

## CALCULATIONS OF OIL CARGOES.

### SURVEYOR'S EVIDENCE AT LA CRESCENTA INQUIRY.

### EXAMINED ON LOADING AND TRIMMING FACTORS.

THE last of the inquiries by the Board of Trade into the loss of four British ships was continued yesterday at the Institution of Civil Engineers, Westminster. The inquiry concerns La Crescenta, an oil tanker of 5,880 tons gross, 400ft. length, 53ft. beam, 32ft. 10ins. depth, built in 1923 by the Furness Shipbuilding Co., Ltd., Haverton Hill-on-Tees, and owned by the Crescent Navigation Co., Ltd. (Messrs. Harris and Dixon, Ltd., managers, London). La Crescenta was lost in December, 1934, with her crew of 30, during a voyage from California to Japan with a cargo of crude oil.

Lord Merrivale, Wreck Commissioner, presides over the court, and is assisted by Commander H. Stockwell, Commander J. R. Williams, Mr. Edmond Wilson (marine engineer), and Mr. E. H. Mitchell as assessors.

The parties to the inquiry are as follows:—The Board of Trade, represented by the Solicitor-General, Sir Donald B. Somervell, and Mr. G. St. C. Pileher (instructed by the solicitor to the Board of Trade); the Crescent Navigation Co., Ltd. (the owners of La Crescenta) and Mr. Sydney Graham, represented by Mr. J. V. Naisby (instructed by Messrs. Middleton, Lewis and Clarke); Mr. R. F. Hayward and Mr. Harold Griffin (instructed by Messrs. G. F. Hudson, Matthews and Co.) for the relatives of the dead officers, and the following officers' and engineers' protection societies who are represented on the National Maritime Board:—Officers (Merchant Navy) Federation, the Imperial Merchant Service Guild, the Mercantile Marine Service Association, and the Marine Engineers' Association, Ltd.; Mr. Vere Hunt and Mr. Peter Bucknill (instructed by Messrs. Russell, Jones and Co.) represent the National Union of Seamen and the Transport and General Workers' Union; Mr. W. L. McNair (instructed by Messrs. Parker, Garrett and Co.) holds a watching brief for Lloyd's Register of Shipping.

#### SURVEYOR'S INVESTIGATIONS.

Mr. Henry Edward Steel, the Board of Trade surveyor, continued his evidence, and was questioned by Mr. Naisby.

You told us yesterday that you had investigated 18 voyages in La Crescenta when she was under the command of Captain Dillon?—Yes.

You remember what the cargoes were on those voyages?—I have a list in front of me.

Were they mostly light oils—petrols?—Gas oil, fuel oil; one voyage was crude oil.

Were they mostly light oils?—Well, I have no particulars as to the density, but gas oil might include a light oil.

Have you got a copy of your calculations that were put in yesterday as part of your evidence?—Yes.

And in those vessels you have calculated the deadweight and the corresponding draft of the oil on various occasions?—Yes.

The first voyage is the voyage from Batoum on February 27?—Yes.

You are not a seaman, Mr. Steel?—No.

Do you know how the tonnage of these oil cargoes is arrived at?—Yes.

Is it done by calculation of the quantity and taking into account the specific gravity and the temperature?—Yes.

#### OIL TONNAGE CALCULATIONS.

In other words, it is a fuel which is calculated and not measured or weighed?—That is so. It is calculated from a measured volume. It is taken in two places; first on shore before being discharged into the ship, and then on board the ship. The measurements in the

tanks are made by taking a depth measurement of the oil in the tanks, and from that the volume of the oil discharged into the ship is known.

Do you suggest that these weights calculated in that way can be relied upon as giving the true weight?—The weight as obtained from the ship measurement is less reliable than the weight obtained from the shore measurements.

Do you agree that in the case of this vessel, in the correspondence we see differences in the weight of the cargo on some six or seven occasions in the vicinity of as much as 50 tons?—I cannot say right off. There were differences, 25 tons in the first voyage—that is, between the shore weights and the ship's weights. There were 19 tons in the July voyage.

It is difficult, is it not, to ascertain the weight of oil even when you know the specific gravity, the cubic capacity and the temperature?—I don't think so. It is a straight calculation.

Do you suggest that you can really, of a tonnage of, say, 8,000 tons, tell within 50 tons? Can you give some possible errors?—For an error of .1 degree gravity measured in the American Petrol Institute method, I estimate that the error on 8,500 tons would be 5½ tons.

The temperature of oil in a tank is difficult to take?—Yes. It is more difficult in a ship's tank than in shore tanks.

#### SMALL ERROR POSSIBLE.

The reason is that there is more difficulty in putting the thermometer in a ship's tank in the right place and to get the same temperature of the other places in the tank?—There is a possibility of a small error.

Lord Merrivale.—I have worked out the possible error assuming there were 100 tons wrong with a cargo of 8,400 tons; it is just over 1½ per cent. Does that really affect the issues in this case? Let us deal with the maximums in this case.

Mr. Naisby.—I appreciate what your lordship says. I am proposing that the question of 40 or 50 tons may matter when we come to December 5 or December 6.

The President.—The critical date isn't December 6. The critical date, whether the law was complied with, is a month earlier.

Mr. Naisby.—Well, my lord, it is November 24. There is another question which is to be answered by your lordship and those assisting, and that is the cause of loss of this vessel.

The President.—That is so, and with regard to that if you find overloading on the previous date, it wasn't so on that date. That is a very material factor. If you find a system in operation which business people and scientific people—all of them—regard as a practical system on which the tanker service works, I am to decide that.

Mr. Naisby, to witness.—On this voyage was the figure for fresh water 183 tons?—Yes.

Do you think the ship sailed with 183 tons of fresh water on board?—I have no reason to doubt it.

According to the documents it appears she took 195 tons as a rule?—Yes.

The fresh water tanks for reserve feed water have a capacity of 72 tons, and she would want some drinking water?—Yes, the maximum capacity for domestic water was 18 tons, but four or five tons would be sufficient for the crew on the voyage.

The ship would leave San Luis with 180 tons of fresh water on board?—Yes, if water could not be obtained in Japan.

The President.—I do not at the moment appreciate the further stage to which you are carrying this inquiry.

Mr. Naisby.—This vessel would have 180 tons on board when she was lost?—No, that is quite incorrect. I calculate that about 77 tons of fresh water would have been used by December 6.

Questioned about the reserve buoyancy of the ship, witness said he had not calculated what the freeboard would be according to the trim at the time of the loss.

Am I right in saying that the hatch and the hatch cover (forward hold) were unusually strong, with unusually strong coamings, beams and webs for a vessel of this size?—Yes, the beams were rather strong, but no criticism has been made of the hatch.

#### THE GANGWAY'S STRENGTH.

I want to ask you one or two questions about this gangway between the bridge and the after bridge. The alterations required to the gangway to give the tanker freeboard to enable her to load some 10 or 11ins. deeper meant that she would have to have fitted longitudinal stringer angles on each side?—Yes.

To some extent that would increase the strength of the gangway?—Yes.

It would give the gangway strength to resist forces from the side?—Yes, it was nearly always sideway forces that would attack the gangway. A sea striking the bridge in the front would tend to rise and force the gangway up.

Do you consider it possible for this vessel to be properly loaded and still have the same freeboard she would have had half-way between the bridge and the flying bridge, as she must have had if your calculations as to her sailing with 10½ins. overloading are accurate?—I do not understand you.

If the vessel is overloaded to 10½ins. she is deeper in the water than she ought to be?—Yes.

But it does not follow that each separate portion of the vessel is deeper than it ought to be, does it?—That depends on the trim.

The President.—If she was down on her stern that would raise the points the learned counsel is referring to to a proportionate degree?

Mr. Naisby.—No, my lord, it would lower it, because it is abaft amidships.

The President.—Very well, yes.

#### TRIM OF VESSEL.

By Mr. Naisby.—The forward end of the ship would be higher out of the water, and that would have had effect on her seaworthiness and the water coming on board.

But it is true to say that this vessel might have been probably laden with her flying bridge or this gangway aft in as vulnerable a position as you calculated must have been?—Excepting for the point I have mentioned, that the forward part of the ship would be higher out of the water, and would be less likely to take heavy seas on board.

The higher the forward part of the ship is, of course, the more protection from a head sea it gives the after part?—Yes, or a sea on the bow, port or starboard.

You were asked some questions yesterday, Mr. Steel, about the buckling of the decks of the tanker?—Yes.

And I rather fancy you wanted to say something that you did not get the opportunity of saying yesterday. I would like to give you that opportunity now. Am I right in thinking that it is an uncommon thing to get what one might call a buckling or wave in the deck of a tanker?—It is uncommon, because most tankers are built on the longitudinal system. It is not uncommon in ships to have buckling in the decks if the deck is thin.

You have had no practical experience in tankers, have you?—No.

You don't regard four inches of buckling as being a likely figure?—I think it is absurd.

#### CLEANING OF TANKS.

The Solicitor-General.—It was suggested to you that between September 17-19, while the vessel was going from San Pedro to San Luis, some fresh water might have been used for cleaning tanks. Was she partly laden at that time?—Yes.

Does that throw any light on the probability of whether they would be cleaning the tanks or not?—In this respect. That before tanks are cleaned they are usually in a congested condition. The tanks would have been cleaned beforehand.

The fact that she was partly laden makes it less likely that they would have been cleaned on those two days?—Yes.

In answer to further questions by the Solicitor-General, the witness said that the possibility of a drought in Japan would entail the possibility of taking on a much larger amount of water at the beginning of the voyage, and that the 183 tons of water would be used from day to day to make up the wastage of boiler water.

Had instructions been given, to which you refer in your note on the second voyage, that the evaporator was to be used in order to replenish the daily boiler wastage?—Yes.

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If those were the instructions the 183 tons would remain practically intact except for small quantities for domestic purposes?—Yes.

Is your first calculation made on the assumption that those instructions were absurd, and therefore the amount of fresh water used before the last message was received would be very small?—Yes, about three tons.

Supposing those instructions weren't absurd about using the evaporator, about how much boiler wastage would there be per day?—Probably about seven tons per day.

How many days till the last message?—11 days, 77 tons in all.

Can you, in fact, suggest how 109 tons of the 183 could be consumed in 11 days?—No, unless it was used to make up feed water.

#### LEAKAGE INTO SHIP.

Answering further questions by the Solicitor-General with reference to water getting into the ship, including the large 'tween deck bunker, the witness said that if the watertight doors were shut, and assuming that they were not watertight, sufficient water could not get through to endanger the ship.

The Solicitor-General.—Now about water getting down the chutes to the coal bunkers, what would happen?—The 'tween deck bunkers could hold about 307 tons of water, and the ship would get a sinkage of an extra 7½ inches, and that would put the stern deeper in the water, and the top of the bridge would be exposed to more serious damage from the seas. It would be very difficult to plug the chutes. The men would be walking about in water and coal, and the water would get into the engine-room and the crew's quarters aft.

If the wooden hatchway was broken the ship would be doomed?—Yes, unless the crew could quickly re-cover the hatch. But "doomed" is rather a serious word. She would be in a very serious condition. The crew would be very exposed to the sea in trying to re-cover this hatch, and when the flying bridge was struck the pipes to the wireless, the telemotor and the telegraph to the engine-room would all be damaged.

It is impossible in bad weather to go along the deck of a tanker. You must use the gangway?—Yes.

Mr. John Martin Binmore, engineer surveyor, Board of Trade, in his evidence to the Solicitor-General dealt with the trouble about water pumps while the vessel was coming from Japan in June and July, 1934.

Were the reports satisfactorily dealt with?—Yes, quite satisfactorily.

Did you get any evidence of the repair to the settling tank?—None that I have seen.

If this valve was not repaired, you could not use the settling tanks?—No.

Are there any letters that show you the tanks were not used in this way?—There is a statement that the valve was broken.

Quantities of water might pass over with the oil, and that would interfere with the running of the fires?—Yes.

Would that be serious?—If a pint of water got into the oil tank it would put out the oil burners.

#### POSSIBILITIES OF EXPLOSION.

The Solicitor-General.—What were the possibilities of an explosion? Is the pump-room a place where fumes could get in in order to form an explosive mixture?—Yes.

Why is it a dangerous place?—There is always a danger of leakage in a pump-room. Oil at very low flash point was being carried in Nos. 3, 4 and 5 tanks; if there was a defective pipe-line there would be a leakage in the pump-room, giving off gas. There could possibly be an explosion in the pump-room.

Are leaks in the pipes common?—Yes, they are common, because considerable corrosion goes on.

The Solicitor-General.—If anybody did want to go in the stores in the pump-room they would have to take a light?—Yes.

Are ordinary electric torches safe?—Yes. By the President.—They are not safe where there is an accumulation of gas.

The Solicitor-General.—In La Crescenta were there any gas ejectors?—None.

There is no actual statutory requirement?—No.

Mr. Hayward.—What is the normal pressure on the boilers of this ship?—About 180 lbs.

Assuming that the ship was using her engines at a reduced speed in heavy weather, how long would it take for steam to get back after the fires were out?—About an hour-and-a-quarter.

The gas you spoke of, that might have escaped. Do they tend to remain in the bottom of the pump-room?—They do.

Have you had experience in tankers?—None.

Mr. Vere Hunt.—If the electric wires near the pump-room had not been overhauled recently would they have caused an explosion in the pump-room?—There were no electric wires near the pump-room to my knowledge.

Witness said he saw no evidence of wiring inspection.

There were plugs for electric lights in the pump-room?—Yes.

The mere insertion of such a plug would cause a spark?—Yes.

That would cause an explosion?—Yes; but I would say there might be a special type of plug to keep the spark inside and make nothing dangerous.

Was that special type of plug used?—I don't know.

#### GAS MASKS ON BOARD.

Do you know if the crew had gas masks for going into the pump-room?—I believe there were some gas masks on board.

Where did you get this report on gas masks?—From another surveyor.

Is there a rule by the Board of Trade to provide gas masks for this type of ship?—I do not know of any.

Do you know anything about fire precautions on tankers?—Yes.

You agree an oil tanker cargo is much more dangerous than an ordinary cargo?—Yes.

But there are no special fire instructions for tankers?—No.

Have the Board of Trade any special details for the number of fire appliances to be carried by a vessel of this kind?—In respect of a ship like La Crescenta there were no definite requirements.

So it was quite possible for this ship to put to sea without any fire extinguishers?—Yes, no portable fire extinguishers.

There were conditions laid down by the Board of Trade regarding the carriage of dangerous cargoes, but their application to the fitting of tankers was not definite.

So there are no special fire regulations for tankers?—No.

Witness said that the ship was classified to carry a cargo of petroleum in bulk, and to burn oil fuel having a flashpoint above 150 degs. Fahr. The distance from the petrol cargoes to the heat of the boilers was roughly about 100ft.

#### DANGER OF EXPLOSION.

Are there any spark arrester rules by the Board of Trade to stop sparks from the funnels going over dangerous cargoes of this sort?—No.

Mr. Hunt.—If there was any leakage from the tanks 3, 4 and 5 to the bilges there would be considerable risk of explosion when those bilges were pumped out?—There are no bilges under these tanks.

Witness said that the safety of going down into gas-filled tanks was left to the judgment of the officers, who were experienced men. To his knowledge, there were no special means on La Crescenta for testing whether tanks were free from gas.

The President.—This depends on the practical knowledge of the men who are operating the tanks?—Yes, my lord.

Witness added that the cleaning of the burners was just a routine job. It took 30 seconds to change a burner and 5 to 10 minutes to clean a burner. It appeared that the burners were quite normal.

Mr. Naisby.—You were asked about sparks. The funnel on La Crescenta, as indeed, I think, on most tankers, is aft?—Yes.

And one of the reasons for putting the funnel aft is that if any sparks happen to be blown out of the top of the funnel they are more likely to go aft than forward?—That is so.

With reference to the broken valve in one of the settling tanks, Mr. Naisby asked witness if the absence of that valve involved any trouble in the working of the engines from August, 1932, until the engine log-books stopped?—As far as the log-books are concerned, none.

At any rate so far as the trouble with the engines is concerned the only evidence is the affidavits we have?—That is so.

Do you think it likely that sufficient water would get into the settling tanks to put out all the burners at once?—Oh, yes.

Answering questions by Mr. Naisby with regard to the leakage in the pump-room, the witness said that leakage depended entirely on the upkeep of the ship. On the last tanker he visited there was absolutely no leakage at all.

So far as you know was the lighting of the pump-room in accordance with Board of Trade requirements?—We have none.

Mr. Pilcher, referring to the possibility of explosion occurring due to a leak of gas from No. 5 tank aft, asked: Do you regard the danger of oil or gas escaping through that restricted portion of the bulkhead serious or not?—I cannot appreciate that there would be any dangerous leakage in the ship.

When you speak of leakage in the pump-room are you speaking of oil or gas?—Of oil which would produce gas.

#### EX-COMMANDER'S EVIDENCE.

Captain Alfred Thomas Hearnden said that from 1914 to 1931 he served in vessels which have been managed by Messrs. Harris and Dixon, with the exception of a few months in between. Since 1919 he had been in command of a number of vessels, including two oil tankers, of which one was La Crescenta. He joined her in February, 1925, and served on board until June or July, 1931.

Cross-examined by Mr. Pilcher, he said that he had Captain Upstill as an apprentice on the latter's first voyage to sea, and subsequently as first, second and third officer. He sailed a number of voyages with him.

Was he a capable and energetic man?—Very capable. He was very resourceful, and a wonderfully good seaman.

Replying to further questions by Mr. Pilcher, the witness said (with reference to No. 1 hatchway) that the hatch was at all times covered with a proper tarpaulin, and on voyages where bad weather was likely it was either lashed or had hatch battens on. There were always three tarpaulins on.

In general terms, how was the bunker hatchway forward of the after bridge secured?—By battens, wedges and, I think, lashings.

What about the saddleback bunker hatchway on the aft bridge?—That was not very often covered; it was generally open.

For what purpose?—Ventilation.

#### "A GOOD SEABOAT."

If you got into bad weather?—There were hatches, wedges and tarpaulins handy.

How would you describe La Crescenta?—As a good seaboat.

Had she a sharp roll or a steady roll?—A steady roll. I have never noticed anything particular about her.

With regard to the buckling, the witness said that he had noticed it many times in other ships. He did not attribute any importance to it; temperature was the cause.

Answering questions regarding the pump-room, witness said that the only recollection he had of lighting arrangements was that there was a special lamp that was temporarily put in the skylight. There was no electric light in the pump-room to his knowledge anywhere.

Continuing, he stated that Mr. Howey was very extravagant with fresh water, and was a very, very keen man on his boilers.

Mr. Hayward.—During your time you told us you were very strict to see the ship was not overloaded?—Those were my orders during my absence, and as far as I know they were carried out.

Witness added that fire training was held on the ship when he first joined, "but it was a washout," and he did not trouble about it any more. Fire appliances were tested.

#### "CORRODED AND BUCKLED."

Mr. Gustavus Joshua Edmund Wildermuth, who joined La Crescenta in July, 1932, as an able seaman, in his evidence said the deck plating in the neighbourhood of No. 5 tank was both corroded and buckled, and it was obviously buckled right across the ship. The undulations extended about 5ft. fore and aft and right across the ship from port to starboard.

He added, in answer to further questions, that on his first voyage there was no leakage, but on the second voyage there was. He remembered occasions where the covers on the lifeboats were burnt by sparks from the funnel.

To Mr. Hayward, witness said that on his voyage through the Mediterranean on La Crescenta there was leakage through the plates, and there was a half-mile of oil film on the sea behind the ship all the time.

Mr. Naisby.—You saw this buckling in the Mediterranean?—Yes, for the first time.

Witness said he never used lashings on the forward hatch because they were not necessary for the safety of the ship.

The Court adjourned until this morning.

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