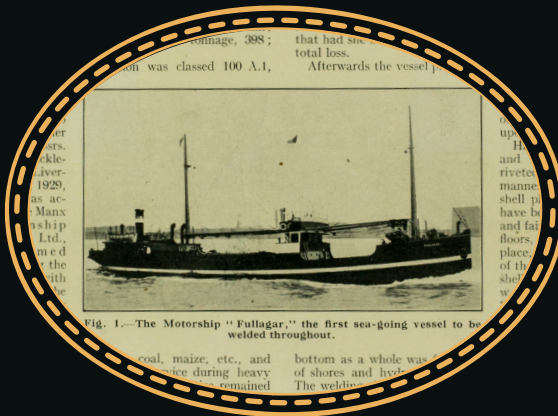


*IMMERSIVE EXPLORATION
OF LLOYD'S REGISTER
SHIP PLANS*



FULLAGAR

*by
Marcelo F. Coelho*

TANGIBLE VR BOOK

FULLAGAR

by

Marcelo F. Coelho

Master of Design and Multimedia, Candidate
University of Coimbra, 2026

Tangible VR Book

Immersive Exploration of Lloyd's Register Ship Plans

Thesis supervisors

Jorge C. S. Cardoso, PhD

Paul David Hardman, PhD



INSTRUCTIONS

Visit the URL noted below using your smartphone and enter "VR" mode. Then, place the smartphone in a compatible mobile headset¹.

URL:

When looking at a marker² through the headset, you should see and/or hear augmented reality content.

Content can be displayed in 4 places: on the marker, to your left, front, or right³.

You can interact with some images, videos and 3D models by aiming the red cursor at the button you wish to activate⁴.

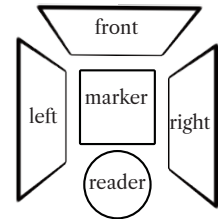
Some elements might have small thumbnail images above; aim with the red cursor to make them larger.



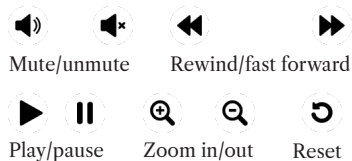
1-Smartphone in mobile headset looking at the book



2-Marker



3-Content position



Up/down/left/right

4-Controls

FULLAGAR

INTRODUCTION

THIS book accompanies the master's thesis *Tangible VR Book: Immersive Exploration of Lloyd's Register Ship Plans* and the associated research project, funded by the *Lloyd's Register Foundation*, aligned with their mission to promote maritime safety education.

The developed tangible VR book framework results in a physical book augmented with digital elements, displayed via a smartphone by scanning the barcodes present in the pages. Readers can thus explore additional multimedia content in augmented reality, enhancing the traditional reading experience.

This particular case focuses on the story of *Fullagar*, the world's first fully welded ship.

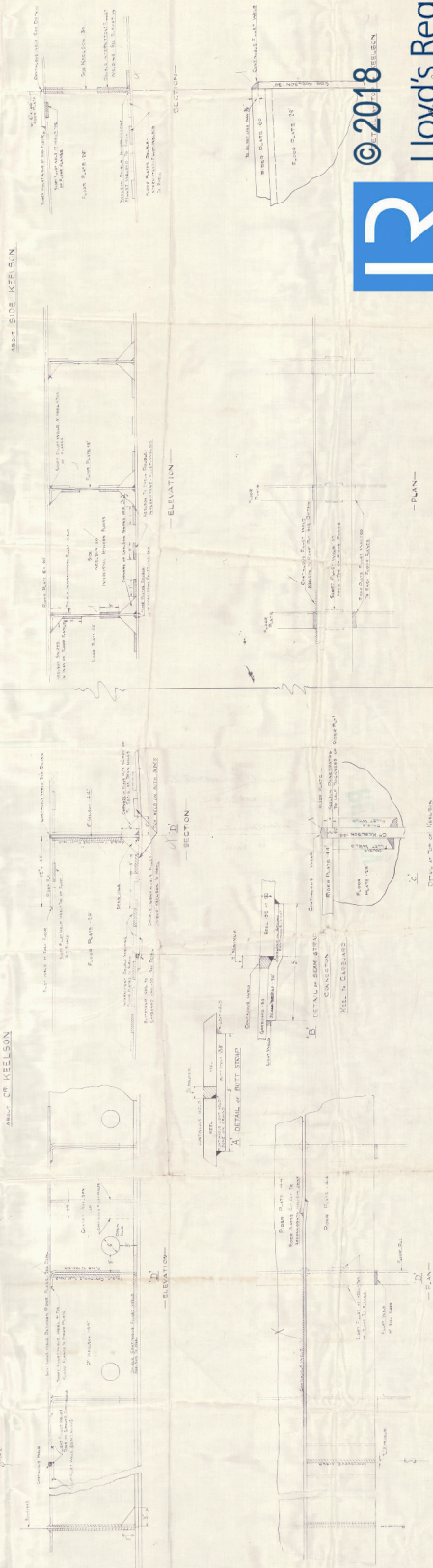
The documents and plans in this book are sourced from the *Lloyd's Register Foundation Heritage Education Centre* archive.

Nº 892

TYPICAL WELDED CONNECTIONS

SCALE 1/4" FULL SIZE DETAILS FULL SIZE

SHEET 1



© 2018

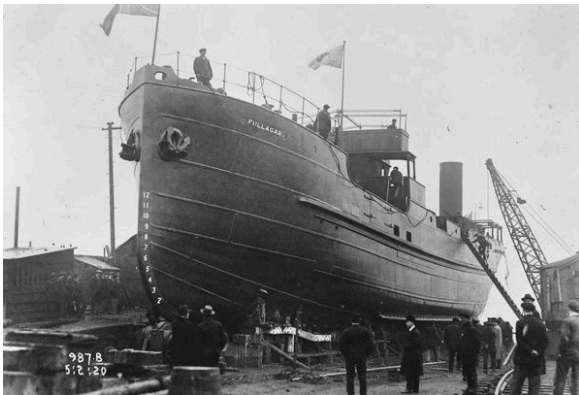
Lloyd's Register
Foundation

1- Welding plans

WORLD'S FIRST FULLY WELDED SHIP



2- Color depiction of Fullagar



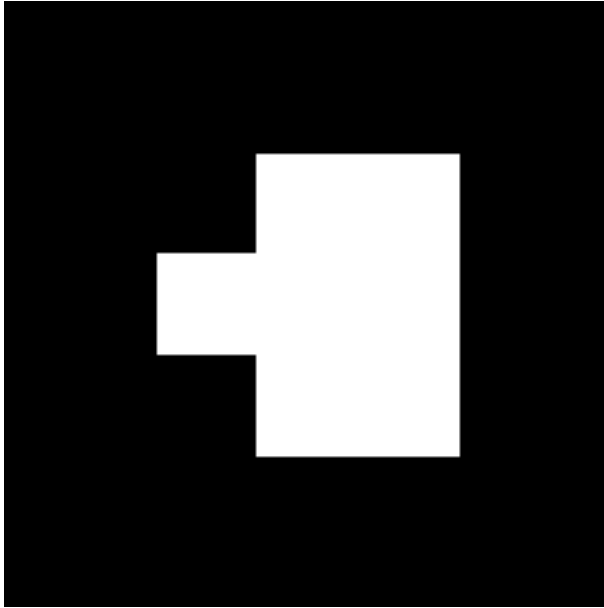
3- 1920 photo of Fullagar

FULLAGAR



4- Approximate 3D model of Fullagar, manipulable in VR

WORLD'S FIRST FULLY WELDED SHIP



Hello! Today we are going to learn about the Fullagar, a special ship in the history of shipbuilding. It was the first ship built entirely using welding, instead of rivets.

It was launched in 1920 and was used to transport goods between Liverpool and Cardiff, in England. At first glance, it looked like just another cargo ship of its time. However, it was an experimental project, created to test a new construction method that did away with traditional metal rivets.

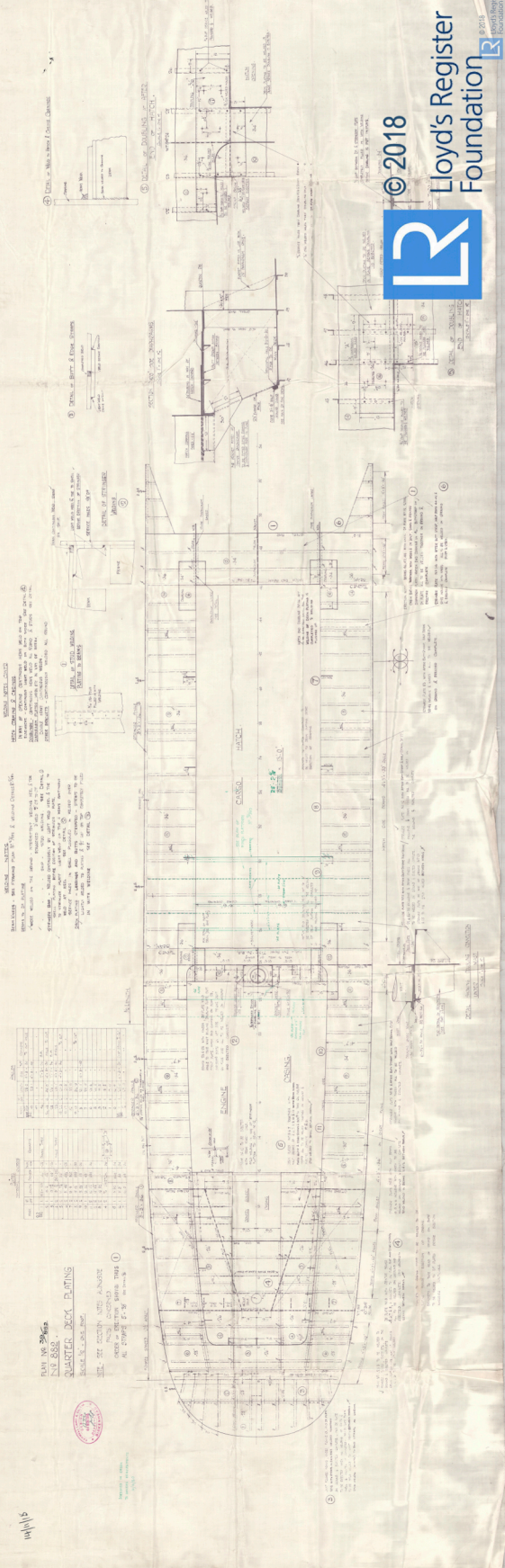
Because it was such a novelty at the time, the ship was subject to strict annual inspections. There were doubts about whether welding would be strong and safe enough to withstand the de-

mands of the sea.

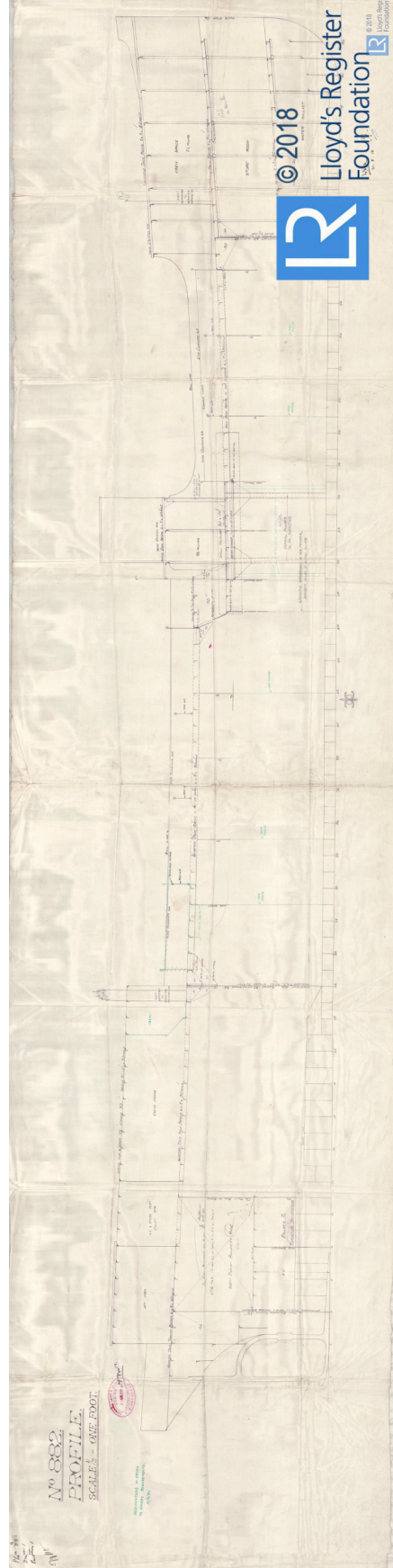
Thanks to the archives of Lloyd's Register, the organization responsible for registering and inspecting ships, we now have access to technical drawings, reports, and correspondence related to the Fullagar.

In front of you, you can see one of the technical drawings of the welded iron plates that formed the ship's structure¹. These drawings show how the plates were joined and reinforced. Here, you can also see a 3D representation of the Fullagar⁴, which helps us imagine what this ship looked like as it sailed between Liverpool and Cardiff.

Let's explore the history of this ship.



5- Rear deck plans



6- Side profile plans



© 2018

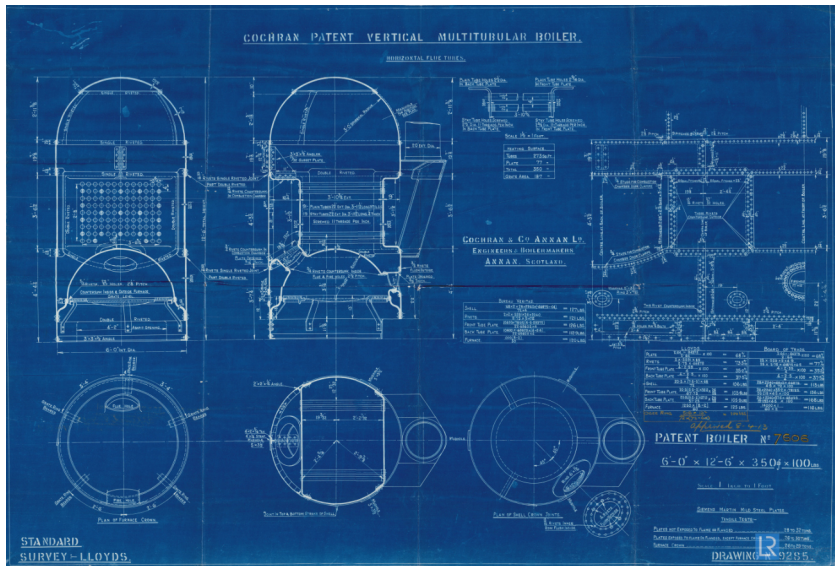
Lloyd's Register
Foundation



© 2018

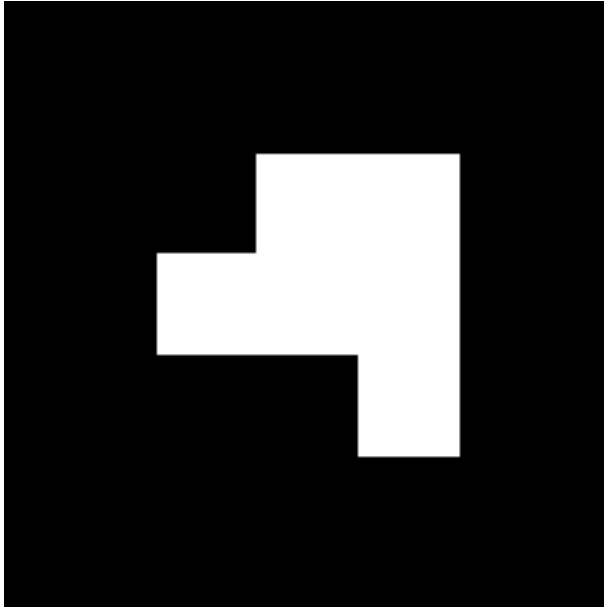
Lloyd's Register
Foundation

FULLAGAR



8- Boiler plans

SHIPBUILDING PLANS



On this page, you can see more technical drawings of the Fullagar, like a boiler diagram⁸, showing how steam was produced to power steam-driven equipment. You can also see the ship's profile drawing⁶, where you can observe its shape, and a plan detailing the location of the engine, as well as other important areas on board⁷.

All these drawings contain very inte-

resting details. You can zoom in on the images to read the text more carefully and closely observe these shipbuilding documents, created between 1918 and 1919. These records help us better understand how the Fullagar was designed, structured, and built.

Carina 4

S.S. "FULLAGAR".

A report has now been received from Mr. Campbell Holms regarding his examination of the S.S. "FULLAGAR", together with a statement showing the service on which the vessel has been engaged since the date of build.

From the statement it would appear that the vessel has been actually engaged in service for about 4½ months and performed 27 voyages between Liverpool and Cardiff. In six of these runs she carried no cargo, in nine she had a full cargo of steel plates, in one a full cargo of coal, in two a full general cargo and in the remainder part cargoes.

It is reported that in some of these voyages very heavy weather was encountered, but no damage was sustained.

Since December last the vessel has been laid up while a new type of motor was being installed.

Mr. Holms made a careful examination of the vessel, and reports that there is no signs of straining of the welded joints. There is local corrosion here and there in some of the hollows of the deck plating, but the welded material has rusted no more than other parts. Mr. Holms is of opinion that sufficient experience has not yet been gained to justify the removal of the notation "Experimental" at present recorded in the Register Book.

It is accordingly suggested that the conclusions given in the endorsement of the 12th October be adhered to.

hss

BH *WJ*
5.11.21.

H.P.

General Committee

Thursday, 17th November, 1921.

Notations of "Experimental" & Subject to Annual Survey
to be retained *as*

EARLY LIFE



ONE OF THE COMPANY'S FLEET OF STEAMERS LOADING IRON AND STEEL PRODUCTS
AT THE STEEL WORKS WHARF.

10- Photo of same era ship, being loaded with metal products



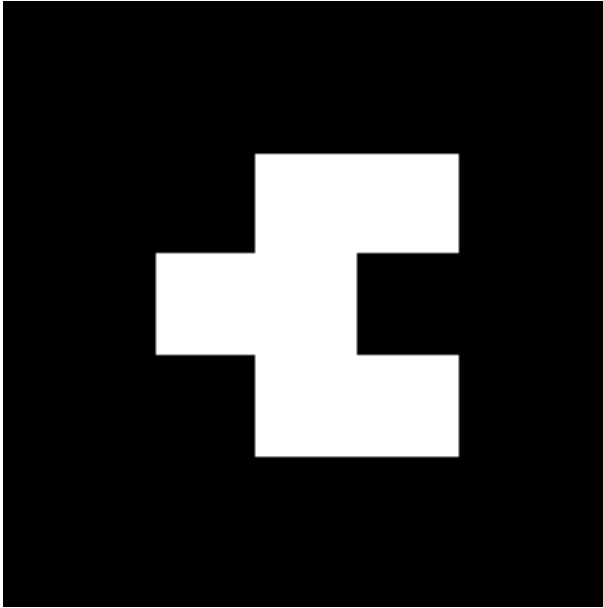
11- Photo of same era ship, loaded with cargo of coal, or similar

FULLAGAR



12- Animated 3D model, viewable in VR

EARLY LIFE



In the records of Lloyd's Register, a 1921 memorandum, about a report by Mr. Campbell Holmes⁹, states:

"A report has now been received from Mr. Campbell Holms, regarding his examination of the S.S. "FULLA-GAR", together with a statement showing the service on which the vessel has been engaged since the date of build. From the statement it would appear that the vessel has been actually engaged in service for about 4 months and performed 27 voyages between Liverpool and Cardiff. In six of these runs she carried no cargo, in nine she had a full cargo of steel plates, in one a full cargo of coal, in two a full general cargo and in the remainder part cargoes. It is reported that in some of these voyages very he-

avy weather was encountered, but no damage was sustained.

Since December last the vessel has been laid up while a new type of motor was being installed. Mr. Holms made a careful examination of the vessel, and reports that there is no signs of straining of the welded joints. There is local corrosion here and there in some of the hollows of the deck plating, but the welded material has rusted no more than other parts. Mr. Holms is of opinion that sufficient experience has not yet been gained to justify the removal of the notation "Experimental" at present recorded in the Register Book. It is accordingly suggested that the conclusions given in the endorsement of the 12th October be adhered to."

26th July 19 24.

Secretary to the Liverpool Committee.

Lloyd's Register
Foundation

FIRST ACCIDENT & RENAME



14- 1920 photo of the Liverpool docks



15- 1920 photo of the Liverpool docks

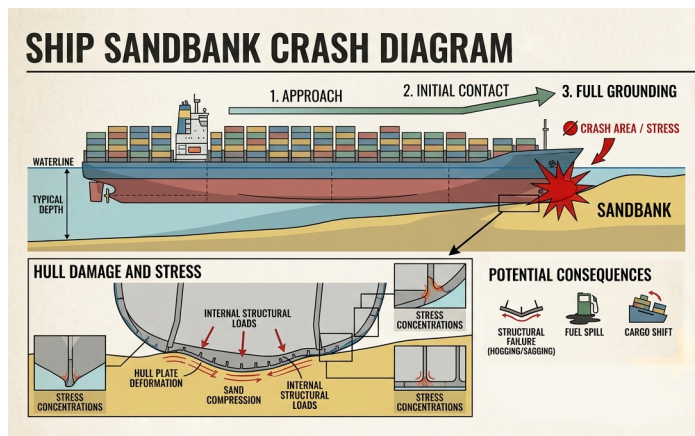
FULLAGAR

In June, 1924, a serious accident occurred to the vessel which has in a striking manner proved the superiority of a ship welded with "Quasi-Arc" electrodes over a riveted ship.

The vessel went aground on a sand bank in the Mersey during a voyage from Liverpool to Belfast, when fully laden. She floated off on the next tide and as she was perfectly watertight proceeded on her voyage and discharged her cargo at Belfast. It was then found that she was damaged to a considerable extent, but as the shell was watertight it was decided to take her back to Liverpool under her own power. When docked the vessel was thoroughly examined and by using sights the bottom was found to be set up 11 in. from bilge to bilge over a length of roughly 70 ft. and from the evidence of inside structural work she had been set up more but had settled when placed on the blocks.

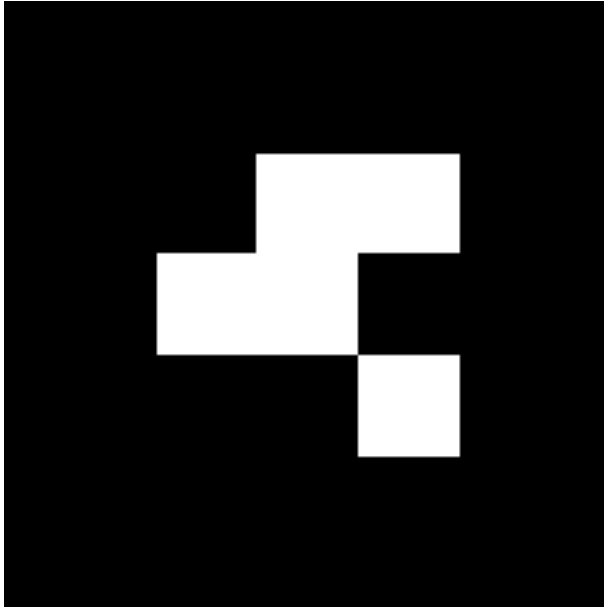
"A Remarkable Test."

16- Clippings confirming 1924 accident



17- Diagram representing a ship sandbank crash

FIRST ACCIDENT & RENAME



But in 1924 something unexpected happened: the Fullagar suffered an accident, clippings¹⁶ state:

"In June, 1924, a serious accident occurred to the vessel which has in a striking manner proved the superiority of a ship welded with "Quasi-Arc" electrodes over a riveted ship.

The vessel went aground on a sand bank in the Mersey during a voyage from Liverpool to Belfast, when fully laden. She floated off on the next tide and as she was perfectly watertight proceeded on her voyage and discharged her cargo at Belfast. It was then found that she was damaged to a considerable extent, but as the shell was watertight it was decided to take her back to Liverpool under her own power. When docked the vessel was thoroughly examined and by using

sights the bottom was found to be set up 11 in. from bilge to bilge over a length of roughly 70 ft. and from the evidence of inside structural work she had been set up more but had settled when placed on the blocks.

"A Remarkable Test."

According to correspondence from Lloyd's Register, the ship was renamed "Caria" and put up for sale. The document¹³ states:

"Dear Sir, I have the honor to return herewith report of survey as below, recently forwarded to us for guidance in the survey of the vessel.

Vessel: Caria. ex Fullagar. Vessel laid up for sale in damaged condition."

Soon, the ship would be about to begin a long journey to its next owners.



Lloyd's Register of Shipping,

Maritime Buildings, East Dock Street,

Dundee, 2nd December, 1924.

LLOYD'S REGISTER
Recd. 3 DEC. 1924
And
LONDON

The Secretary,
London.

Dear Sir,

I have to inform you that the Freeboard Marking on the oil engine vessel "CARIA", have been verified and found in accordance with the Freeboard Certificates issued when the vessel was named "FULLIGAR".

The vessel is now Under survey for damage and S.S.No.1 and on completion it is understood will be purchased by Messrs The British Columbia Cement Co. Ltd., but that the name of the vessel and Port of Registry are to remain unaltered.

New Certificates have been requested and I shall be obliged if you will kindly let me know if any fee is to be charged for these.

The original Certificates are enclosed.

I am, Dear Sir,

Yours faithfully,

© 2018
Lloyd's Register
Foundation

COPY.

21st November, 1924.

Dear Webster,

I am in receipt of your letter of yesterday's date regarding the case of the S.S. "CARIA" ex "FULLAGAR". As this vessel is not classed for any restricted trading, I see no reason why she should not make the trip to Vancouver.

As Sir Westcott and our old friend Thomson have been interested in this particular case, I referred the matter to them and they also see no reason why the vessel should not be permitted to make the trip. Sir Westcott suggests, however, that in forwarding your report on the case you should state the fact that the vessel is going to Vancouver.

As the present freeboard certificate was issued in the name of "FULLAGAR", it will be necessary for you to verify the freeboards and forward the usual verification of marking form, in order that certificates in the new name of the vessel may be issued.

With kind regards,

Yours faithfully,

Geo. Webster, Esq., D.Sc.,

G L A S G O W.



© 2018

Lloyd's Register
Foundation

FULLAGAR



20- Old photo of The British Columbia Cement Co.

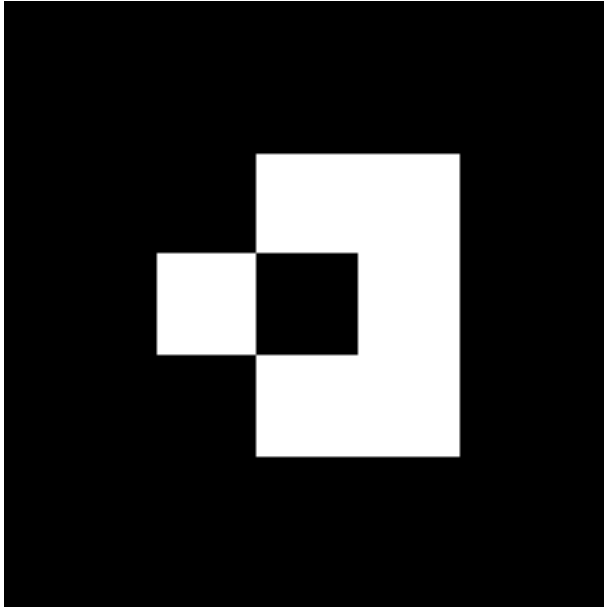


21- Photo of a sign from the cement company



22- Animated 3D model, viewable in VR

VOYAGE TO CANADA



In 1924, the same year as its first accident, the Fullagar would be sold to a cement company in Vancouver, Canada. A Lloyd's Register letter¹⁹ confirms:

"...As this vessel is not classed for any restricted trading, I see no reason why she should not make the trip to Vancouver."

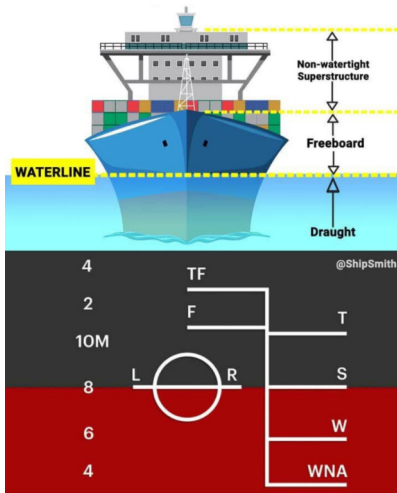
However, before making this long journey, the ship had to be inspected and pass the freeboard test. Freeboard is a technical term, and we will discover its meaning later.

This Lloyd's Register letter regarding the inspection¹⁸ is a vital instrument for ship safety and registration and states:

"Dear Sir, I have to inform you that the freeboard marking of the oil engi-

ne vessel "CARIA" has been verified and found in accordance with the Freeboard Certificates issued when the vessel was named FULLAGAR. The vessel is now under survey for damage, and on completion it is understood will be purchased by The British Columbia Cement Co., but that the name of the vessel and port of registry are to remain unaltered. New certificates have been requested, and I shall be obliged if you will kindly let me know if any fee is to be charged for these. The original certificates are enclosed."

This confirms the ship would be purchased by a Canadian cement company, likely making the long voyage via the Panama Canal.



23- Freeboard and plimsoll line diagram



24- Animated 3D model, viewable in VR



25- Video about freeboard and the plimsoll line, viewable in VR

FREEBOARD AND PLIMSOLL LINE



Freeboard is the vertical distance between the waterline and the deck level on a ship, used to ensure buoyancy margin and stability.

The Fullagar was sold to the British Columbia Cement Company in Van-

couver and was to make the journey from the United Kingdom to Canada. It therefore had to be tested to calculate freeboard and stability for the entire voyage, including crossing the Panama Canal and the Atlantic.

Lloyd's Register of Shipping

BRITISH COLUMBIA

1011 METROPOLITAN BUILDING

VANCOUVER, B. C.

February 15th, 1926.

The Secretary,

LONDON, E.C.

LLOYD'S REGISTER
Recd. 2 MAR 1926
Ans'd.
LONDON

Dear Sir,

Initial "H"

I have to acknowledge receipt of your letter of January 28th, 1926, with regard to the Motor ship "SHEAN", and enclosing a letter for the Owners of this vessel pointing out the necessity for the annual survey which became due in December.

In connection with this case I have to inform you that I have already received a message from Victoria that the Ship is on dry dock and requesting survey of same, and I am leaving for Victoria tonight.

Yours very truly,

A. Scott

© 2018

Lloyd's Register
Foundation

NEW OWNER INSPECTION & RENAME

Steel Motorship "SHEAN" ex "CARIA" ex "FULLAGAR".

This vessel again became due for her Annual Survey at the end of December, 1925. She is now owned by the British Columbia Cement Co. Ltd., and is understood to be employed in the carriage of cement in British Columbian waters.

Case shown to Mr. Ives, who said that in the first place a Notice to the effect that the Annual Survey was due should be sent to the Owners.



© 2018

Lloyd's Register
Foundation

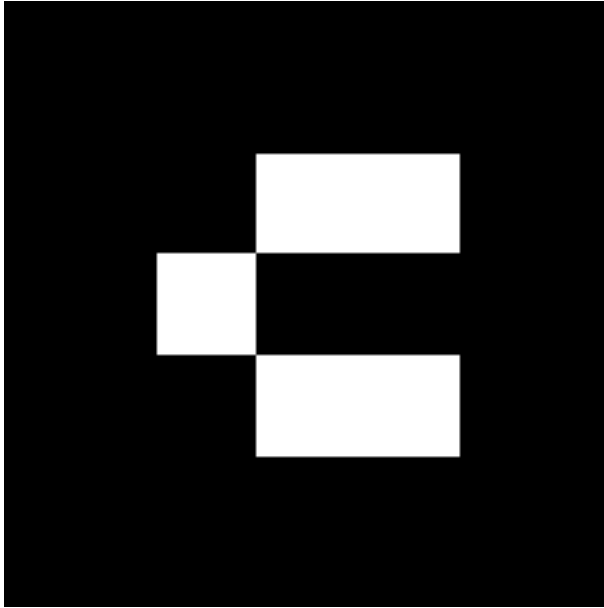
27- Memorandum confirming new ownership of the vessel, now "Shean", and due annual survey

FULLAGAR



28- 1930 photo of another ship on dry dock, in Victoria, British Columbia

NEW OWNER INSPECTION & RENAME



Meanwhile, the new owners had renamed the ship "Shean". From 1925, there is a memorandum reminding the ship's new owners in Canada that the Fullagar must undergo its annual inspection. This memorandum²⁷ states:

"Steel motor vessel Shean, ex Caria, ex Fullagar. This vessel again became due for her annual survey at the end of December 1925..."

A letter from A. Scott of Lloyd's Register confirms that in February 1926, he was about to travel to Victoria, Canada, to carry out the ship's inspection²⁶:

"...I have to inform you that I have already received a message from Victoria that the ship is on dry dock and requesting survey of same, and I am leaving for Victoria tonight."

And so the ship's new owners had the inspection carried out and were able to use it for several years before another unforeseen event occurred which, as we will see, was very bad in one way but good in another.

WELDED JOINTS IN SHIP CONSTRUCTION.

THE "FULLAGAR" AFTER ELEVEN YEARS' SERVICE.

THE first sea-going vessel welded throughout was the motor vessel *Fullagar*, and as she has now been in service for eleven years, her behaviour during that period should be of the utmost importance to ship-builders and the classification societies. The vessel has justified the confidence of those who fostered the welded construction and helped by tests and various experiments to convince the builders, Messrs. Cammell, Laird & Co., Ltd., and Lloyd's Register of Shipping, to whose classification the vessel was built, that the vessel would be successful.

The motor vessel *Fullagar*, since re-named *Caria*, and later *Shean*, was built by Messrs. Cammell, Laird & Co., Ltd., Birkenhead, and was launched in February, 1920. The vessel was constructed throughout by electric welding in place of riveting, and the Quasi-Arc Company's methods and electrodes were used exclusively. Her dimensions are as follows:—Length between perpendiculars, 150 ft.; breadth moulded, 23 ft. 9 in.; depth moulded, 11 ft. 6 in.; depth to quarter deck, 15 ft. 6 in.; hold capacity, 26,000 cub. ft.; gross tonnage, 398; and speed, ten knots.

The *Fullagar* on completion was classed 100 A.1, electrically welded, subject to annual survey, experimental, and went into the service of her owners, Messrs. T. & J. Brocklebank, Ltd., Liverpool, in July, 1929, and later, was acquired by the Manx Isles Steamship Company, Ltd., and re-named *Caria*. During the vessel's career with these companies she passed through very strenuous services in the coastal trade, carrying various cargoes such as steel plates, coal, maize, etc., and has on several occasions been in service during heavy weather, whilst other vessels of the same size remained in port.

Effect of Grounding on Welded Joints.

The vessel has been aground through stress of circumstances several times, and on each examination later in dry dock the keel and bottom plating were found to have withstood the excessive strain of grounding without any ill effects to the welded joints, and on no occasion was there any leakage through the shell.

The forward length of bilge keel on the starboard side had been carried away and the welded angle lugs attaching the bilge keel to the shell were bent. Efforts were made to dislodge these lugs from the shell by hammering, the result being that the heel of the lug itself fractured without disturbing the welding. A collision caused serious indentation to the shell plating abreast the after cargo and also in way of the engine room on the starboard side. Here again the welded joints remained intact, whereas a riveted ship in similar circumstances would have had the rivets "started" and an immediate repair would have become necessary.

The vessel had been surveyed annually and her class 100 A.1 maintained, the ship being in a sound condition, in spite of the very strenuous services and rough usage she had experienced.

In June, 1924, a serious accident occurred to the vessel which has in a striking manner proved the superiority of a ship welded with "Quasi-Arc" electrodes over a riveted ship.

The vessel went aground on a sand bank in the Mersey during a voyage from Liverpool to Belfast, when fully laden. She floated off on the next tide and as she was perfectly watertight proceeded on her voyage and discharged her cargo at Belfast. It was then found that she was damaged to a considerable extent, but as the shell was watertight it was decided to take her back to Liverpool under her own power. When docked the vessel was thoroughly examined and by using sights the bottom was found to be set up 11 in. from bilge to bilge over a length of roughly 70 ft. and from the evidence of inside structural work she had been set up more but had settled when placed on the blocks.

"A Remarkable Test."

Whilst in dock in this condition the vessel was thoroughly examined by Lloyd's surveyors, representatives of the underwriters and owners, also Admiralty officials who were greatly interested, and the opinion was expressed that not only had the welding stood a remarkable test, but, which is of greater importance, that had she been a riveted ship she would have been a total loss.

Afterwards the vessel proceeded under her own power to Leith where an official survey was held and the scheme of repair decided upon.

Had the plating and framing been riveted in the usual manner, the unfair shell plating would have been removed and faired, and the floors, etc. faired in place, but in view of the fact that the shell plating was welded with "Quasi-Arc" electrodes and perfectly sound, none had to be removed and the

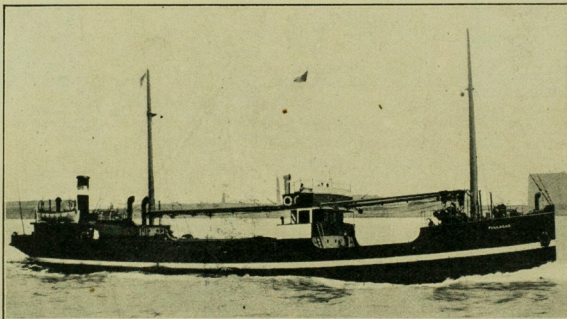


Fig. 1.—The Motorship "Fullagar," the first sea-going vessel to be welded throughout.

bottom as a whole was forced back into line by means of shores and hydraulic jacks from the deck beams. The welding throughout was then examined and found to be quite sound.

As was to be expected, the setting up of the bottom to such an extent, 11 in., and over such a large area, 1,500 sq. ft., caused considerable disturbance to the frames, floors, keelson, etc. These, however, have been partly set back and partly renewed, and made sound and seaworthy: in regard to the keelson, this has been deepened for a considerable portion of its length by the addition of two 8 in. by 3½ in. bulb angles placed back to back on top of the rider plates.

In forcing back the excessive deformation of the plates into their original position, the welds have withstood the reversal of the abnormal stresses equally with the solid plate, which is all one could wish to claim for any form of joint.

Classification Maintained.

Notwithstanding the drastic experience to which the ship had been subjected, it is very interesting to note that the vessel's classification standing at Lloyd's Register Book as "100 A.1, electrically welded, subject to annual survey, Experimental," has been retained without qualification.

A further important point to note is that this vessel, originally designed as a coaster, after passing through all her vicissitudes, is still in such a satisfactory and seaworthy condition that permission was given for her voyage across the Atlantic and through the Panama Canal to the North Pacific Coast, where she has since

been employed in the cement carrying trade, the new owners being the British Columbia Cement Company of Victoria, British Columbia, who have re-named the vessel *Shean*. The owners stated that on October 24, 1930, the *Shean* met with an accident, and the following particulars of the occurrence were given.

The *Shean* struck a rock cliff in the Saanich Inlet, near Victoria, when going at full speed, and had 10,000 bags of cement on board. The photographs show the extent of the damage, and on examination, it was found that in no case did the plates tear apart at the welds, but above and below in the solid plate. Lloyd's and the underwriter's surveyors have stated that the relatively slight amount of damage was a remarkable tribute to the welded vessel.

Had the vessel been riveted, the damage would have no doubt extended beyond the fore peak bulkhead and caused flooding of the cargo space, in which case the cargo would have been irretrievably ruined, whereas less than 400 sacks were damaged, also the vessel would have probably sunk, as she had about 16 ft. of water under her amidships and further aft. The vessel has since been repaired in strict accordance with her class, has passed her tenth annual survey satisfactorily, and is in good condition.

The above is the second occasion on which this vessel has sustained damage which would have resulted in a riveted vessel becoming a total loss.

After more than eleven years' prolonged exposure of the welds to corrosive action of sea water, it is impossible to trace undue corrosion of metal in any part of the structure, which is so satisfactory that Lloyd's have agreed to a Biennial Survey.

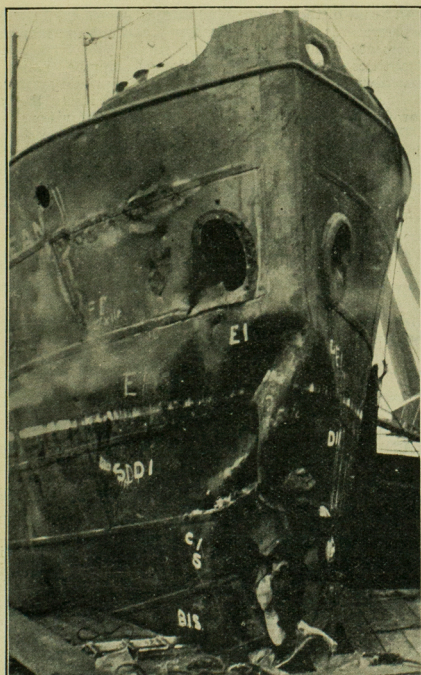


Fig. 2. — Renamed "Caria" and "Shean," the "Fullagar" met with an accident in the Saanich Inlet, near Victoria. At the time she had 10,000 bags of cement on board and was travelling at full speed.

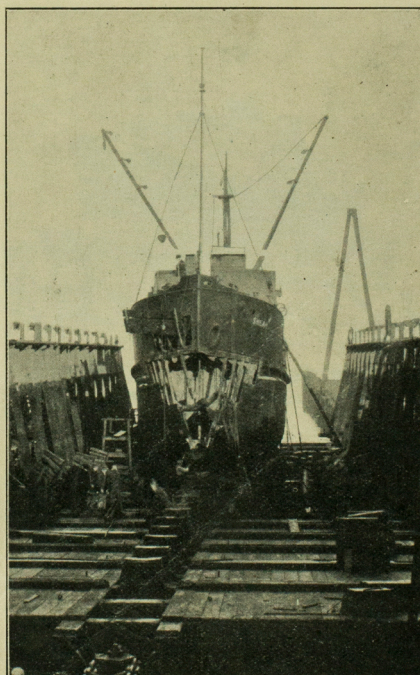


Fig. 3. — Both this illustration and Fig. 2 show the extent of the damage she sustained. Upon examination it was found that in no case did her plates tear apart at the welds, but above and below in the solid plate.

FULLAGAR



31- Close up photo of Fullagar's metal plate damage after the 1930 crash

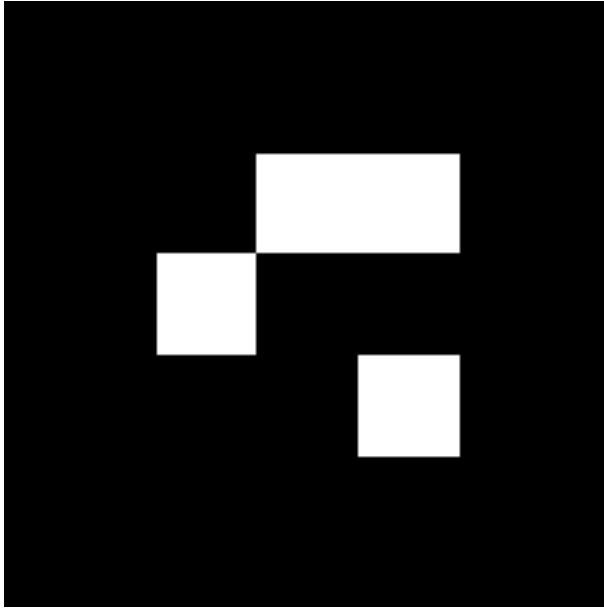


32- AI representation of 10000 bags of cement



33- Animated 3D model,
viewable in VR

SECOND ACCIDENT



A 1931 article³⁰ in The Shipping World titled "Welded Joints in Ship Construction", mainly dedicated to the Fullagar, states the Fullagar suffered a serious accident but managed to withstand it because welded joints were stronger than traditional construction:

"...the new owners..." "...who have renamed the vessel Shean stated that on October 24 1930..." "...struck a rock cliff in the Saanich Inlet, near Victoria, when going at full speed, and had 10,000 bags of cement on board. The photographs show the extent of the damage, and on examination it was found that in no case did the plates tear apart at the welds..."

The results were quite unexpected:

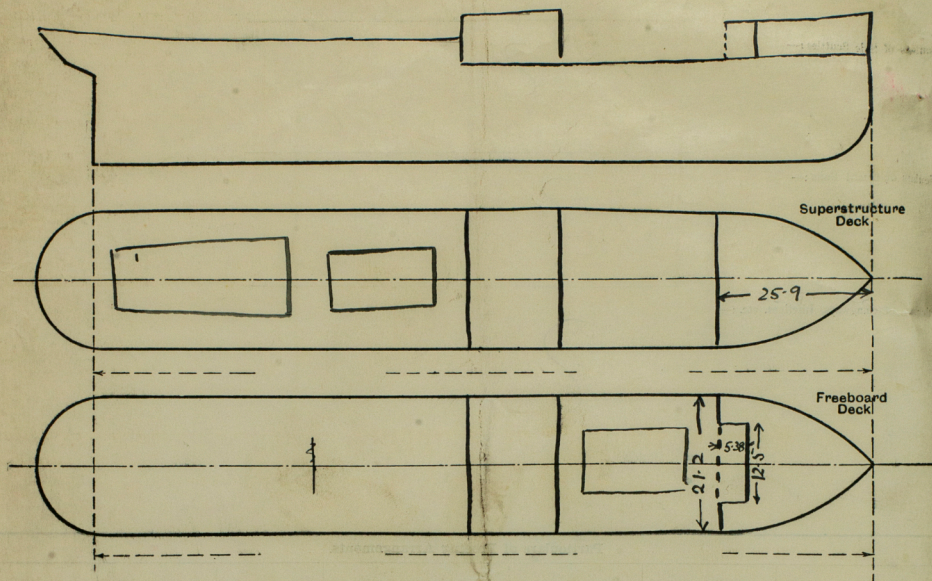
"Had the vessel been riveted, the damage would have no doubt extended beyond the fore peak bulkhead and

caused flooding of the cargo space, in which case the cargo would have been irretrievably ruined, whereas less than 400 sacks were damaged, also the vessel would have probably sunk, as she had about 16 ft. of water under her amidships and further aft. The vessel has since been repaired in strict accordance with her class, has passed her tenth annual survey satisfactorily, and is in good condition.

The above is the second occasion on which this vessel has sustained damage which would have resulted in a riveted vessel becoming a total loss."

After surviving this accident, in which the iron plates broke but not the welds, Lloyd's Register agreed to allow the ship to be inspected every two years instead of annually. The ship would soon be renamed again and sold.

Superstructure bulkheads, trunks, deckhouses, casings, cargo and coaling hatchways, extent and thickness of sheathing on the freeboard deck, gangway, cargo coaling ports, and any other openings, etc., which would affect the seaworthiness of the ship are to be shewn on the following sketches:—



State any special features in the construction of the ship:—

File 25.90
 Recd $\frac{5.38 \times 12.5}{21.2} = - 3.17$
 22.73 equivalent
 removed

Builder's name and yard number

Cammell Hairs & Co. L^{td} J^{rs} N^o. 882

Names of sister ships

Owners

Fee £

Received by me,

PARTICULARS OF PROTECTION TO OPENINGS, ETC.

HATCHWAYS ON FREEBOARD AND SUPERSTRUCTURE DECKS									
Description of Hatchway		Nº 1	Nº 2						
Dimensions of Hatchway		23'4" x 13'0"	28'3" x 13'0"						
COAMINGS	Height above Deck	30"	30"						
	Thickness { Sides	44	44						
	{ Ends	40	40						
	Stiffeners	7 x 3 x 4 BA	2						
	Brackets, Stays	2	2						
HATCH BEAMS	Number	2	2						
	Spacing	7' - 9 1/4'	9' - 5'						
	Scantling and Sketch								
	Bearing Surface	2	2						
FORE AND AFTERS	Number	3	3						
	Spacing	3' - 3"	3' - 3"						
	Unsupported Lengths	7' - 9 1/4'	9' - 5'						
	Scantling* and Sketch								
	Bearing Surface	2	2						
HATCH COVERS	Material	W.P.	W.P.						
	Thickness	2 1/2"	2 1/2"						
	How fitted	stitching	stitching						
	Bearing Surface	2	2						
Spacing of Cleats		2	2						
Number of Tarpaulins		2	2						
*Are wood fore and afters steel shod at all bearing surfaces? 2 ? Are battens and wedges efficient and in good condition? 2 Are tarpaulins in good condition and in accordance with rule requirements? 2 Are lashings provided in accordance with rule requirements? 2									

Particulars of fiddle, funnel and ventilator coamings :—

Particulars of Flush Bunker Scuttles :—

Particulars of Companionways :—

Particulars of Ventilators in exposed positions on freeboard and superstructure decks :—

Particulars of Air Pipes in exposed positions on freeboard, raised quarter, or superstructure decks :—

Particulars of Gangway Cargo and Coaling Ports :—

Particulars of Scuppers and Sanitary Discharge Pipes :—

Particulars of Side Scuttles :—

Particulars of Guard Rails :—

Particulars of Gangways, Lifelines, etc. :—

Particulars of Freeing Arrangements.

	Length of Bulwark	Height of Bulwark	Size of Freeing Ports	Number each side	Area each side	Rule area each side
After Well	88.25	3.0	?	2		
Forward Well	26.85	4.0	2.5 x 1.41	3		

State position of each freeing port { After Well :—
(F. and A. position and height above deck edge) { Forward Well :—

State whether the freeing ports are fitted with shutters, bars, or rails, and give particulars of such :—

Additional area where sheer is less than standard.

Particulars of Superstructures, Trunks, Casings, Deckhouses.

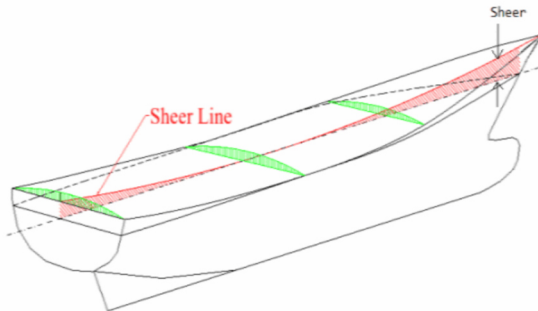
	Coaming	Plating	Stiffeners	Spacing	End Attachments of Stiffeners	Size of Openings	Height of Sills	Height of Casings
Poop Bulkhead	—							
Raised Quarter Deck Bulkhead ...	?	?	?	?	?	?	?	—
Bridge, After Bulkhead	?	?	?	?	?	?	?	—
Bridge, Forward Bulkhead	.28	.24	5 x 2 1/2 = 40 BA	30"	brackets	None	—	—
Forecastle Bulkhead	?	?	?	?	?	?	?	
Trunk, Aft	—							
Trunk, Forward	—							
Exposed Machinery Casings on Freeboard or Raised Quarter Decks ...	?	?	?	?	?	?	?	?
Exposed Machinery Casings on Superstructure Decks	—							
Machinery Casings within Superstructures not fitted with Class I Closing Appliances	—							
Deckhouses on Flush Deck Ships ...	—							

Particulars of Closing Appliances (state if capable of being manipulated from both sides).

Poop Bulkhead	—
Raised Quarter Deck Bulkhead ...	No opening
Bridge, After Bulkhead	No opening
Bridge, Forward Bulkhead	No opening
Forecastle Bulkhead	?
Exposed Machinery Casings on Freeboard or Raised Quarter Decks ...	?
Exposed Machinery Casings on Superstructure Decks	—
Machinery Casings within Superstructures not fitted with Class I Closing Appliances	—
Deckhouses on Flush Deck Ships ...	—

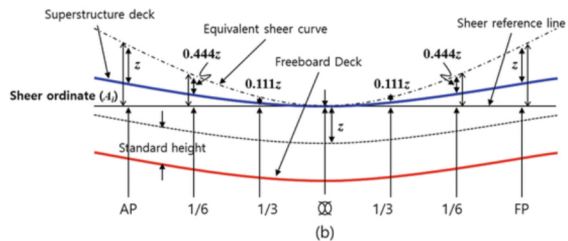
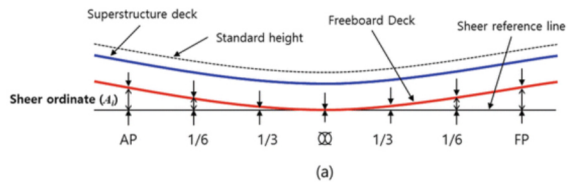
FULLAGAR

Sheer is a measure of longitudinal curvature of a ship's main deck. The sheer is measured from the deck at side to a line of reference drawn parallel to the keel through the sheer line amidships.



(Example of ship sheer diagram for freeboard calculation)

38- Diagram of sheer correction for freeboard calculations



(Example of freeboard calculation diagram)

39- Diagram of superstructure compensation for freeboard calculations



Lloyd's Register of Shipping

BRITISH COLUMBIA

1319 MARINE BUILDING
VANCOUVER, B.C.

September 9th, 1935.

COPY

Chief Surveyor,
Lloyd's Register of Shipping,
New York, N. Y.

Dear Sir:-

M. V. "CEDROS" ex "Shean"

I am enclosing report No. 4029 covering the Special Survey No.3 and L. M. C., Tail Shaft and Donkey Boiler on the M. V. "CEDROS" ex "Shean".

I am also enclosing report No. C 11, two copies of the freeboard verification form and two copies of the provisional certificate, and returning a photostat of C 11 provisional received from the London office, also the original freeboard certificates for cancellation.

This vessel has been sold to Mexico, and will trade between Ensenada and Los Angeles.

The hull certificate is made out as before, subject to Biennial Survey, but in my opinion there does not appear to be any real reason for this, unless it is a standard practice with electrically welded ships.

Yours very truly,

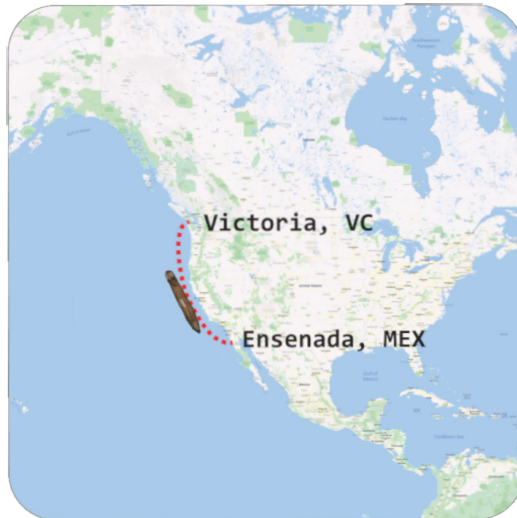
A. Shean
Surveyor.



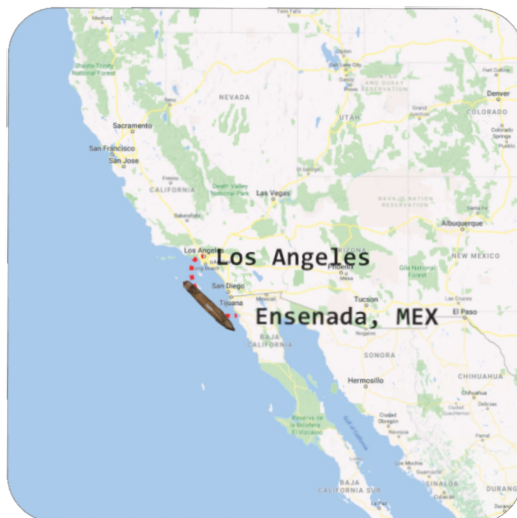
© 2018

Lloyd's Register
Foundation

FULLAGAR

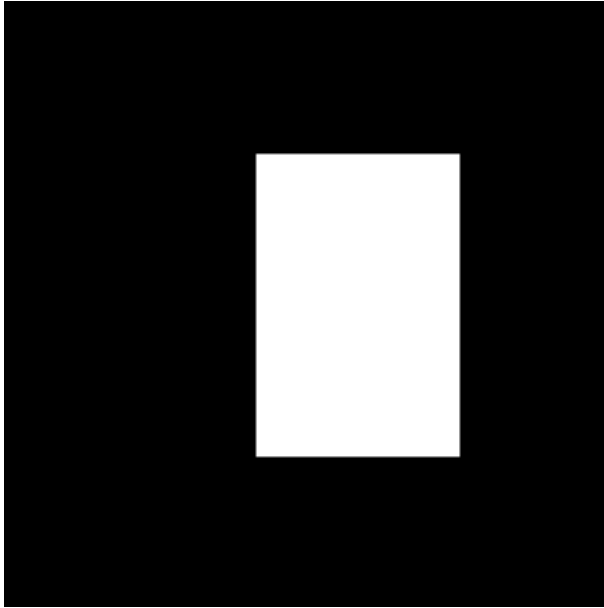


41- Animated 3D model, viewable in VR



42- Animated 3D model, viewable in VR

SURVEY FOR FREEBOARD, SALE AND RENAME



In 1935, an inspection certificate for the ship related to freeboard was issued by Lloyd's Register, titled "Survey for Freeboard". That year, the ship was sold to a company in Mexico. A letter from the Chief Surveyor of Lloyd's Register of Shipping in New York stated⁴⁰:

"Motor vessel 'Cedros', formerly 'She-an'..." "...This vessel has been sold to Mexico, and will trade between Ensenada and Los Angeles. The hull certificate is made out as before, subject to Biennial Survey, but in my opinion there does not appear to be any real reason for this, unless it is a standard practice with electrically welded ships"

The ship was sold and made the long journey to Mexico. In that year's freeboard inspection³⁴, terms such as "Deduction for Superstructure" and "Sheer Correction" appear, with various calculations beneath them.

The terms and calculations present are not easily understood by just anyone; extensive technical training is required to interpret them. This demonstrates that, already in 1935, Lloyd's inspections were rigorous and highly technical, ensuring safe navigation of vessels.

REPORT OF TOTAL LOSS, CASUALTY, &c. 9382

No. 22083 In R. B. Week Book No. 8833
 Vessel's Name **Steel H.S. "Cedros"** of **Ensenada** Tons {Net 181 / Gross 420
 Built at **Ensenada** When 1920 - 7 Casualty notice sent to Owner 13/9/37 Owner's reply *186*
 Owner's Name **O. J. Rodriguez**
 Address **Ensenada, Lower California, Mexico**
 Date 31st August, 1937
 Particulars of Classification: *35 lbs. No. 9.35*
 Case previously before *± 1000/1*
 Classing Committee. Last Minute *5.34*
 Date of Casualty *31st August, 1937*
 Précis of particulars of Casualty *Electrically welded.*

This vessel was reported to have sunk after collision with the m/s "Hidalgo" 30 miles south of Ensenada, Lower California, Mexico, on the 31st August.

A casualty notice was sent to the Owner on the 13th September, but no reply has been received.

Upon enquiry at Lloyd's by telephone today, it was ascertained that the vessel has been accepted by the Underwriters as a total loss & all claims settled.

SOURCE OF INFORMATION.

CEDEROS - Steel, Ensenada, Aug. 21 - Mexican motor vessel CEDROS and Hidalgo reported in collision off Ensenada. Further info. Ensenada leading, later reported sunk.
 London, Sept. 1. - The following cable has been received from New York: Owners of motor vessel Cedros advise total loss by collision with motor vessel HIDALGO Aug. 31, near Ensenada.

CEDEROS - Ensenada, Baja California, Aug. 31 - Motor vessel HIDALGO collided with and sank the motor vessel Cedros thirty miles south of here to-day, and three women on board the Cedros were trapped below the decks and drowned. Fourteen passengers were rescued by the HIDALGO from the Cedros, which sank twenty minutes after the collision. The HIDALGO, once slightly damaged, reported the tragedy upon arrival at this port. The collision occurred in dense fog. The Cedros, southbound toward Mazatlan, was owned by Abelardo Rodriguez, former President of Juarez. The HIDALGO was northbound to Ensenada. - "The Journal of Commerce," New York.



© 2018

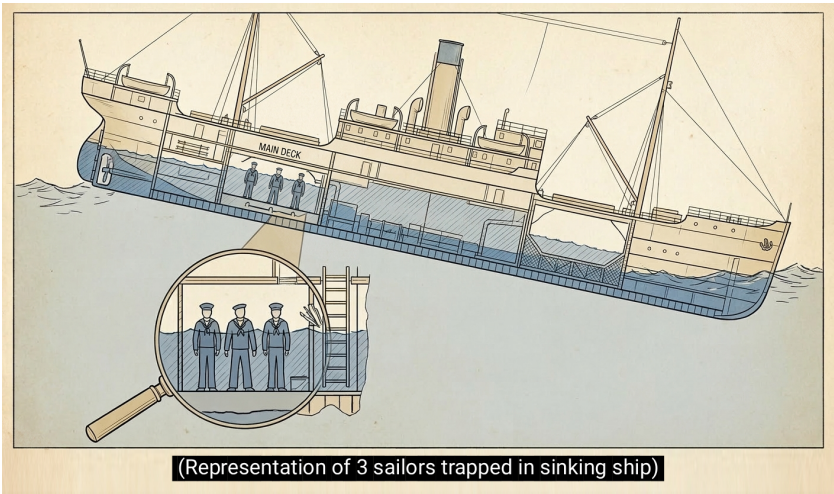
Lloyd's Register Foundation

THIRD ACCIDENT - TOTAL LOSS



44- Animated 3D model, viewable in VR

FULLAGAR

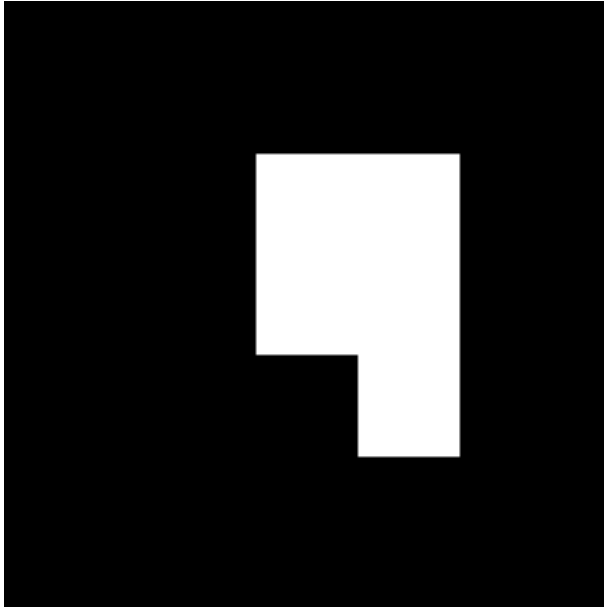


45- Representation of the 3 trapped sailors



46- Representation of the 14 rescued passengers

THIRD ACCIDENT - TOTAL LOSS



Unfortunately, the final voyage of the "Fullagar", now "Cedros", took place in 1937. A total loss report⁴³ was submitted from Ensenada, Mexico, which stated:

"This vessel was reported to have sunk after collision with the 'Hidalgo' 30 miles south of Ensenada, Lower California, Mexico, on the 31st August...." "...Upon enquiry at Lloyd's by telephone today, it was ascertained that the vessel has been accepted by the underwriters as a total loss..."

Clippings attached to this report, under "Source of Information", state:

"...Mexican motor vessels Hidalgo and Cedros were reported in collision off Ensenada. Former put into ensenada leaking, latter reported sunk."

"...Owners of the motor vessel Cedros advise total loss by collision with motor vessel Hidalgo..."

"...Motor vessel Hidalgo collided with and sank the motor vessel Cedros thirty miles south of here today, and three seamen on board the Cedros were trapped below the decks and drowned. Fourteen passengers were rescued by the Hidalgo from the Cedros, which sank twenty minutes after the collision..." "...The Cedros, southbound toward Mazatlan, was owned by Abalaro Rodriguez, former President of Mexico..."

This ends the story of the Fullagar, which over its life proved the effectiveness of welded ship construction.

Its final voyage, with the loss of lives and of the ship itself, revealed that even technological advances and rigorous maintenance could not eliminate all the risks of the sea.

