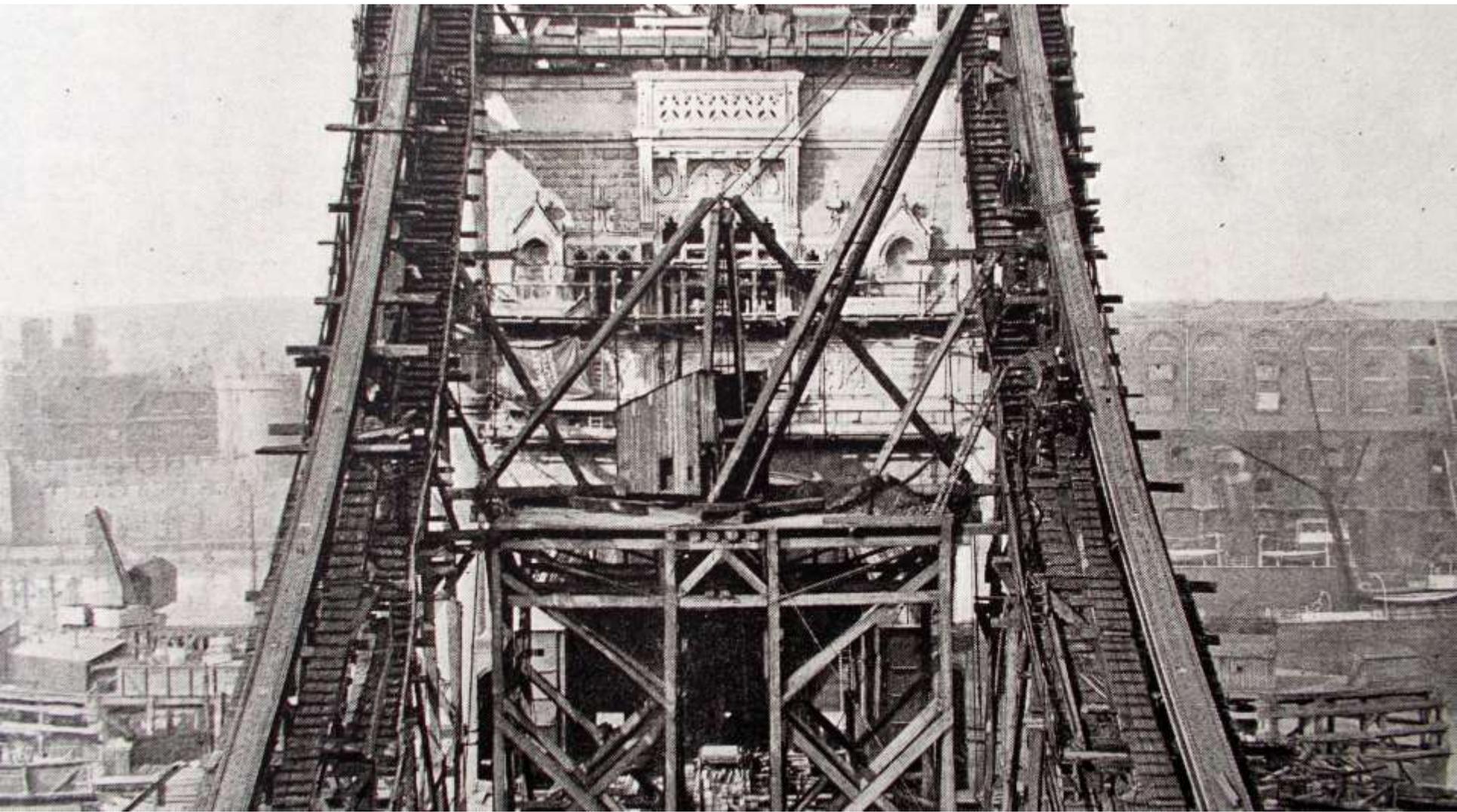
[ICE Archives]



**Tower Bridge's state in October
1892 - after Hunter had worked
on the project nearly 3 years**

[ICE Archives]

TOWER BRIDGE WORKS OCT 18th 1892



Tower Bridge 1892 – note travelling gantry and men on staging adjoining chains – note riveting

[Tuit, 65 Hunter Archive]

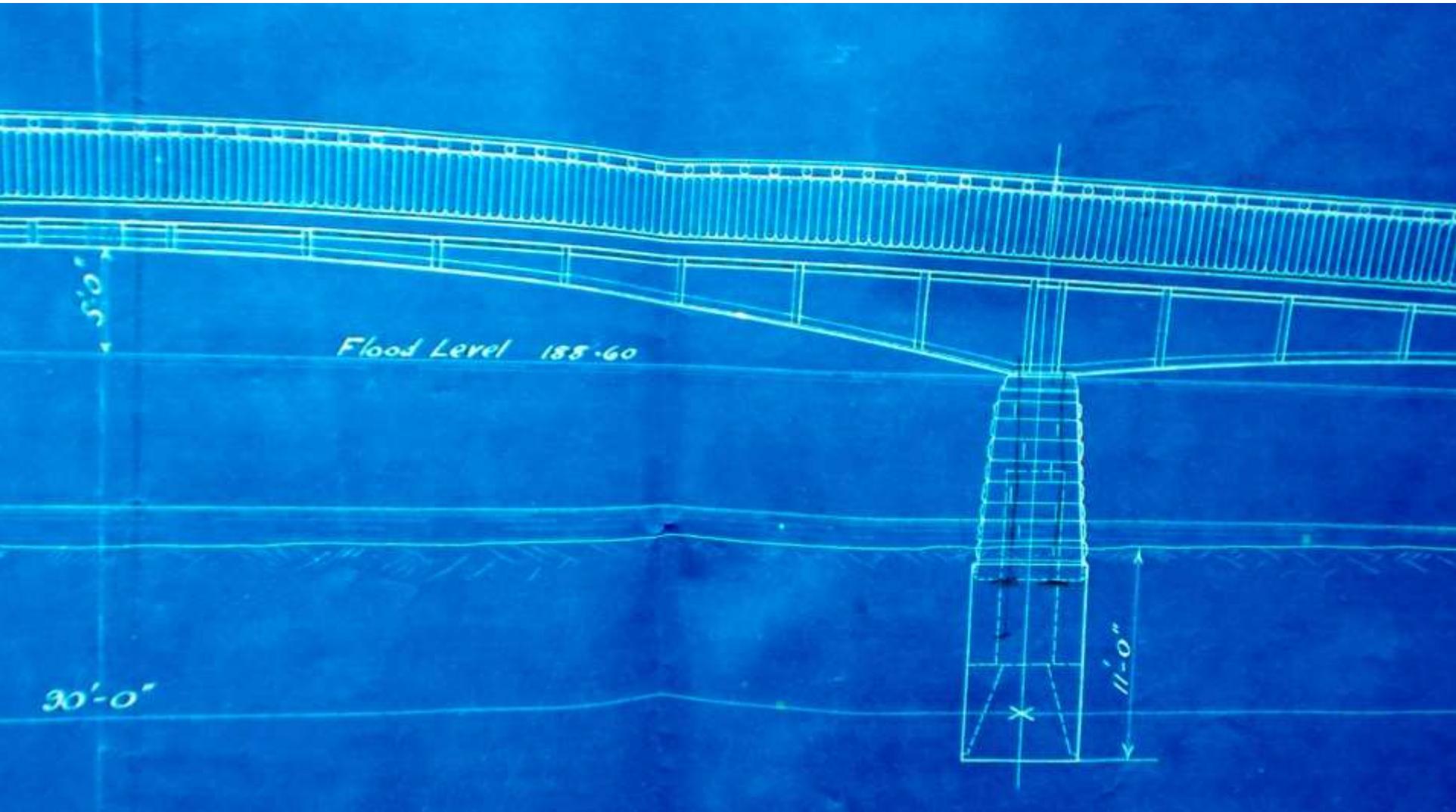


Tower Bridge Novr 1893 [Tuit, 93]. Hunter in 4th year of evening classes at City of London College [Prof. H. Adams] Married Lottie Patrick 1900. Arrol's drawing office moved to Glasgow in 1906. Hunter then promoted *Chief Engineer* on Tuit's death

Dalginross Bridge, Comrie, 1904 – said to be the first steel ‘constrained cantilever’ bridge in UK. Refurbished 2000 and awarded a Saltire Society Civil Engineering ‘Commendation’ on the recommendation of PHEW

[Arrol *Bridges* 1909, 132]





Dalginross Bridge, Comrie, 1904. R. Earn. Cantilever construction continuous over pier, with pendulum link connection at mid-span

[Hunter Archive]



SIR W^M ARROL & CO LTD

GLASGOW Feb. 26th 1904

APPROVED J. J. Tuit. DIRECTOR

DRAWING MADE BY A. G. Harrison.

DRAWING CHECKED BY A. Hunter.

Dalginross Bridge, 1904. Arrol Girder Department blueprint. In 1904 Hunter was promoted *Acting Chief Engineer* after having been *Chief Assistant* from 1895. Tuit died in 1906. Note the responsibilities of the signatories

[Hunter Archive]

STRUCTURAL DESIGN
OF
BUILDINGS.
BY
C. C. SCHNEIDER.
1905.

A. H.

*Admitted
Adam Hunter*

REPORT
ON THE
BLACKWELL'S ISLAND BRIDGE
(QUEENSBORO BRIDGE)

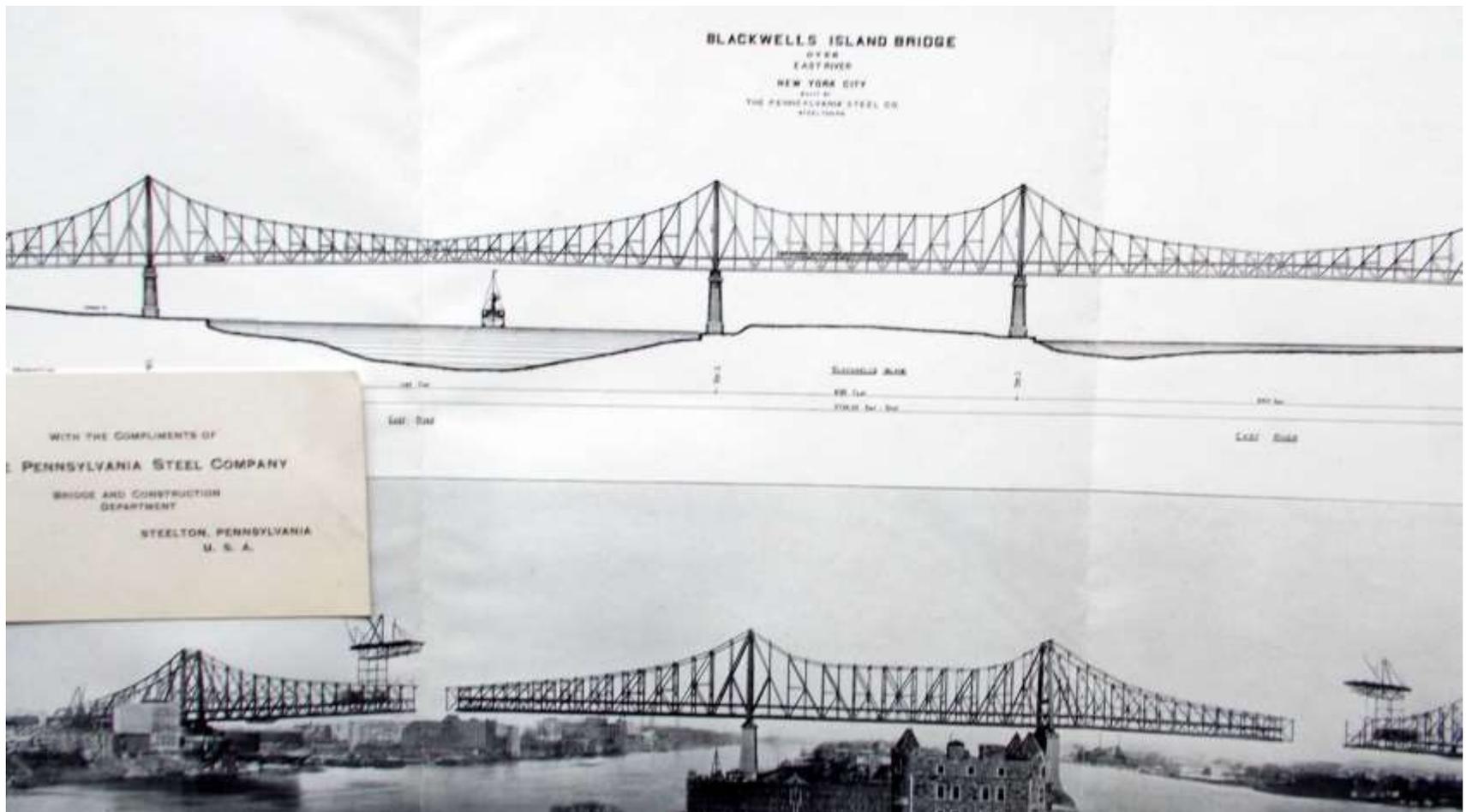
By F. C. KUNZ
Chief Engineer

THE PENNSYLVANIA STEEL CO.

And a Commission consisting of

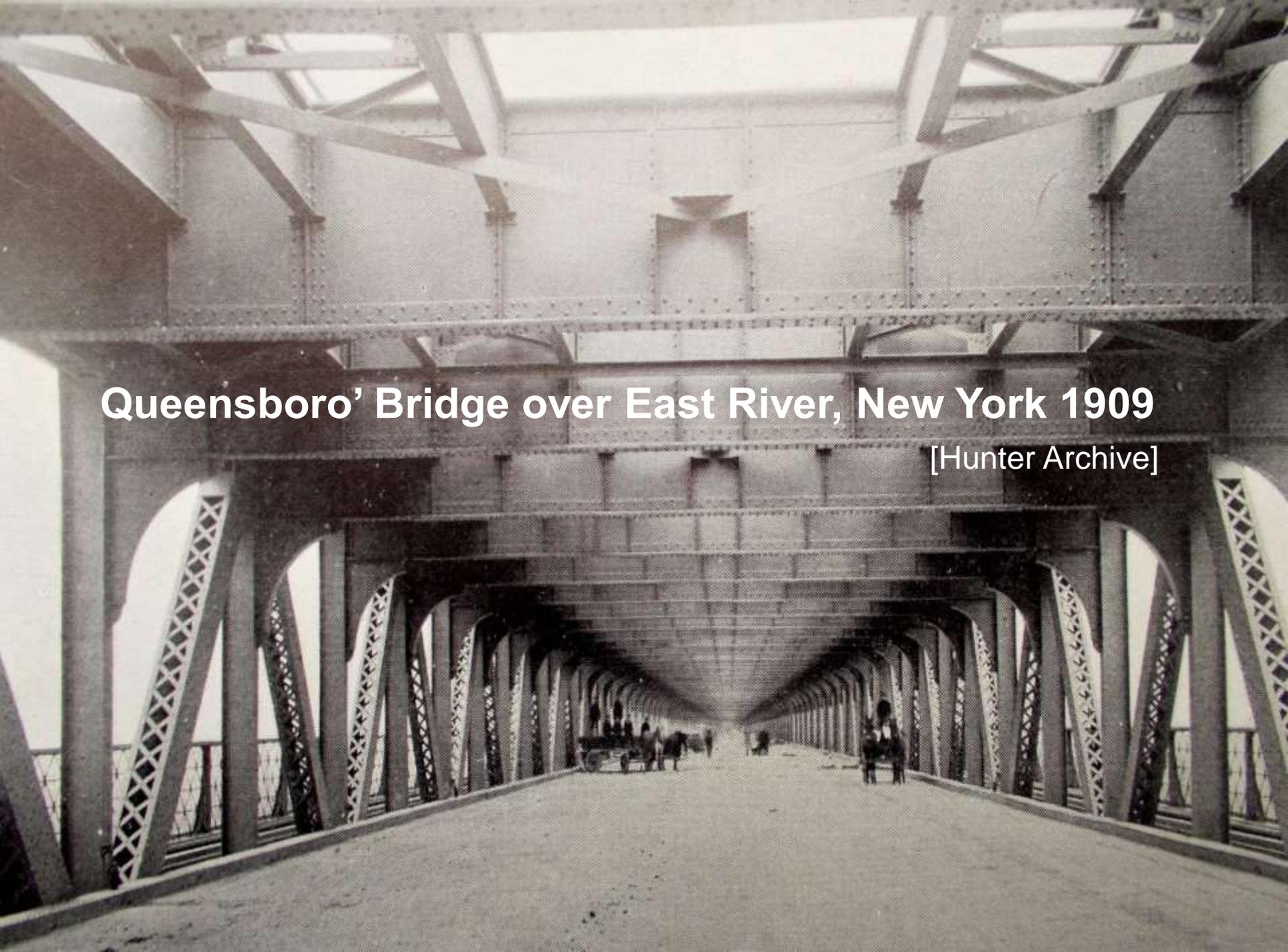
CHARLES MACDONALD, Consulting Engineer
Past-President Am. Soc. C. E.
C. C. SCHNEIDER, Consulting Engineer
Past-President Am. Soc. C. E.
H. R. LEONARD, Consulting Engineer
J. E. GREINER, Consulting Engineer

Hunter was influenced by developments in USA. From 1906-32 he was responsible for the construction and erection of all of the work world-wide carried out by Arrol's [Hunter Archive]



Queensboro Bridge, East River, New York 1909 - 3724 ft long overall - 1182 ft max. span. Use of nickel steel - stronger

[Hunter Archive] Hunter was aware of the value of history in informing bridge practice and noted that in 1810 Thomas 'Pope proposed to build a cantilever bridge of 1800 ft span across the East River' and he had made and tested a model [Hunter 1929, 23]



Queensboro' Bridge over East River, New York 1909

[Hunter Archive]

The Junior Institution of Engineers.

Incorporated.

[1906]

THE
STRUCTURAL DESIGN
OF
ENGINEERING FACTORIES.

BY

ADAM HUNTER,
Assoc. M. Inst. C.E. ; Assoc. M. Am. Soc. C.E.,
(Past-Chairman) OF GLASGOW.

Read 3rd December, 1906, at the Westminster Palace Hotel, London.

*Reprinted from the Transactions of the Institution
by the authority of the Council.*

LONDON :

Published by PERCIVAL MARSHALL & Co., Poppin's Court, Fleet Street,
E.C.

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[IStructE paper in 1929
“of inestimable value to
the younger members of
the profession” PPIStructE]

ERECTION OF METALLIC
BRIDGES.

[by staging or trestles
floating out
protrusion or overhang
or combinations of above]

BY

ADAM HUNTER, M. Inst. C.E., M. Am. Soc. C.E.,
M. I. Struct. E.

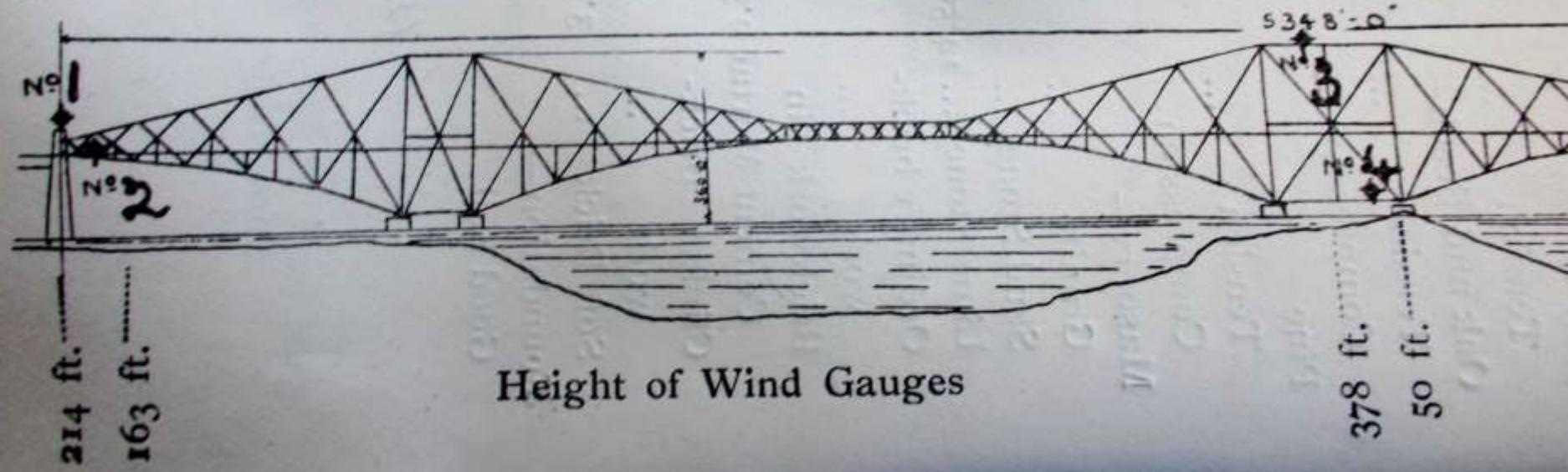
Influential Hunter publications - note his qualifications

[Hunter Archive]

December 29th, 1904	...	30	21	60	
January 21st, 1905	...	32.5	32.5	38	
March 18th, 1905	...	20	22	59	
February 28th, 1905	...	—	—	30	
January 26th, 1906	...	23.5	20	55	
January 11th, 1906	...	25	15		
February 8th, 1906	...				
Average	...	28.0	23.0	50.0	1

QUEENSFERRY. S.

POSITION OF WIND GAUGES



Factory design 1906. For wind pressure Hunter quotes 1905/6 values in lbs/sq ft from 1½-300 sq ft area gauges at the Forth Bridge i.e. 28-50 lbs/sq ft (gauges 1-3) [Hunter, 1906 - Hunter Archive]



**Arrol's Girder Fitting Shop, Dalmarnock Iron Works, Glasgow
– loading arrangements in 1906** [Hunter 1906 pl. 18 – Hunter Archive]

Coventry Ordnance Works, Scotstoun, Glasgow.

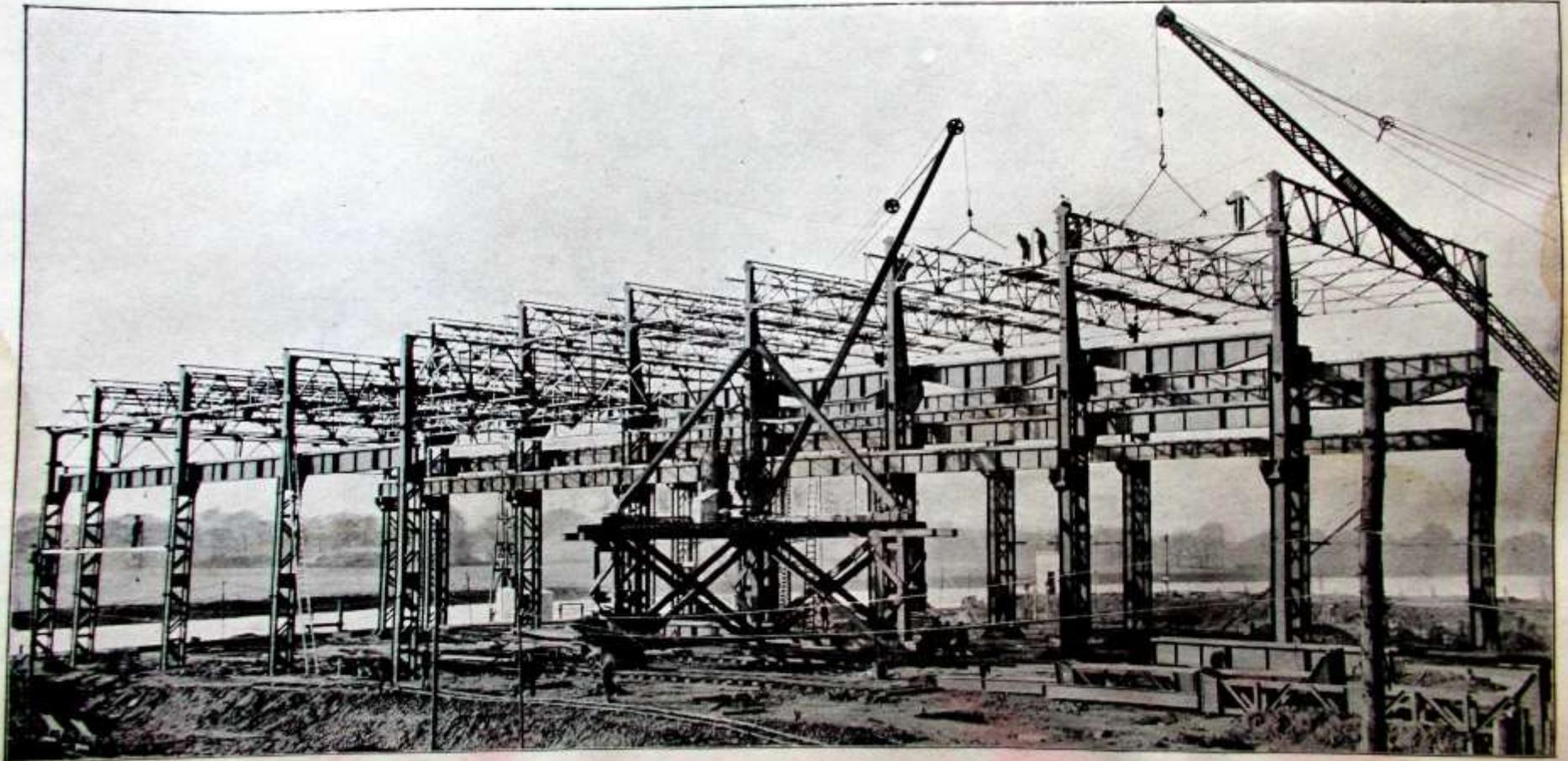
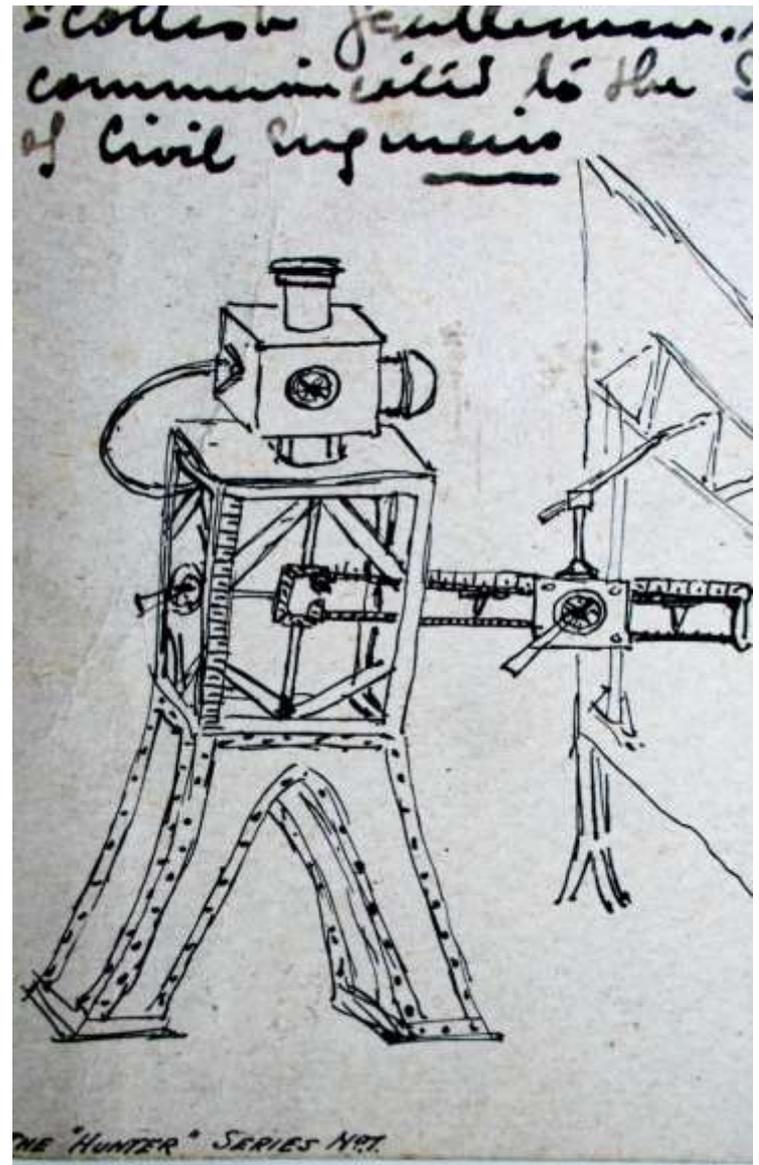


PLATE 21.

**Coventry Ordnance Works, Glasgow, 1906 - Erecting Shops
- one of many similar works erected by the firm**

[Hunter 1906 pl. 21 – Hunter Archive]



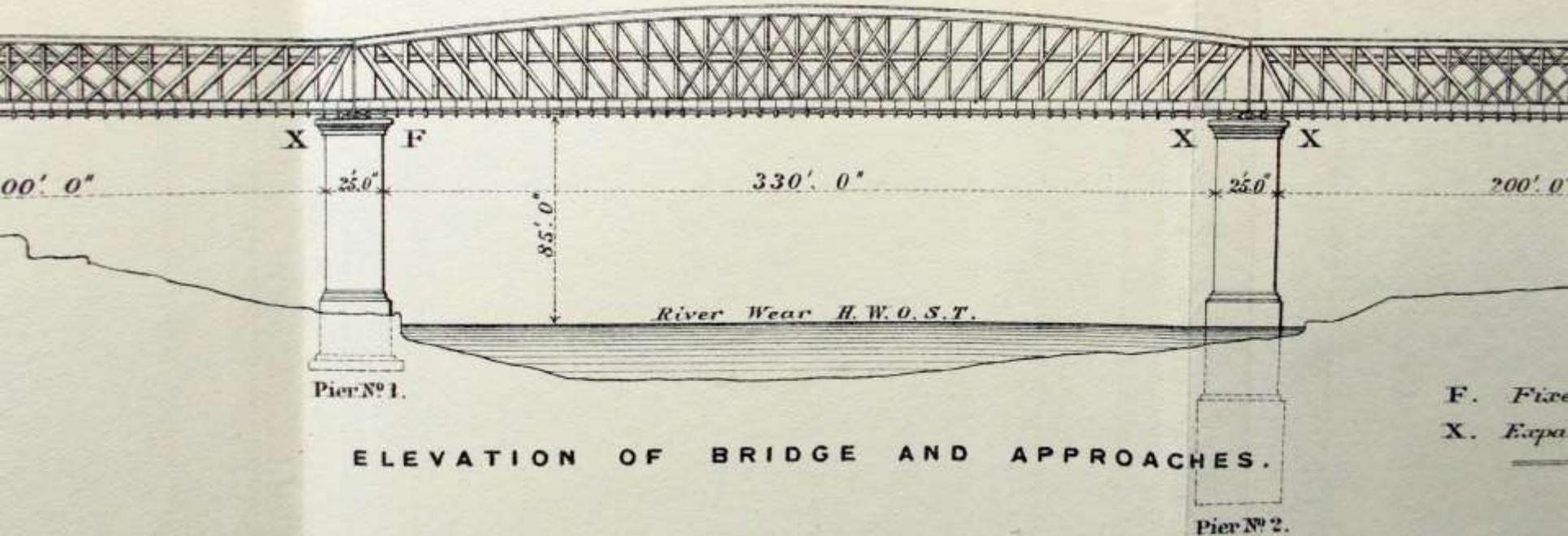
Hunter's 'automaton' self portrait communicated to ICE in 1908
[Post-card sent home to his father - Hunter Archive]

. H.	over the Nile at Cairo, 270 feet, 283 feet, and 1,755 feet in length, £200,000.	
. R.	Acting Chief Engineer to the firm, from March to May, 1904, and designed	19
➤	the foundations and structure for a 150-ton electric derrick crane at Clydebank, £18,000; a road bridge at Comrie, £4,500; and railway bridges on the Suakim-Berber Railway, Egypt, £30,000.	
	Acting Chief Engineer to the firm, from July to November, 1905, and responsible for the design of workshop buildings at Polmadie, £24,000, and at Tranmere Bay, £35,000 ➤ and for a 150-ton hammer-head electric crane at Clydebank, £25,000.	190
. H.	In Egypt, from November, 1905, to March, 1906, as Technical Adviser to	190

Hunter elected AMICE 1895 [proprs Prof H. Adams - admitted by Sir B. Baker]. Extract of his successful transfer application to MICE in April 1909 with his Comrie and Clydebank entries refereed by H. Roberts [M]. For the Clydebank electric derrick crane of 1904 he **designed the foundations and structure**. In 1905 for the Clydebank Titan crane he had **design responsibility**. ASCE (AM 1905, M 1911) IESIS (1906) IStructE, M 1925

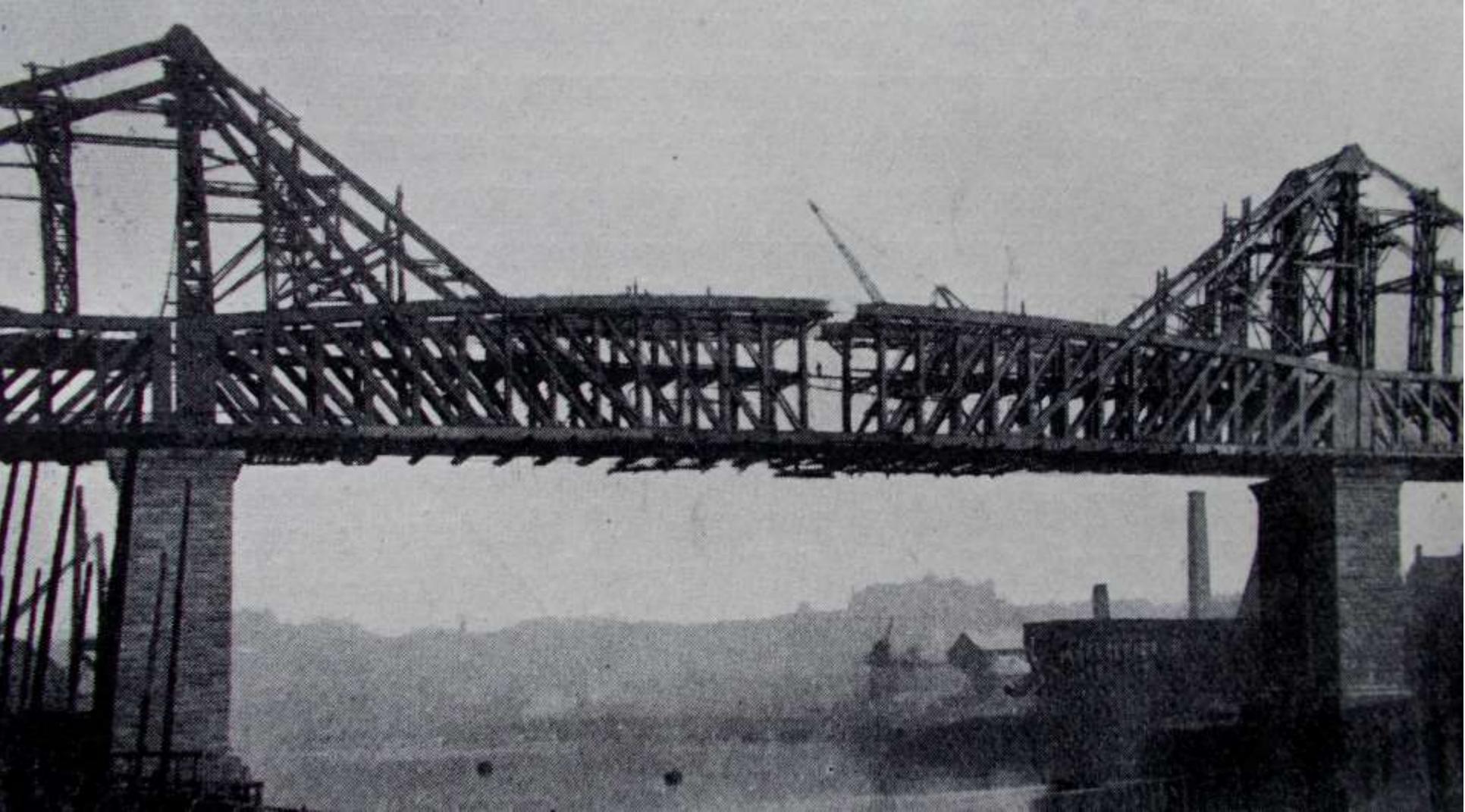
QUEEN ALEXANDRA BRIDGE OVER THE RIVER WEAR, SUNDERLAND

Fig: 3.



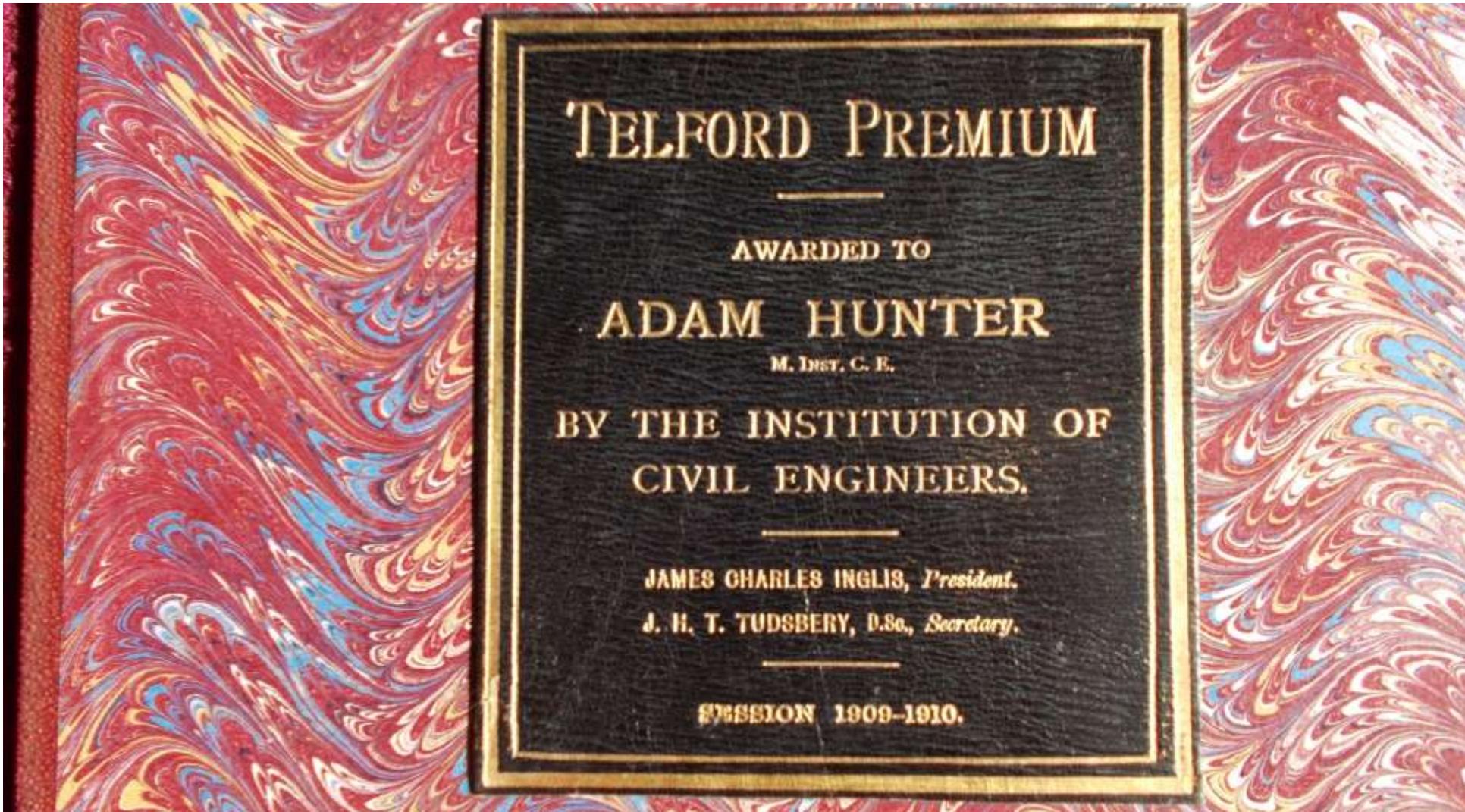
Hunter had a key role in the erection of Queen Alexandra Bridge, Sunderland, 1909 – 1560 ft in length with road and railway decks - 330 ft max. span

[MPICE (1910) 182]



**Queen Alexandra Bridge, Sunderland 1909 –
erection of 330 ft span nearing completion**

[Hunter 1929, 19. Hunter Archive]



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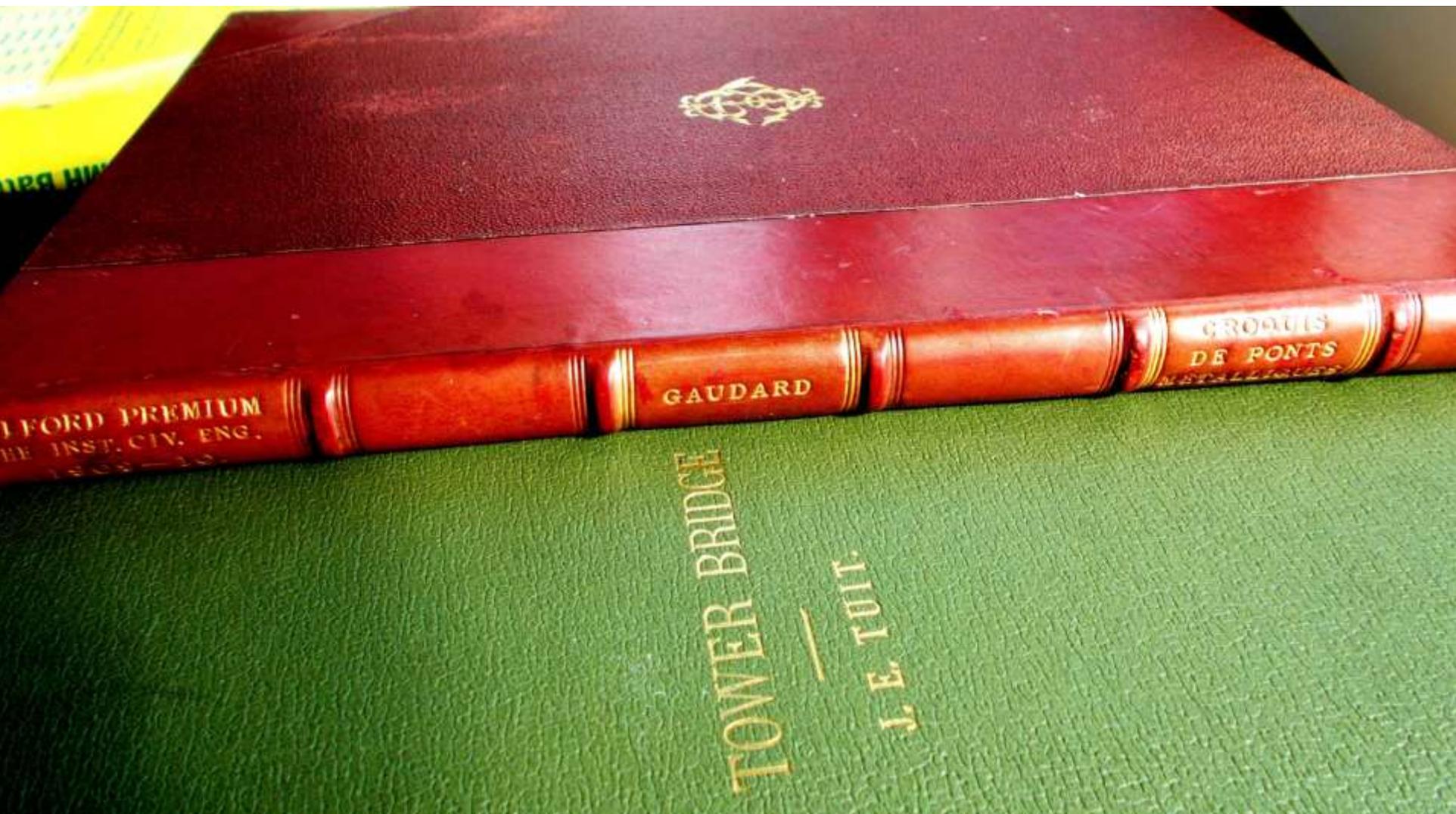
JAMES CHARLES INGLIS, *President.*

J. H. T. TUDSBERY, D.Sc., *Secretary.*

SESSION 1909-1910.

**Book- label from part of Hunter's *Telford Premium* award
1910**

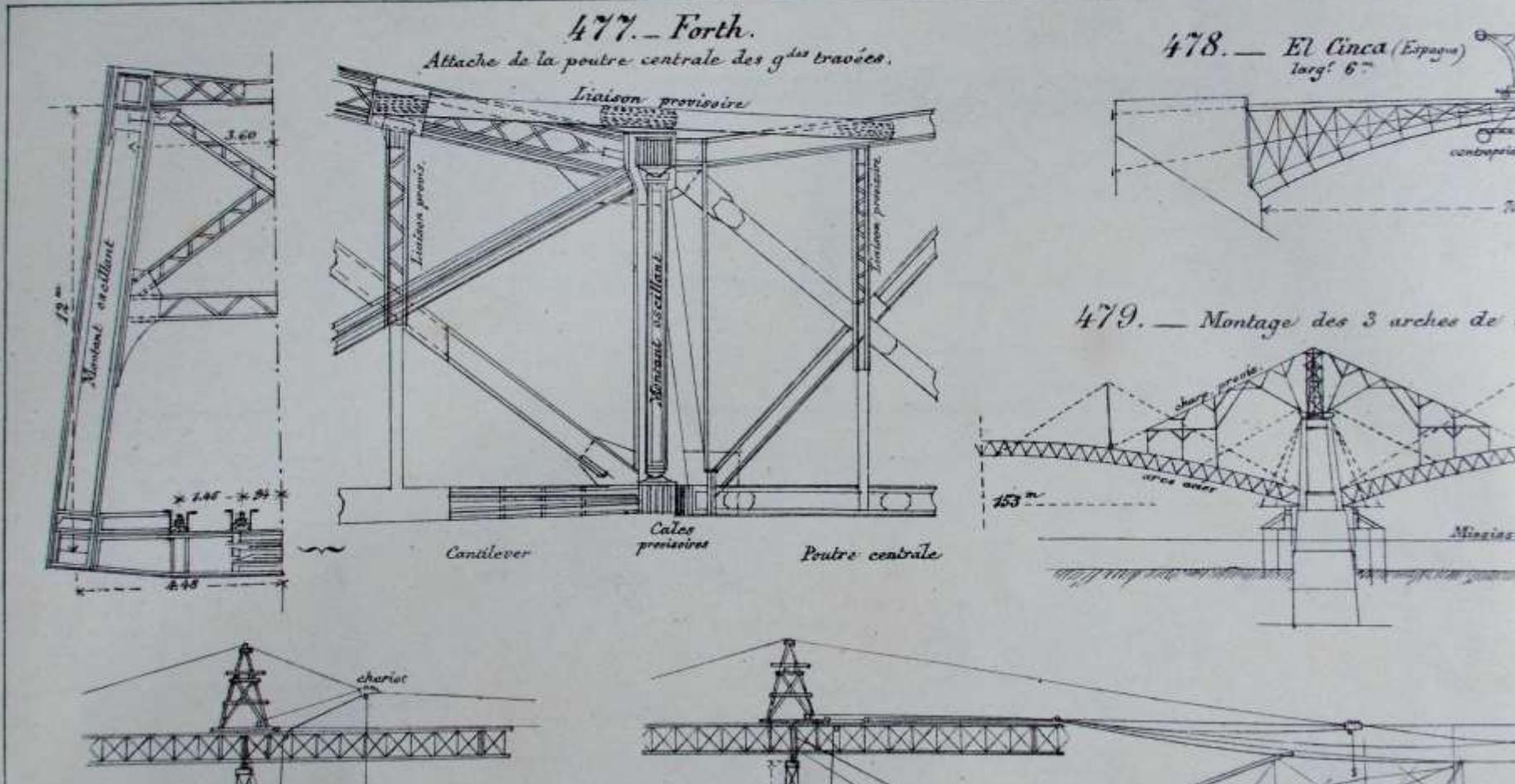
[Hunter Archive]



Part of Hunter's Telford premium Award - Gaudard's *Croquis de Ponts Metalliques* – a good choice for a steel bridge enthusiast [with his copy of Tuit's *Tower Bridge*]

[Hunter Archive]

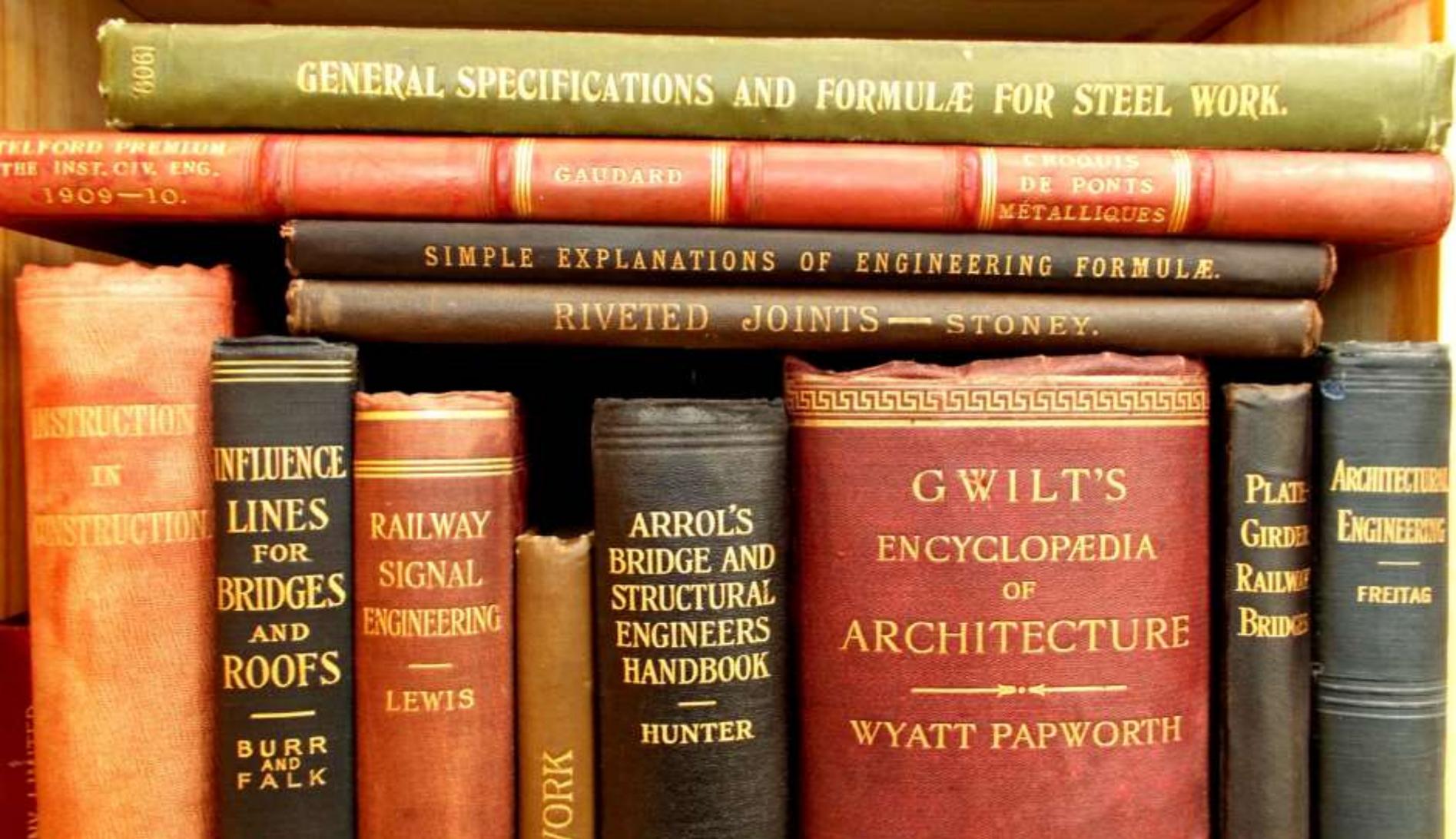
LEVAGE, G^DES ARCHES.



Goudard's 477th illustration of a metallic bridge which is readily recognisable! [Hunter Archive]



**An Arrol drawing office at Dalmarnock Iron Works, Glasgow
in 1909 – part of Hunter’s team at work!** [Arrol *Bridges* 1909, 35]



A selection of Hunter's surviving books [mainly pre-1910] including Prof Adams' 'Strains in Ironwork' here alongside his own '*ARROL'S HANDBOOK*' masterpiece! [Hunter Archive]

BRIDGES,
STRUCTURAL STEEL WORK,
AND
MECHANICAL ENGINEERING PRODUCTION

Arrol publications
of 1909 prepared
largely under
Hunter's direction



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GLASGOW, 1909.

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CHIEF ENGINEER TO THE COMPANY

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1920

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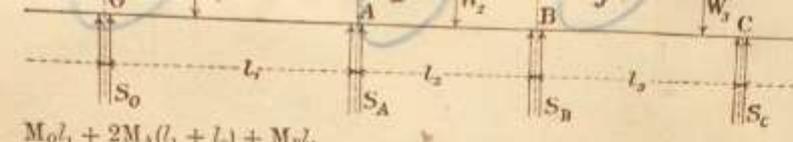
Hunter's most influential publication. Holograph corrected draft of 2nd ed. of his 1928 *Handbook* which was a standard text book for the next 50 years. Dr Jim Shipway [Consultant & Arrol employee 1948-53] wrote of this book in 2004 as "packed with useful information. I used a copy for most of my working life and had to have it rebound from long use"

[Hunter Archive/2004 Memoir]

$$Z_1 + \frac{A_2(Z_2 - Z_1)}{l_2} \left\{ \frac{2(2-n_2)}{2} \right\}$$

are known and the supported, the actual formula:
 $\frac{M_B - M_A}{L}$
 end where the support amount at the other end. are the same ^{rate} as for the free

page 33 in 1st ed
 e reused in new b



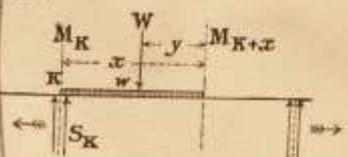
$$M_0 l_1 + 2M_A(l_1 + l_2) + M_B l_3$$

$$= -\sum W l_1^2 (n_1 - n_1^3) - \sum W x^2 (2n_2 - 3n_2^2 + n_2^3) + 6EI \left\{ \frac{h_B - h_A}{l_2} - \frac{h_A - h_0}{l_1} \right\}$$

Similarly obtain any number of equations. See Note, Case (a).
 The last term in all the above equations refers only to the effect of a vertical movement of the points of support, and can generally be rejected.¹

Shearing Force.—The shearing force at any section may be obtained thus:—

- Let M_K = bending moment at any section
- S_K = shear at the section
- M_{K+x} = bending moment at any other section
- W and w = intervening external forces



Then $M_{K+x} = M_K + S_K x - W y - \frac{w x^2}{2}$

That is $S_K = \frac{1}{x} \left(M_{K+x} - M_K + W y - \frac{w x^2}{2} \right)$

In the examples which follow the above equations have been applied, and it is assumed that no vertical movement occurs at the supports.

¹ For a complete mathematical investigation of the theorem of three moments, and its practical application, see *Modern Framed Structures*, by Johnson, Bryan, and Turneaure (Wiley and Sons, New York).

$n_1 / n_2 / n_3 /$

Note to printer
 For corrections see blue print on adjoining page.

Typical page from draft of Hunter's *Manual*, 1928 [Hunter Archive]
 By then he had 'a vast store of engineering knowledge which was always fully at his command' [Prof. Moncur, *TASCE* (1933) 99, 1474]

the

The Sir William Arrol Collection

A Guide to the International Material held in the National Monuments Record of Scotland

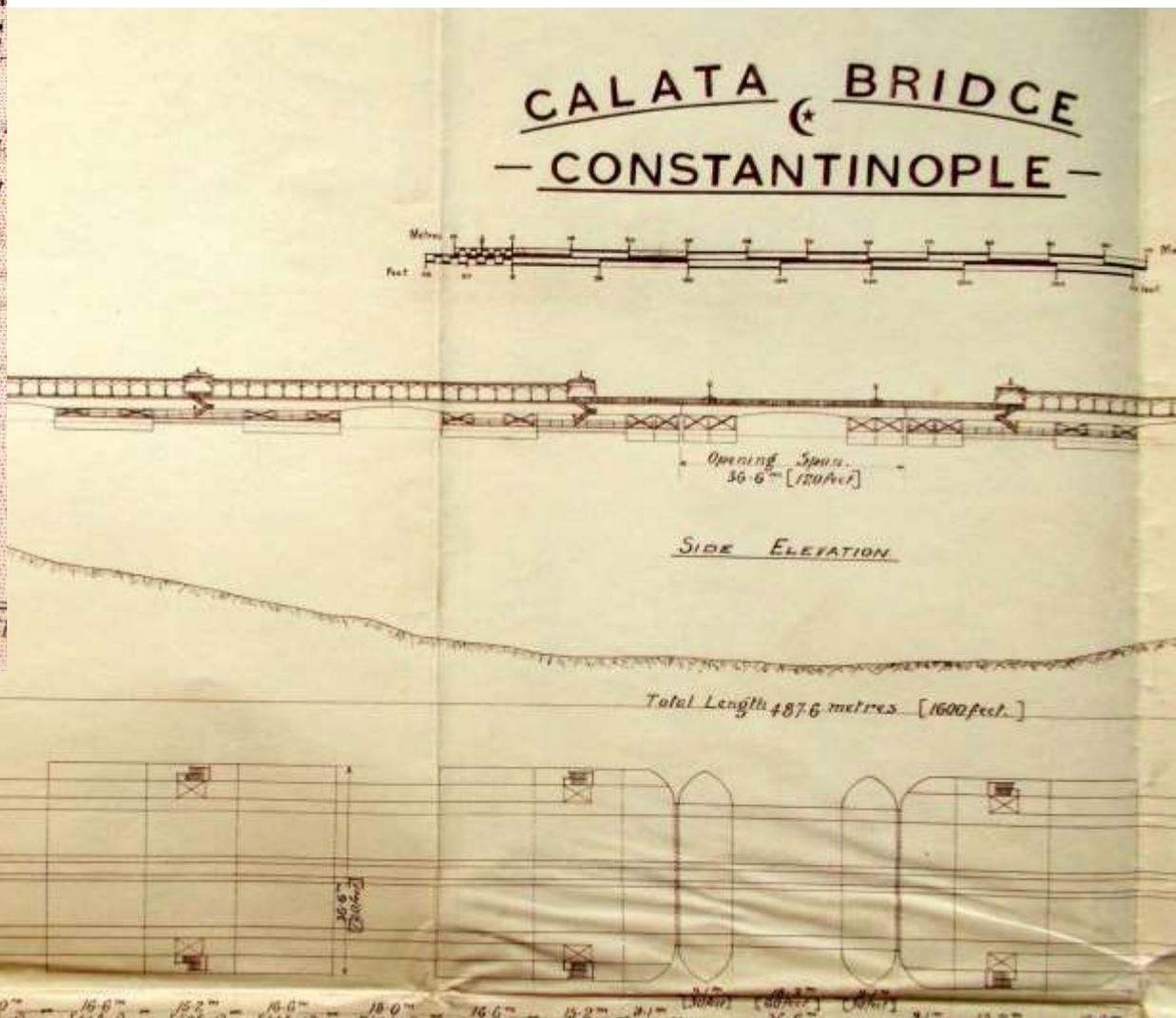


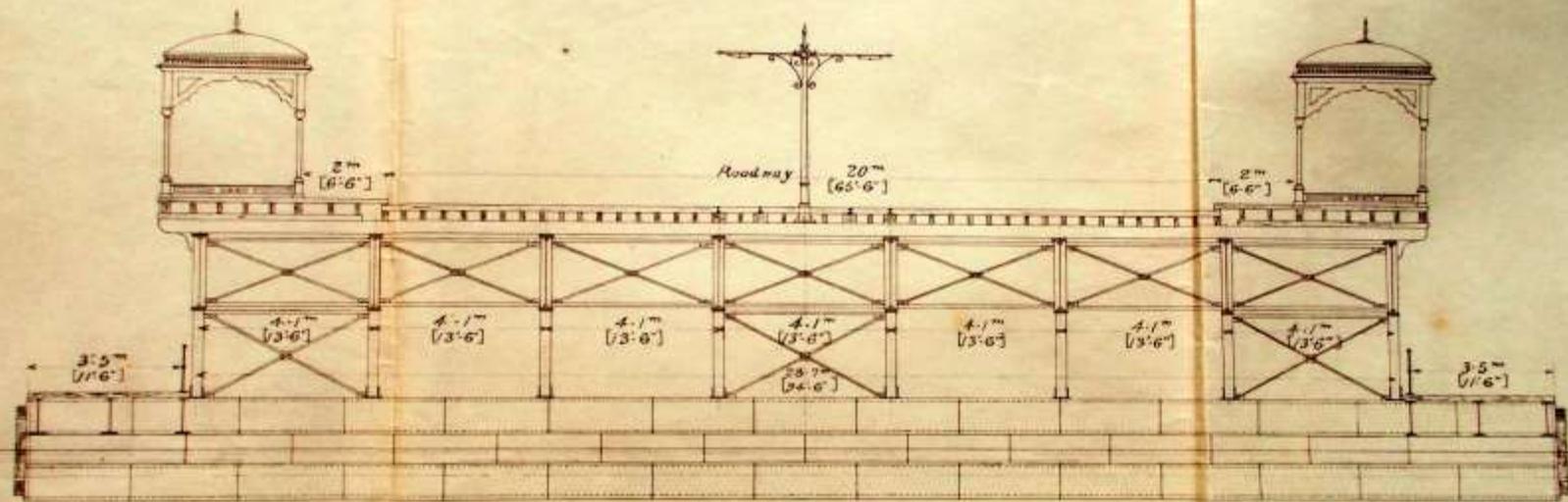
Dalmarnock Works closed in 1987. A large amount of material mainly photographs was salvaged by and donated to RCAHMS who published inventories of it in 1998 and 2000.

This invaluable *International Guide* and other sources indicate **more than 200 major projects on five continents**, from which the following examples can only give the broadest indication of the type and large scale of work **for which Hunter was responsible as Arrol's *Chief Engineer***



Arrol proposal of 1909 for a 1600 ft long floating steel bridge at Galata Istanbul - unexecuted [Hunter Archive]





CROSS SECTION OF BRIDGE.

Galata Bridge proposal Istanbul 1909 – cross-section showing 9 ft deep steel pontoons [Hunter Archive]

HOOGHLY BRIDGE.

A postcard of Arrol's span of Hooghly Bridge sent to Hunter from Calcutta in 1909 by "Willie" (his brother or a colleague?) congratulating him on "his wonderful Sunderland job." [Hunter Archive]



**Blackfriars Bridge 1869, T. Cubitt Engineer – 5 arches,
max. 185 ft. Widened 1907-10 from 75 ft - 105 ft west
under Hunter's overall direction** [www]





30-1-09

Blackfriars Bridge Widening 1907-10

[RCAHMS 2000, p.1.33]

Transporter Bridge, Middlesbrough



Middlesbrough Transporter Bridge erected by Cleveland Bridge and Engineering Ltd & Arrol's 1910-11 [old postcards]



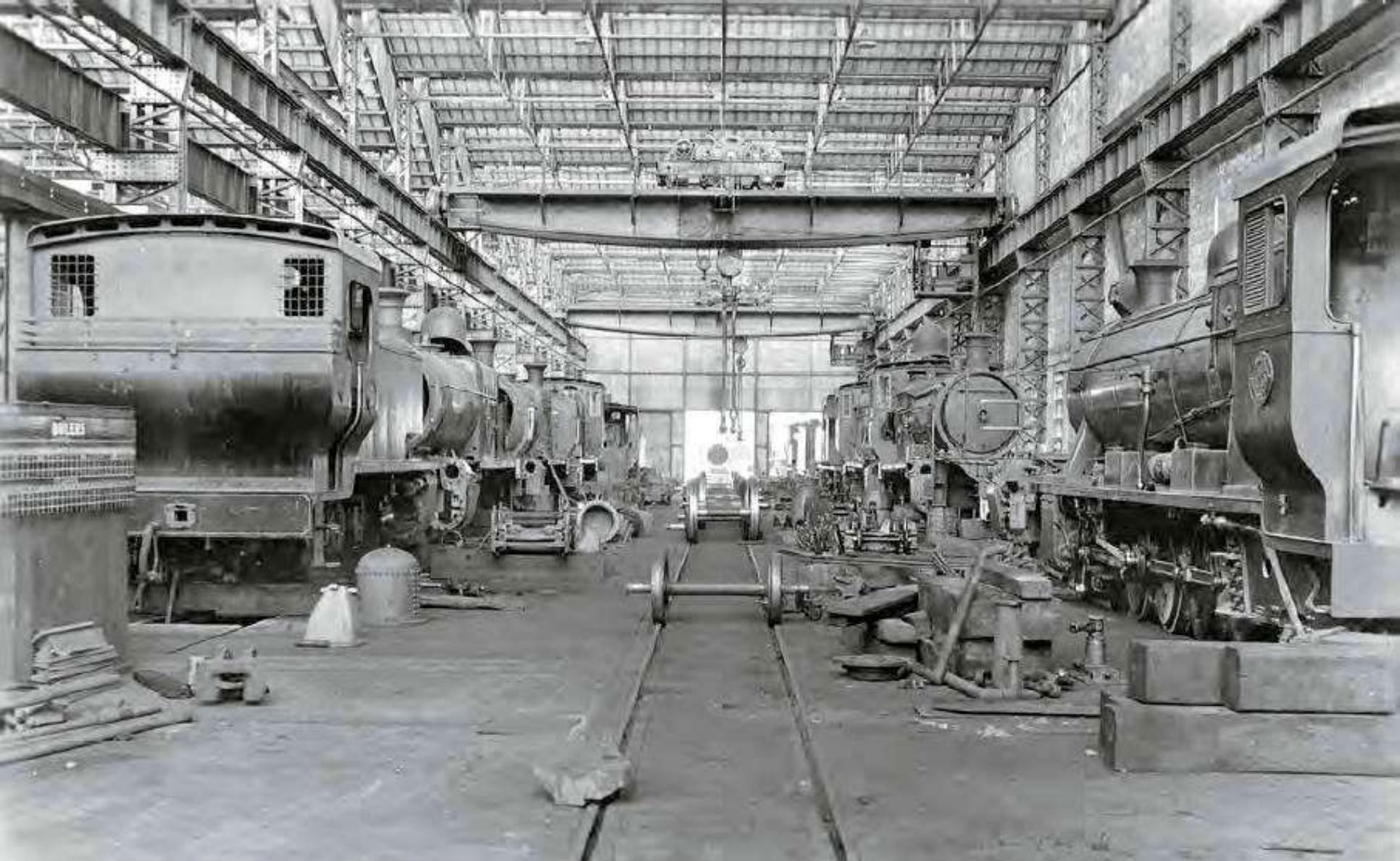
Albert Docks Swing Bridge – Dalmarnock Iron Works 1919
Many other swing bridges erected

[RCAHMS 2000, pl. 85]



**Southwark Bridge - Steelwork
fabricated and erected under
Hunter's general direction**

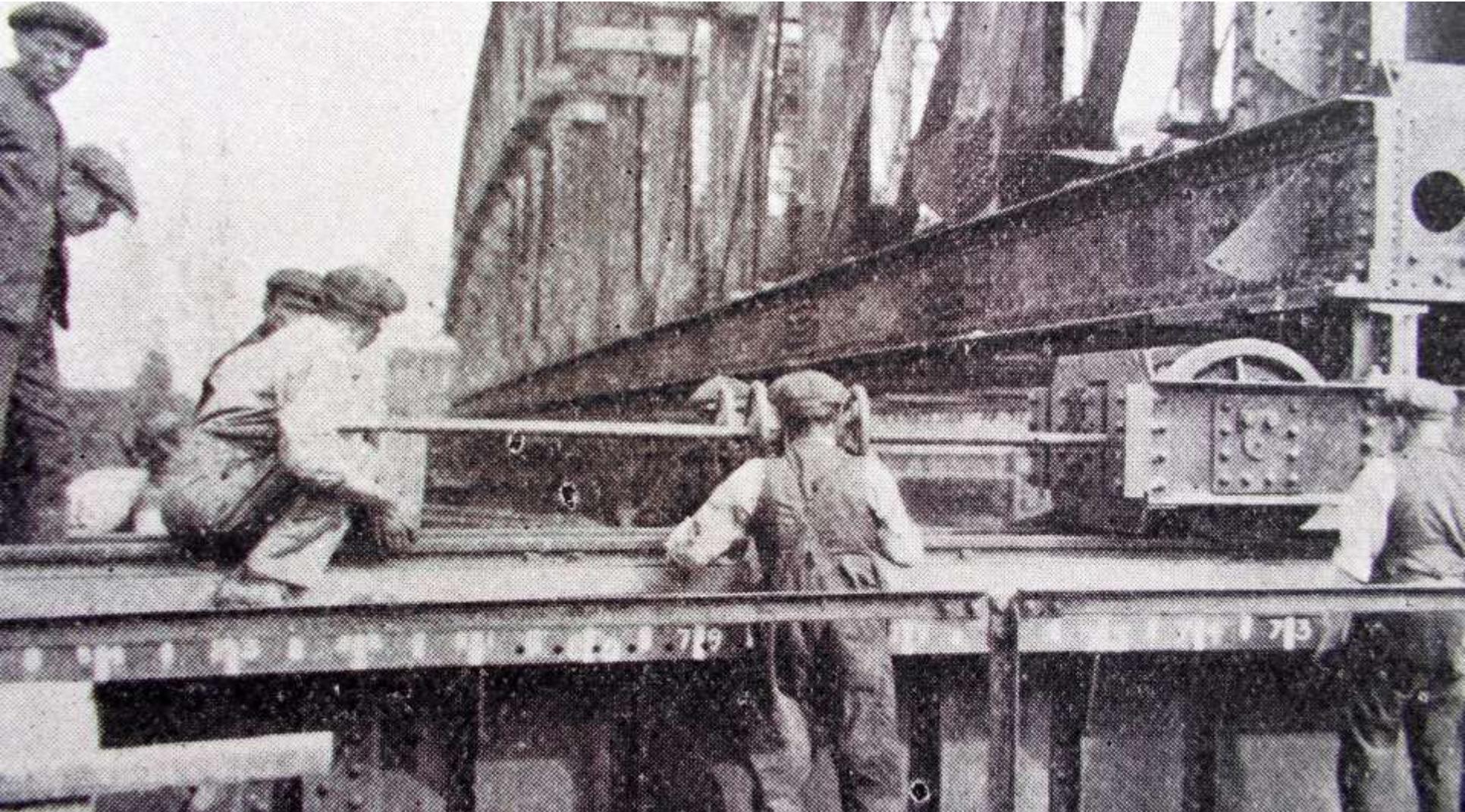
[[www & RCAHMS Guide](http://www.rcahms.org.uk) 2000, pl. 34]



Enugu Railway Workshops Nigeria, 1922 [RCAHMS *Guide* 2000, pl. 67]
More extensive such workshops at Hutt Valley, New Zealand 1928
[RCAHMS *Guide* 2000, pl. 65]

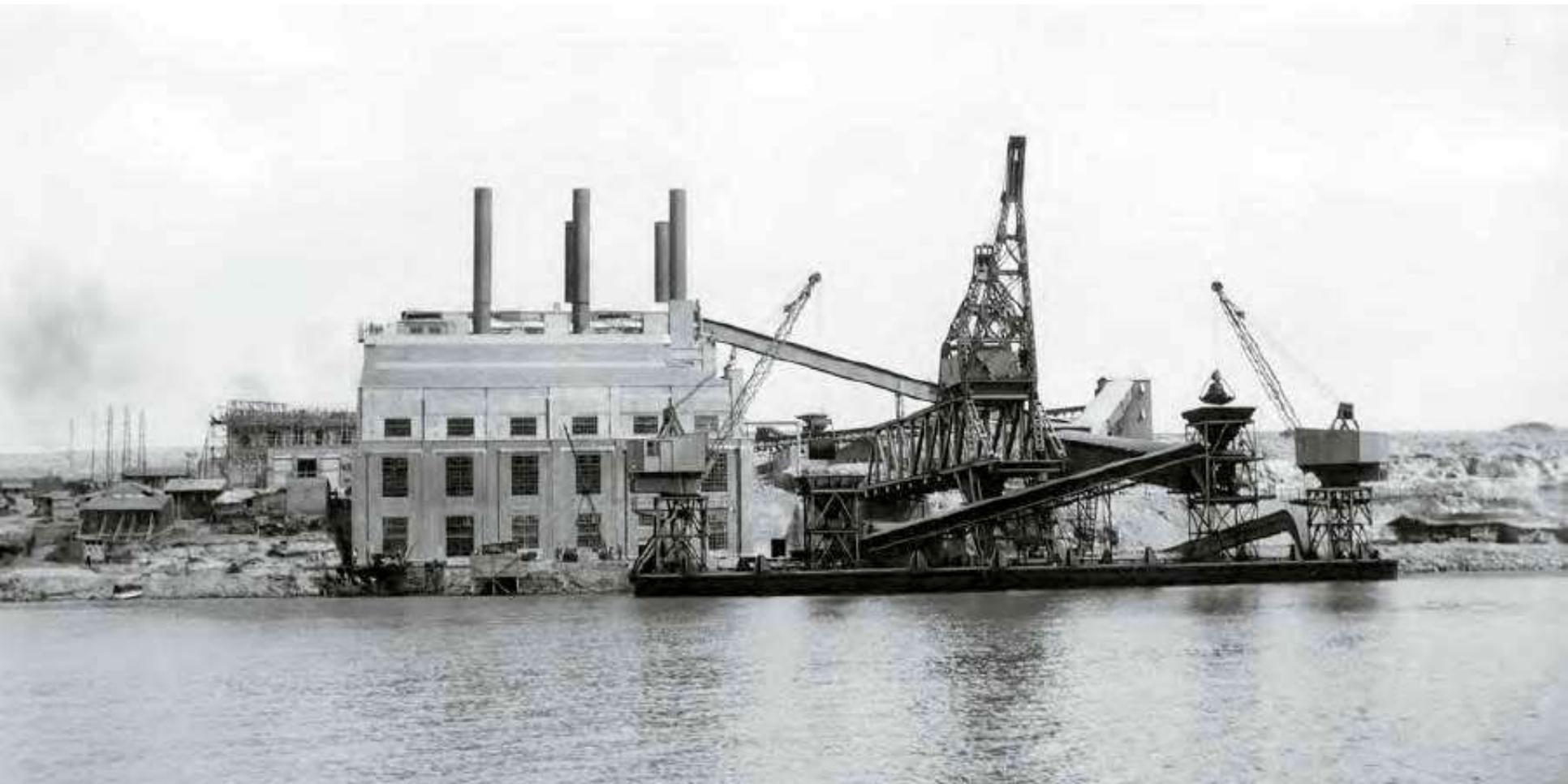


Waterloo Temporary Bridge 1924 - Rolling 280 ft long 600-ton navigation span girder into position. Temporary works design and erection under Hunter's direction [Hunter Archive]



Waterloo Temporary Bridge 1924 - Rolling 280 ft long 600-ton navigation span girder into position

[Hunter 1929 p.25. Hunter Archive]



Athens Power Station 1927 [RCAHMS *Guide* 2000, pl. 58]



Benue Bridge [road/rail], Makurdi, Nigeria - 2584 ft long - nearing completion c.1930. Still in use, recently painted

[RCAHMS *Guide* 2000 pl. 28]



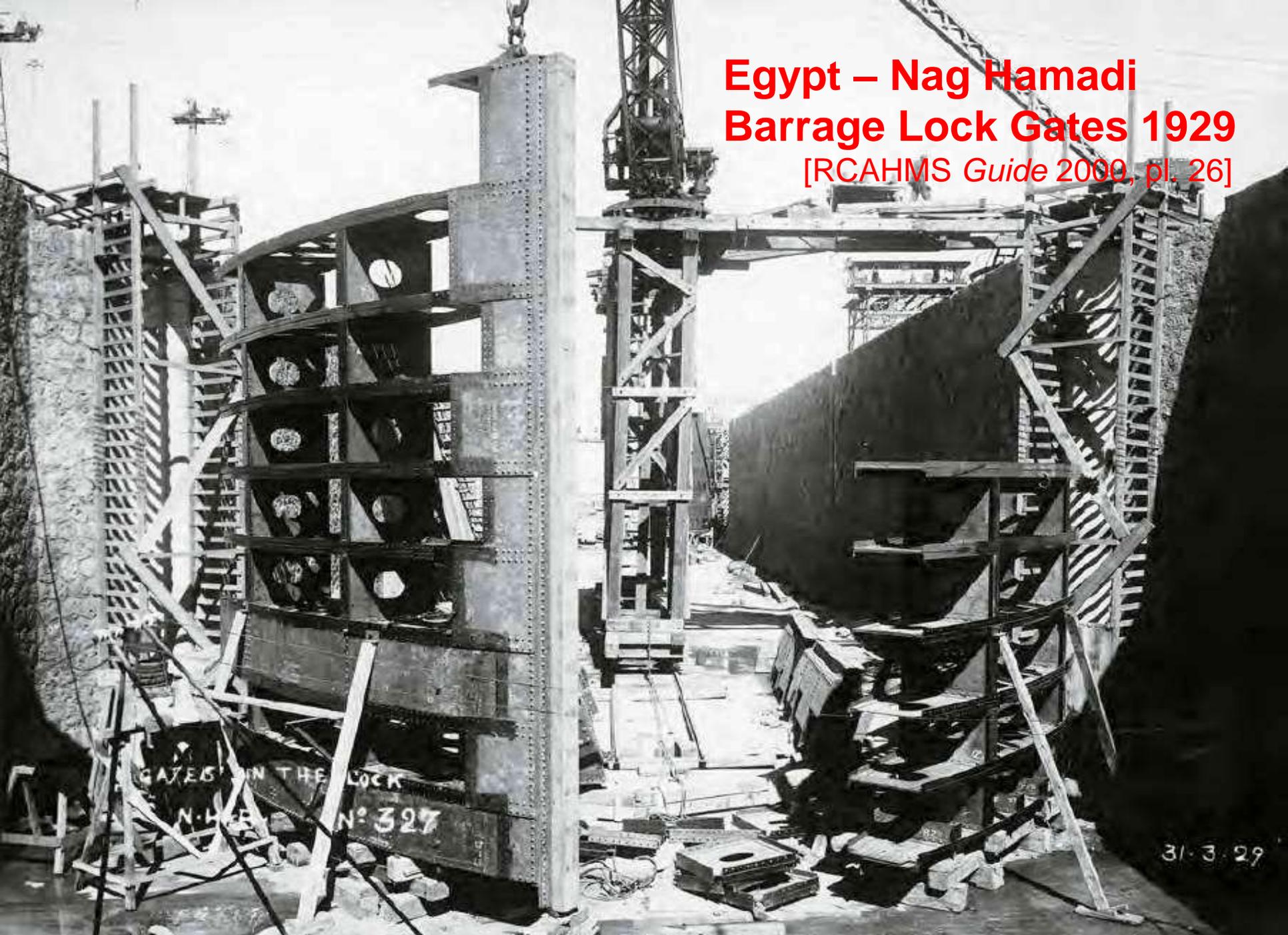
Sunderland Bridge, Wearmouth, 1796 – 236 ft span, then the world’s longest - replaced by Robt Stephenson 1858 [mug c.1810]



Sunderland Bridge in 1928 being over- spanned by 375 ft, 3-pin arch because of land constraints – “erection a very clever piece of work” PPI StructE [Hunter 1929, 31; RCAHMS 2000, pl. 66]

**Egypt – Nag Hamadi
Barrage Lock Gates 1929**

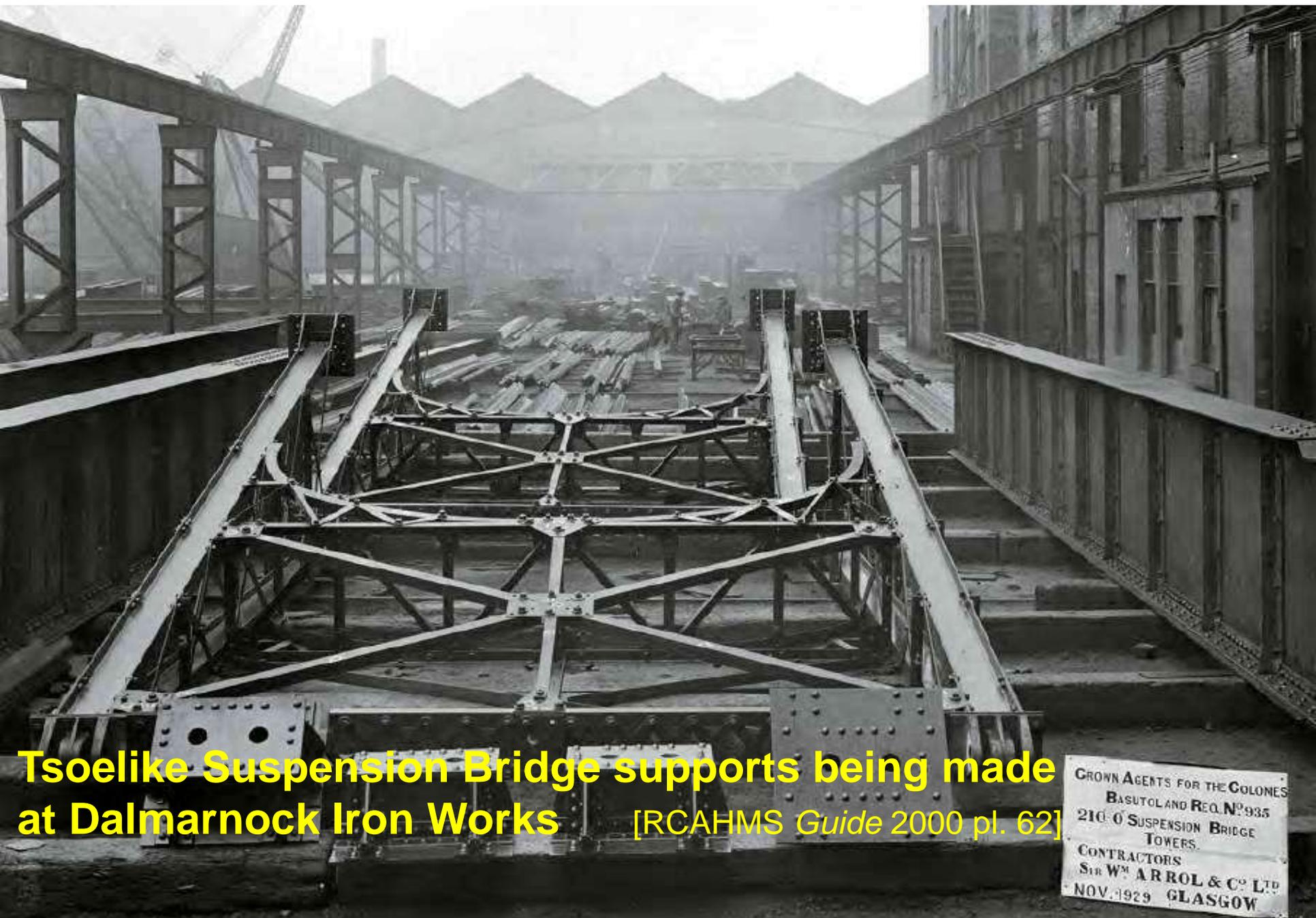
[RCAHMS *Guide* 2000, pl. 26]





Tsoelike Suspension Bridge, Lesotho, Basutoland, 1930

[RCAHMS *Guide* 2000 pl. 63]



Tsoelike Suspension Bridge supports being made at Dalmarnock Iron Works [RCAHMS Guide 2000 pl. 62]

CROWN AGENTS FOR THE COLONIES
BASUTOLAND REQ. NO. 935
210' 0" SUSPENSION BRIDGE
TOWERS.
CONTRACTORS
SIR W. ARROL & CO. LTD.
NOV. 1929 GLASGOW



Masnedesund [road/rail] Bridge (top) connecting Falster and Zeeland, Denmark, under construction in 1934 a few months after Hunter's death

[RCAHMS *Guide* 2000, pl. 53]

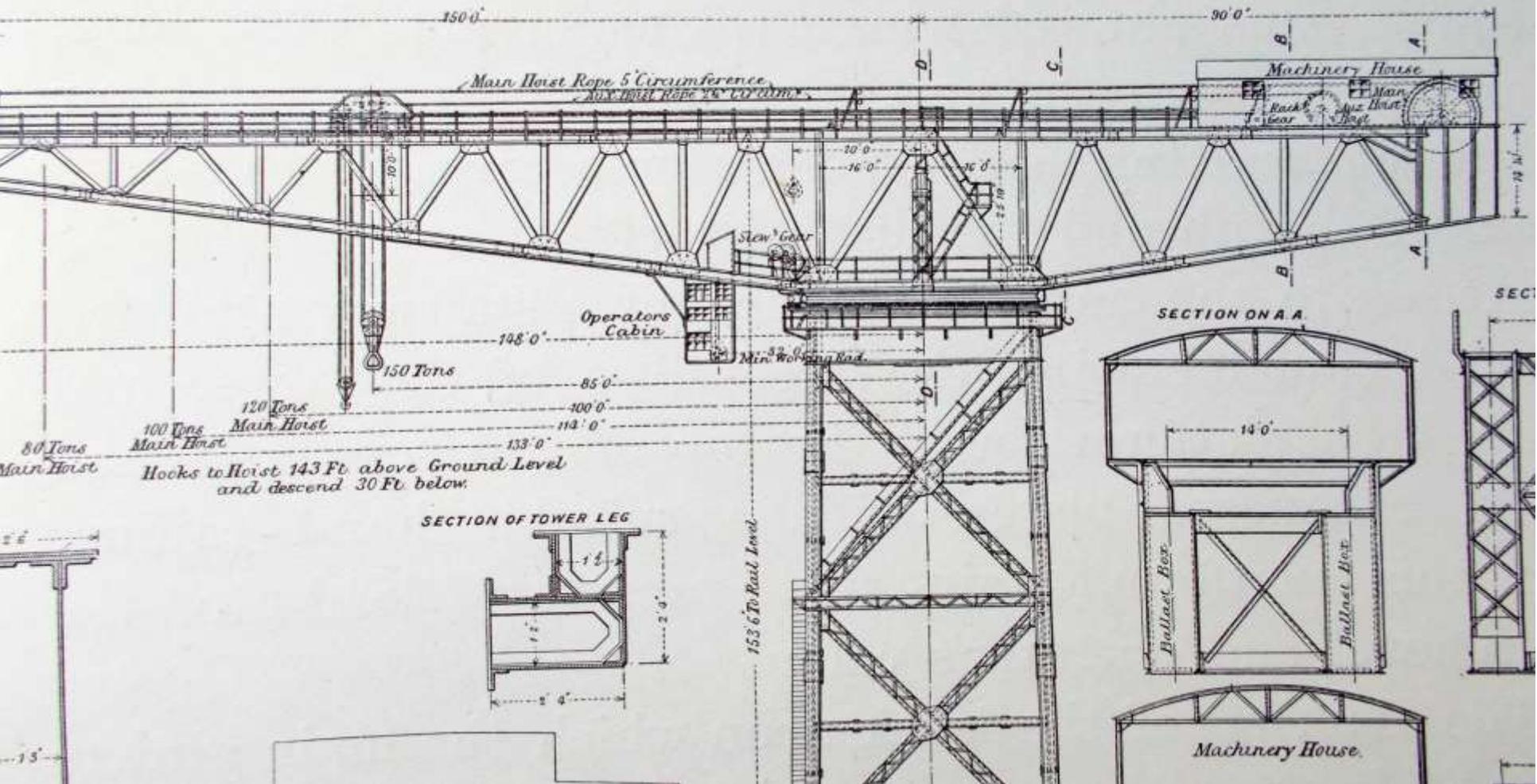


**Waterloo Bridge, London, under demolition in 1935.
Note Rennie's hollow spandrels of c.1813-16 to reduce weight and permit internal inspection but some foundations eventually proved inadequate**

[RCAHMS 2000, pl.35]

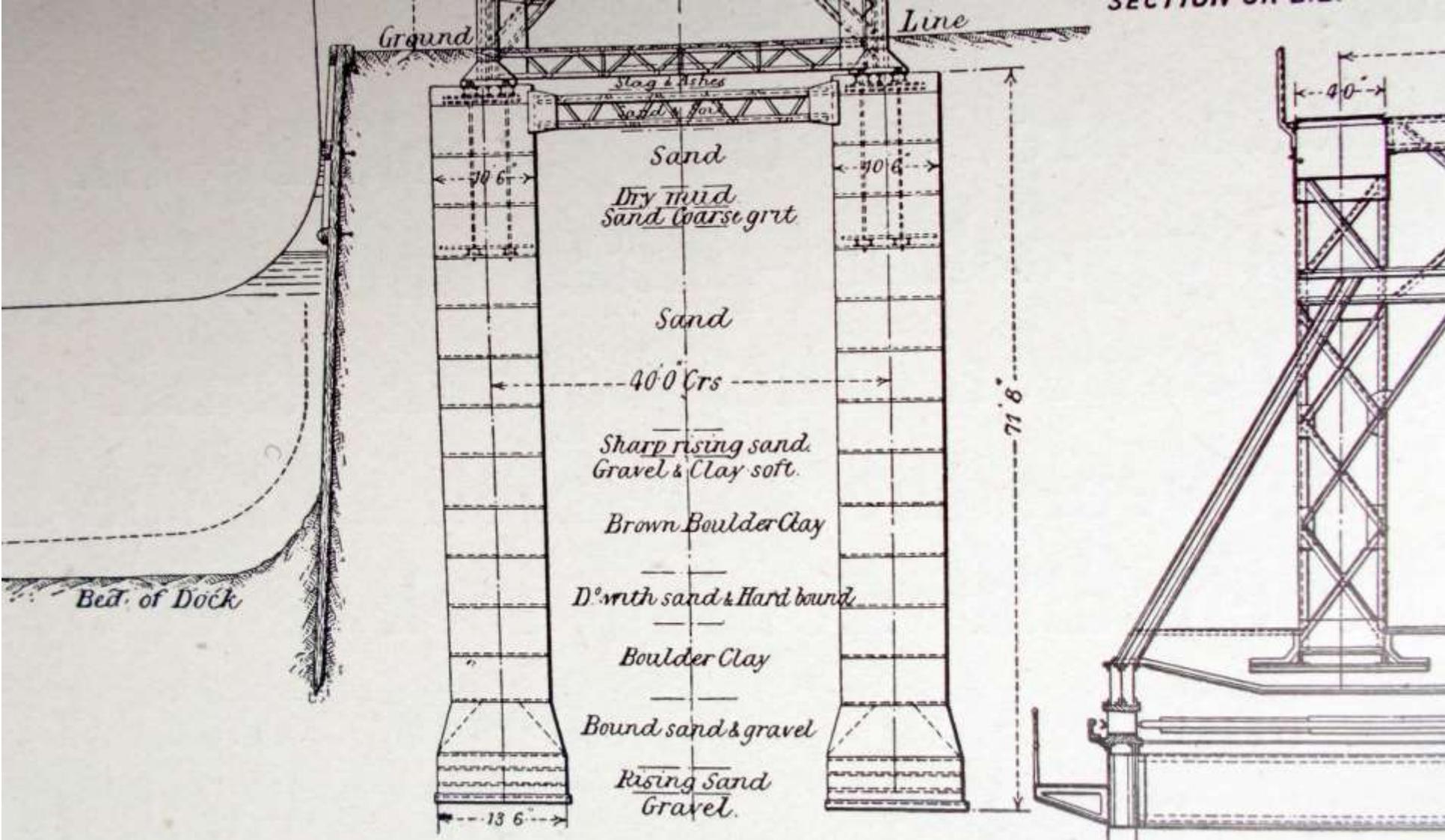


Waterloo Bridge (Rennie, 1817) and Arrol's temporary steel bridge of 1924 under demolition in 1935 after a decade in use [C. Cundall] In 1932 when presiding at a British Standards Committee meeting Hunter had a stroke which resulted in his resignation from the firm, but he continued as a consultant until his death in November 1933



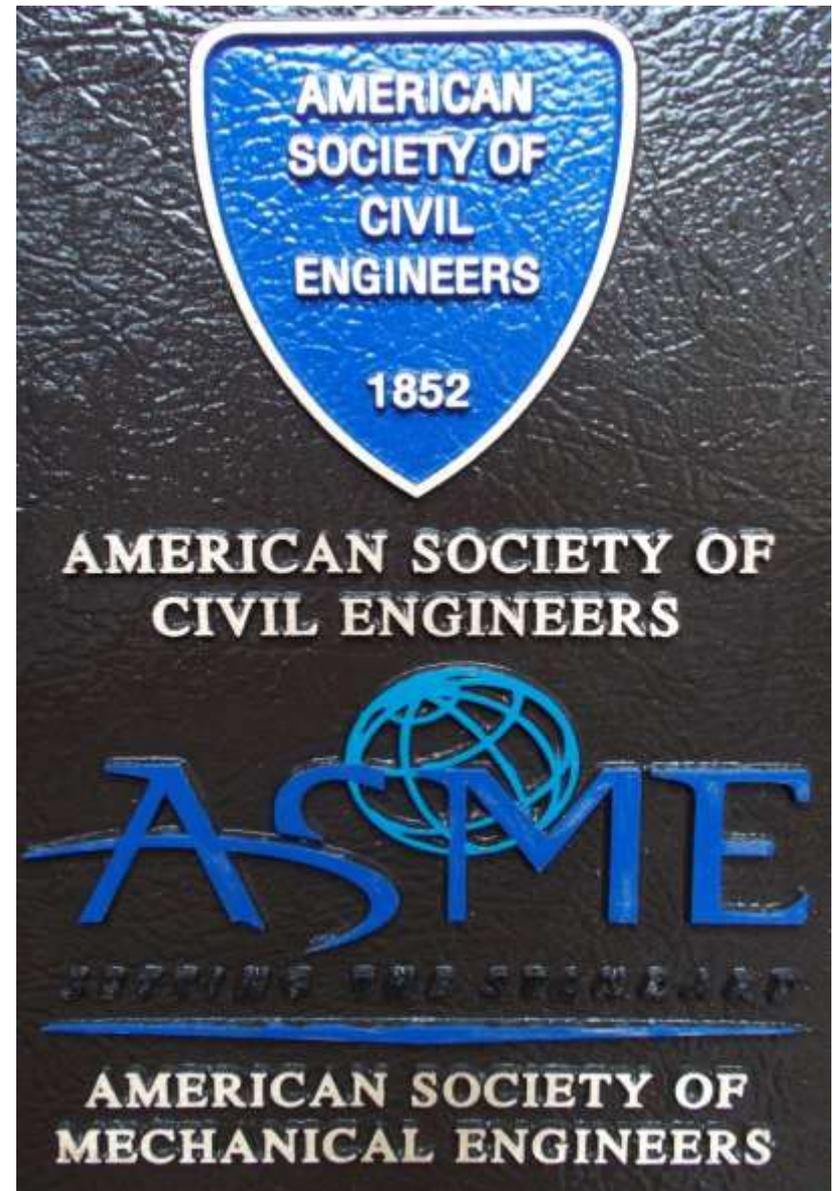
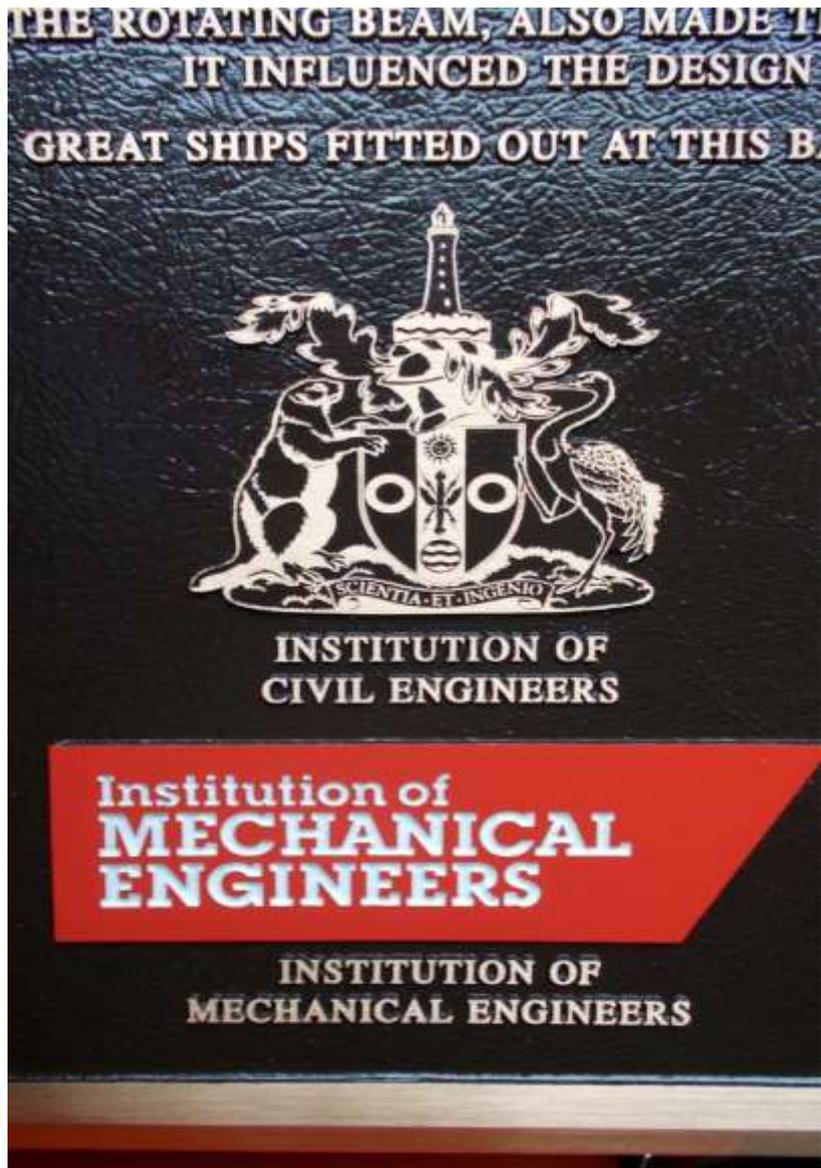
Titan Crane Clydebank – open lattice jib and tower – Jib rotates about tower top. Best reproduction from the original drawing

[Arrol *Bridges* 1909, 263]



Titan Crane Clydebank 1906-07. Note cylindrical foundations 71' 8" deep

[Arrol Bridges 1909, 263]



Designated 'INTERNATIONAL' by world engineering bodies representing >450,000 members on 20 August 2013

INTERNATIONAL HISTORIC
CIVIL AND MECHANICAL ENGINEERING LANDMARK

TITAN CRANE
JOHN BROWN'S SHIPYARD, CLYDEBANK

DESIGNED AND FABRICATED IN 1906-7 BY SIR WILLIAM ARROL & CO LTD.,
GLASGOW, AND MESSRS, STOTHERT AND PITT LTD., BATH,
FOR LIFTING LOADS OF UP TO 150 TONS

CHIEF ENGINEER: ADAM HUNTER (1869-1933, MICE, MASCE)

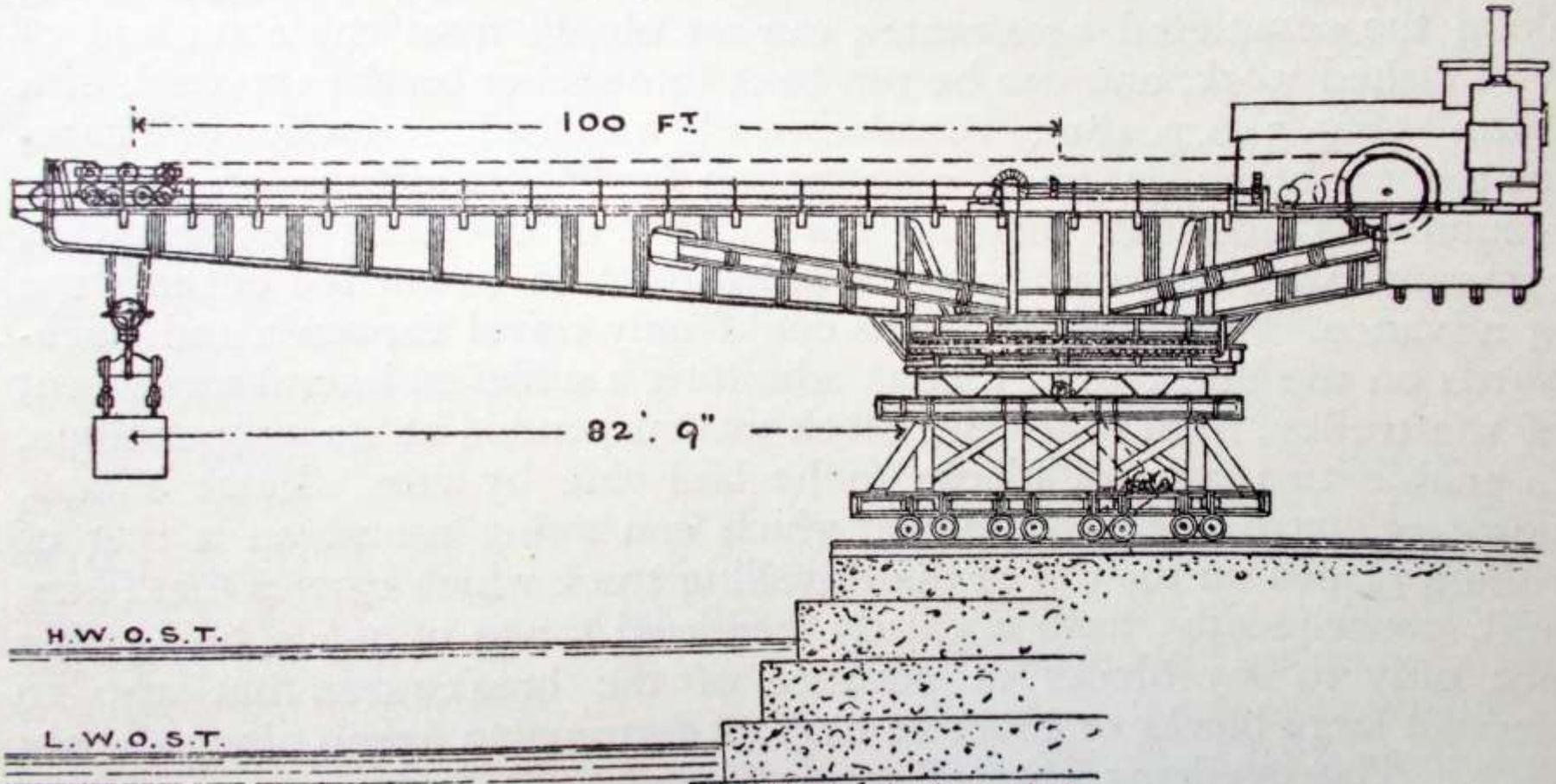
WHEN TESTED WITH A 160-TON LOAD AT A RADIUS OF 85 FT (26 M) AND COMMISSIONED, THIS 164 FT (50 M)
BEST OF THE HAMMERHEAD TYPE. ITS FIXED COUNTERWEIGHT AND ELECTRICALLY OPERATED HOISTS, ALL MC
ATING BEAM, ALSO MADE THIS CRANE FASTER AND MORE RESPONSIVE THAN ITS STEAM-POWERED PREDECESS
T INFLUENCED THE DESIGN OF CRANES OF THIS GENRE WORLDWIDE AND IS NOW THE EARLIEST SURVIVING
SHIPS FITTED OUT AT THIS BASIN INCLUDED AQUITANIA, HMS BARHAM, HMS HOOD, QUEEN MARY
QUEEN ELIZABETH 2 AND HMY BRITANNIA.
PRESENTED TO TITAN CLYDEBANK TRUST
BY



**Part of the Titan Crane International Landmark Plaque
to be presented and dedicated on site on 20 August 2013
Adam Hunter now recognised as the crane's designer**

REVOLVING TITAN.

Fig. 317.—Laying Blocks in Horizontal Courses.



Titan's were used on large dock works from c.1870 and were of this form and size at Peterhead Breakwater [1885-1950s] by c.1900. Basic principle similar to Clydebank Titan, but ran on rails and were steam operated

[Vernon-Harcourt *Civ. Eng.*, 1902, 486]



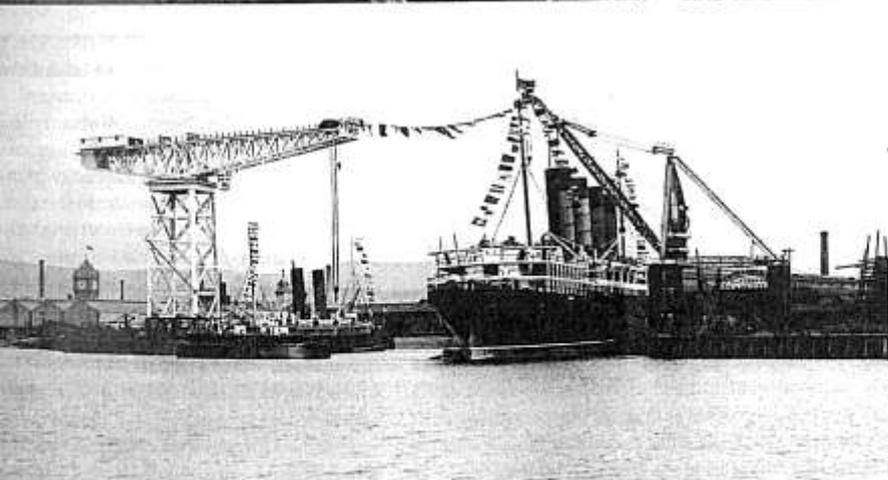
***Lusitania* well-advanced, as viewed from Titan cantilever in 1907.**

[below]

Note electrically operated derrick crane designed by Hunter in 1904 and used for fitting out *Lusitania*

[torpedoed by German U-boat 7 May 1915, 1198 lives lost]

[Johnstone, | *Ships for a Nation*]



Above
A magnificent view over the forward part of *Lusitania* from the 150 ton crane shows work well advanced.

Left
Lusitania dressed overall prior to running trials. The 150 ton cantilever crane has recently been commissioned.

ZEPPELIN RAIDER TWELVE MILES FROM LONDON.

DAILY SKETCH.

GUARANTEED DAILY NETT SALE MORE THAN 1,000,000 COPIES.

No. 1,925.

LONDON, TUESDAY, MAY 11, 1915.

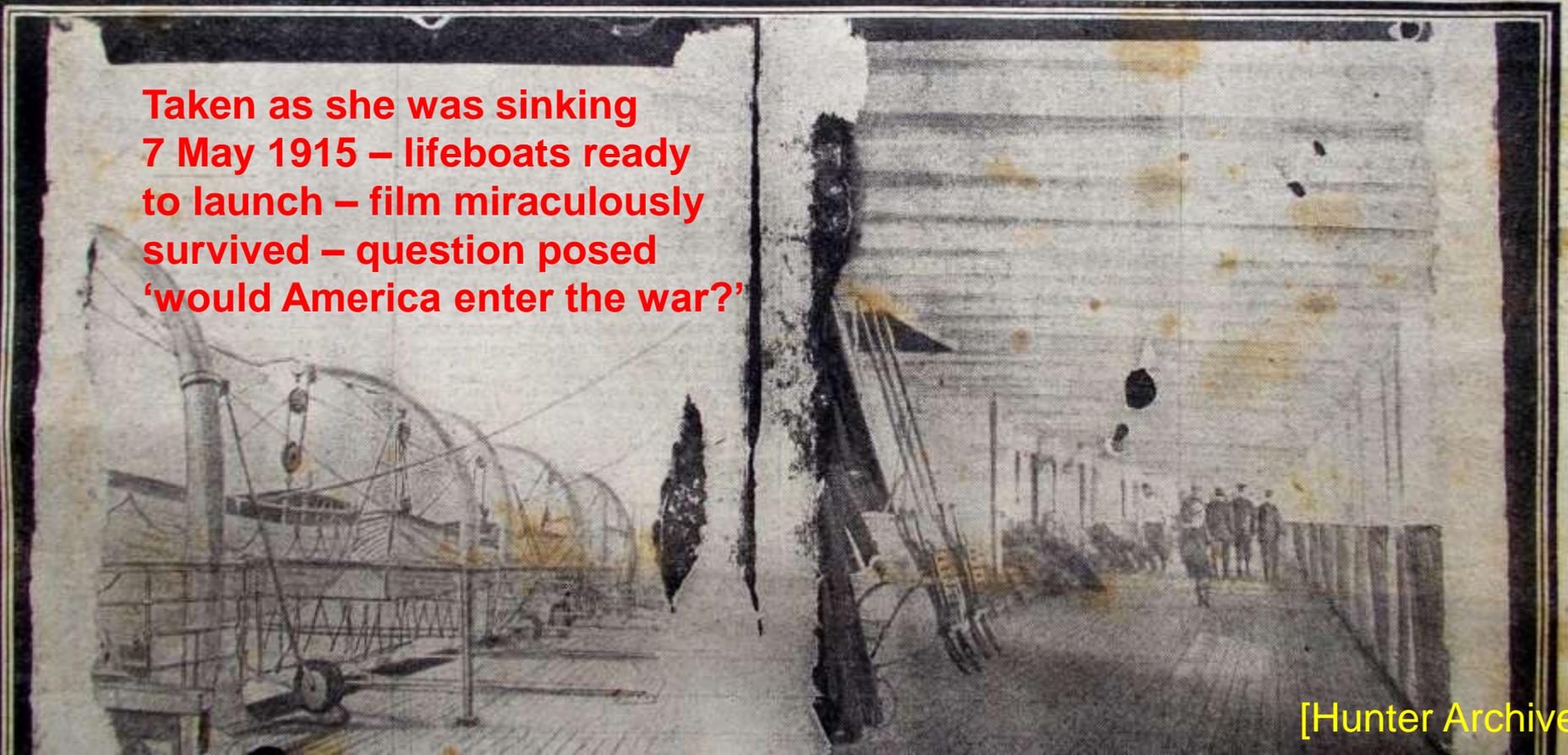
[Registered as a Newspaper.] ONE HALFPENNY.

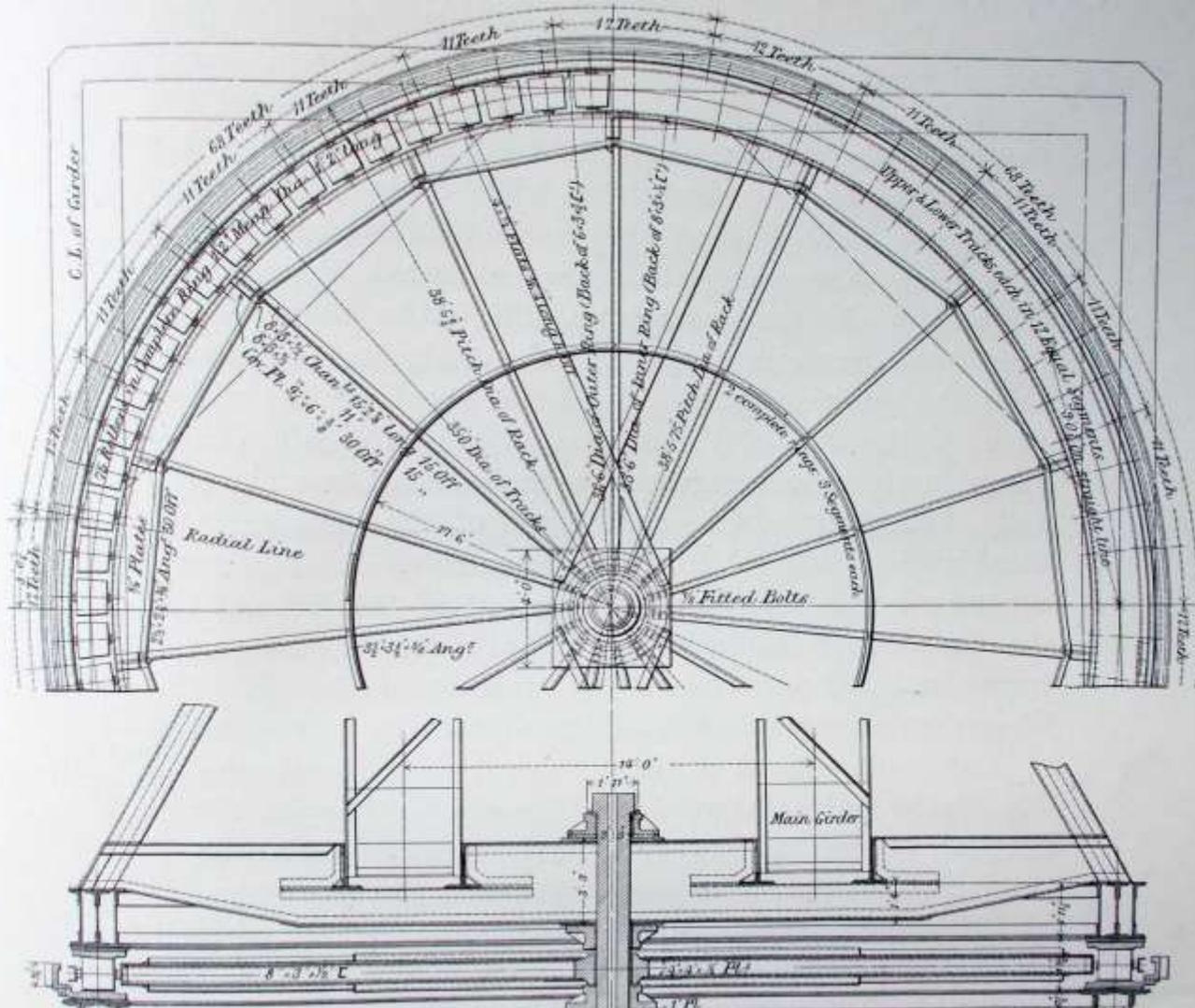


Last Photographs Of The Lusitania.



Taken as she was sinking
7 May 1915 – lifeboats ready
to launch – film miraculously
survived – question posed
'would America enter the war?'





Titan Crane Clydebank – Roller track with 75, 14 in dia. rollers [Arrol Bridges 1909, 265]

Comparable or similar crane projects

- 1904* Beardmore, Dalmuir, UK [Benrather] 150-ton, scrapped 1973
- c.1904* Barrow UK [Benrather made] bombed 1941 [7.2]
- c.1908 **Nagasaki** [Motherwell Bridge - Arrol type] 180-ton
- 1909 Wallsend, UK 150-ton, recently scrapped?
- 1910 Fairfield, Glasgow, UK 150-ton, scrapped 2007
- 1911+ Fairfield, Glasgow, UK 100-ton
- 1911+ Revel, **Russia** 150-ton & 250-ton
- 1911+ Rosyth Dockyard 250-ton
- 1912 Belfast, UK 200-ton
- 1912+ **Mitsubishi Dockyard, Nagasaki**, Japan 300-ton
- 1912 Portsmouth, UK 240-ton
- 1912 **Sasebo, Japan** 250-ton, exists
- 1913+ **Bordeaux, France** 250-ton; **Dunkerque, France** 100-ton
- 1913+ **Hong Kong** 100-ton
- 1915 Woolwich, UK 200-ton

- 1917 Rosyth, UK 100-ton, scrapped 2005
- 1917 Greenock, UK 150-ton, exists
- 1919 North British Engine Works, Whiteinch, Glasgow UK 150-ton?, exists
- 1919* **League Island, Philadelphia**, USA 350-ton, scrapped 1996
- 1929 **Calcutta**, India 250-ton, exists
- 1931 Finnieston, Stobcross, Glasgow, UK 175-ton, exists
- 1931 Walker, Newcastle-upon-Tyne, UK 250-ton
- 1933* **Puget Sound, Bremerton**, USA 250 or 300-ton, exists but not now used?
- 1935* **Pearl Harbor** 200-ton, scrapped 1980
- 1941* **Brooklyn**, USA 350-ton, scrapped 1965
- 1941* **Portsmouth, Virginia**, USA 300-ton, disused
- c.1942 Barrow, UK 150-ton? Replacement for c.1904 Benrather crane, scrapped 2011
- 1951 **Sydney, Australia** 250-ton, disused
- 1958 Belfast Harbour, Stormont Quay, 200-ton, scrapped?

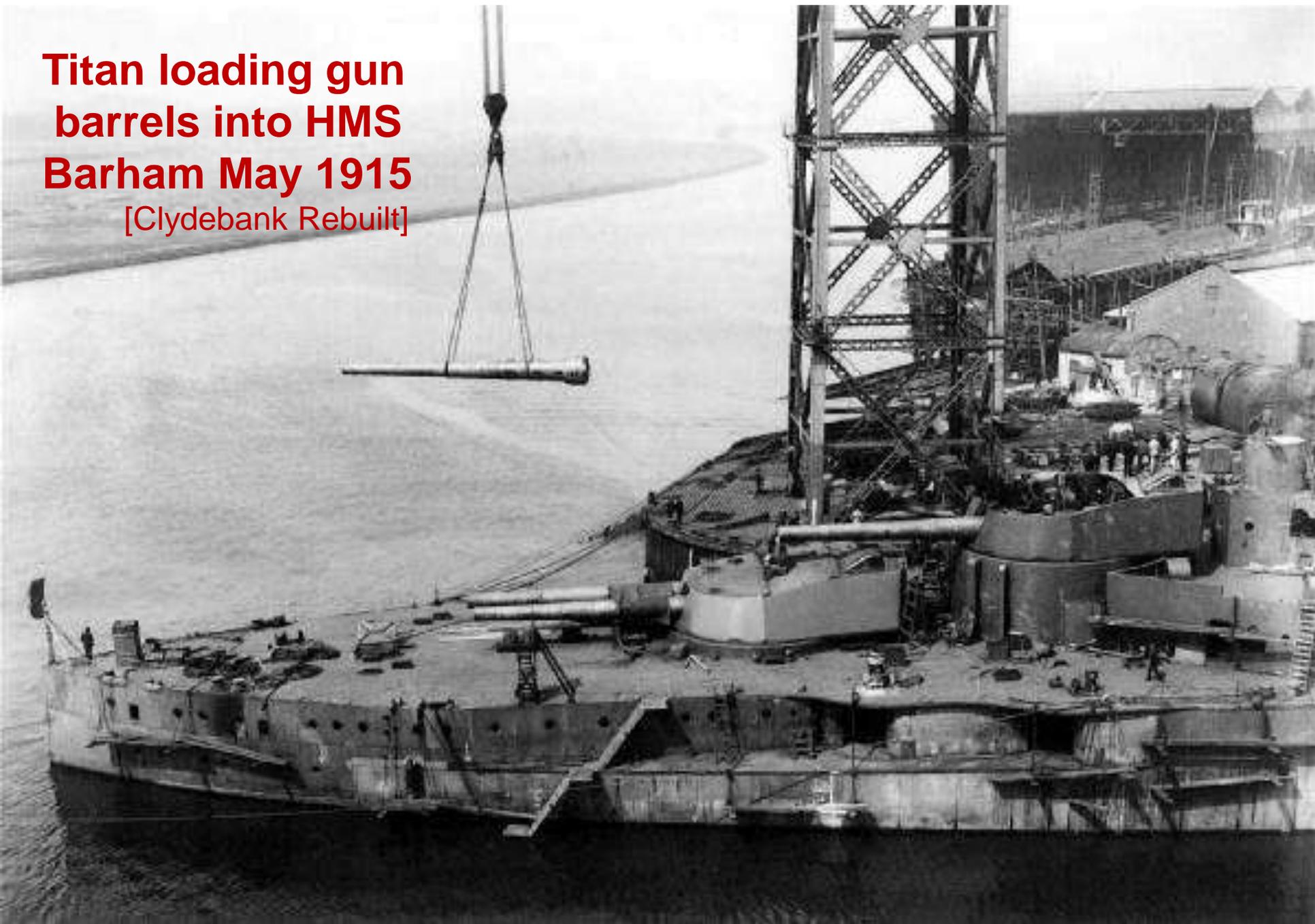
RE DE BREST. — L'Arsenal, vue générale
neral view of the Dock-yard



French variant design crane at Brest Arsenal c.1913

[Hunter Archive]

**Titan loading gun
barrels into HMS
Barham May 1915**
[Clydebank Rebuilt]





USA development. Giant Cantilever Crane, Portsmouth, Virginia, 300-ton, 1941 – now disused [www 28.6.13]

reprinted from
The Engineer,
May 1st, 1931.

A 250 - TON ELECTRIC HAMMERHEAD CRANE

designed, constructed & erected by

The largest of its type
in the world.—1931.



SIR WILLIAM ARROL & COMPANY, LTD.
OF GLASGOW & LONDON

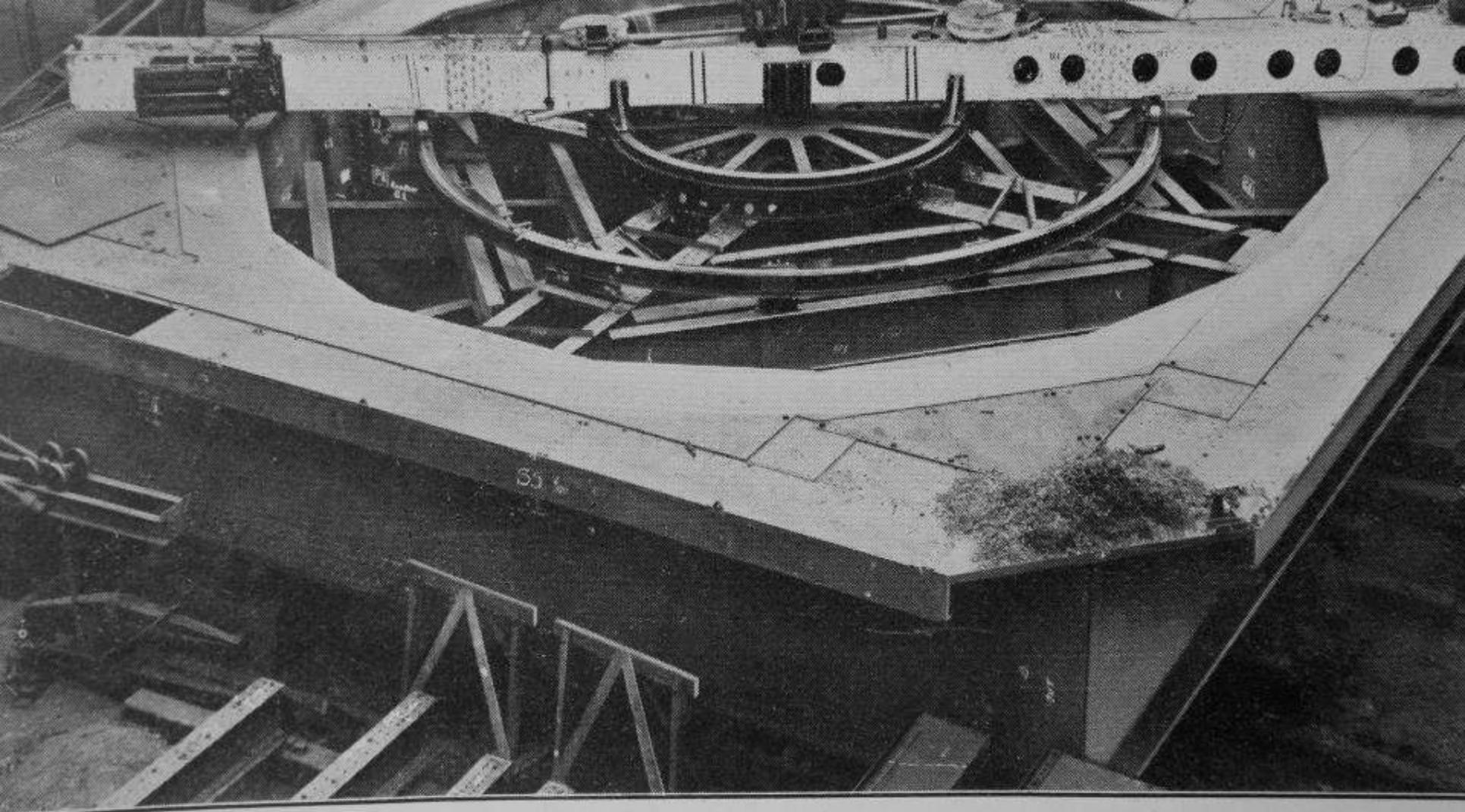
**Vickers Armstrong, Walker Shipyard,
Newcastle-upon-Tyne, Crane - 250-ton, 1931
'largest of its type in the world'**

[Arrol Brochure – Hunter Archive]



Walker Shipyard Crane, Newcastle-upon-Tyne under 300-ton test load in 1931

[Arrol Brochure – Hunter Archive]



Special Revolving Planing Machine for the Roller Paths.

Walker Shipyard Crane, 1931 - Planing roller paths
[Arrol brochure – Hunter Archive]



Walker Shipyard Crane 1931 – mode of erection by a derrick on a stand and balanced cantilever construction

[Arrol brochure – Hunter Archive]

Sydney Morning Herald

FIRST PUBLISHED 1831 NO. 54,749 \$3 (inc GST)

If you can't stand the height, stay out of the restaurant



Giant Crane, Sydney, Australia, 1951 – 250-ton, disused - the penultimate Titan? [Belfast, 1958] [Sydney Morning Herald 29 March 2013]



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sioned architect, sculptor and painter Brett-Livingstone Strong to work on the proposal.

“Our plan is to develop this crane from being a dormant, inefficient and potentially hazardous eyesore ... into a viable, income-producing landmark,”

Dominating the skyline: the crane and, left, an artist's impression of how the venue might look.

Photo: Mick Tsikas

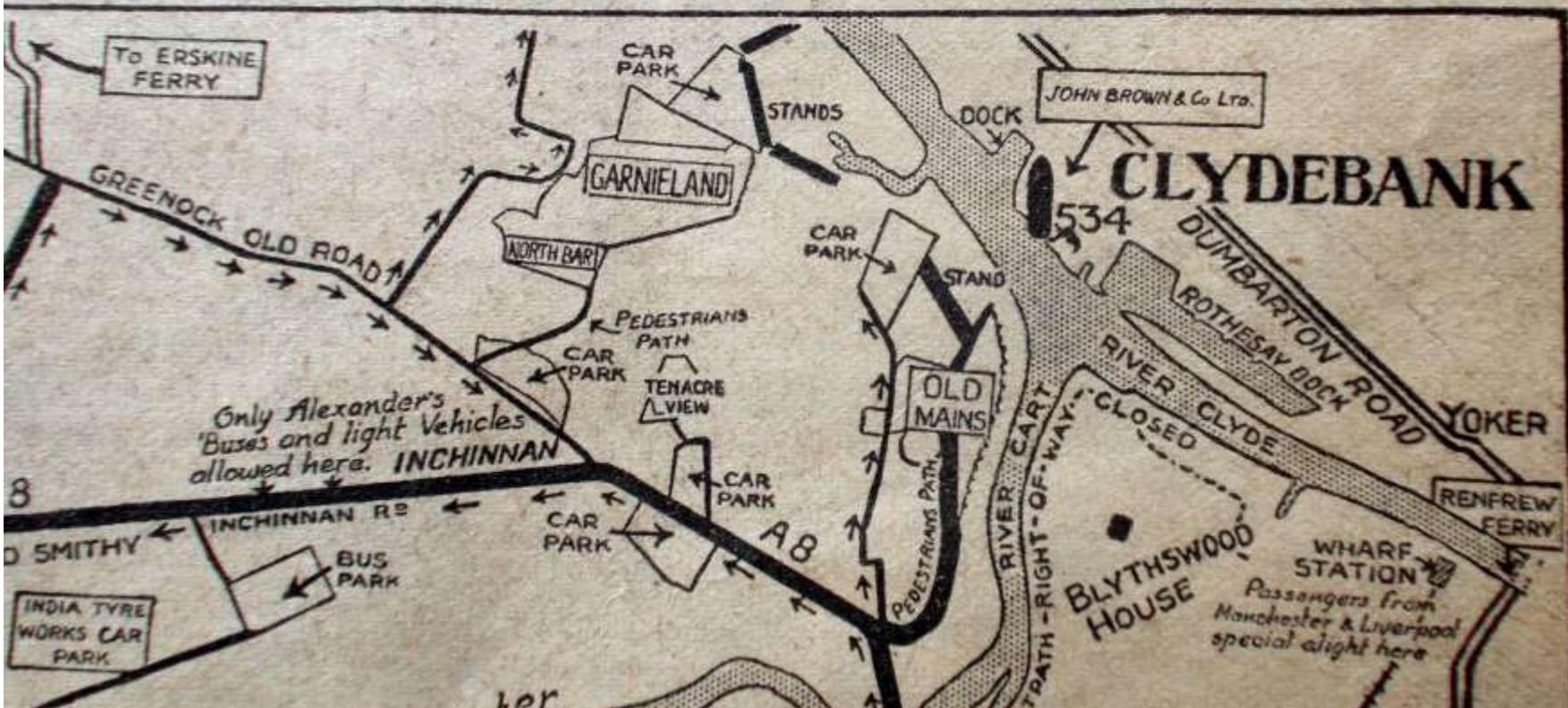
The crane was opened in 1951 and, with its thick beam structure and substantial counterweight section, has dominated the Garden Island skyline and can be seen from a great distance.

It was the largest such crane in the southern hemisphere and one of only 15 in the world.

Sydney Crane 1951 – Conservation proposal for viewing platform/restaurant

[*Sydney Morning Herald* 29 March 2013]

TO CLYDEBANK

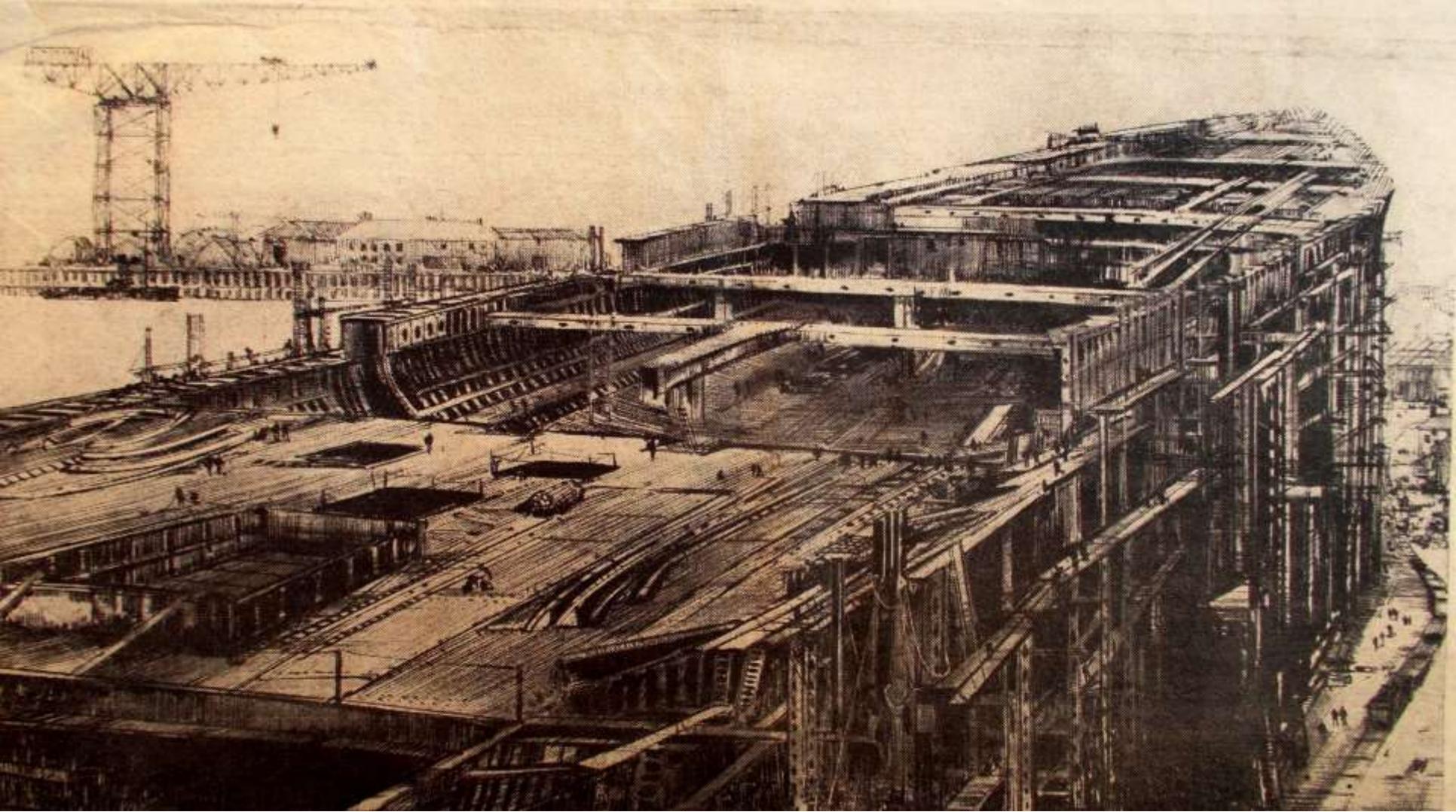


Arrangements for the launch of "534" at Clydebank
- A red letter day! [Daily Record Suppl. 26 September 1934]



**“534” after having been named *Queen Mary* in service
c.1936 - now permanently berthed at Long Beach,
California**

[cont. post card]



“534” at Clydebank c.1933 – with its 2 acres of top surface and 10,000,000 rivets [on completion!] – Note crane and size of men (right)

[Hunter Archive - *Daily Record Suppl.* 26 Sept 1934]

An exceptional characteristic of Hunter was his **masterly direction of structural steelwork applications for Arrol's** from 1906-32. His innate engineering aptitude and maximization of proven rather than new techniques and structural forms enabled him to maintain the firm's success and excellence **in achieving work of special difficulty and great magnitude**

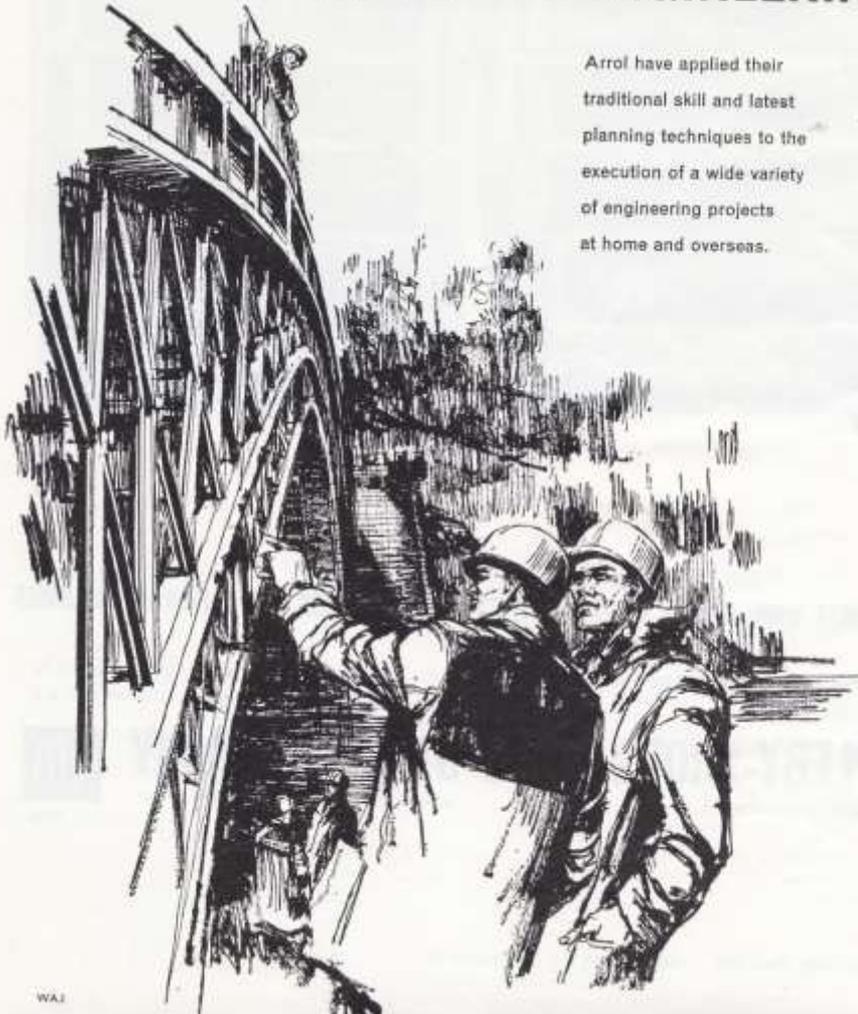
His expertise and achievement, not least his input in erecting notable bridges, established him at **the top of his profession**, and earned him my accolade of '*Engineer Extraordinaire*'

Arrol opinions. Jim Shipway, engineering historian, wrote of Hunter as "**brilliant**" and apart from Sir William Arrol "**probably the most able member of the firm's staff**". Harry Cunningham, Arrol's chairman from 1935, when reviewing the firm's progress to 1950 wrote that "**from 1909 the most important member of staff was Mr Adam Hunter**"

Arrol

**A DIVERSITY OF SKILLS
IN HEAVY ENGINEERING**

Arrol have applied their traditional skill and latest planning techniques to the execution of a wide variety of engineering projects at home and overseas.



**Craigellachie Bridge -
reconstructed above
its 1814 ribs in 1964**

Of Hunter's personal traits Professor George Moncur wrote in 1933:

“he was of a generous and genial disposition [with] hosts of friends both at home and abroad and was very highly esteemed by all who came in touch with him, not only for his great professional ability but for his sterling worth and amiable personality”



FINIS

