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Report on an  
**Explosion and Fire**  
involving the Motor Vessel  
*Atlantic Duchess* at Queen's  
Dock, Swansea, Glamorganshire  
on 2nd February, 1951

LONDON: HIS MAJESTY'S STATIONERY OFFICE

1951

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PETROLEUM (CONSOLIDATION) ACT, 1928

REPORT TO THE RIGHT HONOURABLE  
THE SECRETARY OF STATE FOR THE  
HOME DEPARTMENT ON THE CIRCUM-  
STANCES ATTENDING AN EXPLOSION  
AND FIRE WHICH OCCURRED ON 2ND  
FEBRUARY, 1951, AT QUEEN'S DOCK  
SWANSEA, IN THE COUNTY OF GLAM-  
ORGANSHIRE, INVOLVING THE MOTOR  
VESSEL *ATLANTIC DUCHESS*

BY H. E. WATTS

H. M. CHIEF INSPECTOR OF EXPLOSIVES

LONDON: HIS MAJESTY'S STATIONERY OFFICE

1951

HOME OFFICE,

London S.W. 1

2nd April, 1951

*The Right Honourable Secretary of State  
for the Home Department*

SIR,

I have the honour to report that in obedience to your Order made under Section 14 of the Petroleum (Consolidation) Act, 1928, I have held an inquiry into the circumstances attending the accident which occurred as a result of an explosion and fire on the 2nd February, 1951, on the M.V. "Atlantic Duchess" whilst lying at No. 2 Jetty of the National Oil Refineries Ltd. in Queen's Dock, Swansea in the County of Glamorganshire. In carrying out my inquiry, I was assisted by Mr. A. H. Wilson, Senior Engineer Surveyor, of the Ministry of Transport.

By this accident seven lives were lost, and fourteen persons were injured, namely:—

**Killed and missing**

S. Loskis	...	Chief Officer, M.V. "Atlantic Duchess"
D. Callinicos	...	Senior Second Officer, M.V. "Atlantic Duchess"
F. Tzaratzouris	...	Junior Second Officer, M.V. "Atlantic Duchess"
P. Spanoroulos	...	Chief Engineer, M.V. "Atlantic Duchess"
E. Varoumas	...	Chief Steward, M.V. "Atlantic Duchess"
N. Mavridoglou	...	Pumpman, M.V. "Atlantic Duchess"
E. Foumelis	...	A.B. Seaman, M.V. "Atlantic Duchess"

**Injured**

Captain A. Tsesmelis		
Captain M. Kaminis		M.V. "Atlantic Duchess"
I. Fikaris	...	Wireless Operator, M.V. "Atlantic Duchess"
Mr. K. E. Johansen		Swedish Technician, M.V. "Atlantic Duchess"
Mr. John Bookis	...	London Agent's Representative
Mr. J. O. Lumsden	...	Builder's Representative
H. G. H. Davies	...	Leading Fireman, Swansea Fire Brigade
J. Neill	...	Fireman, Swansea Fire Brigade
A. J. May	...	Fireman, Swansea Fire Brigade
G. F. Collerton	...	Fireman, Swansea Fire Brigade
T. A. Walkey	...	Fireman, Swansea Fire Brigade
E. R. Gabriel	...	Fireman, Swansea Fire Brigade
R. T. Daniel	...	Fireman, Swansea Fire Brigade
H. Downing	...	Fireman, Glamorgan County Fire Brigade

**Description of the Vessel**

The "Atlantic Duchess" was a motor ship constructed to carry petroleum in bulk. Registered dimensions were 479·8 feet in length, 62·8 feet in breadth and 35·3 feet in depth. Gross tonnage 8798·73. Machinery of 4720. B.H.P. and two cylindrical, multitubular, single ended marine type boilers were situated at the after end of the ship. Port of registration Monrovia (Liberia).

She was built by William Gray and Co., Ltd., West Hartlepool in 1950 and fully classed in Lloyds Register. The vessel was owned by the Atlantic Oil Carriers, Ltd., Liberia. The London Agents for the owners were Messrs. S. Livanos & Co., Bevis Mark House, London, E.C.3. The vessel was fitted with 9 tanks each of which was divided into three compartments. Each main compartment was situated in the centre and the other two compartments were on the port and starboard sides, so that there were 27 compartments in all. The skin of the vessel formed the outside wall of the wing tanks. The capacities of each of the tank compartments were as follows:—

No. of Tank	Capacity in cubic feet		
	Port Compartment	Centre Compartment	Starboard Compartment
1	10,815	35,560	10,185
2	14,500	34,960	14,500
3	15,930	34,765	15,930
4	16,135	34,855	16,135
5	21,555	41,230	21,555
6	18,860	34,765	18,860
7	16,070	34,765	16,070
8	15,620	34,855	15,620
9	14,280	34,765	14,280

Total cubic capacity of all compartments=608,050 cubic feet.

Each centre compartment was fitted with two 10 inches diameter pipes and each wing compartment with one 10 inches diameter pipe, connected to two fore and aft pipe lines through valves which were so arranged that any compartment could be filled or emptied by opening or closing the appropriate valves operated from the deck immediately over each compartment. Heating coils were fitted in each compartment, and main hatches to each compartment were situated on the deck in the open.

A gas vent pipe was attached to each main hatch, and the three gas vent pipes from the three main hatches of the three compartments of each tank were connected to a common line, which was connected through a "Tiros" valve to a common vent pipe which ran fore and aft along the centre of the deck and terminated in a flame trap near the top of the mast. The deck fore and aft vapour pipe was in two sections, the forward section served tanks Nos. 1, 2, 3 and 4 and the outlet pipe from this was led up the foremast, the after section served tanks No. 5, 6, 7, 8 and 9 and the outlet pipe from this was led up the mainmast.

The "Tiros" valves were stated to open and discharge vapour into the common vent pipe when the pressure in the tank compartments rose above 3 lbs. per square inch above that of the atmosphere, and similarly when the pressure in the tank compartments fell to about 1 lb. per square inch below that of the atmosphere they admitted air into the tank compartments. This would cover the operation of filling and emptying the tank compartments. A valve was provided at each main hatch where the gas vent pipes were attached so that any gas vent pipe could be isolated from the common vent pipe running along the centre of the deck and from the other two compartments of the tank.

Each tank was provided with a Butterworth hatch in the deck for the insertion of the Butterworth cleaning system. A blue-print of the hatch is contained in plan A attached\*. This opening consisted of a short metal cylinder about 18 inches in diameter, the top of which was about 12 inches above the deck.

\*Plans A, B and C are contained in a pocket in the back cover.

The top of the cylinder was covered with a metal plate in which an ullage plug, about 6 inches in diameter, was screwed. These openings were not protected by wire gauze. Each tank was also provided with a steam ejection pipe which could be used for sounding the tanks. Tanks No. 4, port, centre and starboard had sounding pipes with screwed plugs flush with the deck. No arrangement was made for dipping the tanks from the main hatches.

The Officers' accommodation was situated amidships and was immediately over the greater part of Nos. 4 and 5 tanks (centre, port and starboard compartments). The main deck space below the bridge accommodation (known as the centre castle) was enclosed by plating all round. In the port wing were situated the potato, flour, beer and dry provisions stores, and in the starboard wing were situated the carpenter's shop, deck store and lamp and paint room. The plating at the forward end was over No. 4 tank, and in the plating was fitted a door on the port side and a door on the starboard side. The plating at the after end was over No. 5 tank and a door was fitted in this on the centre line. The Butterworth hatch covers were fitted with ullage plugs and No. 4, centre, port and starboard tanks and No. 5 centre compartment were within this bridge space enclosure. The remainder of the Butterworth hatches were in the open. There was a pump room immediately aft of No. 5 tank and it contained two steam pumps for pumping oil or ballast. The pump room casing was on the middle line and about 18 feet abaft the after end of the centre castle. The crew accommodation, boiler room, engine room, engineers accommodation were situated aft and were separated from the bridge space by tanks Nos. 6, 7, 8 and 9. The tanks Nos. 1, 2 and 3 were forward of the bridge space. A general arrangement plan of the vessel is contained in Plan B attached. The Butterworth hatches are shown on this plan.

#### **Circumstances leading up to and attending the accident**

The M.V. "Atlantic Duchess" sailed from West Hartlepool for Abadan on her maiden voyage on the 30th November, 1950, where she loaded approximately 12,000 tons of lali butanised crude oil (flash point below 73° F.) for delivery to the National Oil Refineries, Limited. A copy of the laboratory report on the oil furnished by National Oil Refineries, Limited, is contained in Appendix 1 attached. She arrived at Swansea during the night of 29th January, 1951, and was finally berthed at No. 2 jetty, Queens Dock, Swansea, at 4.50 a.m. on the 1st February, 1951, with her port side to the jetty and her head towards the lock. The general arrangement of the jetties is shown in plan C attached. She carried a crew of about 35, but on this occasion a relief captain boarded the ship on her arrival at Swansea in company with Mr. Bookis, the London Agent's representative. In addition to the usual crew, Mr. J. O. Lumsden of the Central Marine Engine Works of William Gray & Co., Ship and Engine Builders, West Hartlepool, was also aboard as he was flown out to Abadan to supervise repairs to the engines which had developed faults on the outward journey, and further repairs were to be made in Swansea.

Mr. K. E. Johansen of the Nydgvist and Holm Company, Engine Builders, of Trollhøltan, Sweden, was also aboard supervising the overhaul of the engine.

As soon as the vessel was securely moored, W. H. James, Shift Supervisor, employed by the National Oil Refineries, Limited went aboard and handed the shore regulations to the Master. Arrangements were made for the representative of the National Oil Refineries, Limited, to take samples of the cargo, to measure the dips of the tank compartments in the tanker and to connect the cargo flexible hoses between ship and shore. The discharge of the cargo commenced at 5.35 a.m. on the 1st February, 1951, and finished at about

2.45 a.m. on the 2nd February. The flexible hoses were drained and disconnected and the shore lines blanked off at about 3.30 a.m. on the 2nd February. During this period at about 2.30 a.m., W. H. James with W. Thomas (Pumpsman dipper, employed by the National Oil Refineries, Limited) went aboard the tanker when they saw the two Captains, the mate and others. They inquired how long it would be before all the cargo would be pumped out, and the captain said in 15 minutes. They were then finishing pumping out tanks Nos. 5 and 9. W. Thomas dipped all the tanks, and an A.B., Nicolas Zoumidis went with them and removed the ullage plugs and replaced them giving them seven or eight turns, finger tight. Thomas did not notice whether the plugs were put back after he had carried out the dipping. During this visit the second mate informed James that they were going to take in ballast. James gave permission for this once they had broken the shore lines.

James left the ship at 3 a.m. and Thomas left before this as James had to get agreement about the quantity of sediment left in the tanks.

After the shore lines had been disconnected, at about 3 a.m., the ship's pumps were heard to be working by men on the jetty and they were presumably pumping in ballast.

During the discharge of the cargo it was stated that Captain Tsesmelis, Captain Kaminis and the Chief Officer, Mr. Loskis, were on duty. Mr. Loskis was supervising the discharge of the cargo from start to finish. When this was accomplished, and he had gone round with James to inspect the tanks, he went off duty, and the Senior Second Officer, Mr. Callinicos, supervised the ballasting of the ship, and he was ordered to put ballast into Nos. 1, 3, 5 and 7 centre tanks. The two Captains retired after they heard the pumps commence ballasting, and they went to bed between 3 a.m., and 4 a.m. The members of the crew left on duty to ballast the tanks were as follows:—

Senior Second Officer	...	Mr. D. Callinicos
Pumpsman	... ..	N. Mavridoglou
A. B. Seaman	... ..	E. Foumelis
A. B. Seaman	... ..	J. Kalogerou

Kalogerou stated that he came on duty at 4 a.m., on the 2nd February, 1951, and that water had been pumped into No. 1 centre tank by 4 a.m. They filled No. 3 centre tank with water; and then started to fill No. 5 centre tank. He said he watched them testing the tanks with a stick about 6 feet long marked with a cross. They were dipping the stick down the tank every five minutes, and whilst they were dipping, the ullage plug was off the whole of the time.

Mr. Callinicos used an electric torch while taking the dips, and this torch was about 6 or 7 inches long and was provided with a rubber sleeve. The ullage plug to No. 5 centre tank was removed and at about 4.55 a.m., he left the other three members of the crew standing on the deck, underneath the Captain's bridge, near No. 5 tank and went aft to get a drink of water. He estimated that by this time they had been working on this tank for 3-5 minutes. About a minute later, when he was in the mess room, he heard an explosion. He ran towards the officer's quarters and saw a fire burning on the starboard side underneath the Captain's bridge near where he had seen the three men standing.

There seems to be no doubt that there were two explosions, and the second explosion was louder than the first, and the interval between the two explosions was a few seconds. According to most observers the flash was seen to come from the starboard side of the bridge structure and the flames were at the base of the bridgework. According to a member of the crew on duty in the

engine room the explosion occurred at 5 a.m. on the 2nd February. There was a light wind from the south-east recorded from midnight on Thursday, the 1st February, 1951, and this continued throughout the day of the 2nd February.

### Result of the explosion

The fire brigade arrived at Queen's Dock at approximately 5.10 a.m., and by 8 a.m. the fire was under control and a search was made for the missing members of the crew. The remains of seven bodies were recovered, only one of which was identifiable. The others were quite unrecognisable and were a burned indeterminate mass.

At approximately 10.25 a.m., on the 2nd February, a further explosion occurred in No. 5 centre tank compartment, and as a result of this explosion six members of the Swansea Fire Brigade were injured. The vessel had developed a list of approximately 16 degrees to port, and on dipping the tanks to ascertain the quantity of ballast they contained, it was found impossible to reach the bottom of the tanks. Accordingly the ullage, the depth from the tank contents to the cover of the main hatch, was measured. All measurements were taken from similar positions at each main hatch cover. Nos. 4 and 5 tanks could not be examined since the damaged superstructure of the vessel had collapsed on the tank hatches. The measurements together with the approximate quantity of water are given in the following table:—

Tank No.	Port		Centre		Starboard	
	Ullage	Equivalent quantity of water content	Ullage	Equivalent quantity of water content	Ullage	Equivalent quantity of water content
1	13' 10"	230 tons	18' 5½"	582 tons	Empty	Empty
2	16' 7"	271 tons	1' (dip)	22 tons	Empty	Empty
3	19' 8½"	306 tons	24' 9"	341 tons	Empty	Empty
4		Unable to examine		Open to dock		
5		Unable to examine		Open to dock		
6	Empty	Empty	Empty (small quantity of water due to steam condensation)		Empty	Empty
7	Empty		Empty		Empty	
8	Empty		Empty		Empty	
9	Empty		Empty		Empty	

These readings were taken after tanks 6, 7, 8 and 9 had been rendered gas free. The water had been pumped into Nos. 1, 3 and 5 centre tanks and the presence of water in Nos. 1, 2 and 3 port tanks is probably due to the fact that the cast iron lines in the tanks were fractured by the explosion wherever there was a turn or bend in the pipes and water had passed from the centre tanks to Nos. 1, 2 and 3 port tanks.

With regard to the vessel, the whole of the bridge accommodation was a complete wreck. The structure was severely damaged by fire and by the force of the explosion. The structure collapsed and little was left inside the accommodation except charred material and metal. Tanks 4 and 5 were severely damaged, and the port and starboard sides of No. 4 wing tanks were ripped open. The bulkheads were also severely damaged. It is not possible to assess the full extent of the damage until a complete survey has been made, but plates I—XI will give a general indication of the damage.

## Cause of the Accident

The cargo of oil had been discharged from the tanker and therefore the atmosphere in all the tanks would consist of a mixture of air and vapour from the oil, and would most probably have been explosive. The explosive limits of butane in air is from 1·6 to 8·5 per cent of butane, so that very little gas is required to render the atmosphere explosive. It is at this stage that the tanks are in a most dangerous state.

A.B. Seaman Kalogerou stated that from three to five minutes before he went away to get a drink, they had started to pump water ballast in centre tank No. 5, and the ullage plug in the Butterworth hatch to this tank had been removed. As soon as water was pumped into No. 5 centre tank some vapour in this tank would be displaced into the centre castle under the officers' accommodation, through the ullage plug hole to No. 5 centre tank situated near the fresh water tank.

The vapour would not go through the vent pipe up the mast as it would have to overcome the pressure of 3 lbs. per square inch to pass through the "Tiros" valve. It is therefore clear that this space could soon be filled with an explosive mixture. In order to fire this mixture it is only necessary to produce some source of ignition, such as a spark or naked light of some kind. When the vessel was inspected after the explosion not only was there no ullage plug in the Butterworth hatch No. 5 centre tank, but there was also no ullage plug in the Butterworth hatches on No. 5 port tank or No. 4 port tank. We were informed that when preparations were being made to gas free the tanks, there was no ullage plug in the Butterworth hatch in No. 3 centre tank, and that the ullage plug in No. 8 port tank was also missing. These two plugs were replaced. It was thought that the ullage plug from No. 8 port tank was knocked out of its hole by projected debris from the explosion.

According to the information received from Lloyd's Register of Shipping, the 'tween deck space above tanks 4 and 5 and underneath the Officers' accommodation was provided with flame proof electric lighting, but that the other electrical fittings, such as switches, were either in the open or in the accommodation over the space. On the deck above this space ordinary commercial electrical fittings were provided.

The Shipbuilders stated that the electric lighting installed in the Officers' accommodation amidships consisted of ordinary Roanid light fittings, non-flameproof double pole switches and Siemens' Zed type cartridge fuses. The cables were vulcanised indiarubber, lead covered.

The electric lighting within the centre castle, the space immediately under the accommodation, consisted of Dorman Smith fixed ceiling type flame-proof fittings—certificate No. F.L.P. 1646. There were no switches, fuses or junction boxes in this space and all cables were vulcanised indiarubber, lead covered, single wired armouring run on open trays. All cables passing through the lower bridge space to the officers' accommodation passed through packed glands. The only portable lamps that they supplied to this ship were battery lights for secondary lighting in passengers' and officers' rooms. These were supplied by Messrs. Eli Griffith & Sons, Ltd., Birmingham and they were approved by the Factory Department of the Ministry of Labour and National Service for use in atmospheres containing petroleum and acetone vapours.

Subsequent to the explosion a non-flameproof electric torch was found on the deck in a broken condition together with two pieces of a blue jacket, with merchant service buttons on them. The body of the torch was found about four feet forward of the pump room ventilator on the port side and about



PLATE I. *Stern view.*

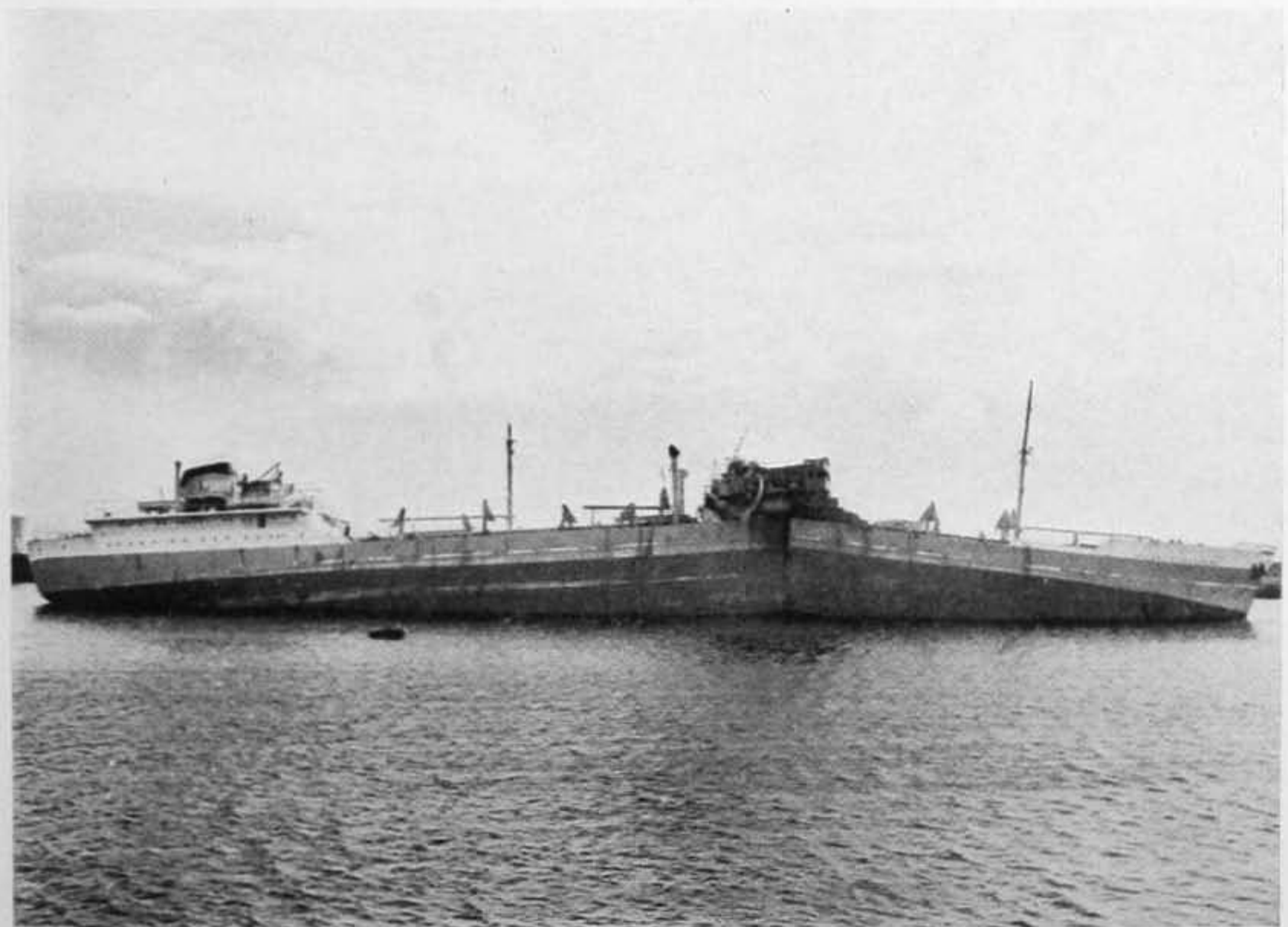


PLATE II. *General view, Starboard side.*

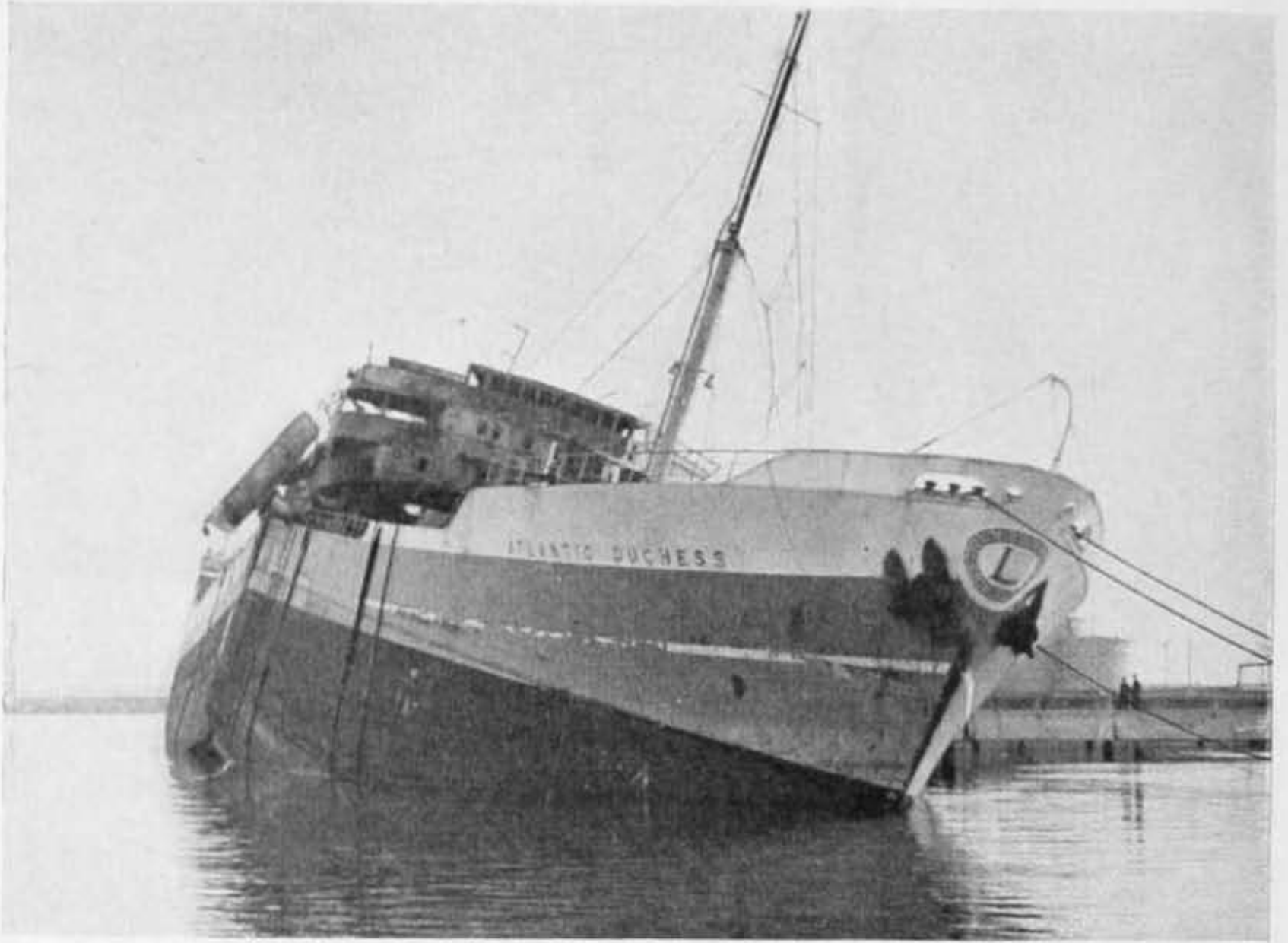


PLATE III. *View starboard side looking aft.*

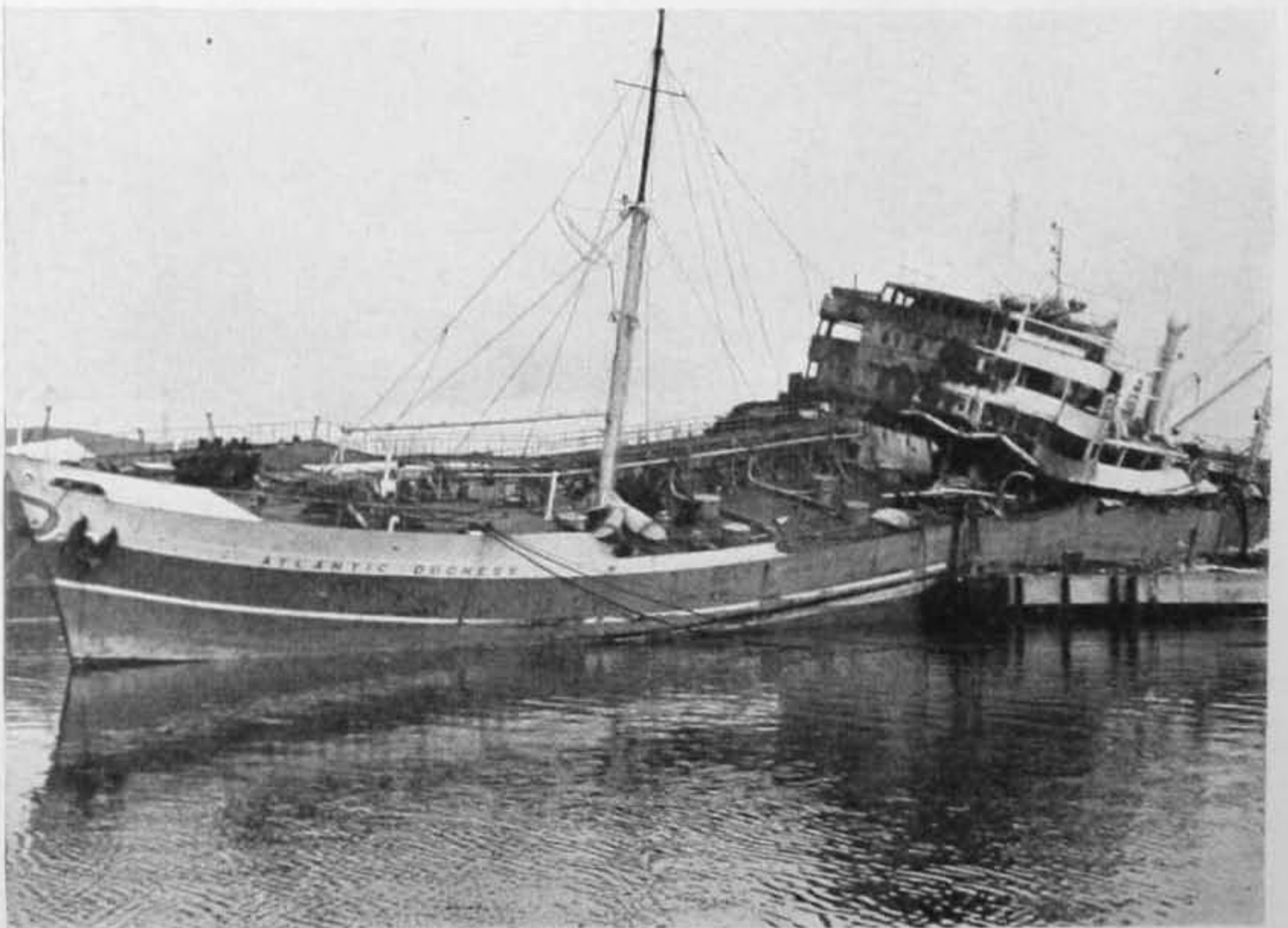


PLATE IV. *General view, port side.*



PLATE V. *View of centre castle and jetty head (port side).*

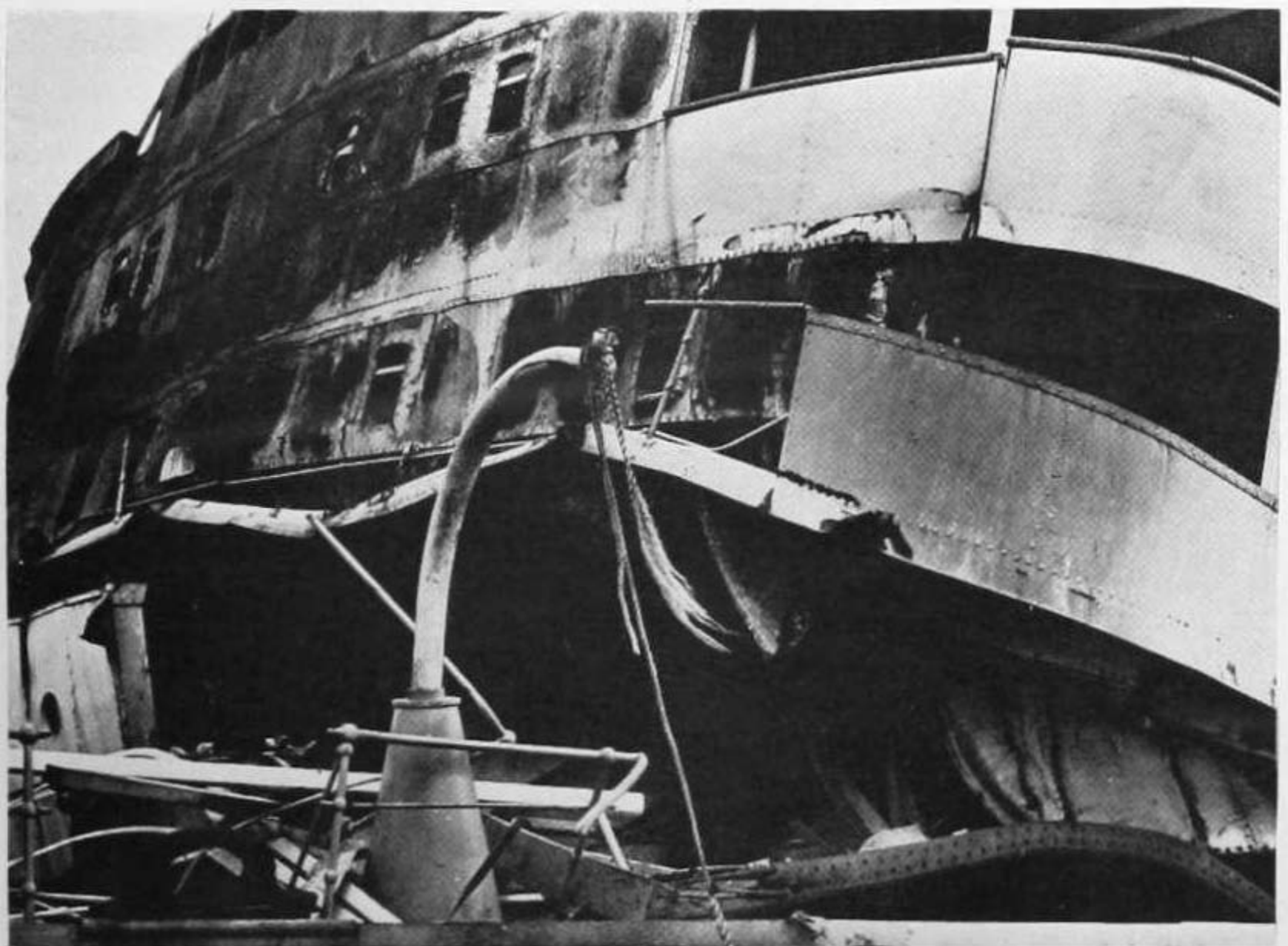


PLATE VI. *Three-quarter front view on port side of centre castle.*

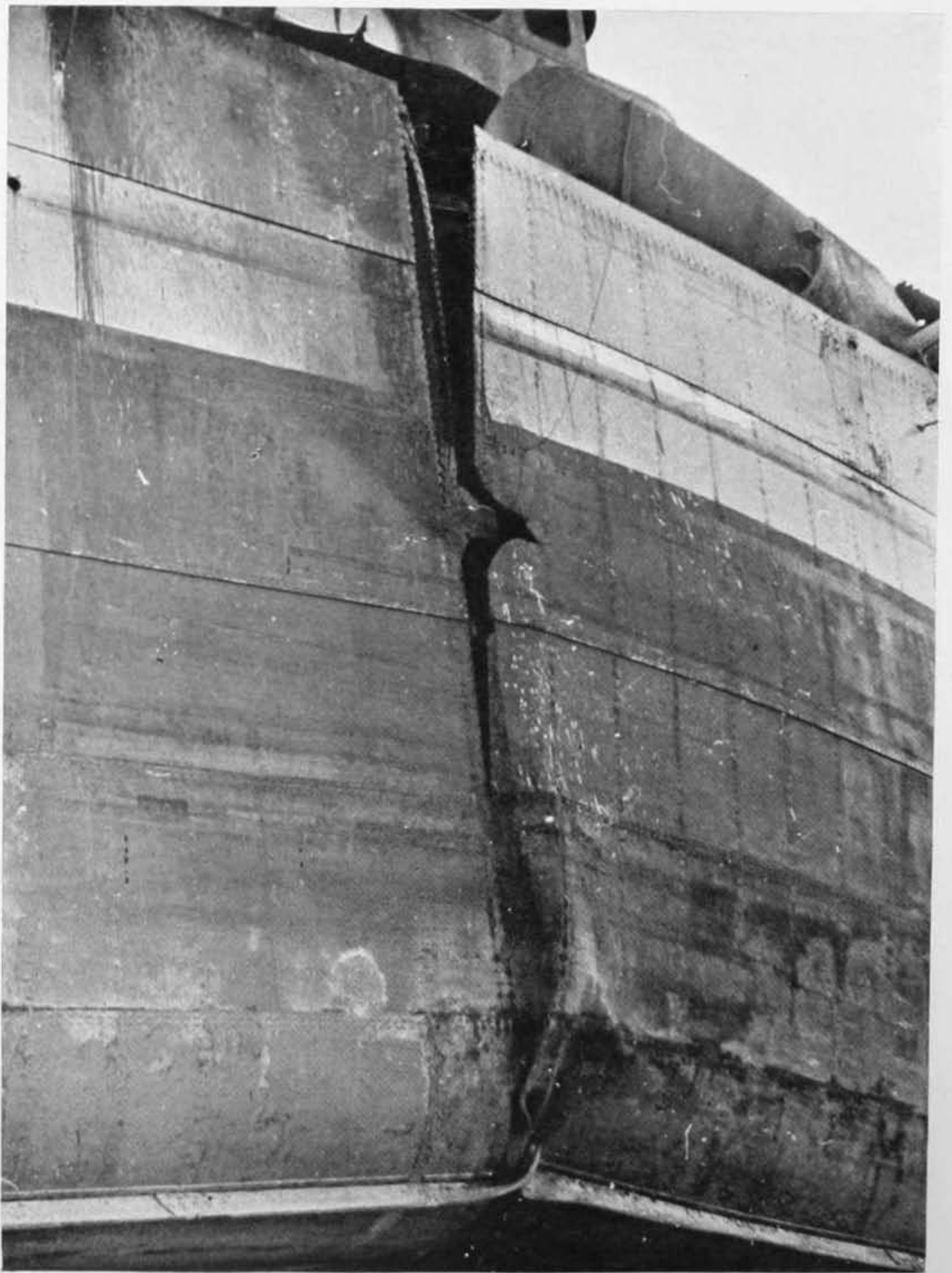


PLATE VII. *Break in hull, starboard side.*

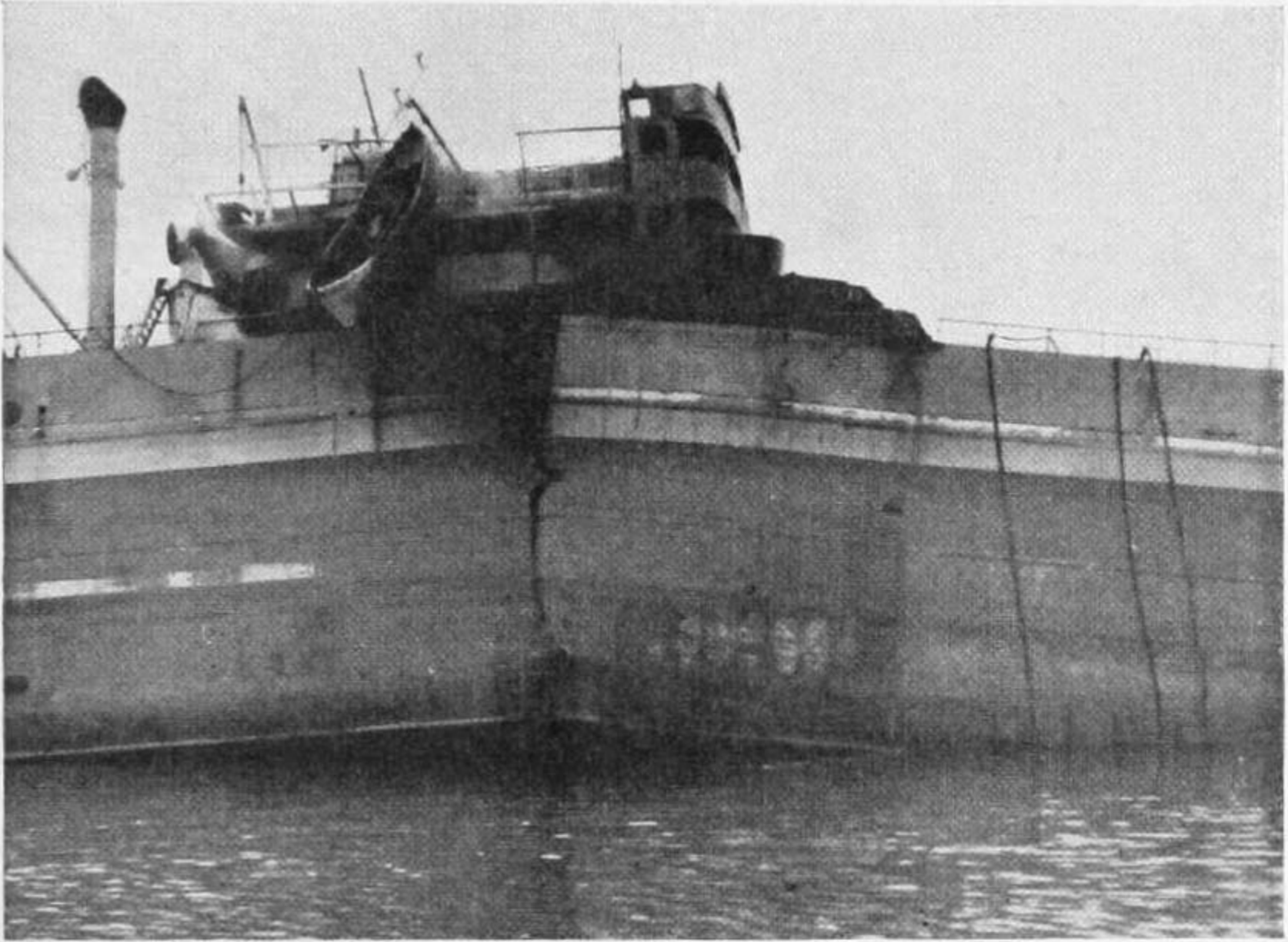


PLATE VIII. *Starboard side amidships, showing centre castle and break in hull.*

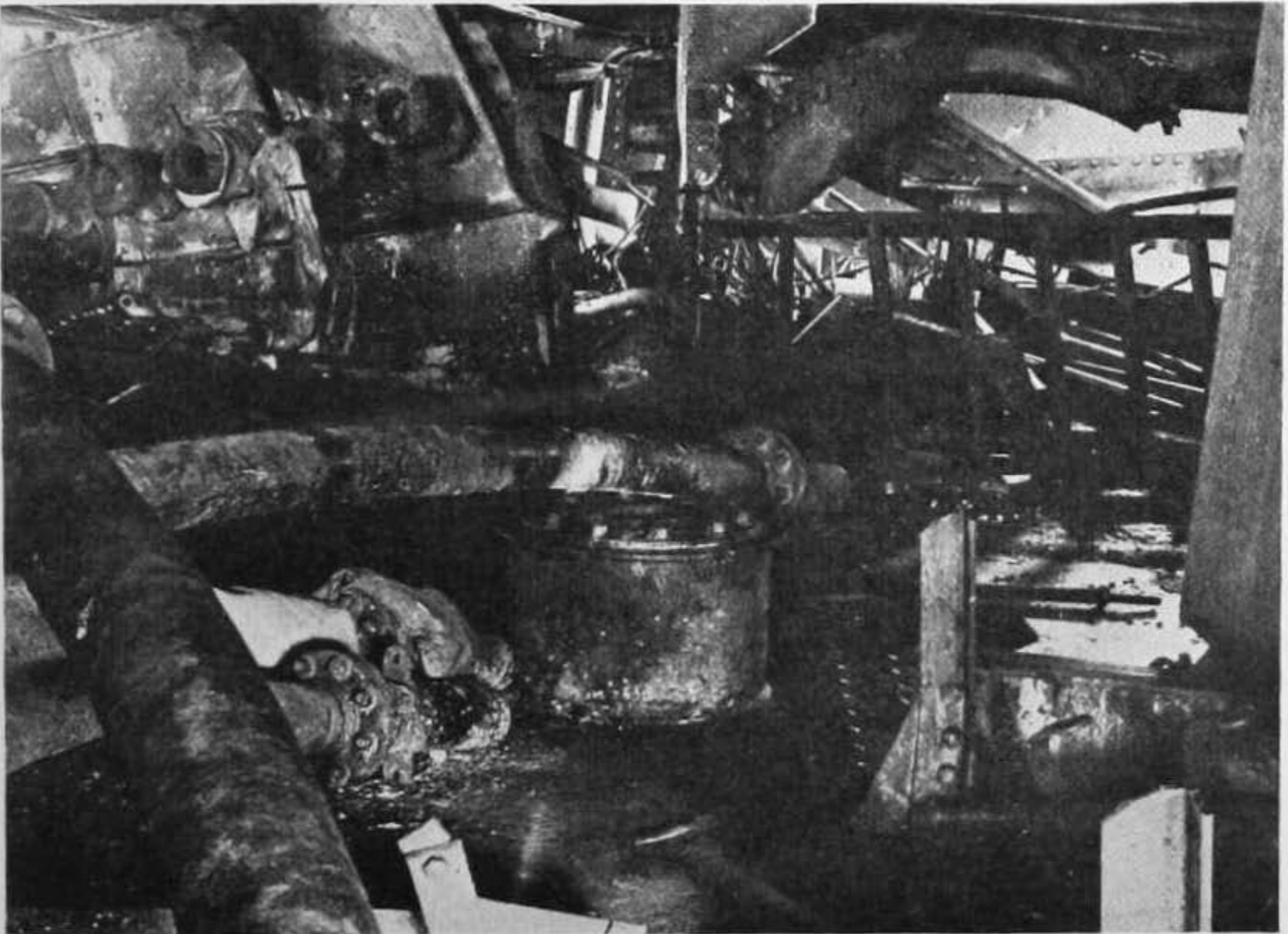


PLATE IX. *No. 5 centre ullage chamber with missing cap ; also view of centre castle after bulkhead with steam and water line flanges. View taken looking aft.*

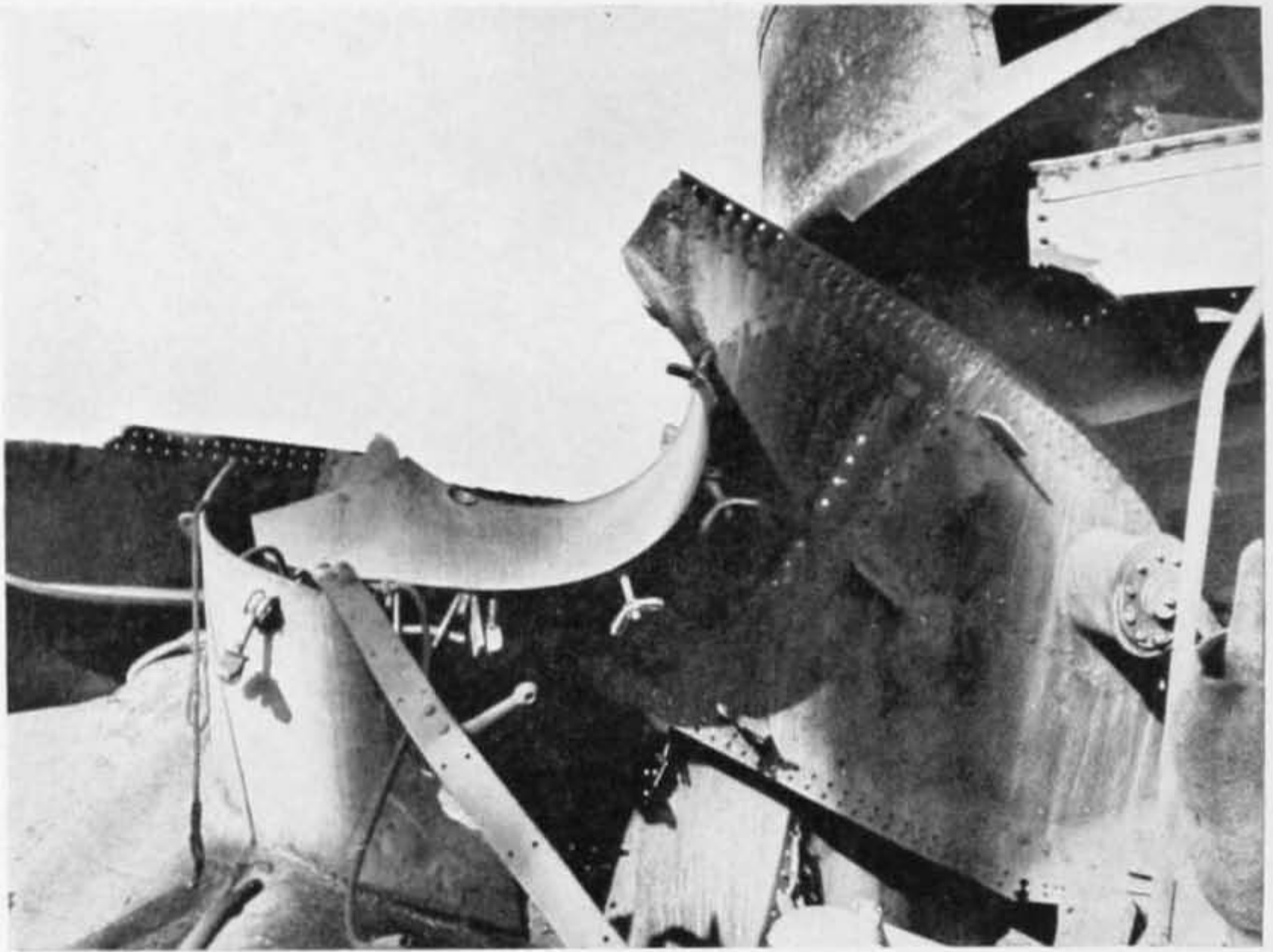


PLATE X. *No. 4 starboard wing tank—deck plates, hatch combing and ullage hatch and plug.*



PLATE XI. *Second view No. 4 wing tank—deck plates, main hatch combing, ullage chamber and plug.*

midway between No. 5 centre and No. 5 port main hatch combings. The reflector of the torch was found about one foot forward of the pump room bulkhead and about eighteen inches in from the port side of the pump room. This torch was marked "Ray-O-Vac" Pat. 1,774,722. This torch was not of flameproof construction and they are not on sale in this country. A new torch was obtained from America and the non-flameproof construction was confirmed. The remains of the torch were not recognised by Captain Tsesmelis or by Kalogerou. The latter, however, did recognise a Vidor torch as having been used. This torch was provided with a rubber sheath but no claim is made to its being flameproof. Subsequently the remains of a flameproof lamp were found near No. 5 Butterworth hatch.

With regard to other possible sources of ignition, it is possible that the crew may have thought that as they had discharged the cargo there was no reason to observe all the necessary safety precautions that had been impressed upon them. They may have been ignorant of the fact that the tanks of the vessel were in a far more dangerous condition than when they are full of oil. It is just possible that someone may have been smoking, or a naked light may have been produced in some other manner.

Captain Tsesmelis stated that he had never before carried a cargo of Middle East crude oil. He also stated at the Inquest that no smoking was allowed in the Officers' quarters. It was only allowed in the smoking room in the aft part of the ship. I do not accept this statement, as a meeting was held on board the vessel on the 1st February, 1951, to discuss the damage sustained by the vessel in the bows when entering Swansea Docks on the 30th January, 1951. At this meeting smoking took place in the Master's Office amidships. The room became hot and as someone made a move to open one of the windows the Master intervened and stated that it was not advisable to do so when discharging the particular cargo carried. This came to light after the adjourned inquest during the course of my inquiries.

Furthermore, the National Oil Refineries representative suspected that smoking was taking place, and they handed a letter on the 1st February, 1951, on the subject to a member of the crew who could speak English and requested him to take a letter to the Master. The allegation in the letter was not refuted. A copy of the letter is contained in Appendix 2 attached. It is not possible to say how the ignition of the vapour and air mixture was produced, but in view of the conditions prevailing in the ship it is quite easy to visualise how such an accident could occur. It is possible that the torch bulb was broken by accident or the ignition may have been produced in some other way. It is probable that the first explosion occurred in 'tween decks space and that this explosion either communicated to No. 4 tank through an open ullage hole in No. 4 tank (no ullage plug was present in the Butterworth hatch on No. 4 port tank and there was a sooty mark across the hatch), or fractured No. 4 tank and the contents of this tank then exploded and formed the second and more violent explosion.

It seems likely that the explosion in No. 4 tank communicated to No. 4 centre, port and starboard tanks, as the vapour line connecting these tanks was damaged.

It is possible that the intensity of the fire in the Officers' accommodation may have been due to the presence of gas displaced from No. 5 centre tank, but against this Captain Tsesmelis stated that the mechanical ventilation in the Officers' accommodation was working during the night prior to the explosion.

The third explosion, which occurred at about 10.25 a.m. on the 2nd February took place in No. 5 tank and as a result, the hatch cover over No. 5 centre hatch was blown off. It is possible that the oil vapour air mixture in this tank was ignited by some burning material immediately above this tank, or one of its compartments.

## OBSERVATIONS

In view of the fact that smoking took place on the vessel whilst she was in the harbour and during the discharge of the petroleum spirit, and also that non-flameproof torches were being used whilst the tanks of the ship were not closed and had not been rendered free from inflammable vapour, it would appear that there had been a breach of regulations 7 and 8 (1) of the Petroleum Spirit in Harbours Order, 1939 (S.R. & O. 1939 No. 1180). The National Oil Refineries Ltd. have drawn up regulations for loading and discharging petroleum and its products at Queen's Dock, Swansea. A copy of these regulations is contained in Appendix 3 attached.

These regulations are excellent but unfortunately they do not have the force of law.

## RECOMMENDATIONS

1. The Harbour Authority have made Harbour Byelaws under the Petroleum Acts, 1871 to 1881 and under the Harbours, Docks and Piers Clauses Act, 1847. At present these Byelaws are superseded to some extent by the Petroleum Spirit in Harbours Order, 1939, but this Order depends for its validity upon the Emergency Laws (Miscellaneous Provisions) Act, 1947, and thus might be brought to an end at any time. I therefore recommend that the Byelaws under the Petroleum Acts should be brought up to date and be made on lines of the Model Code of Byelaws issued by the Ministry of Transport; and that they should be made under the Petroleum (Consolidation) Act, 1928.

2. In the enclosed space under the officers' accommodation, Butterworth hatches provided with ullage plugs were fitted to No. 4 port tank, No. 4 centre tank, No. 4 starboard tank and No. 5 centre tank. I consider that these Butterworth hatches fitted with ullage plugs should have been in the open so that the displaced oil vapour is dissipated in the open air during the process of pumping ballast into the tanks. Furthermore, I consider that it would be better to fit the ullage plugs in the main hatches, otherwise this may give rise to the spillage of oil at sea due to the motion of the vessel if the ullage openings are used when the tanks are loaded with oil. I recommend that consideration be given to this point by the owners of the vessel, and also by the firms who build petroleum tankers.

3. I recommend that the attention of the owners of the vessel should be drawn to the notice issued by the Ministry of Transport to owners and Masters of Oil-carrying Vessels regarding the use of lamps. A copy of this notice is contained in Appendix 4 attached. Their attention should also be drawn to the provisions of the Petroleum Spirit in Harbours Order, 1939, particularly to the question of smoking on the vessel during the unloading of petroleum spirit.

## INQUEST AND VERDICT OF JURY

I attended the adjourned Inquest held at the Central Police Station, Swansea on the 28th February, 1951, by Mr. D. M. Clarke, Coroner for the County Borough of Swansea, to whom my best thanks are due for the facilities given to me to cross-examine the witnesses.

The Jury brought in a verdict of " Death due to multiple injuries caused by explosion and fire on board the ' Atlantic Duchess ' . There is no evidence to show what caused the explosion and fire " .

In conclusion I would express my thanks to Mr. A. H. Wilson, Senior Engineer Surveyor, Ministry of Transport, the Chief Constable, Swansea Borough Police, the Chief Officer, Swansea Borough Fire Brigade, Mr. Southall, National Oil Refineries, Lloyd's Register of Shipping, William Gray and Company Ltd., for the assistance they have rendered me in carrying out my inquiry.

I have the honour to be, Sir,

Your obedient Servant,

H. E. WATTS,

H.M. Chief Inspector of Explosives.

APPENDIX 1

NATIONAL OIL REFINERIES, LIMITED, LLANDARCY  
LALI CRUDE (BUTANISED) IMPORTED

TANKER ... ..	m.v. "ATLANTIC DUCHESS"
Arrival ... ..	31st January, 1951.
Quantity received ... ..	11,938.79 tons.
Specific Gravity @ 60° F. IP. 59/49 ... ..	0.8335
Water Content % AIOC. 56/39 ... ..	Trace.
Sediment by Extraction % IP. 53/42 (T) ... ..	Trace.
Sulphur Content % IP. 61/49 ... ..	0.84
R.V.P. lbs./sq. inch IP. 69/45 ... ..	10.7
H <sub>2</sub> S Content grms. wt. % Sunbury Report No. 4047 ... ..	0.012
<i>Distillation Preliminary</i> IP. 24/44 ... ..	
I.B.P. °C. ... ..	24
% recovered at 50°C. ... ..	3.5
" " " 75°C. ... ..	7.5
" " " 100°C. ... ..	10.5
" " " 125°C. ... ..	15.0
" " " 150°C. ... ..	20.5
" " " 175°C. ... ..	27.0
" " " 200°C. ... ..	32.0
" " " 225°C. ... ..	37.0
" " " 250°C. ... ..	42.0
" " " 275°C. ... ..	47.5
" " " 300°C. ... ..	55.0
Specific Gravity @ 60° F. distillate ... ..	0.776
% Residue (vol.) ... ..	42.0
Specific Gravity @ 60° F. residue ... ..	0.930
Loss, % ... ..	3.0
Room Temperature, °F. ... ..	60
Barometric Pressure, inches ... ..	28.61
<i>Podbielniak Analyses:</i>	
Ethane, % wt. ... ..	—
Propane, % wt. ... ..	0.17
Butane, % wt. ... ..	5.94

## APPENDIX 2

NATIONAL OIL REFINERIES, LIMITED,  
BRITANNIC HOUSE,  
LLANDARCY, NEATH, GLAM.

*The Master,*  
*" Atlantic Duchess "*,  
*No. 2 Jetty,*  
*Queen Dock.*

Dear Sir,

It has been reported that there is smoking taking place aboard your vessel. Will you kindly stop this immediately and conform with the Port Regulations.

I remain, Dear Sir,

Yours faithfully,

(Sgd.) DALRYMPLE.

Wharf Superintendent,

For General Manager,

National Oil Refineries, Ltd.

This letter was handed to a man on board who could speak English, on Thursday, 1st February, 1951.

## APPENDIX 3

NATIONAL OIL REFINERIES, LIMITED

### *Regulations for Loading and Discharging Petroleum and its Products at Queen's Docks, Swansea*

1. That part of the water surface of the Queen's Dock which is within the zone of the Company's operations is declared a DANGER ZONE, such zone being within 300 feet of any vessel loading or discharging petroleum and its products or discharging or taking in ballast.

**SMOKING** is strictly prohibited

(a) on all craft within that zone which have or have had on board oils having a flash point below 150° F. and are not gas-free, and

(b) on shore inside the fenced area, except in those places specifically set aside for that purpose in the shore quarters.

OFFENDERS against this regulation will be PROSECUTED and in the case of A.I.O.C. (or Subsidiary Companies') employees summarily DISMISSED.

2. No ashes must be discharged overboard inside the Queen's Dock.

3. No hand or portable lamps, electric or otherwise, except of a type to comply with British Classification Societies' requirements, or those approved by the Home Office for use in fiery mines, may be used on board or inside the fenced area.

4. STORES must not be unloaded from or taken aboard vessels whilst loading or discharging OILS HAVING A FLASH POINT LOWER THAN 150° F.

5. No naked lights or fires other than those for power purposes will be allowed on any ship alongside a jetty, unless permission has been given by the Company's Wharf Superintendent. Galleys for cooking purposes are provided ashore for the personnel of tankers loading oils having a flash point lower than 150° F. or as otherwise directed.

6. Tankers lying alongside the jetties must display the following signals:—

(a) when actually loading or discharging petroleum or its products having a flash point lower than 150° F.

1.—in daytime, a red flag with white disc to be flown on the foremast.

2.—in hours of darkness, a red light to be displayed visible all round the horizon and suspended not less than 20 feet above the deck.

In such circumstances no craft (except in emergency tugs to assist) to be permitted to approach within 100 feet.

(b) when the loading or discharging of petroleum or its products having a flash point lower than 150° F., is completed and pipelines have been disconnected and blanked off.

1.—in daytime, the red flag with white disc to be flown from the triatic stay amidships.

2.—in hours of darkness, a white light to be suspended 6 feet below the red light and to be similarly visible all round.

In these circumstances authorised craft such as tugs, stores launches, etc., may proceed alongside.

7. (a) All vessels coming within the Company's zone of operations must have efficient spark arrestors fitted to their funnels, and in the event of sparking being observed, steps must be taken to eliminate sparking even if it means temporarily extinguishing all fires under boilers.

(b) Any launch which comes alongside a petroleum ship or any of the jetties, must be equipped with adequate fire-fighting appliances and must not be left unmanned.

8. No craft is allowed to ply from any point in the docks to oil-carrying vessels moored to the oil jetties in the Queen's Dock without the permission of the N.O.R., Management, Marine Superintendent or Wharf Superintendent.

9. No person will be allowed inside the fenced area without authority. Ladies and children are prohibited from entering the fenced area except with a pass from the N.O.R., Management, Marine Superintendent or Wharf Superintendent.

10. No person shall carry into the fenced area matches or lighters or electric torches of unapproved pattern, and all persons entering the said area are liable to be searched for such articles.

11. Police have instructions to arrest any unauthorised person loitering in the vicinity of the Company's Jetties, Pumping Station, Storage Tanks or Pipelines.

12. REPAIR WORK on any SHIP discharging or loading petroleum or its products is prohibited unless permission is first obtained in writing from the Wharf Superintendent. On permission being granted, a list of names of shore workmen to be employed on the ship must be handed to the Wharf Superintendent.

Repair work on any JETTY or EQUIPMENT within the fenced area must not be commenced until covered by a fire permit issued by the N.O.R., Management.

13. Vessels loading petroleum or its products having a flash point below 150° F. must have all fires drawn before operations commence. No cleaning of boilers or boiler tubes will be permitted during loading.

14. Ship's scuppers must be effectively plugged. Leakage or spillage aboard ship must not be swept or washed overboard. Swabs used for mopping up spillage must be brought ashore for destruction in an incinerator erected outside the fenced area.

15. No ballast water which could possibly contain oil must be discharged from any vessel except through the oil and water separator installed on shore.

16. (a) All ships must be electrically earthed during loading or discharging.

(b) All pipes, joints, flexible hoses and other appliances must be free from oil leakages and must be adequately earthed.

(c) Before discharging or loading operations are commenced, the Ship's Master or his deputy and the shore official must see and note the position of all fire-fighting equipment aboard and check that the equipment is ready for immediate use.

(d) The Company's Fire Services Superintendent is authorised to visit any ship whilst alongside for the purpose of examining fire preventive apparatus.

17. Loading or discharging must not commence until:—

(a) The master or Chief Officer AND the Shore Supervisor have exchanged certificates to the effect that all necessary valves ashore and those essential aboard ship are open.

(b) The master or Chief Officer has ascertained and certified in writing that all ship's pumproom sea inlet valves are closed or blank flanged.

(c) The Master or Chief Officer has signed a certificate to the effect that the Company's rules are being observed.

18. Throughout the period of loading or discharging operations the following conditions will be strictly enforced:—

(a) A responsible ship's officer must be on watch on board and adequate crew must remain aboard to deal with emergencies.

(b) A responsible member of the ship's crew must be stationed by the ship's main control valves nearest the shore.

(c) A responsible member of the shore staff must stand by the valves at the shore end of the flexible pipes.

(d) Direct telephonic communication between jetty head and shore pumphouse must be in perfect working order.

19. After completion of loading or discharging, ships must not lie alongside the jetties longer than is necessary, and permission must be obtained from the Wharf Superintendent for any period in excess of twelve hours.

By Order,

(Sgd.) R. B. SOUTHALL,

General Manager.

LLANDARCY—October, 1948.

## APPENDIX 4

### NOTICE TO OWNERS AND MASTERS OF OIL-CARRYING VESSELS

#### *Use of Lamps*

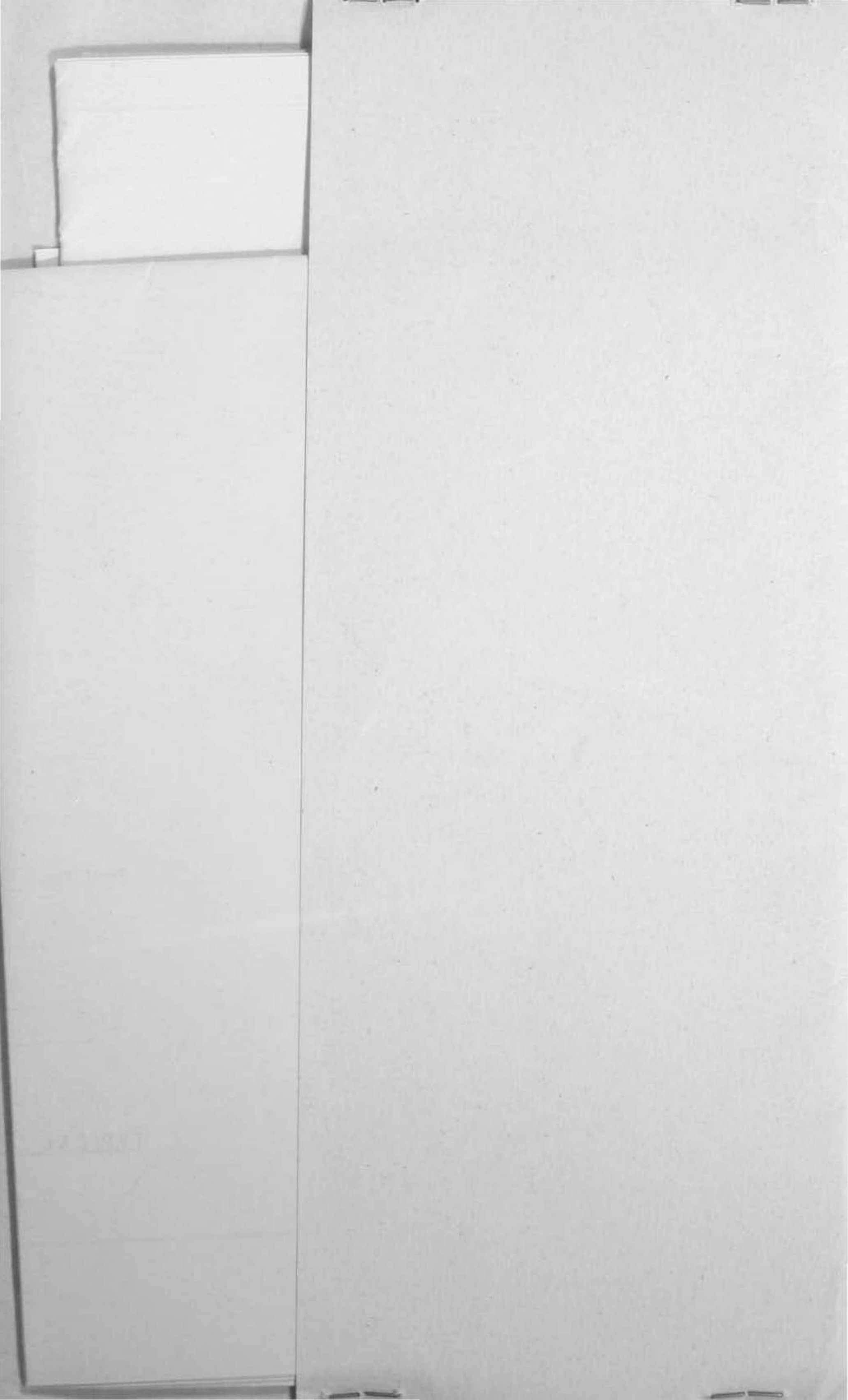
An explosion, resulting in the death of two members of the crew and serious injury to six others, occurred on a steamship discharging a cargo of petroleum spirit. The spirit was carried in tanks and during the discharge an electric lamp on a wandering lead was lowered into one of the partially discharged tanks. A few seconds after the light was lowered, the explosion occurred.

The Court which inquired into the casualty found that the lead was in reasonably good condition but the lamp was defective in that the wire cage originally fitted to the holder had fallen off or had been removed. The Court was unable to say whether the ignition was caused by a short circuit in the lead or by the fracture of the unprotected bulb, but it thought that the latter was the more probable.

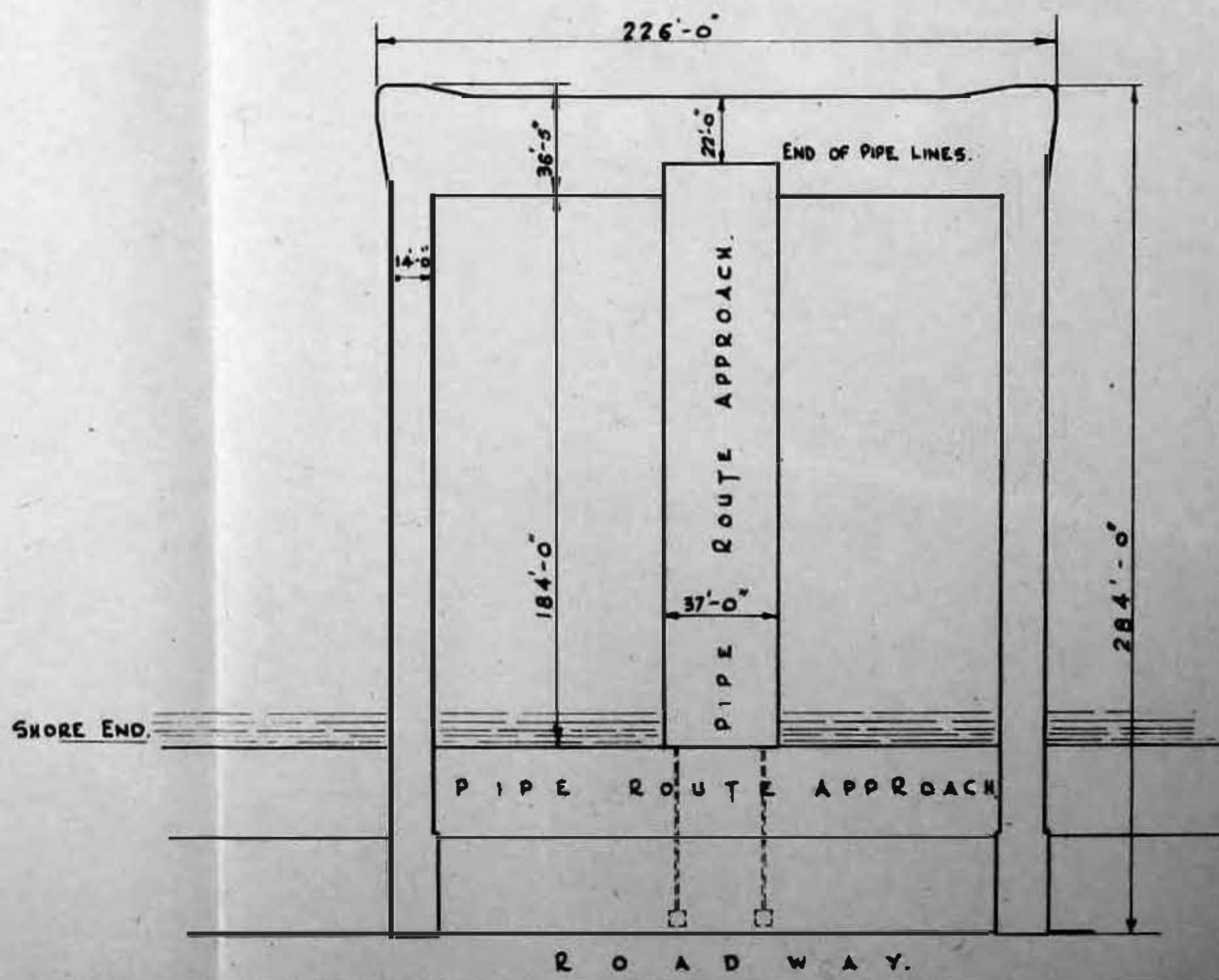
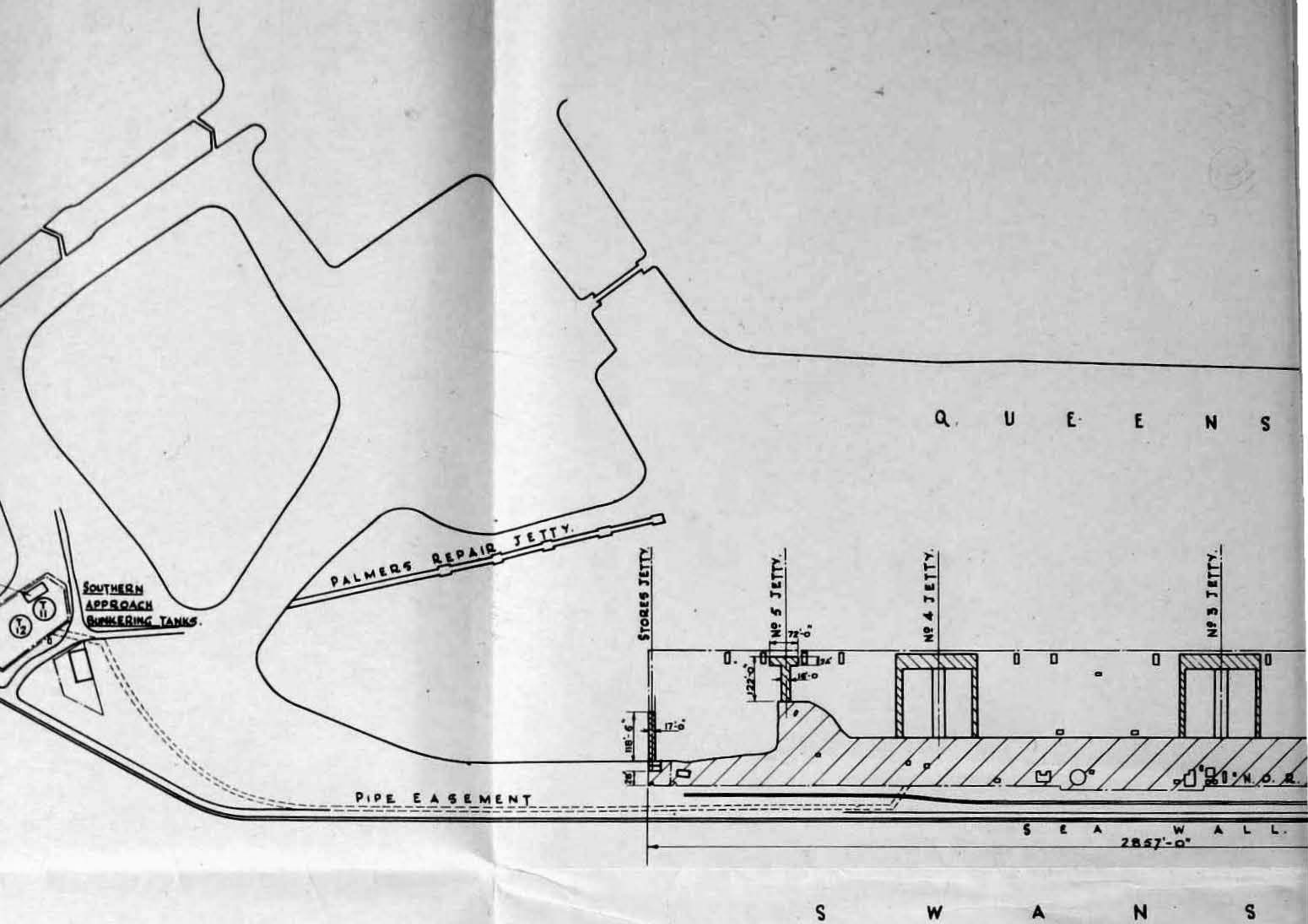
The Ministry desire to call attention of owners and masters of oil carrying vessels to the necessity for seeing that the electric lighting installation is maintained throughout in a satisfactory condition. Lamps and other fittings and the wiring leading thereto should be suitably protected, and every precaution should be taken to avoid the risk of explosion which may be caused by sparks from defective fittings and connections. Where it is necessary to introduce a lamp into a compartment, pump room, cofferdam or other enclosed space before it has been ascertained that the space is free of gas, only battery fed hand lamps of a type approved by the Home Office for use in fiery coal mines should be used. Ordinary portable lamps, such as pocket torches, and lamps attached to cables are unsuitable for use in dangerous spaces.

MARINE SAFETY DIVISION,

MINISTRY OF TRANSPORT.



# PLAN C

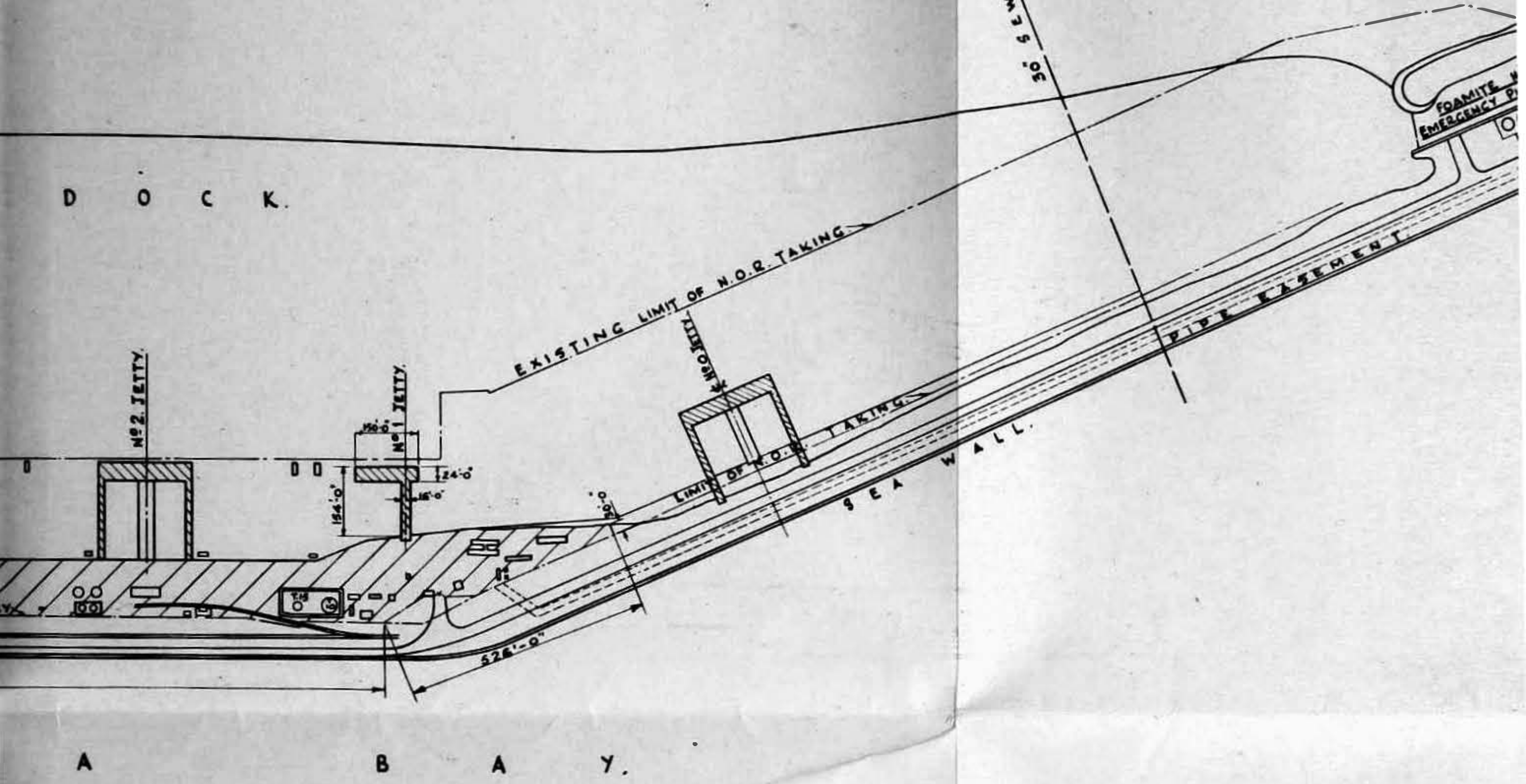


TYPICAL PLAN OF NEW CONCRETE JETTIES NOS 2, 3, 4.

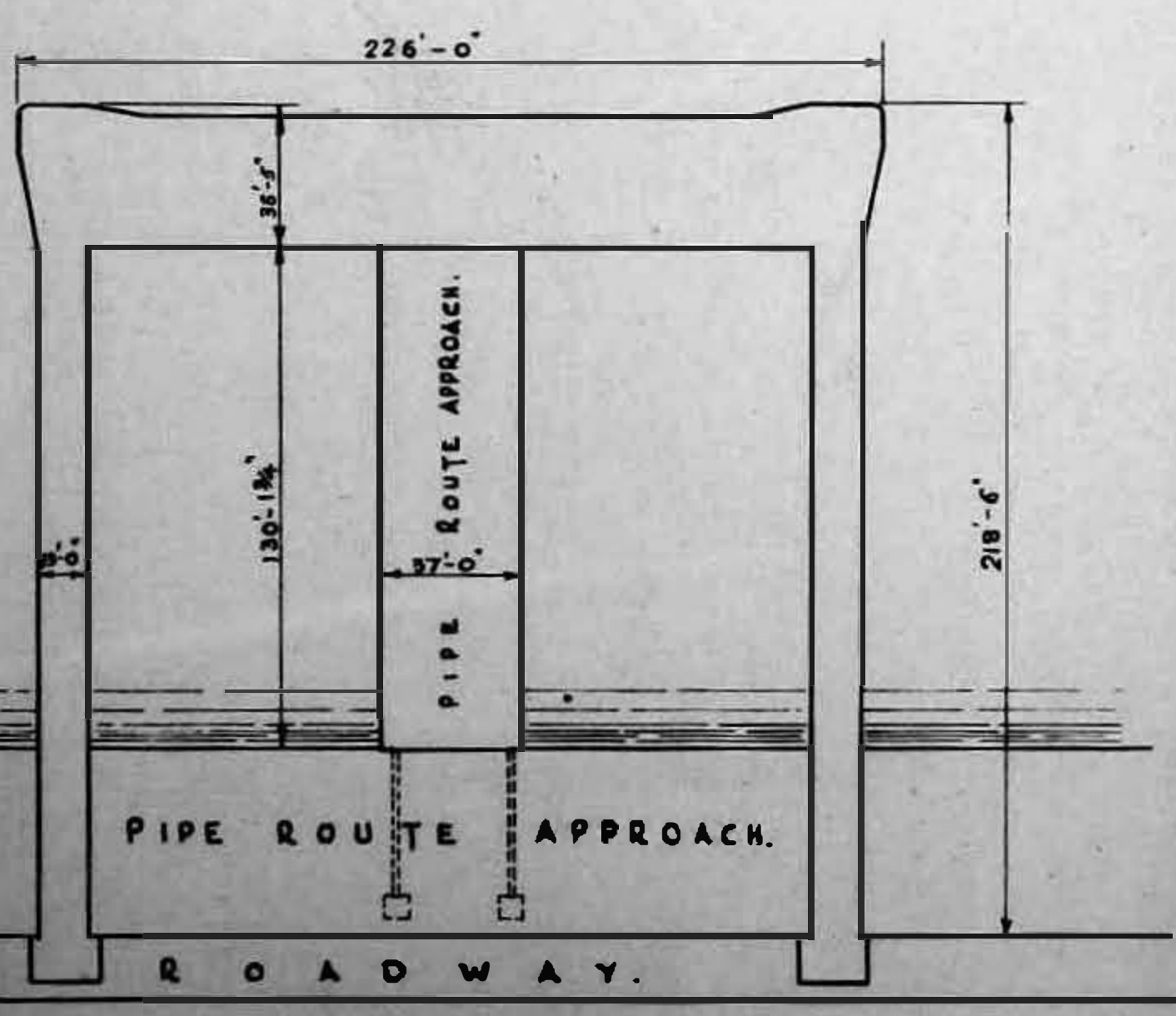
SCALE 80 FT TO 1 INCH.



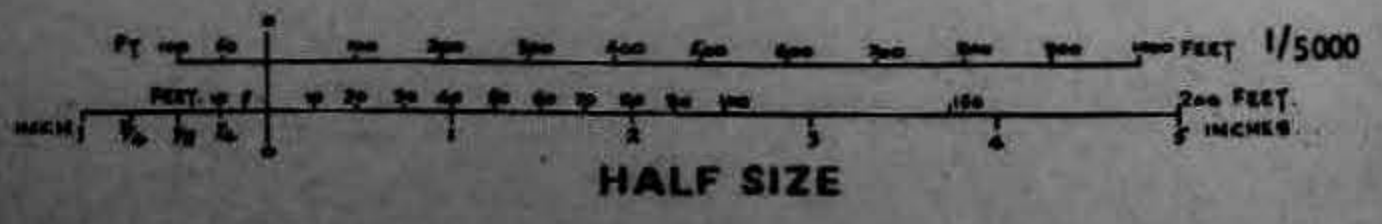
D O C K.



A B A Y.

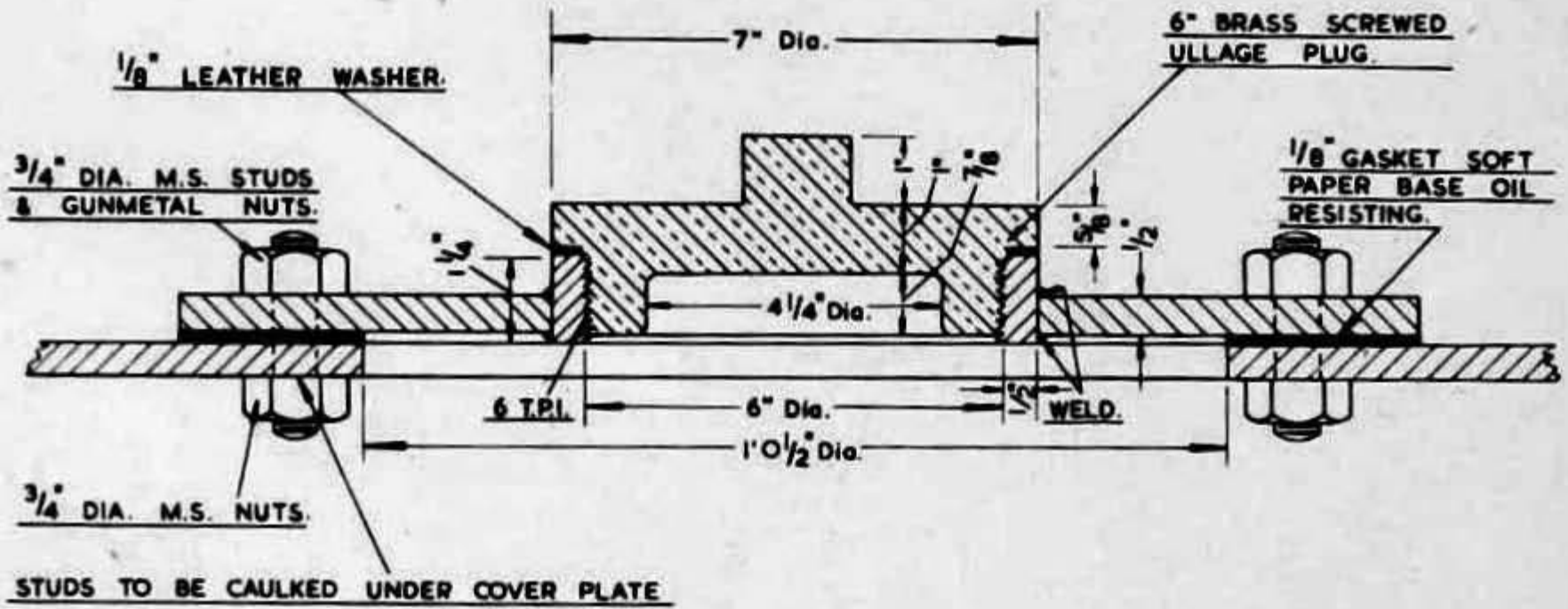


PLAN OF NEW CONCRETE JETTY NO. 0.  
 SCALE 80 FT TO 1 INCH.

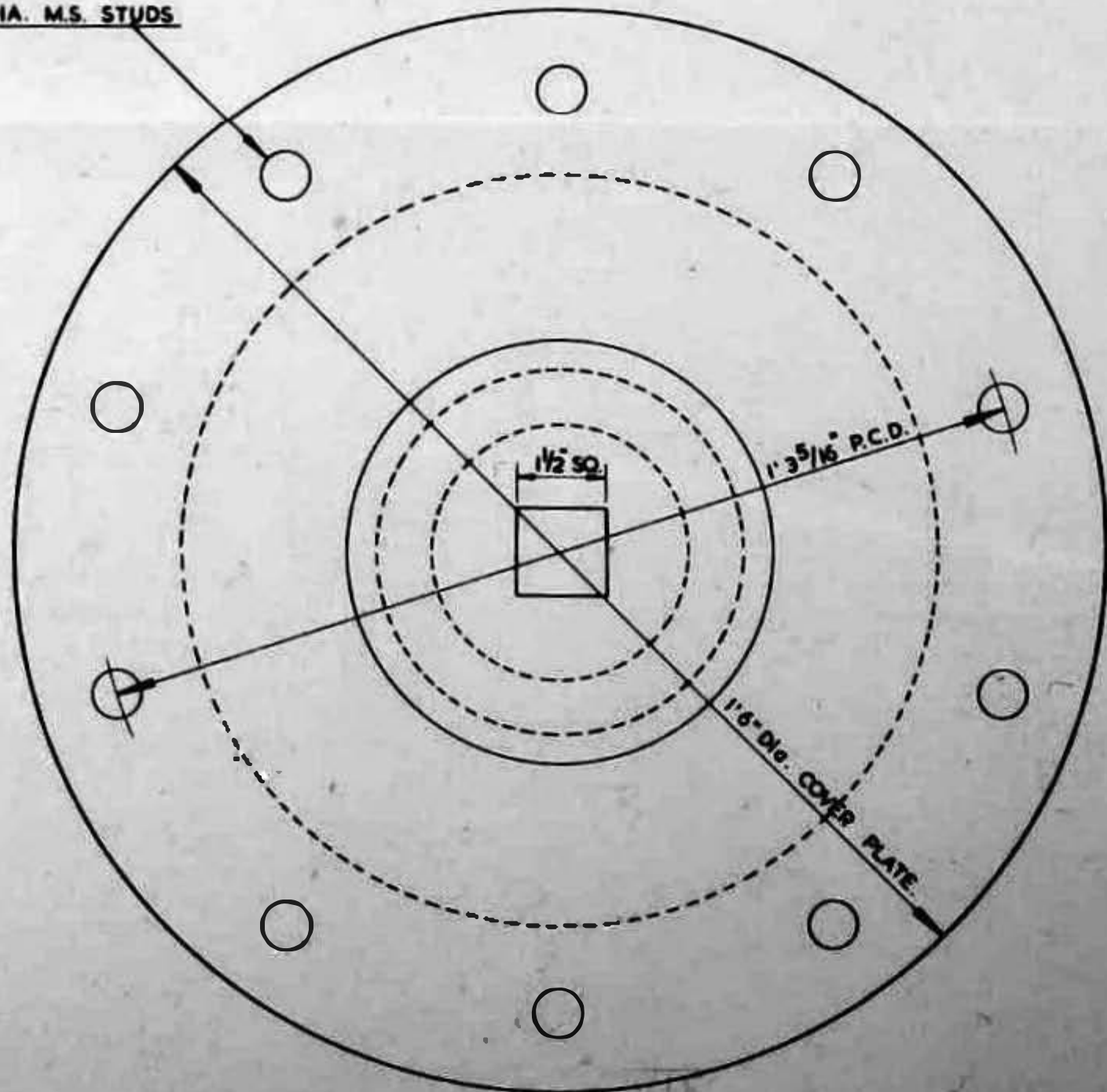


# PLAN A

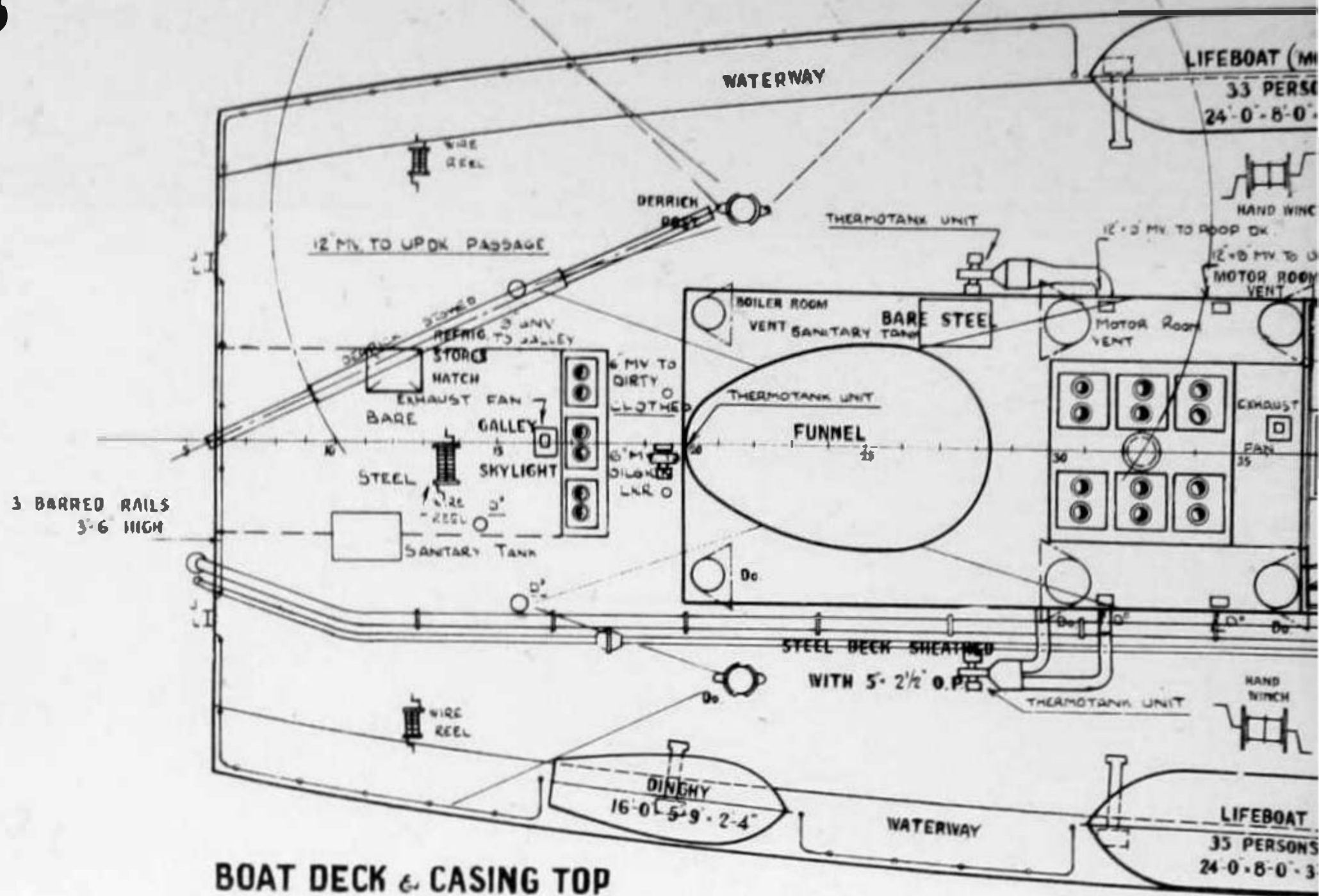
## DETAIL OF ULLAGE PLUG & COVER PLATE



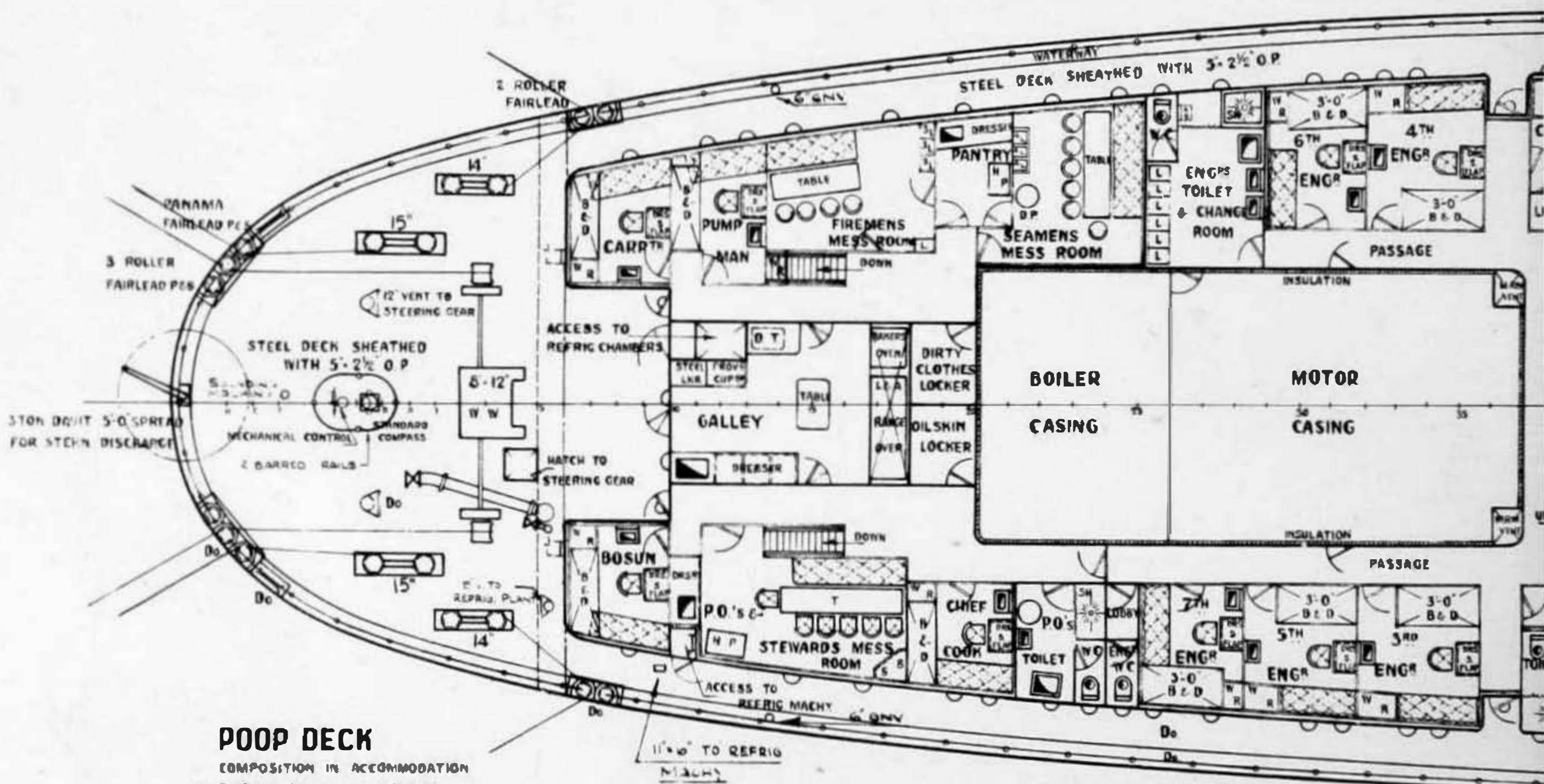
10 - 3/4" DIA. M.S. STUDS



# PLAN B



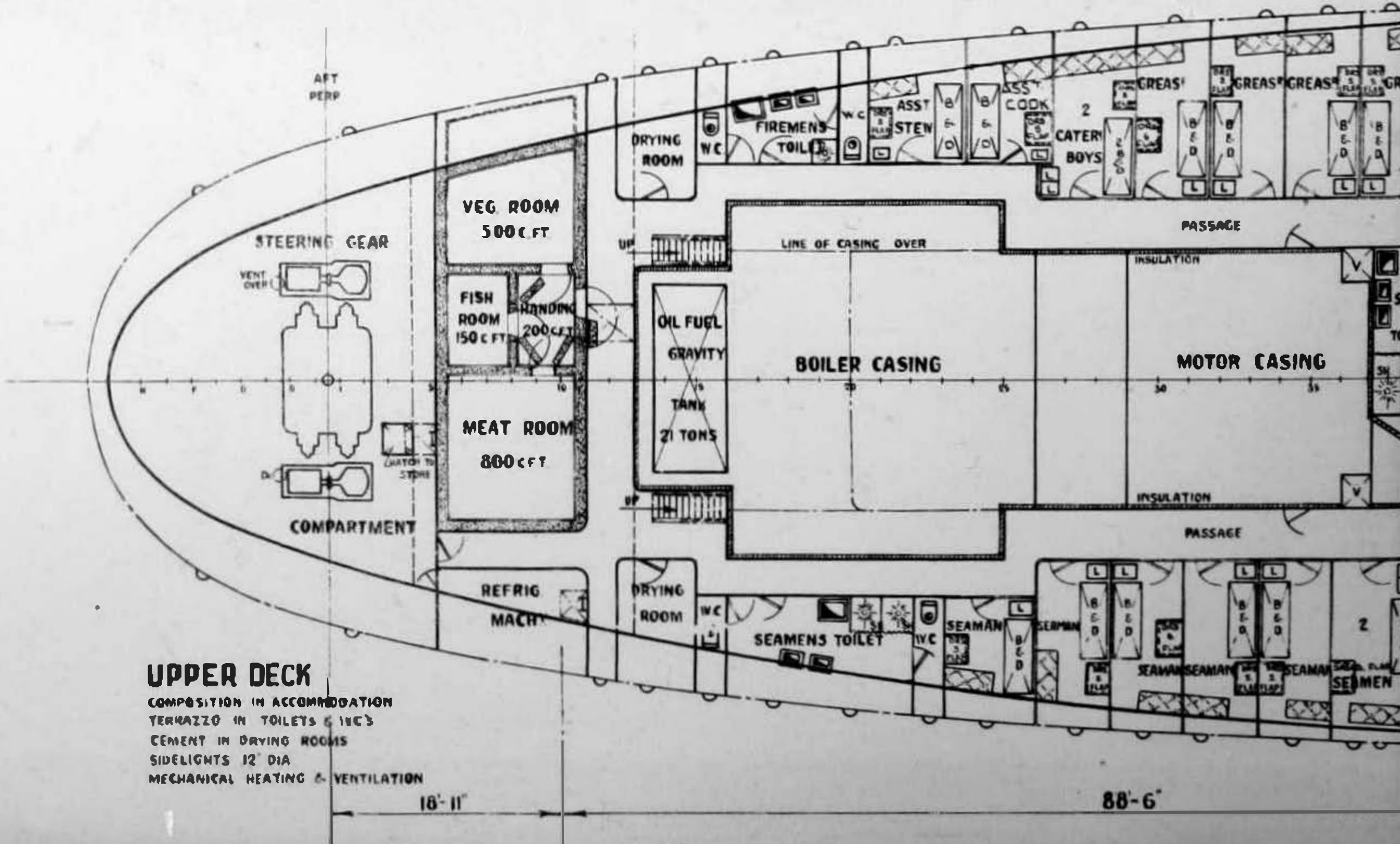
**BOAT DECK & CASING TOP**



## POOP DECK

COMPOSITION IN ACCOMMODATION  
 TILES IN ENGINEERS TOILETS  
 TERRAZZO IN P.O.'S TOILET  
 SIDELIGHTS 16" DIA  
 MECHANICAL VENTILATION & HEATING

24' FRAME SPACING      30' FRAME SPACING



## UPPER DECK

COMPOSITION IN ACCOMMODATION  
 TERRAZZO IN TOILETS & W.C.'S  
 CEMENT IN DRYING ROOMS  
 SIDELIGHTS 12" DIA  
 MECHANICAL HEATING & VENTILATION

16'-11"

88'-6"

M.V. "ATLANTIC DUCHESS"

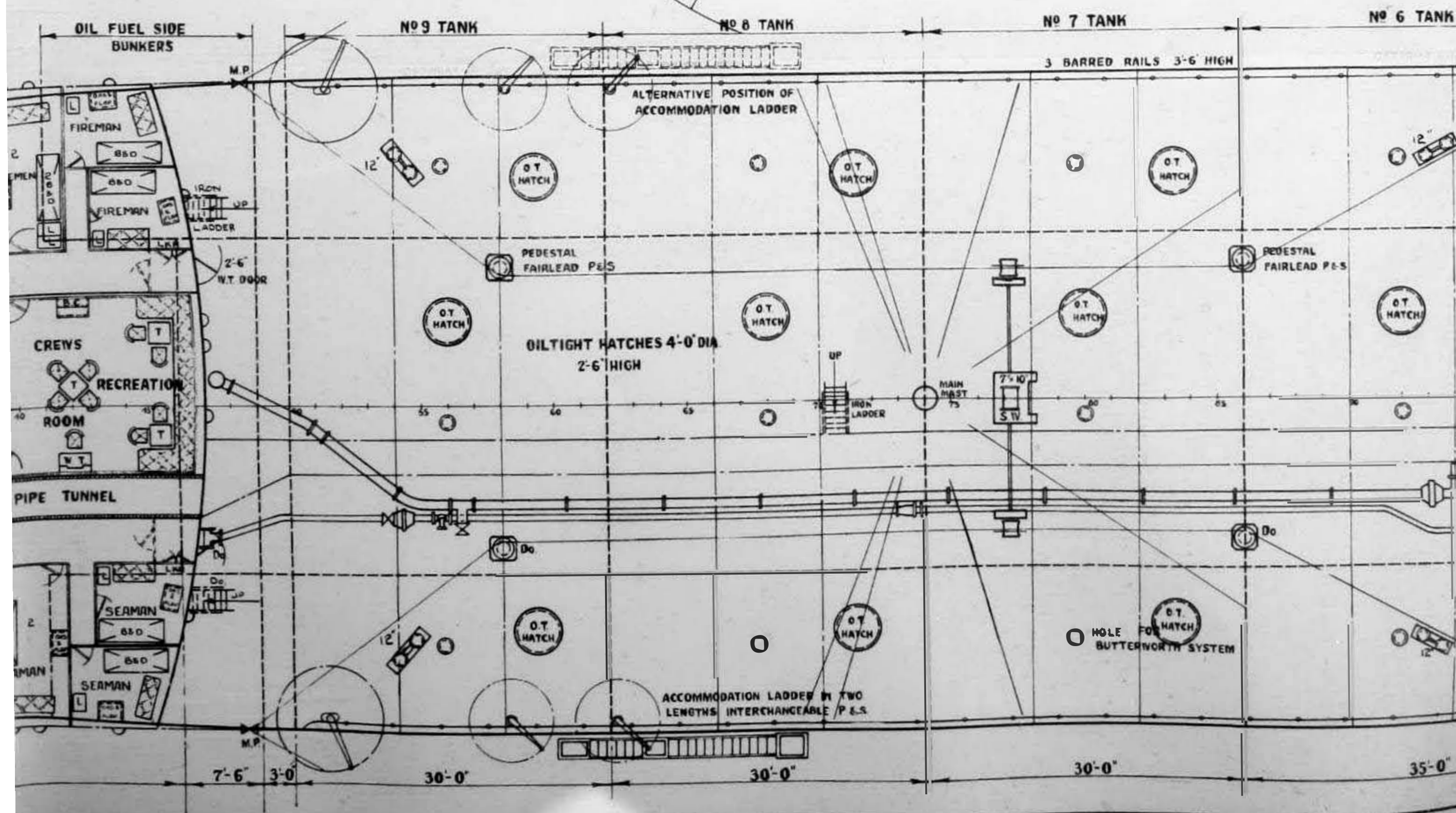
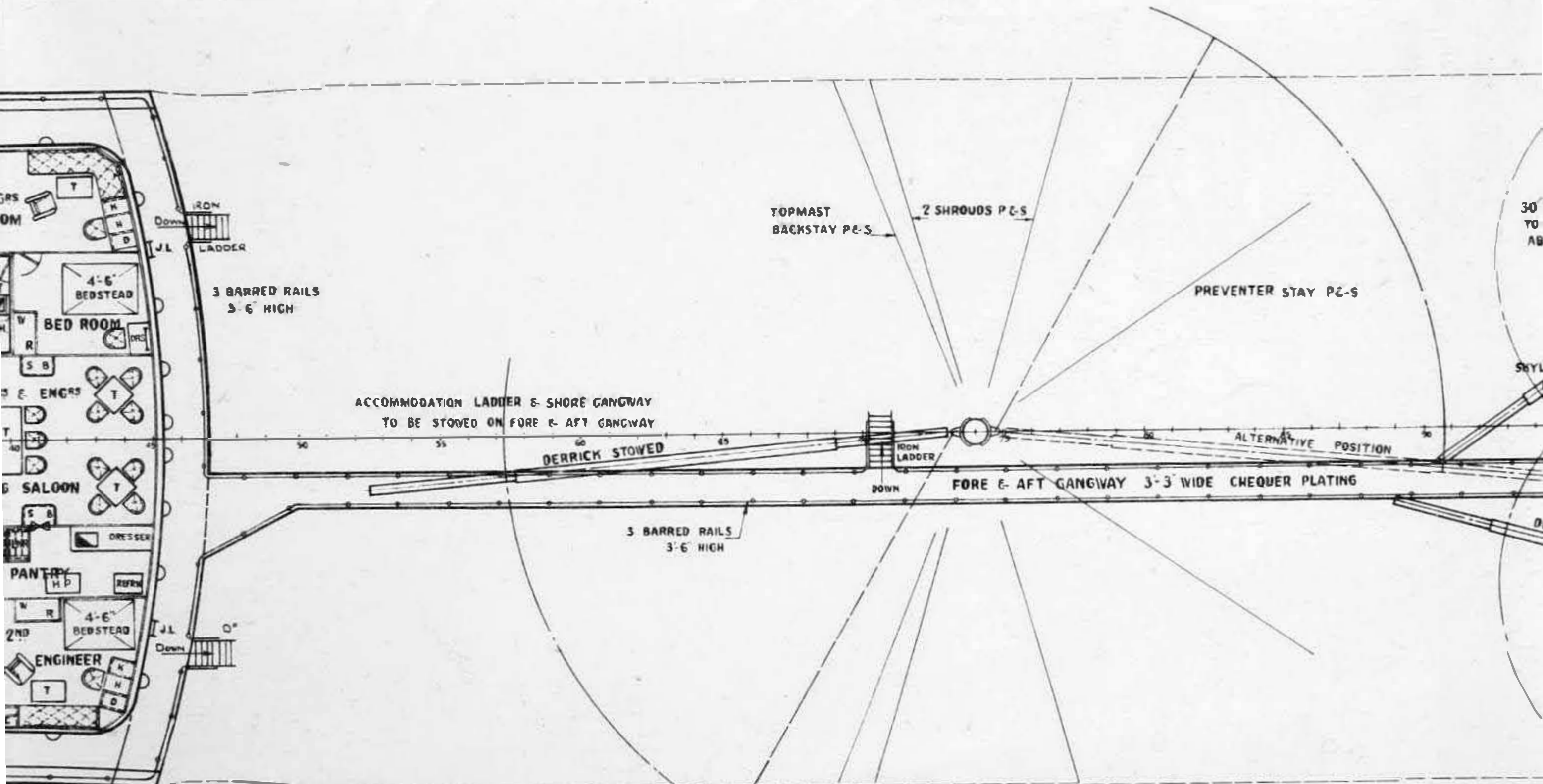
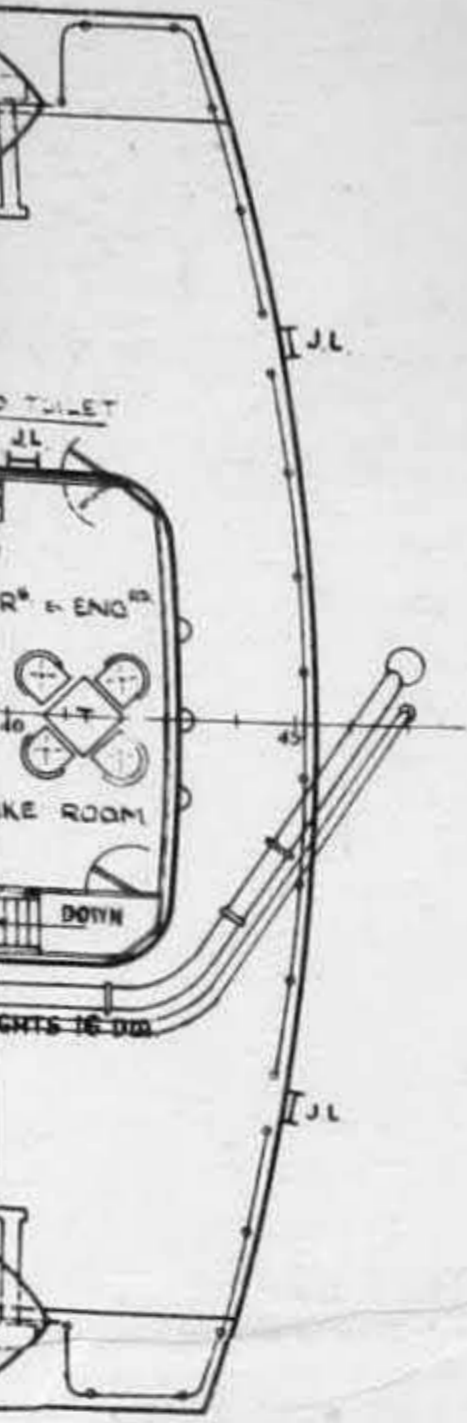
No. 1237

# GENERAL ARRANGEMENT

## "PLAN"

SCALE 1/16 INCH=1 FOOT

PRINCIPAL DIMENSIONS :-470'-0" L B.P. - 62'-6" B. M.L.D. - 35'-6" O. M.L.D. TO UPPER DECK



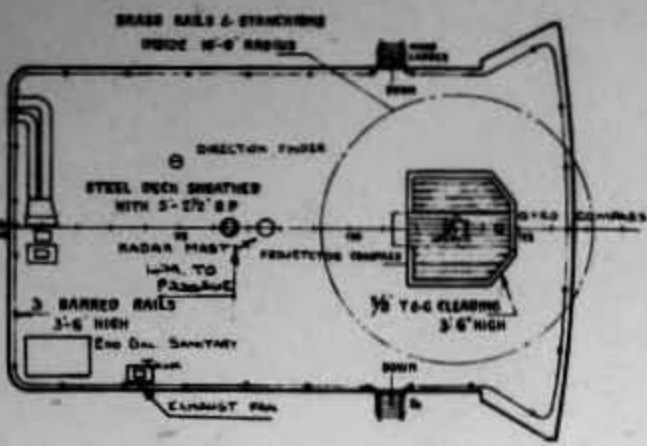


BRASS RAILS 2'-6" HIGH  
 INSIDE 14'-6" RADIUS

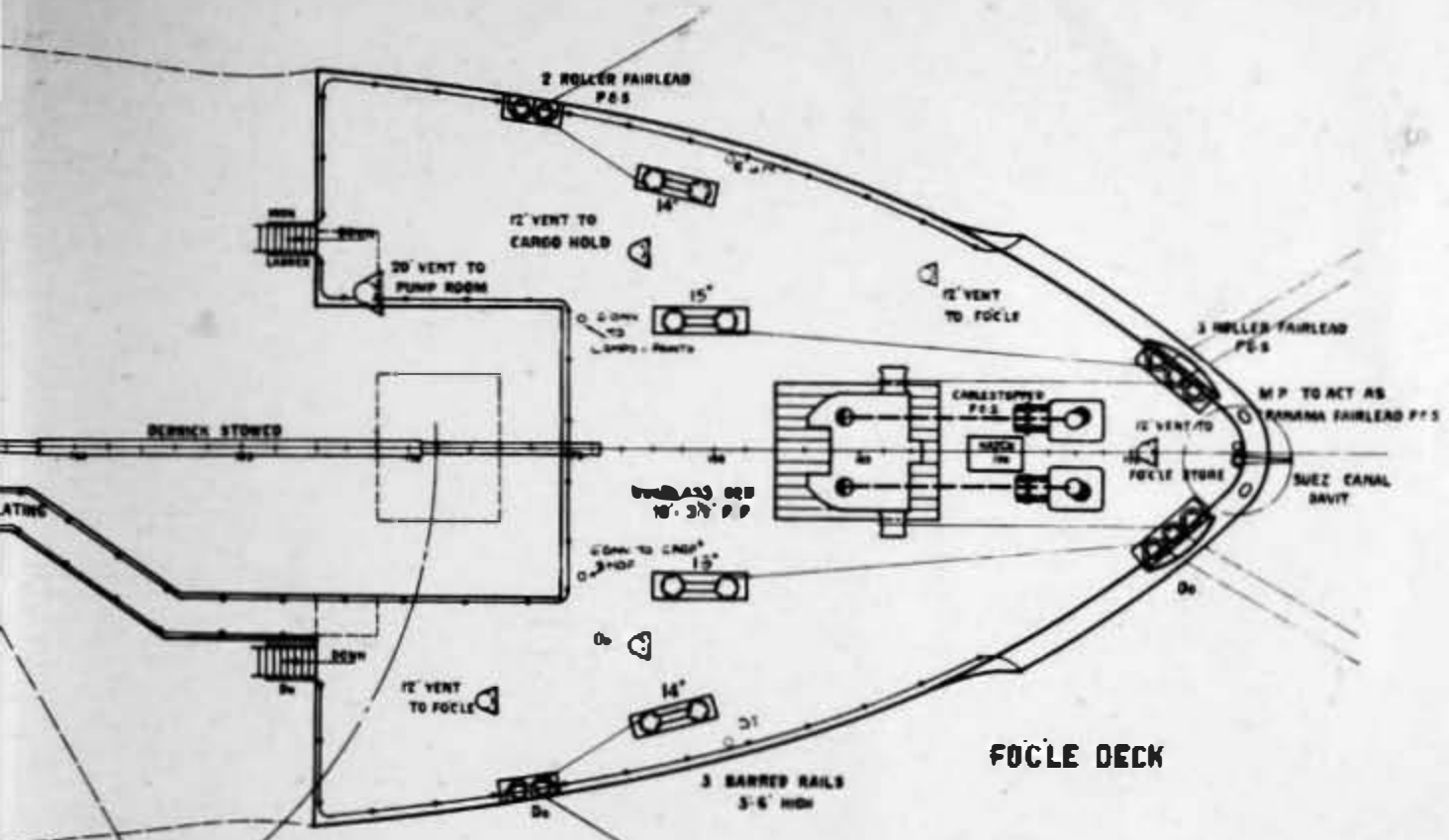
BLINDS WINDOWED TO BE  
 OF SOLIDMINT TYPE

THEOPHILUS WHIT

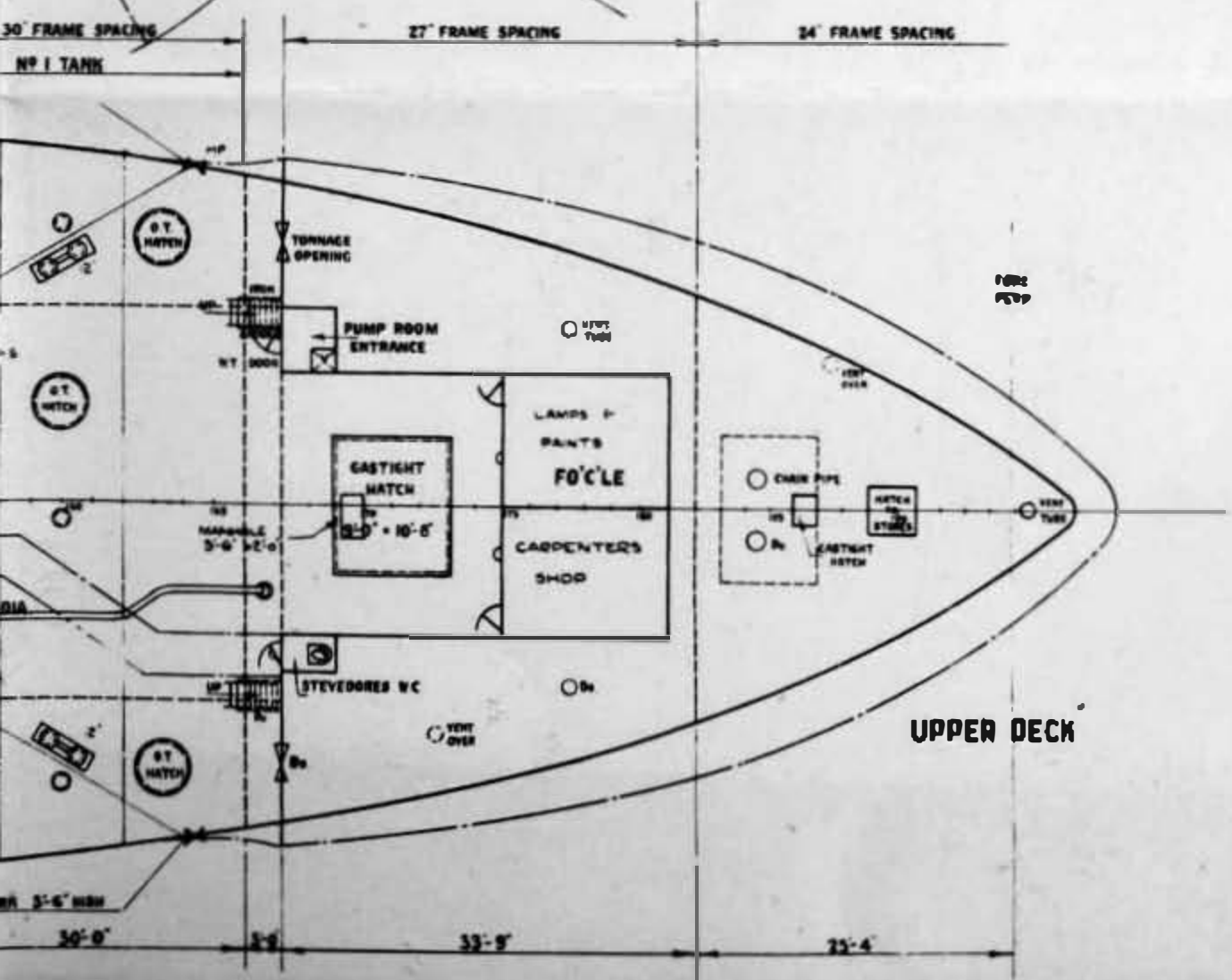
KEEP CLEAR VIEW  
 SCREEN



**COMPASS PLATFORM**



**FORE DECK**



**UPPER DECK**

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PRINTED IN GREAT BRITAIN

S.O. Code No. 34-347