"A New Form of Insulation for High Temperatures."

The following is published as an appendix to the Paper and discussion on this subject, which appeared in the Transactions for December, 1927 :—

Copy of National Physical Laboratory Report on Glass Silk Insulation.

N.P.L. Engineering Department Test Mark :—*DRQ.*

The test was made upon an electrically-heated pipe at a temperature of approximately 800°F. In this test the heat loss is measured by the electrical energy supplied to the heating coils, and the losses from the ends of the pipe are corrected for by determining the heat loss from a pipe of much shorter length with similar ends. The apparatus has been fully described in " Engineering," Vol. 123, No. 3,182 (7.1.1927), and is referred to there as Pipe No. 1.

Description of Cover.

The glass silk insulation material was applied to the test pipe in layers of approximately half-inch thickness. When the necessary total thickness had been applied, a wire netting ¼in. mesh, was fixed over the outer layer to hold the material in place. The final thickness of the cover was very irregular and varied from 2¾in. to 3¼in., the mean being 3·06 inches.

Particulars of Pipe and Cover.

Length of test pipe	11ft. 6ins.
External diameter of test pipe	4·49 ins.
Area of surface of pipe	13·52 sq. ft.
Length of cover under test	11ft. 6ins.
Mean thickness of cover	3·06 ins.
Weight of cover (13·5ft. run)	75¼ lbs.
Weight per sq. ft. of 4in. pipe covered	4·75 lbs.
Weight per ft. run of 4in. pipe covered	5·6 lbs.

Results of Test.

Mean temperature of Pipe: °F. ($\varnothing_1$)	686	776	838	800
Mean temperature of Air: °F. ($\varnothing_a$)	63	64	63	70
Difference of temperature Pipe to Air: ($\varnothing_1 - \varnothing_a$)	623	712	775	730
Mean temperature of surface of cover: °F.	112°	127°	135°	—
Loss of heat per sq. ft. of pipe surface B.T.U. per hour	194	251	300	263
Loss of heat per sq. ft. per hr. per degree difference of temperature: B.T.U. (=q	·312	·352	·388	·361
Loss of heat from bare pipe per sq ft. per hr. per degree (F) difference of temperature: B. T. U. (=q_b)	5·96	6·91	7·64	7·11
Efficiency: Saving of Bare Pipe Loss	94·7	94·9	95·0	94·9

The figures in the last column are calculated from the value of "q" plotted against ($\varnothing_1$—$\varnothing_a$), for a pipe temperature of 800° F. ($\varnothing_1$), and an air temperature of 70° F. ($\varnothing_a$).

The temperature of the surface of the cover was obtained by soldering two thermo-junctions to the outside wire netting, 3ft. apart, and approximately on a level with the axis of the pipe. A mean of the two readings was taken and is given in the table above.

13th January, 1928.

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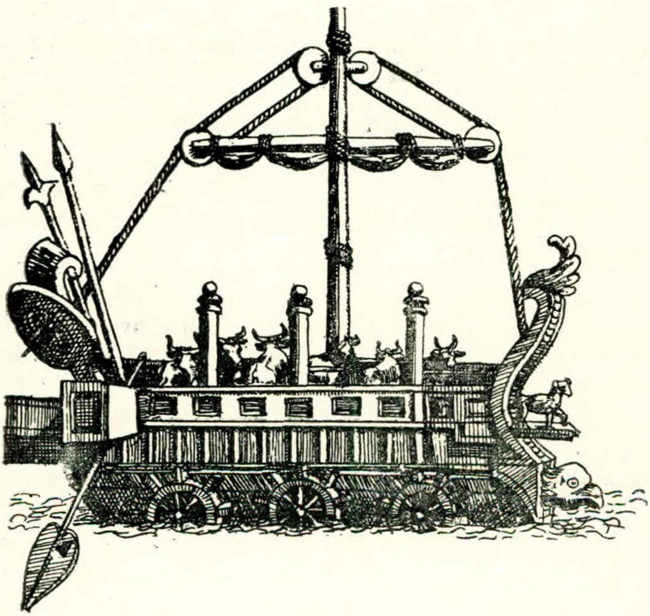
The Story of the Ship.

Referring to the resumé of Sir Westcott Abell's lecture published in the January Transactions (pp. 711-717), the following letter has been received from Mr. W. Hamilton Martin (Member): —

" By a curious coincidence, on arriving home on the evening " of December 6th after attending Sir Westcott Abell's fascin- " ating lecture on " The Story of the Ship," I received my " copy of the Weekly Journal of the Dutch Society of Engi- " neers, in which I found an interesting reference to the use " of paddle-propelled ships long before the days in which we " had considered that such means of propulsion were invented. " Most of us had been under the impression that paddles were " only adopted after the advent of steam power, but the " article above referred to shows that paddles driven by oxen " were actually used by the Romans and Carthaginians."



By the courtesy of the Chief Editor of " De Ingenieur," the journal of the Dutch Society, I am able to supply the above illustration of this paddle ship used by the Romans, which is taken from an old Dutch book entitled "Ancient and Modern Shipbuilding and Navigation," by Nicolaes Witsen, published in Amsterdam in 1671. In the chapter on "Various types of ships of the Ancients, and especially those which were uprighted by Philopater and Hiero," one finds the following description of the above ship (the translation being more or less literal, from the old Dutch):—

"With paddle wheels which scooped in the water and were "turned by oxen which walked round a shaft on the upper "deck, one saw in those early days ships passing through the "water with such power that everything was annihilated which "came across their bows, and the form of which is shown in "the accompanying sketch."

Editorial Note.—We take this opportunity of thanking Mr. Hamilton Martin for having brought the above interesting facts to our notice. We are also grateful to the Secretary of the Dutch Society of Engineers for the loan of the block, and for the following additional information on the subject which he has received since publishing the article, and which would seem further to confirm the existence of mechanically propelled vessels in those early days:—

Citations from the book by Professor Thurston (Professor of Mechanics at the Stevens Polytechnic Institute at Hoboken, N.Y., U.S.A.).

"It is said that the Roman Army commanded by Claudius "Caudex was transported to Sicily in vessels moved by paddle "wheels which were driven by oxen, Vulturius gives draw- "ings of these ships."

"The paddle wheel was used in very early days to take the "place of oars, and one can find in Tiamelli's book entitled "'De L'Artificioses Machines,' published in old French in the "year 1588, a description which curiously enough illustrates "in an old woodcut paddles applied to vessels."

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Notes.

The following is from "The Shipping World" of February 1st:—

VIBRATION IN SHIPS.—A notable feature of the papers recently read before the Institution of Engineers and Shipbuilders in Scotland and the North East Coast Institution of Engineers and Shipbuilders has been the attention given to the subject of vibration in ships. Last week attention was called to Mr. Carslaw's paper entitled "Some Notes on Deck Supports," which was read at Glasgow, and dealt with the provision of adequate stiffness of hull and deck erections in order to prevent vibration. At Newcastle, Mr. Calderwood recently dealt with the important subject of the vibration caused by auxiliary oil engines, while on Friday last, also at Newcastle, Mr. Lockwood Taylor gave an exhaustive paper on "Ship Vibration Periods," describing types of vibration, the way in which they can be calculated, and how vibration periods can be varied by modifications in hull design. A valuable part of Mr. Lockwood Taylor's paper is the very complete bibliography which is appended to it, in which reference is made to some twelve papers given since the War, and an equal number of pre-war papers dealing with various aspects of this subject.

In introducing his paper, Mr. Lockwood Taylor referred to the adoption of the steam turbine having seemed at one time to have solved the problem of vibration, and he went on to say that the problem has reappeared with the comparatively large reciprocating masses of the internal-combustion engine now installed in motor-ships. While this is in part true, it is only fair to say that the consensus of opinion of those best qualified to judge, is that there has been comparatively little vibration in recently completed large motor liners. It is true that in one or two cases vibration has been felt, but it has been eliminated by altering the speed of either the main or the auxiliary engines. With the new type of vibrometer designed by the Cambridge Instrument Company, Ltd., it is now possible to record actual vibrations on a moving strip of celluloid and to compare these vibrations very accurately. In this way the effect of different arrangements of cranks and different engine speeds can be gauged. There is no doubt that with a more accurate knowledge of these problems and with the close co-operation of engine builders and naval architects, any problems arising from ship vibration are now capable of solution to a very large extent.

The following is from the "Nautical Gazette," New York, November 19th:—

TANK STEAMER FIRES AND EXPLOSIONS (Extracts from Paper read at the Thirty-fifth General Meeting of the Society of Naval Architects and Marine Engineers by Robert L. Hague):—During the period of nearly five and one-half years from January 1st, 1922, to May 1st, 1927, the world's tank steamer tonnage afloat averaged almost exactly 8,000,000 deadweight tons. There were transported in that period 135,000,000,000 gallons of petroleum products in bulk, across 225,000,000 miles of ocean. This is an average of 135 gallons per minute for every minute since the birth of Christ.

Against this all but incredible record of performance the aggregate number of fire and explosions in tank steamers, whether loading or discharging, undergoing repairs, or in free route at sea, has been but fifty-seven, or the remarkably small amount of thirty-two one-hundredths of one per cent (·32 per cent.) of all the marine casualties reported during the period, which numbered in excess of 17,600.

A non-technical explanation of the peculiar nature of petroleum vapors may therefore be helpful in bringing about a better understanding of the danger to be guarded against in carrying petroleum and its products in bulk; while an investigation into the causes of past explosions, coupled with an enumeration of the precautions observed by experienced and prudent operators, may serve to reduce further the number of accidents with their attendant loss of life and property.

Petroleum Vapors.—A large proportion of the crude petroleums and their refined products give off large quantities of vapor when exposed to free air at ordinary temperatures. These vapors are for the most part composed of hydrocarbons, although some crudes, notably the light Mexican, give off in addition hydrogen sulphide (H_2S).

Stated in the simplest terms, the hydrocarbon vapors from crude petroleum and its products, although differing in chemical composition, possess in common the following properties:—

1. They are heavier than air, and therefore, in still air seek the low levels of tanks, containers or ships.

2. They are at all times flammable.

3. When present in air in relatively low concentrations they are intoxicating. Air containing as little as fourteen-hundredth of one per cent. (0·14 per cent.) by volume may produce a noticeable effect if breathed for several hours. It is usual, however, to consider three tenths of one per cent (0.3 per cent.) as the danger limit. Most men can work in an atmosphere of this concentration for periods up to thirty minutes. Air containing more than three-tenths of one per cent. of petroleum vapors should not be breathed.

4. As the concentration increases, these vapors become also highly explosive; attended with scattering or disruptive effect. The explosive range extends from one per cent. to six per cent. by volume, being most intense up to 3½ per cent. Above six per cent. the vapors for all practical purposes cease to be explosive and again become merely flammable.

The hydrogen sulphide gas (H_2S) given off by the Mexican crudes is not only flammable but is much more toxic than the hydrocarbon vapors. It has been found to be slightly toxic in concentrations as low as 0·005 per cent. and men exposed daily to such percentages would, in all probability, suffer irritation of the eyes. In higher concentration this gas is definitely toxic and capable of producing dangerous and sometimes deadly effects when inhaled for periods not exceeding a few minutes.

While the subject of petroleum vapors is in itself one concerning which volumes might be, and have been written, the facts of importance for the purpose of this paper are as expressed above, and anything additional might be confusing. The fundamental of the problem lies in appreciation of the fugitive character of the gases generated; the fact that they are heavier than air; and lastly, that the danger of explosion is greatest when the uninstructed or uninformed person would expect it least—in other words, that it is associated not with the full tank, which is the relatively safe tank, but with the empty or indifferently cleaned tank; with leaky cocks, joints and rivets; with fractured petroleum oil pipes and settling tank gauge glasses; with sediment around and under rivet heads; with leaky case oil containers; and with re-evaporation from rust and scale. These are the conditions under which danger screams out loud.

Causes of Past Explosions.—The evidence is conclusive that, in the majority of cases, fires and explosions have had their inception through ignition of the vapors above described. A review of the surprising variety of ways in which such ignition has occurred will best point the way to improvements in future practice.

In terms of practical ship operation, the fact that petroleum vapors are heavier than air and are most explosive in low concentrations indicates that the compartments of greatest potential danger in a loaded tank steamer are the bilges of the pump rooms, the fire-room bilges, and, when settling tanks are located therein, the engine-room bilges.

In the pump room the congestion of piping under the floor plates, coupled with the possibility of small leaks, and the necessity of breaking joints for overhaul, all lend themselves to the accumulation and retention of vapors. The record of fires and explosions originating in these spaces and resulting either from short circuits in electric portables, lamps, or sparks from tools in use for repairs is very impressive.

There is an unusual instance on record in which failure to close a sea valve in the pump room resulted in setting 300 tons of benzine adrift over the surface of a river, which, becoming ignited, spread fire for miles.

A condition similar to that prevailing in the pump-room bilges prevails, although to a lesser extent, in the fire-room and engine-room bilges. Accumulations of sediment and oil in the fire-room have been ignited by burner flare-backs, while in the engine-room accumulations of gas or oil from broken pipes or leaky cocks, weeping rivets, or fractured gauge glasses of settling tanks have been ignited by short circuits in portable lamps as in the pump-room.

Gases accumulating in the main cargo tanks themselves during the processes of loading or discharging have been ignited by defective portable electric lamps introduced for examination of the loading level. There is also record of an explosion resulting from filling a recently discharged cargo tank with ballast water leaving the tank lids open. The large volume of gas expelled through tank openings was ignited, followed by explosion and loss of the vessel.

Other than failures of electrical connections, the principal source of trouble in the ship has generally been carelessness by the ship's personnel, which has occurred in the galleys, crews' quarters and storerooms. Carelessness in handling galley fires owing to grease and general lack of cleanliness have all contributed, as have fires in crews' quarters through intoxication, fires in storerooms from oil waste, and even the smoking of opium in dark corners by Chinese crews.

Outside the ship there have been ignitions by the exhaust of gasoline launches and from towboat smokepipes, while there are at least two authenticated records of freak performance, one an ignition caused by the clashing together of steel girders being hoisted overhead, and another of disastrous explosion on an oil barge from sparks generated by the nails in the captain's boots on the steel deck, which ignited gases formed from leaky cocks. Fires have been caused also by the upsetting of naked lights on collision or hard groundings.

Defective and dilapidated wharf structures have played their part. Short circuits in electrical equipment igniting the leakage from defective discharge connections are common. There is one instance in which the lowly teredo itself had a part—a worm-eaten pile having broken an electrical connection, with attendant sparking and fire; and there is another instance of disastrous fire resulting from a burst hose becoming ignited by a naked light in a telephone booth.

The dispatch of tank steamers to repair yards for docking and overhaul introduces a new and more dangerous set of conditions, as in such cases every tank in the ship is a potential source of danger; while the chances of ignition, through the operation of acetylene torches, rivetting or chipping hammers, or the careless use of matches, are materially increased.

Analysing the foregoing, it will be seen that in a large sense there are two general conditions which, so far as possible, have to be guarded against; namely, carelessness in loading or discharging, and inadequate cleaning of tanks and removal of gas from the vessel.

To begin with it may be well to point out that, while " incombustible " means not combustible, " inflammable " does not mean not flammable. Inflammable in its usual sense implies explosiveness, or of a character that will burn readily and rapidly. "Flammable," which is the same word with the prefix omitted, means exactly the same thing.

Fire protection engineers, who were among the first to be inconvenienced by this confusion of terms, decided a few years ago to abandon the use of the word "inflammable" entirely. Now "flammable" is used to indicate ready combustibility, while "non-flammable" is for the opposite.

In the matter of fire protection and fire-fighting methods, there appears to be room for considerable improvement, both afloat and ashore.

As a spectacle the petroleum fire, accompanied by sheets of lurid flame and volumes of dense black smoke, is terrifying in the extreme. In point of fact, the consequential damage to adjacent property and personnel is surprisingly small. This is explained in the case of fire by the fact that, although there is an abundance of flame, there are no sparks; and, in the case of an explosion, by the fact that the disruptive or rending effect is so tremendous and instantaneous as to admit of no splinters.

Water is of limited usefulness in quenching petroleum fires. If not applied in sufficient volume, it makes matters worse by scattering the masses of burning material. There is an instance on record in which a tank steamer fire at sea was put out by allowing a heavy Atlantic sea to break over the ship. However, as Atlantic seas are not ordinarily available, recourse must be had to other measures, among which steam and chemical smothering lines are the most efficient.

In the steam-driven vessels of the Standard Oil Company (New Jersey) steam smothering lines are led to all cargo spaces, bunkers, cofferdams, lamp room, paint locker and pump room. Boiler rooms are for the most part equipped with a gravity foamite (carbon tetrachloride) system, having an independent flexible hose connection with the engine room which is further fitted with portable extinguishers of the acid and foam type. Officer and crew quarters, mess rooms and the upper deck structure generally are protected by the ship's fire main supplemented by portable extinguishers.

In all the Diesel-driven ships there has been substituted for the main steam smothering line, to the pump room, fore hold, cargo spaces, storerooms, motor rooms, fire room, etc., a chemical smothering line of the Lux (carbon-dioxide) type. There is also provided an auxiliary steam smothering line connected with the donkey boiler. The usual assortment of portable apparatus is also provided.

A device which is credited with having extinguished a blazing tank of oil 20ft. in diameter in less than a minute has recently been added to the list of equipment previously available. It consists of a large hopper containing foam powder. The hopper is connected with a hose, through which water is passing at about 80 pounds pressure. A chemical reaction takes place between the ingredients passing through the hose and a strong jet of foam issues from the nozzle of the hose. The generator, with necessary chemicals, weighs less than 200 pounds.

Equipment of this type is installed in the motor rooms of many of our Diesel-driven tankers in addition to Lux, and, if included in the fire protection of tank steamers, wharves, bridge structures and canal locks generally, would materially assist in checking a petroleum fire; but when all has been said and done the fact remains that no perfection of mechanical equipment can discount carelessness, and that the only assurance of security lies in unceasing vigilance and conscientious performance of duty on the part of personnel.

The following interesting possibilities carry us back to our schooldays. The notice is from "The Shipping World" of December 28th:—

The Ships of Tiberius.—Archæological research in Italy continues to reveal many features of the social life of the ancient Roman Republic and Empire, and excavations are constantly being made at the sites, or supposed sites, of the cities of the olden time. There is a legend that the Emperor Tiberius—or, as some say, Caligula—built two floating palaces on Lake Nemi, near Rome. These palaces, in course of time, foundered and sank near the shore at a depth of about 60ft.

Various attempts to salve them have been made at different times, with varying degrees of success. Signor Mussolini has now decided that the ships are to be refloated. A plan has been devised to empty Lake Nemi to permit the ships being reached. This is rendered possible by the fact that alongside Lake Nemi, but at a lower level and separated from it by a mountain, is another and much larger lake, the Lake of Albano. By digging a tunnel from the bottom of Lake Nemi to the Lake of Albano it will be possible to pour the water of the former into the latter. The redundant water will be disposed of by means of a tunnel leading out of the Lake of Albano, which was built by the Romans and needs but to be suitably enlarged.

The practical details of this plan are still being studied. It is believed that about 10,000,000 lire will be required for this work. An interesting point about the ships of Tiberius is that they are the earliest known forerunners of our modern steel ships. They were made by covering the wooden hulls of the ships with clay, upon which molten iron was poured by a process, the secret of which has been lost. The hull was built up to a considerable thickness by means of alternate layers of clay and iron. The result was a hard, iron-like substance which has defied the corrosion of water for almost 20 centuries. It is possible, therefore, that the salvage of these vessels may disclose information useful even to present-day naval architects.

The following report was published in the "Times" of February 8th:—

Petrol Ships in the Thames. The Inflammability of Floating Oil.—Details of experiments to test the inflammability of floating oil were given yesterday at the resumed inquiry, ordered by the Minister of Transport, into the Port of London Authority's application for new by-laws to allow petrol ships to proceed up the Thames as far as Purfleet.

There was first a discussion on the question of the authority given to Mr. Rossiter Sinclair, who appeared at the last sitting on behalf of the Fire Offices Committee, to answer questions in cross-examination on the statement that had been sent by that body to the Ministry of Transport. Eventually the Commissioners decided that they had no authority to compel a witness to attend, or documents to be produced.

Mr. James Kewley, chief chemist in London of the Shell-Mex group, who opposed the application, said that he had made experiments to ascertain what amount of evaporation was necessary to reach safety point in exposed petrol. For this purpose he had exposed layers of petrol on the surface of water in various circumstances and conditions.

In enclosed conditions a layer of 1/50th of an inch would not ignite with a match after four minutes of evaporation. With 1/20th of an inch, between 18 and 25 minutes were necessary before the residue refused to light. With $\frac{1}{4}$ of an inch—between $1\frac{1}{2}$ and $1\frac{3}{4}$ hours. A further experiment in an open yard showed that a layer of 1/20th of an inch ignited with a match after ten minutes. With an inch thick layer it would ignite after $2\frac{1}{2}$ hours. In artificial conditions representing a gale of wind quarter of an inch ignited after 17 minutes.

As a result of the experiments he concluded that a film of petrol of quarter of an inch floating on water over a small area would be decidedly dangerous up to 20 minutes or so; and if the film was one inch thick danger would probably continue for several hours.

Mr. Kewley said that he did not agree with the evidence of a previous witness who said danger point had been passed within ten minutes when the *Seminole* stranded in the Mersey recently. There must have been other circumstances to explain the results of experiments made there. As to dangers which would arise from a collision between two vessels, one or both of which was carrying petrol, if the collision was sufficiently severe to punch a hole in the tanker and liberate the petrol, he thought it likely sufficient heat or electricity would be generated by the impact as to cause sparks which would ignite the petrol at the moment of liberation before there was any chance of evaporation.

Cross-examined by Mr. Macmillan, K.C., Mr. Kewley said the object of the experiments was to ascertain at what period after liberation petrol became innocuous—when the vapour was so diluted that it was not capable of ignition. There were a large number of factors that would operate in that process. He agreed that the evidence available as the result of such experiments as he had described was very slender at present.

Replying to Mr. Tyldesley Jones, K.C., Mr. Kewley said so far as he knew the Shell-Mex Company had decided to oppose the application in this case before he was asked to make the experiments he had spoken of. The company had a large number of tankers which they sent to enclosed ports in this country and elsewhere, and he had never been asked to make any such experiments in respect to them.

Mr. Jones: So that the anxiety of the Shell-Mex Company at the expense of their shareholders for the safety of the public, has never previously been displayed in respect of any other port to the extent of having these experiments made? I don't know about that.

Fires on Tankers.

Sir J. Fortescue-Flannery, senior partner in a firm of naval engineers and architects and consulting marine engineer to the Crown Agents for the Colonies, next gave evidence. He said he had had great experience in the matter of petroleum ships from the very first, and his firm had continuous supervision of tankers. He could recall 12 cases of fire damage among ships under the technical supervision of his firm, either during building or while running them.

In regard to one there was an explosion on board the *Black Sea* on February 13th, 1927, in New York Harbour. She was well fitted and equipped with safety appliances. There was a loss of life of one officer and three stewards and a considerable amount of damage. The ship was towed away from the wharf, and some of the cargo drifted away on the surface of the water. Another vessel got into this floating cargo, and someone must have thrown overboard hot ashes, as the oil caught fire. The cause of the explosion on the *Black Sea* was never ascertained, and it was a characteristic of such accidents that their origin could not be traced. There was one such on an Admiralty tanker under their firm's supervision in Chatham Dockyard last November, when happily there was no loss of life.

Another case was that of the *Oriflame* in the English Channel in 1919. There was a fire believed to have been due to the throwing of a lighted cigarette on the deck where there was a leakage of oil spirit. The ship soon became on fire from end to end and after being abandoned by the crew drifted down the Channel towards the Isle of Wight. It was feared she would become a danger to other shipping and by order of the Admiral Commanding in Chief at Portsmouth she was sunk by gunfire.

An attempt had been made in modern shipbuilding to minimise various risks in tankers, but designers had to contend with many other more pressing considerations, and he was of opinion that while modern tankers had great strength and resilience in heavy weather, they were more susceptible to damage in case of collision. The majority of collisions were glancing ones, but they could be at times disastrous. There was the case of the *Titanic*. As they all knew she struck an iceberg a glancing blow, but when the side was penetrated the force of the ship's impetus resulted in part of the ship's plates being torn for a considerable distance and she sank almost at once.

The witness proceeded to illustrate by drawings his contention that danger from the transport of petrol up the Thames would be less in the case of barges than in tankers because it was easier to institute protective measures in the barge, and they were required by P.L.A. regulations.

The inquiry was adjourned.

Ventilation of Motor Ships. Lack of Appreciation of the Problems Involved.—There is an article on this subject in the Shipbuilding and Engineering Edition of the "Journal of Commerce" of January 19th. A good practical paper based upon experience is much to be desired and there is ample scope for discussion on the subject.

In the same issue there is noted with regret the accidental death by drowning of Mr. A. W. Baird, of Messrs. Kelvin, Bottomley and Baird, while landing from the *British Faith* on the Tay.

Submerged Flame Combustion.—Members who are interested in this subject and its possibilities will find the summary of a paper in the Journal of Commerce of January 5th, on the unsuitibility of the submerged flame for power generation, read before the Institution of Chemical Engineers by Mr. Norman Swindin.

New Engineer-in-Chief. — Engineer Vice-Admiral Sir Robert B. Dixon, K.C.B, will relinquish the post of Engineer-in-Chief of the Fleet on June 1st next, when he will have been six years in the appointment. According to a revised regulation instituted in December, 1926, the engineer-in-chief is to be retired on vacating that office. Sir Robert Dixon entered the Navy on July 1st, 1888, and will thus have completed 40 years' service all but a month when he leaves the Admiralty. Before taking up his present post he was deputy engineer-in-chief.

Engineer Rear-Admiral Reginald W. Skelton, C.B., C.B.E., D.S.O., who has been chosen to fill the vacancy, is the senior officer of his rank, and has had a varied and distinguished career. As an engineer, he served with the National Antarctic Expedition in 1900-02. During the War, he was engineer officer of the battleship *Agincourt*, and was appointed D.S.O. for his services at Jutland. In 1919 he was appointed C.B.E. and C.B. for " valuable services in the Archangel area of the White Sea, where he was chief engineer on the staff of Rear-Admiral Sir John Green. In 1920, he became fleet engineer officer on the staff of Admiral Sir John de Robeck, then Commander-in-Chief in the Mediterranean, and in July, 1925, after similar service in the Atlantic Fleet, he was appointed engineer rear-admiral on the staff of the Commander-in-Chief, Portsmouth.

The publication of the good news that His Majesty the King has conferred upon His Royal Highness the Prince of Wales, the important rank of Master of the Merchant Navy and Fishing Fleets, has been received with acclamation, not only by the various branches comprising the Mercantile Marine, but by interested onlookers. It was becoming that we should express our congratulations, and a telegram was sent to His Royal Highness conveying our warm appreciation of the honour bestowed.

It was proposed at a meeting of the French Academy of Science that a tunnel might, with advantage, be run from Spain to North Africa and a plan was put forward by Senor C. Ibanez de Ibero, a Spanish engineer. The line of the tunnel was under a sea depth of 396 m.—about 1,320ft., and the length about 53 km., or 33 miles, including about 13 miles for the land inlet and outlet.

The attempts of the swimmer to accomplish the crossing before the tunnel came into being having failed, it will be interesting to watch for further developments.

Boiler Explosion Acts 1882, 1890. Report No. 2,844.—The steamship *Anubis* was a single screw cargo steamer of the raised quarterdeck type with he machinery space at the after end of the ship. She had one boiler 15ft. diam. x 10ft. 6in. long. The shell plates were 1 3/16th inch thick; there were three corrugated Deighton type furnaces 3ft. 8in. diam. with separate combustion chambers; working pressure 160 lbs., with the usual mountings. The machinery was in charge of two engineers with a staff on six-hour watches. On December 20th, 1926, the *Anubis* left the Mersey en route from Manchester via the canal to Glasgow. The back of the boiler was at the for'd end of the engine room and the water gauge was so fitted as to be within the range of the engineers on watch. On the way down the river the water gauge indicated about half glass, and later on it showed about $\frac{1}{4}$in. from the top of the glass. The engineer-in-charge of the watch had not been relieved, as the ship was still in the narrows, and it was concluded by then that the condenser had been leaking, thus causing the rise Unfortunately neither the gauge glass nor the feed water were tested to verify the conclusion before the blow-down cock was opened to reduce the water in the boiler, which, according to observation, was reduced to what was considered normal, but again showed a rise. The Chief Engineer, at 1.10 a.m. found the boiler pressure had fallen to 60 lbs. and the engines slowing down. He went into the stokehold, and on entering the forward end, several of the tubes of the starboard side came out, the water and steam escaping through the furnace. On looking at the water gauge glass, it showed empty. On further examination it was found that the port furnace was collapsed. Steam was raised on the donkey boiler and tube stoppers were fitted where the tubes had given way and an attempt was made to refill the main boiler with water, but it was a vain effort and assistance was signalled for, and a tug came to tow the *Anubis* to Garston. Investigation of the whole circumstances conducted by Mr. H. L. Walker, Board of Trade Surveyor, Liverpool, brought forth the cause of the disaster, which resulted in the boiler being scrapped. Examination of the gauge glass mountings showed that the handle of the G.G. cock was twisted, and when it was considered to be in normal position as full open, the passage-way was restricted, and would tend to show false reading; the cock in question was the top one—the steam connection.

Examination of the boiler showed that due to shortage of water the combustion chambers, furnaces and tube plates were all damaged more or less severely, and the whole condition was such that the boiler was beyond repair and a new one was ordered to replace it.

The observations of Mr. A. E. Laslett, Engineer Surveyor-in-Chief, were that this was a very bad case of overheating, which was clearly caused by shortage of water brought about by blowing the boiler down on the false assumption that a high water level in the water gauge was due to an excess of feed from a leaky condenser. Both the engineers concerned were certificated and experienced officers, and it is surprising that neither took steps before blowing down the boiler to test the feed water or verify the correctness of the water level as shown in the gauge glass. The defect in the cock which caused the obstruction in the steam end of the water gauge was apparently of long standing, and it is evident that insufficient attention had been given to the upkeep and care of this most important fitting.

BOILER EXPLOSION ACTS 1882, 1890. REPORT No. 2,876.—The steam drifter *Letterfourie*, 77 tons gross of Buckie. The boiler is of steel 9ft. diam. x 9ft. long with two plain furnaces, the shell plate being $\frac{5}{8}$in. thick, combustion chamber wrapper plates 17/32nd inch, and was built in 1908 at the West of Scotland Boiler Works, Pollockshaws. The boiler was fired from the after end, and was thus in view from the engine room. On April 12th the drifter left Buckie for the Irish fishing grounds, and carried on operations. On May 17th at about 3.30 p.m. she left Helvick for the fishing area, and soon after when the fireman had raked the fires and was near the engine, he heard a thud, and the door of the starboard furnace was blown open, followed by smoke, flame and steam. When the debris cleared away and the fires drawn, examination showed that the commotion had been caused by a small hole 9/16th inch in the bottom plate of the starboard combustion chamber. The *Letterfourie* was towed to Youghal and a temporary repair was made to enable her to proceed homeward. The boiler was fully opened up and examined by Mr. W. L. Mennie, Board of Trade Surveyor, Aberdeen, who found that the sides and bottom of the combustion chamber were formed of one piece of plate which had been originally 17/32nd inch thick, and at the bottom of the chamber the thickness of this plate was reduced by corrosion on the fire side to about $\frac{1}{8}$in. in thickness at the edge of the deposited metal on the furnace plate landing; this metal was deposited previous to 1921, due to a repair by reinforcing. The wastage of the plate became gradually less till 12in. from the landing, when it was the full thickness. The plate was also corroded on the water side and was in the form of grooving, and appeared to be of more recent date than that on the fire side and had developed quicker.

The boiler was examined by a Surveyor for an Insurance Company in April, 1926, and he had passed it without apparently discovering any wastage of the plates and need for overhaul, no leakage having shown. The safety valves were set to 145 lbs. pressure on April 27th, although the boiler was built and the valves set for 130 lbs. and the Surveyor who acted in doing so could have readily found out he was in error. The observations made by Mr. A. E. Laslett were that it is not unusual to find serious wastage of a plate forming the bottom of a combustion chamber of a boiler, which has been in use for a number of years, and it is not a difficult matter even under such conditions as those which exist in these small fishing boats, to ascertain definitely the actual condition of such parts. For the proper maintenance of boilers it is essential that they should be examined regularly and thoroughly, and had such an examination been made in this case, the serious condition of the plate which failed would not have escaped notice.

"Titanic" Engineering Staff Memorial Benevolent Fund.—Donations of one guinea each are gratefully acknowledged from John Stewart (Vice-President), Durban, and D. Jenkins (Member), New Southgate, N.11.; also 8/6 from H. Acton (Member), Liverpool.

Dr. F. Sass who gained the Denny Gold Medal for his paper on "A new type of Solid Injection Double-Acting Two-Stroke Oil Engine," has kindly contributed £10.

The London Shipping Orchestra are arranging to give a concert at Kingsway Hall, on March 21st, the proceeds of which are to be given to the fund.

It was with regret we noted the death of Sir Fred. W. Young on December 20th. He gave us a paper on Salvage Operations, November 27th, 1925, and our intercourse with him was such that pleasant memories are associated with his name, and adding to our regret.

News of the death of Jas. Innes of Greenock, on January 25th, was received with keen regret by many old friends and associates. Born of Scotch parentage in Liverpool, 18th February, 1857, he served his engineering apprenticeship with Messrs. Jas. Jack and Co., and afterwards went to sea in the Moss Line, serving in the *Magdala*, *Marcolis*, *Sesostris* and *Nephtis*, obtaining in due course his Chief's Certificate. In April, 1883, he was appointed a Surveyor to the late Underwriters' Registry and in 1885 he was appointed Surveyor to Lloyds Register of Shipping at Hull, whence he was transferred to Hartlepool as senior in 1904, then to Greenock in the same capacity in 1915, and retired in 1922, but remaining a resident to carry on helpful social work in which he was deeply interested. He was a member of the Institute from 1909 to 1922, when he retired on pension and resigned. On February 6th, 1911, he read a paper on "Notes on Marine Boiler Repairs."

He was keenly occupied in Church work in Greenock, being an office bearer of Trinity Presbyterian Church, prior to which he held office in the Church at Hull. The minister bore testimony to the high appreciation in which he was held when news of his death was intimated. He was works convener in connection with the Mariner's Asylum, Greenock—founded by Sir Gabriel Wood as a home for seafarers; and in view of his work for good causes and his interest to promote such, he was cordially voted for and elected to the Greenock Town Council, November, 1927. Deep sympathy has been manifested towards his widow and family.

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Books Added to Library.

"MARINE ENGINEERING IN THEORY AND PRACTICE," VOL. II. APPLIED, by S. G. Wheeler, Engineer-Commander, R.N. Crosby, Lockwood and Son. Price 35/- net.—The subject, which is the title of this work, is now so vast as to be incapable of compression into one volume, however large, and this fact has been appreciated by the author, who has successfully handled a difficult task.

The chapters on turbines are indeed excellent and most complete. Practically every known turbine is dealt with and fully explained. A good deal of care has been taken to make the construction clear, and the various methods of blading are well illustrated and described in detail. A considerable part of the book is devoted to internal combustion engines, and the reader is introduced to the latest practice in light and heavy oil engines. The reader benefits also by the author's special experience of water-tube boilers.

There is a slight inaccuracy in describing the operation of See's ash ejector. It is also noted that in the exercises the allowance for double shear in riveted joints is given as 1·75. This of course was increased to 1·875 in boiler work some years ago by the authorities.

In spite of these minor criticisms the book is of undoubted worth. It is enhanced by a special chapter on metals and strength of materials by Commander G. C. Malden, R.N. As a work of reference the book supplies a long felt want, and it should find a place on every engineer's bookshelf.

"This Airship Business," by E. F. Spanner. Williams and Norgate, Ltd. Price 25/- net. Obtainable from the author only, at 9, Billiter Square, London, E.C.3.—In this book, which definitely denounces the utility of airships, the author displays that intense earnestness and serious application to the problem in hand which characterises his work. In the case against the airship he marshals his facts with conspicuous ability and develops his arguments to their logical conclusions. The book deals first with personalities who figure prominently in the airship building schemes, and he exposes the alarming fact that the "experts" have little or no knowledge of their job. Dealing with the theoretical structural design it is made clear that no sound theory of stresses in airships has yet been evolved, and it also emerges that there is very little agreement as to the construction of the essential framework.

The author throws new light on the difficulties of safely mooring airships to the mast, which has been accepted as the only permissible method of securing these monsters at their termini. He shows that while so moored the airship is subjected to all the dangers that occur in flight and, unlike a vessel in port, there is no period of comparative immunity. The book is a complete indictment of the Government policy in carrying on with an airship building scheme after the disastrous calamities that have previously occurred.

It will also come as an unpleasant surprise to the reader to find that the Government are committed to heavy expenditure in subsidies to a commercial concern which is building an airship. Mr. Spanner has shown considerable ingenuity in obtaining information which was not intended for the public.

The book should be widely read and the persons to whom it is principally addressed should have no difficulty in arriving at a conclusion regarding the commercial value of airships.

The "Journal of Commerce" Annual Review.—The Review contains, among many features, a special series of letters contributed by prominent shipowners, shipbuilders and engineers at the request of the paper, giving their views on the progress during 1927, and their expectations for 1928. These make interesting reading. In addition much useful information on new ships is presented, also a number of well chosen engineering contributions.

Purchased :—

TECHNOLOGICAL DICTIONARY, by A. Tolhausen, Ph.D.—Vol. I.: French—German—English. Vol. II.: English—German—French. Vol. III.: German—English—French. Leipzig—Bernhard Tauchnitz, 1924.

Presented by the Publishers :—

" DIESEL ENGINES," by Arthur H. Goldingham. Published by E. & F. N. Spon. Price 21/-.—The rapid progress that has been made in the design of Diesel engines for ship propulsion has taken place over a comparatively short period of time and in many directions. So much has this been the case, that the average engineer must find considerable difficulty in obtaining reliable and adequate information on the almost infinite variety of types now in common use. The author and publishers of this volume have had this circumstance in mind when undertaking the issue of the third edition of their book. The subject matter has been to some extent re-written and the book has expanded as a result of the addition of considerable new material. The work is thoroughly up-to-date and the latest types of engines are clearly illustrated and fully explained. The introductory chapters deal concisely with essential principles and consideration of design and construction. Some useful information on standard methods of testing installations and actual test data are included. The greatest part of the work is devoted to marine engines.

The book is not a theoretical treatise on Diesel engines; it is a practical book for practical men, and to them it is commended as a useful addition to the comparatively small number of comprehensive works on a subject which is becoming of increased importance to Marine Engineers.

REGULATIONS FOR HIS MAJESTY'S SEA TRANSPORT SERVICE (WITH SPECIFICATIONS FOR FITTING) TO BE OBSERVED IN RESPECT OF SHIPS EMPLOYED BY THE ADMIRALTY OR BOARD OF TRADE AS TRANSPORTS OR FREIGHT SHIPS. Published by H.M. Stationery Office, 1927. Obtainable through any Bookseller. Price 1/6 net.

INSTRUCTIONS FOR MASTERS OF TRANSPORTS. Published by H.M. Stationery Office, 1927. Price 6d. net.

INSTRUCTIONS FOR MASTERS OF FREIGHT SHIPS. Published by H.M. Stationery Office, 1927. Price 3d. net.

INSTRUCTIONS AS TO THE SURVEY OF LIGHTS AND SOUND SIGNALS. Published by H.M. Stationery Office, 1927. Price 4d. net.

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Election of Members.

List of those elected at Council Meeting of February 13th, 1928:—

Members.

James Allison, The Asiatic Petroleum Co., Ltd., Bulk Oil Installation, South Beach, Madras, India.

Roland Arno, Box 821, Post Office, Lagos, Nigeria.

Frederick Ashton, 11, Heathbank Road, Birkenhead.

William Chance, Mackinnon, Mackenzie & Co., B.I.S.N. Co., Calcutta, India

John James Corlett, 26, Vaughan Road, Harrow-on-the-Hill.

James Duncan, 46, Malford Grove, Snaresbrook, Essex.

Thomas, Edward Holmes, 12, Gasworks Road, Reading.

Charles Miles Martin, 19, Manners Road, Southsea, Hants.

Alexander James Middler, Clinton House, King Edward Street, Fraserburgh.

Gilbert Williams Mosscrop, L.C.C. Engineers' Dept., Old County Hall, Spring Gardens, S.W.1.

Albert Henry Roberts, Inspector in Charge, Indian Stores Dept., 49, Artillery Maidan, Karachi, India.

Frederick Thornton Sinclair, 59, Crawford Avenue, Wavertree, Liverpool.

Osbert Esme Boyce Wynn, Evelith Mill, Shifnal, Salop.

Companions.

Joseph Storey Commander, Stanley House, Kenneth Road, Thundersley, Essex.

Hippolyte Lebot, Rue Turenne, Dunkirk.

Associate-Members.

Henri Louis Béliard, 85, Rue Lamoriniere, Antwerp, Belgium.

Reginald Emile Aitken-Quack, "Bryn Gwlyn," Manor Green Road, Epsom.

Geoffrey Charles Aylward. Kirkman, York Avenue, New Milton, Hants.

Associate.

B. K. Sarkar, *c.o.* J. Samuel White & Co., Ltd., Cowes, I.O.W.

Graduates.

John Ward Greenhalgh, B.A., "Summerhill," Sharples, Bolton, Lancs.

James Thomson, "Gartcows," Jerviston Street, Motherwell.

Transferred from Associate-Member to Member.

G. R. Hutchinson, 21, Manor Road, Kenton, Middlesex.

C. E. Pinel, Nielson & Malcolm, Hankow, China.

George McKenzie Wilson, B.I. Engineers' Club, Calcutta.

Transferred from Associate to Associate-Member.

H. D. Smith, 40, Balmoral Terrace, Heaton, Newcastle-on-Tyne.

Transferred from Graduate to Associate-Member.

Mohamed Hasan Amer, Ports and Lights Administration, Alexandria.

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BOARD OF TRADE EXAMINATIONS.

List of candidates who are reported as having passed examination under the provisions of the Merchant Shipping Acts, during the week ended 14th January, 1928 :—

NAME.	GRADE.	PORT OF EXAMINATION.
Williams, William R.	2.C.	Cardiff
Jones, Leonard J.	2.C.	,,
Mirams, Thomas F. P.	2.C.	,,
Thomas, John	2.C.	,,
Golby, Clarence A.	1.C.	Glasgow
Stewart, John D.	1.C.	,,
Thomas, Kenneth D.	1.C.	,,
Lindsay, William	2.C.	,,
Prentice, William	2.C.	,,
Morrison, William G.	1.C.	Leith
Dalgarno, Cecil M.	2.C.	,,
Wright, Charles H.	2.C.	,,
Tate, Alexander E.	2.C M.	,,
Campbell, Robert T.	1.C.M.E.	Liverpool
McAdam, Andrew...	1.C.M.E.	,,
Birnie, Robert	1.C.	,,
Daniel, Richard H.	1.C.	,,
McIntyre, Duncan...	1.C.	,,
Oldham, Jack L.	1.C.	,,
Wright, William	1.C.	,,
Coulthard, Hugh	2.C.	,,
Naylor, Harry	2.C.	,,
Williams, James A.	2.C.	,,
Freemantle, Douglas W.	1.C.	London
Ross, William H.	2.C.	,,
Smith, Walter A.	2.C.	,,
Tonkin, Frederick E.	2.C.M.	,,
Owen, Thomas T.	1.C.	North Shields
Craig, Thomas H....	2.C.	,,
Hodgson, John W.	2.C.M.	,,
Ratcliffe, Thomas	2.C.M.	,,
Cole, Albert E.	1.C.	Southampton
Savage, Hugh L.	2.C.	,,

Ex. 1.C. Extra 1st Class. 1.C.M. 1st Class Motor. 2.C.M. 2nd Class Motor.
1.C. First Class. 2.C. 2nd Class. M.E. Motor Endorsement.

BOARD OF TRADE EXAMINATIONS.

List of Candidates who are reported as having passed examination under the provisions of the Merchant Shipping Acts, during the week ended 21st January, 1928 :—

NAME.	GRADE.	PORT OF EXAMINATION.
Fisher, Arthur J.	1.C.M.E.	London
Robson, Thomas E.	1.C.M.E.	Glasgow
Waugh, Samuel	1.C.M.E.	,,
Jack, Thomas I.	1.C.	,,
Ross, William H.	1.C.	,,
Stewart, Louis	1.C.	,,
MacDonald, Neil J.	2.C.	,,
McMurdo, Robert D.	2.C.	,,
Smith, James	2.C.	,,
Potts, John W.	1.C.	London
Fletcher, James P.	1.C.	North Shields
Humble, John G. R.	1.C.	,,
Scarth, Percy D.	1.C.	,,
Turnbull, Robert G.	2.C.	,,
Mitchell, John	2.C.M.	,,
Amey, Henry D.	2.C.M.	Sunderland
Knapton, George H. V.	2.C.	,,
Macfarlane, John M.	2.C.	,,
Simmonite, William E.	1.C.	Liverpool
Tolley, Joseph E.	2.C.	,,
Bradley, Denis S.	1.C.M.E.	,,
Cowin, William C.	1.C.M.E.	,,

Ex. 1.C. Extra 1st Class. 1.C. First Class. 1.C.M. 1st Class Motor.
2.C. 2nd Class. 2.C.M. 2nd Class Motor. M.E. Motor Endorsement.

BOARD OF TRADE EXAMINATIONS.

List of Candidates who are reported as having passed examination under the provisions of the Merchant Shipping Acts, during the week ended 28th January, 1928 :—

NAME.	GRADE.	PORT OF EXAMINATION.
Paul, John	1.C.M.E.	Cardiff
Sinclair, John C.	2.C.M.E.	Glasgow
Menzies, William H.	1.C.M.E.	London
Sinclair, David	Ex.1.C.	Glasgow
Boyd, Samuel	Ex.1.C.	Liverpool
Graham, Joseph	Ex.1.C.	,,
Lacey, Henry B.	Ex.1.C.	North Shields
Legg, Albert J.	1.C.M.E.	Belfast
Woods, Thomas	1.C.M.	,,
John, William E. G.	1.C.	Cardiff
White, Arthur R.	1.C.	,,
Evans, Harry	2.C.	,,
Gillis, William G. M.	2.C.	,,
Glean, James H. P.	2.C.	,,
James, Wilfrid A....	2.C.	,,
Jenkins, Gerald W.	2.C.	,,
Cook, Donald S.	1.C.	Glasgow
Stewart, James	2.C.	,,
Prentice, William	2.C.M.	,,
Wilson, Alfred W.	1.C.	Southampton
Gibbs, Reginald D. W.	2.C.	,,
Maberly, Charles	2.C.	North Shields
Macfarlane, James W.	2.C.	,,
Penrice, Wilfred H. M.	1.C.M.E.	,,
Christie, George M.	2.C.	Leith
McBain, George	2.C.	,,
Poulson, John F. N.	2.C.	,,
Willox, Robert	2.C.	,,
Hudson, Stanley	1.C.	Liverpool
Keates, Harold	1.C.	,,
Blakiston, Lionel S.	2.C.	,,
Hewitt, William J. F.	2.C.	,,
Lee, Reggy	2.C.	,,
Loxham, Robert	2.C.	,,
Maconochie, Herbert A.	2.C.	,,
Powis, Ralph	2.C.M.	London
Guyner, Joseph V.	1.C.	,,
Mallett, William E.	1.C.	,,
Webb, Frederick W. J.	2.C.	,,

Ex.1.C. Extra First Class. 1.C.M. 1st Class Motor. 2.C.M. 2nd Class Motor.
1.C. First Class. 2.C. 2nd Class. M.E. Motor Endorsement.