CIRCULATES IN EVERY PROVINCE OF CANADA AND ABROAD

MARINE ENGINEERING of Canada

A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World. Published by The MacLean Publishing Co., Limited

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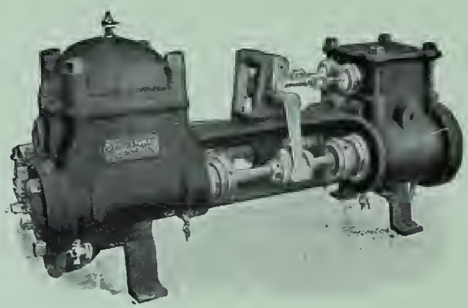

The Publisher's Page

By B.G.N.

ANNUAL OUTFITTING NUMBER

Next month's issue of Marine Engineering will be our

ANNUAL OUTFITTING NUMBER.

It will be the biggest and best number yet. It will be unusually interesting editorially. The cover will be in colors.

It will review events in marine circles during the past year, and articles on seasonable and appropriate subjects will make it an issue well worth preserving.

It is predicted that an era of unexampled prosperity lies just ahead for the shipbuilders of Canada. One leading shipbuilder stated recently that only the supply of steel and shipbuilding facilities would limit the industry during the coming years.

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MARINE ENGINEERING
143 UNIVERSITY AVENUE TORONTO, CANADA

Ice-Breaking Car Ferry Steamer, "Prince Edward Island"

By C.T.D.

As will have been noted from recent issues of our journal, ice-breaking car ferries have been conspicuously in evidence so far as marine transportation in Canadian waters is concerned. This latest addition—like the others, is now in service, and gives every indication of maintaining the reputation of her builders, and the high opinion formed by those who have had the opportunity of inspecting the vessel equipment and variety appointments.

THE car ferry steamer Prince Edward Island, arrived in Halifax, N.S., from the yard of her builders, Sir W. G. Armstrong, Whitworth & Co., Wallsend-on-Tyne, in July of last year, having been launched in October 1914, but delayed in completion as a result of the war.

The new vessel has been designed in accordance with the experience gained by the firm in building a number of ice-breaking steamers for service in the Baltic Sea, and on Lake Baikal, on the Trans-Siberian Railway, and approaches to some extent the Russian ice-breaker Ermack, although not quite as powerful. The governing principle in designing such vessels is to provide as far as possible against the nip of two approaching ice floes. The ice conditions which the Prince Edward Island will be called upon to cope with are severe, although not of the same magnitude as those which have been successfully overcome on the Baltic Sea.

The Prince Edward Island has been built for the special service of transporting trains across the Northumberland Straits from Cape Tormentine, N.B., to Carleton Point, P.E.I., at all seasons. Provision has had to be made for breaking ice which will probably attain a thickness of some three or four feet, and this severe duty has materially affected the design, both as regards the form and scantling of the hull and the power and arrangement of the propelling machinery.

FORWARD END OF CAR FERRY "PRINCE EDWARD ISLAND" ON EVE OF LAUNCH.

The principal dimensions of the S.S. Prince Edward Island are: Length over all, 300 ft.; length between perpendiculars, 285 ft.; breadth extreme over fenders, 53 ft. 10 in.; breadth moulded at deck, 52 ft.; depth moulded 24 ft. The mean draught of water when laden with gross weight of cars and freight of 500 tons, together with 150 tons of coal and stores, is 18 ft. The general arrangement of the vessel is shown by the accompanying cuts. There is an upper or railway deck with a superstructure in which is provided accommodation for passengers and officers. The cars will be run over a hinged gangway at the after deck, and will be secured in position by chance of breaking loose in a rough sea. suitable appliances so as to avoid any

A feature of the vessel is the arrangement of the propelling machinery. There are three sets of triple expansion engines working under 180 lbs. steam pressure. Two sets of engines drive twin screws fitted as usual at the stern, and the third a screw at the bow.

Ice-breaking steamers to be effective must have considerable manoeuvring powers, as they have often a very small space in which to work, and for this reason the twin screw arrangement is advisable. The bow screw is not introduced for speed purposes, as it is generally known that a propeller in this position has very little propulsion efficiency. When used for disintegrating packed ice, however, it is very effective It also disturbs the water under the ice,

CAR FERRY "PRINCE EDWARD ISLAND" AS SHE APPEARS IN SERVICE.

thus depriving it of its support, and so reducing its resistance to crushing by the overhanging hull. The bow propeller is useful when manoeuvring alongside the landing pier, and for driving the vessel astern when working in heavy ice

BOAT DECK, CAR FERRY "PRINCE EDWARD ISLAND."

The after propelling machinery is of 5,000 i.h.p., and is capable of propelling the vessel at 14 knots an hour in open water. The forward propelling set is of 2,000 i.h.p.. The propelling machinery is of the inverted direct acting triple expansion type, the after engines having cylinders of 23, 37, and 60 ins. diam., with a stroke of 39 ins., and the forward engines cylinders of 21, 33½ and 54 ins. diam., with a stroke of 36 ins. Steam is supplied by six single-ended boilers, each 16 ft. diameter by 11¾ ft. long, fitted with Howden's forced draught, and having a total heating surface of about 16,500 sq. ft. There are four funnels placed two at each side of the vessel so as to give a clear train deck. Fore and aft tubular stays and cross lattice stays bind the funnels together.

The hull is extra substantial of construction and heavy. The stem and stern post consist of heavy steel castings. The frames are closely spaced and the hull generally has been specially designed to give ample strength to the car deck, on which the trains will run. A belt of flush plating, some 12 ft. deep and 1 in. thick extends from stem to stem at the waterline, and, generally speaking, every constructional detail has been worked out so as to offer the greatest resistance to ice pressure. The principle of subdivision has been carried to the limit of experience and possible contingencies, so that the vessel may be pierced in several compartments before she will be in danger of sinking, at least rapidly. In addition, a double bottom is fitted. The hull is divided into nine compartment by eight watertight bulkheads, water ballast tanks constituting the cellular double bottom.

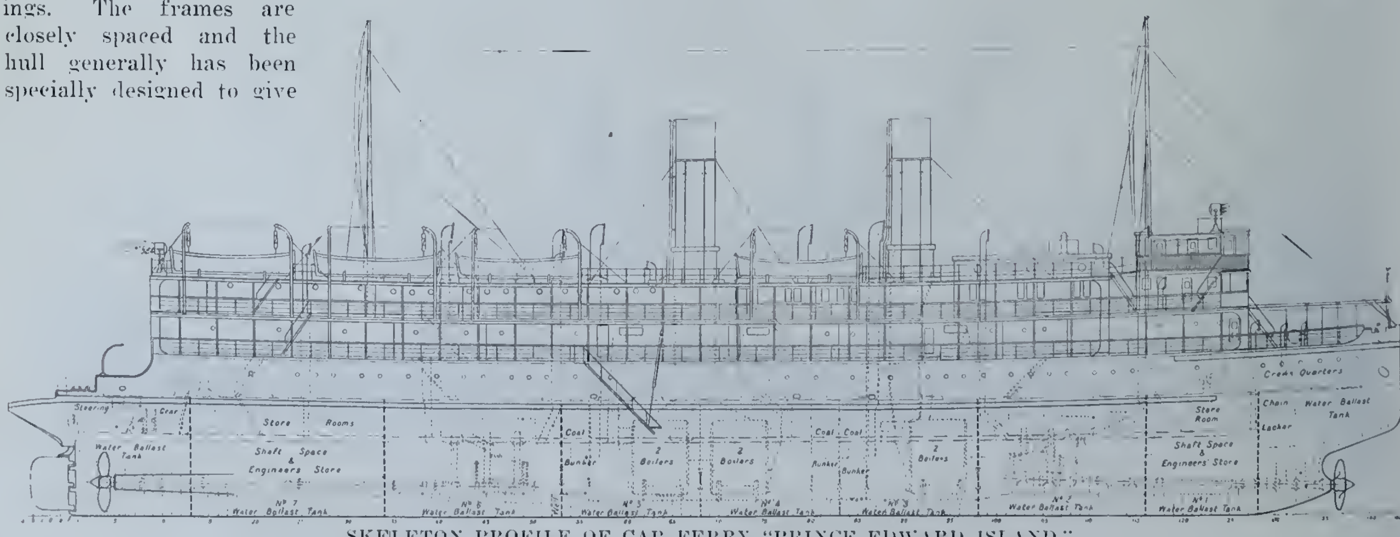
The propelling machinery condensers are installed separate from the engine framing, and are of the uniflux type. The pumping arrangements have been specially designed to suit the various requirements of the vessel service.

The car tracks are placed on the main deck, above which are three decks — promenade, upper promenade and boat deck. The engineers and crew are located on the main deck, the former aft and the latter forward. Stores, etc., are provided for on other parts of the same deck.

The promenade deck is immediately above the main deck and extends round the space occupied by the cars. Over this is the upper promenade and saloon deck. The forward house on the deck contains staterooms for the captain, chief and second officer, and the first-class saloon, with seats for 38 passengers, ladies' room, smoking room, pantry and stateroom for the stewardess. The aft deckhouse contains similar accommodations for second class passengers. Above the promenade deck is the boat deck, fitted with davits for eight lifeboats, the wheelhouse being forward. The passengers alight from the cars and pass to the promenade deck by means of stairways on both sides of the vessel. These stairways lead to the entrance hall of the saloon deckhouses, from which large doors give access to the several compartments. From the pantries lifts go down to the main deck, where the galley is situated.

The first class public rooms are handsomely fitted, the dining room being a large apartment at the forward end of the promenade deck. The floor is of oak parquet artistically arranged, while the framing and pannelling throughout is of solid oak handsomely carved. The ceiling is decorated with painted panel mouldings. A number of small dining tables are arranged to seat altogether 46 people. The ladies' and smoking rooms are fitted up in somewhat the same style. The general effect has been worked out with the view to departing as far as possible from the stereotyped forms of internal decoration peculiar to steamships, and to provide rooms and passages which resemble those of a well appointed house.

The second class public rooms, entrances and corridors are handsomely panelled in oak and mahogany, and have swing doors with plate glass panels arranged in small squares. The stairways



SKELETON PROFILE OF CAR FERRY "PRINCE EDWARD ISLAND."

from the entrance to the promenade deck are of carved mahogany with rubber treads. The captain's night and day cabins are at the forward end of the upper promenade deck.

The accommodation for the officers and engineers is above the second class accommodation. The petty officers,' cooks' and stewards' accommodation, together with the first and second class men's lavatories, galley, lamp and paint room, messrooms for seamen and firemen, are arranged at the sides of the railway deck inside the superstructure. The crew are berthed at the forward end of the railway deck. The life-saving appliances of the vessel comply with latest requirements.

A powerful warping winch is fitted at the forward end of the railway deck, and two capstans at the after end, for hauling cars on board. A powerful windlass is fitted at the forward end of the promenade deck, and a combined hand and steam steering gear is fitted at the stern on the second deck. The electric light installation is of a very complete nature and includes two 25,000 c. p. searchlights. The propelling machinery was supplied by the Wallsend Slipway Co., Wallsend-on-Tyne, the main engines design features being cast iron front and back columns, piston valves for the high and medium pressure cylinders, double bar links, etc.

TRAIN DECK, CAR FERRY "PRINCE EDWARD ISLAND."

British Shipbuilding in 1915.—In the United Kingdom only 517 merchant vessels were built during 1915, representing a total tonnage of 649,336 tons, as against 1,294 vessels of 1,722,154 tons the previous year. The largest vessel launched on the Clyde last year was the steamer Aotearoa, a liner of 15,000 tons, built for the Union Steamship Co. of New Zealand.

PROTECTION AND PRESERVATION OF PROPELLER SHAFTS*

By A. J. Lebeda.

ENGINEERS have tried various methods of preventing corrosion to the propeller shafts of steamers, as well as reducing the friction in the stern tubes. Water, as is well known, is not a lubricant; and yet, strange to say, 70 per cent. of steamers in service depend on water for the lubrication of their stern bushes and propeller shafts. No engineer would lubricate his engine with sea water, and yet the most important bearing in the ship is usually lubricated with it.

If a suitable lubricant can be employed in the stern tube, it stands to reason that the friction would be greatly reduced. Careful experiments conducted by a prominent marine engine builder have clearly proved this. He has ascertained that with a shaft having a brass liner running in a lignum-vitae bush and lubricated with sea water, the co-efficient of friction is 0.094, whereas with a steel shaft running in white metal and lubricated with oil, the co-efficient of friction is 0.048.

Lubricant Features

Some engineers have tried tallow or solidified oil in the stern tubes. These are not desirable for several reasons. Tallow sometimes contains mineral acids and usually also an appreciable percentage of free fatty acid; it also has a tendency to turn rancid and to generate still more fatty acid. These acids tends to corrode the shaft and to perpetuate the galvanic corrosion which is caused by sea water. Another objection to tallow and to all solid lubricants is that any particles of sand which enter the stern bush are kept against the shaft and act like a file upon it. Any oil used in a stern tube should be non-corrosive, not only free from mineral acid, but free from fatty acid; it should also be a semi-solid or non-fluid oil, for a thin oil has a much greater tendency to work out of the stern tube and be lost. The difficulty is to find a non-corrosive oil which is really a good lubricant and yet free from fatty acid.

Hydrocarbon oils, such as vaseline, are free from fatty acid, but they have not the "oiliness" or high lubricating power which is essential for a large bearing like the stern bush. The corrosion which takes place in the stern tube is usually the result of galvanic action, just the same as the corrosion between the two metals in the battery of an electric bell. In selecting a lubricant with peculiar power of adherence to metal surfaces, so that once on the tail shaft it would be practically impossible for water to wash it off, it should be such as to make when mixed with water a flat or velvety lather (not a frothy one) of a very rich nature. Shafts which have been lubricated with this class of oil for many years are not showing the least sign of corrosion or rust.

Lubricant Application

There are various methods of applying the oil to the tail shafts. Some engineers force it into the stern tubes and allow it to find its way through the bush. Others simply feed the oil by gravitation. Sometimes both these methods answer, but usually, sooner or later, it is found to work unsatisfactorily. Also both these methods are far from economical.

Engineers who have made a point of lubricating the propeller shafts of their steamers, have found that it is a costly item on account of the oil running out of the tubes, a great part of it being wasted. By adopting a stern tube appliance or patent gland which is fitted at the after-end of the tube, this waste can be avoided, and at the same time the sand and grit excluded from the stern bush.

Patent Sterntube Appliances

There are several patent stern tube appliances on the market, they differ very little from each other in principle, and are all more or less efficient. I will describe one of the best-known and simplest appliances in use, which is called the Vickers' Patent Tail Shaft Appliance. This fitting is composed of two of more glands, fixed at the after-end of the stern bush, the glands containing one or more specially made floating packing rings, which are so fitted to the shaft that they prevent any leakage of oil, and also prevent any water from entering the tube. In the after-gland two elastic washers are fitted which act as brushes, and brush away all sand and grit, which is likely to enter into the stern bush and score the shaft, and in some cases cause a great amount of dam-

*From a paper read before the Institute of Marine Engineers.

age. This fitting is extremely simple, and can be applied to almost any vessel providing there is at least a space of two inches between the propeller boss and the end of the stern bush. The appliance works equally well with a plain shaft or with a shaft having liners, and with any kind of bush, lignumvitae, white metal, or plain cast iron.

Vessels with this appliance have been able to have their stern glands at the forward end of the tubes re-packed while the ship was floating, and the fittings were so tight that not a drop of water has entered the tubes. This goes to show that, although the appliance in itself is of a very simple construction, it is at the same time most efficient. The writer has had the opportunity of inspecting the shafts of two twin-screw vessels which were fitted with this appliance in 1901, and after 11 years' service the shafts were perfectly bright and free from corrosion, and the white metal bushes had only worn down one-sixteenth of an inch from the total diameter. These are two ordinary passenger steamers, running at about 16 knots' speed, and similar results have been obtained on a number of others.

Vibration Reduction

This type of stern tube appliance is working very satisfactorily on turbine steamers, where the revolutions of the shafts are 700 per minute, and although this is a very high speed, the highest average temperature obtained in the tubes has only been 140 deg. Fahr. A thing which is very noticeable on vessels thus fitted is the almost entire absence of vibration at the after-end of the vessel. This in itself is a great advantage, especially in high-speed passenger steamers where the sleeping accommodation is very often at the after-end of the vessel.

This type of fitting has also found great favor amongst the owners of dredgers and hoppers. As these vessels are continually working in water fully charged with sand, it is very often a costly item to keep the bushes and shafts in good condition on account of the sand and grit wearing them away in a very short time. Another feature also is that the special floating packing rings last a considerable time and very seldom require renewing. The only parts that are subject to excessive wear are the elastic washers, and as these are not a costly item, very little is spent on upkeep.

There are one or two other very good appliances also on the market, but the majority of them contain springs and depend on the efficiency of these to keep the appliances up against the face of the stern bush, and also to keep the box tight. There have been some very good results obtained also with these appliances, and some steamers have been running for a period of about 15 to 16 years without renewing either tail shafts or bushes. There is no doubt that in the near future there will be hardly any steamer of note which will not have the propeller shaft lubricated and protected by some means.

SHIPS TO CARRY GRAIN

THE grain blockade, which has been in existence in Canada ever since the movement of the huge wheat crop harvested in the west this year commenced, is to be partially relieved, it is understood, by ships furnished by the British Government. Recent cable despatches from London have contained the news that Great Britain has been requisitioning vessels right and left. Under new powers recently vested in itself the Government can take over all tonnage of British registration on short notice and has been doing so.

Representations, it is learned, have been made with a view to obtaining some of these bottoms for Canada's transportation needs. The Imperial authorities have been informed that Canadian wheat for shipment to the Old Country is being held up in Canada for need of vessels to move it and it is understood that as a result the Dominion will be furnished some of the requisitioned ships.

Other arrangements, however, are being made for the shipment of the 15,-000,000 odd bushels of high-grade wheat recently commandeered by the Canadian Government. This wheat, it is announced, is for Italy and is to be transported in Italian vessels. The Italian Government has announced its ability to look after the shipment of its own wheat and its offer will be welcomed as relieving the situation somewhat.

SHIPPING BLACK LIST

THE black list of neutral shipping issued by the Government for the guidance of British shippers, who are advised not to charter ships appearing on it, as they are suspected of actual trading with Great Britain's foes or other unneutral service, or as representing German capital, now shows the names of 102 steamers. The gross tonnage of these vessels is 80,000, which means a carrying capacity of 200,000 tons unavailable to British shippers and neutral charters in any way dependent on British shipping.

Neutral nations represented on the list now brought up to date, with the number of ships of each nation, are as follows: United States, 11; Norway, 38; Sweden, 37; Denmark, 8; Spain, 1; Holland, 4, and Brazil, 3.

over the first black list issued three over the first blacklist issued three months ago, but as a number of the Swedish and Norwegian steamers included are small trading boats, operating exclusively in the Baltic, their exclusion from the chartering market will not have much effect. With the growing shortage of tonnage, however, the presence of so many overseas freighters on the list is seriously affecting shippers, who already are complaining bitterly of their inability to secure charters.

Neutral shippers expect that the effects of the black list will even extend to neutral trade which does not touch at any belligerent port. They explain that under the licensing plan for British bottoms operating between foreign ports, these ships can be withdrawn at any time from this service.

Many neutral shippers depend for the bulk of their carrying trade on British ships, supplemented by neutral ships. Should these shippers attempt to charter any vessels on the blacklist, their trade, it is argued, could be ruined by the withdrawal of British bottoms, for with the prevailing shortage of tonnage, it is declared it would be impossible for them to secure sufficient neutral vessels to keep up their shipments.

NEWFOUNDLAND REVERTS TO THE SAILING SHIPS

A REVIVAL of the building of sailing vessels in Newfoundland is in prospect as a result of the situation in the fisheries industry of the colony brought about by the war. During the last ten years the export trade in fish has been carried on chiefly by steamers, but most of the freighters previously available have now been requisitioned by the British and French Admiralties for war transpart purposes. In addition, all the steel steamers which have hitherto engaged in the annual hunt for seals in the Gulf of St. Lawrence in the early spring and during the remainder of the year have carried large cargoes of fish abroad have been bought by Russia for use as ice breakers.

There was much difficulty this year in finding enough vessels to carry Newfoundland fish to foreign markets. Moreover, so many Newfoundland mariners are now serving with the British navy that there was a shortage of men qualified to act as masters and mates. Construction of large wooden sailing vessels to supply the needs of the colony already has begun, and it is expected that in the next year or two there will be a large addition to the Newfoundland merchant marine.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

UNUSUAL CAUSE OF A BREAK-DOWN

By A. L. Haas

BREAKDOWNS and engine wrecks have occurred from a variety of causes, but the following is probably unique. The plant consisted of a condensing steam engine with the usual auxiliary apparatus, the circulating pump having its axis vertical and being at a lower level than the horizontal steam cylinder. The circulating pump was driven by means of bell crank link from the tail rod of piston. Needless to say, the plant was scarcely modern in design. The circulating pump was of marine pattern with foot, delivery and bucket valves having ribbed radial seating. The district in which the plant operates is extremely chalky, and a water softening apparatus is used to purify the make-up boiler feed. It is possible that the bad local water made a condensing plant imperative from the boiler point of view.

Circulating Pump Valves Choked

The engine having met with a mishap involving a bad breakdown, which included a broken bell crank, cracked cylinder cover, bent piston rod, etc., was under the necessity of a considerable repair. Upon investigation, the valve seats in the pump bucket were found very nearly closed with lime deposit. Obvious neglect to periodically overhaul the pump was thus indicated. The wreck was directly attributable to this restriction of area of the pump valves, a circumstance it is believed so unusual as to constitute a precedent. In the cement industry all plant is worked to its limiting capacity and the time allowed for overhauling is cut down to a bare minimum. The pump was awkwardly situated, and the presumption is that so long as nothing happened, overhauling was repeatedly shelved until a more convenient season.

The vacuum obtained must have been satisfactory, otherwise attention would have been given the pump. The gradually choking up bucket valve seats reached the condition however, that when the usual quantity of water got between the foot valve and bucket, the water acted as a solid mass under the descent of the latter, and something of the engine mechanism had to go.

Incrustation is looked for and provided against with boiler feed water; circulating water on the other hand being simply used for cooling purposes is not generally suspected. It is probable that as the volume of cooling water diminished the temperature rose in a corresponding manner so that the deposition of the lime was cumulative in ratio to the rise in temperature. Possibly there were other contributing factors in the incrustration but not being a chemist, the writer's attention was wholly directed to the necessary repairs to get the plant under way at the earliest possible moment.

It would, however, be interesting to learn of the behavior of a centrifugal under similar conditions, but as this would be separately driven, the main engine could not suffer damage. It would appear that under the conditions related a rotary pump would be most suitable.

The reduction of area due to the incrustration exceeded 85 per cent. in some instances, while the sector between the ribs was closed entirely.

THREADING DIES AND PIPE CUTTING TOOLS

By P. W. Blair.

WITH reference to the criticism by J. E. H., of my article on threading dies and pipe cutting tools, which appeared in these columns some time ago, my experience shows clearly that the majority of users of pipe threading tools do not give the latter the attention they deserve so as to maintain them in first class operating condition. If imperfect threads are produced, or they be off standard, the tool is immediately condemned, no consideration being given to the fact that a good standard thread depends on other things besides the tool employed.

Leading manufacturers of pipe-threading tools put standard marks on their dies and chasers, and make to Briggs standard. My experience is that the variation in diameters is very slight. Users of these tools do not seem to realize that they will find variations in fittings of the same manufacture and that there actually is a considerable variation in the fittings of different manufacturers.

I thoroughly agree with J. E . H. that to get good results in threading any metal, the dies or chasers must be ground to suit same with a lip or hook rake in place of a drag cut. By using the chasers with a lip cut it enables them to cut free in place of dragging or pushing the metal off.

The individual piece of pipe has something to do with the resultant thread and there is considerable variety in the quality of pipe.

You will find hard and soft spots also pipe improperly welded. You will also find pipe out of round, thick on one side and thin on the other, yet the average person using the threading dies condemns the threading tool right off hand when the threads are not perfect.

I am pleased to see that J. E. H. agrees with me when he admits that the lubricant and the proper care of tools are one of the important points for the production of good threads. The users of thread-cutting tools have found out that the question of lubrication is a serious one. I have seen tools returned for repair or for lack of thread-cutting qualities, which looked as if mucilage had been used as a lubricant.

I have also seen high-priced threading tools in some plants look as if they had never been cleaned since the day they were received.

I would like to see the user of hand and machine pipe-threading tools educated to where he at least understands the proper care of the tools and learns that good threads cannot be cut if varnish or wood filler is used as a lubricant.

Chip space is another of the practical points that must be taken into consideration when using dies, because if you have not the right amount of clearance on your chasers, the chips cannot get clear away, and pack in the teeth and strip part of the thread or tear it off. The art of tool-making has been so developed within the past fifteen years and manufacturers of pipe-threading tools have so much confidence in the quality of their product that they now furnish an unconditional guarantee.

DUPLEX PUMP TROUBLE QUERY

By "Subscriber"

I WOULD like to have opinions on a duplex pump which has been giving us a little trouble. The pump in question is a 12 x 18 x 12 x 12-inch unit, and operates against a pressure from 70 to 130 lbs. On the start of the return stroke it jerks heavily, and much more so when the condenser is on. I should imagine from the slap of the valves in the water end that they had too much lift or there is not tension enough on the springs. It works very well non-condensing at 20 to 24 strokes per minute, but over that it jerks and hammers hard.

I put new valves in water end some two or three months ago, but this did not help matters much. I have had a lot of trouble with springs breaking, the cone shape appearing to last longest. I want to know where to get good springs, and also suitable valves. Although in charge of the plant for three years, I have not had occasion to order any of the above, as there was a variety of all kind on hand.

PREVENTING CORROSION IN MARINE BOILERS

A DEMONSTRATION was recently given in London, Eng., of the Cumberland Electrolytic Process for preventing corrosion of all metals immersed in liquids. This system has been developed with special reference to marine boiler application.

According to the inventor, Mr. Elliot Cumberland, the boiler or condenser shell is connected to the negative pole of a 10-volt dynamo; the iron anodes being attached to insulated bolts passing through the shell, and each anode separately joined to the positive pole through an adjustable resistance and a switch. An anode lasted 18 to 24 months, the system requiring very little attention. The current which compensated the corrosive electromotive force also effectually removed hard scale from heating surfaces; the hydrogen bubbles detached the scale, and prevented its further formation. About 2 amperes were requird per 100 sq. ft. of heating surface; the anode, of wrought iron, could be utilized until almost eaten away. The British Admiralty has now adopted the system, and surprising results as to scale removal have been obtained on recent trips across the Atlantic.

OPERATION OF D.C. MOTORS AS GENERATORS

By B. H. Chatto.

THERE appears to be a lack of understanding in regard to the characteristics of a direct-current motor when operated as a generator, and the rating which may be obtained from a given motor when wound as a generator to run at the same rated speed. At first thought, it may appear that a motor having 75 per cent. efficiency could be made to deliver as a generator the same kilowatts as it will deliver horse-power as a motor, since the line amperes and voltage would be the same in either case. Such an assumption is approximately true, provided the speed is increased to a point where the machine will deliver as a generator its rated voltage at the terminals. This speed is in proportion to the motor speed as $(E + IR)$ is to $(E - IR)$, where E is the terminal voltage, and IR is the internal drop in the windings and brushes.

In the case just cited, a slight increase in temperature may be expected, because the armature current has been increased by an amount equal to twice the shunt field current; and because the core loss, friction and windage are greater than at the motor speed. On the other hand, heat radiated from the armature per degree rise will have increased because of the higher peripheral speed. In general, motors with a continuous duty rating operate at temperatures low enough to permit their use as generators under the conditions just outlined.

If it is desired to rewind a motor to operate as a generator at its rated speed and voltage, and to maintain temperatures equal to the motor rating, it is necessary to increase the number of armature turns in the proportion of $(E+IR)$ to $(E - IR)$. If the design is such that the number of turns can be so increased without any sacrifice in efficiency, an output can be obtained in watts equal to that of the motor in watts; that is, for a given temperature, generator output in watts equals the motor output in horsepower times 746. The reason for this is evident from the fact that for a given watts output and efficiency there will be the same losses whether the output is in the form of mechanical or electrical energy. In one case the losses are taken from the line, while in the other they are supplied by the driving engine motor.—Electric Journal.

SHIP-BRAKE EXPERIMENTS

AT the New York November meeting of the Society of Naval Architects and Marine Engineers, Captain W. Strother Smith, U.S. Navy, presented a brief communication on experiments made in the model tank of the Navy Yard, Washington, with the Lacoste ship-brake. Some trials had already been made with this brake in 1910 on board the U.S.S. Indiana, but the ship proved then, and again recently, unsuitable for such experiments. A model of the S.S. St. Louis (536 ft. long, 62¾ ft. beam, 28 ft. draught, 17,230 tons) was used. The brakes were a kind of vertical fin, fixed in pairs on hinges to the sides of the ship and held so as to form various angles up to 90 deg. with the ship's axis. One pair of brakes mostly was used, two pairs (at frames 76 and 95) not proving more efficient than one pair. The dimensions of the brakes ranged from 6 ft. by 6 ft. to 12 ft. by 14 ft. The length of the model, or of the section to which these large brakes were attached, was nearly 25 ft. There are no explanations to the diagrams. As a rule the upper edge of the brake was in the water-line. The stopping-power varied directly as the projected area opposed at 90 deg. to the fore-and-aft line. The pressure per square foot decreased as the width of the brake was reduced; but when a certain width was exceeded, the pressure was no longer increased.

The effective horse-power trials, made with the model before attaching the brakes, roughly gave the figures 10,000 and 25,000 for speeds of 19 and 23 knots; after attaching the brakes the powers ranged from 25,000 to 50,000 for 19 knots and from 40,000 to 85,000 for 23 knots. With the 11¾ ft. by 14 ft. (depth) brakes at 90 deg. the speed of 18 knots was decreased to 15.2 knots in 500 ft., to 11.6 knots in 1,000 ft., to 7.15 knots in 2,000 ft.—all without the aid of reversing by the propellers. The striking blow (for the 17,230 tons) would at 18 knots be 247,300 ft.-sec. tons, and at 7.15 knots 39,000 ft.-sec. tons, and the speed of 18 knots would be reduced in 50, 100, 150, 200 seconds respectively, to 11.1, 7.35, 5.85, 4.7 knots.

As regards the power and mechanism to work the brakes, Captain Smith found that hydraulic cylinders athwart a stiffened bulkhead would involve an additional weight of 190 tons, including 33 tons of water, and that toggle joints, and rack and pinion, etc., could not make such gear practicable. The brakes would hence simply have to be released by a lever (actuated from the bridge) and opened by the water pressure. A design of this type has been made for the S.S. Empress of Asia, of the Canadian Pacific Line. Without in any way discussing his curves and experiments and the practicability of the proposals, Captain Smith considers that the further question of installing such a brake is a financial one.

CO_2 REFRIGERATION MACHINES

WHILE ammonia machines have been particularly prominent in developments that have taken place, there have been as marked improvements in machinery using other than ammonia as the refrigerant. This is particularly true of the carbonic acid gas machines, the efficiency of which has been greatly increased and a large number are now in successful operation. They are claimed to be specially suitable for hotels, restaurants, on shipboard, etc. As the field of refrigeration widens the question often arises, what refrigerant is best for a given purpose. No longer does one buy refrigerating equipment simply because it can produce refrigeration, but the purchaser now asks for the type of equipment that will be the best and most efficient for the purpose for which it is to be used.

Series of Practical Questions and Answers for Engineers

By "Artificer"

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals will be found a useful companion study. With a view to meeting the need of many of our lake and inland waterway engineers who, during the closed season of navigation, take positions in steam power plants ashore, questions relative to the latter department will also find a place in the series.

Question.—Do you reckon the ammonia compression system more liable to serious trouble than the ammonia absorption system?

Answer.—Leakage of ammonia is the trouble inferred from your query, regarding which, should a break occur in the machinery equipment or its piping, there would be little to choose between the two systems. The absorption system embodies more piping than does that of compression, therefore the liability to leakage, and even breakage of pipes is correspondingly greater; on the other hand, stuffing box leakage at the ammonia end of the compressor is for the most part larger than that of the liquor pump of the absorption machine.

* * *

Question.—Can coal high in volatile matter be burned economically by forced or normal firing, and without an abnormal discharge of smoke from the stack?

Answer.—The crux of your query lies wholly in the design and arrangement of furnace. A high furnace temperature must be maintained, sufficient air must be admitted by way of the grate and a capacity of combustion chamber must be provided to ensure complete combustion of the volatile matter before the gases reach the tubes or other heating surfaces which are comparatively cooler. Carbon losses, which appear as smoke are not so extraordinary as is too often believed, seldom going beyond one per cent. These are visible and may as they sometimes do lead to prosecution because of their constituting a smoke nuisance. The escape of combustible hut unconsumed gases on the other hand may reach as high as ten per cent., and at the same time give absolutely no indication of their discharge at the stack mouth.

* * *

Question.— What are the basic troubles arising from the use of impure water in steam boilers?

Answer.—Corrosion, incrustation or scale, fouling or thickening of the water in the boiler which like incrustation or scale forms a non-conducting condition; each may result from the use of impure water, and it is possible for all to be effective at one time.

Question.—Although I am aware that the purpose of a chimney in connection with a steam boiler is to produce a draft by promoting a flow of air through the furnace, I am not quite clear as to how the result is attained. A brief explanation as to the latter will be esteemed.

Answer.—The air or gases in a chimney being hot are therefore lighter than the surrounding or outside atmosphere. The latter, in consequence endeavors to force its way into the chimney from below in order to if possible restore the balance of pressure. The only inlet to the chimney is of course by way of the grate bars, fuel and furnace door grid, and, in passing through these, the air maintains combustion and becomes highly heated, making the operation of the chimney, or draft as we term it, practically continuous.

* * *

Question.—What type constituent of feed water is responsible for producing corrosion in a steam boiler?

Answer.—Corrosion, whether external or internal, is due to the presence in water in contact with boiler plates of some oxidising agent. Air, carbonic acid gas, free acids or dissolved salts such as magnesium chloride, exert a corrosive action on iron and steel.

* * *

Question.—In laying out and installing the condensing apparatus for a steam power plant what considerations must be accounted in order to contribute to its successful operation?

Answer.—The condenser should be placed as close to the engine as possible, the air pump being on a lower level than the condenser. The injection supply should not come to the pump under a head, since this would destroy the efficiency of the vacuum breaker and might allow water to be drawn into the engine cylinder. The exhaust main between the engine and condenser should be fitted with an atmospheric connection embodying an automatic exhaust relief valve. All air leaks in the exhaust main must be avoided if a high vacuum is to be maintained. The air pump should not discharge against a greater head than two feet.

Question.—For what purposes are footvalves and strainers attached to the outer end of pump suction pipes?

Answer.—A footvalve ensures the quick starting up of a pump, particularly if the lift be high—15 feet or over, or if the suction line be long—100 ft. or more, by maintaining a full volume of water in the pipe. In the case of a pump being started and stopped several times during an operative shift, the advantage of a footvalve becomes increasingly apparent. A strainer with openings of a combined area equal to four or five times the area of the pipe is attached to the outer end of the footvalve, or may form the face of a well into which the end of the suction pipe and footvalve dips. The purpose of the strainer is to prevent foreign matter, chips, etc., from finding their way through the piping to the pump.

* * *

Question.—What is the theoretical height limit to which water can be lifted by atmospheric pressure alone, and how does same compare with practice?

Answer.—The extreme theoretical height to which water can be lifted by atmospheric pressure is 33.9 feet. In practice, however, 25 feet is seldom exceeded, and in most cases effort is made to keep the lift as much below this amount as possible.

* * *

Question.—Hot water, I understand, cannot be raised by suction, why is this, and what provision must be made to deal with it otherwise?

Answer.—Hot water cannot be raised by suction because it vaporizes when the atmospheric pressure is removed, and the vapor is alternately expanded and compressed in the pump cylinders without being expelled. The pump must be located so that the water will flow to its suction opening under a sufficient head to ensure the water cylinders always being full of water, and not with a mixture of water and vapor. When the temperature of the water approaches boiling point, the head on the suction opening of the pump should be from 10 to 15 feet, and under such circumstances the size of the suction pipe should be very ample. In the case of thick liquids, those should always flow to the pump by gravity—in other words, under a head.

* * *

Question.—To determine the water horse-power or theoretical horse-power of a pump what data concerning the latter must be available and how must it be applied?

Answer.—To calculate the theoretical horse-power of a pump, the discharge in gallons per minute, the weight per gallon of water and the height of lift in feet including those of suction and friction heads, must be known. Multiplying all of those together and dividing by 33,000 will then give the water or theoretrical horse-power. Thhe actual horse-power depends on the efficiency of the pump, and is found by multiplying the theoretical horse-power by 100, and dividing by that efficiency. For example, if the theoretical horse-power were 30, and the pump efficiency listed at 60, then 30 multiplied by 100 and divided by 60, would give the actual horse-power required, in other words 50 horse-power.

* * *

Question.—Superheated steam is finding a large place in steam power plant operation, for which reason it must necessarily possess some considerable advantages over saturated steam. The enumeration of a few of these will be esteemed?

Answer.—Superheated steam admits of more economical operation of the engine to which it is admitted, not wholly, however, in practice, because the steam is applied at a higher temperature and as a result enables a wider range of the latter to be compassed. Superheated steam ceases to be such, generally before cut-off takes place in the engine cylinder, in which case the theoretical economy gives place to a lesser but practical realization. As already stated, before cut-off takes place, the superheated steam admitted has become saturated, but its heat or excess temperature has gone to warm up the inner surface of the cylinder and the piston face, these having been cooled by the evaporation of water deposited on them. The economy produced reaches in some cases as high as 20 per cent., and may be stated briefly as being due to the cylinder walls and piston faces being subjected to lesser variations of temperature than is possible with saturated steam.

* * *

Question.—What is understood by the term load factor as applied to power plants or a unit of same?

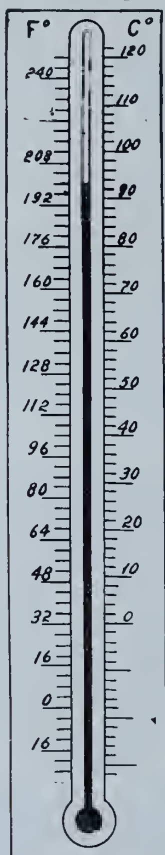
Answer.—By load factor is meant the ratio of average output to the maximum. Thus, if in an electrical installation, M= maximum kilo-watt output, and K = total output in (n) hours, then the load factor for that period is K divided by Mn. This is commonly expressed as a percentage, in which case the load factor $= \dfrac{K \times 100}{Mn}$. The period generally taken is one year in working days, the load factor being then =

$$\frac{\text{Total units generated} \times 100}{\text{Maximum load} \times 300 \times 24}$$

* * *

Question—(a).—What is the corresponding reading on the Centigrade thermometer of 200° Fahrenheit?
(b)—What is the method used in changing a reading from one scale to the other?

Answer—(a).— 93 1-3 degrees centigrade, see skeleton diagram.



(b)—The boiling point on the Fahrenheit scale is 212 degrees, and on the Centigrade scale 100 degrees. The zero reading on the Centigrade thermometer is at the freezing point, while the freezing temperature on the Fahrenheit scale is 32 degrees above zero; therefore the space occupied by 100 degrees on the Centigrade scale is divided into 212—32 = 180 degrees, and the proportional space for each degree is

$$\frac{180}{100} = \frac{9}{5} \text{ or } \frac{100}{180} = \frac{5}{9}$$

Then by taking 9/5 of any Centigrade reading and adding 32 the result will be the same temperature on the Fahrenheit scale; or by subtracting 32 from any Fahrenheit reading and taking 5/9 of the remainder the result will be the corresponding temperature on the Centigrade scale.

By formula $F = \frac{9}{5} C + 32$ or $C = \frac{5}{9} (F—32)$; thus to change 200° F to corresponding temperature on C. scale we have

$$C = \frac{5}{9}(F—32) = \frac{5}{9}(200—32) = \frac{5}{9} \text{ of } \frac{168}{1} = \frac{280}{3} = 93 \text{ 1-3 degrees.}$$

* * *

Question.—It is required to find the theoretical horse-power necessary to elevate a stream of water to a given height.

Answer.—Multiply the weight of water elevated per minute by the height in feet and divide the product by 33,000.

* * *

Question.—(a)—What is the steam consumption of a duplex pump with steam cylinder 12 in. diameter, water plunger 8½ inches, stroke 10 inches, when pumping 500 g.p.m., against a head of 110 feet, static and friction? Steam pressure 100 pounds.

(b)—What is the steam consumption per hour, same steam pressure and water head, pumping 500 g.p.m., when using a duplex tandem compound pump, high pressure steam cylinder 8 inches diameter, low pressure steam cylinders 12 inch diameter, water plunger 8½ inches, stroke 10 inches?

Answer.—The data given are based on average practice, as shown by tests on various makes of pumps. The dimensions given for these pumps are ordinary dimensions, and, therefore, would come under the range of ordinary practice.

As to the first question, (a) we figure the theoretical h.p. of water end.

$$\frac{500 \times 8.333 \times 110}{33{,}000} = 13.89$$

Assume the efficiency of water end approximately 80 per cent.

The delivered h.p. would be

$$\frac{13.89}{.80} = 17.36$$

The steam consumption at 100 single strokes per cylinder per minute may be assumed at 120 pounds per h.p., because of relatively high cylinder condensation when working under low head at rated speed. The steam consumption would be 120×17.36 = 2083 pounds per hour.

Referring to question (b), a compound pump of the size given would reduce the consumption about 20 per cent., which would make it about 1,666 pounds per hour when working at a capacity of 500 gallons per minute.

Shipbuilding and Ship-Repairing in Canada During 1915

By "Mariner"

In spite of the fact that the war in its various phases has been and still is responsible for an extraordinary shortage of "bottoms," it does not appear that Canadian shipyards enjoyed that activity in new construction during 1915, that the above-mentioned circumstance appears to have warranted. The high cost of materials entering into shipbuilding has no doubt militated against the development of any considerable degree of activity, notwithstanding, there is ample evidence that attention to our marine requirements may not be unduly ignored

DESPITE the fact that the manufacture of munitions has in large measure displaced that of other steel and iron products, shipbuilding and ship-repairing in Canada may be said to have maintained at least its average activity in both departments. The conclusion of the war, and, of necessity, probably earlier, will witness an enlargement of both shipbuilding and marine engineering production everywhere, and we in Canada cannot fail to participate to some extent, even be it but to fill our own needs, which are daily becoming more pressing. The following details covering the work of the year 1915 have come to hand:

Collingwood Shipbuilding Co.

This establishment is enjoying considerable activity in new work, having launched on the 15th of December, the first of two vessels under construction for the Imperial Oil Co. These boats are being specially built for carrying oil on the Great Lakes, but the equipment includes all the necessary appliances for ocean service. Principal dimensions: Length. 258 feet; beam, 43 feet; depth, 18 feet. The large freighter for which a contract was recently closed, is now in course of construction and will employ a considerable number of hands during the winter. Particulars of this boat are as follows: Length, 550 feet; beam, 58 ft.; depth. molded. 31 ft.; gross tonnage, about 8,000; deadweight on 19 ft. 6 in. mean draft, 11,000 tons. Three Scotch type boilers each 13 ft. diameter by 11 feet long, will be installed, the triple expansion engines having cylinders 24 in., 40 in., 66 in., dia. by 42 in. stroke. Other launches included a steel steam hopper barge for the Department of Public Works, Ottawa, for use on the St. Lawrence River. This barge is self-propelled, with the following dimensions: Length, 187 ft.; beam, 32 ft.; depth, 14½ ft. The usual quota of general repair work has been completed with encouraging prospects for a good share of this class of work during the ensuing months. The production of 18-pdr. shrapnel and 4.5 high explosive shells has been, as elsewhere, an important development at this plant.

Polson Ironworks, Toronto

The accompanying tables indicate at a glance the substance of the shipbuilding and marine engineering work completed and in process at the yards of the Polson Ironworks, Toronto. In addition to what is there stated, a considerable amount of new and repair, general and stationary engineering and boiler construction has been put through during 1915. Shell production has formed a quite important feature of the total output to the year's credit, and we are informed that in every direction of the firm's activities, the prospects for the ensuing year are in every respect encouraging.

Repair Work, 1915— Polson Ironworks, Toronto

Name of Vessel.	Owners.	Description of Repairs.
Ontario No. 1	Ontario Car Ferry Co. Can. Government	New H.P. cylinder port engine. New firehold floor. Patent stern gate similar to No. 2. Portable hatches over engines. Boilers electric welded, and general overhauling.
Dredge No. 117	Dept. Public Works	General overhauling.

Vessels Completed 1915—Polson Ironworks, Toronto.

Name of Vessel	Yard No.	Type	Principal Dimensions	Gross Tonnage	Engines	Boilers	Speed	Designation	Date of Launching	Port of Registry	Owners.
C. G. S. Grenville	119	Buoy Steamer	Length 164'-6" Breadth M. 30'-0" Depth M. 13'-0"	497	Triple exp'n 14"-22½"-38" 24"	2-Scotch 10' dia. 11'-0"g. Howdens Draught	13 miles	Lloyds 100 A1	Nov., 1914	Ottawa	Can. Govt., Dept. Marine and Fisheries
Ontario No. 2	126	Car Ferry	Length 318'-0" Breadth M. 54'-0" Depth M. 20'-6"	5567	2-Triple exp'n 20½"-33"-54" 36"	4-Scotch 14' dia. 12'-0"g. Howdens Draught	15 miles	Great Lakes	April. 1915	Montreal	Ontario Car Ferry Co.
Wanda III.	127	Yacht	Length 94'-0" Breadth M. 12'-0" Depth M. 6'-0"		Triple exp'n 9"-13½"-20" 11"	1-Thornycroft 1220 sq. ft. H. S.	18 miles		May, 1915	Toronto	Mrs. T. Eaton
Patricia	128	Motor Tug	Length 36'-0" Breadth M. 9'-6" Depth M. 4'-0"		30 H.P. Heavy Duty Gasoline		10 miles		June, 1915		Hudson Bay Co.

Kingston Shipbuilding Co.

During 1915 no new vessels were built at the plant of the Kingston Shipbuilding Co., Kingston, Ont. The amount of repair work was well up to the average, and in the matter of the immediate future in this respect, the following vessels are in hand:—Keyport, repairing stem damage; Keywest, Keybell, Keyvive, Saskatoon and Arabian, repairing bottom damage.

Western Drydock and Shipbuilding Co.

No new tonnage construction work appears on the 1915 record of the Western Drydock & Shipbuilding Co., Port Arthur, Ont.; it will be noted, however, that the ship repairs undertaken were quite heavy. An addition to the regular line of work was the manufacture of light tractors for farm work, twelve carloads of which were shipped to the Western provinces. Owing to the abnormally high price of steel and unsatisfactory deliveries, any increase in activity during the early part of the year is not looked for unless an unexpected change in conditions takes place. Repair jobs in dry dock during season of 1915 included the following steamships: Paliki, 17 shell plates and general overhauling for classification with Lloyds; Turret Chief, partially reconstructed, including the replacing of 119 plates; Frater Taylor, 14 plates and 19 feet of stem; Turret Cape, 21 plates; Glenlivet, 26 plates; Pellatt, 1 plate; Glenlyon, repairs to top and hatch coamings; Collingwood, 11 plates; A. E. Ames, 22 plates; Meaford, 38 plates; Glenfinnan, 25 plates; Lehigh, 1 plate; Inland, 26 plates.

Canadian Vickers, Ltd.

There are at present under construction at the plant of Canadian Vickers, Ltd., Montreal, the following vessels for the Canadian Government:—Steel twin screw icebreaker, of length over all, 292 ft., 57 ft. 6 in. moulded breadth, and 32 ft. moulded depth; steel twin screw centre ladder and hopper barge loading dredger, of length over all, 292 ft. 1½ in., 48 ft. moulded breadth, and 20 ft. 6 in. molded depth. During the 1915 season of navigation, twenty-four vessels were docked and repaired on the floating ship dock Duke of Connaught. In addition, repairs were carried out on a large number of vessels afloat. The foregoing is altogether exclusive of naval armaments or war munitions work.

M. Beatty & Sons, Welland, Ont.

In addition to a considerable number of repair jobs carried out on vessels plying between Port Colborne and Montreal, M. Beatty & Sons completed during the past year the 20-inch, all-steel, hydraulic dredge Primrose to the order of the Canadian Dredging Co., Midland, Ont., for service on Section 5 of the new Welland Ship Canal. They also built and completed a steel fishing tug for Misener & Tedford, Port Burwell, Ont. Alterations are at present proceeding on the steamer Algonquin, preparatory to that vessel entering ocean service next spring. The steamer Nyanza is also being overhauled, and prospects are quite equal to the average of former years in the matter of refitting lake craft wintering at Port Colborne and elsewhere.

OIL ENGINED COAL CARRIERS FOR GREAT LAKES

THE experiment which is about to be made on the Great Lakes with auxiliary oil-engined colliers will be watched, says Syren and Shipping, with interest by shipowners in the ocean trade. Since the outbreak of war the same idea has been given a new lease of life by owners on the British side of the Atlantic who have acquired a good many ocean-going windjammers and are fitting them with auxiliary engines. In the exceptional circumstances of the moment there is no doubt that the enterprises will be profitable — very profitable indeed — although it is doubtful if, when the conditions become normal, auxiliary ships will be able to live in competition with the large full-powered vessels which will be available.

At first sight the Great Lake experiments seem to have been induced by a sudden discovery of the hot-bulb engine's possibilities. As a matter of fact, however, through the withdrawal of steamers for ocean service much the same shipping position has been created on North America's great inland sea as exists elsewhere in the world. There is a shortage of tonnage, and in the circumstances the ordinary economic law which rules is inoperative.

What that economical law embodies is excellently illustrated by the New York paper which booms the new departure. "The old-fashioned 1,600-ton steamer went," it says, "to the scrap-heap long ago, for it could not carry enough, and discharging by primitive means was expensive. Bigger steamers, equipped with powerful steam winches, were built, and then bigger steamers yet with self-trimming devices, the latest of these carrying anywhere from 5,000 to 10,000 tons deadweight."

In view of that the average man will find it difficult to regard the future of auxiliaries "able to carry 4,000 to 5,000 tons" as rosy. Still, this is obviously a different problem from that which is in process of solution on Britain's side of the water. Schooner-rigged auxiliary vessels of this carrying capacity may cut into a good deal of the Great Lakes coal trade, and the type lends itself, especially in American hands, to very economical working. On this account shipowners will, we think, find a great deal in the experiments to interest them.

GEORGIAN BAY CANAL

IT is a matter for regret that advocates of this scheme should seek to add to the cares of the Government by bringing forward at this time the question of proceeding with this undertaking. While no one is justified in condemning the project as impracticable, the present state of transportation facilities throughout the Dominion justifies the statement that the proposed waterway is economically impossible and financially undesirable. The estimated cost of the entire work is $150,000,000, to be raised by the sale of bonds guaranteed by the Government; failing which the Government could construct it, and meet the cost, as of other public works, with funds from the public treasury. The past history of the Grand Trunk Pacific and the present trials of Canadian Northern will doubtless act as a deterrent to future Government participation in, or encouragement of, such stupendous undertakings.

The question of commercial justification of the Georgian Bay Canal will remain unsettled until it is built and has been in operation for several decades. The great development of the North-West has been made possible by transportation facilities, which in turn have depended on the North-West for a continuance of their existence. The main source of traffic would be the carriage of grain. That, again, would be obtained at the expense of the Transcontinental Railways, and also the enlarged Welland Canal, provided, of course, that the rates were low enough to offer a saving over the expense of the longer trip round the lower lakes. While no such troubles would be experienced as are at present happening in the Panama Canal, the large number of locks would increase the possibility of delay by accidents which are all too frequent in the Welland Canal now, while the greater length of it would cause any tie-up to affect so much more traffic.

One of the arguments advanced in favor of the proposal is the probability of diverting to Canadian channels a portion of the Canadian grain which now reaches the Atlantic via Buffalo and New York. Such diversion could be more completely and permanently accomplished if the estimated cost of the proposed canal were devoted to the improvement of navigation conditions on the St. Lawrence River. The inequality of insurance rates is the principal reason for the preference given the southern route. Remove this handicap from which the St. Lawrence route suffers, and increased shipments would soon result.

If the Georgian Bay Canal were to be constructed and no provision made for equalizing insurance rates, the net results would amount to the saving of a few hours in time. The higher rates and possibility of longer delays might easily offset the time saved over the Lower Lakes route, while the greater certainty of this route would still have many advocates. The interest return on one hundred and fifty million dollars, if applied in the form of insurance rebates, would, with the enlarged Welland Canal, offer sufficient inducement to shippers to keep the grain in the one bottom from Lake Superior to Europe.

Once conditions were equalized, the grain port business would take care of itself. In addition to indefinitely delaying such an event, the Georgian Bay Canal would probably interfere sufficiently with the business of existing waterways to prevent either systems from being efficiently utilized. Better far to have one canal doing business on a healthy basis than two canals struggling for existence at the expense of the country.

What is efficiency? Is it not doing a thing in a clean, quick, competent way? Is it not doing a thing with the least expenditure of brain and force? Is it not doing a thing the way a thing ought to be done. Efficiency means effort; it means study; it means the development of our own powers; it means applying those powers to every task.

ERECTING THE NEW QUEBEC BRIDGE

STAFF ARTICLE

Public interest in the Quebec Bridge is again manifesting itself as the work of erection proceeds rapidly and successfully. The structure is now at approximately the same stage of completion as its ill-fated predecessor at the time of its collapse. The actual linking up of rails is scheduled for the fall of 1916, and the work from now on will occupy an increasingly important position in the ranks of Canada's many great national engineering feats.

DURING the past year, despite the unsettled conditions of the country, the progress of the erection of the new Quebec Bridge across the St. Lawrence River has been very satisfactory. At the close of last year the north shore anchor arm had been completed with the exception of the upper portions of the three panels adjoining the main pier. The north portal and approach to the main structure was erected during the winter, also a certain amount of riveting was done.

The appearance of the structure at the commencement of operations in the spring of 1915 is shown in Fig. 1. About the middle of April the work was again started, and for the past eight months the pre-arranged programme of the contractors has been closely followed; in fact, certain sections were erected in shorter time than had been expected. The main posts, 10 feet square, which had been fabricated at the shops of the St. Lawrence Bridge Works, near Montreal, were transported by rail to the bridge site in twenty-seven separate sections, with the splice plates attached. The erection of these various sections necessitated very careful and accurate handling of the cranes and hoisting equipment. At the point where these various sections are spliced together, temporary platforms were constructed for the use of the men when riveting up the splices. This work is now practically completed. To enable the reader to have some conception of the massiveness of this structure, and the ingenuity demanded in the assembling of these many details, we would refer to Fig. 2. This shows the cap and top chord connection which forms the upper end of the main post. This piece alone weighs nearly 72 tons, and will be 310 feet above the main shoe, which rests on the concrete pier.

The work of assembling the structure proceeds on both sides simultaneously. The two north shore main posts, weighing approximately 1,000 tons each, were erected in thirty days. The main panels adjoining the centre posts were also assembled in about thirty days; the second panel on the north shore cantilever was completed in twenty-one days, with proportionately shorter periods on the successive panels.

Each section of the cantilever arm is completed as the work progresses, the rear boom of the traveller placing the bracing in position, while the side members of the forward panel are being erected by the front boom.

An interesting feature in the erection of the lower chords is the use of a steel platform called a "flying bridge." These chords have a vertical splice midway between panel supports, and it was necessary to construct this platform so as to take in one complete panel. The "flying bridge" is supported at the shore end by means of pins connected to the chords, and the outer end is held in position by means of links extending down from the upper web members. The platform is moved to a new position by the travelling crane.

Due to the fact that work is progressing from both sides of the river, it is essential that accurate calculations and observations be taken at stated periods of construction, to insure the perfect alignment of the structure. This is one of the chief points in connection with this huge engineering undertaking. When the north shore anchor arm was completed, the main post was

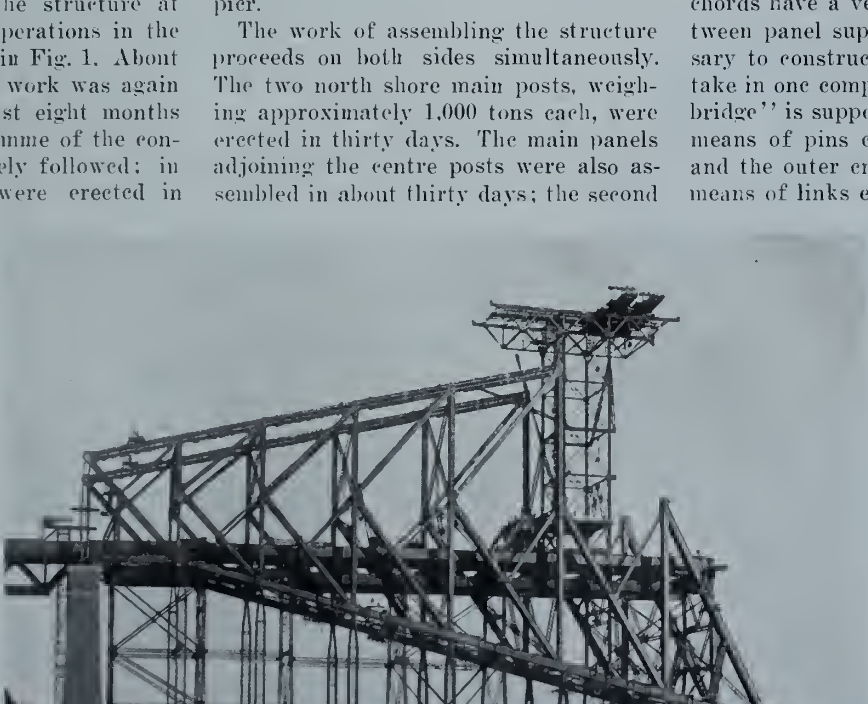


FIG. 1. NORTH ANCHOR ARM AS IT APPEARED ON NOVEMBER 30, 1914.

about fifteen inches out of plumb, due to the unbalanced weight of the uncompleted structure. At this stage of construction the lower chord had a camber or sag of several inches, while the members of the upper chord were so constructed that they were bolted in position temporarily while the cantilever arm was being constructed. As each panel of the cantilever arm was erected, its weight balanced that of the corresponding panel on the anchor arm, and the members of this panel was then permanently secured. As each succeeding section of the river arm was completed the corresponding shore arm section was secured in position. At the present stage, when the north shore structure is practically finished, the main post is still about five inches out of plumb. However, the calculations have proven so accurate that when the centre span is in position the centre post of each main truss will be practically perpendicular.

To test the accuracy of their calculations, the designers, on the completion of the cantilever arm, jacked up the shore or anchor arm to see what pressure was necessary to balance the structure, and their expectations were more than realized when they found they were within a few thousand pounds of the predetermined amount.

Another interesting feature is that of maintaining alignment of uprights and equalizing the strain during construction of the outer arms. In the triangle formed by the centre post and the main tension and compression members of the anchor arm main panel, a large horizontal brace, fitted with an adjusting screw, was used to overcome any undue stress in the various members caused by the continual changing in the shape of the panels as weight was added to the cantilever arm.

FIG. 5 NORTH SHORE TRUSS AS IT APPEARED ON NOVEMBER 7, 1915.

The work on the south shore is progressing more rapidly than did that on the opposite side, as the experience gained in the erection of the north anchor arm and its falsework has greatly facilitated later construction.

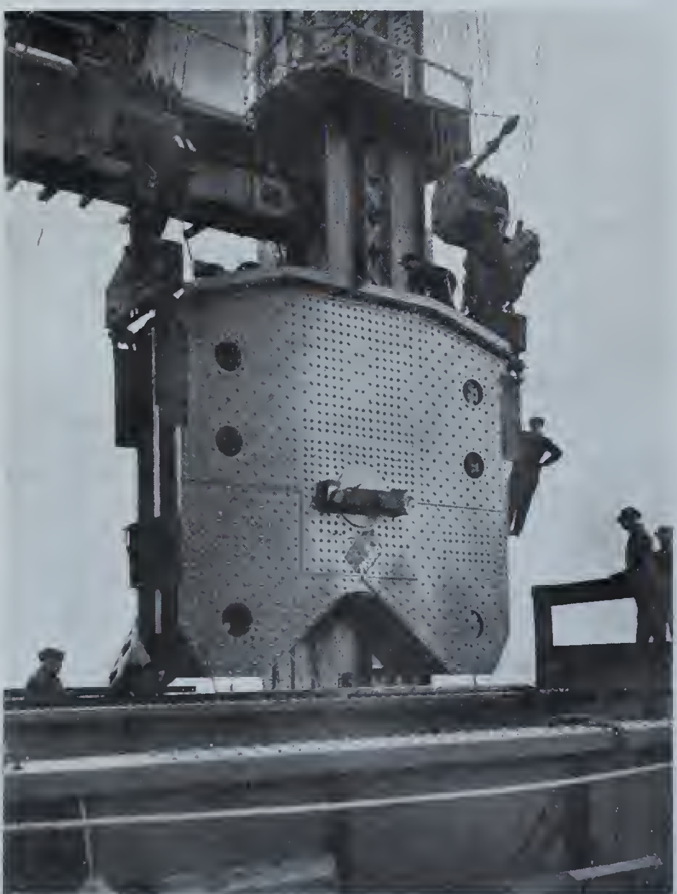


FIG. 2. MAIN POST CAP AND CHORD CONNECTION BEING HOISTED INTO PLACE

On the south shore, the portal and anchor arm are finished as far as presently possible. Fig. 3 is a view of the south anchor arm at it appeared at the end of November, 1915. During the winter months little can be accomplished and work on the structure will be suspended until the arrival of milder weather next spring.

At the close of November, 1915, actual construction work on the north shore end was completed, with the exception of some riveting and other detail features. Since the middle of November workmen have been busy removing the falsework from beneath the anchor arm, and are also removing the traveller, which will be taken to the site where the centre span will be constructed.

The photograph reproduced in Fig. 4 shows an excellent view of the existing structure as it extends out over the waters of the St. Lawrence River, like the arm of some giant sentinel.

The view shown in Fig. 5 was taken from the south side of the river early in November, as the work on the north was just being completed.

At present about 150 men are employed at the works completing the fabricated material for next year's work. This part of the work is expected to be finished early in the spring. Some time in April operations will commence on the cantilever arm of the north shore truss; at the same time work will begin on the assembling of the centre span. This suspended portion, which will be 640 feet long and 88 feet wide, centre to centre of side trusses, will be 110 feet high at the centre, and will weigh approximately 6,000 tons. It will be erected at Sillery—about three miles below the bridge—on six specially-constructed pontoons, with falsework supported on concrete piers. Each pontoon will be 185 feet long, 32 feet wide and 12 feet deep, with steel frames and stiffening trusses, wooden sheeting and flooring.

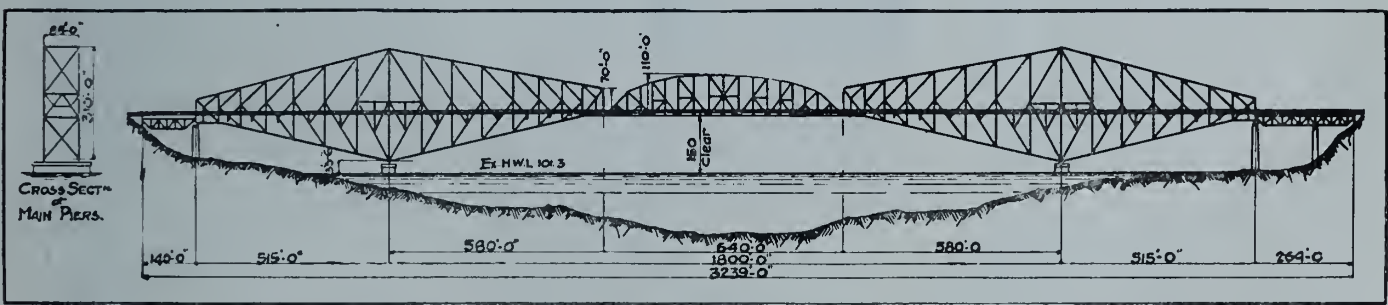
It is anticipated that this section will be ready when the south truss has been completed. The finished span will then be floated up the river and anchored in position beneath the bridge. The span will then be raised to its final position, a distance of 140 feet, by means of 2,000-ton jacks placed at each corner, and specially-designed hangers suspended from each of the cantilever arms. If the schedule of operations of next year's work can be carried out as successfully as the past year's programme, the feat of placing the suspended span in position will take place some time in October, and the bridge will be ready for the passage of trains in November, 1916. However, the regular traffic across the river will not take place until the spring of 1917. During the winter of '16 and '17 a great amount of detail work will be completed, such as the laying of walks, painting, etc.

FIG. 3. SOUTH SHORE ANCHOR AS IT APPEARED ON NOVEMBER 11TH, 1915.

At the close of this season's work 45,000 tons of steel have been placed in position, and when the completed structure has been finally erected the total weight resting on the main piers will be about 65,000 tons, 55,000 tons being fabricated material.

Owing to the climatic conditions, and the wide range of temperature between midsummer and midwinter, which is from 100 to 120 degrees F, about 30 inches must be allowed for expansion and contraction in the total length of the bridge. It is difficult to appreciate the magnitude of this undertaking from a brief description of the work being done. One requires to see the various component parts in course of construction and observe the manner in which the many problems of erection are being successfully overcome.

The designing, construction and erection of this bridge form one of the great engineering feats of modern times, and the official opening of this wonderful structure will mark the completion of the last link in the unbroken rail-to-rail highway, which will then extend from ocean to ocean. A noteworthy feature of the work is the immunity from accident during erection. From the nature of the undertaking, a steady percentage of minor casualties is to be expected, but the number of fatalities has been surprisingly low. The efforts of the company to provide comfortable and attractive camp life for the men have met with all the success deserved, and such conditions have doubtless exerted a restraining influence on the workmen in exercising more than ordinary care in performing their duties.



SKELETON VIEW OF THE QUEBEC BRIDGE, SHOWING PRINCIPAL DIMENSIONS.

FIG. 4. GENERAL APPEARANCE OF BRIDGE AS COMPLETED UP TO NOVEMBER, 1915.

The Lay-out of Ship's Ventilator Cowls with Girth Seams

By J. W. Ross

While the methods described in the accompanying article have immediate reference to work in connection with shipbuilding, the adaptation of the principles involved are applicable to many manufacturing lines. Exhaust systems in shops and mills offer occasional instances where such work may be necessary, but the fact that such instances are occasional, renders a clear understanding of the procedure to be followed all the more desirable.

THE perspective view, Fig. 1, shows a girth seamed ventilator cowl. Its visual effect is not so pleasing as that of the hammered or blocked out type with the longitudinal seams. However, its chief advantage lies in economical construction.

The Outline Construction

Measure off the base line, A B, Fig. 2, equal to 20 inches. Locate the point C on the continuation of the base line, equal to ½ the distance of A B. With centre C and radius C B, strike the quadrant B E. The point D is located by measuring from C a length equal to half the distance B C. Erect the perpendicular F D. With radius equal to twice the length of A B, and at centre E, strike the arc to intersect the perpendicular D F, thus locating the point F. Connect F to E. With radius equal to D A and with F as centre locate the point G. With G as centre and the same radius strike the quadrant F L H, tangent to the perpendicular A J.

In this cowl there are five courses. Count each end course as one and the intermediate courses as two each. Therefore this total of the courses will be 8. Divide the outline A K L F into 8 equal parts. At the first division point locate J. Then take two parts and locate K. Two parts again for L. Similarly for M. Divide the quadrant B E into the same number of parts.

The point W is located at the first division point. P is denoted by taking two parts; similarly locate the points Q and R. Connect the points J W, K P, L Q and M R. These lines are rivet lines. Bisect the rivet lines, locating the points X, S, T, U, V and W. Connect the points A to J, J to K, L to M, and M to F, by straight lines. These lines are drawn in showing each course with its overlaps, looking downwards. Connect the points on the throat in a similar manner. This completes the side elevation.

The front elevation is projected over, although it is not essential to the development of the patterns.

Prolong the base line A B to Fig. 3. Erect the perpendicular X^1 F^1. Draw the projecting line F F^1 parallel to A X^1. This locates F^1. Also parallel to A X^1, project the point W, Fig. 2, to its intersection of the axial line X^1 F^1, thus locating W^1. With centre W^1 and radius W^1 F^1, draw the circle defining the mouth of the cowl.

By parallel line to A X^1 project over all the centres S, T, U, V, Fig. 2, to the points S^1, T^1, U^1, V^1, Fig. 3. With radius V M Fig. 2, and centre V^1, mark off the distances V^1 V^2. Measure off U^1 U^2, Fig. 3, equal to U L or U Q, Fig. 2. Similarly locate the distances T^1 T^2, S^1 S^2 and X^1 X^2, Fig. 3, by the respective distances T K, S J and X A, Fig. 2. Connect the points X^2 to S^2, S^2 to T^2, T^2 to U^2, U^2 to V^2 and V^2 to W^2. This completes the front elevation.

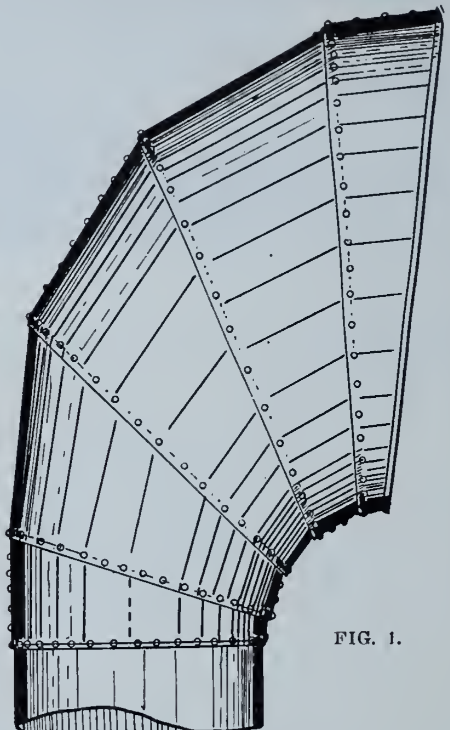


FIG. 1.

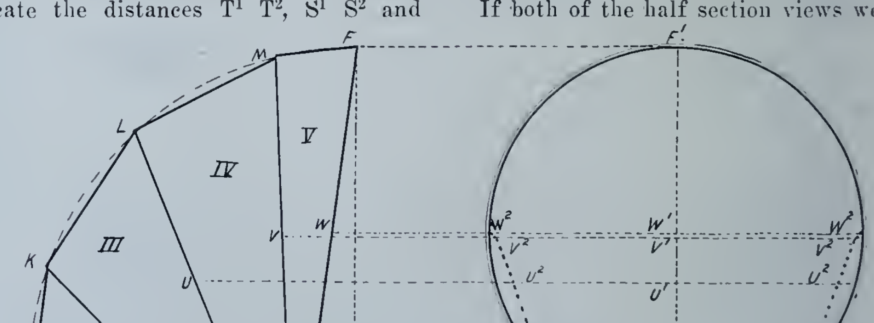


FIG. 2. FIG. 3.

Triangular Construction

As no two courses are alike, a separate development will be required for each course. One of the courses, therefore, will be herewith developed, the others being developed in precisely the same manner.

Let course III be selected for development. To save confusion of lines, transfer carefully the outline of the course III —as represented by the letters K, L. U. Q, P, T—Fig. 2, over to Fig. 4.

With centre T and radius T K or T P describe the half section view K 5 P. Divide this semicircle into a suitable number of equal parts; the greater the number, the more accurate the templet. In this case it is divided into 8 equal parts. Project all these points to, and at right angles with K, T, P.

With U as centre and radius U L or U Q, describe the half section view, L 5^1 Q. Divide this semicircle into equal parts, the same number as that used for the semicircle K 5 P.

Erect perpendiculars from L U Q to these division points. Number the division points on both circles in consecutive order and in relation to one another. Also number the projection points on the lines L U Q and K T P in respect to their relative projection lines. Connect the points 2^2 to 2^3, 3^2 to 3^3, 4^2 to 4^3, etc., by straight lines.

If both of the half section views were equal, these straight lines, 2^2 2^3, 3^2 3^3, etc., would be shown in the drawing by their true lengths. However, the sections are not equal, therefore the lines in question will be foreshortened.

Their true lengths are found by triangulation, as follows: Draw the horizontal line $2^3\ 8^3$, Fig. 5. Erect perpendiculars at any point, as at O. Measure off the perpendicular O 2^2, Fig. 5, equal in length to $2^3\ 2^2$, Fig. 4. Take the difference of the lengths of the projector lines $2^2\ 2^1$ and 2^3 2, Fig. 4. Place this dif-

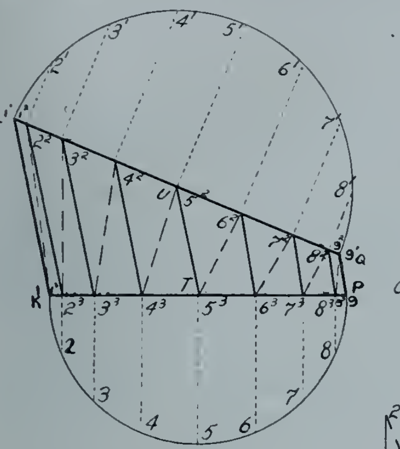


FIG. 4.

ference on the horizontal line, as O 2^3, Fig. 4. Connect 2^3 to 2^2, Fig. 4. This line is the true length of the foreshortened line $2^2\,2^3$, Fig. 4.

Take the distance $3^2\ 3^3$, Fig. 4, and place it on the perpendicular O 3^2, Fig. 5. Measure 3^3 3, Fig. 4, against $3^2\ 3^1$, and place the difference, as O 3^3, Fig. 5. Connect by a straight line 3^3 to 3^2. This inclined line, or the hypothenuse of the right angle 3^3, O, 3^2, is the true length of the foreshortened line $3^2\ 3^3$, Fig. 4.

Again, make O 4^2, Fig. 5, equal in length to $4^3\ 4^2$, Fig. 4. The base of the triangle O 4^3, Fig. 5, is equal to the difference in length of the projectors 4 4^3 and $4^2\ 4^1$. The hypothenuse, $4^3\ 4^2$, being the true length. Proceed in a similar manner with lines $5^2\ 5^3$, $6^2\ 6^3$, $7^2\ 7^3$, and $8^2\ 8^3$, Fig. 4, locating the true lengths by the inclined lines $5^2\ 5^3$, $6^2\ 6^3$, $7^2\ 7^3$ and $8^2\ 8^3$, respectively, Fig. 5.

In Fig. 4, connect the points 1^3 to 2^2, 2^3 to 3^2, 3^3 to 4^2, and 4^3 to 5^2, etc., as shown by the short dash lines. These lines are also shown foreshortened. Their true lengths are obtained in a similar fashion as the other lines. Draw the horizontal line $1^3\ 8^3$, Fig. 6. Erect perpendiculars at the points X. Measure off X 2^2 equal in length to $1^3\ 2^2$, Fig. 4. The distance X 1^3, Fig. 6, equals $2^3\ 2^1$, Fig. 4. Connect by a straight line the points to 1^3 to 2^2. This line equals the true length of the foreshortened line, $1^3\ 2^2$, Fig. 4. Transfer the distance $2^3\ 3^2$, Fig. 4, over to the perpendicular X 3^2, Fig. 6. Measure off X 2^3 equal to the difference of the projectors 2^3 2 and $3^2\ 3^1$, Fig. 4. The points connected, 2^3 to 3^2, by a straight line defines the true length. Again, transfer the distance $4^3\ 4^2$ over to X 4^2, Fig. 6. Obtain the difference between the projectors 3 3^3 and $4^2\ 4^1$, and place at X 3^3, Fig. 6. The true length is shown by the line $4^2\ 4^3$. In a similar manner define the true lengths of the remaining dash lines.

Having obtained all the true lengths, the development of the plate will be next proceeded with.

Plate Development

In this course it is decided to have the vertical seam on the line 9 9^1. Therefore,

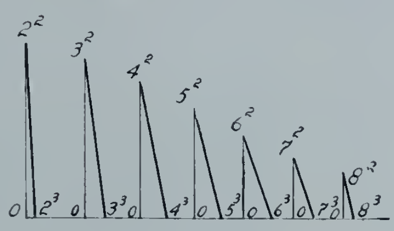


FIG. 5.

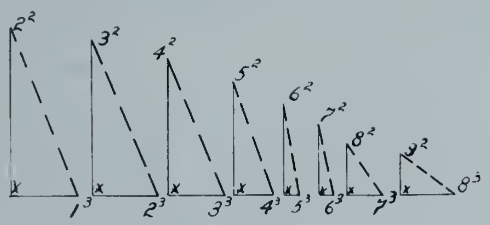


FIG. 6.

the centre line of the pattern will be $1^2\ 1^3$.

Measure the vertical line $1^3\ 1^2$, Fig. 7, equal to its true length $1^2\ 1^3$, Fig. 4. Set the dividers to the distance $1^3\,2^3$, Fig. 6, and transfer over to Fig. 7 by using 1^3 as centre and striking the arc at 2^2. By careful measurement obtain the exact length of the arc between the division points on the semicircle L 5^1 Q, as 1^1 to 2^1, or 2^1 to 3^1, Fig. 4. All the divisions being equal, it is a matter of indifference which division length is taken. With the dividers set to this distance, place one point on 1^2 and strike the intersecting arc at 2^2, Fig. 7.

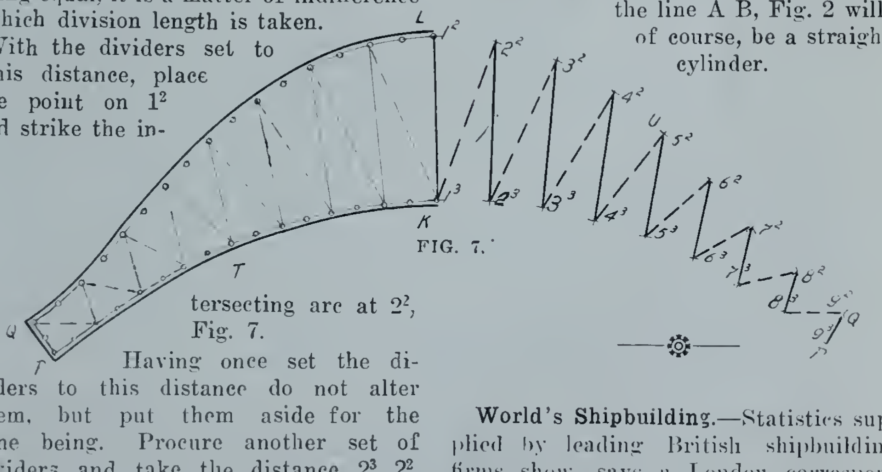


FIG. 7.

Having once set the dividers to this distance do not alter them, but put them aside for the time being. Procure another set of dividers and take the distance $2^3\ 2^2$, Fig. 5. Transfer to Fig. 7. With one point on 2^2 strike the arc at 2^3. Now measure carefully the length of the arc, between the division points, on the semicircle K 5 P. Transfer this length to Fig. 7 by placing one point on 1^3, striking the intersecting arc at 2^3. Hold these dividers at this distance.

Again, procure another pair of dividers; that is three pair of dividers in use. With centre 2^3 and distance $2^3\ 3^2$ equal in length to $2^3\ 3^2$, Fig. 5, strike the arc at 3^2, Fig. 7. Now with the first pair of dividers strike the intersecting arc at 3^2. Of course, $2^2\ 3^2$ is equal to $1^2\ 2^2$.

With No. 3 dividers transfer the distance $3^2\ 3^3$, Fig. 5, to $3^2\ 3^3$, Fig. 7. With the No. 2 dividers on point 2^3 strike the intersecting arc at 3^3, Fig. 7. With centre 3^3 and radius $3^3\ 4^2$ equal to $3^3\ 4^2$, Fig. 6, strike the arc at 4^2. With 3^2 as centre and radius $3^2\ 2^2$, strike the intersecting arc at 4^2, Fig. 7. Proceed in a similar manner with the remaining lines. Care being taken to have all the distances $1^2\ 2^2$, $2^2\ 3^2$, $3^2\ 4^2$, $4^2\ 5^2$, etc., Fig. 7, equal to each other, also equal to the divisions of the semicircle L 5^1 Q, Fig. 4. Then the length of the curve through the points from 1^2 to 9^2, Fig. 7, will be equal to the length of the semicircle L 5^1 Q.

Similarly the divisions 1^3 to 2^3, $2^3\ 3^3$, $3^3\ 4^3$, $4^3\ 5^3$, etc., Fig. 7, are equal to the divisions of the semicircle K 5 P, Fig. 4; then evidently the curve line 1^3 to 9^3 will be equal in length to that of the stretch-out of the semicircle K 5 P, Fig. 4.

On the right of Fig. 7 the construction lines are shown. On the left the curves are shown drawn in. These curves are the rivet lines to which is added suitable laps. The rivet holes are spaced off accordingly. The location points, 2^2, 3^2, $1^3\ 2^3$, etc., may be used for rivet centres. Other centres being spaced in as desired.

This completes the templet for course III. The other courses being developed in exactly the same manner.

The continuation of the pipe below the line A B, Fig. 2 will, of course, be a straight cylinder.

World's Shipbuilding.—Statistics supplied by leading British shipbuilding firms show, says a London correspondent, that during the past year only 1,655 merchant vessels, representing a total of 1,670,610 tons, have been added to the mercantile marine of the world, compared with 3,165 vessels of 3,481,171 tons during 1914.

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Vol. VI JANUARY, 1916 No. 1

PRINCIPAL CONTENTS.

THE WORLD'S SHIPBUILDING IN 1915

IN our January issue of former years we have featured in a more or less comprehensive manner the world's shipbuilding of the preceding twelve months. So far as the year 1915 is concerned, the European War has made the value of any detailed statement and statistical record meantime available, quite problematical, hence the omission on this occasion. It may be, however, that at some later date when peace has been declared and the remnant of the warriors have returned to commercial and industrial pursuits, that we will be in a position to place before our readers the data in all its usual variety and completeness—not to speak of its added highly interesting and war influenced activities.

RETROSPECT AND PROSPECT

INDUSTRIAL prosperity has been a marked feature of the past year, and although unavoidably of a grim type, its immediate effect has been such as to place Canadian business and commercial enterprises on a pedestal of achievement hitherto considered beyond their grasp. The manufacture of munitions of war has demonstrated our readiness to cope with an emergency, as well as our resourcefulness, ingenuity and operative skill. Our metal-working plant capacities have been increased twofold, and, what is perhaps of greater importance, we have been enabled to break away from our traditional conservatism as regards manufacturing a greater variety product and catering to wider scope markets. Shell making on its own account and the activity developed in the machine tool and steel industries has, of course, overshadowed everything else in volume and value output.

New Welland Ship Canal

Work on this undertaking is proceeding satisfactorily, the importance of its completion within the anticipated time, because of the transportation advantages to be realized, nullifying as far as possible any restriction of expenditure that the war might tend to create. Unlike its big brother, the projected Georgian Bay Ship Canal, the Welland Canal is a proven utility, and will continue to enhance its reputation as such with the development of each succeeding year's Canadian agricultural and manufacturing enterprise. As regards the proposed Georgian Bay Canal, we are inclined to think that the war has made it more of a dream than ever before. In any case, at least a decade will pass before its sponsors evidence further activity on its behalf.

Port and Harbor Development

Port, harbor and waterway development, although not prosecuted on the like extensive scale to which we have been accustomed in recent years, has not wholly been halted. The Department of Marine and Fisheries and the various harbor commissions at our principal lake and ocean ports have applied themselves during the year to not only the maintenance of facilities already installed, but to their improvement in many directions, and to their addition in a host of others. Port records in some instances are not likely to make as good a showing for 1915 as for some immediately preceding seasons of navigation, due entirely to the disorganization of steamship services through the requisitioning of so many vessels from the fleets of leading shipping corporations for trooping and hospital purposes, etc.

New Quebec Bridge

Notwithstanding the general business upset due to the war and the widespread organization of our factories for munitions manufacture, work has proceeded at a most satisfactory pace on the erection of the new Quebec bridge. The illustrations accompanying the article appearing in another section of this issue indicate very clearly the progress made during 1915, and more particularly so if comparison be made between pictures of the structure when operations ceased for the winter of 1914, and the present one.

MARINE NEWS FROM EVERY SOURCE

St. John's, Nfld.—The Dominion Coal Co., steamer Coban went ashore at Placentia during a heavy gale on December 27.

The Owen Sound Iron Works Co., Owen Sound, Ont., have started work on repairing the C.P.R. steamers Keewatin and Assiniboia.

Sarnia, Ont.—A meeting of the Northern Navigation Co., agents from the different points will be held in this city January 27 to talk over plans and make arrangements for the coming season.

M. Beatty & Sons, Ltd., Welland, Ont., have received an order from the Confederation Construction Co., contractors on section 3, Welland Ship Canal, for six electric hoists. Two of these are 50 h.p. with single drums; two 50 h.p. with double drums; two 35 h.p. with double drums. All are to be used on the new concrete handling plant which the contractors are building this winter for use on the twin flight locks next spring.

Winter Lights on Lakes—The Government has decided to maintain all outlying light stations on the Great Lakes continuously winter and summer after this year. The practice has been to discontinue these lights at the close of navigation, but it has been found that the presence of lights would be of great value to winter traffic on the lakes, even after the official closing of navigation.

Toronto Harbour Works.. The Toronto Board of Harbour Commissioners on Jan. 5, passed their estimates for the year. They will spend in 1916 $2,500,-000. The estimates last year amounted to $2,100,000, of which there was spent $1,200,000. Of the estimates this year the sum of $650,000 is for reclamation work, $100,000 for the proposed lift bridge over the Don at Cherry street, and the remainder for different construction work. The work of the commission will depend somewhat on the speed with which the reconstruction of the defective Government work is carried out. A start on this was made in the fall, and it will proceed in earnest in the spring. The commission has to fill in behind the cribwork.

Great Lakes 1915 Trade.—During 1915, 89,195,875 net tons of bulk freight were handled on the Great Lakes, an increase of 16,256,272 over 1914.

Schooner a Total Wreck.—The Halifax schooner Louis K. Collingham, is ashore at Seal Island, off Yarmouth, and will be a total wreck. All the crew were saved. The schooner sailed from Halifax for New York with a cargo of lumber.

British Admiralty Patrol Service.—Many applications are being received at the Naval Service Department, Ottawa, from Toronto, Montreal, Kingston, Ottawa, St. John, Halifax and other points, from motor boat men who wish to join the auxiliary patrol service of the British Admiralty.

Lake Freighters Change Hands.—The Frontier Steamship Co. and the Niagara Transit Co. have closed deals for the sale to M. A. Hanna & Co., Cleveland, of five steel freight steamers at $2,020,-000. The boats, which are now in Buffalo harbor with storage grain aboard, are the Charles Weston, James Corrigan, Joshua G. Munro, Daniel M. Meacham and William A. Rogers.

Shipbuilding in British Columbia.—Steps are being taken towards the establishment and furtherance of the shipbuilding industry in British Columbia. Several meetings have been held recently at Victoria and a committee has been appointed to wait on the Provincial Government to ask for a bonus or otherwise help develop the industry. The B. C. Manufacturer's Association and the Boards of Trade of several municipalities in the province have representatives on the committee.

Port Dalhousie, Ont.—The Muir dry dock at Port Dalhousie extended somewhat its usual season, having docked several boats up to Jan. 15, on which date the tug Gwennith went in for repairs. On Dec. 31, the large steel dredge Fundy was docked, a large dockage was also made the day before Christmas. Until quite recently there was open water at Port Dalhousie. Laid up at the Muir Bros. dry dock wharves are the Windsor Dredging Co., fleet, consisting of dredge Peletier, tug Tim Healy and three scows. In addition to these are the steamer Garden City, the concrete scow Pioneer, and tug Meteor.

British Ships and Neutral Ports.—Although the British Government took measures some time ago to reduce largely trading by British ships between neutral ports, there is no intention of cutting off this trade entirely. Replying in the House of Commons on January 24, to a question on this subject, the President of the Board of Trade said the use of British vessels between neutral ports was being restricted as much as possible, but that absolute prohibition would not be attempted, as it would not be to the interests of the nation.

N. T. R. Car Ferry "Leonard".—The National Transcontinental Railway car ferry "Leonard," which was specially designed for the transferring of freight cars to and from Quebec and Point Levis, pending the completion of the Quebec Bridge, and the combating of ice conditions in the St. Lawrence, has been measuring up to all expectations. Since its first trip between Quebec and Levis, on May 12, 1915, the Leonard has transferred as many as ninety cars in a single day. The vessel makes three or four trips daily, much depending upon the amount of freight to be handled.

IMPERIAL MERCHANT SERVICE GUILD ANNUAL

THE annual meeting of the Imperial Merchant Service Guild was held at Collingwood, Ont., on January 21. There was a large gathering of masters and mates from Collingwood and vicinity, also representatives from Owen Sound, Midland, Sarnia, St. Catharines and Kingston. Some caustic criticism of the Canadian Shipping Act was indulged in. Captain W. Inkster, the Canadian representative of the guild, in a lengthy speech, reviewed its history, stating that the organization had been in existence in England for twenty years, and now had branches throughout the Empire and also in a number of other countries. At present the membership in Canada was about 600, while throughout the Empire it totalled 120,000.

The object of the guild, Captain Inkster said, was to unite all certificated officers in the Empire in order that they might have a voice in legislation that would protect themselves and raise the merchant service to a higher standard by improving conditions. He also advocated the appointment of a Parliamentary Committee to represent the interests of the master mariners in the Dominion Parliament.

Strong Criticisms

Dealing directly with the Canadian Shipping Act ,he said it was so full of imperfections as to be totally unworthy of the Dominion of Canada or the British Empire, and was in a large measure detrimental to the successful carrying on of the work of navigation. He declared emphatically that 5 per cent. of the vessels on the lakes were under-equipped, and that, according to the present law, it was not necessary to have even a chart aboard, nor was it compulsory to have many of the under officers. According to the law, "each vessel must carry a crew necessary to navigate," which, he made plain, afforded such a wide difference of opinion as to endanger life and property.

Captain Inkster also severely criticized the methods of appointing lighthouse keepers, where, he claimed, farmers, tinkers, and what not, are to be found; also of harbormasters and equipment inspectors, who, too often, are men unacquainted with the needs of seamen. These and other deficiencies could be remedied if the marine men were united and had a voice in the Dominion Parliament that would be recognized and would be feared.

Officers were elected as follows:—Chairman, Capt. W. C. Jordan, Collingwood; secretary-treasurer, Capt. W. Inkster, Collingwood. Executive—Captains P. McIntyre, Sarnia; H. R. Boyle, St. Catharines; H. Hudson, Midland; A. Ferguson, Kingston; R. D. Simpson, Owen Sound; C. R. Robertson, Goderich; F. Davis, Port McNichol; F. Johnson, Port Colborne; S. Hill, Orillia; J. F. Davis, Wiarton; J. N. Wood, Port Dalhousie; J. N. Foote, Collingwood; J. B. Currie, Owen Sound; D. Whitley, Sombra; Robert O. McLeod, Picton.

ST. LAWRENCE AND CHICAGO STEAM NAVIGATION CO.

THE annual report of the St. Lawrence & Chicago Steam Navigation Co., for the year ended December 31, 1915 reflects a more than ordinarily profitable year. Earnings were over five and a half times those of 1914 and twice those of 1913, being 28.8 per cent. on the common stock, as against 3.93 per cent. in 1914, 15.33 per cent. in 1913, 14.06 per cent. in 1912., 5.63 per cent. in 1911, 3.35 per cent. in 1910, 13.13 per cent. in 1909, 7.04 per cent. in 1908, 11.15 per cent. in 1907, and 16.38 per cent. in 1906.

The financial statement shows that during the year the insurance fund was increased from $70,314 to $135,689. Bills payable are $10,464, as against $50,345 a year ago; accounts receivable, $631, as against nothing a year ago. The number of steamers owned has been reduced from five to four by the sale of the G. R. Growe, which the company found unsuitable for its business.

PANAMA CANAL STOPPAGE

THE slides which are at present obstructing the passage of the Panama Canal have been of occasional occurrence since the days of De Lesseps. Mr. Vaughan Cornish, the well-known engineer who paid a visit to the canal some time ago says that the behavior of the rock formation of the Culebra Cut is a novel occurrence in engineering work. At a certain spot, not only have both sides collapsed at times, but the rocky bottom has in numerous places bulged up to a height of 20 feet, and in one or two places 30 feet, both in the wet and dry seasons during the last four years.

The formation of Gold Hill, for instance, on the east side of the canal consists of rock intrusions which have tilted the strata or surface layers so that they now lie into a number of troughs, each of which slopes steeply toward the cut. The volcanic sediments which form these strata, have not only been much fractured by the rock intrusions, but have been decomposed by weather to a considerable depth, the weathered product forming a capping of red marly clay from 20 to 30 feet thick.

Dr. C. W. Hayes, chief geologist of the United States Geological Survey, offers the following explanation of the upheavals: "The weakest member in the sedimentary series occurring in the Culebra Cut is the lignite or lignitic clay. When the lateral support is removed from a lignite bed, it tends to give way under the weight of the overlying rock, and a slide results. The same result may occur even if the weak bed be not cut through, but merely unloaded by excavating down nearly to it. In this case it flows out from under the load and bulges up in the excavation. This type of slide has occurred at various points between Empire and Gold Hill, and in nearly every case the immediate cause appears to be the failure of a lignite bed under the unbalanced pressure due to the excavation."

SIR JOHN KENNEDY BANQUETIED

AT the Edinburgh Cafe on January 15, eighty-four members of the permanent staff of the Montreal Harbor Commission met to express their appreciation of the honor which had fallen to their old colleague, John Kennedy, C.E. who was made a Knight Bachelor by his Majesty The King on January 1, in recognition of the valuable services he has rendered to the port of Montreal and the channel of the River St. Lawrence. Interesting reminiscences of the harbor front in 1875, when Sir John first took the position of engineer to the Harbor Commission, and tributes to the part played in the development of the port by the new knight formed the subject-matter of the speeches.

Commission Chairman's Eulogy

Major David Seath, secretary of the Harbor Commission, presided. W. G. Ross, chairman of the Harbor Commissioners, and Colonel A. E. Labelle, commissioner, sent letters of regret that they were unable to be present on account of attacks of la grippe. Mr. Ross referred to the fact that Sir John was the first engineer to design and lay a double-track railway in Canada. He was at that time chief engineer of the Great Western Railway, and the road was laid between Windsor and Glencoe in Ontario.

For eighteen out of the 33 years during which Sir John was in charge of the engineering department for the Harbor Commission, he was also chief engineer of the St. Lawrence Ship Channel between Montreal and Quebec. Under his direction, the channel had been dredged from 16½ to 27½ feet deep, and as a result of that work Montreal really became the national port of Canada. The tonnage had increased from less than a million in 1875, when his term as engineer with the harbor began, to six and a half millions when his term ended in 1907, through his retirement to become consulting engineer.

Mr. Ross also referred to the total blindness which had overtaken Sir John a few months after he had left the commission, and to the fine quality of courage he had displayed by contining his profession and carrying his reputation to even a higher pinacle by his work as an engineer than it had attained before. As an example of what Sir John Kennedy had done since he became blind in 1907, rather than give up, as so many have done under similar circumstances, Mr. Ross mentioned the two dipper dredges, Nos. 10 and 11, the largest in the world, now being used in dredging the ship channel by the Department of Marine and Fisheries. Since his blindness came upon him, he had also designed and practically completed one of the finest piers in the world for the Department of Railways and Canals at Halifax.

Thirty-three Years Ago

Farquhar Robertson, commissioner, in proposing the health of Sir John, told of the difficulties he as a lumber merchant experienced back in 1875 and 1876 when his vehicles had to be backed down against boats at the old Molson's wharf into two and three feet of mud to get a load. Generally an extra horse would have to be put on to pull the load out of the mud, and up to Notre Dame street. There were bad floods during these years and no high-level wharves. To get down to the wharves one had to go down 15 or 20 feet to low level.

Steamers, small to modern sizes, were berthed alongside riverside quays, there being no piers. Temporary wooden sheds of one storey, 40 feet wide and 100 feet long, were taken down every fall and re-erected in the spring to avoid the ice shoves. Sir John was appointed by the government on the Royal Flood Commission to investigate conditions in the harbor with regard to ice. As a result the guard pier was built in 1896 or 1897. The report made at that time by Sir John really started the present development of the port of Montreal, which up to that time was of a ram-shackle character, with sheds falling into decay.

After building the guard pier to protect the wharves, which he afterwards raised to high level from McGill street to Victoria Pier, Sir John built the King Edward, Jacques Cartier, Victoria and Alexandra piers to a length of 1,000 feet, a length which everybody considered foolish at that time, but which is scarcely adequate now. The design of No. 1 elevator was also made by him. He had made the harbor what it was in 1907, and most of what it is to-day. He had designed dredges now working on the Nile, and had evidences of his ability and industry all over the world.

Sir John's Reply

Sir John, after acknowledging all the congratulations which had been showered upon him, said that the work done during his thirty-three years with the Harbor Commission was not as prominent in his mind as the men who had worked with him in securing that development. These men he mentioned by name, many of them being dead, while others were present. In speaking of the development of the city and the port Sir John said that he often wondered why Jacques Cartier and Champlain had founded the city where it stands to-day. It would have been much easier to have started the city down below St. Mary's Current than to have come up against the rapids to where the city was ultimately established. He gave some graphic figures showing that with the development of the harbor and ship channel, railroad traffic and population had increased to marked degree in Montreal.

Major David Seath proposed the health of the Engineering Department of the Montreal Harbor Commission, and F. W. Cowie, chief engineer, replied, he having entered the service of the commission in 1880 as a student under Sir John Kennedy.

CANADIAN LOAD-LINE FOR SHIPS PROPOSED

THE establishment of a Canadian load-line regulation for ocean-going ships, similar to that in effect in Great Britain and other maritime countries, is under consideration by the Hon. J. D. Hazen, Minister of Marine and Fisheries.

This question has been before the Canadian authorities for many years, and in 1892 a law was passed adopting a load-line, but under conditions which proved unacceptable to the Imperial Government, and this law has never been in operation.

Just prior to the outbreak of war arrangements had been completed for joint action by the Canadian and United States Governments as parties to an international conference to draw up such regulations as would place the shipping of the two countries as nearly as possible on an equality with regard to load-line requirements. The outbreak of war upset these arrangements, and both Canada and the United States are still without laws providing for a load-line. The absence of such a law is believed to be responsible for many marine disasters through overloading of ships. It is expected that legislation will be introduced at the present session providing for the fixing of a load-line for each vessel and for the withholding of clearance papers in cases of violation of the regulation. The old law was objected to by the British authorities on the ground that the owner of the vessel was allowed to participate in fixing the load-line. This objection will be removed in any new legislature.

PANAMA CANAL RE-OPENING OUTLOOK

THE U.S. War Department, Washington, D.C., have been advised by Major-General Goethals, governor of the canal zone, that he is still unable to make any prediction as to when the slides in the Gaillard Cut will be sufficiently removed to allow the world's shipping to pass through the Panama Canal. Several small vessels have been allowed to pass through, but these drew fifteen and one-half feet of water and less. The depth of water in the locks and in the channel of the canal is to be forty feet, when the slides are removed.

The fact that General Goethals is not able to say when the canal will be ready for use by larger vessels and commerce generally was announced by the Washington office of the Canal on December 21, after messages had been sent to General Goethals seeking the facts. When his reply was received, this announcement was issued:

"There have been several reports recently in the newspapers regarding the passage of vessels through the Panama Canal. A cablegram asking for information has been sent to the Isthmus and a reply has been received from which it would seem that a temporary opportunity to pass small craft drawing 15½ feet or less was taken advantage of, and certain vessels which had been held since the canal closed were allowed to pass the slide. If a similar opportunity offers a few additional vessels of greater draught, which have also been here since the closure of the canal, will probably be passed through, but the governor warns that conditions are very unstable, and it is impossible to estimate in advance what the probable available channel will be at any succeeding date."

SOO CANAL TRAFFIC RETURNS

FREIGHT traffic through the American and Canadian canals in the season just closed aggregated 71,290,304 tons, according to the report compiled by L. C. Sabin, superintendent of the American canals.

Traffic for the year was 15,920,370 tons greater than in 1914, and has been exceeded in volume only in two previous years—1913, with a total of 79,718,344 tons, and 1912, with 72,472,676 tons.

Wheat shipments were 255,481,558 bushels, an increase of 105,197,463 bushels; copper shipments aggregated 156,436 short tons, or 64,672 tons more than last year. Both these commodities established new season's records.

The movement of iron ore was 45,213,604 tons, an increase of 13,799,839 tons compared with 1914. General merchandise, aggregating 1,595,398 tons, represented a gain of 278,094 tons.

The season's lumber movement was 456,451,000 feet, an increase of 4,303,000.

Both anthracite and bituminous coal shipments fell short of 1914. The hard coal movement was 2,030,730 tons, a decrease of 209,775 tons, while soft coal shipments of 11,326,328 tons were 920,388 less than 1914.

Freight traffic through the canals in December aggregated 2,180,420 short tons, against 551,886 tons in 1914

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

John Kennedy, consulting engineer of Montreal and an authority on harbor works, has been knighted.

Captain John Moore, of Windsor, Ont., a well-known lake captain, died recently at Cincinnati, Ohio, while on a visit.

Jerry J. Flynn, assistant superintendent of the old Welland Canal since 1896, died after five days illness from pneumonia.

Hugh S. Wallace, Harbor Commissioner at Hamilton, Ont., has resigned his position in order to take up the management of the Standard Sanitary Co., Toronto.

Lindsay T. Barclay, of the Western Dry Dock and Shipbuilding Co., Port Arthur, Ont., has returned to his home in Port Arthur from Winnipeg after attending the six weeks' officers training course.

Capt. G. C. Coles, who has been lecturer on marine matters and examiner of masters and mates, for the past ten years at Collingwood, Ont., has resumed his winter's work and is holding lectures twice a week as usual.

I. E. Suckling, of Toronto, has been appointed general agent for Ontario of the passenger department of the new Canadian Pacific Ocean Service, Ltd. Mr. Suckling has been assistant district passenger agent of the Canadian Pacific Railway's Ocean Lines at Toronto.

W. J. McCormack, who has been superintendent for the Northern Navigation Co. at Sarnia, Ont., for some years past, has been appointed manager of the steamers operated by the Algoma Central Railway Co., with headquarters at Sault Ste. Marie, Ont. Mr. McCormack assumed his new duties on the first of the year.

F. F. Pickard, inspector of hulls for the port of Victoria, B.C., was a passenger aboard the liner Persia when that vessel was sunk in the Mediterranean. He was en route for Mesopotamia, where he was to take charge of machine shops at Basra. Up to the present nothing has been learned of his safety.

Pilots' Committee—At the general annual meeting of the Montreal Pilots held recently, the following members were elected to the executive committee for the ensuing year: Alberic Angers, president; Messrs. J. D. Frenette, Fortunat Hamelin and J. C. Gauthier. The secretary is C. B. Hamelin.

LICENSED PILOTS.

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio
Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

THE SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

GRAND COUNCIL, N.A.M.E. OFFICERS.

L. B. Cronk, Windsor, Ont., Grand President.
A. F. Hamelin, Montreal, Que., Grand Vice-President
Neil J. Morrison, P. O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
E. Read, Vancouver, B.C., Grand Conductor.
A. J. Ross, Halifax, N.S., Grand Doorkeeper.
James Gillie and A. E Kennedy, Kingston, Ont, Grand Auditors.

J. H. Lauer, general manager of the Marconi Wireless Telegraph Co., of Canada, has returned to Montreal, from St. John, where he has been representing the interests of the shipping companies on the Board of Arbitration appointed by the Dominion Government to settle differences with the local longshoremen of that port.

J. F. Conradi, supervising engineer, Maxim Munitions Co., New Haven, Conn., died Jan. 12, in New York City from pneumonia. He was a munitions engineer of note and had for a number of years been manager of Vickers-Maxim plant at Erith, near London, England. He was for a time works manager at the John McDougall, Caledonian Ironworks, Montreal, and at the Polson Ironworks, Toronto.

National Association of Marine Engineers.—As we go to press no official intimation has been received of the intention to hold the biennial convention of this body, some difference of opinion appearing to exist among the various lodges as to the advisability of holding a grand council meeting at this time, due to the war. The opening days of February have in the past been the convention dates, and Toronto was expected to have been the place of meeting this year.

St. John, N.B. N.A.M.E.—St. John, N.B., No. 2 National Association of Marine Engineers has selected the following officers for 1916:—President, H. Phippen; 1st vice-president, B. C. Estabrooks; 2nd vice-president J. Thorne;

1915 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Chas. M. Arnott,	94 Hanley Street	J. S. Adams,	631 Gladstone Ave.
St. John,	2	G. J. McVicar,	49 Winslow St. West	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	Wm. Whipps,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	L. E. Spencer,	24 Clergy St.	James Gillie,	101 Clergy St.
Montreal,	5	Henry Lamereaux,	280 St. Andre St.	O. L. Marchand,	378 Clark St.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	W. G. Wooster,	Room 10, Jones Bldg.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	S. G. Guenard	Bienville, Levis, Que.
Sorel,	9	Nap. Biandon,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John McLeod,	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. E. Wilson,	P.O. Box 204	Roy N. Smith,	Box 178
Halifax,	13	Robt. Blair,	29 Preston St.	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Rd.	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	Philip Bridges,	Stewart St.	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

secretary, G. T. G. Blewett; assistant secretary, J. H. Hayter; treasurer, Wm. B. Parks; conductor, H. T. Cowan; door keeper, Oakley McCleery; auditors, N. J. Morrison and J. Thorne. The members of Council elected were the president and Messrs. McVicar. Thorne Whelpley and O. McCleery.

The Shipmasters Association of America will hold their annual convention in Toronto, from Jan. 25 to 29 inclusive. The Carls-Rite Hotel will be the headquarters for delegates and business sessions. The Board of Control of the City of Toronto will entertain the delegates who are expected to number 150 to 200. The social programme includes a banquet on January 26, an automobile drive and being present at an entertainment in the Royal Alexandra Theatre. Capt. Charles J. Smith, president of Toronto Branch No. 18 of the Shipmasters Association is chairman of the Reception Committee. Problems referring to aids to navigation will form the main topic of discussions by the convention. This is the first time the association has met in Canada. It has 1,500 members. Last year the convention was held in Washington, D.C. The association has lodges at Toronto, Owen Sound, Midland, Port Arthur and Fort William.

MORE CAUTION URGED

THE necessity for greater caution in navigation of vessels was emphasized in the annual report of the Advisory Committee, submitted by Chairman Ashley, of Cleveland, to the Great Lakes Protective Association in convention at Detroit, Mich, on January 23.

The number of damage reports received in 1915 was 420, against 414 in 1914. Nearly half of the association's partial losses last year, the report said, occurred in October and November. Only two total losses ocurred in 1915, these being the steamers Hoctaw and Onoko. Among the accidents reported were 30 strandings, 28 groundings, 26 collisions and 28 vessels damaged by striking channel banks and structural works.

The profit on last season's business of the association, according to the report, was 18 per cent. All members of the Advisory Committee were re-elected, and this committee, at its regular meeting, will choose officers of the association for 1916.

Catalogues

Stop and Check Valves.—The Lunkenheimer Company, Cincinnati, Ohio, have issued a bulletin dealing with their non-return safety boiler stop valves, screw down check valves and regulating check valves. Each type of valve is fully described, and the service for which it is best suited stated. The illustrations show the principal constructional features and tables give the price for each size of the different combinations to suit various conditions of pressure, superheat and engineers' specifications.

Indicators.—James L. Robertson & Sons, Inc., New York, have issued a catalogue dealing mainly with the improved Robertson-Thompson steam engine indicator. The indicator is fully described special reference being made to the more important features of design while the illustrations show these features in detail. Directions for using are included together with a table of springs. The catalogue also contains full particulars covering various indicator attachments and planimeters etc., with instructions for using apparatus which is fully illustrated. The concluding pages are devoted to a description of the "Hine" steam indicator and various lines of "Eureka" packings.

Steam Tables for Condenser Work.—The third edition of this handbook of steam tables has been published by the Wheeler Condenser & Engineering Co., Carteret, N.J. The book contains 31 pages, 14 of which cover three tables, No. 1 being a vacuum table and giving properties of saturated steam from 29.8 in. of vacuum to atmospheric pressure. No. 2 is a temperature table and gives properties of saturated steam from 30 degrees to 212 degrees Fah. No. 3 is a gauge and absolute pressure table and gives the properties of saturated steam from 0 lbs. gauge pressure to 200 lbs. gauge pressure. The concluding section contains constants and tables, etc., for the correction of readings. The steam tables are based on the properties of saturated steam given in the latest tables of Marks & Davis and were especially calculated for this book by Prof. Marks. This useful publication may be obtained on application from the Wheeler Condenser & Engineering Co.

Book Reviews

The "Mechanical World" Pocket Diary and Year Book for 1916. Published by Emmott & Co., Ltd., Manchester, England. Price, 25c. The twenty-ninth issue of this extremely useful little publication is now on sale, and, as is the usual custom, additional information has been introduced. The section on steam boilers has been largely rewritten and enlarged, including particulars of boiler scantlings, the requirements as to boiler mountings, etc. A separate and enlarged section is now devoted to the Diesel engine, embodying a good deal of concisely arranged data which will be appreciated by designers. Some notes on brazing and soldering have also been introduced. Among the several new tables, mention may be made of those relating to Lancashire and Cornish boilers, dimensions of locomotive boilers, steel plates, friction clutches, circle spacing table, etc. Other tables have been extended, and the book generally has been thoroughly revised. The book contains 264 pages full of useful engineering notes, rules, tables and data, etc.; while in addition there is the usual diary, index and advertising matter, a total of 429 pages. The book is fully illustrated and bound in substantial cloth covers.


HINTS TO BUYERS

CIRCULATES IN EVERY PROVINCE OF CANADA AND ABROAD

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A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World. Published by
The MacLean Publishing Co., Limited

MONTREAL, Eastern Townships Bank Bldg. TORONTO 143-153 University Ave. WINNIPEG, 34 Royal Bank Bldg. LONDON, ENG., 88 Fleet St.

Vol. VI. Publication Office, Toronto— February, 1916 No. 2

"Watch the Thermometer"

A Sick Boiler Means A Sick Ship—

Your Steamer's Boiler is Your Steamer's Heart
And a boiler that's not functioning properly *is* sick.

Eckliff Automatic Boiler Circulators

Because of anatomical features peculiar to it, the Scotch type of boiler is subject to a most damnable functional disorder: POOR CIRCULATION.

This disease is pernicious, insidious and deadly. It has been the hidden cause of many an internal trouble for which it has escaped the blame. Through the agency of its own secret accomplices (and hiding behind them) it begins its work of hindrance and destruction with the boiler's *first* breath—and hastens its *last*. And from the first, the health of the boiler is impaired, its usefulness diminished; before long it becomes a chronic invalid, requiring much careful nursing and expensive nourishment to get *half* the work out of it that a *healthy* boiler would do *without* such pampering and expense.

Much doctoring and surgery have been resorted to in an effort to alleviate the weakening and destructive conditions which inevitably follow poor circulation. Various stimulants, injections and drugs have been administered, and cutting and tinkering done—but it's an endless job—and it doesn't reach the *source*. It doesn't *cure* the disease—but *perpetuates* it.

Photo by N.Y. Shipbuilding Co.

The "Plymouth" is one of the splendid Eckliff-equipped steamers of the Coastwise Transportation Co., Boston, Mass. Thirty-four boilers in all.

Doctoring evil *effects* doesn't eliminate evil *causes*. Calking leaky seams and replacing broken stays don't lessen boiler strains. Chemicals that dissolve scale will eat steel. Forced fires only aggravate and intensify the troubles—and waste good fuel; sending more heat *up* doesn't appreciably increase water temperatures *below* the grates.

Create and Maintain Perfect Circulation

No wonder Scotch Boilers are below par during life and become old, pitted, grooved, and furrowed before their time! *You* would if you were dosed and nursed all your life because of weak and faulty circulation.

Now, all this doctoring of symptoms, this resorting to temporary and doubtful expediencies, is *foolish* and *costly*. Every Scotch Boiler *can* have sure and *perfect circulation*. There's *one Specific*—and that's the Eckliff Automatic Boiler Circulator. Are *you* nursing any sick boilers? If so, just give one of them the Eckliff treatment—and watch the results. It has already restored many a weak and inefficient boiler to robust health and vigorous power. We have ample testimony and proof—get them, and

GET CIRCULATION!

Eckliff Automatic Boiler Circulator Co.

62 Shelby Street, Detroit, Mich., U.S.A.

NEW YORK OFFICE: Singer Building **PHILADELPHIA OFFICE: Bullitt Building**

Eckliff Circulators are fully protected by U.S. and foreign patents.

"Watch the Thermometer"

The Publisher's Page

By B.G.N.

Concerning Advertising

Extracted from an address before the Technical Publicity Association, N.Y.
By W. L. SAUNDERS, *Chairman of the Board*, INGERSOLL-RAND CO.

Good technical advertising is essentially concrete. It is an exact science, and knowledge of the subject is the first qualification; everything else is secondary to this. Technical advertising involves salesmanship of the highest order. It is not the gift of gab that counts; is not a polished manner or a pleasing presence, but it is familiarity with the thing advertised in all its bearings, which involves a wide general knowledge of the product and business; next a faculty of clear, brief and direct expression. Proper display is not to be neglected, but this is easy.

Advertising affords a means by which the man who knows most about the business may imprint his ideas effectively upon the minds of thousands. His audience is the world, and in no other way can he bring up the average efficiency in productive results. He may not do as much good in each case as though he met the customer personally, but on the whole he creates a greater general impression and paves the way for personal interviews that follow. I speak as one of experience in these matters. Up to recent years I have personally been the advertising man of the interests in my charge.

I realize that the head of the business can well afford to spend his time and energies directing the fundamental conditions that govern good technical advertising. I also realize that there is no fire of genius whatever in this matter and here we must distinguish between technical and general advertising, just as we must distinguish between technical and general salesmanship. A good talker can sell patent medicines regardless of whether they do the customer any good or not. A genius can put a patent medicine on the market and make a fortune out of it, regardless of its merit, but in technical advertising, as in technical selling, the gift of gab is one of the lesser, not greater virtues.

No one with common sense doubts the value of advertising—the only doubt is the value of the man who advertises. You must first establish confidence in the product that you are handling or you can never be successful on large lines. It is just as important that you should thoroughly believe in the thing that you are advertising as it is that the man who hires you should thoroughly believe in you. Confidence is the key-note of it all.

If any advertisement interests you, tear it out now and place with letters to be answered.

The Merchant Navy of Great Britain During War Time *

By W. S. Abell, M.E., M. Inst. C.E. **

The occasion of the Watt Anniversary Lecture before the Greenock Philosophical Society gives the shipbuilding and marine engineering world opportunity to get into somewhat closer touch with developments of the preceding year ,and in which it is more or less intensely interested. In the present instance, the choice of subject was a happy one, the lecturer one of the most capable exponents of the dual craft, and while obvious reasons have made suppression of many facts desirable, the information contained in the following pages will be welcomed by every true citizen of Britain's far-flung Empire, the marine fraternity in particular.

WHEN the writer was honored with the invitation to deliver the Watt Anniversary Lecture for 1916 it was natural that the subject chosen might deal with advantage with the present struggle of the British Empire for that individual liberty and freedom, the foundations of which were consolidated during the lifetime of James Watt. It is perhaps at first somewhat difficult to see the direct connection between the immortal work achieved by Watt, and the work carried on in wartime by the Merchant Navy of the greatest maritime power the world has ever known.

It will be remembered that although the inventor, after many years of self-sacrificing labor, succeeded in placing the stationary steam engine on a satisfactory foundation, yet he was 76 years of age before the first steamboat, the "Comet," made its historic appearance on the Clyde in 1812, and it was not until two years later than the first steam locomotive was brought out by Stephenson. The direct connection of Watt with land and marine transportation would therefore appear to be small; but there is no doubt that indirectly through the famous firm of Boulton & Watt, and more directly through the satisfactory development brought about in the stationary engine, which resulted in the production of a prime mover sufficiently complete in its main parts, the work of the inventor in the adaptation of the steam engine to the uses of transportation was by no means as small as would appear on first acquaintance.

The development of the steam engine enabled more coal to be obtained and more energy to be set free for the production of the manufactures which were essential to the development of sea power, and further brought about at a later date a much larger production of iron and steel for the construction of the means of transportation than would have been possible under conditions of manual labor alone.

The sea power of the British Empire was established in the early years of the eighteenth century, towards the end of the wars of the Spanish Succession, and the seal was set upon it by the battles of Trafalgar and Waterloo in the early part of the nineteenth century. It was, however, due largely to the start gained by the pioneer work of James Watt that this sea power was enabled in the nineteenth century to pass with advantage through the transition from wood to iron, and later, steel vessels, and thus maintain, in the twentieth century, that command of the seas which has been held indisputably for over 200 years.

*Watt Anniversary Lecture for 1916.

**Chief Ship Surveyor to Lloyd's Register.

OCEAN STEAM NAVIGATION CO. SS. "BRITANNIC."

The consideration of the work of the merchant navy in wartime, a work which is by no means so secondary a matter as is commonly accepted, might be dealt with by detailing the difficulties and dangers which have been experienced in marine transportation during such a state of war as had certainly not been experienced before.

In reality, however, the considerations involved affect much greater and more glorious issues, and the question should rather be approached by enquiring what is the maximum effort that can be made by the merchant navy in bringing about the most emphatic use of that sea power of which the Royal Navy is the forceful expression, and to consider how far the work of the merchant navy has approximated to such end.

It is first necessary to obtain some clear understanding of the meaning of the term sea power although an exposition of all the factors, which are grouped under that comprehensive term, would involve more time and space than is at my disposal; yet it is possible to give a brief summary of the main principles involved.

DONALDSON LINE SS. "SATURNIA."

Meaning of Sea Power

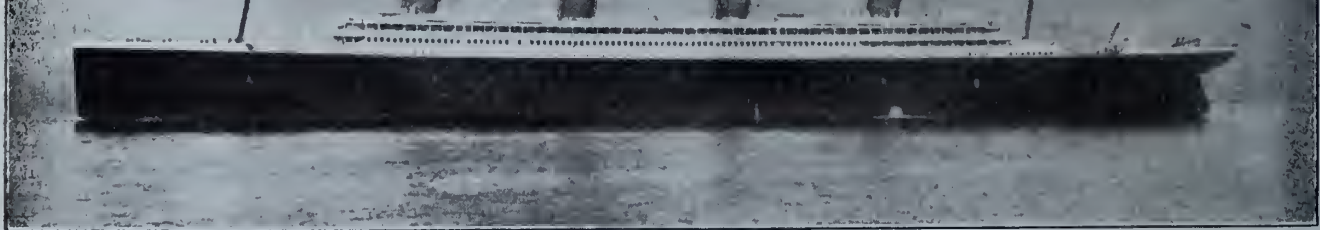
Sea power is the combination of a healthy commerce and mercantile marine with the military navy which ensures by force of arms such protection as will enable the unarmed vessels to carry out their proper functions. It may be said that a military navy springs naturally from a healthy commerce; in fact, in olden times, merchant vessels were the backbone of the fighting fleet. The main factors on which a healthy commerce depends are:—

1.—A power of production involving a necessity to exchange products in order to carry on trade.

2.—A provision of shipping to carry products in exchange.

3.—Colonies to provide points of shelter and protection as well as to enlarge facilities of exchange.

It is thus apparent that sea power is mainly dependent on natural conditions, and the nation which possesses the natural conditions to the fullest extent, and



OCEAN STEAM NAVIGATION CO. SS. "OLYMPIC."

has the capacity to use them to the greatest advantage, will of necessity enjoy the fruits of sea power.

The natural conditions mentioned may be broadly divided into three large groups, viz.:

1.—Geographical position.

2.—Physical characteristics, including conformation, nature and extent of territory as well as number of population.

3.—Character of people, involving form of government.

It is desirable to give brief consideration to these factors, and it will be as well to have in mind, as the exposition is being developed, the extent to which Great Britain satisfies the natural conditions.

Geographical Position

As sea power is dependent on trade, it at once follows that a situation remote from world trade routes is very disadvantageous; it is therefore necessary to consider where the most favorable position is likely to occur. It will be observed that by far the greatest proportion of land, and also of inhabitants, occurs in the northern hemisphere, and it may be stated roughly that the centre of gravity of land and inhabitants is somewhere between 30 degrees and 60 degrees north latitude.

Moreover, owing to the climatic conditions of the world, it is in just this region that the greatest natural energy of man is developed, and if this were not sufficient, a glance at an economic chart indicates that the greatest part of the economic production of the world's energy, coal and iron, is situated within the same narrow range.

It is therefore only to be expected that the sea trade routes necessary for the carriage of raw materials and the export of manufactured articles will naturally focus on narrow sea frontiers between 30° and say 60° North Latitude.

Further, since sea routes are often restricted to comparatively narrow channels, the geographical position is obviously advantageous if it is situated on or within such narrow channels, or it may be on interior lines. It may also be added that the economical production of modern shipping is for climatic reasons mainly confined to the limits of latitude already mentioned.

Physical Characteristics

The exchange of commodities, which constitutes trade, is considerably facilitated and can be more economically pursued by sea than on land. Moreover, a nation whose only frontier is the sea is by nature compelled, unless it prefers to live on its own resources, to seek its natural development on the water. It therefore appears that an insular position, involving a united sea frontier is distinctly advantageous. However, as the greatest dangers to shipping occur when making land, an extensive sea frontier is of little use unless it is provided naturally with deep and safe harbours at frequent and well distributed intervals.

Again, as trade depends upon production, it is advantageous that the country concerned should possess large supplies of natural energy such as coal and iron; and it is also advantageous to sea power, that there should be a natural deficiency of raw material for manufactures such as cotton, wool, vegetable oils, hides, and even wood, since such deficiency would produce a demand for shipping.

As regards number of people it is not difficult to see that a high density of population per mile of coast line is an important asset, since it means the country cannot be self-supporting and it also provides a big reserve of power, both in regard to personnel and material, which can become useful for enforcing sea power in times of emergency.

Character of People and Form of Government

Since sea power is based on peaceful and extensive commerce, it follows that the people must possess a natural instinct for commercial adventure, and the manner in which gain is sought has a much more important bearing on the situation than is commonly realised. For example it is better to seek gain by labour rather than by avarice, by risk rather than by parsimony.

The Spaniards and the Portuguese sought gain, not by healthy development of commerce and shipping, but by the acquisition of gold and silver treasure. The importation of such treasure involved very little shipping and consequently the wealth was easily seized by enemies and the operations of war paralysed. On the contrary the pro-

CANADIAN PACIFIC OCEAN SERVICES SS. "ALSATIAN."

duction of manufacture involves bulky imports which are scattered in a large number of vessels over all parts of the world, and consequently a war on commerce has to be conducted on a very large scale before serious crippling effects are produced.

Other nations, well situated by nature to become sea powers, have sought gain by parsimony, by economy, and by hoarding, venturing timidly and narrowmindedly, producing comparative average wealth and yet not reaching to great heights in national prosperity. Further, since colonies appear to be essential to sea power, the national character must possess the power of adaptability to change of environment, and self reliance in adapting the rules of life and government to the altered conditions.

The form of government is a reflex of the national character, and may influence sea power in a variety of ways. It might adopt a policy which fettered national progress, or a policy which developed sea power, even if no tendencies towards it existed. It might, on the other hand, add financial encouragement to the natural advantages and thus assist adventure by sea. The government might also insure the continuance of its commerce by the proper provision of a fighting navy, and might organise means for a rapid development of the resources of its sea power in times of war.

DONALDSON LINE SS. "ATHENIA."

It is thus evident that it is perfectly possible with certain forms of government to produce for a time very broad and apparently powerful manifestations of sea power; but, and history affords some instances of such occurrences, unless sea power is firmly based on the natural conditions which have been briefly outlined, such manifestations of power can only be of an ephemeral character.

The general factors affecting sea power being now somewhat clear, it remains to be seen what is the most efficient use that can be made of that power when its governing conditions are largely affected by the existence of a state of war. These remarks must however, be prefaced by one aspect of maritime transportation which is of supreme importance to our Empire as affecting the financial provision so necessary for the conduct of war.

Import and Export Features

It is common knowledge that the imports of Great Britain exceed the exports by a considerable sum, and in order that the balance of trade shall be adjusted other financial provision has to be found. This difference is stated to be met by the interest on British capital invested in foreign countries as well as by the British mercantile marine in the transportation of goods for other nations.

It has been estimated that the shipping of Great Britain carries about one half of the total trade of the world, and that nearly one half of the British vessels engaged in ocean overseas trade are employed between ports both of which are outside the United Kingdom. It is also commonly accepted that the gross earnings thus received from other countries are in the neighbourhood of 100 million pounds sterling per annum. It follows therefore that conditions of trade will demand that production and transportation of manufactures shall proceed in war time at the greatest rate

CANADIAN PACIFIC OCEAN SERVICES SS. "PRINCESS MARGARET."

which is compatible with the attainment of the maximum effectiveness of the fighting forces of the country, or in other words, the maximum efficiency of sea power can only be obtained by a judicious utilisation of both the fighting navy and the merchant marine.

Offensive Operations of Sea Power

The prime duty of the fighting navy of a large maritime Power appears to be something more than a sure shield—to be rather an offensive weapon which shall gain such time as will be necessary to bring about the complete organization of the resources of the Country, and to allow full opportunity for the diversion of the monetary reserves into such channels as will enable a war endurance to be maintained.

This object will be most effectively attained, either by the destruction of the main enemy fleet, or, if this operation is rendered difficult or impossible, as in the present case, by the occupation of such strategic positions as will render the enemy impotent in the use of naval force.

The establishment of a strategic blockade requires the provision of suitable naval bases within striking distance of any probable district of activity, and, as these bases are not in general situated on the main lines of land transportation, it is necessary to arrange floating depots for the storage of the numerous articles which are comprehended in the general term of naval stores, and which comprise fuel (coal and oil), water, provisions, and ammunition. Moreover, as these stores become used, a supply train of transports is necessary to replenish the stocks, and for this purpose, as well as for the floating store ships, considerable demands must be made upon suitable ships of the mercantile marine.

The creation of a commerce blockade, which would necessarily follow the siege of an enemy fleet, involves, in order to make the most effective use of sea power, a further demand for small merchant ships for observation of movements of the enemy, and for the examination of neutral and enemy vessels which may be carrying contraband articles through the blockade.

Another, yet secondary, function of the fighting navy is to safeguard, as far as possible, the free movement of the trade of the Country by the protection of trade routes, and, if necessary, by the use of fighting vessels for purposes of convoy. This will involve a search for, and the destruction of, any armed raiding cruisers, or other types of fighting vessels, and in this task the converted merchantman type is helpful, and has been used.

Further, in the clearing of the traffic lanes from mines, considerable use can be made of merchant vessels for sweeping, and even as some provision for guarding unarmed vessels against surface attack by submarine.

The third function of the fighting navy is to extend the power of the land forces by enabling them to strike at unexpected points, by establishing army land bases by force on the sea coasts of the enemy country, and by safeguarding the sea line of communications to such bases. It is obvious that great demands for transportation will be made on the mercantile marine, since no purely naval power is likely to make during times of peace sufficient provision for the large operations that may be thus required.

There still remains a large part for the merchant navy to play after these functions have been satisfactorily fulfilled, for it is necessary, as before mentioned, to make a rapid development of the fighting resources required for the army. In the present war, equipment, munitions, and armament have been manufactured for the Allies by a large proportion of the neutral countries of the world, and these articles have had to be transported long distances by sea. Moreover, the carriage of food supplies—a large undertaking in normal times, for the British Isles, alone—has had to be largely augmented by the necessity of assisting the other Allies who are not so fortunately situated.

Lastly, the duty of the Merchant Fleet must be to maintain the general trade of the Country in order that the balance of the national trading account may be as favourable as possible, and in order that provision may be made for an enormous expenditure on war material abroad without unduly crippling financial resources.

Duties of the Merchant Navy

The ideal duties which the Mercantile Fleet of this Empire might be expected to fulfil being now outlined, it will probably be well, first of all, to examine its actual performances, and later to examine the nature of the war perils to which it has been subjected.

The work of the Merchant Navy during war time has been admirably dealt with by Sir Norman Hills in a report which he has lately made to the Liverpool Shipowners' Association, and which deals with a period covering the first year of the war. In the course of this report he observes that out of a total number of British vessels of about 20,000, only about 4,500 vessels are engaged in foreign trade, and of this total only about 3,800 are larger than 1,000 gross tons.

A number of foreign trading vessels work only between the limits of what is commonly known as the home trade, i.e., a geographical area which comprises the British Islands and the European Coast from Brest to Hamburg. It is really the ocean-going trader which carries out the bulk of the marine transportation work of the Country, and the great majority of these vessels have a gross tonnage which exceeds 1,000 tons measurement.

It appears, therefore, reasonable to confine attention to the vessels which exceed that size, and if this be done the total number of British vessels employed is reduced to 3,600, divided approximately into one-third liners and two-thirds general traders. By the term liner is of course to be understood not only vessels which carry passengers, but vessels which also carry merchandise along regular routes only. The term "general trader" or "tramp" means a vessel which carries merchandise irregularly from any one port to any other port. The average size of these vessels is about 5,800 tons gross for the liner class, and 4,000 tons gross for the general cargo trader.

The effect of the war would naturally be to largely reduce the numbers of vessels employed in ordinary trading by the actual requirements of the Navy, by the detention of vessels in enemy and neutral ports and by the losses arising from operations of war.

The report quoted states, that taking vessels which exceed 1,000 tons gross in size, approximately 800 have been requisitioned by the Admiralty for purposes of supply and for transportation of army units. Further, 42 steamers have been detained in enemy ports, and 78 in neutral or allied ports in the Black and Baltic Seas. The result of commerce raiding during the first year of war was the destruction of 139 steamers useful for ocean-going purposes. The total number of steamers which were not available for the various causes mentioned is thus about 1,050; but as a set-off against this reduction about 100 captured and interned German vessels are being used by Great Britain for various purposes.

It thus appears that the effect of the first year of war was to cause a reduction in the number of vessels available for overseas trade of about 950 out of a total of 3,600. In other words the facilities for the mercantile marine transportation of the United Kingdom were reduced on the whole by about 25 per cent.

Merchant Marine Personnel

The question of the personnel must also be taken into account, for the large requirements of the Navy in war time are bound to affect the number of seafaring men which are available.

It has been estimated that the number of seamen employed in the British

Mercantile Marine is about 250,000, of which some 30,000 are foreigners, and some 45,000 Lascars. There are in addition about 35,000 men engaged in the fishing industries of the Country, which industry is seriously diminished by war-like operations, but which on the other hand furnishes seamen of great capability, who are peculiarly adapted for use in the many auxiliary vessels for the fighting Navy. It thus appears that the total personnel available, who are British subjects, is about 255,000, including 45,000 Lascars.

The effect of the war has been to draw heavily, for naval purposes, upon the personnel part of the Merchant Marine, and yet, in opposition to the many warnings which were uttered in the past as to the adequacy of reserves of useful seamen for the Navy, it has been a source of gratification to all concerned to find that all the requirements of the fighting fleet for men of every grade appear to have been met with facility, and this notwithstanding the many and unforeseen demands that have been made for naval service.

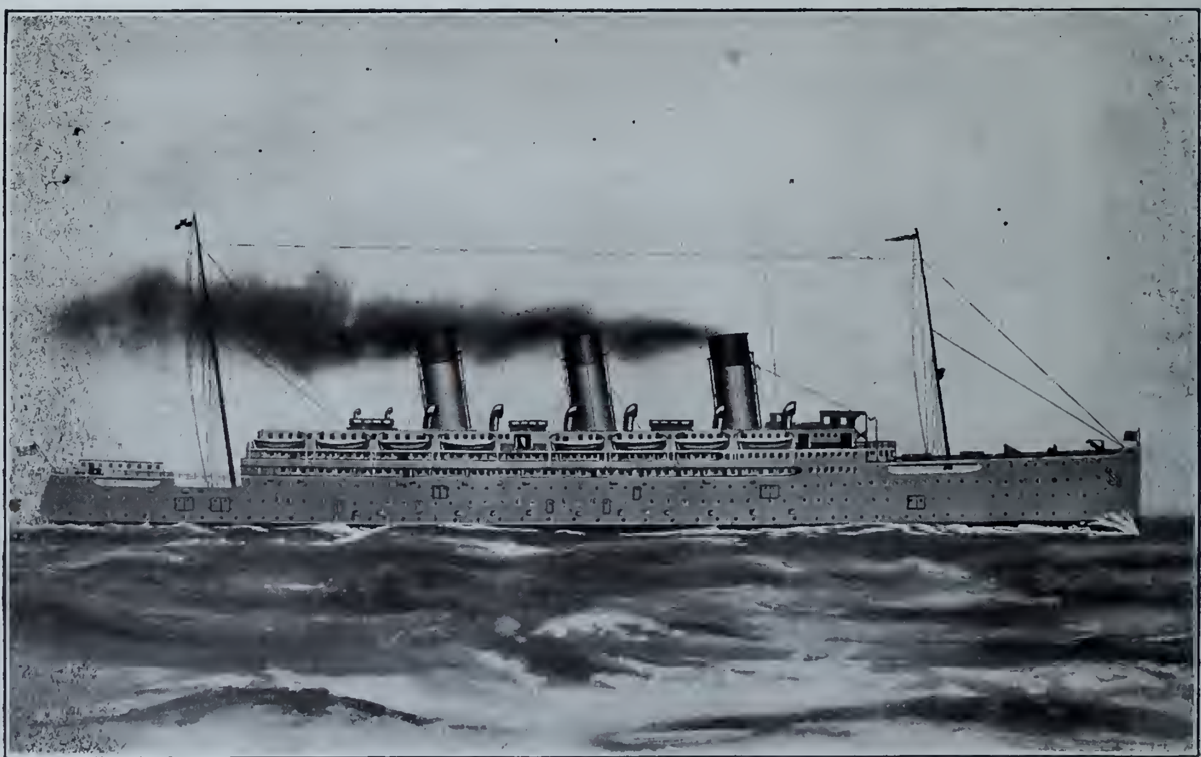
CANADIAN PACIFIC OCEAN SERVICES SS. "MISSANABIE."

The declaration of war at once deprived merchant steamers of the services of those officers and men who formed the Royal Naval Reserve as well as those who had passed from the Navy into the ranks of the Royal Fleet Reserve. The conversion of passenger liners into auxiliary cruisers made further demands, as their crews were necessarily more numerous in war than in peace. The same condition of affairs also applies to the various vessels that were used for transports and for fleet auxiliary purposes. Naturally also with the risks consequent on commerce raiding, the number of foreign seamen employed in British ships decreased, causing a further demand on the resources of the Country.

Although it is of course not possible to give an exact estimate of the reduction in the personnel, yet, in view of the various tendencies which have been outlined above, it seems reasonable to infer that broadly speaking the reduction of personnel would be as much as the reduction of ships, and that the total number of seamen available in war time for the commercial work of the Mercantile Marine would be only 75 per cent. of the normal supply.

Tonnage Transportation in War Time

Efficiency of marine transporation is such as important matter and has received so much careful attention during the war by all concerned with the ship-



CANADIAN PACIFIC OCEAN SERVICES SS. "EMPRESS OF RUSSIA."

ping industry, that it was to be expected that the number of tons weight carried for each gross measurement ton would have increased in the period of the war. It must not be forgotten that the measure of the carrying capacity of the shipping industry must be based on the imports, since these are much more bulky than the exports.

The supplies on short sea voyages fell off, and these goods have had to be replaced from more distant countries; consequently the number of voyages possible for a given ship in a given time was reduced. For example, the importation of grain from Russia was practically stopped from the Baltic districts, and was entirely impossible from the Black Sea ports; whereas the statistics show that the total imports of grain have been very little less during the first year of war than in peace time.

Sir Norman Hill, from a very extensive analysis of the trade returns for the first year of war in comparison with those of previous years, has estimated that in spite of the various disabilities to which the merchant fleet has been subjected, the weight of the imports carried was only reduced by about 13 per cent. He also states that the number of entrances to Britain of vessels engaged in the ocean-going oversea trade had fallen off to the extent of nearly 30 per cent. for the reason already mentioned, that vessels had to go much further afield for the supplies necessary for the country.

It therefore appears that, notwithstanding the reduction of 25 per cent. in number of vessels engaged in oversea trading, the reduction in the number of men of about the same extent, and the falling off in average number of voyages per ship per annum from 4½ to nearly 3, the weight of the merchandise imported was only reduced by about one-eighth, and the weight of cargo carried for each 100 tons net of shipping was increased from 115 tons weight to nearly 145 tons weight.

The efficiency of transportation of the merchant steamers, as measured by tonnage, has therefore been wonderfully improved, and this appears to have been due, among other causes, to the replacement of passenger steamers in the ordinary liner traffic by large general traders, by the utilisation of the steerage accommodation of passenger liners for cargo purposes, and by the fuller loading of the ordinary cargo vessels, since owing to the abandonment of the regular sailings, greater time has been allowed for the collection of cargo.

As so much is heard of the effect of freight charges on the cost of living it may be mentioned here that the report already quoted deals at some length with the effect of freight charges on the cost of wheat. It is there estimated that during the first year of war the cost of wheat in Britain had risen from 32s. to 48s. per quarter of 480 lbs., an increase of 16s.; whereas the cost of freight for the same quantity had only increased from 28d. to 81d., or 4 shillings and 5 pence, in spite of the much greater distances which the alteration of the sources of supply has occasioned. It will thus be seen, and in all fairness to the shipping industry this point should be mentioned in a review of this nature—that as regards the cost of grain the question of availability of supply has been a much more potent factor than the cost of transportation.

13-KNOT, 11,000-TON SHELTER DECKER FOR J. & C. HARRISON, LTD.

Increased Risks to Merchant Shipping

The admirable performances which have just been demonstrated, have been carried out in spite of the dangers and risks which have been experienced by those engaged in the enormous supply services of our great Maritime Country.

In considering these risks, it may not be out of place to briefly refer to the experience of previous maritime wars. As regards the general utility of commerce raiding, the late Admiral Mahan, of the United States Navy, says as a result of much research into the military value of such tactics, that commerce destruction is a most important secondary operation of naval war. It certainly causes much embarrassment and distress, but regarded as a primary measure sufficient in itself to crush an enemy it is probably a most dangerous delusion. Especially is it misleading when the nation against whom it is directed possesses, as Great Britain does, the two requisites of a strong sea power, a widespread commerce and a powerful Navy. Such an attack can only be fatal by a prolonged control of the strategic centres of commerce and such control can only be wrung from a powerful navy by fighting and overcoming it.

It is extremely difficult now to obtain exact figures as to the average extent of damage done to merchant shipping in previous wars. It only possible to get a few sets of figures, which will furnish a relative standard for comparison with present circumstances. It is on record that American privateers had captured nearly 1,000 British merchant ships of a total value of about two million pounds, between July, 1776, and the end of 1778; it is probable, however, that in regard to the balance of shipping the losses of the Americans were even greater in extent than the figures given. In contrast with this record may be placed the performance of one cruiser, the famous Emden, which, working on the main trade routes to China and Australia, sank 17 vessels, involving about the same total value for ships and cargo, viz., two millions sterling.

During the Napoleonic wars, the losses due to captures in the Indian and China Trades were such as to occasion a premium on the value of ships (not cargoes), of 15 guineas per cent. in 1782, which, when a proper disposition of naval force was obtained in 1805, fell off to 5 per cent. when vessels were protected by a convoy. It may be remarked that this premium of 5 per cent. on the value of the ship alone was about the same as 1 per cent. on the value of the total cargoes carried. Lloyd's lists for the years 1793 to 1800 show that the net losses of British vessels for the period referred to after making allowances for re-captures, amounted to something like 3,500 vessels, or about 500 ships per annum.

The statistics for the whole period of war from 1793 to 1814, involving about 20 years of actual warfare, indicate that the losses amounted to some two and a half per cent. of the average annual number of vessels entering and clearing from ports in Great Britain. In confirmation of this figure of two and a half per cent., it may be remarked that during the year ending September, 1800, the value of prize goods received in France amounted to nearly one million and a quarter pounds sterling, whereas the total value of British exports for that year reached some fifty-six million pounds.

It is curious to observe in view of present conditions, that the Royal Commission on Food Supply in Time of War estimated in 1905, from somewhat meagre data, that the premiums for war risks should be taken at 5 per cent. on ship values and 1 per cent. on property values. This rate was fixed by the State under the war risks scheme for the present war, 80 per cent. of the losses being borne by the Country and the balance by the ordinary Insurance Associations.

CUNARD CO. QUADRUPLE SCREW TURBINE STEAMER "AQUITANIA."

The experience of the first twelve months of war has indicated that this empirical value approximated very closely to the truth; 172 out of 4,400 steamships entered in the war risks associations being lost by perils of war; the shipping value lost was $6\frac{1}{4}$ millions out of about 150 millions, while the property losses came to $7\frac{1}{4}$ millions out of a total value of cargo of about 1,500 million pounds. The losses of value among entered ships for the first year of war were thus about 4 per cent. per annum and for property one half of one per cent.

Commerce Destruction by Cruisers

There is little doubt that part of the German plan which had been laid down for an attack on the sea power of Great Britain had included a definite and well-thought out programme for commerce raiding. Although it had been persistently denied that the German ocean liners carried their armament in peace time, proof to the contrary was soon obtained at the beginning of the War by the rapid conversion of such vessels into armed merchant cruisers. This possibilit must have occurred to British shipowners, for it is well known that certain liners which carried provisions were fitted with astern gun positions, enabling them to be easily fitted with weapons for their own protection.

The German naval programme from 1906, when the first of the Leipzig class was finished, contains indications that the special type of very light cruiser suitable for this class of warfare received very serious consideration. The Leipzig type was armed with ten 4.1 guns, was provided with a 2 inch protective deck, and had a speed of 23.5-knots, with a large coal capacity for this type, of 800 tons. The development proceeded with the Emden type, completed in 1908, in which the speed was increased to 27-knots, and later the armament was increased to 12 guns of the same calibre, the protection and coal supply remaining the same.

BRITISH INDIA STEAM NAVIGATION CO. T.S.S. "VARELA."

At the outbreak of war, the German Navy possessed 14 vessels of the 27-knot class, and 11 vessels of the older, 23.5 knot type. It is difficult to estimate how many vessels of this class would be deemed to be necessary for the use with the main war fleet; but certainly all of these 25 vessels must be regarded as potential commerce raiders.

The conditions which are considered to be desirable for the successful prosecution of this type of warfare are that the raiders should have a powerful supporting squadron for protection against what may be termed fighting ships proper, that the raiders should be capable of scattering widely, and that they should have ready access to friendly ports and supplies.

Owing to the disposition of the British Naval forces in August, 1914, the only raiding squadron of any potential value to the enemy was that which was based on Kiaochau. This force consisted of two high speed (23 to 24-knots) armoured cruisers, the Gneisenau and Scharnhorst, provided with eight 8.2 inch guns, and protected with side armour, as well as by a protective deck. The armed light cruiser raiders at liberty consisted of six vessels, the Karlsruhe, Dresden, Emden, Konigsberg, Leipsig, and Nurnberg. In addition to these vessels, the armoured cruiser Goeben, in association with the light cruiser Breslau, were in European waters, but their period of activity was very short, as they arrived in the Dardanelles on August 10, 1914, and so had no effect on commerce raiding. In addition to these vessels a number of merchant liners were speedily converted into light armoured cruisers, so that it is considered that somewhere about 20 commerce raiders were at large in the early days of the war.

Search For Raiders

The search for the raiders involved a long chase among unknown islands, and over wide regions of the world, and it was stated at one time that no less than seventy cruisers belonging to the various Allies, as well as several armed merchantmen, were engaged in the pursuit. The Allies at the same time captured all outlying German posts and wireless stations, and thus prevented the raiders from the use of the friendly ports, making their existence as difficult as possible.

ANCHOR LINE CO. SS. "CAMERONIA."

The maximum period of activity is shown by the fact that most of the losses occurred between August 15 and October 24, 1914—the remaining losses, which were few in number, occurred, however, for another seven months. That their activity was so short-lived, and their depredations so limited—the loss of merchant steamers from these raiders did not exceed a total of fifty vessels—was due to the defeat of the main squadron in the Falkland Islands battle on December 8, 1914. In this battle, the Gneisenau and Scharnhorst, armoured cruisers, were sunk, and the light cruisers, Leipsig and Nurnberg, were similarly disposed of, while the Dresden, which then escaped, was destroyed off Juan Fernandez on March 14, 1915.

The two light cruisers which caused the greatest loss were the Emden and the Karlsruhe. The Emden, the results of whose career are detailed elsewhere, worked effectively for some six weeks, from September 10 till October 19, 1914. She was caught by H.M.A.S. Sydney, and destroyed at the Cocos Islands on November 9 of that year.

The Karlsruhe operated entirely in the Atlantic, mainly in the region of the equator, and disposed of seventeen steamers, of an estimated value of a million and a half pounds, before she disappeared, from some unknown cause, in November, 1914. The other light cruisers had very little real success.

The armed merchantmen were nearly as successful as the cruisers, for the Kronprinz Wilhelm, which escaped from New York, sank some nine steamers and four sailing vessels, of a value of about a million pounds, before being finally interned at Newport News in April, 1915. The Eitel Friedrich, also working in the Atlantic, whence she had come from China, disposed of 13 vessels, mostly sailing ships, before she also was interned at the same port as the Kronprintz Wilhelm, at about the same time.

Two other merchant liners achieved some distinction, the Kaiser Wilhelm der Grosse being the first to be destroyed on August 26, 1914, by a British light cruiser. The second vessel, the Cap Trafalgar, was sunk after a fight of nearly two hours with a British armed merchantman, the Carmania, of the Cunard Line. This is the only recorded action in which merchantmen only were engaged, and great credit was reflected on the British mercantile marine on that occasion.

Thus the threatened menace to the sea power of this country by means of cruiser raiders was practically broken after the first three months of war, although some of the after effects lingered until a further eight months had elapsed. This phase of enemy activity was thus sooner, or more easily disposed of, than had been thought at all probable by students of warfare previously to the war. For whatever reasons this may be due—and full information to deduce these reasons is not available—great credit for the work done in this connection is reflected on the men, both of the Royal Navy and of the Merchant Marine.

EAGLE OIL TRANSPORT CO. OIL-TANK SS. "SAN NAZARIO."

Submarine Menace

Before this menace had been fully removed, a much more serious danger had appeared on the shores of Great Britain, which threatened to dislocate the shipping industry at its source, and to some extent to paralyze marine transportation which was seen to be so necessary to the Allied cause.

This danger was the greater because its possibilities were unknown; the development of the new weapon of offence, the submarine, was so recent that proper means of defence against attack were necessarily of a "tentative order." Consequently the third scheme of German attack on the sea power of this country—the first two possibilities, the destruction of the fighting Navy and the raiding by surface vessels having failed—was awaited with some concern by those who might be expected to know something of the potentialities of this weapon of warfare.

CANADIAN NORTHERN RAILWAY CO. SS. "ROYAL GEORGE."

It is believed that in the spring of the year 1914, before the beginning of the war the German Navy possessed about 30 submarines. Of these some third part were quite small, each being of about 250 tons displacement when submerged, while a further class were of about double the size, leaving a small remainder, each of about 750 tons displacement submerged. These latter vessels had a speed of 14 knots on the surface and of 8 knots when submerged, and were provided with 4 torpedo tubes, one 3-inch gun, and two one-pounder quick-firing guns.

There were known to be under construction some six similar, but slightly larger vessels, which were expected to have a surface speed of 16 knots, while, according to Brassey's Annual, some ten vessels of much larger size were also believed to be under construction. This has since proved to be the case for a photograph taken of U 36 indicates that the length of this vessel was about 250 feet, which would correspond roughly to 1,200 tons displacement given by the publication quoted above. These vessels were stated to have been expected to obtain a speed of 20 knots on the surface, and 12 knots submerged, with a horse power of 2,500 obtained by two Diesel motors, each of about 1,250 horse power.

It is probable that the number of boats under construction which, as stated, was believed to be some sixteen, was far below the actual number, and it is not unreasonable to conclude that the total number of German submarines at the beginning of the war was at least 30 in existence and say 50 under construction, taking into account several vessels under construction for other powers.

Moreover, it is extremely probable that owing to the great length of time required for the construction of these craft that this number was not largely added to before the end of the first year of war—in spite of the fact that additional establishments were provided in Belgium and elsewhere for the construction of such vessels.

Submarine Blockade

Prior to the formal declaration of the submarine blockade on February 18, 1915, several attempts were made to attack and sink merchant ships. The first British merchantman to be destroyed was the Glitra, which was sunk by U 17 on the 20th October, 1914. This was followed by occasional attacks on other vessels, most notably the refugee vessel Amiral Ganteaume, which was torpedoed on October 26 without warning, when conveying over 2,000 refugees to France. The total number of British losses from submarine attack, excluding fishing vessels, was however, only four from October 20 until January 30, on which day and the day following no less than five vessels were sunk in the Irish Sea and English Channel.

A formal notice was issued by the Chief of Staff of the German Admiralty on February 4, 1915, to the general effect that the waters around Great Britain and Ireland, including the whole of the English Channel, were declared a military area, and that from February 18 following, every hostile merchant ship in those waters would be destroyed even if it were not always possible to avoid danger to crew and passengers.

From that time the policy of frightfulness in the destruction of merchant ships, crews, and passengers, without previous warning and without any respect to previous international agreements for the safety of neutrals and non-combatants, was carried on in accordance with the German idea of thoroughness.

There is little to comment on regarding the various forms and variations of the attacks. Judging by the vessels sunk, there were some periods when the activity of the submarines was more marked than others, indicating that the enemy vessels employed had to traverse a good distance from their base of operations. Apart from this, there is only one period, viz.:—August 19 to 26, 1915, when an abnormal number of losses of large vessels occurred, reaching in that

GRAND TRUNK PACIFIC SS. "PRINCE RUPERT."

brief period 22 British steamers alone.

It is to be observed, however, that, as has already been mentioned in quite another connection, the greatest danger from submarine attacks arose when making land. It will be a matter of common knowledge that the majority of vessels sunk were attacked in very narrow regions. If a line be drawn on the map from Dover to Limerick, embracing Beachy Head, Start Point, Land's End, the mouths of the Bristol Channel and the Irish Sea as well as the South Coast of Ireland, it will be found that out of a total number of losses of 87 recorded up to June 30th, 1915, 63 per cent. of the total occurred in the home waters which are situated to the southward of this line.

It is not necessary to detail here the attacks on passenger liners, for the terrible circumstances attending the loss of the Falaba, Lusitania, Arabic, and quite recently the Italian emigrant line "Ancona," are so engraved on the mind that the mere mention of the name of the vessel is a sufficient reminder of the character of the warfare that has had to be faced.

Vessel Losses Through Submarine Blockades

It is not possible to express exactly what have been the total losses of British steamers brought about by the submarine blockade, for the Admiralty have decided very wisely to refuse publication of the details. Consequently there is no exact information beyond October 14, 1915, up to which date it was stated in the reply to a parliamentary question that, exclusive of fishing vessels, the total number of British registered vessels lost amounted to 183, of which 93, or almost exactly one-half had been torpedoed. Nearly the whole of these were British steamers, and the large majority well exceeded 1,000 tons gross.

The same parliamentary reply also stated that up to the same date the enemy had also sunk 175 fishing vessels, but in this latter class it was not possible to give the exact number that had been torpedoed. The war on fishing vessels has been particularly characterized by vindictiveness and cruelty, and some of the episodes connected therewith are markedly brutal.

Offsetting the Submarine Menace

There is little doubt that the measures taken by the British Navy to deal with the serious menace to shipping in home waters have been satisfactory, and have been more successful than had been expected in view of the many unknown factors in an entirely new problem. The number of enemy submarines which have been destroyed has been the subject of world-wide speculation, but such matters must, of necessity, be left to the naval historian of the future.

There is no need, however, to look far for an admission of success, for Count Reventlow has publicly stated that the failure of the submarine menace has not been brought about by the British Navy but by the geographical configuration of the German Ocean, and also because the German submarines have of later days considered it more profitable to pursue their avocations in the Mediterranean rather than in the Home waters. In this district there is of course a greater freedom of activity for submarines, but there is a corresponding drawback of a lack of friendly bases of supply. It is therefore to be hoped, and may be reasonably expected that the senior service of the Country will rise to the difficulties of another phase of a new problem, in view of the measures they have concerted for defence against a more imminent peril.

Mines

It is not possible to go into much detail in connection with the losses that have arisen from this cause, for the general sowing of the waters with these engines of destruction has occurred in such an indiscriminate manner that nothing of importance can be deduced from a critical survey of this particular phase of warfare.

What of the Men?

Surely it is sufficient to say that "The men were made in England, in England."

Whether reading of the heroic self sacrifice of the officers and crew of the murdered passenger liners, whether reading the defiant unarmed merchantmen which turns its face to an enemy submarine and rams, whether reading of the gallant work of the large fishing fleet which has taken a valiant part in the very dangerous operation of clearing from mines the narrow traffic lanes of the home waters, whether reading of the gallant aid rendered by the steam trawlers and other mercantile units in the immortal occupation of the Gallipoli peninsula, whether reading of the manifold glorious actions of the fighting navy proper, in which many men of the merchant navy have taken part, and whether reading of the bravery of the same men when engaged in the prosaic pursuance of their every day practical labor of furthering the commerce of the Country—by supplying the allied powers with food for men and guns—the mind is overwhelmed with the greatness of character which has distinguished their conduct, and which it may humbly be suggested is epitomized in the repeated refrain, "The men were made in England, in England."

CANADIAN PACIFIC OCEAN SERVICES SS. "PRINCESS ALICE."

It is perhaps presumption for a looker-on to comment or to express approval, but the many tales of derring-do, of great adventure which have been told to some privileged persons are certainly quite in keeping with the glorious traditions that have been handed down from the times of Nelson.

When the day comes for the present chapter of the sea power of Great Britain to be written it will be found that the part played by the Merchant Navy will lay the foundations of a tradition which will be as glorious to the mercantile marine of the future as the fame of Nelson has been to that fighting navy in which the whole of the Empire has evinced a joyous pride of possession.

WELLAND SHIP CANAL PROGRESS

IN the report of the Department of Railways and Canals for the year ending March 31, 1915, Engineer J. L. Weller, in charge of the new Welland Ship Canal construction, makes the following statement in part. The work is divided into 9 sections, of which section No. 1, approximately three miles, at the Lake Ontario end of the canal, was placed under contract on August 1, 1913; section No. 2, approximately 4¾ miles, was placed under contract December 31, 1913; section No. 3, approximately 2 miles, was placed under contract on October 4, 1913; section No. 5 was placed under contract on December 22, 1913. During the year 1913-14 the sum of $994,257.60 was expended, and during the fiscal year 1914-15 the sum of $4,074,200.69, making the total expenditure $5,068,458.29; to this is to be added for previous expenditure, for preliminary surveys, borings, etc., $187,238.15, making the total cost up to the 31st of March, 1915, $5,255,696.44.

General Progress of Work

A comparison of the actual work done to date on sections Nos. 1 2 and 3, with the theoretical progress that would be required to complete these contracts on the dates specified, namely, April 1, 1917, shows that sections Nos. 1 and 2 are about six months behind the theoretical line, and section No. 3 about twelve months behind, but now that the work on these sections is in full swing they are all gaining somewhat, and it appears to me that section No. 1 will be so near completion by the spring of 1917 that any work remaining to be done will not interfere with the opening of the canal. Section No. 2 should be very nearly as far advanced as section No. 1, but section No. 3 can hardly expect to place the enormous amount of concrete necessary to complete the work within the contract time, but there is no reason that I can see which should delay the completion of this section for more than one year, namely, until the spring of 1918, and as, under my latest plan I propose that the lock gates shall be built at some convenient point on Lake Ontario and floated into position ready to be set up in the locks, I can see no reason why the canal should not be opened for navigation, as originally contemplated, in the year 1918.

There are five sections on the upper level of the canal yet to be placed under contract, and in order that the above prediction may be fulfilled it will be necessary to place these sections under contract as early as possible in the present year (1916), and it would be much better if two of these sections, Nos. 4 and 8, could be placed under contract not later than January, 1916.

Since the first shovelful of earth was taken out in October, 1913, an enormous amount of work has been done and great obstacles overcome. This has only been possible through the earnest efforts and active co-operation of all concerned. The contractors and their staffs and my assistants with their staffs have been working at high tension during all this period in an earnest endeavor to push on the work, and at the same time make it a credit to all concerned.

It is very satisfactory for me to be able to report that already a majority of the rather unusual methods which were specified for the carrying out of the work have been successfully accomplished to such an extent as makes it certain that they are entirely practicable and economical.

CANADIAN PACIFIC OCEAN SERVICE

THE Canadian Pacific Ocean Services, announce over the signature of H. Maitland Kersey, managing director, various appointments as managers of the ocean service of the Canadian Pacific Railway Co., and the Allan Line Steamship Co. The head office is at No. 8 Waterloo place, Pall Mall, London, S.W. The Canadian Pacific Railway Company will act as traffic agents, and Allan Bros., U.K., will act as traffic agents for the Allan Line Steamship Co. The following are the officers' appointments:—

J. A. Martin, assistant manager, Liverpool.

H. S. Carmichael, passenger and freight manager, London.

L. J. Coates, chief accountant, Liverpool.

W. D. Grosset, agent, Glasgow.

A. S. Ray, agent, Bristol.

Captain J. T. Walsh, R.N.R., assistant manager for Canada, Montreal

Captain J. V. Forster, R.N.R., general superintendent, Liverpool.

Captain D. R. W. Parsons, R. N. R., marine superintendent, London.

Captain W. Christie, marine superintendtnt, Glasgow

Captain E. Beetham, R.N.R., marine superintendent, Vancouver.

W. J. Sergent, chief superintendent engineer, Liverpool.

Kenneth Mackenzie, assistant superintendent engineer, Liverpool.

G. H. Butterworth, assistant superintendent engineer, London.

John Russell, assistant superintendent engineer, Glasgow.

James McGown, assistant superintendent engineer, Vancouver.

H. T. Richardson, assistant superintendent engineer, Hong Kong.

W. Adams, purchasing agent, Liverpool.

CANADA STEAMSHIP LINES

J. W. NORCROSS, vice-president and managing director of the Canadian Steamship Lines has returned to Montreal after a short trip to England. Mr. Norcross went to the Old Country for the purpose of giving a report of the 1915 business, and the prospects for 1916, to the company's London committee.

Bermuda business was reported by Mr. Norcross to be showing substantial monthly increases over the corresponding periods of last year. Boats engaged in ocean trade were also stated to be making satisfactory earnings. The vice-president said that sixteen vessels, used during the summer months on lake trade, were now engaged in coastwise and Atlantic service, and that many of the charters covering them would shortly expire. He anticipated no difficulty in re-chartering the ships.

Mr. Norcross believes that there will be a scarcity of tonnage for at least six months after the cessation of hostilities. He pointed out that none of the large Germans' boats, now tied up in New York and other American ports, could be expected to immediately re-enter ocean service after peace was declared. It would first be necessary that all of them be thoroughly overhauled. It would also take a long time for the boats now being destroyed by mines, submarines and perils of the sea to be replaced. Since the outbreak of the war practically no merchant ships had been built in the British Isles and for some time to come very little new tonnage could be expected.

The outlook for the present year was characterized as promising. Mr. Norcross expected a good tonnage of grain from the upper lakes next summer and said that competition for this business would not be as keen as during 1915. The reason for this was that a large number of the American vessels operating on the Great Lakes had been chartered to transport ore to eastern ports.

World's Shipbuilding in 1915, Exclusive of War Ships

From Lloyd's Registry

For obvious reasons, complete details of the 1915 World's Shipbuilding are not available for publication at this time. It may be, however, that at some later date when peace has been declared and the remnant of the warriors have returned to peacetime commercial and industrial pursuits that we will be able to place before our readers the data in all its usual variety and fulness, not to speak of the added highly interesting, war-influenced activity.

As pointed out for some time past in Lloyd's Quarterly Shipbuilding Returns, the rate of progress in merchant ship construction in the United Kingdom has been very much reduced in present circumstances, resulting in a corresponding decrease in the immediate output. During 1915, excluding all vessels not intended for merchant purposes, 327 vessels of 650,919 tons (viz., 317 steamers of 648,629 tons and 10 sailing vessels of 2,290 tons) have been launched in the United Kingdom. The sailing ship tonnage is composed, however, almost entirely of barges and similar craft. The output of mercantile tonnage in the United Kingdom during 1915, shows a decrease of 1,032.634 tons compared with that of last year. Practically the whole of the tonnage launched was composed of steel steam tonnage.

Nationality of Tonnage Launched

Of the total output, nearly 85¼ per cent., or 554,803 tons (553,363 steam tons and 1,440 sailing tons), was built for registration in the United Kingdom. The amount of tonnage launched for other countries during 1915 was 96,116 tons (including 20,965 tons for British Colonies), forming about 14¾ per cent. of the total output, as compared with an average percentage of 22½ for the previous five years.

Size of Vessels

The returns for 1915 show that 33 vessels of 6,000 tons and above were launched. Of these, 3 were over 10.000 tons each, the largest being one of 13,400 tons. The average tonnage of steamers launched in the United Kingdom during 1915 is 2,046 tons, but if steamers of less than 500 tons be excluded, the average of the remaining steamers reaches 3,791 tons gross, which is a considerable reduction on the mean of the averages of the five previous years.

Turbines or Internal Combustion Engine Vessels

Six steamers were launched with a total tonnage of 53,192 tons, all of which will have Parsons geared steam turbine engines. The launches for the year also include 2 vessels with a total tonnage of 10,700 tons fitted with internal combustion engines.

Special Types of Vessels

Of steamers building on the Isherwood system of longitudinal framing, 7 were launched during 1915 with a gross total tonnage of 43,665 tons. Including 4 of these vessels with a tonnage of 24,084 tons, there were launched during the past year 5 steamers of 31,684 tons for the carriage of oil in bulk. The returns also include 8 vessels of 66,334 tons with cruiser sterns; 104 steam trawlers and other fishing vessels; besides a number of tugs, dredgers, barges, and other vessels designed for channel, river, and other special services.

Output of Leading Districts

As was the case last year, the Clyde district occupies the first place among the shipbuilding centres of Great Britain, showing an output of 205,073 tons (Glasgow, 106,203 tons, and Greenock, 98,870 tons). Then follow the Tyne (124,001 tons), the Wear (110,942 tons), Hartlepool (59,308 tons), Middlesbro (58,574 tons), and Belfast (33,729 tons).

Other Countries

It appears that, outside the United Kingdom, there have been launched during the year, 416 vessels of 550,719 tons (313 steamers of 518,948 tons and 103 sailing vessels of 31,771 tons). These figures show a decrease of nearly 53 per cent. compared with those for 1914, but it should be borne in mind that they are incomplete, Germany, Austria-Hungary, and Belgium not being included. The returns for the year include 33 vessels of over 5,000 tons each. The largest vessel of the year was a collier built in the United States of about 11,000 tons. During 1915 eleven vessels of over 1,000 tons each, to be fitted with internal combustion engines, were launched, their aggregate tonnage being about 42,000 tons. The returns for the year include 12 steamers with a total tonnage of 71,467 tons, building (all in the United States) on the Isherwood system of longitudinal framing, and 6 steamers of 35,000 tons to be fitted with steam turbine engines. There are also 6 oil carrying vessels of about 33,000 tons.

United States

The tonnage launched in the United States (177,460 tons), is 23,302 tons less than that of the previous year. During the year there were launched on the coast 13 sea-going steamers of from 5,000 to 7,000 tons each, and one collier of about 11,000 tons. The total output includes 5 steamers with a total tonnage of about 30,000 tons to carry oil in bulk. Including these 5 vessels, there were launched in the United States 12 steamers of 71,467 tons building on the Isherwood system of longitudinal framing.

Holland

The total tonnage (113,075 tons) launched in Holland during the past year is about 5,000 tons less than the output in 1914, which was a record in the Society's returns for that country. This total does not include vessels known to be exclusively intended for river navigation, and which tonnage appears from information to hand to amount to over 70,000 tons; so that the total output, including such craft, would appear to reach over 183,000 tons. The largest vessel launched during the year was of about 8,000 tons. There were 4 other steamers of from 5,000 to 7,500 tons each.

Norway

The returns for the year show the output to be 62,070 tons, which is about 8,000 tons more than the total for the previous year, and is the highest ever recorded in the Society's return for this country. As in other years, the tonnage launched is practically composed of vessels of between one and two thousand tons. Only one vessel of a larger tonnage has been launched, viz.:—a motor vessel of 2,600 tons.

Japan

The tonnage launched during the year (49,408 tons) is over 42 per cent. lower than the output for 1914. It comprises 2 steamers of about 9,500 tons each, and 1 steamer, 7,375 tons, fitted with steam turbine engines.

Denmark

The figures (45,198 tons) exceed those for the previous year by nearly 13,000 tons, and are the highest on record. Included in this total are 6 vessels of about 30,000 tons, which are to be fitted with Diesel engines.

Classed by Lloyd's Register

Of the merchant vessels launched during last year, 378 of 874,775 tons (including 91 vessels of 299,743 tons launched outside the United Kingdom), have been built under the society's inspection with a view to classification in Lloyd's Register Book.

ISHERWOOD SYSTEM OF SHIP CONSTRUCTION

THE universal acceptance of the Isherwood system of ship construction has been, during the past year, much emphasized, despite the fact that the war has so considerably altered mercantile output. The advantages of the system, from the points of view of stability and strength and of economy, seem to have been tested with success by practically every class of builder and ship-owner in Great Britain, the United States, and elsewhere. Moreover, there is reason to believe that in some of the special types of Admiralty ships the system has been adopted as offering the advantage of procuring greater strength and greater resisting power under certain conditions.

The activity of shipbuilding in the United States has brought into greater prominence there the Isherwood system, and there is reason to believe that it will be largely adopted in a considerable number of large ships which are likely to be contracted for in American shipyards during the coming few months. There is a statement, as a matter of fact, that Mr. Isherwood is presently arranging to visit the United States in connection with the foregoing.

It is of primary interest and importance, however, to learn that in Great Britain designs for certain large passenger liners, which are under preparation, may possibly include this now established system of construction. Although the past year has not offered many facilities for the building of mercantile vessels, owing to the demands made upon shipbuilders by the Government, it is interesting to note that 1915 has been a record period for the Isherwood system, orders for more vessels on that principle having been placed than in any preceding year.

The total number of Isherwood vessels contracted for to date in the current year is 135 approximating to 615,315 gross tons, which is almost equal to 1,000,000 tons in deadweight carrying capacity.

The following analysis of vessels built or being built clearly demonstrates the suitability of the Isherwood system for all types of craft, and at the same time emphasizes the predominance it has gained in the construction of certain classes of vessels:—

Vessel type	No.	Gross tons (about)
General cargo	167	745,763
Tankers	181	1,054,783
Colliers	21	130,760
Great Lakes freighters	16	111,745
Passenger	9	27,769
Barges	43	12,742
Dredgers	2	750
Trawler	1	570
	446	2,084,892

In the United States three more large freighters for the Lakes trade have been placed on order, and to evidence the firm footing the system has gained in Japan, it may be stated that 22 vessels have recently been contracted for.

ADMIRAL BEATTY'S PLEA

THE commander of the first British battle-cruiser squadron, vice-admiral Sir David Beatty, whose ships defated the Germans in the North Sea, has made a stirring appeal for a great religious revival in England as a necessary step to victory in the war. In a letter read at the Annual Convention of the Society for the Propagation of Christian Knowledge he writes:

"Surely Almighty God does not intend this war to be just a hideous fracas or blood-drunken orgy. There must be a purpose in it; improvement must come out of it. In what direction? France has already shown us the way and has risen out of her ruined cities with a revival of religion that is wonderful. Russia has been welded into a whole, and religion plays a great part. England still remains to be taken out of the stupor of self-satisfaction and complacency into which her flourishing condition has steeped her. Until she can be stirred out of this condition, until a religious revival takes place, just so long will the war continue.

"When she can look on the future with humbler eyes and a prayer on her lips, then we can begin to count the days towards the end. Your society is helping towards this and so is helping to bring the war to a successful end."

BRITISH MARINE LOSSES

SINCE the outbreak of the war to the end of last October, 254 British merchant steamers, aggregating 542,648 tons, were lost "through enemy action," according to a white paper issued on January 27. Of these, 171 were sunk by submarines, 46 by warships, and 37 by mines.

Nineteen sailing ships, of a tonnage of 15,542, were sunk. The fishing vessels sunk numbered 227, of which 158 were steam and sixty-nine sailing. Their aggregate tonnage was 14,104.

In the same period, 167 steamers, aggregating 143,992 tons, were lost "by ordinary marine casualties," of which 14, of a tonnage of 14,133, were returned as missing. The loss of some of these, says a footnote, was "probably due to mines or other enemy action."

Sailing vessels to the number of 229, and of a tonnage of 31,253 were also the victims of ordinary marine casualties.

MYSTERY OF THE SCREW PROPELLER

IN a paper contributed to the Journal of the American Society of Naval Engineers, by Captain C. W. Dyson, U.S. Navy, it is stated that:—The efficiency of performance of the propeller is seriously affected by its position in relation to the hull of the vessel which it is driving, and by the fulness of the hull lines at the after body.

That for any given propeller working under constant hull conditions of form, the effective horse-power for any given engine power remains constant, and this is independent of the speed of the vessel.

That for any given propeller working under constant hull conditions of form, the revolutions necessary to deliver any given effective horse-power vary with the speed of ship, the engine power remaining constant.

That model tank effective horse-power curves are correct, and that the appendage resistance varies according to the "laws of comparison."

That trials of vessels ocer shallow-water courses should be prohibited, as such courses change completely the character of the water flow to the propeller.

That deep-water trials, by the close agreement of actual with estimated results, demonstrate the correctness of the above statements.

That in view of the great accuracy of torsion meters and indicators used on official trials, the large estimate of from three to five per cent. error usually credited to these instruments is incorrect, particularly at high powers.

That results obtained from model-tank experiments with model propellers will be correct when the model is properly proportioned to the full-size propeller, which does not mean that the pitch ratio of the propeller and of the model shall be the same, and the chart condition of the model propeller, working with no hull, or rather behind a phantom ship, can be calculated.

It shows, finally, that where vessels are entered into competition based upon relative efficiencies of their propelling machinery, it is a positive error to base these efficiencies upon speed or revolutions, as both speed and revolutions for equal load upon the propellers, represented by equal effective horse-powers, vary with the loading of the hull, foulness of ships' bottoms, weather and sea, while the engine power for this effective horse-power remains constant, except in cases where propellers are foul or their blades distorted. It shows, therefore, that the true criterion for efficiency of propelling machinery should be indicated or shaft horse-power developed by that machinery, and that the speed of ship and revolutions of propellers should be neglected.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

WHY DUPLEX PUMPS KNOCK

By H. W. Benton.

IN the January issue of Marine Engineering of Canada, a reader asks for advice as to what causes a steam-driven duplex pump to knock. He states that the knock is worse when the pump is running condensing than when non-condensing; also that he has been using up a supply of valve springs that he found were on hand when he took charge.

From the manner of his letter I take it that he has been using an assortment of springs ,etc., that the former engineer had left, and if so, then there is reason for his pumps knocking. It is very important, for the proper operation of a duplex pump, that all valves are given the same amount of lift, and that all valves are fitted with springs of the same size and strength; so as to produce the same pressure on each valve. In a pump having only eight valves, four inlet or suction and four outlet or discharge valves; suppose one of the suction valves to be fitted with a very stiff spring; then, under such a condition, there would very likely be a knock because the heavy spring would offer sufficient excess resistance to the flow of water into the pump cylinder as to prevent the latter being filled with water, hence when the pump reversed its stroke instead of the water piston being up against a cylinder full of water it jumps a short distance until the water does fill up the cylinder, and, the instant this happens, the knock is heard, because the piston has hit a solid body of water, just as a steam piston knocks when there is water in a steam cylinder and the piston comes "smack" up against it near the end of its stroke.

When we consider the force required to put the water into the pump cylinder, it becomes very plain that spring tension on the valves is quite important. For instance, consider a duplex pump receiving its water by gravity from an overhead tank and assume that the supply of water is three feet above the pump, then the pressure produced by this water due to its height above the pump would be 1.3 lbs. per square inch. Now, if the pump valve had a face area of six square inches, then the force trying to open this valve would be six times 1.3 or 7.8 lbs. If we had a spring on top of this valve exerting a force (to keep the valve on its seat) of 7.8 lbs., then the forces would just balance and no water would get into the pump. If the force produced by the spring be only 2 lbs., then there is a difference in favor of the water getting into the cylinder.

By reasoning thus, it becomes plain why a pump will operate quite satisfactorily at a fair speed, but if speeded up will knock, because the force that puts the water into the cylinder is enough to keep the pump supplied at the fair speed, but at the increased speed the pump does not get enough water and, of course, the result is a knock.

Consider a pump receiving its supply of water by "suction"; in this case the water is forced into the pump cylinder by the pressure of the atmosphere exerted upon the surface of the water outside the suction pipe. There is a limit here also to the pressure available to put the water into the pump; and if we tax this pressure almost to the limit to force the water up to the pump and then expect it to force open a valve held down with a stiff valve spring, we are going to be disappointed. We will have a knocking pump, because we are not going to get a full supply of water.

When the steam and water piston are tight and a pump knocks, I have invariably found the cause to be in the suction valves or the suction line; a slight air leakage in the suction line will sometimes make a pump knock and sometimes a sticking discharge valve will bring about a similar condition.

THE CARE OF MOTORS AND GENERATORS

By C. L.

THIS subject has been written about until one would almost think nothing more could be said, yet I was particularly struck by some advice published in the December number of Marine Engineering of Canada, entitled "Electrical Machinery Operations."

The writer started out very nicely, but it seems he has been more accustomed to old type machines with oil cups and copper brushes than those modern and up-to-date, judging by his remark, "If there is ring lubrication."

All modern machines, or those built in the past 15 years at least by up-to-date builders, are of the ring lubricating type. A few have used chains instead of rings, but these are practically the same. In all, the rings or chains are so proportioned that the oil if of proper quality, will not hinder their rotation. The rings, however, sometimes become slightly out of round by rough handling when the armature or journals are being removed for repair. This should be carefully avoided when repairs are being made.

If modern carbon or graphite brushes are used—being always found on up-to-date machines, there is no necessity to raise them off the commutator when the machine is stopped, and few are built so that this can be done. The brushes, however, should be kept clean and free to move so that they will easily accommodate themselves to any slight unevenness that might be in the commutator. Serious sparking results, should the brushes or any one or two of them become stuck fast in the holders as the latter circumstance causes poor contact with the commutator bars.

The technical man is all right, but he is of little use in regulating brushes. Vibration of the machine from any cause is very bad for the commutator, and causes it to wear excessively, being accompanied with more or less sparking and frequently causing flats.

I am surprised to note that emery cloth is recommended for use in cleaning the commutator or for grinding out flats, especially after the writer has spoken of being careful about copper dust getting between the bars. Emery is a conductor of electricity and more liable than copper to stick between the commutator bars.

Therefore, the use of emery cloth should by all means be avoided, for should any of it get into the journals, which it might easily do, there will be plenty of trouble ahead. The farther emery cloth can be kept away from the machine the better. Sand paper of about No. 2 grade should be used to grind up the commutator, and if used on a nicely fitting curved block will produce a very satisfactory job. No. 1 grade should be used to make a smooth finish.

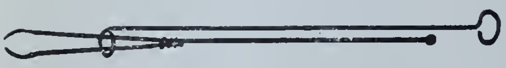
It is practically impossible to file out a flat on a commutator. A piece of an old grind stone curved out to fit does good work with no danger of causing trouble, between the bars. Should the depressions be too deep to grind out, the lathe is the only cure, and here the use of emery as recommended by the writer of the article, who is probably more technical than practical, should be strictly avoided. Fine sand paper only should be used to do the polishing after the lathe work is done.

The best way to avoid trouble with electrical machines is to put them in charge of careful and experienced engineers, and a periodical inspection by an expert will not then be necessary.

WHICH—FIVE CENTS OR FIVE DOLLARS?

By H. W. Benton

FREQUENTLY as we journey through life, we run up against something that seems to be impossible, yet, many im-



WHICH—FIVE CENTS OR FIVE DOLLARS.

possible things of yesterday are accomplished, and almost forgotten to-day in the persistent race to the front. This is true of small things as well as large ones. I once read a statement on the wall of an office which is worth remembering:—"The world moves along so rapidly now-a-days, that, the man who says 'it can't be done,' is frequently interrupted by someone doing it." Let us all aim to keep clear of interruption!

Recently while one of my assistants was inspecting the water end of a duplex pump, he dropped a small wedge down throught the suction valve seat into the suction chamber. It looked like a big job to get that wedge out, for it could not be reached by the hand, or with a long pair of tongs. He made a wire hook and tried to work a slip loop over the end of the wedge, but to no avail. Later he came to me with the statement that the wedge was in the suction chamber of the pump and that the only way to get it out was to take down the suction line and reach up into the short nipple which was screwed in the pump body.

To do this it would have taken some hours on account of the system of piping in connection with the pump.

The wedge was ultimately taken out by the use of the tweezers shown herewith, and without dismantling the piping. These were made of 3-32 inch copper wire; the ends being hammered flat in order to grip the wedge. The tweezers were let down through the valve seat, and placed over the wedge, then by pressing down on the loop wire, they were closed upon the wedge and the latter lifted up to the valve seat where it was easily handled. The job cost about five cents. Taking the pipe line down would cost at least $5.

TESTING ARMATURE FAULTS

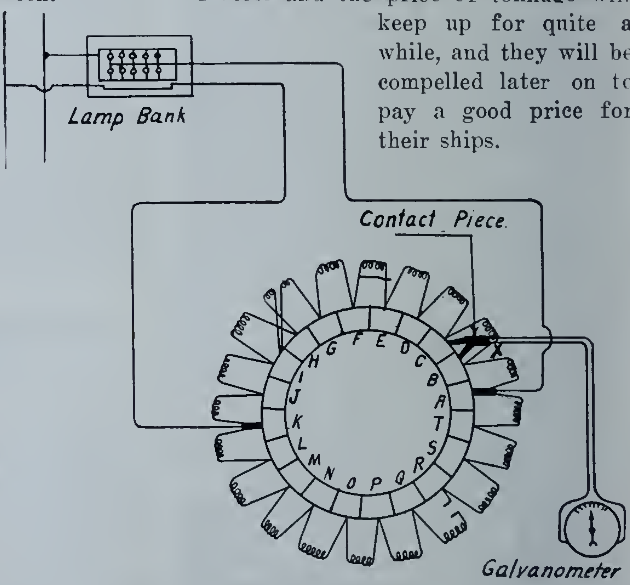
By W. H. Smith

THE bar-to-bar test is, in my opinion, the best that can be carried out by the ordinary operating engineer for detecting armature faults. Briefly, it consists of sending a current through the armature and measuring the drop across adjacent bars. Obviously, if the coils are in good shape, and connected correctly, the drop will be the same between all bars, or at least nearly so.

Referring to the diagram, a current is sent in through the armature at bar A, and out at bar K. The galvanometer is connected to a contact piece in which the contacts are so spaced as to rest on adjacent bars. To make the test, the lamp bank is adjusted so that the galvanometer gives a good readable deflection. Suppose the contact piece is on bars B and C, and a good coil X is between, correctly connected, a standard deflection will be obtained. The latter will also be obtained on each set of bars in moving toward E till bars E and F are bridged, when little or no deflection will be noted as the coil between is short circuited and its resistance lowered thereby.

Bars F and G will give a standard deflection, while bars G and H will give about twice the standard deflection as two coils are connected between. Bars H and I will give a standard deflection but in the opposite direction as the coil is crossed between. Bars I and J will give about twice the standard deflection, due to two coils being between.

In trying the other side of the commutator, we find that bars L and M give no deflection, so the circuit must be open somewhere. No deflection is obtained until we bridge bars Q and R, when a violent throw of the needle locates the open circuit between these bars. Bars P and Q, and S and T show deflection, again proving that the break is in one of the leads to bar R. If these defects are remedied, and all connections are good, about the same deflection will be obtained between all bars, although it will not be the same as the previous standard on account of there now being two paths for the current around the armature where before there was only one.



TESTING FOR ARMATURE FAULTS.

A temporary remedy for an open circuit is to connect the bars that are open by a short piece of copper wire, but the break should be repaired permanently as soon as possible. A short-circuited coil (except where the turns are short-circuited on each other when temporary repairs are of no avail), may be temporarily repaired by opening the coil at its ends, binding the latter back out of the way, tapping them over, and connecting the bars as for an open circuit. However, a short-circuited coil usually burns itself out, so permanent repairs are in order. The remedy for the crossed or reverse connections is obvious.

SOME OBSERVATIONS ON THE SHIPBUILDING SITUATION

By C. T. R.

THE demand for merchant ships and the lack of the usual opportunity to not only supply them, but to, in some measure, compensate for their wastage through the ravages of war and their wholesale requisitioning for transport and other duties arising from the latter, are at the moment live issues and becoming daily more intensively so.

As far as I can see the outlook for Canadian shipbuilding is very bright, but I believe that most of the business will have to be tonnage required for salt water service. Two lake shipowners have already indicated that while they want tonnage badly they positively will not pay present prices, as they fear they would be discounted in the future to a considerable extent. This may or may not be true, but personally I believe they are wrong. I think that the price of steel and the price of tonnage will keep up for quite a while, and they will be compelled later on to pay a good price for their ships.

Dearth of Skilled Labor

Canadian shipbuilding is now suffering from a serious handicap imposed by the action of the authorities in Great Britain and in Ottawa sending recruiting agents to this country to pick up all available shipbuilding help, in addition, all the machinists and mechanics they could get together to go over to the Old Country to both build and repair warships and make munitions. There is the additional loss occasioned by skilled help joining the colors.

It can readily be understood that men skilled in shipbuilding cannot be replaced by men off the farms, as it takes years of patient training to produce results. The output, therefore, of Canadian shipyards will be limited by the number of men available and by the supply of raw materials. The steel mills in the United States are now overloaded with orders, and are naming from four to six months' delivery; other than that, if material is required for quick delivery, a very heavy premium must be paid, which makes the ships very expensive to the owners.

Second-Hand Tonnage

For some time past there has been a wild scramble for second-hand tonnage, owing to the fact that new ships could not be had quick enough to replace the wastage due to the war and other causes, and to the huge amount of German tonnage which is laid up and out of commission all over the globe. Exorbitant prices are being paid, and old ships have been fitted out again, which in ordinary times would possibly not be allowed to clear from any port. This is evident from the fact that on some of these old vessels, as much as twenty-five per cent. insurance for the trip to Archangel has been paid.

Second-hand dealers, therefore, are reaping a golden harvest, while shipbuilders find it difficult to get owners to agree to a price which covers only a reasonable profit, the claim being that while they are prepared to pay fancy prices for immediate tonnage, conditions may change so rapidly that by the time a new ship is built and ready for commission the war may be at an end. This, of course, is mere speculation, but serves as an argument why they should not pay any big prices.

Skilled Men and Material Delivery

If shipbuilders in Canada had all the men they require and could get reasonable deliveries of material, they could get all the tonnage they want to build at the present time. As stated already, however, the scarcity of the proper kind of men and the long delivery on raw materials limits the output. In these years when reasonable returns might be secured to make up for a great many lean periods, other conditions have loomed up which make it very hard indeed for a Canadian shipbuilder to grasp the opportunities now open. The authorities in Ottawa have shown no desire to discriminate in the class of men they enlist first. It is well known that they must get men, but it would be well for the country's industries if they endeavored to take those first who could best be spared.

Mr. Balfour, the First Lord of the British Admiralty, recently stated in the House of Commons that he considered that merchant shipbuilding should be proceeded with as rapidly as possible, and that he considered that merchant tonnage was now second only in importance to munitions themselves and should be treated accordingly. Men in the yards in Great Britain have been exempt from enlisting, men in Lloyd's Register of Shipping, and men in the insurance department of Lloyd's have also been refused permission to join the forces.

It would appear, therefore, that shipbuilding in Canada, especially where vessels are being built for overseas service, should be given some consideration when men are being enlisted. Lack of discrimination will surely tell in a great many industries besides shipbuilding, but no doubt the authorities at Ottawa who have undertaken to recruit 500,000 men want to make good their promise without taking into consideration what class of men they enlist first.

GROUP OF DELEGATES AT CONVENTION OF SHIPMASTERS' ASSOCIATION OF AMERICA, HELD IN TORONTO, ONT., JANUARY 25 TO 29.

SEA FREEDOM

SENATOR LODGE, ranking minority member of the Foreign Relations Committee, made a speech in the U. S. Senate, Washington, D.C., on Feb. 18, declaring that abandonment by the United States at this time of the principles that its ports were open to, and its citizens free to travel upon merchant men of belligerent nations armed solely for defensive purposes would be an unneutral act and a step toward war. He said it would make the U. S. the ally of the belligerent, whose merchant marine had been swept from the seas.

Should Be Protested

Senator Sterling, of South Dakota, spoke on his resolution to declare the senate's concern at the recent German naval order to sink all armed allied merchant ships. He said the issue brought the U.S. to its gravest international crisis.

"Instead of yielding to the claims of the German Admiralty," he said, "their very mention should meet with vigorous protest. Instead of denying this old right of the seas, we should now, of all times, vie with her or any other nation in seeking to uphold it. It is possible some danger will be incurred, but I do not much fear that dangers will be increased beyond what they are at present.

CONVENTION DELEGATES AND FRIENDS OF THE NATIONAL ASSOCIATION OF MARINE ENGINEERS BANQUETTED AT THE WALKER HOUSE BY THE CITY OF TORONT O.

Status of Cargo Handling at American Marine Terminals

By J. A. Jackson and R. H. Rogers *

This article is a digest of two papers by the above writers read before the International Engineering Congress in San Francisco last September. The authors describe awakening of the great terminals to the possibilities of machinery equipment, and deal at considerable length with differences in the problems arising from handling bulk and package freight.

THE last few decades have seen practically every great industry stimulated and intensified by the wholesale adoption of modern organization and modern mechanism, and no better example of this tendency can be found than in the improvements in the transportation of commodities between communities, by land and sea. Freight movements, in the broad sense, are carried out with marvelous dispatch, low cost and commendable safety, all making for an efficiency that does not leave much margin for improvement. Only very lately has this time and money saving movement invaded the terminals, which heretofore have seemed immune to the infection of modern tendencies.

Bulk Freight

The methods and machinery associated with bulk freight will be treated of first. Freight can be classified into three main divisions, viz., bulk freight, live freight, and miscellaneous or package freight.

Bulk freight consists of free-flowing material, such as coal, ore, grain, certain fertilizers, etc., which can be transported and handled in bulk. The classification of bulk freight can be carried only two steps, viz., kind of material and weight; and this simplicity has been a large factor in the development of the rapid means now used for handling such freight. The history of the handling of bulk or free-flowing freight makes interesting reading, and there is probably no better place to follow it out than on our own Great Lakes, where the development of rapid, economical handling has been carried to a very high degree.

In the early days, any kind of boat willing to take a bulk cargo was used, and loading and unloading was accomplished largely by men with wheelbarrows. As business increased, keen competition arose and the hand methods became too slow and too expensive. This condition spurred on the designers of boats, piers and handling machinery, with the result that specially designed bulk-freight boats began to appear, grain elevators, coal and ore piers, etc., arranged to load the boats from spouts, were built; steam-operated cable-type bridges replaced the wheelbarrows for unloading, thereby causing a revolution in the handling of bulk freight.

Development along these same lines, with perhaps some radical improvements in unloading machinery, have continued unabated, until Lake boats now carry cargoes of 12,000 to 13,000 tons, which, in some instances, have been loaded at a maximum rate of over 22,000 tons per hour, and unloaded at the rate of over 2,000 tons per hour. The cost per ton has been reduced from somewhere around $3.000 to about $1.08 and the time saved is enormous.

Bulk freight, by virtue of its free-flowing nature, lends itself very readily to mechanical handling, and machinery for handling it has been developed to a high degree of efficiency. It is beyond the scope of this paper to go into a detailed description of this apparatus, so only a broad view of some of the general types of machinery will be given.

Bulk Freight Carriers

The boats designed for this service, particularly on our Great Lakes, deserve special mention. Machinery and living quarters are crowded fore and aft, leaving the centre free for freight. This central space is so designed, structurally, that it is entirely free from stanchions, bulkheads or obstructions of any kind —in other words, it is one immense bin, offering the greatest amount of freedom for the huge unloading buckets to pick up their load. The deck contains a continuous line of hatches, close enough together so that the jaws of a clean-up bucket will span from one hatch to the next, thus doing away with the necessity for hand shovelling.

Ocean going bulk freighters have been given the same special consideration with regard to maximum carrying capacity and special adaptation to the use of loading and unloading machinery. While their design is somewhat different from the Lake boats, the same requirements are met. In each case, ease of loading and unloading and capacity are given careful consideration.

Loading and Unloading Equipment

Bulk-freight loading and unloading equipment varies according to the kind of material handled and the conditions to be met. For loading vessels, where storage facilities are desired as well, a typical arrangement consists of the bin-type pier. This consists of a pier entirely covered with storage bins. Railroad cars are run to the top of the bins and dumped directly into them. Numerous hinged spouts lead from the bottom of the bins to the hatches of boats lying alongside, and the material flows by gravity from the bins to the boats.

Where storage facilities are not required, car dumpers represent an efficient type of loading apparatus. With this apparatus, gondola type freight cars are hoisted to the required height and turned over bodily, thus dumping their contents into a chute leading to the vessel's hatch. In other cases, where conditions justify it, continuous bucket or belt conveyors are used, which deliver material from stock bins to the vessels. In general, the unloading of bulk freight is taken care of to-day by bridges, stiff-leg unloaders, towers, conveyors and combinations of the above devices. The first three of these devices use self-digging, self-dumping buckets of various capacities.

Bridges

Bridges are of two general designs— the man trolley type, where the operator rides with the trolley and bucket, and the rope-operated type, where the operator and the machinery are stationary and the bucket travels across the bridge by a cable. Both accomplish the same purpose, which is to unload the boat and deliver the material to either the stock pile, railway cars, transfer cars or weighing lorries. Buckets, with capacities of from ten to fifteen tons, are in use, which will handle a bucket load in from a minute to a minute and a half, depending on where the load is being dumped. One bridge is in operation at a port on the Great Lakes, which has a maximum unloading capacity of 880 tons of coal per hour when dumping about 150 feet back from the boat.

Hulett Unloader

Perhaps the most radical departure in unloading machinery came with the introduction of the stiff-leg pantograph unloader, generally known as the **Hulett Unloader**, and it makes an excellent example of what inventive genius and boldness will do under stress of pressure. These unloaders are built in the shape of a huge pantograph mounted on a track.

*Power and Mining Engineering Department, General Electric Co.

The lower end of one of the vertical arms carries the bucket and the operator's cab so that the operator travels with his bucket and can work to the best advantage. On picking up a bucket of ore in the hold of the vessel, the bucket is raised, after which the entire pantograph travels backwards on tracks until the bucket is over a hopper, into which it is dumped. From the hopper, the ore goes to a weighing lorry, and thence to the stock pile or a railroad car.

The largest of these unloaders has a 15-ton capacity bucket, and a complete cycle of operation takes about one minute. By actual weight, the 15-ton bucket has picked up 21 tons at one grab. The capacity of the machine, under favorable circumstances, is somewhere around 900 tons per hour. The design of the bucket is such that it is very efficient in cleaning up material in the bottom of boats, thus doing away with hand shovelling.

Tower Type Unloaders and Conveyors

Tower-type unloaders are generally used where great rapidity is necessary; they simply hoist the material out of the boat and dump it into a hopper with the shortest possible trip. Conveyors are generally used to take the material from the hopper to the storage pile. On account of the high speed, which, on some towers, is 20 seconds per round trip, the buckets are of moderate capacity, ranging from one to two and a half tons. Conveyors are most generally used in connection with some of the above unloaders, except in handling grain, and in some special cases where conveyors load and unload directly in the boat.

Package Freight

Package freight requires entirely different treatment as the following shows:

Miscellaneous or package freight presents the most serious problem, as it forms the greater part of all freight, both in weight and bulk. The varying size, shape, strength and weight of packages makes its classification an endless task; a single cargo often containing 50 to 100 thousand packages, divided into hundreds of different sizes, shapes and weights, and consigned to several hundred different parties. The transportation companies have an elaborate system of classifying this package freight to determine the freight charges, but such a classification would be of little value so far as handling is concerned. A classification based on size, weight and shape would be the logical way of attacking the problem.

The greatest advance toward dispatch and economy is attained in terminals by the use of mechanical devices for handling freight in and out of ships, to and from storage piles and warehouses, and into and out of cars. Many of the larger and more progressive ports are investigating and testing various electrical machines, and there is, at present, quite a commendable quantity of such machinery in the package freight work; but the surface has hardly been disturbed as yet, either in the design of such devices or in their general adoption. A brief review of progress, to date, along these lines is too important to be omitted.

Winches

Electric winches, single, double, and with one or two motors are in quite general use to supplant or supplement the ship's cargo winches. Head frames are provided on pier buildings to accommodate one whip, while the other is trained through the block or the ship's boom. Such apparatus provides greater speed, with greater safety, than is the case with steam, due to the uniform speeds, ample power braking and quickness of control that electricity provides. The most recent innovation in this country in this line is the use of a double portable master-controller carried by the winch operator, which gives him perfect control of both drums from any convenient position on the ship or elsewhere. The advantage of always having the draft in sight adds greatly to the dispatch, and this end can be attained in no other way.

Conveyors

Sectionalized portable conveyors of ingenious design and great utility are rapidly becoming common on the piers, where they are used to discharge from the decks of ships, lighters or barges to the pier or storage pile, without rehandling. A single whip, or two working in multiple from the same hatch, supply the conveyor, which makes the horizontal transfer at great speed. A remarkable feature of this type of machine is its reservoir capacity, or fly-wheel effect, by virtue of the receiving area provided through its constantly presenting new empty surfaces to the loading device. Power consumption is very low, and the machines are not expensive to install or limited in their application.

Cranes

While much relied upon abroad, cranes are but little used along our coasts in the package cargo handling. Some of the most notable are:—The banana conveyor cranes at New Orleans (ten in number), each with a capacity of forty-two bunches per minute; the battery of cargo cranes at Balboa, Panama Canal; and the variety of types seen about New York Harbor, which, however, are largely used for lighters and barges.

So much depends upon the proper storage of cargo in ships, that much improvement in dispatch in that direction cannot be looked for with package freight. One of the most striking advances in dispatch is found in the use of portable electric cranes for loading and unloading gondola and flat cars.

Trailer and Tractor Plan

Another system which speeds up internal movements of freight is the trailer and tractor plan, whereby simple platform four-wheel trucks are towed in groups by an electric tractor, which carries no load itself. Trailers are provided far in excess of the number towed at one time, so that the tractor never waits for loading or unloading but picks up the trailers that are ready each time.

The pressure of factory production is as nothing compared with the pressure that traffic puts on the terminals. Each day's burden must be disposed of to make place for to-morrow's load. Like a man in a leaky boat, who must keep bailing or be swamped, the terminals are ever faced by the grave emergency of congestion, where dispatch is no more, and the trouble spreads to unbelievable distances along the arteries of commerce. The ample provision of varied and well-adapted machinery is the simplest method of attaining dispatch and retaining it, and it is the line along which most terminal progress is being made at the present time.

Industrial Trucks

These little machines are readily operated by longshoremen, and when the surrounding conditions are right, they cut the costs of moving freight to a marked extent. They work to best advantage on packages that can be readily handled by one or two men, because each piece has to be lifted on or off by hand, or by some other means. The distances must be rather great to make a good showing over hand trucks, and the approaches to loading and unloading points must be good.

Car Pullers

These machines may be vertical or horizontal; the vertical type can be set into a wharf, so that the drum only is visible. These pullers are very handy in minor car movements that would not warrant the calling of a switch engine. While the savings effected by these devices are indirect, they are nevertheless important. By moving cars from twenty to fifty feet, the cost of unloading or loading them can sometimes be cut in two.

Portable Cranes

The type using a storage battery for its source of power has a wide range of utility, with its most marked economies in the loading and unloading of gondola and flat cars. The machine, being a combined crane and electric truck, makes one handling of iron pipes, structural steel, timbers, logs, etc., between car and storage pile and gives the added advantage of economical tiering. Its greatest usefulness lies in short lifts of heavy weights, with moderate distance transfers. Another type is actuated by means of a motor having a cable leading to a receptacle or service station forming a part of the power distribution system. This machine is not self-propelling and is used principally to give unrigged barges, floats or lighters a rapid and economical cargo-handling equipment equal to or better than that of ships. These devices make the best showing on quantities of freight in units up to 1,000-pound weight and requiring a considerable vertical movement. They discharge on to industrial trucks, trailers or hand trucks, or receive from them when loading boats.

Adoption of Electricity

Air, steam and water have been used to actuate cargo machinery, but just as electricity has superseded all other forms of power in all large industries, so will it be universally adopted for cargo handling machinery. Ship's boilers or donkey boilers should not be depended on for cargo handling machinery, as they have not proved reliable. Central station electric power is available in all port cities and is sufficiently reliable to meet the requirements demanded of it by dock machinery.

Direct current seems ideal for this service, as control and wiring problems are much simpler and more satisfactory than with alternating current. However, alternating current can be used satisfactorily, if necessary. With either direct or alternating current the most desirable voltage is from 220 to 250, from the standpoint of safety and insulation.

General Terminal Improvements

Terminal accessories are of great importance and interest, and while not directly involved, they influence greatly the safety, despatch and economy of great commercial centres. At large progressive seaports, particularly at those whose facilities are in part or wholly publicly owned, many provisions for the safety of rolling and floating property are to be found, and are becoming considered in a greater degree. Among these tendencies may be noted:

The deepening, widening and straightening of approach channels, with improved buoying and lighting by Federal authorities, is doing much to make safe and easy the arrival and departure of shipping. Compulsory piloting, while deemed a hardship by some navigators, tends toward reducing losses by collision or grounding, especially in ports where tidal and current conditions are severe and changeable. The gradual increase in the size and power of harbor tugs and the wonderful skill of tugmen are factors agreeable to all who go down to the sea in ships.

Dry docks and marine railways in sufficient numbers and of ample size insure the confidence of foreign ship-owning companies and allow of periodical cleaning, even if no repairs are needed. While dry docks of enormous size are under construction and planned, there are many ships touching at our ports that could not possibly be docked on our coasts.

In ports, such as New York, where there is much car float traffic, recent improvements in floats and float bridges are notable additions to harbor and property safety features. The newer, all-steel, water-tight compartment floats, carrying twenty and more cars, are practically non-sinkable, and much more care and judgment is being used in the design and equipment of float bridges, thereby minimizing the damage to and loss of freight cars in this peculiar branch of traffic.

In terminal yards, the extensive and successful introduction of electric yard locomotives is largely accounted for by the reduction in damage to property by their use, where the entire work is largely starting, stopping and short shifting—requiring a maximum of control in order to avoid rough work. Clever and extensive yard-signal and switch-interlocking devices all lend their aid to the conservation of property.

Employes' Protection

Taking up the precautions necessary for the protection of employes, we come to a condition that has been neglected as far as terminals are concerned, though well advanced in almost every other industry. Such an advance is very desirable in this work, as great numbers of men are here employed in the most strenuous labor, under high pressure night and day, amid rapidly moving and swinging loads and under changing conditions, so that accidents of every kind are very frequent. The ambulance is as familiar a sight along the "beach" as the lunch wagon, largely because even the most obvious precautions are entirely neglected. If one should look for the one thing that best proves the backwardness of terminal development, it could be found in the circumstances under which men do their work.

Common Accidents

Under ordinary accidents may be enumerated: Falling into hold; being hit by falling freight from sling or pile; being struck by broken gear, such as wire ropes, hooks, staging, etc.; injuries to feet and ankles, by hand and power trucks; torn hands, by bands and wire on packages and by box and bale hooks. Other accidents are all too frequent, such as falling into harbor; being suffocated by fumigating operations; being overcome by fumes, dust or poisonous exhalation from cargoes; scalding, from broken valves or steam pipes to winches; injuries due to shifting or banging cars without warning, etc. Stages are erected. to meet temporary conditions, on which men work, handling material under conditions that would not be tolerated in any other line of work.

Good drinking water is frequently not available or is not located nearby. Sanitary precautions and conveniences are absent or are of a low order. Poor food, improperly prepared, is served along the front from carts, under no supervision or inspection. The laborers frequent waterfront saloons of the lowest order—unclean, unventilated and mismanaged. Absence from work, due to accident or sickness, is hardly noticed, as most of the employes are "casual laborers" or shenangoes.

It is, therefore, clear that there is great necessity for improvement in the conditions surounding the nearly a million terminal employes, and at least the ordinary, obvious precautions should be adopted to reduce the great economic losses now prevailing due to sickness and accident.

Fire Prevention

The matter of fire prevention is rapidly forging ahead, as is proven by the general introduction of large and efficient steam and steam-electric fire tugs in all ports of importance. Warehouses, piers and sheds are being piped for sprinkler systems, and the water-front skyline is becoming punctuated by elevated tanks for fire service duty.

Yard locomotives are being fitted with fire fighting apparatus, and being on the spot, often prevent serious fires among freight cars. inflammable freight and terminal properties. Smoking is universally prohibited in piers, and only recently have automobiles and power trucks been allowed access to these places. Electricity has largely superseded the open gas jet as a lighting medium, thereby adding another step in the right direction.

Ship Deck Equipment

In the design of cargo ships, many improvements are manifest, looking to speedier discharging and receiving. The new cargo boats have large steam winches in greater numbers than formerly prevailed, and well they may, for the standby charge on a moderate-sized ship runs from $300 to $500 per day, and money cannot be better invested than in facilities tending to shorten the stay in port. Modern coastwise ships are provided with more and larger side ports. It is a new and good practice to provide an elevated position for the cargo winches, leaving a clear deck for deck loads and placing the winch man in a more commanding position. Hatch covers have come in for their share of attention, and the old standard strongback construction, with hand boards, is giving way to hinged steel trap-doors of clever design that are quickly handled by the cargo winches and provide a certain closure when at sea.

The holds of the newer ships are free, or nearly so, from the stanchions that so profusely stud the working spaces of the older ships. The former tendency to specialize ships for certain cargoes has not been found expedient, as commerce does not usually provide similar cargoes both ways, consequently the normal cargo carrier is almost a universal ship. Donkey boilers are now of more liberal capacity, as in the older ships much delay is caused by lack of steam for all the winches without firing up the main boilers.

Handling and Transportation

In review of the whole field the cost of handling freight through terminals is enormous as compared with the cost of hauling the same freight from place to place. The reason for this high cost is the universal use of manual labor, which has been retained largely because it is plentiful in the coast cities. The farmer has not adopted his wonderful machinery to the almost entire exclusion of manual labor, from any love for machinery, but from dire necessity. His load factor is low, for his machinery is of special nature for seasonal work, a couple of weeks per year being an average condition.

With the terminals, the load factor could be nearly 100 per cent., but not being forced into its use by the absence of good labor, the terminals have been satisfied to work along the old lines. The use of machinery well adapted for the work has in many cases cut the labor costs to one-fourth the figure that formerly prevailed.

Broadly speaking, the future trend is toward more machinery for cargo handling. Three important steps must be covered in order to bring about the adoption of machinery:—First, the educating of steamboat companies, stevedores and labor unions to see its advantage; second, the design of vessels and piers to be especially adaptable to the use of machinery; third, a systematic scientific study of freight and freight movements.

HIGH SPEED MOTOR BOATS FOR NAVAL SERVICE

A GREAT deal has been said during the past year regarding the possibilities of the fast seagoing motor boat, particularly in connection with the tracking of submarines and generally for patrol service. High-speed in smooth water says the Liverpool Journal of Commerce, is one thing, but high speed for continuous service and during months of the year when the climatic conditions are not too considerate is another question, and, indeed, a problem which must be well considered.

In the first place, it might well be said that any small craft which has a speed of around 15 knots is a high-speed vessel, and that to give much above this in a light displacement, earnest consideration must be given to the stiffening of the hull in order to counteract the great vibration. It is of the greatest importance to bear in mind maximum speed; this means the highest speed that can be attained. Although at times the possession of this speed may be exceedingly valuable, it is not to be taken as the average running speed, which is always between 10 per cent. to 25 per cent. less.

The fast naval patrol motor boats in service to-day have a speed that cannot exceed 26 to 28 knots at the utmost, but the fact remains that if they were run at this speed for a prolonged period they would indeed be reduced to uselessness. The point is that with modern construction it is well nigh impossible to build a motor boat for sea service, and to requirements which have been rendered necessary for naval work, which will maintain a speed of 25 knots for any prolonged period. No boat of the sort can be built to-day which is totally free from hull strain set up by vibration. In the writer's opinion not only have we got to consider vibration, but we have also got to consider, and very seriously too, the strain set up in a lightly constructed hull through excessive pounding which must inevitably arise when the boat is to be of a seaworthy type and is intended to carry out service in moderately rough weather.

The British Government may at the moment be putting into service patrol motor boats with a speed of anything up to 28 knots, but such a boat is a lightly-constructed craft, and when the elements are against her she is doing well if she can carry on at half her smooth-water speed. In the future, possibly within the next year or two, there is little doubt but that we will be able to develop a sea-going patrol boat propelled by internal combustion engines, which will be able to attain a speed of 35 or 40 knots, but it is desirable that even to the imaginative mind present actualities should be distinguished from future possibilities. At the present time the patrol boat of 25 knots able to do a burst of 30 knots in comparative smooth water is, indeed, about as much as one must expect, and certainly pays tribute to the light type internal combustion engine of the present day.

THE LOSS OF THE "KING EDWARD"

THE loss of the pre-Dreadnought battleship King Edward VII. through striking a mine in the North Sea during weather so heavy that there was no chance of keeping the wounded vessel afloat, has followed hard upon the destruction of H.M.S. Natal through an internal explosion. Except for their relation in time, however, these two incidents have fortunately no points of resemblance. The explosion in the Natal made a grievous drain upon the personnel of the Navy, just as when the Formidable perished by torpedo or mine misadventure in the English Channel about a year ago, or when the Bulwark blew up and sank at her moorings off Sheerness, leaving not even one member of her crew to tell or guess the cause of her extinction.

These have been two of the gravest losses that the Navy has sustained; for while we can replace ships of all kinds very much more rapidly than the accidents of war by blockade can remove them, it takes time to train men to take their places efficiently in the floating machine-rooms which keep the seas for us. It is very satisfactory to be able to state that the whole complement of the King Edward VII. was available for transference to a Dreadnought of the newest pattern.

The way they have in the Navy of getting things done, through discipline, training, and readiness for emergencies, could hardly have a finer illustration than in the fact that in spite of very heavy weather the 825 members of the ship's company quitted the vessel in safety, only two men being injured.

WARSHIP BUILDING IN AUSTRALIA

AUSTRALIA'S latest destroyer of the river class, the Swan, was christened by Lady Cresswell, wife of Admiral Sir Wm. Cresswell, and successfully launched from the slips at Cockatoo Dockyard, Sydney, recently, in the presence of thousands of spectators. The Swan is the fourth warship built at Cockatoo Island in twelve months. Lady Cresswell, in christening the vessel, said: "I name this vessel the Swan. May she be as graceful in motion and as fierce in fight as her namesake. Good fortune to all who sail in her."

The vessel glided from the slips to the accompaniment of airs played by the dockyard band and to the cheers of the visitors and workers on the island.

She was afterwards towed to the southern portion of the island, where she was tied up in line with her sister ships, the Huon (once the Derwent) and the Torrens.

Series of Practical Questions and Answers for Engineers

By "Artificer"

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals will be found a useful companion study. With a view to meeting the need of many of our lake and inland waterway engineers who, during the closed season of navigation, take positions in steam power plants ashore, questions relative to the latter department will also find a place in the series.

Question.—What is the minimum monthly coal consumption that will warrant the installation of an ash conveyor in a boiler plant?

Answer.—Naturally the problem depends on the percentage of ash in the fuel and various local conditions, such as construction of power-house, manner in which ash must be disposed of, etc. Speaking generally, where the furnace refuse is approximately 12½ per cent. of the coal fired, and with the usual arrangement of power-house, an ash conveyor may be found profitable when the monthly coal consumption exceeds 2,500 to 3,000 tons.

* * *

Question.—Other conditions being the same, does the over-all efficiency of boiler furnaces vary as between small isolated heating or power plants and large central power stations?

Answer.—Theoretically the over-all efficiency of large furnaces should be higher, because radiation losses are proportional to the extent of the external surfaces, while the work done, other things being equal, is proportional to the cubical contents. It is assumed, of course, that the comparison is between furnaces of similar proportions. In ordinary practice, however, the radiation losses are masked by other much larger losses, and it is only when these other losses are measured or eliminated that the effect due to reduced ratio of radiating surface can be recognized. The ordinary isolated heating or power plant is less efficient than that of the large central station, not because the furnace or boiler units are small, but because a hundred rules of good practice which are followed by the central station boiler room superintendent are either unknown to or are neglected by the isolated plant engineer, who usually has troubles enough of the boiler room.

* * *

Question.—Size of engine being given, how may size of generator for direct connection be determined?

Answer.—For a direct-current generator, 0.746 $\times$ engine brake horse-power equals the equivalent kilowatt capacity of the engine, which will be the power input to the generator. Multiplying this quantity by the assumed efficiency of the generator gives the kilowatts output of the generator. The efficiency may be assumed to be 90 per cent., which is an average value. Thus 0.90×0.746 B.h.p. = the kilowatt rating of the generator. In the case of an alternating-current generator the rating as found above must be divided by the power-factor at which the generator is to be rated to determine the k.v.a. rating. The above is based upon the assumption that brake horse-power is known. In case it is not known it may be found by multiplying the indicated horse-power by the engine efficiency, an average value of which is taken as 0.90. The generator which is selected should have the same approximate overload capacity as the engine.

* * *

Question.—The brake horse-power of a steam engine is 60, and the indicated horse-power is 75; from this data determine the mechanical efficiency and state same in percentage terms.

Answer.—Multiply the brake horsepower (b.h.p.) by 100, and divide the resultant total by the indicated horsepower (i.h.p.). Stated as a formula, mechanical efficiency $= \dfrac{60 \times 100}{75} = 80$ per cent.

* * *

Question.—The area of an indicator diagram from a simple steam engine is 3 square inches; its length is 4 inches, and the spring used on the indicator piston is rated as 100. The diameter of the engine cylinder is 15 inches, the stroke 24 inches, and the working speed 150 r.p.m.: calculate the indicated horsepower.

Answer.—The first procedure in answering this question is to find the average height of the diagram, and this is got by dividing the area by the length, both of which are given. Average height of diagram $= \frac{3}{4} = .75$ inch. As each inch in diagram height represents 100 pounds pressure, the spring rating being 100, multiplying the average height by 100 will give us the mean pressure exerted on the piston in the direction in which the engine is moving. Thus, $.75 \times 100 = 75$ pounds.

The indicated horse-power (i.h.p.) is found by multiplying together the above mean pressure, twice the length of engine stroke in feet—there being two strokes in each revolution, the area of engine piston in sq. inches, the revolutions per minute, and dividing the result by 33,000, which is the foot-pound representation and standard for one horsepower. Area of engine piston is found by multiplying its diameter by itself and by .7854, or as may be more compactly expressed, squaring the piston diameter and multiplying by .7854. Thus, $15^2 \times .7854$, or $15 \times 15 \times .7854 = 176.715$ sq. ins. piston area on which mean pressure acts. The stroke of the engine is 24 inches, and this divided by 12—there being twelve inches in one foot, gives us a 2-ft. stroke.

We now multiply together 75 pounds mean pressure, twice the 2-ft. stroke, the piston area of 176.715 sq. inches, and the revolutions per minute, 150, and divide the result to get the indicated horsepower. Thus. $\dfrac{75 \times 2 \times 2 \times 176.715 \times 150}{33,000} = 240.975$ = indicated horse required.

* * *

Question.—When a steam boiler is under pressure, to what particular strain is the shell subjected?

Answer. — Under either steam or hydraulic pressure, the shell of a boiler comes under a tensile or tearing-apart strain in the girth direction of the plating. On this account, what is known as the ultimate tensile strength of the shell plate material is used in calculations pertaining to any proposed or to-be-determined working steam pressure.

* * *

Question.—A water-tube boiler contains 120 tubes of 4 inches outside diameter and 16 feet long. What is the total tube heating surface in sq. ft.?

Answer.—The circumference of a 4-inch diameter tube is the first requirement, and this is found by multiplying the diameter by 3.1416. Thus, $4 \times 3.1416 = 12.5664$ inches. It will be noted that the heating surface required is expressed in sq. ft., and as this is recognized practice, it becomes necessary to convert the 12.5664 inches circumference of one 4-

inch tube into feet. This is done by dividing the total inches by 12. Thus,

$$\frac{12.5664}{12} = 1.0472 \text{ feet.}$$

Multiplying 1.0472 by 16, which is the tube lengths given, we get $1.0472 \times 16 = 16.7552$ sq. ft. as the heating surface of one tube. This in turn multiplied by 120, thus, $16.7552 \times 120 = 2010.624$ sq. ft., gives us the total tube heating surface.

Stated as a compact formula, total tube

$$\text{heating surface} = \frac{3.1416 \times 4 \times 16 \times 120}{12} = 2010.624 \text{ sq. ft.}$$

* * *

Question.—With a high degree of superheat, what precautions are necessary over and above those taken for saturated steam?

Answer.—Careful design and constructional detail of the stop valves and steam piping between the superheater and the engine, also of the piston and valve of the first cylinder into which the superheated steam enters become imperative. An efficient and reliable system of cylinder lubrication is also an absolute necessity.

* * *

Question.—What are the two systems generally employed to superheat saturated steam?

Answer.—The first and most common arrangement consists in placing the superheater in the flue space of the boiler to abstract the necessary heat from the hot gases. The second arrangement depends on a separate furnace for imparting the superheat.

* * *

Question.—To what strains are the piston and connecting rods of a steam engine subjected when the latter is in operation?

Answer.—When the piston is moving toward the shaft, they are each under a compressive strain and on the return stroke they are subject to a tensile strain. The compressive strain is the more severe, hence the practice of increasing the connecting rod diameter at the middle of its length or of tapering it from inner to outer end.

* * *

Question.—What is meant by the expression "capacity" as applied to pumps and pumping engines?

Answer.—By "capacity" is implied the quantity of water delivered in a given time. It is expressed as thousand gallons per hour or million gallons per 24 hours, according to size of unit.

* * *

Question.—What steps should be taken and precautions adopted before admitting steam to pipe lines or to an engine?

Answer.—All drain cocks should be opened fully, it having been previously ascertained that the passages in same and those of their connecting pipes to drains or traps are free from obstruction. As regards stop valves on piping or on the engine, these should be opened quite gradually, so as to allow the piping or engine to warm up slowly and become cleared of the water of condensation before the full head of steam comes upon them.

* * *

Question.—With the pressure of steam still on the pipe line, what condition is likely to be produced and what eventuality may be expected if a stop valve or drain cock is opened on a range of piping, known to contain water or where the latter possibility may exist?

Answer.—There is grave danger under the conditions stated, "water hammer" being almost certain to ensue, followed by burst pipes and valves, and possible disastrous explosion in the zone immediately affected. If a pipe, which is under steam, is believed to contain water, the boiler or other stop valve involved should be closed, after which the drain cock may be opened, and the water run out and steam again slowly admitted to the piping. When steam is not required, it should be shut off and all drain cocks opened on the piping or cylinders.

* * *

Question.—The belt flywheel on a horizontal engine is 10 feet in diameter and runs 100 revolutions per minute, what is the belt speed in feet per minute?

Answer.—Multiplying the flywheel diameter in feet by 3.1416, we get the number of feet in the circumference of the flywheel, or what amounts to the same thing, the number of feet that the belt travels in one revolution of the engine. Thus, $10 \times 3.1416 = 31.416$ feet. Multiplying this result by the engine revolutions per minute, we arrive at the belt speed in feet per minute. Thus, $31.416 \times 100 = 3141.6$ = belt speed in feet per minute. Stated as a compact formula, $10 \times 3.1416 \times 100 = 3141.6$, or belt speed in feet per minute. Where the diameter of belt flywheel contains odd inches, as for instance, with a diameter of 106 inches, it becomes necessary to bring the inches to a basis of feet. This is done by dividing 106 by 12, there being 12 inches in one foot. Thus, $\frac{106}{12} = 8.8333$ feet diameter. Taking the example as given in the original question and calling the flywheel diameter 120 inches instead of 10 feet, the formula would become

$$\frac{120 \times 3.1416 \times 100}{12} = 3141.6$$

feet of belt speed per minute, as already stated.

Question.—Under what special circumstances is it desirable to use rubber belting in preference to leather?

Answer.—Rubber belting should be installed wherever the drive is exposed to the elements, or when the drive is located in a damp or steamy enclosed place. Leather belting is believed, however, to give cheaper service and to last longer under normally favorable conditions. The life of leather belting, as indeed any type of belting, depends largely on the manner of application or nature of drive, and the amount of care and attention bestowed.

* * *

Question.—Enumerate some of the advantages to be derived from keeping an accurate record of the amount of feed water supplied to the boiler or boilers in a steam power plant?

Answer.—It enables the boiler efficiency to be determined; or, in other words, gives easily appreciable evidence of the heat units recovered per pound of fuel. Choice can be made of the grade or class of fuel to employ so as to secure the highest attainable efficiency and economy as a combination. Firing methods and capabilities of different firemen may be brought under review. Air leaks in boiler settings, leaky boiler mountings, determination of comparative efficiencies between scaly and sooty heating surfaces, and last, but not least, the decidedly uplifting moral tendency on the part of the operators to maintain the standard of efficiency of service which a feed water recorder insists that they attain to, are a few other advantages likely to accrue from the installation of the necessary apparatus.

* * *

Question.—What line of action should be taken or procedure adopted when firing a boiler to ensure the best possible results in steam raising and pressure maintenance?

Answer.—When stoking, do it quickly and regularly, and keep the firebars evenly and well covered. Throw the coal only where it is required. Do not use the rake unless the coals cake considerably, and the fire cannot be kept level without it. Keep the fire-doors open as short a time as possible. Never allow the bars to become bare. If too much cold air gets in, less steam will be raised, and the fuel wasted.

* * *

Question.—What advantage has the piston valve over the ordinary slide valve, and in what circumstances is it used?

Answer.—It is more perfectly balanced, being as nearly as possible in equilibrium, thereby reducing the strain on the valve rod and gear due to valve and valve face friction. It is used in preference to a slide valve for the above reason, when the working steam pressure is high and when the necessary slide valve would be of large area.

REFRIGERATION DEPARTMENT

REFRIGERATION BY COLD OR COMPRESSED AIR

By W. M. McRobert.

MANY interesting and instructive articles relative to ammonia refrigeration have appeared in these columns from time to time, and it may not be out of place to give an outline of the cold or compressed air system of refrigeration. From an economical aspect this method of producing cold may not compare too favorably with the ammonia or carbonic acid systems, but, when "Safety first" is the principal consideration, its adaptability to meet this slogan cannot be questioned.

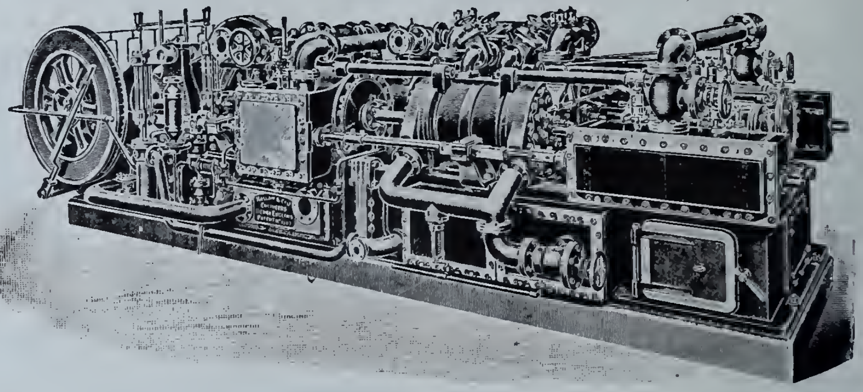


FIG. 2. HORIZONTAL DUPLEX TYPE DRY AIR MACHINE.

One advantage that can be claimed for cold air refrigeration is that there is no cost for the reagent, and that the supply is always present; also that there is an entire absence of any pungent odor. Many readers have experienced the numerous troubles associated with ammonia refrigeration, due to having too little or too much liquid in the system. This trouble is not met with in the cold air method, as the only refrigerant necessary is the atmosphere which we breathe.

The system herein described is principally employed in marine service, being extensively used in the navy, also in the large ocean liners carrying frozen meat, etc., from Australia and New Zealand to Great Britain and other parts of Europe. Many points of merit may be claimed for cold air plants, one being that apart from the compressor itself there is practically no piping to look after; also there is not the constant danger of a blow-out as is always present with other methods of refrigeration.

This alone is a valuable factor, as it can be readily imagined what loss of property and probably life would occur on a steamer in mid-ocean, in the event of an accident taking place with ammonia. Of course, ammonia refrigeration is also used in marine practice, but it is not generally employed where valuable and delicate cargoes have to be carried over long distances by sea. The risk is too great, consequently insurance rates are high.

The writer has in mind an instance where an entire cargo was lost, due to the head blowing off an ammonia compressor at sea. Had it not been that when the accident occurred the vessel was veered round to the wind and the entire charge of ammonia allowed to escape, probably a considerable loss of life would have taken place. This article is simply an outline of the principle employed in producing cold by compressed air.

The sketch, Fig. 1, indicates how the air is conveyed by the machine to and from the cold storage chambers. The illustration, Fig. 3, is that of a vertical dry air machine fitted with a compound surface condensing engine, while Fig. 2 is a horizontal machine of a similar type.

The steam engine by which the compressor is operated can be made either simple or compound, and be connected to one or more compression and expansion cylinders. The sketch, Fig. 1, is that in connection with a horizontal machine. Although only one cold storage chamber is shown on the drawing, that

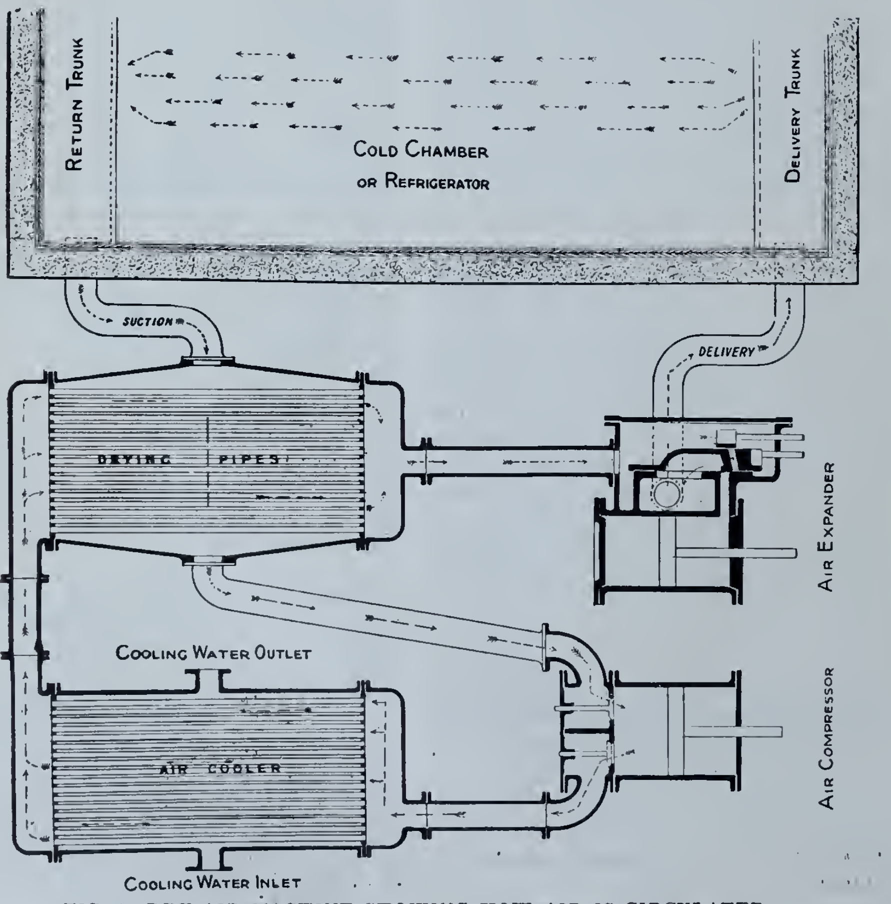


FIG. 1. DRY AIR MACHINE SHOWING HOW AIR IS CIRCULATED.

does not imply that the cold air system cannot be adapted to a number of compartments. The air is transmitted to the various chambers by means of chutes or trunks, and the required temperature maintained by means of regulating dampers fitted in the trunks, which can be opened or closed to conform with the desired conditions.

Cycle of Operation

The air is drawn from the cold storage rooms at a temperature of about 20° F., and, passing through the drying chamber on the outside of the tubes, is raised to a temperature of about 40° F. After passing through the dryer, it is drawn into the compression cylinder of the machine, and compressed to about 60 lbs. gauge pressure, which raises its temperature to over 300° F. The air is now discharged to the cooler, and passed through the tubes of that vessel, where it is reduced to a temperature corresponding to that of the cooling water.

It next passes through (not over) the tubes in the drying chamber, and by coming in indirect contact with the air returning from the refrigerating compartments is further reduced to a temperature of 40°. The air at this temperature is then drawn in to the expansion cylinder of the compressor, and is cut off by means of the slide valve at ¼ to 1-3 of the stroke. The air during the process of expansion in the cylinder is reduced to a temperature of 60° to 70° below zero, according to the ratio of expansion. While the air is being expanded it is of considerable help in the driving of the machine. The air at the above low temperature is now discharged through the snow box and along the trunks to the various chambers, and the cycle as described continued.

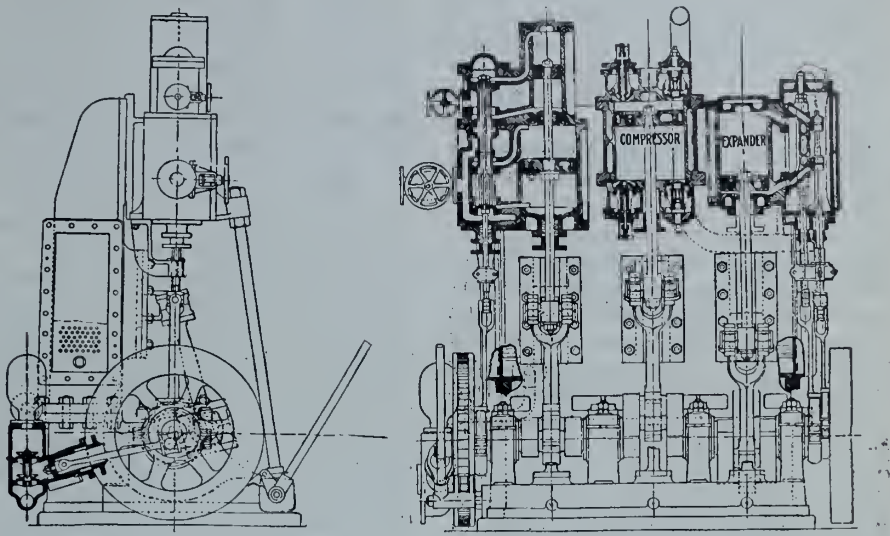


FIG. 4. SECTIONAL VIEWS OF VERTICAL DRY AIR MACHINE.

Moisture Removal From the Air

The cold air returning from the storage rooms passes on the outside of the tubes of the drying chamber at a temperature of about 20° F., while the compressed air from the cooler at a temperature of 70° F. passes through the tubes of the drying chamber, reducing its temperature to about 40°. By this means the moisture is partly condensed, and the condensation can be drained off as required, thereby keeping the air in a practically dry condition.

If the air were allowed to contain moisture to any extent it would soon collect in the expansion cylinder of the machine, thereby preventing free operation of the valves and causing scoring of the cylinder. The suction and delivery valves of the compressor are usually made of tough brass or phosphor bronze, and are kept in position by spiral springs of a similar material.

Oil is never used as a lubricant, but glycerine is employed, and is found to be excellently adapted for the purpose.

The water which is used in the air cooler is also employed on the water jacket of the air compressor and for the circulating water service of the steam surface condenser.

The complete cycle of refrigeration by compressed or cold air may be briefly summarized as follows:—The atmosphere is simply compressed, cooled, dried, and expanded by mechanical means.

ICE PLANT LEAKS

LEAKS of ammonia are frequent, but not as common as steam. The engine and ammonia compressor should be overhauled every year, and new valves and new piston rings should be put in, if needed, to avoid leaks during the busy season, when time is so precious.

Small leaks in the brine tank are not an infrequent occurrence and often times they are not noticed until the leaks have been of long standing. For this reason the brine solution should be tested from time to time with what is known as Nessler's reagent.

More leaks can be avoided by having the packing around the valve stems in good condition; these should be repacked every year, especially on the ammonia condenser where the pressure is highest.

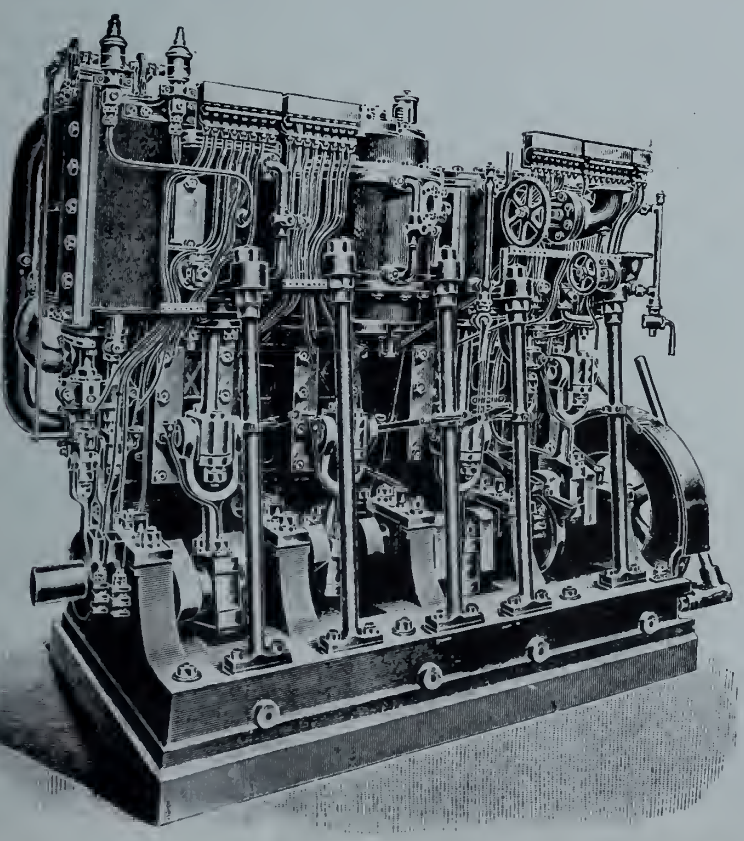


FIG. 3. VERTICAL DRY AIR MACHINE WITH COMPOUND ENGINE.

HUDSON BAY NAVIGATION

THE Government Railways Department on February 8, in the form of an answer to a question asked in the House by Hon. G. P. Graham, made reply to various assertions as to the unnavigability of the Hudson Bay route based on a recent report by Mr. Anderson, officer in charge of Hudson Bay surveys for the Marine Department. The statement is to the effect that Mr. Anderson's own mature opinion, as previously expressed, is that the route is a navigable one.

The question asked by the member for South Renfrew was whether the railways and canals department intended making any reply to the Anderson report. The answer of the department is that none is contemplated. It goes on to state that the chief engineer of the Railways Department, W. A. Bowden, in a memorandum to the Minister of Railways and Canals, reports that Mr. Anderson presented his report on the navigability of Hudson Bay on conditions as he found them. His work as hydrographic surveyor naturally took him into bays and inlets where conditions would be quite different from those obtaining on the main steamship lines. Owing to this his report contained very little information having any bearing on navigation in the Hudson Bay route. It appeared, said Mr. Bowden, that at the beginning of the season Mr. Anderson's work took him into the neighborhood of Cape Chidley, the Button Islands and Port Burwell on the south side of the eastern entrance. It was well known to all navigators of experience in these waters that in the early season the strait should be entered on the north side which was usually clear of ice several weeks earlier than the Button Island region.

Reports of Passages

This was confirmed by the passage into the strait on August 4 of six vessels operated by the Department of Railways and Canals, five of which were lightly constructed without ice strengthening of any kind. On the same day Mr. Anderson in the ice-breaker Acadia was still ice-bound.

Mr. Anderson, the memorandum continues, was equally unfortunate toward the end of the navigation season, when on October 13, he encountered closely packed and extremely heavy fox channel ice, "which would cause serious trouble to an ordinary freight steamer." The Railway Department's vessels had been more fortunate. The S.S. Durley Chine, for instance, outward bound, was off the western entrance of the strait on the night of October 10, and reached the eastern end on the morning of October 13. The S.S. Bellavtneure passed the eastern entrance October 9 and the western entrance on October 12. Both the S.S. Sheba and Bellaventure, outward bound, passed the western entrance Oct. 22, and the eastern entrance on October 25. The Durley Chine and Sheba were single-deck cargo vessels without any ice strengthening whatever, yet suffered no injury. They had been subjected to ice, gales, fogs and snowstorms, all of which had been mentioned by Mr. Anderson as causes of delay and yet, as the time of their passages showed, these had proved negligible.

Open July 15 to November 15

It would seem, continued the memorandum, that Anderson's report, "had been found susceptible of perversion by prejudiced readers who, by abstracting isolated paragraphs, are enabled to draw inferences quite at variance with his deliberately prepared expressions of opinion." Just before Mr. Anderson left on his last voyage to Hudson Bay he prepared an article, entitled "Supplement relating to Hudson Bay and Strait," for the Arctic Pilot, this being the result of his long experience and mature observation of conditions in Hudson Bay and Strait.

His conclusion in this article was that "there is sufficient information on hand now to decide upon the period during which Hudson Bay and Straight can be navigated with comparative safety" and concludes that "the period during which properly constructed vessels could enter Hudson Strait with comparative safety may be taken to extend from July 15 to November 15, with slight extension at either end according to season."

The memorandum states that it is hardly likely Mr. Anderson would abandon this deliberately expressed opinion because of difficulties encountered during a single season. That same season 37 passages through the strait were made in vessels operated by various departments of the Government and others, all of them escaping serious injury. The memorandum concludes that it seemed unfair to Mr. Anderson that his report on 1914 conditions should be subjected to such perversion.

RUSSIAN VOYAGE OF ICE-BREAKER "MINTO"

WITH a record of seven ships relieved in the White Sea, Captain J. L. Read and his crew of Prince Edward Island sailors are back from the far port of Archangel, the northern gate of Russia in Europe.

Captain Read had charge of the ice-breaker Minto, which the Canadian Government sold to Russia to augment the fleet of ice crushers, which is keeping open the channel to Archangel. The Minto sailed from Halifax and arrived at Alexandrovisk in seventeen days in spite of encountering very heavy weather.

Captain Read, in a letter to the Marine Department, tells of cutting ship after ship out of the ice in the White Sea. The first mentioned of these is the British steamer Moriddio, loaded with munitions, the captain of this ship having about decided to run his vessel ashore when the Minto appeared. The British ship Northern Coast, also laden with munitions, and the Russian steamer Zimorodok were found in the ice and taken to open water, afterwards making harbor at the mouth of the White Sea.

Next the Minto rescued and took in tow the British steamer Malatian, carrying rifles and ammunition. While towing the Malatian, the Minto came upon the Russian ice-breaker Kanada, formerly the Earl Grey of the Canadian service, stuck in drift ice ninety miles from Archangel, and with only eight tons of coal in her bunkers. Captain Read cruised about, found a coal boat stuck fast in rafter ice, cut her out and took her along with her coal to the Kanada.

The Minto then proceeded toward Archangel, rescued the Kursk, loaded with munitions, and finally arrived at Archangel bar with the Kursk, the Sibir, the Kovda and the Nicholia.

After handing over his vessel to the Russian authorities, Captain Read proceeded to Petrograd where he was thanked by the Russian Minister of Trade for his work in the White Sea.

ST. LAWRENCE SHIP CHANNEL

AT the opening of the House of Commons, Ottawa, on Feb. 11, Hon. J. D. Hazen, Minister of Marine, read a memorandum outlining the work done during the past year on the St. Lawrence ship channel. During 1915, some 15 dredges had been kept at work day and night deepening and improving the ship channel from Montreal to the foot of the Island of Orleans, removing a total amount of 8,462,957 cubic yards of material. Considerable work had also been done in the widening of the channel through Montreal Harbor in St. Mary's current and Longueuil shoal, where it is proposed to widen the channel from 700 to 800 feet. Good progress in deepening the channel to 35 feet at extreme low water was made between Three Rivers and Montreal, some eight miles of this work having been accomplished during the season. There now remains only a small portion of the channel through Lake St. Peter which has not been deepened to 35 feet.

The Cap Charles Channel, Cap a la Roche district, was completed to 30 feet at extreme low water and widened from 300 to 450 feet and 650 feet at the curve, new range lights to mark the centre were constructed, the channel was buoyed to give increased width and opened to navigation. The Grondines channel was also completed to 30 feet in depth and 450 feet in width, the channel buoyed and new range lights installed. The widening at Cap a la Roche curve is almost completed but there remains considerable deepening and clearing yet to be done.

Channel for Light Draught Vessels

The new channel for light draught vessels and tows through the islands opposite Sorel to Lake St. Peter to a depth of 15 feet at low water and a maximum width of 400 feet was completed and will be opened to navigation this spring. New lighthouses have been constructed to mark the different courses. This will oblige all tows, etc., to keep out of the ship channel. There is now a distance of over 50 miles between Lake St. Peter and Montreal where the tows and light draught vessels can keep out of the ship channel. This will avoid the delays and annoyances caused to ocean vessels by them.

A commencement has been made on the construction of the compensation dam as recommended by the commission appointed to investigate the water levels of the River St. Lawrence below Montreal. In order to lessen the cost, it was decided to utilize dredging material from the ship channel and deposit it on the site of the proposed dams. This has been done at Repentigny, Chenal Corbeau, Chenal des Barques and Pointe du Lac.

Mr. Marcil, of Bonaventure, asked if, in view of the increased German activity on the sea, additional precautions were being taken to protect the ship channel. "I would rather give that information privately to the hon. gentleman,'' said Mr. Hazen.

The Minister also replied to a question by Mr. Marcil as to when the proposed Longeuil extension would be done. Mr. Hazen said that he believed the Montreal Harbor Commissioners were contemplating dredging operations and extensions. He pointed out, however, that, because of the war, public works were not going forward as rapidly as before.

AUTOMATIC STEAM TOWING WINCH

THE annual outlay for renewing Manila tow-line is an item of considerable importance in the towing business, and any means whereby such expense can be reduced safely and profitably will be welcomed by all engaged in this business.

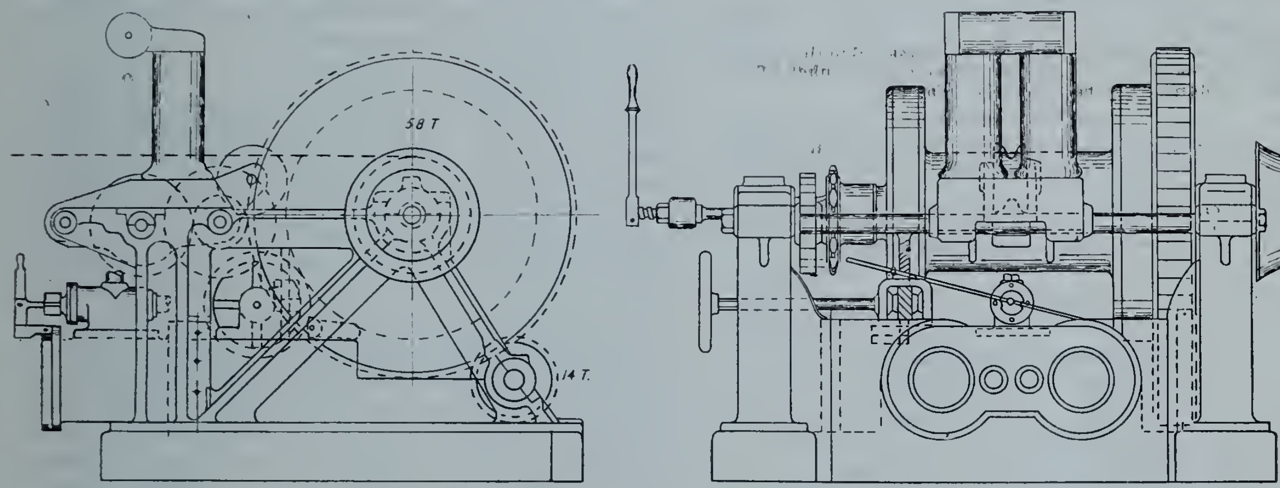
The Corbet double steam cylinder automatic vessel towing winch has been designed to use steel cable, which has a useful life of many years, this feature, along with the saving of manual labor, resulting in considerable reduction of operating costs.

The machine, two views of which are shown in the accompanying illustration, has accommodation for 1,200 feet of 1-in. steel hawser, which passes through the automatic hawser leader which travels to and fro across the front of the machine, thereby preventing the hawser from climbing on top of itself on the drum. This leader is traversed by means of a shaft having right and left-hand screws, and it is geared to the drum, so that the sideways movement of the leader is in proportion to the speed of the drum. It further enables the hawser to be drawn in when the tugboat is at any angle with the object in tow.

The entire operation is controlled by one lever, which starts, stops, and reverses, one man operating it with ease. The engine is located between the side frames and consists of two 8 in. x 8 in. cylinders ,operating the drum and spool by a 10 in. diameter pinion on the crank shaft meshing with a 52 in. diameter gear on the drum shaft, both of 4 in. face. The spool can be operated independently of the drum by means of a friction between the gear and the drum, thereby enabling the winch to serve two purposes at one and the same time.

The location of the cylinders to the rear of the drum allows the winch to be placed nearer the centre of the tug, so as to facilitate steering, while the whole design is kept as low as possible to reduce the tendency to tip when the tug is at right angles to the direction of the tow. In the case of the largest size machines, this effect is obtained by putting the cylinders outside of the frame, thus allowing the reduced height to be maintained.

The Corbet Foundry & Machine Co., Ltd., of Owen Sound, Ont., are the builders of these winches.



STEAM TOWING WINCH WITH AUTOMATIC HAWSER LEAD.

VARIATION OF THE COMPASS IN HIGH LATITUDES

Question.—Will you inform me of the greatest variation of the compass so far noted in northern latitudes, and whether I am correct in assuming that if an observer were in practically the same longitude as that of the north magnetic pole and in a few miles higher latitude than that in which it lies, the north point of the needle would point practically south, showing a variation of the compass of approximately 180 degrees either east or west, according as his position varied easterly or westerly from the meridian in which the magnetic pole lies.

Answer.—The greatest value of the variation of the compass in northern latitudes shown by the records of this office is 115° 38′ W., which was observed at Cape Hawks, lat. 79° 33′ N., lon. 73° 15′ W., by Dr. Hayes in 1861. The assumption that the variation is approximately 180 degrees in the meridian of the magnetic pole and in a few miles higher latitude is correct, the variation being east or west according as the position is west or east, respectively, of the meridian of the magnetic pole.—U. S. Hydrographic Office Bulletin.

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Vol. VI FEBRUARY, 1916 No. 2

EDITORIAL CONTENTS

SHIPBUILDING IN CANADA

As was to be expected, the wholesale destruction of the merchant marine of Great Britain and her Allies, and the practical cessation of merchant shipbuilding in those countries have turned attention to Canada's possibilities for the establishment and development of a gigantic shipbuilding industry. It is hinted that even now her opportunity is available, and relative to this we might say that the meantime opportunity can be stated as fact in one respect. Orders for the construction of ocean going vessels are simply being showered upon Canadian shipbuilders at the present time, but in every case they are being turned down. The lack of steel is, of course, one reason, the lack of skilled help another reason, and arising out of a phase of the war situation which we may not here disclose, are to be found the elements constituting the third reason.

Steel for shipbuilding purposes has, of course, to be imported into Canada, and even with the end of hostilities and the advent of a boom in shipbuilding the world over, it is a moot point on that account whether we will feel any abnormal activity effects. Steel will continue to be for many months subsequent to the war a scarce commodity, even scarcer than at present so far as ship plates and shapes are concerned. Unless, therefore, some steps are taken now to meet the situation when the real opportune moment arrives, little better than prolonged normal activity is likely to be experienced.

The labor situation may, however, affect our shipbuilding possibilities to their detriment to an even greater extent than will the steel situation in the matter of the cost of the former. It is generally assumed that steel and labor costs will each be considerably higher than those existent in pre-war days, notwithstanding, their comparative costs as between Canada, Great Britain and the United States will have a determining effect in placing contracts here.

The shipbuilding industry in Canada may be said to be on the eve of being established on a foundation never before available and of being developed to a degree of importance hitherto undreamt of. The cost of steel may possibly be beyond the power of our Government, our shipbuilders, or their employees to control, but the latter will undoubtedly have a large say in the matter of labor cost.

With labor, therefore, there rests largely the future of shipbuilding in Canada. If its demands are extravagant, then a world boom in shipbuilding will give no evidence of its existence here, and an industry which contributes so much to the commercial success of other countries will continue to be reckoned as having to eke out within our borders the like precarious existence as formerly.

Ship repairing plants on our lake, river and ocean shores are recognized necessities of our national existence, but real, up-to-date shipbuilding and marine engineering plants should be even more so. We are possessed of the latter, yet their maintenance in the past has been one continuous struggle against almost insuperable odds. If we may not be able to modify the steel situation, community of effort by employer and employee can offset largely its handicap.

The proposed new taxation for war purposes is of more than ordinary interest to our commercial and industrial communities, and, taken as a whole, the proposals have met with at least friendly criticism. All of us were prepared for something more or less drastic and comprehensive.

Marine News From Every Source

Port Colborne, Ont.—A new western breakwater will be built here to ensure quiet water in the harbour during storms.

St. John, N.B.—The for alarm station and oil warehouse at Cape Spencer, on the Bay of Fundy, were destroyed by fire on February 4.

St. John, N.B.—The St. John River steamer Victoria was burned to the water's edge on February 4, as she lay in winter quarters here.

London, Ont. — The London & Port Stanley Commission will ask the Dominion Government for $115,000 towards dock improvements at Port Stanley.

The Western Drydock and Shipbuilding Co., Port Arthur, Ont., have closed a contract for a freighter of Welland Canal size. This order is additional to that for two steamers secured some time previously.

Kingston, Ont.—The Board of Trade has passed a resolution calling upon the Government to prepare Kingston harbor to receive large vessels which will come from the upper lakes through the new Welland ship canal. The harbor depth must be 25 feet.

James Playfair, of Midland. Ont., has purchased the steel steamer A. E. Stewart from the Barlum Steamship Co. The sale is reported to have been on a cash basis for $225,000. The Stewart was built in 1902 at West Bay City. She is of 3,943 gross tons register, 356 feet long, with fifty feet beam, anl carrying capacity for 6,000 tons of ore.

Port Moody, B.C.—The shipbuilding company which is proposing to locate in this city asks that the council guarantee its bonds in the sum of $200,000 on the understanding that the company first buys a site and expends $50,000 on equipment, etc. The company also ask for water at 5 cents per 100 cubic feet and exemption from taxation on improvements for a period of 20 years.

Grain Elevator Contracts.—Robert F. Durham, vice-president of John Metcalf, Montreal, who has been in Australia for some months, has signed agreements with several State Governments to design and construct a number of grain elevators. The contracts are estimated to total between four and five million pounds sterling.

Vancouver, B.C. — Concessions from the city in the shape of a grant of water frontage on English Bay and freedom from taxation for ten years have been asked from the civic finance committee by representatives of Coates & Co., on behalf of a syndicate which proposes to build a pier there at a cost of $250,000. The committee referred the delegation to the Park Board before it would give any answer.

Bids Asked to Raise Vessel.—The underwriters are asking bids for raising the sunken steamer Charles S. Price, which lies upside down on the bottom of Lake Huron thirteen miles from Sarnia, where she turned turtle on Sunday, November 9, 1913, during the big storm. The boat lies in seventy feet of water. It will be a condition of the contract that she be brought into port.

Lake Boats Lost on Ocean.—During the season. of 1915, five of the thirty-nine vessels that were removed from the Great Lakes to ocean service since the war began have been lost at sea. They are—the Midland Queen. Dunelm, Donnacona. Fairmount and Northmount.One Owen Sounder, so far as is known, lost his life in the loss of the vessels. Richard Quinlan, son of Andrew Quinlan, Owen Sound is thought to have been lost on the Dunelm.

U.S. Shipbuilding to Foreign Order.—Norwegian interests have closed with the Mainitowoc Shipbuilding Co., for six merchant ships of 3,000 tons capacity each, making a total of twenty-seven vessels building in American yards from that source. A great many of these craft will be built by lake yards, all the lake companies having contracts. Prices are said to be at least 50 per cent. higher than was paid before the European war started.

Ferries had to Return.—Tied up in an ice jam at Snake Island, about nine miles from Kingston, Ont., the two big car ferries, Ontario No. 1, and Ontario No. 2, previously reported as having reached the harbor, had to give up the task of making Kingston where one of the ferries was to undergo repairs at the drydock. In sight of Kingston, an ice jam of tremendous proportions blocked progress, and after several attempts the undertaking had to be abandoned, the ferries returning to Cobourg. It was found necessary to use dynamite to get the vessels turned round in the ice jam so as to make the return trip. The ice was some seven feet thick around Snake Island.

Aid for Shipbuilders.—The Imperial Government has decided to grant facilities to British shipbuilders to complete half a million tons of mercantile shipping which is nearing the launching and fitting out stages. It is understood this action is to be taken with a view to relieving the markets as soon as possible from the effects of high freight rates. A number of shipbuilders some weeks ago appealed to the Government for financial assistance to complete contracts, and it is inferred arrangements have been made.

Ottawa, Ont.—Tenders will be received until Monday, February 28, 1916, for the construction of timber lock gates and their equipment for the East River Lock, near New Glasgow, Pictou County, N.S. Plans and forms of contract can be seen and specification and forms of tender obtained at the Department of Public Works, Ottawa, and at the offices of the district engineers at Antigonish, N.S.; Halifax, N.S.; Shaughnessy Building, Montreal, P.Q.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at New Glasgow, N.S.

Newfoundland Sealing Captains. — The following captains will prosecute the Newfoundland seal hunt this spring:

Florizel—Capt. A. Kean.
Terra Nova—Capt. S. R. Winsor.
Eagle—Capt. Ed. Bishop.
Viking—Capt. Wm. Bartlett. sr.
Ranger—Capt. Wm. Bartlett, jr.
Neptune—Capt. Geo. Barbour.
Sam Blandford—Capt. W. C. Winsor.
Erik—Capt. N. Kean.
Diana—Capt. D. Martin.
Bloodhound—Capt. Randell.
Sable I.—Capt. Bob Bartlett.
Seal—Capt. Jacob Kean.

We understand that it has not been fully decided whether or not the Kite will prosecute the fishery this spring.

Sarnia, Ont.—It is announced that the Reid Wrecking Co. have sold the steamers Inland, John Sharples and J. B. Ketcham II. The Sharples goes to the Charcoal Iron Co. of America, Detroit; the Inland, which was formerly the I. W. Nicholas, to the Standard Shipping Co., and the Ketcham to the Canadian Shipping Co. All three boats were salvaged by the Reids in the last few years, and have been rebuilt and operated by that concern. Negotiations for their sale were reported several weeks ago. Captain Reid says there is an active demand for steamers of every type, and that many transfers are likely to be made within the next few months.

Steamer Brought $175,000.—At a recent meeting of the shareholders of the Western Navigation Co., Fort William, the deal for the sale of the steamer Kaministiquia was finally closed, the purchasers being the Great Lakes Tansportation Co. of Midland, and the purchase price $175.000 net. The Western Navigation Co., Fort William, is a purely local concern, of which James Murphy has been president and H. W. Robinson secretary since its organization. The Kaministiquia was purchased in 1909. the boat being built on the Tyne, and brought over under her own steam by Captain Stevens, who has been in command of her ever since. From that date she has run on the upper lakes continuously and profitably until a year ago, when she was taken through the canals and put into the Atlantic coastwise trade.

To Take What Is Needed.—An Order in Council empowers the British Admiralty, Army Council or Board of Munitions to take possession of any war material. food, forage or stores of any description, or of any articles requisite to their production, and also to take possession of any factory in which goods of any description needed for war purposes may be manufactured. Another Order in Council provides for a more stringent control of shipping by decreeing that after March 1 no British ship exceeding 500 tons, except it is engaged in the coasting trade, shall be allowed to proceed on any voyage unless a license to do so is granted by the Board of Trade. This is simultaneously announced with the new order restricting imports so as to release shipping for war work.

Vessel Purchases — The Canada Steamship Lines, is reported to have purchased the wooden steamer Sarnor, formerly the Britannic, for use in the coal trade down the St. Lawrence. A. B. McKay of Hamilton has purchased the Algonquin, a 2500-ton steel ship owned by the Port Colborne & St. Lawrence Navigation Co. He will use her on the lakes for a while and later may send her to the coast. C. W. Bryson and associates have purchased controlling interest in the Gilchrist Transportation Co., and Canadians have inspectors looking over boats at some of the American ports. Only small boats are left to sell. It is also reported that J. L. Crosthwaite of New York has sold the steamers Georgetown and Waccamaw to coast buyers. The Georgetown is a steel ship of 2200 tons capacity and 243 feet long, and the Waccamaw is a sister ship. Both were built in 1900, and are equipped with surface condensers. They usually ply in the St. Lawrence trade. It is said the ships have been sold for sea service.

SHIPPING FEDERATION OF CANADA ANNUAL

AT the annual meeting of the Shipping Federation of Canada, held on February 10, it was reported by the president, Col. Andrew A. Allan, that only nine vessels entered and affiliated with the Federation in the Canadian trade had been lost through the operations of German submarines during the past year. These nine vessels, not specified, had a gross tonnage of 37,145.

War measures took up a large portion of Col. Allan's report, it being shown that owing to the requisitioning of so many vessels for war service the passenger trade had fallen off considerably, both east and westbound. On the other hand, those vessels still sailing generally had full lists. The total number of seagoing vessels to arrive in Montreal was reported as 810, a decrease of 106 from the previous year.

Particular reference was made by Col. Allan to the manner in which steamship companies, both ocean and inland, had responded to the call for troopships, which had in no small degree aided the British Government in carrying on the war. In this connection, Col. Allan also warmly thanked the employes of all these companies for the way in which they had aided this emergency work for the Empire.

There was a full attendance at the meeting, and the following officers were elected:

President—Col. Andrew A. Allan.

Treasurer—J. R. Binning.

Asst. Treasurer—E. W. Foulds.

Executive Council—Col. Andrew A. Allan, W. R. Eakin, J. R. Binning, R. W. Reford, D. W. Campbell, John Torrance and A. Mackenzie.

Sub-committees—Bill of Lading: Col. W. I. Gear, Messrs. John Torrance, J. R. Binning and D. A. Watt. Harbor Equipment: Col. Andrew A. Allan, Col. W. I. Gear and Mr. John Torrance.

Manager and Secretary—Thos. Robb.

President's Report

In presenting the 13th annual report. Col. Allan pointed out that the season of 1915 had been unusually long. The first vessel to arrive had been the Thespis, on April 30, one day later than the first arrival for 1914. The last vessel to leave was the Port Dalhousie, an upper lake vessel, which cleared for sea on December 11, the latest sailing on record. In order to meet the large export business many tramp steamers had been required at current high rates, which meant loss to those who had contracted to ship goods before the war rates started. Proceeding, Col. Allan said:

"In looking over the exports for the past year, I find that increases have been recorded in the following commodities as compared with 1914:—Cheese, 441,026 boxes; butter, 47,195 packages; eggs, 167,000 cases; hay, 1,708,586 bales; lumber, 35,113,323 feet; while decreases are shown in flour, 1,150,926 bags; apples, 48,205 barrels; oats, 1,142,570 and wheat 26,298,429 bushels.

Transportation of Troops

"On the outbreak of the war, it became obvious that a large number of merchant vessels would be required, and also that they must be had in some different method than that which has been used in previous emergencies. When one considers that the British Government did not possess a single transport or a vessel adapted for the carrying of troops, horses or stores, the magnitude of the work done, which has lately been so often before you, I need not dwell on.

"The part taken by our inland shipping friends and ocean and coasting mercantile shipping interests in preparing, storing, fitting and altering the vessels to suit the Militia Department reflects the greatest credit on all concerned, and I think it is my duty to take this opportunity of thanking the respective employes — superintendents, stevedores. longshoremen and ship liners for their able assistance, for without their co-operation we would have been unable to attain the end that has given such satisfaction to the Minister of Militia."

Proceeding, Col. Allan expressed the gratification of the Shipping Federation that the Dominion Government had interested itself in keeping the river channel open as long as possible, and had agreed not to remove any buoys, weather permitting, until the last vessel had sailed.

Labor Conditions

With regard to labor conditions, Col. Allan reported, that, "although the agreement between the respective shipping lines and the longshoremen expired on 31st December last, no new agreement was renewed with the men during the year; no trouble was experienced whatever, the men working on the conditions of the old agreement. There was a plentiful supply of labor all through the season."

Thanks to Government

Concluding, Col. Allan said: "During the year just closed, I am pleased to state that our relations with the various Government Departments have been, as in the past, most cordial, and our hearty thanks are due to Hon. J. D. Hazen, Minister of Marine and Fisheries, and to A. Johnston, Deputy Minister of Marine, for their courteous and considerate attention to all matters we had occasion to bring to their notice.

"Our thanks are also due to Major-General Sir Sam Hughes, K.C.B., Minister of Militia and Defence; to Quarter Master-General D. A. MacDonald and Colonel J. Lyons Biggar, Director of Supplies and Transport, for their unfailing courtesy and business-like manner in dealing with the many questions that have had to be taken in hand during the past year."

NORTHERN NAVIGATION COMPANY ANNUAL

THAT the season of 1916 will be one of the most prosperous in the history of the Northern Navigation Co., was the unanimous opinion of the various officials and agents present at the ninth annual meeting held recently at Toronto. At the gathering were representatives from various cities on the Great Lakes. While similar meetings of officials and agents are now held by various corporations, the Northern Navigation Co. was one of the first in Northern America to bring its officials together annually. These gatherings are said to be largely responsible for the excellent service found upon all the company's excursion steamers.

General Manager H. H. Gildersleeve, who presided at the meeting, said that during the past year more testimonial letters and petitions commending the officers of the various steamers, had been received than ever before. Upon the return trip of nearly every boat, the passengers adopted resolutions expressing their hearty approval of the service rendered by the officers and crews, and few, if any, complaints were received. Everyone seemed to be pleased with the manner in which we conducted our lake trips. During the meeting suggestions were made which will make possible even better service during the ensuing year.

The following representatives attended:—

General Manager H. H. Gildersleeve; General Freight Agent R. V. Robinson; General Passenger Agent E. W. Holton, Sarnia; General Agent B. Batten, Port Arthur; Northwestern Agent H. Hurdon, Duluth; W. H. Smith, Owen Sound; W. F. Gilchiese, Sault Ste. Marie, Ont.; R. W. Thom, Collingwood; J. H. Morrison, chief commissary, Sarnia; C. H. Bowden, traveling freight and passenger agent, Montreal; C. D. George, traveling freight and passenger agent, Sarnia; J. T. Brennan, auditor passenger receipts, Montreal; A. E. W. Kimmerly, auditor freight receipts, Montreal; H. T. Ewald, advertising manager, Detroit.

In addition, the following Grand Trunk officials attended:

General Freight Agent H. C. Martin, Montreal; Division Freight Agent G. T. Pettigrew, Montreal; Division Freight Agent James Edwards, Ottawa; Division Freight Agent R. W. Long, Hamilton; Division Freight Agent R. J. S. Weatherston, Stratford: Assistant General Passenger Agent C. E. Johnson, Montreal; District Passenger Agent C. E. Horning, Toronto; General Baggage Agent J. E. Quick, Toronto.

UNITED KINGDOM SHIPBUILDING SUPREMACY

ALTHOUGH its shipbuilding yards were more fully engaged on warship work during 1915 than in any previous year, the United Kingdom is still maintaining the lead as the most important producer of mercantile shipping. Being demonstrated by the latest statistics issued by Lloyd's Register of Shipping. The appended table has been prepared in order to show the total gross tonnage of merchant vessels of over 100 tons each launched (a) throughout the world, and (b) in the United Kingdom, while the third column shows (c) the percentage of the world's total output for which British shipbuilders have been responsible during each of the last six years:—

	World	U.K.	%
1910	1 957.853	1.143.169	58.4
1911	2 650 140	1.803 844	68.0
1912	2 901.769	1.738.514	59.9
1913	3 332 882	1.932.153	57.9
1914	2 852 753	1.683 553	59.0
1915	1,201.638	650.919	54.0

In comparing the above figures it should be remembered that the 650.919 tons of merchant shipping launched in the United Kingdom last year only includes those vessels intended for purely mercantile work. It should also be added that the total tonnage launched throughout the world in 1915, as recorded above, excludes those vessels consigned to the water from German, Austrian, and Belgian yards.

$1,000,000 SHIPBUILDING PLANT FOR CATALINA, NFLD.

W. F. COAKER, head of the Fisherman's Union of Newfoundland, was in Halifax N.S., recently, taking initial steps for the establishment of what he says will be a million-dollar shipbuilding plant at Catalina, on the north coast of the colony, to be ready for operation in 1917. Should the enterprise materialize, it will be somewhat serious for the City of St. John's, which previously has been the headquarters of the industrial life of the colony. Mr. Coaker, in speaking of his new enterprise, said: "The sealing industry has long been a great one in Newfoundland, but has dwindled from a million dollars a year to $250,000. The principal reason for this is the scarcity of suitable ships to carry on the industry. The situation has become more pronounced since the war, due to the requisition by the Government of so many of the steamers used for the fisheries. There are only about six or seven ships suitable for carrying on the seal fisheries at present. There used to be a fleet of at least twenty-five. When the shipbuilding industry was booming no difficulty was experienced in keeping the sealing fleet up to maximum, but this, too, has dwindled until it has practically gone out of existence."

Mr. Coaker said wooden ships were more suitable for the sealing industry than iron, some of the latter being too large and the cost of maintaining and operating them too great.

DOMINION DREDGE SUPERINTENDENT DISMISSED

AUGUST KASTELLA, a German-born official of the Public Works Department, Ottawa, has been dismissed from his position as mechanical superintendent of Dominion dredges. The action was taken by the Minister of Public Works, Hon. Robert Rogers, following the debate in the Commons on Teuton intrigue in Canada, and the retention on the civil service list of Canada of men of German birth. Mr. Kastella, who was formerly chief power plant engineer at the G. T. R. shops, Stratford, Ont., was appointed to the responsible position of mechanical superintendent of dredges some two or three years ago. He did not take out his naturalization papers until after the outbreak of the war.

Although there has been considerable criticism in the press of his retention in the service, on the score of his German birth and family associations, it is stated by the Minister of Public Works that the dismissal is not due to this. The reason given is that there have been some irregularities and unsatisfactory work in connection with the discharge of his departmental duties. An investigation has been under way for some time. Details, however, are not forthcoming at present.

Kastella was for some four years chief engineer of the power plant at the G. T. R. shops, Stratford, in 1913 being appointed to a similar position at the new G.T.R. depot, Ottawa, and later being given the post of Dominion superintendent of dredges.

MARINE ESTIMATES

THE main estimates for the coming fiscal year tabled in the House of Commons on Feb. 3, by the Minister of Finance provide for a total expenditure of $188,981,218. Of this amount $158,958,730 is charged up to consolidated fund expenditure and $30,022,488 to capital amount. War and supplementary domestic expenditures are of course additional.

As compared with the total estimates voted by Parliament last session, apart from war, there is a decrease of $7,809,398. Last year the supplementary estimates totalled $6,677,540, as compared with the main estimates of last year, therefore the total reduction is a little over one million dollars. How large the supplementary estimates will be this year is, of course, not yet known. When the fiscal vote for all the domestic expenditures of the year is passed it will probably be found that it will be fully as large as the amount voted last year.

Some of the Main Items

Some of the main items for new works, or for the continuation of works already begun include the following:—

Port Arthur and Fort William harbor improvements, $1,000,000.

Quebec drydock, $1,500,000.

St. John harbor improvements, $1,000,000.

Intercolonial Railway bridges, $483,000.

Halifax terminals, $3,000,000.

Quebec Bridge, $3,450,000.

Hudson Bay Railway, $3,000,000.

National Transcontinental Railway, $1,500,000.

Welland Canal, $4,500,000.

Trent Canal, $1,000,000.

Toronto Harbor, $600,000.

Harbor and River Works

Votes for harbors and rivers in Ontario include the following:—

Bowmanville, repairs to pier, $10,000.

Brighton, wharf, $24,500.

Burlington, revetment wall, $12,000.

Cockburn Island, repairs and extension to wharf, $5,000.

Collingwood, harbor improvements $75,000.

Depot Harbor, wharf renewal, $5,000.

Fighting Island, (Detroit River), improvements to channel, $57,000.

Fort Frances, wharf, $5,000.

French River, dams, repairs and maintenance, $3,000.

Goderich, harbor improvements $90,000.

Hamilton, harbor improvements, $250,000.

Kagawong, wharf, $15,000.

Kensington, wharf, $15,000.
000.

Kingston, harbor improvements, $120,000.

Leamington, breakwater, $10,000.

Leith, wharf reconstruction, $10,000.

Little Castor River, improvements, $5,000.

Nation River, improvements, $10,000.

Newcastle, repairs to east pier, $17,500.

Oshawa, harbor improvements, $50,000.

Peterboro drydock, $25,000.

Port Bruce, repairs to piers $1,800.

Port Credit, harbor improvements $40,000.

Port Dover, harbor improvements, $50,000.

Port Elgin, renewal to breakwater, $10,500.

Port Hope, harbor improvements, $7,000.

Sarnia, wharf and shelter basin, $50,000.

Sault Ste. Marie, wharf repairs, $5,000.

GREAT LAKES TRANSIT CO. ORGANIZED

ORGANIZATION of the Great Lakes Transit Co. to control 85 per cent. of the passenger, packet freight and grain steamships navigating the Great Lakes was announced in New York, on Feb. 22, by Levy Mayer, of Chicago, general counsel of the Company, on behalf of W. J. Connors, of Buffalo, who was elected chairman of the board of directors. The company's fleet will comprise 35 vessels with a freight capacity of 150,000 tons. The steamers were formerly owned by six railroad companies which were compelled to relinquish them under the section of the Panama Canal Act forbidding rail lines to own competing water routes.

Capitalization

The capitalization of the company, it was announced, will be $20,000,000. Tariffs for through rail-and-water east and west-bound traffic will be filed with the Inter-state Commerce Commission by April 1. The new rates, it was stated, will not differ from those which prevailed before lake navigation closed last December. The Company plans to overhaul all its vessels, and to begin active operations April 1 with the transportation of 3,000,000 bushels of wheat from the head of Lake Superior to Buffalo. The principal operating offices will be in Buffalo.

The names of the men who will serve on the board of directors with Mr. Connors will be announced as soon as the charter papers have been completed. James Carey Evans, now vice-president and general manager of the Anchor Line, whose boats the new company took over from the Pennsylvania Railroad, will be president.

WHY CHILE REFUSED THE TWO SUBMARINES

CAPTAIN CHAS. PLAZA, former chief of the Chilean Naval Commission in the United States, has written the Vancouver Sun regarding the purchase of two submarines for the Canadian navy, details of which were investigated by Sir Chas. Davidson. Commenting on the trials of the submarines on July 22 and 24, 1914, Capt. Plaza writes:

"In submerged standardization trials, I found that both boats were overweighted, a serious defect in submarine craft, as it affects unfavorably the craft's trimming for submerged navigation. This overweight ought to have been counterbalanced by taking it from fuel, provisions, stores, etc., an operation which would have shortened sensibly the radius of action of the boats."

Plaza asserts that statements of J. V. Patterson, president of the Seattle Construction & Dry Dock Co., that he could dispose of the boats owing to the Chilean Government being unable to pay for them are untrue.

"Patterson," he said, "was perfectly well aware of the causes why the boats were not accepted, but, of course, he knew that if he said these boats had been rejected by the Chilean Naval Commission he could never have thought of asking $1,150,000 for them."

CANADIAN GOVERNMENT ICE-BREAKERS

THE Minister of Marine and Fisheries, Hon. J. D. Hazen, explaining a vote of $510,000 for the construction of a new ice-breaker, said that there had been a vote for the same purpose in last year's estimate but that only about $200,000 of it had been expended. The war had delayed the construction of the vessel, which would be one of the best of its kind in the world.

Mr. Hazen informed Mr. Marcil of Bonaventure, that ice-breaking operations in the St. Lawrence would be carried on this year with the Montcalm and the Lady Grey. Replying to another question, he said that more than a year ago the Russian Government had purchased the ice-breaker Earl Grey for use at Archangel and that during the year just ended the same Government had desired to purchase the Minto for operations at the same port. As the Minto would not be required to keep a channel open between P.E.I. and the mainland, the Canadian Government had sold it and delivered it at Archangel. The new car ferry which has been provided for the service to Prince Edward Island was so constructed that it could be used to keep the channel open.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Capt. J. L. Read and his crew of P.E.I. sailors, which took the Dominion Government ice-breaker Minto to Archangel, Russia, have returned

Captain F. M. Passow, commander of the American Line mail steamer St. Paul, has retired from active service. Capt. Passow was born in Halifax, N.S.

Captain Garnons-Williams, R. N., for some years stationed at Esquimalt, died recently. He came to the Pacific Coast on H.M.S. Daphne, which was engaged for some time in cruising the Behring Sea, to see if sealing regulations were being regarded. He subsequently became commander of H.M.S. Warspite.

Kingston No. 4, N.A.M.E., have elected and installed their officers for the ensuing year. They are as follows:—Joseph W. Kennedy, president; Robert Knight, 1st vice-president; John Kennedy, 2nd vice-president; J. F. McEwen, treasurer; James Gillie, secretary; Arthur Dunn, conductor; John Lentz, doorkeeper; R. Knight and W. Dunngan, auditors; A. R. Melone, J. F. McEwen, trustees

Vancouver, No. 7, N.A.M.E., have chosen the following officers for the year 1916:—President, Isaac N. Kendall; 1st vice-president, Joseph Dick; 2nd vice-president, Andrew T. Roy; sec'y-treas., Ephraim Read; conductor, Albert Anderson; doorkeeper, Axil G. Thoren; auditors, P. Larsen and A. L. Stevenson; members of council, the president, I. N. Kendall, W. G. Wooster, Andrew T. Roy, Alfred H. Evans and Ephraim Read.

Midland No. 12, N.A.M.E., at a recent meeting elected the following officers:—Past president, Joseph Silverthorn; pres., Geo. W. M. McDonald; 1st vice-president, Harry McElroy; 2nd vice-president, Geo. Smith; secretary, Ray N. Smith; assistant secretary, Fred Hanson; treasurer, J. Bruce Hanley; conductor, Edgar Root; doorkeeper, Wm. Keith; auditors, Geo. Smith, Ludwig Butler; finance committee, Joseph Silverthorn, Frank Norton, Robert Chalmers.

Toronto, No. 1, N.A.M.E.—On Jan. 3, the second regular meeting of the local council was held in the Sons of England Hall, Bertie Street, where the following officers were elected and installed for the ensuing twelve months:—President, A McLaren; 1st vice., W. Wood; 2nd vice., J. Bonner; secretary, E. Prince, 108 Chester Avenue; treasurer, S. Gillespie; asst. secy., H. F. Vivian; conductor, H. McDonald; doorkeeper, C. Holmes; Auditors, Lariche, Harrison, Richardson; correspondent, H. F. Vivian.

LICENSED PILOTS.

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio
Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

THE SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

GRAND COUNCIL, N.A.M.E. OFFICERS.

L. B. Cronk, Windsor, Ont., Grand President.
A. F. Hamelin, Montreal, Que., Grand Vice-President.
Neil J. Morrison, P. O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
E. Read, Vancouver, B.C., Grand Conductor.
A J. Ross, Halifax, N.S., Grand Doorkeeper.
James Gillie and A. E Kennedy, Kingston, Ont. Grand Auditors.

SHIPMASTERS' ASSOCIATION OF AMERICA CONVENTION

THE annual convention of the Shipmasters' Association of America was held in Toronto from January 25 to 29, the delegates making their headquarters at the Carls-Rite Hotel. Business sessions were largely taken up with the discussion of such important subjects as insurance, safety and pilotage on our Great Lakes.

The Grand Lodge was organized in Buffalo some twenty-six years ago, and incidentally it may be stated here that a subordinate lodge came into official existence in Toronto during convention week. Captain James E. Mann is president of this latest addition. Although subordinate lodges have for some years been operating in Midland, Owen Sound, Port Arthur and Fort William, the recent convention—26th annual is the first of its kind to be held in Canada. The total membership is, we understand, about 1,500, and something like $400,000 has been paid out in benefits to date.

The social side of the convention included sight seeing by means of automobiles and on foot, and a banquet provided by the City Council of Toronto. At this latter function, Mayor Church presided and addressed the gathering. Others present, and who took part in

1916 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Chas. M. Arnott,	94 Hanley Street	J. S. Adams,	[illegible]31 Gladstone Ave.
St. John,	2	G. J. McVicar,	49 Winslow St. West	[illegible] T. G. Blewett,	36 Murray St.
Collingwood,	3	Wm. Whipps,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	L. E. Spencer,	24 Clergy St.	James Gillie,	101 Clergy St.
Montreal,	5	Henry Lamereaux,	280 St. Andre St.	O. L. Marchand.	[illegible] Clark St.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	W. G. Wooster,	Room 10, Jones Bldg.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	S. G. Guenard	Bienville, Levis, Que.
Sorel,	9	Nap. Blandon,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John McLeod,	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	[illegible] London St. W.
Midland,	12	Geo. E. Wilson,	P.O. Box 204	Roy N. Smith,	Box 178
Halifax,	13	Robt. Blair,	29 Preston St.	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Rd.	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	Phillip Bridges,	Stewart St.	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

the speech-making were Capt. Charles Smith, Capt. Booth, Capt. Hamilton, Chicago; Capt. E. J Smith, Controller Thomson, Ald. Ryding, Sqhire Cohen, Capt. Crosby, Capt. Hubbard, Capt. J. E. Mann, Harbor Commission Laxton, Alderman Ramsden and Property Commissioner Chisholm, Toronto. Altogether, a profitable convention time was spent, and golden opinions of "Queen City" hospitality and interest in the Association's work mingled with the good-bye of each departing guest.

NATIONAL ASSOCIATION OF MARINE ENGINEERS CONVENTION

THE thirteenth biennial convention of the National Association of Marine Engineers was held in Toronto from January 31 to February 5, the Carls-Rite Hotel, as in the case of the Shipmasters' Association being sessions and delegates' headquarters. As on former occasions, business relative to the various activities of the Association entailed long, as well as late and early sessions. All work and no play is as bad for the engineer as it is for "Jack," and this was recognised not only by the delegates themselves, but their many friends in, and by the administration of Canada's Queen City.

On Monday night, January 31, the delegates were the guests of the management of the Toronto Arena at a hockey match. On Tuesday they were the guests of William C. Wilson, on an automobile tour round and through the city. On Wednesday night, the city council entertained the delegates to a banquet at the Walker House. Alderman Ryding in the absence of Mayor Church being in the chair.

Following the election of Grand Council Officers on Friday morning, the delegates were the guests of Wm. Newman, general manager, the Polson Ironworks, Toronto, on another round of sightseeing by automobiles. The Parliament Buildings, New Central Technical School and City Hall were visited. At the latter, Mayor Church gave a brief address appropriate to the occasion, to which Grand President, A. R. Milne, Kingston, replied. Following a reception at the Walker House, on Saturday, by the new officers, the delegates left for their different destinations. The Grand Council Officers elected for the ensuing two years' term are as follows:

Grand Pres., A. R. Milne, Kingston, Ont., Council No. 4.

Grand Vice-Pres., J. E. Belanger, Levis, Que., Council No. 8.

Grand Sec. Treas., Neil J. Morrison, St. John, N. B., Council No. 2

Conductor, J. W. McCleod, Owen Sound, Ont., Council No. 10.

Doorkeeper, L. Winchester, Charlottetown, P.E.I., Council No. 15.

Grand Auditors, J. Scott, Halifax, N.S., Council No. 13.

A. Charbonneau, Sorel, P. Q. Council No. 9.

Catalogues

Condensers.—The York Mfg. Co., York, Pa., have issued a leaflet illustrating and describing the "York" flooded ammonia condenser for refrigeration plants. Copies of the leaflet may be obtained from The Canadian Ice Machine Co., Toronto.

Graphite Products. — The Jospeh Dixon Crucible Co., Jersey City, N.J., are distributing a booklet entitled "Valuable Graphite Products," which deals with the company's well known and extensive line of these specialties. The class of work for which each product is intended is stated and its principal features dealt with fully. Price lists are included for the various lines.

McKim Gaskets, is the title of Catalogue No. 16, issued by the McCord Mfg. Co., Detroit, Mich. The essential features of the McKim copper asbestos gaskets are described fully and dimensions and prices given for the various sizes. The wide range of service is dealt with accompanied by illustrations showing a variety of joints on which the gaskets are used.

Mechanical Rubber Goods made by the Quaker City Rubber Co., Philadelphia, Pa. An interesting and extensive line of mechanical rubber goods including belting, hose for a large variety of purposes, sheet and rod packings, gaskets, valves, tires, etc., are described and illustrated. Many of the illustrations are colored giving the catalogue a highly attractive appearance. Several useful tables on belt transmission and pulley diameters are included and the concluding page contains a telegraph cipher code and index.

Recording Thermometers made by the Bristol Company, Waterbury, Conn., are described and illustrated in catalogue No. 120. In addition to the matter dealing with the various types of thermometer are a number of specimen sections of the different sizes of charts for use with the thermometers. The catalogue also describes different styles of connecting tubes for various purposes and contains in the same section price lists for the various recording thermometers described in the preceding pages. A partial list of users of the "Bristol" recording thermometers is included.

Psychrometric Tables for Cooling Tower Work, published by the Wheeler Condenser & Engineering Co., Cartaret, N.J. This is a companion book to "Steam Tables for Condenser Work" and consists of a handbook of tables giving dry and wet bulb thermometer readings, dew point, humidity and the pounds of water vapor per thousand cubic feet and per hundred pounds of air, together with a discussion of psychrometry and the use of the sling psychrometer. The tables were read from an alignment chart specially prepared for the company.

Oiling Devices made by the Canadian Winkley Co., Windsor, Ont., are the subject of catalogue No. 10. A large number of styles are illustrated and described in detail. accompanied by price list and principal dimensions for each size.

Ball Bearings.—The Norma Co., of America, New York, have issued a catalogue No. 105 just off the press dealing with the "Norma" precision bearings. The catalogue contains 123 pages and endeavor has been made to present the subject in a way that will be interesting and helpful to engineers and also of some permanent text book value. The first 18 pages contain all the essential facts about "Norma" roller and ball bearings covering the principal features embodied in their construction. The succeeding 20 pages deal with the principles of anti-friction efficiency as applied to "Norma" bearings covering the various types and explaining the facts in relation to bearing principles. Following the text matter comes 60 pages of tabular data giving the principal dimensions of the various types accompanied by diagrams and revealing the wide scope of the "Norma" line of bearings. Pages 102 to 115 contain a large variety of application drawings as suggestion for the draughtsman engineer while the concluding pages contain notes and suggestions on the selection of anti-friction bearings.

Centrifugal Pumps for all purposes, including condenser circulation, irrigation, drainage, dry docks, and general mill and power plant service, for motor, engine or belt drive, are now being built by the Wheeler Condenser & Engineering Co., of Carteret, N.J., and are described in their new bulletin 108—A. These pumps are of the single-stage, double-suction, split-casing type, for heads from 0 to 300 feet. Particular stress is laid in this bulletin to the adequate testing facilities in the Wheeler hydraulic laboratory, provided with calibrated motors, gauges and tanks with V-notch and rectangular weirs for measuring the quantity of water, and secondly, to the accurate casting and machining of pump parts, particularly the impellers. A short description of foundry methods is given. Among the designs of pumps shown, several are of particular interest, such as, a combined motor and geared turbine-driven centrifugal pump, a typical complete surface condenser auxiliary, with geared circulating pump direct connected to turbo air and condensate pump driven from a common turbine, a large vertical shaft dry dock pump, etc. Several pages are devoted to vertical shaft pumps, and excellent illustrations show the design of the vertical thrust bearing with self-contained lubricating oil pump, of the lower self-lubricating guide bearing, and the design of impeller and casing.

If any advertisement interests you, tear it out now and place with letters to be answered.


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CAR FERRY ONTARIO No. 2

The Publisher's Page

By B.G.N.

Announcement

WE have pleasure in announcing to manufacturers, dealers and agents the arrival in Canada of our European Manager, Mr. E. J. Dodd.

Mr. Dodd, with headquarters in London, Eng., represents MARINE ENGINEERING and thirteen other journals published by The MacLean Publishing Company. He enjoys a very wide acquaintance among manufacturers, especially in Great Britain, and is recognized and consulted as a leading authority on matters pertaining to Canada and Canadian trade.

He is here to familiarize himself with the changed conditions which have been brought about by the war—to secure a first-hand knowledge of this prospering and progressive country, with its newly-acquired aggressiveness and confidence. He is at the service of our friends who may be desirous of securing information regarding British lines, and he is prepared to execute any reasonable commission upon his return to London in a few weeks' time.

We shall be glad to hear from interested parties, either by letter, telephone or telegraph, when an appointment can be arranged with Mr. Dodd, who will visit Toronto, Winnipeg, Montreal, Halifax, St. John and other cities.

It will be understood, of course, that whatever we may be able to do for our friends through the good offices of Mr. Dodd will not place them under obligation in any way—whatever we are privileged to do will be in line with our policy of rendering a *greater* service to our subscribers and advertisers.

Analysis of Welland and Georgian Bay Canal Projects

By R. W. Leonard

The author discusses the economic and strategic aspects of the enlargement of the Welland Canal now in progress as also the similar features relative to proposed Georgian Bay Ship Canal. Internationally, constricted waterways at various points and boundary dispositions are liable to become involved should friction arise between Canada and the United States, while commercially the economies of both projects must needs be compared with transportation by rail and with one another.

AFTER the War of 1812 the British Government—recognizing the necessity of having a line of communication for military purposes away from the boundary—canalized the Ottawa River from Montreal to Ottawa, and the Rideau and Cataraqui Rivers from Ottawa to Kingston for barges drawing five feet of water at a cost of $3,911,700, which system they subsequently gave to Canada free of cost. The Depart- of Railways and Canals has since nearly completed the Trent canal system from Trenton on Lake Ontario to Georgian Bay, for barges drawing about five feet of water at a cost to date (1914) of $13,611,035, exclusive of interest. These last two systems—however interesting to the summer tourist as canoe and yachting routes—are not of great economic or strategic importance under modern conditions. The cost, maintenance, operation and repairs for the year 1913 was $309,822.65, and the tonnage passing through (mainly pleasure boats, cord wood, lumber and sand) amounted to 227.023 tons.

Ottawa-French River Route

About 1904 the Dominion Government (Public Works Department) started a survey of the Ottawa-French River route for the purpose of arriving at the cost of a 22 ft. ship canal. The result is embodied in a very voluminous report, dated 1908, including estimates as follows :—

Total length of canal	440 miles
Free navigation	346 miles
Improved channels ...	66 miles
Excavated canal	28 miles
Total , 22 ft. deep	440 miles
Cost	$100,000,000.00

The system is estimated to be capable of developing 1,000,000 H.P. on the direct canal route, and this estimate might probably be doubled by figuring the power developed in regulating the tributary streams. It is significant that about the same time the Department of Railways and Canals commenced to make surveys to determine the posibility of enlarging the Welland Canal from the present 14 ft. draft to 30 ft. draft. These surveys were completed in 1913, and the parliamentary estimate for that year included $2,000,000 for the enlargement of the Welland Canal and $500,000 for canalizing the French River from Georgian Bay to Lake Nipissing.

Welland Canal Enlargement —

The total esimate of the cost of enlarging the Welland Canal (26 miles) is reported to be $50,000,000, probably two-thirds of which is expended in the United States for fuel and machinery, and in various foreign countries in the form of wages sent home by laborers. The lift of 325 ft is overcome by 7 locks of 46.5 ft. lift, 800 ft. long x 80 ft. wide x 30 ft. draft.

The St. Lawrence canals enlargement has not been surveyed and no information is therefore available to indicate whether corresponding enlargement to suit that at the Welland Canala is physically possible at any cost of construction, and the people of Canada have not been informed of any treaty with the United States sanctioning such deepening of international waters with the probable construction of international dams, etc. During 1913-14 contracts were let for the construction of about ten miles of the Welland Ship Canal, including all the locks at a cost of probably $35,000,000, and the work of excavation is possibly half done. Internally considered, this question is of supreme national importance, as involving such questions as national defence and the very possibility of holding Canada for the Empire.

U. S. Canal Activities

In this connection, it must be done in mind that New York State is enlarging the Erie Canal from Troy to Oswego and to Buffalo, from six or seven feet draft to twelve feet with a lock length of 311 feet, and width of 45 feet, to accommodate barges of 1,500 tons capacity,* and these canals will open Lakes Ontario and Erie to formidable United States war vessels giving them absolute control of these lakes at all times, unless Canada be supplied with similar transport facilities apart from the boundary waters of the St. Lawrence River from Kingston to Prescott. The enlargement of the Welland Canal will also carry a great preponderance of large United States steel freighters into Lake Ontario, thus giving to that country an undisputed control of that lake.

Canada has enjoyed a century of peace with her powerful Southern neighbor, and it is the wish of all good citizens to enjoy another one, even avoiding in the coming century such incidents as the "Trent Affair," the Fenian Raids, Venezuela messages and the Panama Canal question, serious boundary disputes, fishery disputes, international water power questions, etc., to say nothing of United States Senate Reports, 1889-1890 (Testimony of Joseph Nimmo, Jr.), etc. Such questions having arisen in the past, however, they will naturally arise in the future, and the peaceful settlement of them depends largely upon the temper and temptations at the time. So long as an international boundary is to be retained, so long should the policy of Canada be to preserve peace while safeguarding her honor and interests.

Our Canal Problem

It is not apparent to the public that this canal problem (probably Canada's most expensive commercial project under construction), has been considered by the Canadian people from the national point of view, though pamphlets have been published ad nauseam by Boards of Trade of various municipalities treating the subject in a spirit of parochial politics, each exaggerating the advantages of one route and the disadvantages of the other, the very apparent incentive in each case being the expenditure of public money on construction in the immediate vicinity of the municipalities interested.

If the question be approached from a purely economic point of view, it is probable that freight (and grain from the prairies to the Atlantic seaboard in Canada is the most important commodity at present), can most cheaply be handled by rail from Winnipeg to Fort William and Port Arthur, by ship to Georgian Bay, and by rail over a direct line with easy gradients to Montreal, than by any canal at present built or proposed. On this route the C.P.R. has a double track from the West to Fort William; the G. T. P. and the C. N. R. have each a single track between the same points.

There is a large fleet of United States steamers engaged in the coal, grain and ore trade on the lakes, and the Canadian fleet is growing rapidly. The C.P.R. has a line with easy gradients from Port McNicoll, on Georgian Bay, where it has built large grain elevators, to connect

*From a paper read recently before the Canadian Society of Civil Engineers.

*Report of State Engineer and Surveyor, 1913.

with its Toronto, Montreal line, with a view to carrying grain in competition with the canals, and they probably have estimates of comparative cost warranting the expenditure, even under the unequal conditions that the traffic by the railway must pay interest, depreciation and upkeep, while the Government assumes these enormous sums in the case of the waterways making the canals free to all ships alike, Canadian and foreign.

Water Transportation and Rail Freight Rates

The people are educated to demand water transportation "to regulate rail freights," and to what extent a larger canal than the present 14-foot Welland-St. Lawrence system will result in a reduction of rates is a question that can be figured in many different ways with varying results. Figures have been prepared by competent authorities showing that the maximum saving in freight on wheat from Fort William to Montreal by the enlargement of the Welland Canal will be ⅜c per bushel, which will amount to $187,500 per year on 50,000,000 bushels—at a cost in interest on $50,000,000 of say $2,000,000 per year plus depreciation, upkeep and operation. Return cargoes of coal are obtained in Lake Erie ports. Probably few will contend that 14 ft. draft ships are not economical for package freight from Lake Ontario or St. Lawrence points.

It will be of interest in this connection to have a report on the feasibility and cost from an engineering point of view of lengthening the existing locks on the Welland and St. Lawrence canals 100 ft., and the economic results of such lengthening if it be practicable.

The estimate for the enlargement of the Welland is generally stated to be $50,000,000; which amount at 4 per cent. interest, together with amortization, upkeep and supervision of the two existing canals and the proposed canal, may be estimated at another $1,000,000, or a total of $3,000,000 per year, which sum is probably under the mark unless all past experience in cost of Government contracts be reversed.

Assuming the distance from Port McNicoll to Montreal to be 400 miles, and a paying freight rate to be four-tenths cents per ton mile, or $1.60 per ton, or 5c a bushel, then $3,000,000 per year would pay the rail freight from Georgian Bay to Montreal on 60,000,000 bushels, which is much greater than the amount of grain and flour shipped in the past from Montreal in any one year, and 50 per cent. greater than the greatest Canadian tonnage through the Welland Canal bound down in one year.

Water Power Development

This enlargement of the Welland Canal will not materially increase the water power development, as that is regulated by international treaty and works out so that, though Canada owns two-thirds of the water flowing over Niagara Falls, she gets the use of only one-third of the power development therefrom, the United States getting two-thirds.

It is manifest that the only saving effected by enlarging the Welland will be that effected by the difference in freight rates between 2,000-ton ships from Port Colborne to Montreal vs. 8,000-ton ships from Port Colborne to Prescott, plus 2,000-ton ships from Prescott to Montreal; estimated above at ⅜c per bushel on wheat.

Oswego is about 150 miles nearer (by Erie Canal) to Troy than is Buffalo, and, as the enlarged Welland Canal will be, by treaty, free to United States ships their largest lake ships will deliver grain cargoes to 1,500-ton United States barges at Oswego, in the New York State Barge Canal for New York instead of into 200 or 300-ton barges at Buffalo as at present, and thus compete with large Canadian ships discharging into 2,000-ton barges at Prescott or Kingston for Montreal.

Welland Canal Enlargement Benefits United States

In the past the little Erie canal boats taking grain from Buffalo to New York have been very keen competitors against the St. Lawrence route. What will be the result of the new conditions when in operation? It would appear that the expenditure on the proposed Welland Canal enlargement when completed will be quite as much to the advantage of the United States as to Canada, and during construction probably much more than half the cost goes to the United States for coal and machinery.

The canalization of the French River to North Bay to a depth of 22 feet, a distance of 82½ miles, is estimated to cost $14,275,000, and would develop 35,000 h.p.* It could bring coal and coarse freight to North Bay for railway distribution, and return pulp-wood and probably ores from that district, and partially develop a lot of power for which there is probably no immediate market in sight, but the value of which will doubtless be very great in a few years if we judge from the phenomenal increase in the use and value of hydro-electric power during the past twenty years. Probably this construction is warranted only in anticipation of the completion of the entire canal to Montreal.

Assuming that the appropriations in the estimates for the Welland and French River works are preliminary to the extension of each system through to Montreal:

The Welland-St. Lawrence system (unless an entirely new route inland to the north of the St. Lawrence can be found) passes through international waters from Kingston to Cornwall, and probably nothing can be done toward enlarging this portion without international agreement, including a natural demand by the United States for a share of the power development, (loosely estimated at 2,000,000 h.p. by some writers in the press.)

Would the United States, having the free use of the enlarged Welland to carry their big ships to Oswego (the end of their Erie canal) consent to the enlarging of the St. Lawrence system to divert the trade from Troy and New York to Montreal? What share of the expense would they bear? What share of the power developed would they demand?

Sufficient information is not available to indicate the nature or cost of such an enlargement of the St. Lawrence canals. to a depth of 22 feet, but in the case of the Ottawa-French River system, careful surveys and estimates have been made by the Public Works Department. The total length of the canal is 440 miles. of which 346 miles is free navigation. 66 miles in improved channels and 28 miles in excavated canal.* The cost is estimated at $100,000,000.*

The system is estimated to be capable of developing one million h.p. on the direct route* and 3,000,000 h.p., including the tributaries† which probably within twenty years will (if carefully conserved and utilized by the nation) be worth from twenty to one hundred dollars per year per horse power utilized over the cost of production from coal. depending upon the purpose for which it is used.

St. Lawrence Canal's Enlargement

In the absence of authentic estimates and reports on the St. Lawrence route, it is impossible to compare the two routes as to practicability, cost, time of transit and economy of operation. It is not known whether the St. Lawrence enlargement is at all possible due to international questions. If it be possible, then the two systems can be compared in regard to length and total height of locking only. From Lake Superior to Montreal the Ottawa route is 661 miles long, and the total lockage up and down is 780 feet. The Welland-St. Lawrence route is 943 miles long, and the total lockage is 578 feet. Both routes pass through United States waters in the St. Mary River. The St. Lawrence route passes through contracted international waters at St. Clair River, Detroit River and St. Lawrence River. The deepened Welland-St. Lawrence Canal would be

*Report of Government Engineers, 1908.

*Report of Government Engineers, 1908.

†Estimate of Government Engineers, 1908.

found to have probably three times the length of actual excavated canal and about the same length of restricted river navigation, as compared with the Ottawa route.

Much has been written about fogs, rock-excavated channels and sharp curves on the Ottawa route. Any Canadian knows that the St. Lawrence probably suffers quite as much as the Ottawa from fogs. About half of the existing Welland Canal is in rock excavation and the new canal will not have less. It is not known how much of such channels the proposed St. Lawrence enlargement will include. The Ottawa route has sharp curves, so has the Thames below London, and it is not known what curves will be required on the proposed St. Lawrence enlargement. There are, however, sharp curves in swift currents in St. Mary River at Neebish and other points. Without surveys the distances through restricted waters cannot be compared and therefore neither the time necessary to pass through, nor the dangers of navigation.

St. Lawrence Route Longer Than Ottawa River Route

The St. Lawrence route is known to be longer and will demand greater fuel consumption per ton of freight, and probably more time in transit. The weeks per year when they will be open for navigation will probably not greatly differ, although the St. Lawrence system would doubtless have a slight advantage in this respect. If, as shown above, the annual expense of enlarging the Welland Canal alone would pay the freight on double the quantity of wheat and flour at present carried per year from Lake Huron to Montreal, it is unnecessary to prove that (commercially speaking) neither scheme can be defended as a canal solely. Without further information they cannot be compared physically, nor is the possibility of the St. Lawrence enlargement even sure.

Conclusions

In view of the foregoing, the writer cannot avoid the following conclusions:

(a)—Neither canal system can be made, as a canal, a commercial success

(b)—On account of the geographical position and abundance of power capable of being developed along the Ottawa-French River system, that canal and power development (if undertaken by the Government) can probably be made a commercial success in a few years and will be a very valuable asset in case of international disputes, giving Canada a chance for defence on the Upper Lakes that she can never enjoy without it. This canal might be considered by the Dominion Government on the same basis as colonization railways which have been freely encouraged all over Canada.

(c)—The possibility of the enlargement of the St. Lawrence system is as yet undetermined, as it requires the cooperation of the United States.

(d)—The cost and value of the power development thereon is unknown as no international agreement, surveys or estimates have been prepared.

(e)—The enlargement of the Welland Canal without a corresponding enlargement of the Welland-St. Lawrence system will at least benefit United States quite as much as Canadian interests, and it is questionable if it will not divert trade from Montreal to New York.

(f)—It will give the United States control of Lake Ontario in case of international trouble, and be an important factor contributing to the probable loss of the wealthiest and most populous part of Canada.

The Dominion Government has recently appointed a commission to report on the proposed Ottawa Ship Canal, which doubtless will add much to the present knowledge of the commercial feasibility of this project, and it is to be hoped of an alternative project of a 14 ft. barge canal. It is to be hoped that it will also give some similar information regarding the enlargement of the Welland Canal and the proposed extension of the enlargement to Montreal that will guide the Government in deciding on the wisdom of such vast expenditures of public money before the projects are actually undertaken.

It is to be regretted that a similar commission had not been appointed before the Government committed the country to the expenditure of several hundred millions, on the simultaneous construction of two additional Transcontinental railways, and numerous other expensive projects.

The following figures are added for reference. They have been taken from Canal Statistics, Department of Railways and Canals, 1911, and Report of Government Engineers on Georgian Bay Ship Canal, 1908. It is very difficult to get definite and accurate information regarding water transportation costs, which heretofore have not been obtained by the Government, and some of these figures are subject to correction; especially those relating to freight rates, insurance charges and interest, which are liable to change from year to year.

Distances

Fort William to Montreal (via Georgian Bay Canal . .	934 miles
Fort William to Montreal (via Welland Canal)	1.216 "
Fort William to New York (via Erie Canal)	1.358 "
Proposed Georgian Bay Canal (length)	440 "
French River village to North Bay	$82\frac{1}{2}$ miles
North Bay to Montreal harbor	$357\frac{1}{2}$ "
	440 miles
Free navigation	346 miles
Improved navigation	66 "
Canal excavation	28 "
	440 miles

Canal Depths

Proposed Georgian Bay Canal . .	22 ft.
Welland-St. Lawrence Canals . . .	14 "
Proposed Welland Canal	24 "
Sault Ste. Marie Canal (Canada)	20.2 "
Sault Ste. Marie Canal (United States	16 and 20.5 ft
Erie Canal	7 ft.
New York State Barge Canal . .	12 "

It should be noted that excavation in St. Mary River, below the locks, has materially reduced depths over lower sills below figures in the above table.

Lockage

Proposed Georgian Bay Canal, 27 locks, 758 ft. up and down.

Existing Welland Canal 26 locks, 326 feet.

Proposed Georgian Bay Canal, 7 locks, 326 ft.

St. Lawrence Canals, 22 locks, 207.5 feet.

Erie Canal, 72 locks, 660 ft.

Rates

Water rate on grain Fort William to Montreal	$4\frac{1}{2}$c bushel	
Water rate Fort William to Buffalo	$3\frac{1}{2}$c	
Rail rate Buffalo to New York	$5\frac{1}{2}$c	
	9c	"
All water rates Fort William to New York	5.3c	"

Water rate Fort William to Buffalo is at times as low as $1\frac{1}{2}$c per bushel.

Although distance and rates are in favor of Montreal, diversion to American ports is due to the following reasons: Availability of ocean tonnage at New York; lower ocean rates between New York and foreign ports; lower insurance rates from New York.

Insurance

Montreal, 65c to $1.10 per $100.

New York, $12\frac{1}{2}$c to 15c per $100.

Cost of existing Canadian Canals, Fort William to Montreal		$80,000,000
Interest at $3\frac{1}{2}\%$ . .	$2,800,000	
Maintenance and operation	1,400,000	
	$4,200,000	

Water freight rate per ton mile, Fort William to Montreal	163c
Interest and maintenance	135c
	.298c

Government contribution, 135c per ton mile.

Welland Canal traffic, 1912, 2,537,629 tons, of which 51% was Canadian and 49% American.

On the 51% of Canadian traffic, the Government contribution would amount to .265c. per ton mile, as compared with a freight rate of .163c per ton mile.

Rail freight, Fort William to Montreal on grain 0.421c per ton mile.

Water freight, Fort William to Montreal, including interest and maintenance 0.428c per ton mile.

It will be seen that the all-water rate from Fort William to Montreal, including interest and maintenance of canals would exceed the all-rail rate by .007c per ton mile, based on the amount of Canadian traffic passing through the Welland Canal, but in case tolls were charged to meet these interest and maintenance charges, the United States traffic would also have to contribute towards this revenue, and the ton-mile charge for the all-water route would be reduced to .295c per ton mile. Government contribution does not include cost and maintenance of harbors, lighthouses, buoys, etc.

PHENOMENA OF ENGINE CYLINDER WEAR

IN modern high-speed steam and internal-combustion engines, cast iron, says "Engineering," is, up to the present, the only metal which has given satisfactory working results when used for the construction of certain vital parts, such as pistons, piston-rings, and cylinders. This fact, coupled with the serious drawbacks of cast iron in other ways, is sufficient to prove the tremendous importance of a careful study of this subject. The two chief properties required of cast iron for the purposes named are maximum resistance to wear, and the most perfect running properties under the conditions existing in the engine. The mechanical properties, such as the tensile and transverse strength, can usually, without much difficulty, be obtained sufficiently high to withstand the stresses involved in the use of the generally accepted thickneses of material employed.

Weight and Tensile Strength

The modern tendency, however, seems to be to cut down the weight of members to a minimum, and for this reason higher tensile strength irons will be more and more in demand. The wear in the particular case of engine cylinders is the loss in weight sustained by the cylinder under the action of the piston. The running property of an engine cylinder is a peculiar property whereby the cylinder is enabled to give the most satisfactory results in actual working from the point of view of absence of trouble from overheating and galling or seizing.

In the ideal engine the piston proper is separated from actual contact with the cylinder by a thin film of lubricant, and the piston-rings alone are in actual contact, scraping the surface of the liner. When in action the piston does not exert a constant and equally-distributed pressure over the whole surface of the cylinder, but by the reaction of the connecting-rod at certain positions the surface of the liner is subject to alternately varying loads, which act at portions of the liner surface in the vertical plane.

The wear of the cylinder is generally supposed to vary with the hardness — that is, under a constant load. The engineer is often confronted with cylinders rejected for excessive wear, in which the hardness is identical with other sets which are running perfectly well; and in records of liner failures it is very often an impossibility to correlate the hardness figures and the wear. In composite metals, such as cast iron, in addition to the hardness numeral, the surface structure and arrangement exert a tremendous influence on the wear. The surface is composed of soft, ductile, and tenacious grains, together with hard and brittle grains, broken up by numerous graphite plates. Under the continuous rubbing action, these grains, which are very weakly cemented together by the graphite plates, become loosened, and eventually detached.

Worn Liner Disclosures

An examination of worn liner surfaces under the lens shows the slight loosening of the grains under the alternating action of the piston. This dislocation of the grains is in all probability brought about mainly by the direct abrasive action of the piston-rings, assisted by a sort of fatigue brought about by the vibratory motion of the piston, which assists in the loosening of the grains.

At the same time as this dislocating action is taking place, another action, somewhat different in character, is also going on. This action is practically identical with that of polishing microsections in bas-relief, and is in all probability due to the action of the piston proper, together with the polishing action of the suspended powder resulting from the first-named action. The effect of this is that the harder phosphide, entectic and cementite grains stand in relief. These hard points, under the influence of the former dislocating action, in a like manner become detached, and with the constant repetition of this action the total wear is increased. Our contemporary further considers the means which should be used in casting and machining cylinders in order to minimize these tendencies to wear.

PROBLEMS FOR NAVAL DESIGNERS

A RUMOR from France indicates that battleships without funnels may be looked for in the near future. In merchant vessels, the funnels do not form a serious obstacle to the working of the ship, but in the case of Dreadnoughts this is very different. The smoke stacks, especially in large, high-speed battleships, are not only in the way, but they are a positive source of danger. They interfere with the arcs of training guns, and are an excellent guide to the target, while big ships are best recognized by their funnels. They are like a birth-mark, and it is only needed to realize how much of a giveaway these adjuncts constitute, when the trick played by the officers of the famous Emden is recalled, which went into a Japanese port, about a year ago, and got away safely through being disguised by the addition of a dummy funnel.

That the problem will be solved in time goes without saying; the finding of an efficient type of propelling machinery for battleships, in the operation of which funnels will not be needed. This will also be a step toward constructing a vessel of a type which will combine the qualities of the surface ship and the submersible. This, by the way, is the greatest problem which confronts the naval designer of the future, and is bound to be thought out sooner or later.

SS. "CITY OF MIDLAND" DESTROYED BY FIRE

BY a fire which broke out on the morning of March 17, at Collingwood Harbor, the Northern Navigation Co. steamer City of Midland of the Collingwood and Sault Ste. Marie division was totally destroyed. The fire appears to have originated in the cabin above the engine room, in which men had been engaged during the previous few days fitting out for the ensuing season.

The blaze was first noticed by two workmen, who were working throughout the night repairing the boilers, and though they immediately gave the alarm, when the firemen arrived the steamer was soon ablaze from end to end.

The steamer City of Midland was a fine wooden passenger and freight steamer, and was built by Captain John Simpson in Owen Sound in 1890 for the North Shore Navigation Co. In 1894 the steamer was lengthened and otherwise improved, and in 1905, upon the amalgamation of the rival companies on the Georgian Bay and the formation of the Northern Navigation Co., it was taken over with the other boats, and has since plied out of Collingwood to Sault Ste. Marie. She was 176 feet long, 28 feet beam, 10 feet deep, and was well equipped.

Sheet Metal Elbows, Their Development and Laying Off--I.

By J. W. Ross

In order to thoroughly understand the principles involved in the development of cylindrical and other forms, such as are met in sheet metal work, a considerable knowledge of geometry is desirable. Through the medium of these articles, the author places practical examples at the disposal of our readers, and the knowledge to be gained by a close and persistent study of the principles and methods employed will well repay the time spent.

THE fabrication of elbows forms a considerable part of sheet iron workers' practice. The various forms, cylindrical, oval and rectangular, will be herewith described, and the patterns developed for both heavy and light plate.

For the purpose of students' home practice, the measurements will be given in inches, so that the developments may be made on stiff paper. The patterns may be perforated at the located "rivet holes," by a punch similar to a tram conductor's transfer punch, which may be purchased at any 15-cent store, this punches a round hole. The patterns can then be connected together by common paper fasteners. This is good practice for the student in laying out the rivet holes, which will give him the necessary confidence when laying out on the plate.

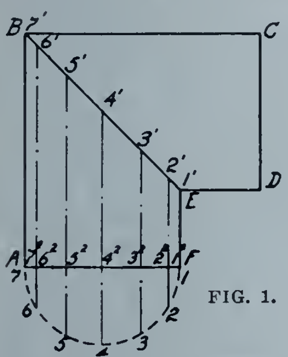

FIG. 1.

Cylindrical Elbows

Fig. 1 shows an ordinary two-piece 90-degree elbow which will be developed by the parallel line method.

Measure off AF, Fig. 1, equal to 1½ inches. at right angles to AF. draw AB and FE, making AB equal to 2¼ inches, and FE ¾ inch. BC is drawn parallel to AF. and equal in length to AB. CD is parallel to BA, and equal in length to AF. DE is drawn at right angles to CD and EF, and of the same length as EF. Connect the mitre line BE. which is at 45 degrees. to the lines BA and BC. Bisect AF, and with 4^2 as centre and 4^2 A as radius, describe the semi-circle A 4F, showing the half section view of the elbow. Divide this view into a suitable number of equal parts, in this case 6 parts are chosen. Each point is numbered in consecutive order. From these points draw lines parallel to the lines AB and EF, up to their insections with the mitre line BE, which are numbered in relation to the points on the half plan view.

As the elbow is made in two courses and of equal diameters, it will readily be seen that the mitre line as stated forms an angle of 45° degrees, therefore it will only be necessary to lay out one course, from which afterwards the other may be marked.

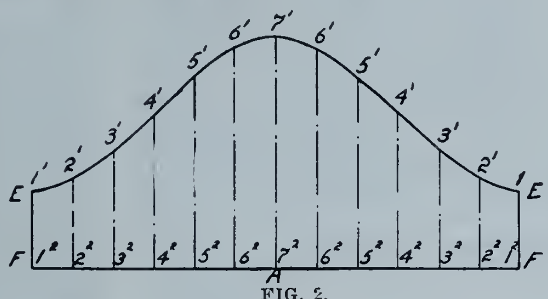

FIG. 2.

The neutral circumference of the elbow, or the stretchout as it is more generally termed, equals the neutral diameter multiplied by either 3 1/7 or 3.14, which equals $1.5 \times 3.14 = 4.71$ inches, or slightly under 4¾ inches. Measure off FAF, Fig. 2, equal to 4¾ inches. Bisect at 7^2 and erect the perpendicular 7^27^1. Divide 1^2 to 7^2 into the same number of equal spaces, as in Fig. 1 on the plan view; also divide 7^21^2 similarly, thus making 12 spaces in all. Erect perpendiculars on these points, which are, of course, at right angles to the line FAF, and parallel to the centre line AB. Set the dividers to the distance 7^27^1, Fig. 1; transfer this over to the corresponding number in Fig. 2. It will be noted the seam is located on the line 1^21^1, Fig. 1.

Reset the dividers in each case to the distances 6^26^1, 5^25^1, 4^24^1, 3^23^1, 2^22^1, 1^21^1, Fig. 1, and transfer over each distance to its allocated line in Fig. 2.

A smooth even curve drawn through these located points will define the mitre line, which is also the rivet line. Laps are to be added to the rivet mitre line, and also the rivet lines 1^21^1, Fig. 2, for the vertical seam.

As both courses are the same size, the connection at the mitre line, after the plate is rolled up, will necessitate one of the courses to be slightly opened out with a machine suitable for that purpose, or, in default, with a hammer, so that one course will fit over the other.

In tinsmith work suitable seaming allowances are made according to the style of seaming. Fig. 2 shows the pattern without any allowance for laps.

60-Degree Elbow

Fig. 3 shows the elevation and half-sectional views of a two-course cylindrical 60-degree elbow. Draw the line GLO, make OL equal to 1 1/16 inches, and the neutral diameter of the elbow GL equal to 1½ inches. With centre O and radius G, describe the arc GI. With the same radius and G as centre describe another arc to intersect arc GI at I. Connect I to O by a straight line.

The angle formed by GO and IO is 60 degrees. Bisect the arc GI at M, and through this point draw a straight line from O, extending to H. At right angles to GL draw the lines GH and LK to intersect the mitre line HK. Connect H to I and K to J. If carefully constructed the course GHKL will be equal to

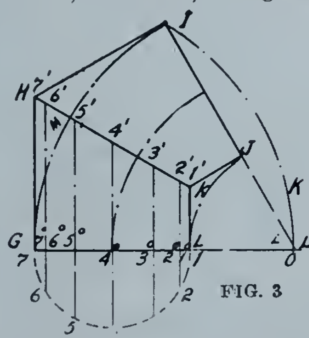

FIG. 3

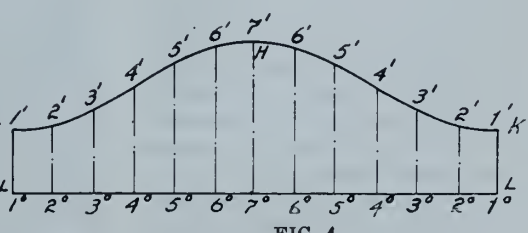

FIG. 4

HIJK. Bisect GL at 4^0 and draw in the half-sectional view G4L. Divide this semi-circle into any number of equal parts, according to the exigencies of the work. Project these located points to the mitre line, as explained in Fig. 1.

The stretchout LGL, Fig. 4, equals 1½ times 3.14, which equals 4.71 inches, or slightly less than 4¾ inches. Bisect this line LGL at 7^0 and erect the perpendicular 7^07^1, thus locating the centre line of the templet, and also defining the seam lines $1^0 1^1$ and $1^0 1^1$. Divide $1^0 7^0$ and $7^0 7^0$ each into the same number of equal spaces, as in Fig. 3. Erect perpendiculars parallel to the centre line $7^0 7^1$ through the points thus located, also numbering each perpendicular in relation to the construction lines, as $1^0 1^1$, $2^0 2^1$, etc., in Fig. 3. Transfer all the distances $7^0 7^1$, $6^0 6^1$, $5^0 5^1$, etc., in Fig. 3, over to their corresponding ordinates in Fig. 4. An even drawn curve through these points locates the rivet line or seaming line. Laps to be added accordingly.

Elbow With Gore

Fig. 5 illustrates a two-course 90-degree elbow, with the section BKC cut away to clear an obstruction, the gore BCH being fitted to the resultant opening. Fig. 9 shows the templet for the gore, and Fig. 6 for each of the courses.

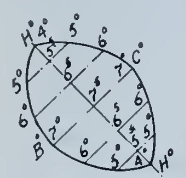

FIG. 9

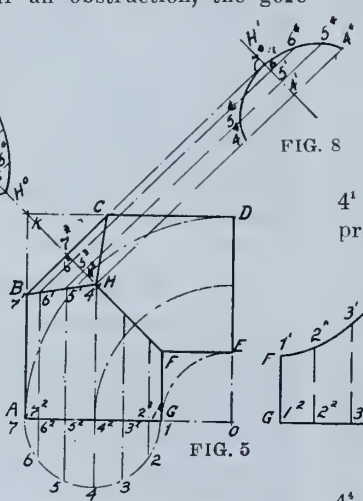

FIG. 8

FIG. 5

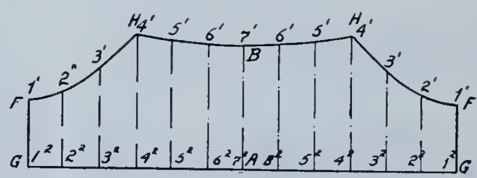

FIG. 6

Measure off on the line AGO, Fig. 5, AG equal to 1½ inches and GO to ¾-inch. With O as centre and OA as radius, strike the quadrant AD. With OG as radius and O as centre, strike the quadrant GE. Connect D to E, which is in line with O and at right angles to AG. Bisect the quadrant AD, and through this point draw a straight line from O to K, thus locating the mitre line. Draw KA at right angles to AG, and KD parallel to AG. Locate the points B, C by measuring ⅞-inch from the point K. Connect B to C, thus defining the portion cut away.

With 4^2 as centre, draw in the half-sectional view 7, 4, 1. Erect the perpendicular $4^2 4^1$ on the line AG. The point H where the line intersects the mitre line KF will also locate the termination of the gore. Connect B to H and H to C, which makes BH and CH the mitre lines between the gore and the courses. Divide the half-sectional view into a number of suitable equal spaces, as shown. Project the points 6 and 5 to their intersection with BH, also the points 3 and 2 to the mitre line HF.

The stretchout GAG, Fig. 6, equals 3.14 times the neutral diameter 7 1, which equals $3.14 \times 1\frac{1}{2}$ = slightly less than 4¾ inches.

Measure off GAG, Fig. 6, equal to 4¾ inches. Divide this into 12 equal spaces, erect perpendiculars and number in relation to their corresponding lines in Fig. 5. Set the dividers to the various distances, $7^2 7^1$, $6^2 6^1$, $5^2 5^1$, $4^2 4^1$, $3^2 3^1$, $2^2 2^1$, $1^2 1^1$, in Fig. 5, and transfer these over to their allocated lines on Fig. 6. An evenly-drawn curve through these points locates the mitre or rivet line. Fig. 6 illustrates the templet, to which must be added laps according to requirements, whether for seaming or riveting.

The gore BCH will now be dealt with. It is here necessary to have a cross sectional view through the plane $H7^3$, Fig. 5, to obtain the true length or stretchout of the gore, which is foreshortened in the elevation view shown in Fig. 5.

The cross sectional view is shown in Fig. 8.

The construction of such is as follows: From the points 7^1, 6^1, 5^1, 4^1 draw parallel lines to BC, and project to the points 7^4, 6^4, 5^4, 4^4, Fig. 8. Draw in the line H^1F^1 parallel to KH, and right angles to the projection lines, $7^1 7^4$, $6^1 6^4$, etc. Now with distance equal $4^2 4$ in plan view, Fig. 5, measure off the distances 4.4^4 in Fig. 8. Similarly with distances $5^2 5$ and $6^2 6$, Fig. 5, transfer to $5{,}5^4$ and $6{,}6^4$, Fig. 8. Draw an even curve through these points. This shows the true length of the gore through 7^3H, Fig. 5. The mitre line FK is extended to H^0H^0. On this is laid off the true length of the gore which has just been computed.

The exact length of the distances 7^4 to 6^4, 6^4 to 5^4, and 5^4 to 4^4, measured along the curve, is transferred to Fig. 9, as 7^5 to 6^5, 6^5 to 5^5, and 5^5 to 4^0. Lines are drawn through these points at right angles to the line H^0H^0. The distances on the gore BCH, $7^3 7^1$, $6^3 6^1$, and $5^3 5^1$, Fig. 5, are transferred and measured in Fig. 9, as $7^5 7^0$, $6^5 6^0$, $5^5 5^0$. A curve drawn through these points completes the pattern, with the exception of the laps. This curve locates the rivet lines, and all the points of intersection on the templets, Figs. 6 and 9, may be used for the pitch of the rivet centres through which the holes may be punched—by the punch already referred to, so as to facilitate the fitting up of the paper models—and in the case of plates for riveting together by.

LAKE SAILORS SCARCE

TRAFFIC on the Great Lakes is threatened with a serious dearth of sailors, engineers and officers, many of those hitherto employed having enlisted. The executive of the Dominion Marine Association, at a meeting held in Toronto on March 21, decided to open a recruiting office for mariners there, as a shortage will prove a serious handicap to filling contracts already entered into.

"Never before in the history of Canadian steamship concerns has there been such a shortage of sailors," says a prominent steamship man. "The situation is much more serious than it has ever been. Judging from present indications some difficulty will be experienced in obtaining men to fill the places of those who have enlisted. We do not want the recruiting sergeants to further invade our territory if they can possibly avoid it.

"The indications are that there will be plenty of business for the lake freighters this summer, but if we are unable to get men it will mean a heavy loss to some of the companies."

W. E. Burke, president of the Association, presided, and among those present were: W. H. McCormack, of the Algoma Central Steamship Co.; A. A. Wright, of the Chicago & St. Lawrence Navigation Co.; Francis King, secretary Kingston; Lawrence Henderson, Montreal Transportation Co.; W. Reid, Marks & Co., Port Arthur; A. E. Mathews, of the Mathews Steamship Co.; F. F. Stuart, Montreal; and Norman Rule, Canada Steamship Lines.

VESSEL CASUALTIES ARISING FROM THE WAR

LLOYD'S official list of the prizes of war, including war casualties and vessels sunk, has been issued up to 22nd January, 1916. From this it appears that the following damage has been done by enemy submarines to British, Allied and neutral vessels:

Nationality of Ships	Vessels sunk	Vessels damaged
British mercantile ships..	225	27
British trawlers	173	3
Allied mercantile ships...	73	5
Neutral ships	92	9
Total	563	44

It will thus be gathered that up to the present time over 600 mercantile vessels of one sort and another have been sunk, and about another 50 damaged. At a low estimate the value of the vessels sunk would be about $150,000,000. From the lists given it appears that 20 German vessels have been sunk by submarines, whilst 9 have been damaged. The latest date of the sinking of any of these boats (mostly in the Baltic) was apparently 29th November, 1915.

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SHOULDN'T THE ASSISTANT GET SOME CREDIT?

By S. W. B.

SELDOM do we hear a chief engineer say, "My assistants know just as much about this plant as I do." Why don't they say that? Well, in the first place it is quite possible that 90 per cent. of the chiefs wouldn't be telling the truth, and the others would think it unwise to admit it if it were the truth. It is pretty hard for a chief to humble himself before his help.

Chief engineers are good, bad, and indifferent. We have all kinds of them, yet it has been my experience that we can generally divide them into two grand divisions. First—Men naturally endowed with a sense of divining the fitness of things in the order of their occurrence. Second—Men who, because of their superior position on the payroll and by virtue of their titles take great delight in handing advice and remarks to their understudies that they themselves would put on the shelf or ignore as being unnecessary, if personally received from a higher official.

The first class seem to possess the same uniform degree of judgment whether in the act of executing the work personally or superintending it. They have the excellent property of always correctly distinguishing between the right and the wrong way of doing a thing. They have confidence enough in a man who has specialized along a certain line to believe that such a man will, in all ordinary work pertaining to that line, follow the proper tactics in its execution.

The second class are a self-conscious lot. They reason within themselves that, being placed in command of several men, they know more than all subordinates put together. If they feel that they are lacking in knowledge, they proceed to build foundations for themselves when an inspector, manager, or owner is near by "bellowing" at the workers unfortunate enough to be then under observation. I was once under such a man who repeatedly shouted, "Be sure and get that joint steam tight;" "Give that valve another turn;" "If you'd turn that nut the other way it would probably go on;" "Did you put a gasket in there?" "Are you sure the pressure side of that valve is next to the main?" And so forth.

Of course we would submit to his insults though secretly we wished we had nerve enough to stand up and talk to him. Later, when the chief was well away, we would join in a chorus of brainstorms and tell each other what we thought of him.

Such chiefs are also "finnicky" at times. In working with an S-wrench one day bolting up a header I knocked the bolt into the hole with the wrench because it was handier than to get a hammer. Besides, it was light work anyway. The chief saw me do that unpardonable thing and he "lectured" me. "A wrench isn't a hammer," he said. "You should know that by this time." I noted that he was "showing off" to the manager, and so I swallowed it without a murmur.

Another time the chief overheard me ask of a fellow worker, "Where's the big pipe wrench?" He answered, "I don't know." "Sit down, gentlemen," chimed in the boss ironically, "I'll get it for you."

Fortunately, men of this type are rapidly disappearing. The "first division men" are taking their places, and work is being done more smoothly, peacefully, intelligently. The assistant is instructed, not nagged, and that is why, in many of our modern power plants, the chiefs can and do truthfully say, "My assistants know just as much about this plant as I do."

DUPLEX PUMP TROUBLES

IN your January issue a reader asks the cause of steam-driven pumps knocking, and in February you gave the chief reasons. I would like to add what I have sometimes found as a reason. Where more than one operator handles the pumps, if a valve should give out a different person may screw the stem down much tighter than before, or, again, not so tight, making thereby unequal tension on the valve springs. This will cause a knock. I believe it is always best for one man to do the repairs if at all possible.

I would also like an answer to the following question: I am working at a small pumping station, and I have two pumps 14 x 8½ x 12 in. The water is pumped from a quarter of a mile away and then into stand pipes 50 feet high. The suction is 8½ in. and the discharge the same. Both pumps are connected by a tee to an 8 in. main. Is this main large enough? I find when both pumps run more than 35 or 40 r.p.m. they will not do the work.—E.B.

ANSWERS TO READERS' QUERIES

By R. O. Wynne-Roberts.

SUBSCRIBER in a recent issue of Marine Engineering of Canada asks why well water that has been subjected to heat freezes quicker than that which has not been heated; and why does water that has been heated take more heat to bring it to the temperature recorded at the former heating?

The above interesting questions cannot be answered in a few words, but the following observations may help to explain the phenomena. It will be necessary to use the terms "hot water" and "cold water" so as to avoid involved phrases; of course, by "hot water" and "cold water" it is meant to convey the fact that the first has been boiled and the second has not. It is palpable that hot water must become cold before it will freeze.

Common Water Contents

All waters as they come from springs, rivers and lakes contain various gases and salts. Rain water contains the least and certain spring waters have the most of these gases and salts. When water is boiled, the dissolved air and gases are driven out, with the result that some of the salts become insoluble and are deposited in the boilers, kettles, pipes, etc., in the form of lime.

The most important gas is carbon dioxide, which mixed with water converts it into carbonic acid. It is, of course, very dilute and, therefore, harmless. This gas is the same as that contained in mineral water such as in lemonade. The more carbon dioxide contained in water the more lime can be held in solution, causing the water to be "hard." Carbon dioxide is easily driven out by heat, and as the lime then loses its support, it deposits in fine powder and cakes in the boilers, etc.

The freezing point of water is at 32° Fah., but if it contain acid or salt, then the freezing point is lower. I have no data at present to show to what extent carbon dioxide and lime salts act in this way, but in the case of sea water which contains salt of another kind, the freezing point is more than three degrees lower than that of fresh water. Consequently in hot water as the gases and salts have been removed from solution, its freezing point must be higher than that of cold water—if from the same source, hot water then will freeze at

32° Fah., and cold water at a lower temperature, provided the local conditions are alike. Freezing takes place suddenly, as a small fraction of a degree is enough to change water into ice. The temperature of the air round the pipes is often just sufficient to freeze the hot water, but not low enough to freeze the cold water. In any case the hot water freezes first.

There are, however, some other conditions which exert an influence.

Still water may not freeze at several degrees below its freezing point. There may be instances when quiet water has a temperature of ten degrees less than that needed for congelation, yet any change or movement, or the intrusion of a particle of deposit or ice will cause the water to instantly freeze. Cold water, ordinarily, is not in circulation in a building, but hot water must circulate or something will occur; cold water is quite stagnant until the faucet is opened. Hot water is continuously in circulation even until it starts to freeze, excepting in branches where the hot water is stagnant. There is not much sediment in the cold water pipes, but there is some in hot water systems, and, therefore, it will be seen that the conditions are favorable for an earlier freezing in the case of the hot water than in that of the cold water.

Concentration of Salts by Boiling

Another condition is that the boiling of water tends to concentrate the salts and in time the boilers have to be blown out because the salts have become too concentrated. Such water will have a much lower freezing point, for example, if sea water is boiled until the salts are concentrated, the freezing point is lowered considerably. It would be interesting to have statistics as to the frequency of the freezing of hot water heating pipes, hot water supply pipes, and cold water pipes. Concentration of salts cannot take place in a hot water supply system, but it is possible in the case of hot water heating plant.

It is well known that ice cream is prepared by packing ice and salt outside the vessel. The addition of salt to ice causes the ice to melt and the temperature of the water to drop 20° to 30° Fah., thus confirming the statement that salts in solution change the freezing point of water.

If ice be put under pressure it will melt, consequently water put under great pressure has its freezing point lowered, but this does not affect hot and cold water pipes because the pressure in them is not great enough. Acids and salts not only cause the water to freeze at a lower temperature, they also cause the water to boil at a different temperature. The writer hopes the foregoing will be found interesting and clear.

While the bulk of the explanation has dealt more specifically with the freezing feature, it will be quite apparent that the influences at work in that direction must necessarily be correspondingly operative when raising water to a higher temperature.—Ed.

ENGINEERING HUMILITY

By W. F. S.

ARE you a better man than the other fellow whose position you would like to hold? When you are wrong, are you willing to admit that you are wrong, or, do you attempt to "crawl" out of the awkward position into which you got yourself by ceaseless wrangling? Are you a good loser? In case you should be fired to-morrow what would you do or say? Would you have a "fight" with the boss and make your position worse, or would you talk it over with him in a sensible way, meet the inevitable calmly, blaming yourself as much as possible, and blaming the boss as little as possible?

I know an engineer who was told to leave because his services "weren't satisfactory." The boss couldn't give him any definite information as to exactly what was wrong, and so the engineer decided that he was up against "politics." Instead of taking off his coat and offering to fight everybody in sight, this man thought it over carefully, was calm throughout his thinking and talking and finally decided to stay even at a reduction in salary.

The boss wasn't prepared for such humility, and as he didn't really have good grounds for firing the engineer, the outcome was that the latter remained at the same salary which was shortly after increased. The boss has more respect for the engineer now, talks everything over with him, and sort of pals with him, just as bosses should do.

This is no "sure cure" for all troubles. It only illustrates one of the many ways in which troubles can be remedied. Very often men cannot be blamed for "flying off the handle." As a general rule, though, dignified humility and politeness are best.

We all dislike men who "suck around" for a soft snap, as the expression goes; we also dislike bullies. There is a happy medium that we can attain only by careful study of the boss's character and by constantly subjecting ourselves to sober-minded thought.

EMPRESS OF RUSSIA RESUMES HER SERVICE

MUCH significance is attached to the return to the transpacific run of the Canadian Pacific Ocean Services liner Empress of Russia, which was scheduled to sail from Hongkong on March 22, for Victoria and Vancouver.

TIDE RANGES AT PANAMA AND COLON

THE cause of the great difference in the range of tides at Panama and Colon is found in the periodic disturbance of the ocean on account of the periodic differences of attraction of the moon, and to a lesser degree of the sun, upon the waters of the earth, according to the U. S. Hydrographic Bulletin. The tide-producing force of the moon upon a particle of unit mass is the difference between the moon's attraction upon the given unit mass and the moon's attraction upon the entire earth. The vertical components of the attractions of the tide-producing bodies cannot create any sensible disturbance on the oceans; but the horizontal movements oscillating back and forth on the surface of the earth, are effective in the production of the tides, and, by acting upon portions of the oceans that are susceptible of taking up stationary oscillations in approximate unison with the period of the tide-producing attractions, give rise to the dominant tides.

Stationary Oscillation Defined

By a stationary oscillation is meant the kind of motion which is set up in a tank or other artificial vessel of water when one end is raised and lowered at regularly timed intervals. High water at one end of such a rectangular body of water occurs when it is low water at the other end, if the simplest mode of oscillation be under consideration. Between the two ends is a line, styled the "nodal line," along which there is neither rise nor fall, but across which the horizontal motion of the liquid particles is comparatively great. In order that a large and regular oscillation may be maintained, it is necessary that the natural period of the basin of water be very nearly equal to the period of the applied forces, just as a resonator must have certain dimensions if a particular musical tone is to reinforced by its presence.

Of course, the tides at Panama and Colon, being produced by oscillation in strips of two oceans which are separated from each other by a continental barrier, have no connection or mutual influence. Panama is situated at one end of an oscillating strip of the Pacific Ocean, where the rise and fall would naturally be greatest. Colon, on the other hand, is situated on the extension of a well-known nodal line setting out into the Atlantic from the Virgin Island in the Lesser Antilles; and all over the Caribbean Sea the time and range of the tide indicate that this sea is affected by the tide-producing attractions of the moon and sun more as if it were a basin by itself, like Lake Superior, in which the same equilibrium type of tide appears.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

S S "FRANKIER" STRANDING

A FORMAL investigation was held in the Custom House, Halifax, N.S., on Thursday, March 2, 1916, into the causes which led to the grounding of the S S "FRANKIER" on the morning of December 10, 1915, at a place about four miles south of Cranberry Light. Captain L. A. Demers, F.R.S.A., Dominion Wreck Commissioner presided and was assisted by Captain D. C. Stuart, acting as Nautical Asessors. W. A. Henry, K. C., represented the master and owners.

Master's Evidence

The master, John Trattles, deposed that the "FRANKIER" was a steel built, single screw vessel, of 2443 tons net and 3336 tons gross, having triple expansion engines, a speed of 8 knots, and carrying a crew of 27, of which two were certificated officers. She was owned by Messrs. Bryce & Galvin, London, and on 7th December, left Portland with 215,000 bushels of grain, for Dunstan, via Louisburg, it being the intention to bunker at the latter port. The weather met with up to the time of the casualty was squally, with snow and some sea running. No observations for adjustment of the compasses were possible; but the standard compass of Lord Kelvin make, had no more than three degrees deviation. The ship was well supplied with all necessary instruments. He admitted being a total stranger on the coast; that his log, a cherub, was not correct; but he did not know how much the error was. He proceeded along the coast and when he had a glimpse of Cape Sable abeam he fixed his position as being nine miles off.

He remained on deck, on and off untill 3.50 of the 10th, owing to weather conditions being unfavourable. Sometime after passing Cape Sable a light was sighted abeam which he took for Green Island Light, establishing his distance from it at about fourteen miles; but no second bearing was obtained.

Between 2 and 4 o'clock, being on deck, he altered the course of the ship to the eastward several times, finally giving a definite course of NE by E½E. Prior to leaving the bridge, a light which he believed to be Cranberry Light was sighted 3 points on the port bow. He then estimated the distance he would pass off that light, steering NE by E½E at about six miles. At 3.50 he retired to his room and sat on the settee, sleep overtaking him. He awoke at the first bump of the ship on the rocks, and wended his way to the bridge and ordered the engines full speed astern. Soundings were taken around the ship and within it, and when it was discovered that she was making water fast in the fore peak and after the vessel floated off, a course was given for Louisburg, where she arrived without further mishap.

He pointed out to the Court an erasure in the scrap log which had been made, of courses supposed to have been steered between 2 and 4 o'clock, but, notwithstanding this, he confirmed the entries in the mate's log as being correct by affixing his signature. He drew the attention of the Court to the fact that he considered the mate as inefficient.

The second officer, William Barrons, corroborated in part the statements of the master, although a difference existed in his expose of the weather conditions during the watch. He also had words of condemnation of the mate's abilities.

Mate's Evidence

The mate stated that when he came on deck at four he got the course N E by E½E from the 2nd mate; that after a while he estimated that the ship was too near shore and altered the course half a point easterly; but brought her back shortly afterwards to her former course. He also brought her out a quarter of a point and again steered the former course. He said he did not know of bad relations between the master and himself; but there may have been some story telling on board.

Three wheelsmen positively asserted that the ship steered well and was so steered by them. The evidence of one of them, Hugo Manners, particularly impressed the Court. When he relieved the wheel at 4.35 o'clock, he saw the captain standing in the door of the chart room. On this point he was positiveness itself. The look out man said he saw other lights besides the brilliant one, which appeared to him as shore lights.

Second Engineer's Evidence

The 2nd engineer was at his post when the ship grounded. He felt the jar and avers that he had an order from the bridge to stop the engine two and a half to three minutes after the ship first touched. He also entertained a poor opinion of the mate; but the friction seemed purely of a personal nature.

The contradictory evidence was particularly in connection with the state of the weather between 2 and 4 o'clock, or right up to the stranding rather, at 4.45 o'clock. Some said the weather was clear, others foggy, squally, blowing moderate winds, and from heavy to choppy seas, and not much sea.

One of the wheelsmen who was on duty between 2 and 4 o'clock stated that to his knowledge the course was altered six or seven times during that period. On referring to the log no mention is made of such changes, and it is the movements during that period which were effaced from the scrap log.

Court Finding

The evidence obtained, which was of an extremely contradictory nature, and sufficient to awaken suspicion, having been carefuly reviewed and weighed, we find that the master, John Trattles, in his evidence, made many statements which are not in accordance with entries in the log or statements furnished by other members of the crew. He stated that after instituting inquiries in Portland he failed to secure an up-to-date chart, or sailing directions.

We are surprised at this statement in view of the fact that so many Canadian vessels and others sail from that port, and there must necessarily be found, some stores having in stock charts of all descriptions. Failing this, however, had he been anxious to prepare himself to meet conditions on a coast, which was previously unknown to him, such instruments of navigation could have been bought from some of the ships then in Portland.

He admits that his log could not be relied upon, not having studied the tides and their effect on his speed, and having made no attempt to approach the light which he assumed to be Green Island in order to take cross bearings or soundings. After steering various courses between two and four of the morning of the 10th, without keeping count of them as regards time and distances, he chose to lay a course which brought him, or would bring him, at a distance of six miles from Cranberry Head, in a neighbourhood full of hidden dangers. After obtaing a bearing, and only one of the said light, he deliberately left the bridge, the Second Officer remaining in charge of same until he was relieved by the mate at four o'clock, evidently without leaving any special orders for the Mate to be observant and careful, and to report if in doubt.

The master, by attaching his signature to a log which did not include all the facts, showed additional indifference in the navigation of his ship. We note that between the hours of two and four, some entries were made in the scrap log; but afterwards effaced, apparently with a purpose, by some person, whom this Court is unable to locate. The erasing is strikingly visible. The mate's log was written without question as to erasure in scrap log and signed by the master.

The wheelman who took the wheel at 4.25 to allow the other man to get coffee, stated that he saw the master at the chart room door, with his overcoat on. The Court has been impressed by the evidence of this witness owing to its apparent straightforwardness. His statement as to the master's presence at the door at that time surprises us in view of the statement of the master that he had retired to his room and had gone to sleep on the settee, being awakened by the grounding; also the statement of the mate who avers that he had to shake the master and awaken him after the ship had touched. There is nothing to show that the grounding was premeditated; but on the other hand, we affirm that no better methods could be adopted had it been the intention to lose the vessel.

We have noted with interest the master's statement respecting his lack of confidence in the mate, whom he declared to be inefficient. In view of this, the lack of care the master showed in not remaining on the bridge until the change of watches and warning the mate to be very careful and if in doubt to call him, does not strike the Court very favourably.

The Frankier was carrying a precious cargo, which, though consigned to a private firm, would eventually have been forwarded to the Allies. Being entrusted with this we consider he had a double responsibility of great magnitude; it behoved the master therefore to adopt every and all precautionary measures to bring his ship safely to her destination.

For the above reasons we feel it our duty to prevent him from having any further responsibility with respect to this vessel on her present voyage, and therefore suspend his certificate for a period of three months to date from the 3rd of March, 1916, until the 3rd of June, 1916.

Respecting the mate's share in the casualty, we claim that the moment he entertained a doubt as to the ship's position with regard to the land, he should immediately have given the danger he evidently apprehended a wider berth and communicated his doubts to the master, which action would have relieved him of responsibility. Though he felt confident that the vessel appeared dangerously close to land he only made a slight alteration in the course, half a point, and again a quarter of a point, bringing her back to her former course shortly afterwards, she being on that course when she grounded.

It would appear that he did not signal to the engine room to stop the engines until two and a half to three minutes after she touched, according to the evidence of the 2nd Engineer. It is evident that bad feeling existed on board the ship as between the master and second mate, against the mate, whilst the latter, in his evidence had no complaint to make against his associates.

In view of his failing to call the master, and meanwhile adopt means of safety, we hereby suspend the master's certificate, of the mate, Thomas George, for a period of two months to date from 3rd March, 1916 to 3rd May, 1916.

The Second Officer was on the bridge from midnight to four o'clock and we cannot attach any blame to him as he does not seem to have had any responsibilities. He is therefore exonerated, as well as the Second Engineer, who appears to have performed whatever duties were incumbent upon him, in a timely and satisfactory manner.

The Court decided to retain the scrap log, so that it may be forwarded to the Board of Trade, for its information.

S.S. "POTOMAC" STRANDING

A FORMAL investigation was held in the Custom House, Halifax, N.S., on February 28, 1916, into the causes which led to the stranding of the S.S. Potomac at or near a place called Holy Stone Rock, south of Sandwich Point, at the entrance to the harbour of Halifax, on February 19, at about twenty minutes after noon. Captain L. A. Demers, F.R.A.S., F.P.S.A., Dominion Wreck Commissioner, presided assisted by Captain John Fleming and Captain D. C. Stuart, acting as nautical assessors.

Master's Evidence

The master, Ernest Charles Tudway, the first witness examined, stated that he joined the vessel on this particular trip, taking temporary command only for this voyage; that his vessel was a steel built, single screw schooner rigged ship, carrying a crew of 37 men all told. The third officer possessed no certificate.

The "Potomac" is of 3565 gross and 2471 tons net, has an average speed of 9 to 9½ knots, and is equipped with triple expansion engines; her mean draft leaving England was 24 ft. 3 ins. She left Middlesborough on January 29, bound to Galveston, U.S.A.,via Norfolk, with a cargo of creosote Her compasses were adjusted just before leaving, and showed no deviation on N. to E. courses. She was owned by the Anglo-American Oil Company.

During the trip across the weather was boisterous and head winds were encountered. On the morning of the 19th February, fog was encountered and the vessel's speed reduced to comply with regulations and the deep sea lead was used. When Pennant Buoy was sighted, full speed ahead was given, and he rounded the Halifax Lightship, basing his action on the sound of its fog horn. Later, at about 11.09, the engines were put slow, and at 11.20 Chebucto Head fog horn was heard. At that time he estimated the distance of the ship from that point at about 1½ miles, and a course N. by E. was set. The third officer was making frequent casts with the lead. At 12.18 he made land a little on the port bow; also rock on the starboard bow, and the helm was put hard to starboard, simultaneously with the order full speed astern. The ship grounded 1½ minutes afterwards, and remained fast until 9 a.m. on 23rd February.

Immediately after grounding orders were given to run creosote from the forward to the after tanks, whilst the engines were going full speed astern until 2 p.m. He stated that he had very few occasions on which observation could be taken to check the compass courses; that on the NE. course the compass had not been checked. On referring to the deviation book, we note that N. 5 E. and N. 10 E. have 6° and 7° easterly error respectively.

He averred that when off Chebucto, a horn was heard on the port side, sounding two and three blasts; he kept sounding his whistle and proceeded. His excuse for not stopping to await the coming of a pilot boat was the anxiety he was laboring under in view of the falling of the barometer, and his shortage of coal, having but one day's supply on board; also he passed a black and two red buoys which to him indicated that he was in the War Channel, therefore in safe waters, and with the expectation of meeting the examining boat, he was under the impression that similarly to the regulations adopted in English waters, the examining or patrol boat would have the pilot on board.

He volunteered the information, or the theory that his compasses may have been affected by the tossing the vessel had received crossing the Atlantic, thereby expressing an uncertainty as to their reliability. Owing to the fact that he had but taken command of the "Potomac" for the one voyage, he could not enlighten the court as to the time or interval it would require to bring his vessel to a standstill from slow ahead—four miles—with the engines going full speed astern.

He admitted that he established his distance from Chebucto Head, $1\frac{1}{2}$ miles, on one bearing of the fog whistle when it was abeam. He took no other bearings or noticed them. The tide was ebbing and he could not therefore positively assert that his vessel was going 4 or $4\frac{1}{2}$ miles through the water. He further stated that from the time of the grounding until the vessel floated off, nothing was omitted or neglected to release her from her dangerous position.

Second Officer's Evidence

The second officer was next examined and his evidence corroborated the statements of the master that only one bearing was taken of the sound of Chebucto Head fog horn: that he heard some fog horn on the port bow, concluding that it was a sailing vessel southward bound. Immediately preceding the stranding, he perceived a white streak on the port side which as discovered was snow capped hills, and also a rock on the starboard bow; that upon realizing the situation he told the master to have the helm hard astarboarded, which suggestion the master adopted and executed, and the telegraph was put full speed astern. When the ship grounded, he proceeded with the rest of the crew to empty the forward tanks after having sounded the ship.

The two look-out men were then examined, both 17 years of age. They had very little sea experience and their evidence was, therefore, of no importance.

Other Officers' Evidence

The chief officer stated that he was on the forecastle head getting the starboard anchor swung out in readiness to be let go, and therefore did not see the land. The third officer stated that he was in the chains sounding continuously and had obtained from 22 to 14 fathoms, the latter a moment prior to the grounding; that he had measured the lead line and thought it was correctly marked. He holds no certificate: but was placed in charge of a watch alone when the weather was fine, otherwise the master kept watch with him.

The chief engineer very intelligently described what was done when the order full speed astern was received, and stated that such order was executed without loss of time, his assistant and himself both being at their respective posts; that the engine room personnel worked like trojans during the trying episode. He vehemently affirmed that discipline was carried out and that the best relations existed between the deck and engine room staff. Further witnesses were not called, the evidence adduced being deemed sufficient upon which to arrive at a decision.

Finding

Having carefully weighed the evidence adduced, the Court cannot come to any other conclusion than that the master allowed but one thought to occupy his mind, viz.: that of bringing his ship to port as quickly as possible, owing to shortage of fuel, and ignored the following elements of prudence:—1st, By proceeding without waiting for a pilot when he was on their ground; 2nd, by making sure of a distance from Chebucto Head, which was obtained by a single bearing of the sound of the fog whistle; 3rd, by making too positive of the correctness of a compass which had scarcely been checked during the passage across. We note by his deviation book that on the course N. by E. there was found a deviation of 7° east, which was not considered. Had it been applied, his course should have been N. by $\frac{3}{4}$ E., no allowance for leeway being necessary, as there was a very light wind.

Being a stranger to these waters and to the harbor of Halifax, he most decidely showed a lack of judgment in attempting to make a strange port under such adverse conditions. The plea that possibly a current set him ashore cannot be for a moment entertained, nor the fact that he saw three buoys, which to his mind and understanding marked the War Channel. He failed in trusting his distance to sound only. When passing the lightship, had he brought it in view, his position to a certainty would have been obtained.

Further, had he based his position to be $1\frac{1}{2}$ miles from Chebucto Head, steering the course N. by E. he would have passed within half a mile of the automatic whistle and gas buoy, providing his compass was correct. When it was not heard, he should have circled around till the sound of its whistle and the sight of the buoy had been obtained. Apart from the above mentioned principles of prudence he should have stopped his vessel off Chebucto Head and awaited the coming of the pilot boat, which delay would not have affected his shortage of coal. The fact that through stress of weather, his coal ran short causes the Court to deal with him leniently, and therefore we will not interfere with his certificate. We severely reprimand him for his temerity and lack of prudence and judgment.

Counsel called the attention of the Court to the system prevailing here, of having sailing vessels instead of steamers to convey pilots back and forth from the ships. While admitting the criticism to be plausible, that a steamer would perform the transfer of pilots with more rapidity, yet in cases where the master of a ship chooses to keep going on instead of laying to, the adopting of the means suggested would be of little use. The evidence does not show that the officers failed in the performance of their duties, hence they are exonerated. The scrap, deck and engine room logs and deviation book were kept with a degree of care and precision.

The Court deprecates the idea of placing on the look-out two boys with practically no sea experience, incapable of realizing the importance of their duties. We understand, however, the difficulties that ship masters are encountering in finding crews owing to war conditions and for that reason will not criticize any further the actions of the master on this head.

PANAMA CANAL SUSPICIONS

THERE is an uneasy feeling that the closing, or continued closing, of the Panama Canal is not due to "natural causes," says the Practical Engineer of London, England. The waterway has now been closed since the beginning of October, except for a few small ships allowed to pass. The first estimate of reopening was Nov. 1, the second estimate was about Jan. 1, and finally came the gushingly worded announcement, that although there is now a free way for ships they will not be allowed to pass. The reason given is that they could only pass by delaying the work of the dredgers, and that it is in the best interests of all to keep the dredgers at work till they have made a satisfactory clearance. The cause of the suspicion is that some ships bound for Vladivostock with war supplies for Russia are held up in the Canal and that it is to the German interest to prevent them from getting through.

This fact would not in itself carry us far, but there are other facts which give color to it. In the early months of the war, when it was thought that the United States would take sides against Germany, threats were made in open print that Germans would block the Canals. These threats were taken so seriously that special military guards were put on. A further cause of uneasiness is that Germany conducts a campaign of arson and murder quite regularly in the States, and although it is quite evident—in many cases it has been proved in court—that the cost of the campaign comes from German State funds, an elaborate pretence is kept up that the crimes are committed by irresponsible enthusiasts. The Canal delays, therefore, call for explanation. The obviously fair thing is to let the waiting ships pass through as soon as possible and the unfair thing is to keep them waiting by giving out time-to-time promises.

Series of Practical Questions and Answers for Engineers

By "Artificer"

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals will be found a useful companion study. With a view to meeting the need of many of our lake and inland waterway engineers who, during the closed season of navigation, take positions in steam power plants ashore, questions relative to the latter department will also find a place in the series.

Question.—Enumerate some considerations which are worth while being taken account of when raising steam and indicate why?

Answer.—See that there is sufficient water in the boiler before the fire is lighted. Do not force the fire when getting up steam, but let it burn slowly, so as to heat the boiler gradually. If the water is cold take not less than about three hours to raise steam in a small boiler and twice as long in a large one. If for special reasons it is necessary to hurry, less time may be allowed, but if steam is raised too quickly, the boiler will be strained and wear out quickly.

* * *

Question. — Without refering to a table, how can I change a decimal measurement to fraction as thirty-seconds, sixty-fourths, etc., and vice versa?

Answer.—To change a decimal to an equivalent fraction whose denominator is known, multiply the decimal by the required denominator and the integral part of the result will be the numerator of the fraction; thus .375 to sixty-fourths =

$$.375 \times 64 = 24.000 \text{ or } \frac{24}{64} = \frac{3}{8}$$

Again to change .0469 to the nearest sixty-fourth

$.0469 \times 64 = 3.0016$ or a shade over 3-64.

To change a fraction to a decimal, divide the numerator by the denominator and proceed to the desired degree of accuracy: Thus, what is the decimal equivalent of 7-64?

$7 \div 64 = .109375.$

* * *

Question.—What steps should be taken to empty a steam boiler, say, for interior inspection and cleaning-out purposes? Is it good practice to employ the "blow-down" method, if time and circumstance are immaterial? If these are important—as they often are, and "blowing-down" has to be resorted to, what precautions should be adopted?

Answer.—Do not draw the fire, but allow it to burn out, and keep the fire-door and damper shut until it has done so. Do not empty the boiler by blowing the water out, but let it cool with the water in; the water can afterwards, if necessary, be run or pumped out. The steam may be very gradually blown off at the safety valves and, if necessary, the man-hole door may afterwards be taken off to expedite cooling off. Do not take the mud-port doors off until the boiler is thoroughly cooled. Do not put cold water into the boiler to cool it, either by running-up or by pumping. If sufficient time cannot be allowed for the fire to burn out and the boiler to be well cooled down before it is emptied, the fire may be drawn and the water blown out. Care should be taken, however, to have the furnace plates, bars and bridges as cool as possible, and the steam pressure lowered to 50 lbs. per sq. in. or less. It is better not to blow out quite all the water, but to leave a little in the boiler bottom, which can be run or pumped out when the cooling is thoroughly effected later.

* * *

Question.—How is the total heating surface of a return tubular boiler set in brickwork reckoned, and what would it amount to in a boiler 66 inches diameter by 15 ft. long, and containing sixty 3½-inch diameter tubes?

Answer.—The lower half of the boiler shell throughout its length and the surface of all the tubes constitute what is known as the total heating surface in this type boiler. The shell heating surface amounts to one-half the shell circumference in feet multiplied by its total length also in feet. Thus, 66 inches shell diameter, which is 5.5 feet, will have for half circumference

$$\frac{5.5 \times 3.1416}{2} = 8.6394 \text{ feet.}$$

8.6394×15 feet length of shell will give 129.59 square feet, or total shell heating surface.

The tube heating surface is the circumference of the external diameter of one tube in feet multiplied by the length of tube also in feet and again multiplied by the total number of tubes.

The circumference of one 3½-inch tube in feet is found thus

$$\frac{3.5 \times 3.1416}{12} = .9163 \text{ feet.}$$

We divide by 12 because the multiplication of the two upper quantities gives result in inches. Total tube heating surface $= .9163 \times 15 \times 60 = 824.67$ sq. ft

Adding together the shell and tube heating surfaces, we get $129.59 + 824.67 = 954.26$ sq. ft. as the total heating surface of the boiler.

* * *

Question.—Define the principles by which a refrigerating unit accomplishes its purpose, and indicate briefly the cycle of operations involved.

Answer.—We compress by means of external force a gas or vapor and extract its heat to diminish its volume. Again, by causing the compressed gas or vapor to expand, we lower its temperature. Heat is next absorbed by the gas or vapor, and the latter resumes its original condition. Continuity of this cycle of operations maintains the refrigeration effect.

* * *

Question.—We find Corliss valves fitted to steam engines in many power plants. What are their advantages over a slide or piston valve, and what are the disadvantages in comparison?

Answer.—Corliss valves reduce the port clearance to a minimum, give practically a full steam admission opening and sharp clean cut-off instantaneously, permit of water of condensation being drained off through the exhaust ports, are adaptable to close governing, and give independent exhaust valve adjustment. The principal disadvantage lies in the number of revolutions obtainable per minute, these being limited to 150 probably as a maximum, due to the uncertainty of the trip gear engaging and disengaging properly.

* * *

Question.—What are the usual arrangements of Corliss valve gears as found in good stationary steam engineering practice?

Answer—a.—Gears without trip motion, the valves having a positive connection with the eccentric, the valve travel being constant, and the point of cut-off invariable. This arrangement is not much used.

b.—Single eccentric gears with trip motion, the steam valves not being positively connected to the eccentric, but being opened by trips or catches against the resistance of a dashpot and released at some point of the engine stroke, determined by the governor or otherwise.

The exhaust valves are positively connected to the eccentric and receive, therefore, a constant movement .

c.—Double eccentric gears with trip motion, the steam valves being connected and operated in the same manner as those of the single eccentric with trip gear. The exhaust valves are, however, driven from a separate eccentric.

* * *

Question.—Why are the tubes beaded on the rear head of a return tubular boiler, and need they be so on the front head as commonly found in practice?

Answer.—The tubes are beaded on the rear head because their thin edge projecting beyond the plate into the combustion chamber is removed a considerable distance from the water in the boiler, comparatively speaking, and meets the gases from the firegrate before they have transmitted their high temperature heat sufficiently to ensure against the tube ends becoming red hot, burning and loosening the effectiveness of the tube expanding.

They need not be beaded on the front head, because by the time the gases reach there, their temperature is, or should be, reduced on economical grounds, to a point below that of danger of burning. Further, the gases are passing out instead of coming in and impinge less hurtfully on the tube edges. A reason, however, for beading on both front and rear heads is that as no stay tubes are fitted, additional rigidity is secured beyond mere "rolling" or expanding. Stay tubes when fitted are screwed into each head and distributed at lesser or greater intervals of general tube spacing, according to steam pressure carried.

* * *

Question.—Why is the return tubular boiler set in brickwork so much in favor as to be generally installed in factories and industrial plants?

Answer.—Because it is cheap to construct, therefore a low first cost to its owner. It compares favorably with other types in economy, efficiency, and lasting qualities, if properly designed, constructed, operated and cared for.

* * *

Question.—What are understood by the terms exhaust lead and exhaust lap, as applied to steam engines?

Answer.—The terms exhaust lead and lap apply to the slide and piston valves of a steam engine in their middle position on the cylinder valve face, when showing in the former case the ports to cylinder and exhaust pipe open to each other, and in the latter case closed to each other something beyond the "clipping" amount.

* * *

Question.—What is the effect of exhaust lead?

Answer.—Exhaust lead permits of an earlier release or escape of steam and a later compression or closing of steam passage to the exhaust pipe, at the end of the cylinder from which the piston has come and to which it is going in each case respectively .

* * *

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* * *

Question.—How is the surface of a bearing reckoned and why?

Answer.—The surface of a bearing is found by multiplying the diameter in inches by the length in inches. Example—A 3-inch diameter shaft running in a 6-inch length bearing would be reckoned as having 18 square inches bearing surface. The reason for the diameter being used in the calculation instead of the circumference is that the pressure is not exerted all round the bearing, but only top and bottom, front and back, as the case may be, and on either one alone at a given time. The effective surface to take this pressure is one-third of the circumference, and one-third of the circumference is equivalent to the diameter, hence the use of the latter in the calculation.

* * *

Question.—What is understood by the expression "duty" as generally applied to steam engines?

Answer.—By "duty" is meant the fuel economy or work accomplished on a given expenditure of heat. It is a recognized standard of performance, and like the 33,000 foot pounds per minute horse-power standard, originated with and was established by Watt. Three methods of duty rating have been employed; the third, however, is that most generally adopted. They are as follows:

1—The number of pounds of water lifted one foot high by the consumption of 100 pounds of coal.

2—The number of pounds of water lifted one foot high by the consumption of 1,000 lbs. of steam. This latter quantity is taken as the equivalent of 100 pounds of coal, each pound of which is reckoned as evaporating 10 pounds of water into steam.

3—The number of pounds of water lifted one foot high by the consumption of 1,000,000 heat units; this total being the equivalent of 100 pounds of coal, each pound of which will impart 10,000 heat units to the water in the boiler, or whose evaporation from and at 212 degrees Fah. is 10 pounds of water per pound fuel.

The work done in foot pounds is expressed as the area of the pump plunger (corrected for area of pump rod), multiplied by the gross pressure against which the pump is working (measured by pressure gauge on the rising main plus the pressure due to height of gauge above surface of water in well), multiplied by average length of stroke of plunger in feet and multiplied again by the total number of single strokes the pump plunger makes during the trial.

The total number of heat units consumed is found by multiplying the aggregate weight of feed water supply to the boiler or boilers by the total heat of the steam at the working pressure, reckoned from the feed water temperature as a basis and making any necessary corrections for moisture or superheat.

* * *

Question.—How much coal is usually required for banking fires over night, and for raising steam to full working pressure at starting time in the morning?

Answer. — The accompanying data were secured from boiler plant tests, but for this reason the coal burned is perhaps less than the average day-in and day-out amount. "Run of mine coal" was used in the tests.

H.P. Boiler.	Type Boiler.	Banking Coal lbs.	Firing Up Coal lbs.
40	.....H.R.T.	17	...
40	.....H.R.T.	202	...
40	.....Marine	101	...
60	.....H.R.T.	131	...
70	.....H.R.T.	80	270
150	.....H.R.T.	0	800
200	.....Marine	0	785

* * *

Question.—How does steam used for heating purposes in a system where the returns are fed direct to the boiler-feed water pumps compare with that of a receiver?

Answer.—If the whole exhaust is used for heating, then a receiver provides a manner of storing the condensation until it is required for feed-water purposes. Where only part of the exhaust is used for heating, the receiver is of little and even questionable value.

* * *

Question.—What is the equivalent valuation of sawdust or shavings in terms of coal used, if both are fed together to a steam boiler furnace?

Answer.—Much will depend upon the quality of the coal and the character of the wood from which the sawdust and shavings are obtained. A plant large enough to justify separate furnaces for each would prove the more economical method of operation, as the respective furnaces could be adapted to each kind of fuel, instead of being otherwise a compromise.

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EDITORIAL CONTENTS

LAKE MARINER SHORTAGE

IN the realm of shipping as in those of the farm and the workshop, labor scarcity is causing considerable anxiety. Canadian marine interests find the situation meantime so acute, that to protect themselves in the matter of the coming season's business on our Great Lakes, a recruiting office for mariners must needs be established in Toronto at least. Bottoms are of course much less plentiful than in pre-war years, due to so many lake craft having been transferred to ocean and ocean coasting services, nevertheless, it appears that crews are still less plentiful, due to enlistments for overseas service in one or other of the many battalions organized or in process.

Prospects for season 1916 are particularly bright for lake freight transportation, and as many contracts have already been negotiated, it is but reasonable to infer that a shortage in crew complement will not only prove a serious handicap in taking full advantage of the season's activities, but is likely to involve shipowners in losses more or less large. As we understand the situation, the shortage is largely that of sailors, the deck officers and engineers being for the most part again available. Sailors have their place of relative importance on every ship, and a considerable degree of competence in the discharge of their multifarious duties is required, on which latter account we can readily appreciate the vessel owners' present anxiety.

In previous years, with the imminence of navigation opening, vesselmen were always on hand for the preparatory outfitting period, but an equally romantic appeal to that of seafaring has "got them," no doubt largely because of novelty in combination with the prevailing fervor. The chances, we think, are favorable to the men being secured, although the "new hands" are likely to be much more numerous than usual. Judicious distribution of the latter among what will be available of the "seasoned" men will, therefore, be a sine qua non in any transportation accomplishment achieved.

INTER-EMPIRE TRADE

AS a result of her development as a manufacturing country, Canada, at the present moment, is probably the most highly favored of all the British Colonies with respect to future participation in inter-Empire trade. South Africa and Australia are so isolated geographically that their progress in manufacturing has heretofore been limited. In addition, the smallness of their home markets, the high cost of factory equipment, and the comparative scarcity of raw materials and fuel, have militated against their industrial upbuilding. There has, however, always been available to our manufacturers, all the materials and conditions necessary to the development of a manufacturing industry on permanent healthy lines.

Manufacturers throughout Canada are alive to the importance and desirability of securing a share of the Empire's requirements in manufactured products, commensurate with our now proven ability to produce. The present stages of development attained by the two colonies mentioned, closely parallel the state of Canadian development some years ago, when agricultural and allied interests overshadowed all other activity. There, as well as here, however, the war has stimulated home production in many lines to a degree which must not be overlooked by our people in the near future.

For years to come Canadian conditions will favor the production here of many articles, affording our manufacturers the opportunity of building their reputation on solid foundations. What these foundations consist of must be clearly recognized by us, even as they are beginning to be recognized by competitors abroad—"Uniformity of quality and regularity of production are conditions absolutely essential and fundamental to success in any manufacture"—and in no case we might add is the necessity more vital than in export work.

Marine News From Every Source

"Dalhousie City" Fitting Out.—The steamer Dalhousie City is being fitted out at Port Dalhousie for the opening of navigation between that port and Toronto on April 1.

Port Arthur, Ont.—The steamer Rosedale, of the Canada Steamships Line, is being overhauled and fitted out for the Transatlantic trade at the Western Drydock and Shipbuilding Co. plant.

Kingston, Ont.—Soundings are being taken in Kingston harbor by the Public Works Department, in preparation for extensive improvements to be made in connection with the deep waterways scheme.

Sarnia, Ont.—Activity on the local water front is gradually increasing. The owners of the many freighters and lake boats tied up here have started fitting out, to be ready for the opening of navigation, which is now only about six or seven weeks away.

Repairs to "Saronic."—The Northern Navigation Co. has started a $25,000 repair job to the forward cabins of the steamer Saronic, which were badly burned last fall at the time the steamer Majestic was destroyed. The boat will be ready to go into commission next month.

British Merchant Shipping.—The total net British mercantile tonnage on register at the end of 1915 was 12,416,408 tons, as compared with 12,119,891 at the end of 1913. This statement was made in the House of Commons on March 9 by Reginald McKenna, Chancellor of the Exchequer, in answer to a question on the subject.

Sarnia, Ont.—The Grand Trunk Railway, which operates the Port Huron & Duluth Steamship Co., will this spring build a 1,200-foot freight shed at Point Edward, to take the place of the one burned a year ago at Port Huron. A large elevator will also be constructed at the Point this summer, to replace the one destroyed two years ago.

Sarnia, Ont.—President Livingstone, of the Lake Carriers' Association, has announced that the 111 large steamers enrolled under that association will have a new system for filling the drinking water and cooking tanks this summer. The system will include an independent sea cock, independent pump and piping with steam jet connection to the sea cock for sterilization purposes.

Vancouver, B.C.—The Dominion Government steamer Quadra, an old vessel engaged in the fishery patrol and lighthouse service, and worth about $80,000, was cut down amidships by the Canadian Pacific steamer Charmer, Captain Campbell, in a collision on the afternoon of February 26, while the Charmer was leaving Nanaimo harbor. All the crew got off safely.

Halifax, N.S.—The Halifax Graving Dock Co. is making another addition to its plant by building and equipping a floating electric welding plant. The outfit will be a complete one on a barge, and will generate its own electricity. It will be able to go alongside of a ship anywhere on the waters of the harbor. The equipment is also designed for building up weak plates in a ship's hull.

Vancouver, B.C.—The British Columbian Fisheries, Ltd., will sell their entire plant and equipment, including buildings, machinery, tools, refrigerating plant, sawmill and machinery, fertilizer plant and equipment, power plant equipment, steam trawlers and scows, etc. Tenders will be received up to April 15, 1916, and full particulars may be obtained from James Keppel Ball, Yorkshire Building, Vancouver, B.C.

Actions Over Collision.—Action arising over the collision between the Allan Line steamer Pretorian and the American Hawaiian steamer Kansan, which occurred off White Point Light, in the lower St. Lawrence, September 15, 1915, were entered in the Admiralty Court Montreal on March 3. The Allan Line claims $82,000 from the owners of the Kansan, and the latter, in a counter-suit, demand a similar amount from the owners of the Pretorian.

Vancouver, B.C.—Plans and specifications for the car ferry slips at Patricia Bay and the temporary transfer facilities at New Westminster for the Canadian Northern Railway's barge service between the Mainland and Vancouver Island, are expected to arrive from Toronto shortly, according to Mr. McLeod, general manager of the C. N. R.. The contract for the slips and for the barges and tugs will be let before Mr. McLeod leaves for the East. A contract for a $20,000 trestle has already been let.

Lake Boats for Coast Trade. — The wooden steamer Gettysburg and the barge Alexander Anderson have been purchased by McCormick & Moore of New York, and will be taken to the coast shortly after the opening of navigation. The boats have been operated in the lumber trade, and were owned by Burns Bros., of Detroit. The price is not stated. Other lake vessels have been recently purchased by McCormick & Moore for coast trade.

Sarnia, Ont.—A contract for refloating the overturned steamer Charles S. Price has been awarded to the Great Lakes Towing Co., of Cleveland, Ohio, by the underwriters. The Towing Co. will get $9,000 or a percentage of the value of the boat, underwriters' option, for the job. The life of the contract is limited to 12 months, and, according to the terms, the wreckers are to salvage and deliver the steamer, righted, at a port for repairs.

S.S. "Matutua" Fire.—At the inquiry on March 23 into the death of Captain Gilham, who lost his life on the ship Matutua as a result of a fire in her carbide cargo, five of the longshoremen said they had smoked pipes or cigarettes in No. 2 hold. When the fire broke out one was sitting on an automobile case smoking. The coroner's jury found that the captain's death was due to suffocation, but made no finding as to the origin of the fire.

Purchasing Lake Freighters.—It is becoming more and more evident that the traffic on the lakes this year will be much heavier than usual, and in anticipation of this the Canada Steamship Lines are said to have bought up every freighter they could lay their hands on and suitable for the lake routes. Several boats plying out of Ogdensburg have already been acquired and some of the boats that were not in use last year for passenger purposes are being fitted up to be put on routes this year as business prospects are good.

New Freighter Launched.—A steel bulk freighter constructed for the Geo. Hall Coal Co. of Ogdensburg, N.Y., was successfully launched from the Wyandotte yards of the Detroit Shipbuilding Co. on March 11. The new steamer will be known as the George L. Eaton, and is to be used in the coal trade on the lower lakes and St. Lawrence River. She is of full Welland Canal size, 244 feet long, 43 feet beam, and 20.5 feet deep. Her carrying capacity is about 3,000 tons.

Liners as Freighters.—The big passenger steamships Lapland, Baltic and Adriatic, of the White Star Line, will be used exclusively as freight carriers until April 12 at least, according to the International Mercantile Marine Co. announcement on March 1. The steerage accommodation on the vessels has been removed, thus adding cargo space for approximately 2,000 tons more in each. The Lapland was scheduled to sail from New York on March 8, the Baltic on March 15, and the Adriatic on March 29.

Canadian-Built Submarine Activities.—A cable has been received from Sir John Scott, a high official of the British Admiralty, giving expression to the excellence of the ten submarines which were built in record time in Canada and sent across under their own power. These have been doing excellent service in all the war zones. The E-7, which recently made such a phenomenal record in the Sea of Marmora, where it operated for twenty-four days and sunk twenty-three ships, shelled land fortifications, railroad embankments, ammunition trains, arsenals, etc., was one of the ten boats built in Montreal.

International Mercantile Marine. — Unofficial reports in circulation on March 21, placed the net earnings of the International Mercantile Marine Co. for the calendar year of 1915 at $41,000,000. Another report that the earnings were $43,000,000 could not be confirmed. It was said in well-informed circles that about $12,000,000 would have to be allowed for taxes out of the $41,000,000 earned. There will be no war tax on the earnings of the American Line and none on the income from the Holland-American Line stock owned by the International Mercantile Marine.

Lake Vessel Orders.—During the week ending March 11, the American Shipbuilding Co. booked orders for three steamers for ocean service for 1916 delivery, and all berths at lake yards for this year have been taken. "The three ships ordered recently," says President Farr, "make twenty-six vessels we have under contract for delivery in 1916 and 1917. Nine of the boats are for lake trade, and seventeen will go to salt water as soon as they are completed. All the salt water boats will come out this season, but three of the lake steamers are for 1917 delivery."

The Doty Engine Co., has been incorporated at Ottawa with a capital of $100,000 to carry on the business of iron founders, mechanical engineers and manufacturers of machinery, tool makers, brass and other metal products. Head Office to be situated at Toronto. Incorporators, J. S. Lovell, W. Bain, and J. J. Dashwood all of Toronto.

Quebec, Que.—Tenders for freight shed and grain galleries, will be received at the Quebec Harbour Commissioners' Office, Pointe-a Carcy Wharf, Quebec, up to April 15 next. Plans and specifications of the contemplated work may be seen at the Harbour Engineer's Office, Pointe-a-Carcy Wharf. St. George Boswell, Chief Engineer

February Vessel Losses.—An official communication issued on March 2 concerning marine losses says: "British wrecks reported to the Board of Trade in February aggregated sixty-nine, involving a loss of 420 lives. Included in the wrecks were forty-two steamships of a total tonnage of 56,856. Ten of these steamers were sunk by enemy warships with a loss of thirty-six lives; five by mines with a loss of 176 lives; one by a mine or submarine with a loss of eight lives, and one by bombs from a Zeppelin with a loss of thirteen lives. Of twenty-seven sailing ships lost, six were sunk by enemy warships."

Claims Against "Storstad."—By agreement between counsel representing claims in the Empress of Ireland vs. s.s. Storstad case, the total liabilities so far filed of $3,575,429.31 have been reduced to $2,888,238.01. W. Simpson Walker, K.C., Deputy Registrar of the Admiralty Court in Montreal, Que., is proceeding to give awards on the various claims, deciding which claims hold priority and the percentage to be paid on such, out of the $175,000 for which the s.s. Storstad was sold, following the court's finding that she was responsible for the sinking of the C. P. R. liner Empress of Ireland.

Passengers on Lake Freighters.—Great Lakes marine interests see an end of the practice of carrying passengers on lake freighters in a recent order of the Department of Commerce requiring boats carrying passengers to be especially constructed. The order was given according to the provisions of the Seamen's Act. It is understood that this rule will be strictly enforced by local inspectors of steam vessels. The rule is also interpreted to prohibit masters from permitting their wives to accompany them aboard ship. Protests against such interpretation of the rule are expected to come from the Shipmasters' Association and its auxiliary. The vessel owners say they will leave it for the captains to decide whether they will carry their wives or not.

"Empress of Fort William" Sunk.—The Empress of Fort William has been destroyed by a mine off Dover while going to the rescue of the P. & O. liner Maloja. She was owned by the Canada Steamship Lines, and was built at Newcastle-on-Tyne by Swan, Hunter & Richardson, in 1908, for the Canadian Lake trade. She was 250 feet long, 43 beam and 25 feet moulded depth, with a cargo capacity of 3,440 tons. The steamer had been continuously employed in the Upper Lakes coal, ore and grain trade, but last summer was engaged in the Gulf of St. Lawrence coastwise trade. At the end of the St. Lawrence season she was fitted out for the British coastwise trade and left Montreal for Manchester late in November, and had since been employed between the United Kingdom and continental ports on time charter. She was commanded by Capt. W. D. Shepherd, of Aberdeen, Scotland, and her chief engineer was J. Undall, of Montreal. There were no other Canadians in the crew.

Shipyard Extensions in Britain. — In various parts of Great Britain provision is being made either for immediate or for future extensions of shipbuilding yards and ship repairing works and dry docks. Several very interesting available sites have been examined, and one which is likely to create much interest in certain quarters, is that adjoining the the entrance to the New Dock of the Alexandra Dock Co., of Newport, Mon. Another one adjoins the yards of the Ardrossan Shipbuilding Co., near Glasgow. It is also announced that the Caledon Ship-building & Engineering Co. are negotiating with the Dundee Harbor Board for the acquisition of a site for the purpose of extending their yards.

St. John, N.B.—The transportation of Canadian supplies from the port of St. John will be hindered to an appreciable extent by the sinking by an explosion of acetylene gas of a vessel at the C. P. R. dock in the harbor here, according to a statement made in the House of Commons on March 13 by Hon. J. D. Hazen. He said the vessel, which was loaded for Australia with motor cars, carbide, paper and other such commodities, had fortunately contained no war supplies. The explosion was supposed to be due to the ignition of acetylene gas, formed by the combination of the carbide in the vessel's cargo and water which was poured into it to extinguish the fire which had started in the hold. The captain had been killed and the vessel had sunk. Mr. Hazen said it was feared the accident would render the C. P. R. dock in question useless for the balance of the season.

Port Arthur, Ont.—The icebreakers on March 26, were making good headway and it is expected they will cut a channel to the open water of Lake Superior by the end of the month.

Vancouver, B.C.—The Dominion Government has approved the plans of the Amalgamated Dry Dock & Engineering Co., which will build a drydock and shipbuilding plant on the North shore. It will include a graving dock, buildings, marine railway and equipment, etc. J. L. Davidson is manager.

Lachine Canal.—Finding that none of the manufacturers using Lachine Canal water for power had urgent repairs to make to their under-water plant, Dennis O'Brien, superintendent of the Canal, announces that the Department has decided to wait for another year before emptying the Canal in order not to deprive of power for some weeks many factories busy on war supplies. The emptying of the water would still leave ice so thick that it would have to be cleared away before necessary repair work could be done.

Montreal Harbour Development. — Under a Federal Act passed some time ago, the Harbor Commission of Montreal are entitled to loans from time to time from the Government to defray the cost of increased facilities for handling the growing trade of the port. The Government recently authorized a small advance to provide for the continuance of the work under the statute. An Act passed in 1914 authorized the making of advances up to a total of nine millions, which was stated at that time to be sufficient to meet the requirements of the port till 1918. Only a part of the total has been advanced. Previous legislation in 1910 and 1912 had provided for advances up to $12,000,000.

Toronto Harbor Commission. — A $700,000 programme has been outlined by the Harbor Commission in connection with next summer's work. The work in Ashbridge's Bay and at the Humber will be continued, and, in addition, the work of transforming the old harbor will be commenced. It is also announced from Ottawa that a permanent head line has been established in the harbor, from Bathurst to Yonge Street. The plans provide for the establishing of a 17-acre industrial area at the foot of Bathurst Street, which will be served by 800 feet of dock and 20 feet of water. There will also be modern freight sheds and a factory building. In connection with the new windmill line, the railways have waived their riparian rights between Bathurst and York Streets and the companies will join the commission in an application to the Government for approval of the new pierhead and bulkhead lines, and the Harbor Commissioners will receive the patents to the new lots lying between pierhead and bulkhead lines, Hon. Mr. Rogers and Hon. Mr. Hazen both having signed them.

S.S. "Pilot" Stranding.—An enquiry into the accident to the steamer Pilot, of the Quebec and Levis ferry, which was carried ashore at Red Island by ice floes on January 17 last, was held at the Court House, Quebec on March 24. Captain L. A. Demers, Dominion Wreck Commissioner, assisted by Captain Koenig and Captain R. L. Demers, conducted the investigation. The chief officer of the wrecked steamer, Arthur Dechesne, the first mate and two other members of the crew were examined. Their evidence was to the effect that while making a scheduled trip from Tadousac to Riviere du Loup the Pilot was carried by the ice on to the beach at Red Island, where she still rests. The enquiry was concluded and judgment is to be rendered in Ottawa shortly.

DOMINION LINER "ENGLISHMAN" SUNK

THE steamer Englishman, of the Dominion Line, has been sunk, according to Lloyds. It is stated that thus far 68 survivors have been accounted for. The last record of the vessel shows that she sailed from Portland, Maine, February 17, for St. Nazaire and Avonmouth. The Englishman was a vessel of 5,257 tons and was owned by the Mississippi & Dominion Steamship Co., of Liverpool. She was built in 1892 at Belfast.

The 68 men reported saved, in the opinion of the owners constituted most, if not all, those aboard the steamer. The Englishman was commanded by Captain Morehouse, and has been coming to Montreal for many seasons. She was one of the best of the regular cargo liners coming to that port, carying many valuable cargoes from there last year.

1916 LAKE SHIPPING PROSPECTS

PROSPECTS for a fruitful season for the owners of freight boats on the Great Lakes during this year are very bright, according to Harvey C. Beeson, publisher of Beeson's Marine Directory, Chicago. Charters have been granted by individual owners which extend into the early portion of 1917 for the carrying of iron ore. The average tonnage of this ore in previous years has been forty-seven million tons, but this year contracts have been let calling for the delivery of sixty million tons during 1916. According to Mr. Beeson, all available tonnage has been chartered by the big concerns for this year's trade.

Boom in Shipping

"The situation on the Great Lakes has become phenomenal," said Mr. Beeson. "In the first place iron ore has been contracted for as early as the first of last December that will occupy the entire tonnage of the lakes. Some of the charters extend into and include the first half of 1917. The rate of charters is ten cents higher per ton than last year's rate and the total volume to be moved is said to be, after careful consideration, 60,000,000 tons, therefore vessels carrying iron ore will have gross receipts of $6,000,000 more this year owing to the ten-cent rise.

Many Ships Building

"The United States Steel Corporation have chartered all available iron ore tonnage besides their own fleet of ten ships, and they have under construction seven steel steamers of the 600-foot class and other large iron interests are building four others of the same class. There are also in the shipbuilding yards for 1916 and 1917 delivery twenty-eight vessels of Welland Canal size or under, for Norwegian and Swedish owners principally, and a few for Boston parties. It is now impossible to place orders for new boats for delivery under two years. These conditions are partly due to the inability to set a price on ship plate."

PANAMA CANAL REOPENING

OFFICIAL prediction was made on March 15, that the Panama Canal will probably be re-opened for the passage of ships of thirty feet draft on April 15. This prediction was in the form of a statement by the Washington office of the Panama Canal as follows:

"Conditions in Gaillard Cut justify prediction that the canal will be available for ships of 30 feet draft on April 15, subject to probable temporary delays thereafter to meet exigencies of dredging fleet in completing canal to full width and depth and in removing shoals that may possibly develop."

The canal has been closed to navigation since last September on account of the slides at Gold Hill and in Gaillard Cut. While several vessels of light draft have passed through during the past month, it was not until March 15, that canal officials ventured any prediction as to when they thought the canal would again be ready for use by the world's merchant shipping. During January reports were spread that the canal would be ready for traffic by February 15. At that time official announcement was made that these reports were without foundation and that conditions were then still too uncertain for the authorities to make any predictions as to the probable date when the canal would be opened.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

John Martin, for forty years an Allan Line official, died at Liverpool on February 24.

F. Orr Lewis, president of Canadian Vickers, Ltd., has returned to Montreal after an extended visit to England.

Captain William Beasley, aged 75, of the maritime contracting firm of Beasley Brothers, was killed at the Deep Water terminals, Halifax, on Feb. 24, when he was accidentally struck by a sling load of cargo and thrown from the pier to the deck of a lighter.

The Dominion Marine Association will open an office on the Yonge Street wharf, Toronto, Ont., for the purpose of securing hands for the freight and passenger steamers on the Great Lakes. The office will be in charge of Capt. James McMaugh, a retired master of the Chicago & St. Lawrence Navigation Co.

Captain James Block, a veteran lake navigator, died at Port Credit this month at the age of seventy-six. During the fifty years which Captain Block sailed Lake Ontario he never lost one of his crew. He sailed such boats as the Ann Brown and the Defiance, and for a number of years sailed between Toronto, Port Credit, Oakville and Hamilton.

F. T. Jane is dead. He was well known as a writer on naval matters and the author of "Fighting Ships," an annual which is known and used in every navy of the world. Mr. Jane was also the inventor of an extremely ingenious naval war game. For many years he practised as a press artist, giving particular attention to vessels of war. Many articles from his pen and many ship portraits from his brush have appeared from time to time. Mr. Jane, who was only in his forty-sixth year, died quite suddenly.

Collingwood No. 3, N.A.M.E. have elected and installed the following officers for the ensuing year:—President, John Osburn; vice-president, Geo. H. Finn; 2nd vice-president, William Malcolm; secretary, Robert M. Quade; asst. sec'y., p. pres. William Rennie; conductor, William Tymon; doorkeeper, Wiliam Neil: auditors, Geo. H. Finn, Wm. Rennie; treas., p. pres. J. L. Smith.

LICENSED PILOTS.

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston. Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street. Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio
Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

THE SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

GRAND COUNCIL, N.A.M.E. OFFICERS.

A R. Milne, Kingston, Ont., Grand President.
J. E. Belanger, Bienville, Levis, rand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John. N.B., Grand Secretary-Treasurer.
J. W. McDeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I., Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

Halifax, No. 13, N.A.M.E.—At a meeting held on January 12, at the Queens Hotel, all the retiring officers of last year were re-elected for another term by a unanimous vote. They are as follows: President, Robert Blair; 1st vice-pres., M. G. Doyle; 2nd vice-pres., W. A. Case; sec'y-treas., Chas. E. Pearce; door-keeper, L. B. Church; auditors, John D. Clark, Sydney J. Hill; sick com., Wm. A. MacDonald, Alex MacLeod.

A. S. Maynard has been appointed to the important position of purchasing agent for the Canadian Pacific Ocean Services. Mr. Maynard is well qualified for his new duties, having been for a number of years in the purchasing department of the Canadian Pacific Railway, rising to the post of chief commissary agent. He will now handle equipment and supplies for both the Atlantic and Pacific fleets of the company with office at the Windsor Station.

Captain L. B. Gilham, a young Englishman, died aboard his ship, the New Zealand liner Matutua, in a second outbreak of fire on that vessel on the morning of March 13. The body was found in a cabin, and its position indicated that he had been overcome while trying to reach the door. This outbreak was attended by several explosions of calcium carbonic in the holds. One sent flames up through the deck, surrounding the cabin, where the captain, worn out by his fire-fighting of almost twenty-four hours, was asleep. His escape was cut off. The fire first broke out about midnight, March 11, and was fought all night and all the following day, being apparently fully subdued ere night came. The second outbreak came early on the morning of March 13, and so serious was it that it was decided to open the valves and gradually the ship was submerged. The Matutua was ready for sea.

1916 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	[illegible] T. G. Blewett,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy.	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jeamue Mancy Street	O. L. Marchand,	278 Clark St.
Victoria,	6	John E. Jeffcott,	Esquimault. B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall,	Midland. Ont.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Qne.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Blandon,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John McLeod,	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. E. Wilson,	P. O. Box 204	Roy N. Smith,	Box 178
Halifax,	12	Geo. McDonald.	319 11th Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	29 Parrsboro Street	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	Alfred Roebuck,	22 Kent Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

John Flook, one of the best known marine contractors in Western Ontario, died suddenly on March 26, at Chatham, Ont. For nearly a half century he had been a contractor on pier and breakwater construction. He had worked along the river and lake sections and was widely known. He was born in Howard township seventy years ago.

Capt. J. Lem Crossley died recently on board of a British ship of which he was the commander, at a port in South America. The announcement briefly stated that Captain Crossley had died on board his ship. The name of the steamer was not given, but it is supposed that she is engaged in the service of the Imperial Government. The letter stated that death was due to injuries. Captain Crossley was one of the best-known deep sea captains in Canada, sailing many large steamers out of the ports of Halifax, St. John and Montreal. He was born in Hants County, N.S., and followed the sea practically all his life.

CANADA STEAMSHIP LINES ANNUAL

THE reports submitted at the second annual meeting of Canada Steamship Lines, showed an entirely different condition from that which existed at the end of the company's first year of operation. The substantial improvement in affairs was attributed partly to higher freight rates, and partly to the ventures on the Atlantic Ocean and also to the vigorous application of economy throughout the system by the management.

The president, in his address, pointed out that the scarcity of tonnage all over the world, caused by the war, the bountiful crops of Canada and the return of more prosperous conditions of Canada's industries were the principal factors in expanding the operations of the company's field. In this connection, however, it was pointed out that the improved conditions referred to only began to show tangible results in the closing months of the year 1915, the spring and summer business having been below normal. As far as the future was concerned the directors were of opinion that the outlook for the year 1916 is promising and warrants the fullest confidence in the success of the company's undertakings.

The operating account, as well as the general statement of assets and liabilities which were submitted to the meeting, showed a marked improvement in the company's position and, this, with the outlook for the current year, resulted in the report being enthusiastically received by the shareholders. As was pointed out, it was hardly to be expected that the company would make such rapid progress during the ensuing twelve months' period. The operating account shows comparative revenues for 1914 and 1915.

	1915.	1914.
Vessels	$7,399,818.66	$6,272,232.86
Docks and wharves..	165,707.20	193,388.62
Miscellaneous	174,884.04	78,929.21
	$7,680,409.90	$6,544,550.69
Other revenue	94,624.58	41,259.84
Total revenue	$7,775,034.48	$6,585,810.53
Expenses	6,042,977.08	5,667,773.63
Net earnings	$1,732,057.40	$ 928,036.90
From which deduct:		
Int. on mort. bonds.	$ 140,201.54	$ 166,230.47
Int. on deb. stock...	317,585.30	285,234.42
Funded debt exp....	....	5,622.23
Other interest	85,276.39	10,252.36
Res. for deprec......	476,937.91	455,630.18
Reserve for doubtful debts, claims, etc.	35,000.00	50,000.00
Directors' fees	14,906.66	15,000.00
	$1,069,905.80	$ 987,969.66
Profit for year......	662,151.60	....
Net loss	....	59,922.76

The surplus account as at December 31st, 1915, is as follows:

Profit for year ended 31st December, 1915, as per operating account....	$662,151.60
Deduct:	
Loss on Sales, etc., of fixed assets..	3,971.44
Proportion of following charged off:	
Organization expenses	65,835.64
Discount on debenture stock.......	1,028.34
	$ 66,863.98
	$ 70,835.42
	$591,316.18
Deficit as at 31st December, 1914..	$570,432.59
Surplus as per Balance Sheet	$ 20,883.59

CANADIAN VESSELS FOR BRITISH USE

THE Dominion Government has passed an Order-in-Council, under the War Measures Act, prohibiting vessels over 500 tons from trading between Canadian and foreign ports other than ports in the United States except by license.

The prohibition becomes effective April 1, and all vessels failing to obey the new regulation will be subject to forfeiture.

This action follows upon a step taken some months ago by the Imperial Government for the purpose of conserving British registered shipping for British carrying. The Order-in-Council provides that "all Canadian registered steamers whose gross tonnage exceeds 500 tons are, from the first day of April, 1916, prohibited from proceeding on any voyage excepting voyages from a port in Canada to a port in the United States and vice versa unless a license to do so has been granted to or in favor of the owners or charterers of such steamships."

Authority is given to the Minister of Marine and Fisheries, Hon. J. D. Hazen, to appoint a licensing committee for the purpose of granting the licenses, "which may be general in reference to classes of ships or their voyages, or special." It is understood to be the intention of Mr. Hazen to appoint the Deputy Ministers of Marine and Fisheries, Naval Service and Trade and Commerce and the Commissioner of Customs to act in this capacity.

There are something over 300 vessels on the Canadian register of the tonnage affected in the new order, but of these there are a number on the Great Lakes, trading between Canadian and United States ports, and these are excluded from the prohibition.

S.S. "PORT DALHOUSIE" SUNK

THE British steamship Port Dalhousie, 1,744 tons, has been sunk at sea, presumably by a German submarine. Seven members of the crew were landed on March 20.

The Port Dalhousie was owned by McLelland Bros., Kingston, and some of her crew were Canadians. The steamer created a record by steaming down the St. Lawrence last year with a cargo of grain for Liverpool on December 13, the latest date at which a ship of her burthen has used the river route.

The last report of her movements was her departure from Swansea, Wales, on February 10 for Dunkirk, France. She was 250 feet long, 1,744 tons gross, and was built in Newcastle England, in 1913.

Ice Breaking on St. Lawrence. — The Government steamer Lady Grey arrived at Three Rivers from Quebec on the afternoon of March 24, and immediately commenced breaking the ice above the city.

Gauge Glass Adjustment.—If gauge glass fittings are not quite in line, the glass may be bent slightly near one end to bring both ends true with the fittings. A gasoline blow torch may be used to heat the glass, which should be turned in the flame, care being taken not to get the glass so hot that it will run, bulge, or lose its shape. Extra heavy glass is best for the purpose, a piece of wood being put into one end as a handle to avoid burning the fingers. Place the torch near the fittings which are to receive the glass, so that if the bend is not right on first trial. the glass may be reheated before it has time to cool. When right, allow the glass to cool before putting it in place or the contraction when cooling will break the glass and spoil the job.

Stellite.—Stellite is not steel, it contains neither iron nor carbon, but is an alloy of chromium molybdenum and tungsten. It is entirely unaffected by any degree of heat that can be generated by cutting, and, it is claimed, will maintain its edge at speeds which no high speed steel can stand, as well as be used on materials which high speed steel will not cut. Stellite must be held in a tool holder as it is of a brittle nature.

"COLONIAL JOE"—SAILOR AND LANDSMAN

By Capt. Geo. S. Laing

A MAN who has worked at the diamond mines in Kimberley and at sheep farming in Australia, besides bossing coolies in Singapore and Borneo, has some claim to the above sobriquet. Such a man was Joe. Fullerton, wanderer, sailor and landsman turn about. At the Panama Canal operations Joe thought that he had better scramble over the Pacific and get a berth on the Yankee ditch in case the thing fell through as it had done many years ago under the De Lesseps management.

When the war broke out, Joe said in his dry humor, "Canada next and join the home boys." So the first contingent from Toronto carried our Joe, and what he found in the Old Country and eventually his fortunes in France are here related.

Joe Fullerton had been born in London, England, under circumstances that were so unhomelike that at the age of thirteen he had stowed away on a sailing ship bound for Cape Town. It was the old story of a broken home through a father's drinking habits, then when mother died under the misery and shame of such environment, Joe thought it was no sin to desert the thing known as father.

During all his wanderings he had never written "home" because he wasn't sure whether he possessed one or not. This much he did know and it sometimes troubled him—one younger brother and a sister were put in some institution out of their father's charge, but he had never been able to get news of them and now they must be about twenty-five and twenty-seven years of age respectively.

Might he see his brother and sister when at Salisbury Plains? As for the father, he had very likely passed through the corner's hands long ago, and as he had never imbued his offspring with a parental love, the ordinary reciprocal cords of humanity between parent and child had never existed.

Joe was a favorite with the boys, whether it was in camp, at drill, or on furlough. Having led an outdoor life in different climates, Joe was a pretty husky guy, and while he was a rough and ready creature his moves were manly and his motives good. Having learned from the cradle the effects of booze, and having had many a tearful lecture from his long departed mother, our hero had gone through his perambulations without lowering his strength with liquor.

One soldier would say to another, "Where the dickens has Joe Fullerton not been? He seems to be familiar with all parts of the globe." As for a handy man, Joe was the factotum miraculous, and from herring-boning a nail rent in a pair of pants down to opening a pickle bottle or a can of beans without the necessary tools, why, Joe was "it." It is good for the Empire that thousands of Joe's class are now in Europe. They have come from all countries under the sun and war at home was the only magnet on this earth that drew them from their foreign and colonial lairs.

Of course on the boat going over the ocean, Joe was nursing a few sick men whose stomachs had not had previous dealings with Father Neptune's domains, and let me tell you that freinds whom you make in such a way are not likely to desert you later. After landing at Plymouth and doing a few weeks of drilling on Salisbury Plains, Joe found himself in one of the most embarrassing and yet joyous and hopeful positions of his life.

Having confided to a particular soldier friend the ups and downs of his life and the initial circumstances that led thereto, Joe had, after some persuasion, advertised for his long missing brother and sister, and had fruitful results. His sister, Dolly Fullerton, her identity fully established by repeated correspondence, is about to arrive at the nearest railway depot and see her big brother.

"Colonial Joe seems to be doing some tall thinking," said one soldier to anather as the train was signalled. One of Joe's sea-sick chums was with him and as the unusual circumstances were known to him, the man naturally felt that he would stay in the background until beckoned on. Joe was to identify his sister by her "blue blouse with red rose in it," but even with that as a "first aid to the injured," Joe felt uneasy.

Here comes the train. Joe, unaccustomed to introductions at any time, feels his position acutely, and asks, as his companion steps back, "Will I kiss her?" To this question his chum answers, "Huh, if you don't kiss your own sister once on each cheek and hold one hands in her's while you embrace her with the other for at least a minute I'll desert you."

The passengers are pouring out of the train and poor old Joe has already spoken to a dozen women with his childlike eyes of tenderness. After all he was not the spotter, for before he could practise his chum's orders on any girl, a sprightly damsel with charming clothes and genteel bearing was hugging and nose punching Joe till he nearly fell to his knees with the impact. In the tears that ease the heart in joy as well as in grief, Dolly Fullerton was trying to say, "I knew you at once, my dear brother, by mother's face."

What a meeting this was. A volume of words could not depict the heavenly bliss of this brother and sister meeting at the depot. Dolly was in the country's service too, although she had decided not to come in her nurse's uniform to meet her brother. The younger brother was at that moment in the trenches in France, so the Fullerton family were not slackers by any means. No one knew anything of the father. He apparently had gone under in the current that engulfs his class and dashes them into eternity unmourned.

After Joe had signalled for his chum and presented him to Dolly the trio went to lunch at a nearby hotel. A lenient officer was approached later in the day, and a two days' furlough was given Joe so that he could accompany Dolly back to London and meantime glean more news of the veiled happenings in each other's lives.

Two days passed like two hours, and Dolly with melted pearls on her rosy cheeks, was saying good-bye to her resurrected brother. "We must pray that we will all meet after the war and extract from this life a little of the kinship love which was so ruthlessly torn from us in childhood." This love for a sister had made Joe dumb for the moment but any proposition that Dolly propounds is assented to.

In due course Joe was drafted to France while Dolly remained at her work nursing in one of the many military hospitals near London. Naturally Joe half expected to meet his brother in some way or other and before many months had passed the brothers did meet; but alas, the meeting was one of bitter anguish.

Dolly's description of the younger brother to Joe had been so perfect that recognition was easy, and besides did not Tim have his mother's looks and Tim's mail had also told him that big brother Joe had come to life. Joe had been frequently in the firing lines and was accustomed now to the harrowing scenes and noises resulting from the enemy's fire.

One night when Hell itself could be likened to a picnic, part of a front trench had to be evacuated by our brave boys. Joe was in the second line and with others was ready to make a charge. It was just getting daylight and it could be dimly discerned that two or three staggering and rolling figures were attempting to get to safety. Pure madness when you think of the chances taken, but Joe had to go and try to save one poor fellow who was within a hundred feet of the parapet.

"Colonial Joe" was dragging back to safety what was left of a human being and in a minute the two half rolled and half fell into the trench. Some lively counter-motions of the line had kept Joe's part of the trench comparatively quiet for the brief minutes that had elapsed in the bringing in of the wounded man. "Who is it? My God! it's our Tim—my brother and Dolly's brother. He has crossed the river."

Joe's chum who had met Dolly was only a few yards down the ditch and he was asked to come and look upon this youth before he was carried to the rear by the stretcher crews. "Is that a brother of mine?" asks Joe. The Canadian friend looked at Joe and mumbled in a choking voice, "It's Dolly's Tim and the brother that you were never allowed to love."

A brute thought can be excused at a time like this, and Joe says quite audibly, "If there's any fighting in the open this day a few Germans will be short of breath before I ring off. Going out to carry your own dead in after a life of banishment is not easily understood."

Joe is earning a rest behind the danger zone now and is writing to Dolly. With angelic fortitude this brave girl accepted the toll of war. Other girls had lost brothers but oh, who knows how much she would like Joe to come through unscathed. And as we let the veil down on the Fullertons to-day, everyone who knows of the peculiar circumstances surrounding their lives will fervently hope that "Colonial Joe" is allowed to live after the great war and cheer up his bereaved sister.

KING CHATS WITH SKIPPER

THE King's sailor experience enables him to appreciate the work of mine sweeping and submarine hunting performed by the skippers and crews of the small craft that scour the waters of the North Sea, and recently he paid a visit to a boat which had the good fortune to do a piece of work that probably saved a transport from attack, says a London despatch.

"When we got back into harbor," the skipper relates, "I got to know the King was coming, so we made the boat look a bit smart, and presently who should come along but his Majesty and Prince Albert, a lord and an admiral, and some more. I was all of a shake when they came alongside the quay, and the admiral said: 'Your Majesty, this is the ship, and that is the skipper.'

"Then the King stepped aboard. 'Skipper,' says he, quite nice and friendly, 'I am very pleased to meet you. I am very proud of you. You are a brave man, and so are all your crew.' Then he shook hands.

"I 'majestied' him at first, but when he called me skipper I just 'sirred' him, and he seemed pleased. He put his hand on my shoulder and walked with me forward, congratulating the crew, and having a look around.

"'Now, skipper,' said his Majesty, 'I should like to see where you sleep,' and down we went into the cabin.

"'It's a very nice little place,' said the King, and then he says to me, 'Which is your bunk, skipper?' 'This one, sir,' and there was a nice counterpane and pillow case. The King felt it and said, 'Very nice and comfortable, too; you can sleep well there.' Then he asked me how we lived, and I said, 'Champion in the Navy.' The King shook hands with us again on deck and then left."

A PEN FOR ENGINEERS

THE desirability of making notes, records, etc., in ink instead of pencil is a practice which is constantly growing amongst mechanics, power engineers and others. The element of permanency is much in its favor but the necessity for ink supply, etc., occasionally is against its adoption. Many skilled tradesmen, however, include a fountain pen in their tool kit, and recent developments in self-filling pens will tend to increase the custom.

A pen which will appeal to users of this class has been placed on the market by the Laughlin Mfg. Co., Detroit, Mich. This instrument is self-filling and is conspicuous for the absence of external mechanism.

The barrel is made in two halves which when drawn apart, expose a pressure bar. A slight pressure of the finger on the bar compresses a collapsible ink tube, which when the pressure is released fills itself through the penpoint. When the barrel is closed again the appearance of the pen is that of the familiar middle-joint type.

A feature which appeals to hard users is the safety point inside the non-breakable cap. When the cap is screwed on the point section, an internal shoulder is tightened against a small flange on the end of the point section. By this means, any leakage due to rough handling or other extraordinary treatment is safely confined, and all trouble due to leakage is eliminated.

This pen is made in a variety of styles and sizes suited for all classes of work.

Amyl acetate is an ideal paint stripper. Although generally too costly for the purpose, its high solvent properties and low vitality enables it to remove paint and varnish with ease.

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Power Driven Machine Tool Equipment on Board Ship*

By J. H. Thomson

While a regularly constituted workshop, more or less extensively equipped with machine and hand tools and appliances, is far from being a novelty aboard ship and more especially so in the case of the larger size war vessels, the fact remains that little progress has been made in the direction of providing merchant ships with at least a modest installation of power-operated apparatus that would successfully cope with a large percentage of the repair and overhaul work incidental to sea-going service. The subject matter of this paper makes evident that a power-driven machine tool equipment is worth while for many reasons.

IT might be thought that in the present age of machinery, there would be little need to plead for up-to-date power-driven tools for executing the everyday mechanical work on board a modern steamship, yet the majority of ships will be found deficient in this respect, many possessing no power-tools whatever, others only a nondescript lathe put on board with considerable disregard of the probable requirements, size of ship, etc., and of the large range of work which can be economically carried out, if given suitable and suitably equipped tools.

Any repair that can be efficiently carried out on board ship, by the ordinary staff, without entailing the neglect of other duties and without entailing any overtime work, will cost considerably less than ashore. The enormous saving in time would in some cases avoid the ship being detained in port, and owing to the quickness and ease with which work can be done, the machinery will be kept in better repair, as the ship staff will have more time to devote to it.

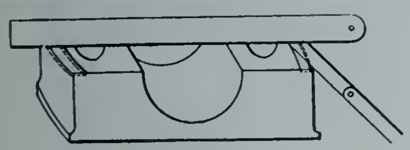


FIG. 1.

Stripping a Bearing

To take a simple illustration of every-day routine work:—Suppose a 3 in. diameter by 2 in. wide bearing wants stripping, the amount of metal to be removed—ascertained in the usual way by leads—is 25-1000. It could be put in the lathe, the amount required taken off to within 1-1000, a true plane surface left, parallel with the opposite plane surface of the bearing, or parallel with the bearing itself as may be required, sharp edges and rags removed—all in well under a half-hour, with a minimum of physical labour by anyone with a slight knowledge of turning.

In the vise, with a good file, the same job would take from an hour to an hour and a half and given a good tradesman, he might have the required amount off to within 3-1000 and in that time have an approximately plane surface, nearly parallel with the other surface of the bearing. With a poor tradesman however, there might be 5-1000 or more of error in the parallelism of the two surfaces. It should further be remembered

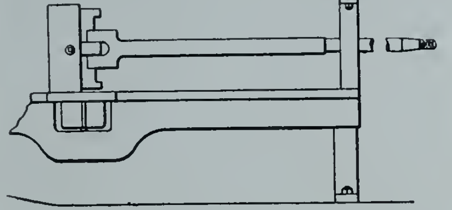


FIG. 2.

that such a job has often to be carried out in an engine-room at a high temperature. Doing the job in the lathe is more or less a pleasure to the engineer, and he is practically as fresh after its completion as he was before he started. Doing it in the vise is mere mechanical drudgery, and the engineer is wet with perspiration, and has lost a considerable amount of energy.

A simple method of taking off exactly the right amount of metal in the lathe might be given. Face up only about a quarter or less of the surface to be stripped, until, when laying a good straight edge across the old surface, the required feeler will just slip in between the straight-edge and the new surface, after which the remainder of old surface can be faced down to the same plane (see Fig. 1).

As illustrating a common repair, the valve-spindle of a steam stop-valve is

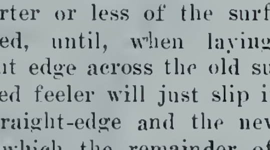


FIG. 3.

broken on the day of sailing. With a power-driven lathe on board, and a small stock of various sizes of brass rod, such a spindle could be replaced in about four hours, possibly less if it so happened that there were any old valve-spindles on board which could be worked up for the job. Without a lathe and with the necessity to send the spindle ashore to be made good, the time lost may be anything from a half-day upwards.

Equipment Minimum

The minimum power-driven tools advocated on board a ship are a lathe, a drilling-machine, and a high-speed grinder. These tools should be so arranged that each can be in use simultaneously. It will be most convenient if the three machines are grouped together, so that all may be driven off the one counter-shaft, fitted in the usual way with driving and loose pulleys. For driving the counter-shaft an electric motor complete with starting switch, etc., will be required, the power of the motor depending upon the size of the tools that it is proposed to instal; one of 2½ horse-power should be ample for all ordinary requirements. A point which might be considered is whether the motor might not be fitted so as to be capable of assisting the lathe gearing in getting the required

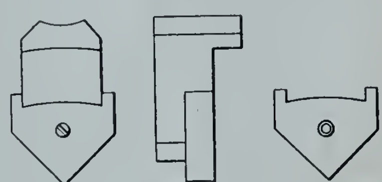


FIG. 4.

slowness of speed for turning a job of large diameter; such a job being of infrequent occurrence, there would be no objection to running the countershaft temporarily at a reduced speed. Getting the lathe to revolve slow enough is sometimes a bit of a problem on board; it can occasionally be solved however, by running the dynamo at a reduced voltage.

The Lathe

It is difficult to fix definitely the size of the lathe that should be fitted on board ship, and the point should be one that will bear discussion. The suggestion is put forward that the aim should be to have a lathe which, with the gap removed, would be capable of dealing with the high pressure junk-ring, the high pressure piston being the one which usually gives the most trouble from wear, etc. The length should be capable of

*From a paper read before the Institute of Marine Engineers recently.

dealing with any of the main-engine valve-spindles, not that it is thereby implied that the valve-spindle should be accommodated between the lathe centres. It will generally be sufficient if, by the aid of a fixed stay (Fig. 2), that part of the spindle which works through the neck bush, stuffing-box, gland and guide are capable of being efficiently dealt with.

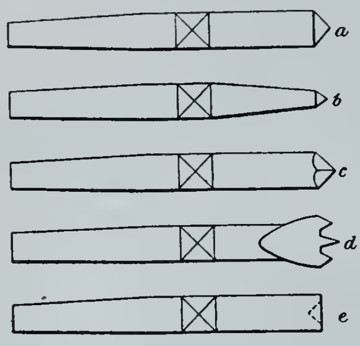


FIG. 5.

Space in a ship for a lathe of such size is not always obtainable, but with a little contriving it should be managed, except in very small boats where the length may require consideration. A suitable position in a turbine-driven ship is often found in the shafting compartment which usually extends right across the engine space; there the lathe, drilling-machine, and grinder can be ranged along the ship's side, using the ship's frames for the purpose of attaching countershaft brackets, motor, etc. The forward starboard side is usually the more suitable, thus leaving the ends of the shears clear for any extra long job to overhang, this point should also be kept in mind if the lathe is placed in the engine-room, as one often sees the end of the shears close up against the ship's skin, which renders the turning of a long job impossible.

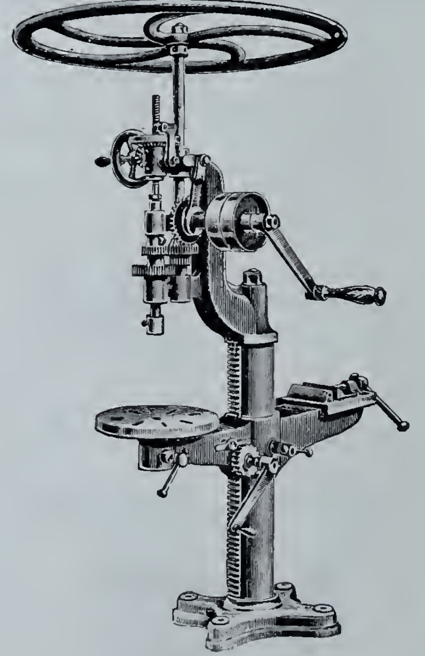
If the space is so limited that the end of the shears cannot be left clear, then they may abut on a hold or bunker bulkhead, which can have a circular hole cut in it in line with the lathe centres, such hole being made water-tight with a covering plate. This means that a time must be selected for doing any job which is extra long, when the bunker is clear of coal, or the hold of cargo. It may be mentioned that such a hole, by bolting a suitably shaped piece of wood to it, may be utilised as a fixed stay.

There is one point that must on no account be lost sight of in selecting a position for these tools. The space selected must be well ventilated, and cool enough at all times, even with steam on the main engines and the ship in the tropics, for a man to work in comparative comfort. The speed at which the ship's lathe can be driven requires more consideration than it usually gets; for seeing that there is only the one machine, it stands to reason that it should be capable of a very much larger range of speed than would be the case in shop practice. Thus, if the suggestion that the lathe should be capable of dealing with the junk-rink be accepted, then it follows that the lathe-spindle should be capable of being driven from a speed suitable for turning a small-diameter brass pin; and if the suggestion made later-on regarding the supplying of one or two emery wheels for use in the lathe be carried out, then the lathe-spindle should be capable of a higher speed still—say 1500 revolutions per minute—which is suitable for a 14-in. diameter wheel.

Cutting Screws

The ship lathe must be capable of cutting screws of all the standard pitches, and it may require to have one or two odd wheels for bastard pitches, if the engine-builder happens to be one of those who use bastard threads—a practice resorted to in order to compel the user to come back to the maker for renewals. The usual compound saddle-rest is required with cross-feed, etc. Quadrant should be marked off in degrees. The moving head-stock should have a cross-adjustment for purposes of alignment or turning up tapers.

A suggested fitting for the moving head-stock which would be of great use



DRILLING MACHINE WITH DOUBLE SWING BRACKET.

is a drill-chuck. This would be attached to the moving cylinder of the head-stock, the boring of holes in work which is attached to the running spindle being of much more frequent occurrence than of that in which the drill is attached to the running spindle. Drills are sometimes supplied capable of being placed in the taper hole which holds the fixed centre or a special drill-holder; but the practice is not good, as the hole gets damaged, and so renders the fixed centre shaky or out of alignment. A suggestion for a holder is given in Fig. 3, which is self-centring and free from shake, and can be detached by drawing in the cylinder by means of its screw, when the holder

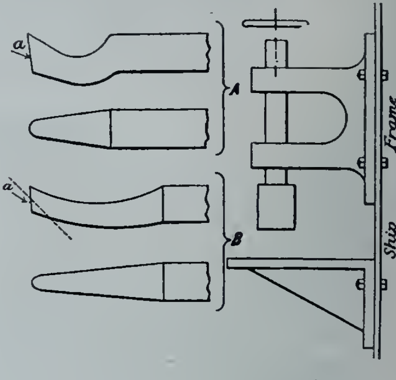


FIG. 6. FIG. 7.

will abut on the barrel, and be forced off; a sunk feather is fitted to the holder, engaging in a keyway on the under side of the cylinder end.

The attachments for the running spindle will consist of:—One large face-plate for use with gap removed; one face-plate for use with gap in place; one driver-plate for driving work held between the centres; and one chuck with four independent dogs, each having three steps, and capable of being reversed, and holding circular work securely when they are so. A shortcoming of most dogs is that they will not very readily catch small work, say, of ¼ in. diameter.

In Fig. 4 is shown an attachment which will be found useful in this connection. Any one wishing to adopt it should make a wooden pattern a neat fit for the dog, and get four forged off it in tool steel; then true up one flat surface of the forgings and fit them to the dogs, making sure when boring the holes and fitting the pins that the strain when screwing up the job will not come on the set-pins. The set-pins will last better if they are also made of tool steel.

After the forgings have been fitted to the dogs, true up the sides of the V-shaped portion until the four points meet in the centre of the plate. The dogs lie in a true circle, and the sides of the V-shaped portions form true radii of a circle. The front faces of the segments may be faced up with the chuck running on the lathe spindle. The V-shaped portions should not come to absolute points, but be left about 1-16 in. wide; a small rack, consisting of a piece of ⅛-inch plate with four tapped holes to take the set-pins, is desirable to hold pins and segments when not in use.

There should also be supplied one drill-chuck which will hold the drills supplied to the ship; this may be one of the numerous small self-centring grip chucks, or a chuck with a plain parallel hole, say 5/8 in. in diameter, if the drills are, as is very common, forged from 5/8 in. round tool-steel bar; one fixed stay, which can be bolted down to the lathe shears; one running stay, which can be attached to the saddle—those with adjustable metal dogs are more useful than those requiring the fitting of various size wooden blocks; one hand-rest for wood-turning tools.

Fig. 5 shows the lathe centres required. These consist of two ordinary pointed centres; one ordinary pointed centre with end of reduced diameter for small work; one cutting centre; two or more driving centres for wood-turning, and one hollow centre (optional). A list of tools follows, those being of ordinary form, 1/2-in. or 5/8-in. square-section of common tool steel, this latter being selected, as the many special self-hardening steels require an experienced tool smith to deal with them. Tools made of such steel could be dressed ashore, but there is always the possibility of them getting broken when away from port and requiring to be redressed by the ship's staff.

Tool List

The tool equipment should include three ball-point roughing tools, two for iron, one for brass; two right-hand side-

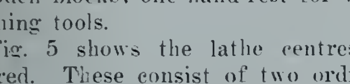


FIG. 8.

cutting tools, one for iron, one for brass; two left-hand side-cutting tools, one for iron, one for brass; one spring scraper; one right-hand knife-tool; one left-band knife-tool; two Whitworth standard-thread screw-cutting tools, one medium, one small, both being dressed as right-hand tools; three parting or square thread-cutting tools, of width, say, 1-12 in., 1/8 in., 1-6 in.; five inside screw-cutting tools to correspond with outside screw-cutting tools; the smaller size V-thread and 1-12 in. square thread to be capable of cutting a thread in a 1/2-in. hole. In the event of the shifting head-stock not being fitted to hold drills, one drill-holder suitable for fixing in the tool-rest, and a set of inside and outside combs should be supplied.

Other tools may be added from time to time as may be required, but with the foregoing outfit any ordinary job can be tackled. In getting tools made or dressed for ship's use, it should be remembered that they will be principally used for light duty—that is, taking a light cut or skimming off work that has been previously machined, and they can therefore be dressed of lighter shape than would be the case for shop work; further, the facilities for grinding tools on board being usually of the most crude description, the under side of the tools should be cut well back, so that there may be as small a surface of steel to grind as possible. At A, Fig. 6 is shown a ball-point roughing-tool as used in the shop, and at B a similar tool for light duty in a ship's lathe. It will be noticed that the surface to be ground (a) when the tool

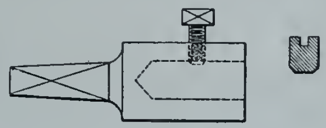


FIG. 9.

requires sharpening is only about one-third in tool B of what it is in tool A.

The Drilling Machine

For ship work a machine which will bore holes from 1-32 in. up to 1 1/2 in. is required, and it must, therefore, have the range of speeds and power required for such sizes. It will not matter if the speed is not quite so high as boring a hole of 1-32 in. permits, but it must be able to revolve slowly enough, and have the requisite power and rigidity for the 1 1/2-in. hole; a speed ranging from 30 revolutions per inch to 300 revolutions per inch per minute should be obtainable. When space can be had, a useful type of machine is the one which has the drill spindle and its driving and feed-gear mounted on a short cast-iron pedestal or column, a double bracket, capable of swinging round, being raised or lowered, and clamped in position on the column. One end of the bracket supports a round table capable of revolving on its axis, and of being clamped; the other end consists of small shears, on which slides a parallel vice. This is a well-known type of machine familiar to all engineers, and made by practically all the well-known tool-makers. It has the further advantage that the brackets, when swung at right angles to the spindle, leave the floor space clear for putting any extra large job under the spindle.

When space is not available various modifications can be made, thus, instead of a double-swing bracket a single one can be used, allowing the machine to go close against a bulkhead, or the ship's

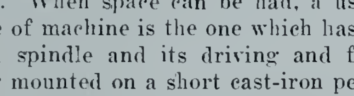


FIG. 10.

side, when the flat revolving table should be retained and a parallel vice supplied, which can be bolted on top of the same. The advantage of the vise fitted on the shears is the clearance which is available under the vise; the limit to the length of the work which may be held being the floor underneath. A ship's frame can be utilized instead of the cast-iron column, the drill spindle and its gear being secured to the frame at a suitable height. The table may consist of an ordinary good-sized cast iron knee-plate, capable of being bolted to the frame at various heights, or of being removed to allow the job to sit upon the floor. A parallel vise should be supplied which will be suitable to attach to the table. Fig. 7 is a rough sketch of a drilling machine attached to the ship's frames; in both instances all driving, feed-gear, etc., is omitted.

Drill Equipment

The drills for the machine are the next consideration. Should they be twist, flute, or common, should they have parallel round shanks, taper round shanks, or taper square shanks? The ideal would be to have two complete sets of drills; the twist or flute for use in the machines only, and the common drills for use in both ratchets and machines; failing this, choice must be made of the one kind for all purposes. The drill which can be most easily made, repaired, and ground, is the common drill forged from plain 5/8-in. round bar tool steel, with a flat at the one end to take the point of the set pin (Fig. 8). The sockets of the ship's ratchets should suit this, or a loose socket with square tapered male end (Fig.

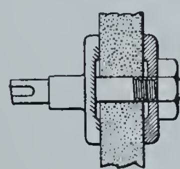


FIG. 11.

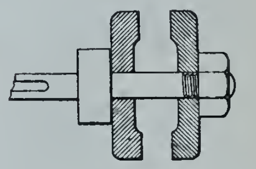


FIG. 12.

9) and round 5/8-in. parallel female end be supplied; such sockets are not very difficult to make, and two or three of various lengths are most useful for ratchet work, and will often save a lot of time being spent in hunting up and fixing packing. The set pins for these sockets should be of tool steel, with the cheese points slightly tempered, each socket having two set pins, one with a square head, and the other of grub-screw shape; the latter being for use when there is not clearance room for the one with the square head.

If flute or twist drills are to be supplied, the flute shape will be the more useful, being more easily ground, and more efficient in reaming out a hole parallel and true to size. At this class of work a twist-drill has a great tendency to draw itself into the work, seize, and snap. In attempting to ream a hole with a twist drill it usually pays to plug up the original hole first with hard wood or brass.

The sizes of drills should range at least from 3-16 in. to 1 1/2 in., advancing by 1-16 in., with four extra drills for

3/8-in., 1/2-in., 5/8-in., and 7/8-in. tapping sizes, and one good large countersink point, making 27 drills in all. It will be better still if the sizes range from 1-16 in. to 1 in. by 1-32 in., and from 1 in. to 1½ in. by 3-16 in,. with countersink point, making 36 drills in all. There remains the question of sizes smaller than 3-16 in.; for this purpose a good method is to have them forged from 1-16-in., 3-32-in., and 1/8-in. square tool steel rod, a short length, say 2 ft. of each size, being also supplied to provide for any breakage or odd length drill that may be required. Steel rod of this size and section requires the minimum of forging, and the square section provides a most efficient grip for the ordinary shark-jaw chuck with which the American brace is usually fitted; for use in the power-driven drilling machine a chuck should be supplied. A useful chuck for the drilling machine and lathe can be made by making a male part, as shown in Fig. 10, to suit the shark jaws and outer nut removed from either the American or the wood brace.

The Grinder

Why, it may be asked, should the engine room of a modern ship, a space full of intricate machinery, have placed in it a dirty, inefficient, manual-power grindstone? The most suitable grinder for a ship should open up some discussion and suggestion from those who have expert knowledge of the subject. A machine with a 12-in. to 14-in. by 1½-in. wet wheel on one end of the spindle. and a similar-sized emery facer on the other end, with suitable rests, etc., should prove a useful and satisfactory machine for ship use. An attachment should be supplied for grinding twist or flute drills. Those who have to contend with the old-fashioned grindstone will find the expedient of getting an emery-wheel and using it in the lathe a welcome help: a sketch of such a wheel fitted on a suitable spindle to fit the drill-chuck is given in Fig. 11. In ordering a wheel for this purpose, get as large a diameter wheel as the lathe will accommodate with the gap in place, in order to get a good peripheral speed; a small wheel at the usual fastest lathe speed is not of much utility.

It should be possible to provide a lathe with a sufficiently high speed for driving an efficient wheel of medium size, and this might be done when, for reasons of want of space, a grinder could not be installed. The drawbacks to the emery-wheel being used in the lathe are the difficulty of keeping the wheel running true, and the grit that tends to get into the spindle bearings and under the saddle: with due care the latter can be much minimized. As the spindle in Fig. 11 requires a special forging, a sketch is given in Fig. 12 of a construction that can be carried out on board ship. The spindle is turned out of a good-sized piece of steel, in order to get as large a collar as possible; the washers are made of ¼-in. plate, one-third the diameter of the wheel, faced on one side sufficient for a collar and nut respectively, and recessed on the other side in order that they may grip the wheel at their edges; or, instead of recessing, a ring of 1-16 in. of paper or fibre on either side will give the same result.

The Forge

This may not be, strictly speaking, a power-driven tool, unless the term may be permitted if the blast is supplied from a power-driven fan; why it should not be so is difficult to understand, as the cost would be not much greater than supplying the usual hand forge. Seeing that the average steamer is provided with power-driven fans for the boiler furnaces, it should not be a difficult matter to provide a forge with an air-pipe led to it from a convenient fan trunk. The following are details of an expedient that was carried out:

The cyclone part of the forge was removed and the remaining cast iron pan and tuyere on its stand were bolted down in a corner of the stokehold, immediately under a fan-trunk; some old 3-in. iron pipes, flanges, and elbows that happened to be on board were utilized to make a connection from the bottom of the fan-trunk to the tuyere; a thick asbestos millboard joint was put between two of the flanges, with a portion of the joint cut away and one bolt left out. In the space thus provided, a bit of sheet iron of U shape was inserted, which acted as a valve. The result was an excellent forge, capable of melting cast iron, as was conclusively proved by the prompt disappearance of the tuyere; however, a new one protected by fire-bricks and fire-clay lasted better and gave most efficient service; a water-cooled tuyere of the usual type would, of course, be better still.

A coal forge is not, however, the ideal fitting for a steamer; such would require to be smokeless or nearly so, able to be put in operation on short notice, and should be capable of heating up ¾ in. square tool steel to white heat in a reasonable time—say 5 minutes. It is seldom that any larger job than this turns up on board, and if it did it could probably be dealt with in one of the boiler furnaces.

This paper has not covered the whole ground of power tools for a ship. There are many other tools which would be most useful and not very costly, such as an arrangement for driving a hack-saw and a small shaping machine, both of which could be arranged as lathe attachments; a portable electrically-driven driller which could be used in any part of the ship, the current being got from the nearest lamp-socket.

WIND JAMMERS STILL A FACTOR

THE war's effect on the shipping industry was made evident recently in Montreal, when it became known that the sailing schooner "N. W. White," 90 tons net register, wintering in the harbour, and recently purchased by the Eastern Canada Fisheries, Ltd., had been chartered to carry a cargo of lumber to the British Isles at the record figure of 360s. a standard. When it is considered that before the war the rate was 33s. 6d. a standard for vessels of similar tonnage, it will be readily seen what a tremendous increase in freight rates the present scarcity of tonnage is causing.

The company recently purchased from Captain Bernier, of Quebec, the schooner "Minnie Maud." This vessel, which has been owned by Captain Bernier for several years and used by him on some of his Arctic expeditions is of 200 tons capacity, and of the regular sailing ship type which, about fifty years ago frequented the Port of Quebec, and were at that time big factors in the shipping industry of the city. These primitive vessels, the "Minnie Maud" was built in 1891, and the "N. W. White," as long ago as 1878, are now undergoing general repairs when they will be placed in charge of experienced mariners, and placed on the high seas.

A few years ago these wooden craft were at the suggestion of the underwriters, removed from ocean service, as they were regarded as a menace to the shipping trade, as well as being dangerous to the more modern and faster steamers, who occasionally ran them down in heavy fogs, causing loss of life, and cargo, resulting in the insurance rates on this class of transport being doubled. Mariners were therefore obliged to abandon the high seas, and seek the fishing trade as a source of livelihood. Now, after a period of some twenty years, it would seem we are obliged to resort to the primitive and slow craft of a generation ago.

British Marine Losses.—Presiding at the annual meeting of the Liverpool and London War Risks Insurance Association at Liverpool, recently, Bruce Ismay said that through war perils the association had lost 62 vessels of 357,838 tons gross, and through marine perils 21 vessels of 103,979 tons gross; but 75 new vessels of 538,048 tons gross had entered in the period. Thus, after 18 months of war, there had been a decrease of only eight in the number of vessels afloat belonging to members of the association, while the tonnage had increased by 76,231 tons gross.

Sarnia, Ont.—The Reid Wrecking Co. has secured a contract to repair and overhaul the steamer Charles M. Luck.

Sheet Metal Elbows, Their Development and Laying Off-II.

By J. W. Ross

In order to thoroughly understand the principles involved in the development of cylindrical and other forms, such as are met in sheet metal work, a considerable knowledge of geometry is desirable. Through the medium of these articles, the author places practical examples at the disposal of our readers, and the knowledge to be gained by a close and persistent study of the principles and methods employed will well repay the time spent.

THREE-COURSE ELBOW OF 90 DEGREES

FIG. 10 shows the elevation and cross sectional views of a three-course elbow of 90 degrees. In making these, no matter to what angle of a circle the elbow conforms, it is not necessary to draw out the full elevation view, as has been done here for explanatory purposes. Enough information for constructive purposes can be obtained by calculating the first mitre line and drawing this to the necessary measurements.

To calculate this mitre line, it is the practice to count each end course as one and the intermediate course or courses as two each. The sum of these is divided into the number of degrees of the elbow, the result being the angle of the mitre line. For instance, in the elbow of 90 degrees, as shown in Fig. 10, the courses I and III are each counted as one, the intermediate course as two, the sum being 4. Now, 90 degrees divided by 4 equals 22½ degrees, thus the mitre line BJO is drawn at an angle of 22½ degrees with AO, and the construction ABJK proceeded with.

For the benefit of the student the whole of the elbow will be drawn. As he becomes familiar with elbows he will find it much quicker to work from the calculation of the mitre line just described.

In Fig. 10, measure off AK equal to 1½ inches and KO to 2 inches. With O as centre and radii OK and OA, strike the quadrants KF and AE. Draw EFO at right angles to AKO. As this is a 90-degree elbow and of three courses, then each end course will be counted as one and the centre course as two, which will equal 4. Now divide the quadrant AE into four equal parts. Through these points draw a straight line from O, thus locating the lines OB, OC, and OD, and dividing the angle of 90 degrees into four parts of 22½ degrees each, this being 22½ degrees each for the courses I and III and 45 degrees for the course II.

At right angles to AK draw in the lines AB and KJ, intersecting the mitre line BJ. Similarly draw at right angles to EF the lines DE and GF to the mitre line DG. Connect B to D by a straight line, which will be tangent to the quadrant AE through the point C. Also connect J to G by a straight line. On this construction the outline of the elevation of the elbow is shown as ABCDEFGHJK, Fig. 10. The sections ABJK, BCHJ, CDGH and DEFG are all equal, the first forming No. I. course, and the second and third sections No. II. course, while the last section forms No. III. course, the reason being readily seen why each end course is counted as one, and intermediate courses as two. Obviously if the complete templet is laid out for course I., it will also be a complete templet for course III and a half templet for course II.

Construct the ½ sectional view A4K, using 4^1 as centre and 4^1A as radius. Divide into the desired number of equal spaces. A4K has six equal spaces, and are numbered as 1, 2, 3, 4, 5, 6, 7. These points are projected up to the mitre line BJ, all the lines being drawn at right angles to AK and parallel to AB and KJ. The intersections of these lines on the mitre line are numbered in relation to their divisions on the semi-circle, as

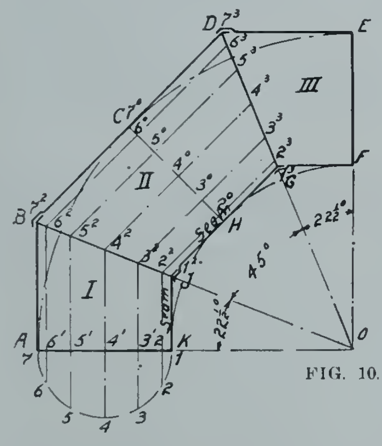


FIG. 10.

shown on the mitre line by the numbers. 7^2, 6^2, 5^2, 4^2, 3^2, 2^2, 1^2. From these points draw in the lines 6^26^3, 5^25^3, etc., parallel to the lines BD and JG.

Measure off the stretchout HCH, Fig. 11, equal to the stretchout of the neutral diameter AK or CH, Fig. 10. This equals $1\frac{1}{2} \times 3.14$, which is nearly 4¾ inches. HCH, Fig. 11, is measured off 4¾ inches, and divided into 12 equal spaces, which is twice the spaces in the ½ sectional view A4K, Fig. 10. Parallel perpendiculars are drawn to HCH through these located points shown as $1^31^01^2$, $2^32^02^2$, $3^33^03^2$, etc. Set the dividers to the distances 7^07^3, or 7^07^2, Fig. 10, which are equal, and transfer over to 7^07^3 and 7^07^2, Fig. 11. Reset the dividers to the distance 6^06^3 and 6^06^2, Fig. 10, also transfer over to Fig. 11. Similarly transfer over the remainder of the distances on Fig. 10 to their allocated positions on Fig. 11.

An even curve drawn through these located points defines the rivet or mitre line. If suitable, these intersecting points may be used for rivet pitch centres, laps being added accordingly. JGDGJBJ, Fig. 11, shows the complete templet—with rivet holes and laps—for the course No. II., Fig. 10. The templets for the courses I. and II. are shown by drawing a line through HCH, Fig. 11, thus halving the templet, each half being the templet for either course.

It will be seen, as previously pointed out, that all the construction lines for the pattern can be obtained from the first calculated mitre line, as BJ, Fig. 10, thus obtaining the pattern for courses I. and III. and the half pattern for course II. It will be also noticed that in the preceding problems the vertical or longitudinal seams of the courses are placed on the inside throat of the elbow, as FE, ED, Fig. 1; LKJ, Fig. 3; CFE, Fig. 5;

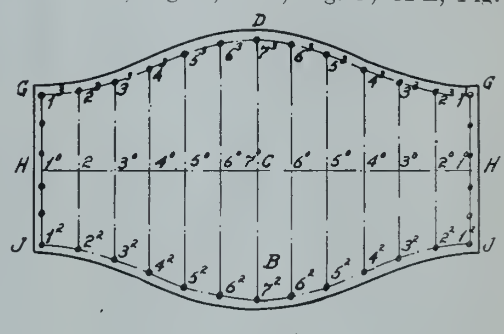


FIG. 11.

and also KJ of course I.; JG, course II.; CF, course III., of Fig. 10. This is the usual practice in the lighter gauges of plate.

In the heavier gauges the seams are generally placed on the centre line of the elevation view, as shown in Fig. 12, also in Fig. 14, the seam of alternate courses being in line, whilst the seam of the adjacent courses are diametrically opposite. The seams being placed at these points, naturally change the contour of the templet usual to the preceding problems.

Of course, if the preceding problems are made in the heavy gauges, it would be better to locate the seams, as will be described in the following problems.

Elbow With Inner and Outer Courses

Fig. 12 shows the elevation and cross sectional view of a cylindrical three-course 90-degree elbow of heavier plate, with inner and outer courses.

In Fig. 10 and in preceding problems on elbows of light plate, the diameters of the courses were the same throughout in each elbow. This necessitated, for fitting up purposes, that the girth seam of a course should be slightly opened out by machine or by hand methods, so that it would fit over its adjacent course. In the heavier gauges this would be inadvisable, and to overcome this, elbows are made with inner and outer as well as telescopic or clinker courses. Fig. 12 shows an elbow constructed with the in and out courses, showing the thickness of the material for explanatory purposes.

Draw AK, Fig. 12, equal to the outside diameter of the elbow, thus showing the thickness of the plate. The inside diameter is 18 inches, the plate being ¼-inch thick; the outside diameter will be 18½ inches, and the neutral diameter 18¼ inches.

Measure KO equal to 24 inches. These

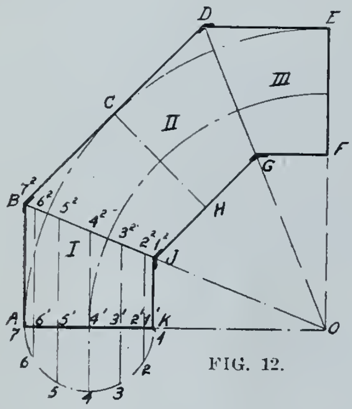


FIG. 12.

measurements may be reduced to scale for paper practice, say, 1 into 1 foot. With O as centre and OA as radius—A being the point located as the inside of the elbow—strike the quadrant AE. Similarly with O as centre and OK as radius, strike the quadrant KF. Thus the inside diameter of these quadrants will represent the inside diameter of the elbow.

As this is a three-course elbow, divide the quadrant AE into four equal parts, as A to B, B to C, C to D, and D to E. Through these points draw straight lines from O, thus locating the mitre lines BO and DO of the elbow. At right angles to AK draw up the lines indicating the thickness of the plate to the mitre line BJ, as AB and KJ. As EFO is at right angles to AKO, draw in the lines DE and GF at right angles to EF.

The intermediate course is an outer one; therefore, draw in the thickness of the plate, as shown, BCD and JHG. Locate the neutral diameter 71, and with 4^1 as centre and 4^17 as radius, strike the neutral half plan view 741. Divide this semi-circle into six equal parts and number as 7, 6, 5, 4, 3, 2, 1. Draw the projection lines 66^16^2, 55^15^2, etc., parallel to the lines AB, JK. The longitudinal seam for this course is located at 4^14^2. The girth seam at BJ.

The neutral diameter of the elbow is 18¼ inches; the stretchout will equal 18¼, multiplied by 3.14, or 3 1-7, which equal 57 5-16 inches along the line SAKS, Fig. 12A. Divide this into twelve equal parts, erect perpendiculars through these points and number as shown, care being observed to locate the vertical seams in their correct positions, 4^14^2, 4^14^2, at the lines SS, SS. Set the dividers to the distances 7^17^2, 6^16^2, 5^15^2, etc., Fig. 12, and transfer over to their relative positions on Fig. 12A. Draw in an even curve through these points for the rivet line, each point also being a rivet centre.

For ¼-inch plate the rivet will be ½-inch diameter, and the holes through the

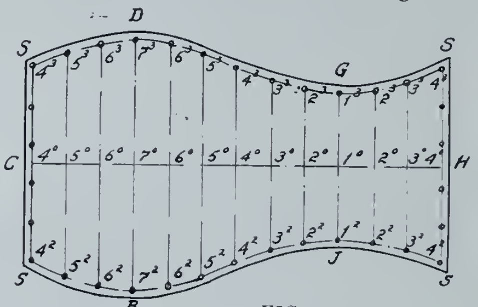


FIG. 13.

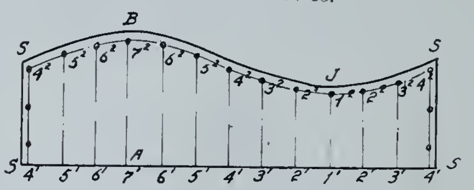


FIG. 12A.

plate 9-16-inch diameter. A suitable lap for this pattern will be twice the diameter of the rivet hole, which equals $2 \times 9\text{-}16 = 1\frac{1}{8}$, this being measured from the rivet line.

Fig. 12A shows the completed templet for courses I. and III. The development for course II. is similar, with the exception that its stretchout is longer than the stretchout of course II.

When one course fits over another, the stretchout is based on whether a tight, easy or slack fit is required, according to the nature of the work. In a previous article it was explained that for good steam-tight work the outer course would be made longer by an amount equal to 6.2 times the thickness of the plate. For an easy fit 6½ times, and for a slack fit 7 times, is used for easy, quick and economical assembling of the parts.

The course I. equals 57 5-16; therefore, the stretchout of course II. will equal $57\ 5\text{-}16 + (7 \times \frac{1}{4}) = 58\ 1\text{-}16$ in. Mark off CH, Fig. 13, equal to 58 1-16 inches. Divide into twelve equal spaces and erect perpendiculars. Number each point accordingly, so that when rolled up the longitudinal seam will be located at the centre of the elevation view similar to course I, but diametrically opposite. Transfer the distances from course I. to each side of CH, Fig. 13, as shown. Draw in the curve of rivet lap, locate the holes and add on the laps. Divide the rivet lines SS, SS into the same number of equal spaces for the rivet centres.

SHIPS' PAPERS

FROM time to time, says the Motor Ship, we receive many applications from correspondents asking us to inform them as to what constitutes the correct papers for a ship; it may, therefore, be of interest to many of our readers to study the list as published below:—

Certificate of Registry.—This is the official voucher of nationality, etc., and, in the case of countries possessing no register of shipping, is represented by a passport, sea letter or brief issued by the government or civil authorities of the ship's port.

Builders' contracts or bill of sale, charter party, muster roll and shipping articles of the crews and log book.

Customs clearance certificate of the last port called at. Ships' manifest—This is a detailed list and description of the cargo, shippers and consignees, with an account of the freight corresponding with the bills of lading, these being duplicates of those given to the shippers. In the ports of the United Kingdom the following papers and documents are necessary for clearance of ships proceeding to sea:—

Certificate of register or measurements certificate, or declaration of nationality, and certificate, whether for foreign or home trade. The receipts for light dues outward, and in foreign vessels the pilotage receipt outward.

Passengers list and masters bond, ships content containing particulars of cargo and voyage. Vessels having no cargo, such as yachts, etc., may be cleared as vessels in ballast.

Victualling Bill.—This is a list of ship's stores, which, when signed by the proper customs officer, releases a vessel for sea. Coasting trade vessels must carry cargo books. The master must give an account of the cargo, etc., in duplicate to the collector, who will sign and return the original, and this is known as the pass or transire. It should be noted that, after clearance outwards, any customs officer can board a ship and demand the ship's clearance while the vessel is within any port of the United Kingdom or within four leagues of the coast thereof. In the case of a foreign vessel, however, when the vessel is one league, or three miles, from the coast or port, the vessel will be out of territorial waters, and will therefore not come under the custom control of the U.K.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

BRINE PUMP POUNDING

By T. J. Rogers

THERE is, among a number of refrigerating engineers, a certain pet theory which has been proven to the writer's entire satisfaction, to be wrong a large number of times. Engineers are frequently troubled by the brine pump pounding, especially on what are known as "gravity return systems." and in the majority of cases they lay the blame to the fact that there is no air in the discharge air chamber. They shut the pump down and spend, or I might say waste, considerable time charging this chamber with air. True, the pound is relieved, but by no means permanently, and, on its return, the foregoing operation is again performed, or else the machine is allowed to run along with the pound and consequent shock and jar.

Now while the above described condition certainly would cause a pump to pound, not one time in a hundred is it the cause of the pounding in the brine pump, when such exists.

The real cause may he stated as follows:—

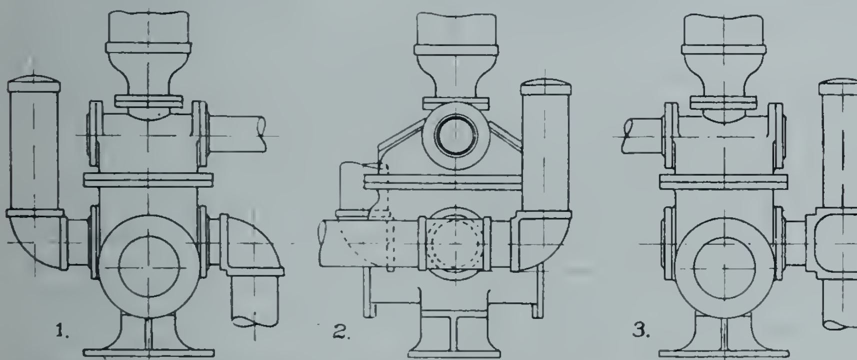
After the brine has passed through the coolers, etc., it falls back to the brine tank and enters same under the pressure caused by the drop. This drop is usually four or five storeys and assuming twenty feet to the storey, the vertical distance would be eighty or 100 feet. To find the approximate pressure in pounds per square inch in the column, we multiply the height in feet by 0.434 and it will be seen that the pressure at which the brine enters the tank is from thirty-five to forty-five pounds per square inch.

It is well understood that before any pump can reverse its stroke it must come to a full stop for an instant. The brine is entering the pump suction under the pressure acquired in the above described manner, and, while the machine is moving, all is well, but at the instant of "stop," in the machine, the brine does not stop. It continues to rush into the pump with force enough to raise the suction valves, which are already on their seats, and allows them to fall back thereon with a loud pound as soon as the machine moves again. It has been the writer's experience that nine times out of ten this is what causes the pound in the brine pumps and not the lack of air in the air chamber.

You might say: "My brine pumps lift the brine by suction as the tank is six feet below the pumps." This would not help the situation any with a closed tank or cooler as the brine would still retain enough pressure to act as above, even though it had to pass through the tank and rise to the pump, as not only will the brine seek its own level but it will be helped out by the vacuum created in the suction pipe by the pump.

The remedy is to install very heavy suction valve springs and, if at all possible, an air chamber in the suction line, using one of the methods shown on the accompanying diagram, giving preference to arrangement No. 1. The benefits derived from a suction air chamber on a brine pump are too numerous to mention here. When the pump starts up there will he a cushion of air established in this chamber and at the moment of each reversal of the machine the brine striking the resistance of the closed suction valves, will rise against the air cushion in the suction air chamber and as the machine moves will flow into the cylinder and follow the piston.

If your brine pumps pound and you make the changes suggested above, it is very safe to say that your troubles in that direction will be at an end.—Illustration and data courtesy of Ice and Refrigeration.



ARRANGEMENTS WHEREBY POUNDING IN BRINE PUMPS MAY BE OBVIATED.

BUSY TIME EXPECTED ON LAKES

MARINERS in Canada are looking forward to a very busy time on the Great Lakes during the season of 1916. Many of the largest steamers of the fleet of 1914-15 will be found this season sailing and doing business on the Atlantic coast. The balance of the fleet, which numbers about 70 vessels, are nearly all chartered from the opening to the close of the season. A few are holding back for a bigger rate for carrying grain.

The steamers Algonquin, Rosedale, Meaford and G. R. Crowe, well known visitors in Toronto harbor, will sail this season in salt water. The Crowe and Meaford are at Midland being fitted out. The Crowe will be cut in two and used as an oil tanker. The Algonquin is at Welland and the Rosedale at Port Arthur.

Lost At Sea

Eight of the forty-one freighters which have left the Great Lakes since May, 1915, have been submarined or abandoned at sea. Four were sunk by submarines—the Midland Queen, the Port Dalhousie, the Empress of Fort William and the Empress of Midland. The Dunelm was lost at sea, the Donnacona and Northmount were abandoned at sea and totally lost, and the Fairmount met with a similar fate in the Bahama Islands. Of the forty-one steamers which formerly plied on the Great Lakes four were engaged in the Atlantic coast service during the winter. They were the steamers Acadian, Canadian. D. A. Gordon and A. E. McKinstry. With the four now in course of preparation for similar service the entire fleet comprises 45 boats, the services of which Canadian shippers will be deprived of until after the war.

Other Marine Plans

According to a despatch from St. John's, Newfoundland, the steamer Turret Court, undergoing repairs, will, when fitted out, sail for Manchester. The steamer Dundee sailed from the same port for Placentia.

According to the meteorological service there is plenty of ice in Lake Huron although it is rapidly disappearing.

Canada Steamship Lines

A. A. Auld will have charge of the terminals of the Canada Steamship lines in Toronto.

Other appointments on the system announced from Montreal include W. J. King, divisional freight agent, in succession to J. J. Nelligan; W. J. Robinson, district freight agent at Windsor, and Brock Batten, western freight agent, with headquarters at Fort William, W. J. King was formerly chief clerk to the freight traffic manager at Toronto. He will be succeeded there by L. Brown, district freight agent at Hamilton.

REGULATIONS AFFECTING MOTOR BOATS

MOTORBOAT men will have to go down further into their pockets this season and buy foghorns, whistles, bells, and in some cases fire extinguishers, to conform with the revised provisions of the Canada Shipping Act. These have been altered so as to harmonize with United States rules, and now read as follows, taking effect on March 1, 1916.

In the following rules the word "motorboat" shall include every vessel propelled by machinery and not more than sixty-five feet in length, except tugboats propelled by steam. The length shall be measured from end to end over the deck, excluding sheer.

Classes

Rule 41—That motorboats subject to the provision of these rules shall be divided into classes as follows:

Class One—Less than twenty-six feet in length.

Class Two—Twenty-six feet or over, and less than forty feet in length.

Class Three—Forty feet or over and not more than sixty-five feet in length.

Lights

Rules 42—That every motorboat in all weathers from sunset to sunshine shall carry the following lights, and during such time no other lights which may be mistaken for those prescribed shall be exhibited.

(a)—Every motorboat of Class One shall carry the following lights:

First—A white light aft to show all around the horizon.

Second—A combined lantern in the fore part of the vessel and lower than the white light aft showing green to starboard and red to port, so fixed as to throw the light from right ahead to two points abaft the beam on their respective sides.

(b) Every motorboat of Classes Two and Three shall carry the following lights:

First—A bright white light in the fore part of the vessel as near the stem as practicable; so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side. The glass or lens shall be of not less than the following dimensions:

Class Two—Nineteen square inches.

Class Three—Thirty-one square inches.

Second—A white light aft to show all around the horizon.

Third—On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side. On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side. The glasses or lenses in the said side lights shall be of not less than the following dimensions on motorboats of—

Class Two—Sixteen square inches.

Class Three—Twenty-five square inches.

On and after March first, nineteen hundred and seventeen, all glasses or lenses prescribed by paragraph (b) of Rule 42 shall be fresnel or fluted. The said lights shall be fitted with inboard screen of sufficient height and so set as to prevent these lights from being seen across the bow and shall be of not less than the following dimensions on motorboats of—

Class Two—Eighteen inches long.

Class Three—Twenty-four inches long, provided, that motorboats as defined in these Rules, when propelled by sail and machinery or under sail alone, shall carry the colored lights prescribed by this rule.

Whistles

Rule 43 (a)—Every motorboat under the provisions of these rules shall be provided with a whistle or other sound-producing mechanical appliance capable of producing a blast of two seconds or more in duration, and, in the case of such boats so provided, a blast of at least two seconds shall be deemed a prolonged blast within the meaning of these rules.

Horns

(b)—Every motorboat of Class Two or Three shall carry an efficient fog horn.

Bells

(c)—Every motorboat of Class Two or Three shall be provided with an efficient bell, which shall be not less than eight inches across the mouth on board of vessels of Class Three.

Fire Appliances

Rule 44.—That every motorboat and also every vessel propelled by machinery other than by steam, more than sixty-five feet in length, shall carry ready for immediate use the means of promptly and effectually extinguishing burning gasoline.

VESSEL LOSSES AND VESSEL SHORTAGE

IN a recent report on merchant shipping losses, Admiral Sir Cyprian Bridge gives the following statement of total losses to shipping from the beginning of the war to March 23, 1916:

Losses to Belligerents

Steamers		Tonnage
British	379	1,320,000
French	41	140,000
Belgian	10	30,000
Russian	27	42,000
Italian	21	70,000
Japanese	3	19,000
Sailing Vessels		
British	31	19,000
French	12	18,000
Russian	8	7,000
Italian	6	3,000

Trawlers

British, 237; French, 7; Belgian, 2.

Losses to Neutrals

Steamers		
Norway	50	96,000
Denmark	18	33,000
Sweden	33	42,000
Holland	22	74,000
United States	6	16,000
Greece	11	22,000
Spain	4	9,000
Persia	1	750
Portugal	1	625
Sailing Vessels		
Norway	22	20,000
Denmark	10	1,600
Sweden	7	2,000
Holland	2	225
United States	1	176

Trawlers

Denmark, 1; Holland, 7.

The loss to British steam shipping, says the report, is less than four per cent. of the total number of vessels under the British flag, and slightly over six per cent. of their total tonnage.

In further comment, Admiral Bridge details the amount of merchant shipping built in France and Great Britain since the beginning of the war, and shows that the war losses have virtually been made good thereby.

"In 1915," says the report, "after more than a year of the war, the steam shipping of Great Britain increased 88 vessels and 344,000 tons." Italy and Russia also show an increase, while France is short only 12,500 tons. It is, therefore, clear that the present shortage of tonnage is due, not to the action of submarines, but to the great requirements of the military and naval forces. The latest published statement of these show that 3,100 merchant vessels are being so utilized.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

"QUADRA"-"CHARMER" COLLISION

THE finding of the Court which investigated the Quadra-Charmer collision case holds the master of the Quadra entirely to blame for the mishap. The Court sat at Nanaimo on March 6 and two following days, and was presided over by Captain J. D. Macpherson, Wreck Commissioner, assisted by Captain Robinson Ridley and Captain E. W. E. Gardner as nautical assessors One of the assessors did not concur in the finding, which is as follows:

"Quadra" Master Blamed

The Court placed the whole blame for the collision on E. LeBlanc, the master of the C. G. S. Quadra, for the following reasons: It was broad daylight, smooth sea and fine, clear weather. The Quadra was bound in to Nanaimo, steering 5.53 W. The Charmer was bound out, steering east. The Quadra, therefore, beyond all doubt, had the latter vessel broad on her own starboard bow and was, therefore, the giving way ship (Art. 19), yet no action whatever was taken until it was too late. Instead of obeying Art. 23, which, as a careful and prudent seaman he should have done, the master disobeyed Art. 22, by attempting to cross the Charmer's bows, with the usual inevitable result.

Further, Art. 25 requires all vessels in narrow channels, if practicable, to keep on their own starboard side of the channel. The Quadra was so far on the port side that the evidence of her own crew placed her about 40 feet off the Black Buoy, which marks the port side of the entrance leading into Nanaimo harbor.

Regulations Violated

Lastly, a considerable amount of evidence, most of which was unreliable and conflicting, was brought forward to establish the fact that the Quadra blew two short blasts on her whistle on first observing the Charmer. The evidence on this point, as already stated, was most conflicting, but that of Robert Steel and Mr. Hutchinson, the engineer and oiler on watch respectively on board the Quadra, was most convincing, and there can be no doubt that these two signals were blown with a short interval between them.

This fact, although established, was, in the opinion of the Court, a violation of Art. 28, which distinctly states that "when vessels are in sight of one another a steam vessel under weigh in taking any course authorized or required by these rules, shall indicate that course by certain signals on her whistle." The Quadra, by blowing two short blasts on her whistle, was thus indicating that she was directing her course to port. This she never did. The evidence of her master clearly proves that the Quadra never deviated from her then course, and in the opinion of the Court had she directed her course to port, such action was most certainly neither authorized or required by the regulations under the existing circumstances.

Certificate Not Dealt With

The Court, however, though imputing for the foregoing reasons the blame for the collision upon Mr. LeBlanc, master of the Quadra, decides not to deal with his certificate, but to very severely reprimand him instead. It is guided to this decision for the following reasons:

(1)—There was fortunately no loss of life.

(2)—That, although the collision was caused by the most flagrant breaches of the regulations for preventing the risk of collision, such breaches were, in the opinion of the Court, not due to ignorance of same or to carelessness, but rather to the stupid assumption, which the Court regrets to say is far too prevalent in British Columbia waters, that the mere fact of being the first to blow a signal whistle gives that vessel the right to choose on which side she will pass an approaching vessel. This sound signal is absolutely unrecognized and without authority in these waters.

(3)—The loss of his vessel as affecting his previous excellent record in the service of the Canadian Government is in itself a severe punishment.

The Court, therefore, severely reprimands Mr. LeBlanc, and warns him, as well as all others who have the handling of vessels in British Columbian waters, whether masters or officers, that until any other duly authorized rules appear, the present existing international regulations for the prevention of collision must be implicitly obeyed and strictly carried out, and that in future any breach of these regulations on the part of those having charge of vessels will be very severely dealt with. No blame, in the opinion of the Court, can be attached to other members of the Quadra crew.

"Charmer" Free of Blame

As regards the Charmer and those in charge of her, the Court in justice finds it difficult to see how in any sense blame can be imputed to them, otherwise the regulations for the prevention of the risk of collision need not exist. It was the duty of the Charmer's master to carry out the one regulation which applied to him under the existing conditions, Article 21. That article requires the vessel that is not the giving-way ship to keep her course and speed. This the master of the Charmer, Charles Campbell, undoubtedly did, and furthermore, when he found that the collision could not be avoided by the action of the giving-way vessel, he took such action as best to avert collision by going full speed astern.

The evidence given and the log books produced both clearly prove that the Charmer's engines were going full speed astern for at least a full minute and a half before the actual impact, and in the opinion of the Court the extent of the injury which the Quadra received in her most vital part is sufficient proof that the speed of the Charmer at the actual time of the impact could not have been very great. The Court, therefore, absolves Charles Campbell, the master of the Charmer, and his officers and crew, from all blame for the collision.

Inquiry Detail

The s.s. Charmer left her wharf at Nanaimo, B.C., on the afternoon of February 26, 1916, at 3.16 p.m. She was bound to Vancouver and had ninety-three passengers on board. After clearing her wharf her engine room telegraph was put to full speed ahead. The weather at the time was fine and clear, wind moderate from the west, sea smooth and an ebb tide. At the entrance of the harbor she met the Quadra bound in, and the two vessels collided, with the result that, though the Charmer received little or no damage, the Quadra shortly afterwards sank. By the engine room register and log book of the Charmer, which books in the opinion of the Court seemed to be very accurately kept (though the reverse was the case in the similar books of the Quadra), the collision occurred at 3.22½ p.m., or exactly six and a half minutes after the Charmer had left her wharf.

The "Alma" Incident

By the same records it was found that,

during the interval of six and a half minutes, the Charmer's engines had been stopped for half a minute. This stop of half a minute occurred whilst the Charmer was passing very close indeed to a gasoline launch called the Alma, both vessels proceeding more or less in the same direction. There can be no doubt, in the opinion of the Court, that these two vessels were dangerously close, and the very proper action of the master of the Charmer in stopping his engines so that the wash from his vessel should not swamp the Alma substantiates this.

A considerable amount of conflicting evidence was given as to whether these two vessels touched. The evidence of Andrew White, the person in charge of the launch, whose statement that the two vessels did touch, was only corrobated by the evidence of one other witness, that of one of the soldier passengers on board the Charmer. All other witnesses of the occurrence, including Mr. Palmer, the first mate of the Charmer, who was specially ordered by the master to look over the Charmer's side and tell him (the master) when the launch was clear so that the engines might be started again, swore positively that the vessels never touched.

"Charmer" Navigated Carefully

The Court is of the opinion that it is hardly conceivable that a vessel the size of the Charmer could hit a gasoline launch of the size of the Alma—both vessels having considerable way on them at the time—without inflicting serious damage on the latter; and further such an incident could hardly occur with one of the two vessels crowded with passengers without being seen and verified by many of the latter. Whether the Charmer and the Alma actually touched each other is immaterial as far as the collision which subsequently occurred between the Quadra and the Charmer was concerned, unless it can be proved that the Charmer was being navigated in a reckless and careless manner due either to incompetency or other graver reasons.

This was certainly not proven, and the action of the master of the Charmer in stopping his engines while passing the Alma and his subsequent actions after the collision with the Quadra had occurred indicated beyond all doubt that he acted throughout in a calm and collected manner.

The one important fact brought out by the episode of the Charmer and Alma was that, in spite of the vigilance of the Government officials in various British Columbian ports, Section 96, pt. 2, Cap. 113, of the Canada Shipping Act, is still being violated with impunity. Andrew White, the person in charge of the launch, stated that he held no certificate of any sort, and that his launch was between five and six tons. He also displayed the most lamentable ignorance of even the rudiments of the regulations for preventing the risk of collision, thus probably being more of a menace to others than he was to himself.

First Signal of "Quadra"

In the opinion of the Court, it was in all probability just about the time when the Charmer was passing the launch Alma that the Quadra blew her first sound signal, and it is conceivable that this fact and the westerly wind then prevailing might account for the fact of this sound signal, whether it was right or wrong, not being heard on board the Charmer. There can be no doubt, however, from the evidence, that the second sound signal blown by the Quadra was blown almost at the moment of collision, and thus was of little use in any event.

After the collision the movements of the Charmer appear to have been somewhat erratic. From the evidence it seems she first backed away, then manoeuvred around at a considerable distance from the other vessel, finally returning to the Quadra after a lapse of time estimated at from eight to fourteen minutes. After a most searching examination, the master of the Charmer, however, accounted for his actions in a very clear and convincing manner, and his actions in the opinion of the Court were certainly not those of an excitable person, he having assured himself that the lives of the crew of the Quadra were in no danger, owing to the fact that all the boats on the port side of that vessel were lowered into the water before the Charmer backed away (indeed, there is every reason for the Court to believe that one at least of the Quadra's boats was in the water before the actual impact).

Having thus assured himself, the master of the Charmer's first consideration was the safety of his own vessel and of the many valuable lives he had on board of her. This was effected by a thorough examination of the fore part of the vessel below water from the inside by some members of the crew, while others were ordered to proceed quietly to the boats, uncover them and get them ready for lowering if required. In the meantime the Charmer, being a vessel of light draught with a high superstructure above the water, was being manoeuvred by her master in such a manner as the circumstances required as to prevent her drifting down on to the shoals under her lee through the combined action of the westerly wind and the ebb tide then prevailing.

Having satisfied himself that his vessel had received no damage and that there was no danger to the life and property under his charge, the master of the Charmer then proceeded towards the Quadra and ascertained that she required no assistance, afterwards continuing on his voyage to Vancouver.

The Quadra, however, had received such injury that her engine room soon filled, but, with the assistance of the Dominion Government tug Point Ellice and the little steamer Alert, she was pushed into comparatively shallow water, where she eventually settled down in about eight feet of water forward and about thirty feet aft, the crew saving most of their effects.

Collision Caused by Stubbornness

This collision, like most collisions which occur at times and seasons when the elements can in no sense contribute to them, was caused, in the opinion of the Court, solely by stubbornness. Because the master of the Quadra wanted to use the south channel, is no reason why all the regulations should be ignored.

The Court is of the opinion that had there been only one entrance to Nanaimo Harbor a collision between two vessels of the class of these two could never have occurred under exactly similar conditions. In that event the Quadra would have been on her own proper starboard side of the channel, and there would have been no necessity to attempt to cross the other ship's bows.

The master of the Quadra had every right to use the south channel if he so chose, but it was nevertheless his duty on approaching that channel to exercise that prudence, judgment and caution which a man in his position is supposed to be endowed with. All that was required of the master of the Quadra was to slow down, wait if necessary for the other vessel to come out, pass the other on his port side, and then use the south channel if he so wished.

Used Unauthorized Signal

Instead of so doing, he uses a sound signal that is absolutely unauthorized in B.C. waters, and by the mere fact of being the first to do so not only decides as to what his actions are going to be, but absolutely decides on the actions of the other vessel as well. It is not difficult to see that if the use of these unauthorized signals is not severely checked, and the international regulations strictly insisted upon and enforced, collisions are inevitable even in the finest weather, and other normal navigating conditions.

A considerable amount of evidence was brought forward to show that the Charmer was travelling at an excessive rate of speed. The Court is of the opinion that this was not the case, and is guided to that opinion by the fact that the Charmer took six minutes to reach the scene of the collision, which works out at a speed of 7.1 miles per hour, which could hardly be deemed excessive.

In conclusion, the Court is of the opinion that immediately after the collision those in charge of both vessels did all that was possible for the preservation of life and property.

Series of Practical Questions and Answers for Engineers

By "Artificer"

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals will be found a useful companion study. With a view to meeting the need of many of our lake and inland waterway engineers who, during the closed season of navigation, take positions in steam power plants ashore, questions relative to the latter department will also find a place in the series.

Question.—What is understood by the term jet condenser as applied to a steam engine?

Answer.—By a jet condenser is meant the mechanical arrangement by which the exhaust steam from an engine cylinder is converted in water. It consists of a box or chamber into which the exhaust steam passes at its top end, and meets a jet or spray of water. The condensed steam is termed the water of condensation, the jet or spray the condensing water.

* * *

Question.—What is understood by the term surface condenser as applied to a steam engine?

Answer.—By a surface condenser is meant the mechanical arrangement by which the exhaust steam from an engine cylinder is converted into water by coming into surface contact with groups of small brass tubes (usually ½ in. to ¾ in. diameter), through which water is being circulated by a pump.

* * *

Question.—Under what particular service conditions are each to be found?

Answer.—The jet condenser is employed when a plentiful supply of fresh water is available, costing nothing, and the boilers are fed from the air pump hot well, the latter receiving both the water of condensation and the condensing water. The surface condenser, on the other hand, is used when fresh water is not available, the boilers being fed from the hot well, or otherwise. If fed from the hot well, only the water of condensation is available. A steamer plying on a fresh water lake and one plying on the ocean are excellent examples of the respective uses of each. Jet condensers are also largely used on stationary engines when fresh water is plentifully available.

* * *

Question.—Which is the more costly, a jet or surface condenser?

Answer.—The surface condenser costs considerably more, its detail construction and contributing mechanism being more elaborate.

* * *

Question.—What is understood by the term air pump as applied to a condenser?

Answer.—By the air pump is meant the apparatus by which the water of condensation and condensing water is withdrawn from the jet condenser, and by which the water of condensation only is withdrawn from the surface condenser.

* * *

Question.—Would the air pump be of the same size for both a jet and surface condenser in the same size or horsepower engine?

Answer.—No, the air pump would be considerably larger with a jet condenser, because it has much more work to do, the latter involving as in the answer to the previous question the handling of both the water of condensation and the condensing water.

* * *

Question.—Is there any difference in the speed with which water and steam will escape from the same boiler?

Answer.—Yes. Volume for volume, the steam will escape about twenty times as fast as the water.

* * *

Question.—What is the effect of accumulation of scale and soot on the heating surfaces of a boiler?

Answer.—A coating of soot or scale, however thick or thin, is a bad conductor of heat, hence heat is prevented from getting as rapidly and as effectively to the water as it otherwise would were the plate surfaces clean, and to get the same amount of steam from the boiler in the former case, extra coal is needed to the following degree:—1-16 inch of scale necessitates 15 per cent. extra fuel; ⅛ inch of scale necessitates 32 per cent. extra fuel; ¼ inch of scale necessitates 66 per cent. extra fuel; ½ inch of scale necessitates 150 per cent. extra fuel.

* * *

Question.—What are some of the causes that may prevent an injector from working satisfactorily?

Answer.—Leak in suction pipe, too low steam pressure, foaming boiler, dirt, such as iron scale, red lead, etc., in pipes, strainer getting clogged up, loose lining in suction hose, bad check valve, etc.

* * *

Question.—What is understood by the expression "water circulation" as applied to a steam boiler?

Answer.—Water is a poor conductor of heat, and must, therefore, be heated by its passing rapidly over heating surfaces so as to expose all its particles to the heat. When water is heated, it expands, becomes lighter and rises; at the same time, cold water rushes in to take its place. The current thus set up is termed "circulation," and the stronger the current the better for many reasons.

* * *

Question.—A steam boiler 16 feet long and 72 inches in diameter, is made of material ½ inch thick, and carries a pressure of 80 pounds per square inch gauge. What is the stress in the shell-plate?

Answer.—The total pressure tending to disrupt the shell would be the total pressure on the longitudinal cross section, which is $16 \times 12 \times 72 \times 80 =$ 1,105,920 pounds. This pressure is distributed over twice the cross sectional area of the plate, or a surface equal to $16 \times 12 \times 2 \times \frac{1}{2} = 192$ square inches. Stress in shell plate is, therefore,

$$\frac{1{,}105{,}920}{192} = 5{,}760 \text{ lbs. per sq. in.}$$

The figure 12 in the formula is employed to bring the boiler length in feet to inches. Further as the tensile strength of boiler shell plates is usually about 60,000 lbs. per sq. inch, it will be noted that the margin of safety is about 10 times that of the working tensile stress.

* * *

Question.—Why is it wrong to feed much cold water to a boiler or let much cold air into the furnace and over the fire?

Answer.—Those parts of the boiler to which the cold feed water or cold air has more or less direct access are cooled unnecessarily, thus setting up hurtful strains as between the hotter and unaffected parts. Comparatively small changes of temperature so produced, will if often repeated, start leaky joints, rivets, etc., as well as contribute to breakage of stays, etc.

* * *

Question.—When examining the interior of a steam boiler what are some of the defects to be looked for and expected?

Answer.—Loose and broken stays and loose rivets; effects of corrosion, such as pitting, grooving, etc.; fractured, burned and laminated plates; defective blow-off connections; thin and defective tubes, etc.

Question.—What should be the chief aim in firing a steam boiler?

Answer.—To secure a complete combustion of the fuel and its gases, so as to prevent the formation of smoke and soot, and at the same time to permit as little excess of air in the furnace as possible, this simply carrying heat up the stack as waste.

* * *

Question.—What would you suggest as a satisfactory method of banking a fire?

Answer.—Push the live coals back against the bridge wall so as to leave the forward part of the grate covered with ashes. Cover the fire with a fairly thick layer of fine coal and some ashes. Leave the damper open a very little to prevent the collection of gas and possible explosion. When starting up, it is simply necessary to pull the fire evenly forward and shovel on fresh coal.

* * *

Question.—What points should be observed in connecting up the water column of a steam boiler?

Answer.—Connecting pipes should not be smaller than one inch in diameter and preferably of extra heavy pipe or drawn brass tubing. Bottom pipe should be connected with a ground joint brass union so that the bottom of the water glass or the bottom gauge cock will be at least $1\frac{1}{2}$ inches above the top row of tubes. Plugged tees should be used instead of elbows to allow cleaning. The bottom pipe should be level and fitted with a gate valve blow-off.

* * *

Question.—A motor running at a speed of 1,000 r.p.m. drives a fan through a countershaft. A 10 in. pulley on the motor drives to a 30 in. pulley on the countershaft, which in turn drives a 20 in. pulley on the fan from a 50 in. pulley. Find the speed of the fan.

Answer.—Drivers are 10 in. and 50 in. Driven are 30 in. and 20 in. Speed of fan, therefore, is

$$\frac{10}{30} \times \frac{50}{20} \times 1{,}000 = 833.33 \text{ r.p.m.}$$

* * *

Question.—What should be the thickness of a 10 in. cast iron water pipe to carry a steady pressure of 200 pounds per sq. in. Ultimate tensile strength of cast iron 20,000 lbs. per sq. in.?

Answer.—Using a factor of safety of 10, the working stress would be $\frac{20{,}000}{10} = 2{,}000$ lbs. per sq. inch.

Pressure tending to disrupt pipe is

$$\frac{10 \times 200}{2} = 1{,}000 \text{ pounds.}$$

Area of metal necessary to resist this

$$= \frac{1{,}000}{2{,}000} = .5 \text{ sq. inches.}$$

As we are considering a section 1 in. long, the required thickness would, therefore, be .5 in. or $\frac{1}{2}$ in.

* * *

Question.—What points should be observed in shutting a plant down indefinitely?

Answer.—Before blowing off, fill the boiler fairly full and put about a gallon of crude oil into the steam space so that. as the water goes down, a coat of oil will be left on the inside of the boiler to prevent rust. When starting up again, clean boiler thoroughly. Clean oil out with soda. Clean soot from flues and furnace parts and cover with a coat of boiled linseed oil. If boiler cannot be emptied when shutting down, fill up completely with water, to which is added some soda ash. Boil off air and close up tight. Cover stack top with water-tight hood if possible and arrange to prevent dampness from entering through breechings, holes in the roof or elsewhere.

* * *

Question.—Why is it that a pump will force water into a boiler against a pressure equal to or greater than the steam that operates it?

Answer.—The area of the steam piston is always greater than the area of the pump plunger, so that if the pressure per sq. inch on steam piston and against pump plunger be the same, the total force or load on the steam piston will be greater than that against which the pump plunger is directed.

* * *

Question.—What procedure is adopted in setting the valves of a duplex pump?

Answer.—First take off the steam chest covers and set both rocker arms exactly plumb. Measure carefully the width of steam ports and place both valves centrally over ports. Set up jam nuts to within half the width of the ports from the valves and lock them in this position. Valves should move in opposite directions to open ports. Replace covers and pump is ready to start.

* * *

Question.—What width of double-ply leather belt would be required to transmit 200 horse-power from a 10-foot pulley at 100 r.p.m.?

Answer.—Using formula

$$w = \frac{\text{H.P.} \times 300}{V}, \text{ in which}$$

w = width of belt in inches.
H.P. = horse-power transmitted.
V = velocity of belt in feet per min.
300 = a constant for double belts.
V = circumference of pulley × r.p.m.

or

$V = 3.1416 \times 10 \times 100 = 3141.6$ ft. per minute.

$$\text{Then } w = \frac{200 \times 300}{3141.6} = 19.098 \text{ inches,}$$

or, say, a 20-inch belt.

Question.—Will a boiler shell burst by ripping lengthwise or in a circular direction?

Answer.—Let the diameter be represented by D and the internal pressure by P. The force tending to split the shell lengthwise is $\frac{D \times P}{2}$. The force tending to rupture it in a circular direction is $\frac{D^2 \times .7854 \times P}{D \times 3.1416} = \frac{D \times P}{4}$

The longitudinal strength is, therefore, only half of the transverse strength.

* * *

Question.—What is the approximate water capacity in gallons of a return tubular boiler, 18 ft. x 72 in. with 72 3-inch tubes?

Answer.—Rule, from 2-3 the volume of the shell subtract the volume of all the tubes.

Volume of 2-3 of shell$=72 \times 72 \times .7854 \times 18 \times 12 \times 2\text{-}3 = 586{,}297.9584$ cu. in.

Volume of one tube is approximately $3 \times 3 \times .7854 \times 18 \times 12 = 1526.8$ cubic inches.

Volume of 72 tubes $= 109{,}929.6$ cubic inches.

Volume of water contained$=586{,}297.9 - 109{,}929.6 = 476{,}368.3$ cubic inches.

$$\text{Number of gallons} = \frac{476{,}368.3}{277.274} = 1718.04$$

* * *

Question.—An engine piston rod is $3\frac{1}{4}$ inches in diameter, and the stuffing box is bored to $4\frac{3}{4}$ inches. How much square flax packing will be required if the box is filled by 5 rings?

Answer.—The mean diameter of the ring is $3\frac{1}{4} + \frac{3}{4} = 4$ inches.

Length of each ring is $4 \times 3{:}1416 = 12.5664$ inches.

Taking off about 0.1 inch for closing up, this becomes 12.46 inches, or for 5 rings $12.46 \times 5 = 62.3$ inches, or a little over 5 feet.

* * *

Question.—A common squirt oil can has a body shaped like a segment of a sphere. Its base diameter is 4.5 inches and its height is 2.1 inches. How many times could it be filled from a can containing a gallon

Answer.—The volume of a spherical segment is three times the square of the radius of the base plus the square of the height multiplied by the height and by .5236.

Radius of base $= 2.25$; $2.25^2 \times 3 = 15.187$.

Height squared $= 2.1^2 = 4.41$.

$4.41 + 15.187 = 19.597$; volume $= 19.597 \times 2.1 \times .5236 = 21.5477$ cub. ins.

$$\text{Number of fillings} = \frac{277.274}{21.5477} = 13.2$$

PROGRESS IN NEW EQUIPMENT

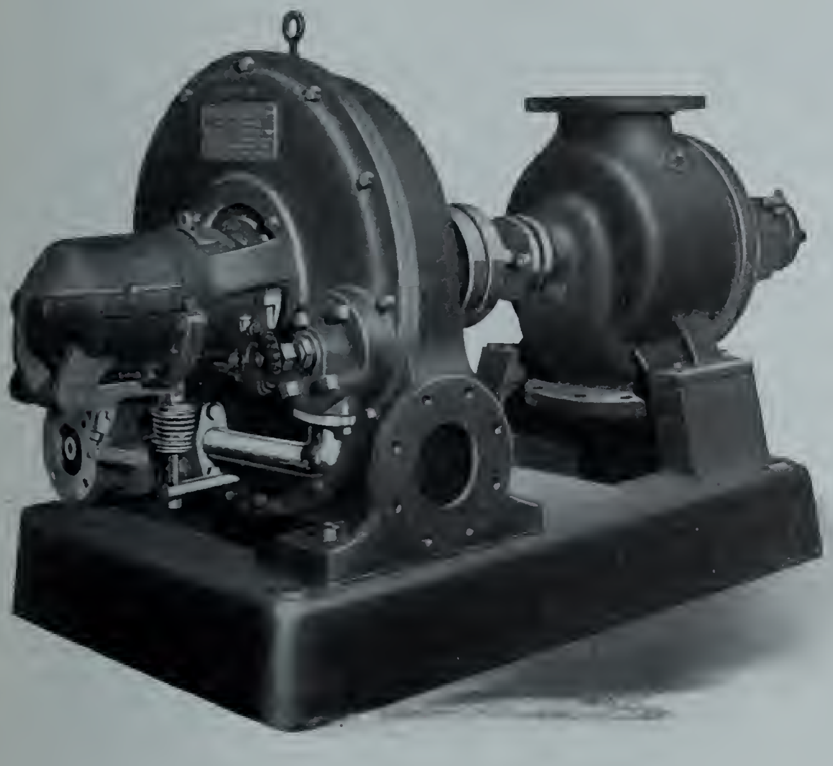
There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineeiing Axuiliary Product Achievement

S EAM TURBINE DRIVEN, LOW LIFT CENTRIFUGAL PUMP

THE illustration shows a low lift centrifugal, turbine-driven pump recently built by the Goldie & McCulloch Co., of Galt, Ont., for condenser service in connection with an 800 k.w. triple expansion, vertical quick revolution engine also supplied by the same concern. It is capable of delivering 1,000 U.S. gallons per minute against a total head of 40 feet when running at approximately 2100 r.p.m. Under these conditions the makers of the pump guaranteed an efficiency of 60 per cent. with a maximum b.h.p. of 16.85 at pump coupling. A flexible coupling connects the pump to a steam turbine of 20 b.h.p. when operating at about 140 pounds gauge and with back pressure of 5 lbs. gauge.

The pump is of the Rees-Roturbo pattern, the design of which is exceedingly simple, consisting of a pressure drum rotating in a casing at moderately high speed. This pressure drum is mounted on a central horizontal shaft mounted in ring-oiled, babbitted bearings. There are no moving parts in contact except at the bearings, and the whole of the internal arrangements are such that the group is in hydraulic balance. The packing arrangements are also exceedingly simple.

When running, the water gravitates, or is drawn into the eye of the revolving pressure drum where it is stationary relative to the drum. The water is carried round by the revolving partitions, and a pressure is created in the revolving drum by the centrifugal action of rotation. The capacity of the drum being large the water slowly moves toward the periphery where are located a number of short nozzles curved in a direction opposite to the direction of rotation. These nozzles convert a portion of the pressure into velocity and the water passing through them behaves as in a water turbine, assisting the rotation of the revolving drum and thereby giving self regulating effect. The escaped water still having velocity in the direction of rotation is passed between stationary diffusion channels which convert the remaining velocity into pressure.



STEAM TURBINE-DRIVEN LOW-LIFT CENTRIFUGAL PUMP.

The special feature of the pump is the construction of the impeller which instead of being built as a flat disc runner with the main object of securing velocity of water in the expanding channels of the fixed casing, is designed in the form of a barrel or pressure chamber, the object aimed at being to secure a constant pressure inside the revolving drum or impeller equivalent to the height of the lift. The impeller having this large capacity, the water inside as it approaches the rim becomes practically stationary relatively to the impeller, thus eliminating all friction losses and generating a pressure by centrifugal force which is the main feature of the patent.

The steam turbine in this set was also made by the Goldie & McCulloch Co., who supply this same type for both pumping and electrical units. In these smaller power units not more than two nozzles are needed, one being directly in series with the throttle governing valve, while the other one may be controlled by means of a hand valve. As in the other types the latter constitutes an auxiliary valve for use when the load increases over the capacity of the main nozzle which is usually designed to carry approximately full load. The governing mechanism and carbon stuffing rings are similar to those used on the larger power units and the same care is taken in the balancing and overspeed testing. These turbines are supplied either of vertical or horizontal split pattern.

NEWFOUNDLAND SHIPPING

ANNOUNCEMENT was made on April 21 of an arrangement between the British Admiralty and the Government of Newfoundland whereby the necessary number of vessels will be supplied to care for the colony's trade. For many months there has been a serious shortage of shipping available, owing to the large number of steamers taken over by the Admiralty for transport purposes or diverted to other routes for reasons due to the war.

Under the new arrangement steamers owned by the paper-making companies in Newfoundland will take paper and pulp to England, and on their return will bring cargoes of salt for the fisheries and of coal. The local sealing fleet, which has just completed its season, will carry coal and general freight between Newfoundland ports and Halifax and Sydney, N.S. Several steamers from the Great Lakes, which are being brought to Montreal, will freight foodstuffs and other cargoes to Newfoundland during the summer, and will return with iron ore for Canadian smelters.

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Vol. VI APRIL, 1916 No. 4

PRINCIPAL CONTENTS

GENERAL BUSINESS, SHIPPING AND SHIPBUILDING

A GRATIFYING feature of the present industrial situation in Canada is that of the steady improvement in domestic business, due to the generally prosperous condition of the country as a whole. The outlook for an increase in exports, other than munitions and war supplies, has improved considerably, and manufacturers look for still more important developments.

So far as our leading steamship lines are concerned, the season's arrangements are well advanced, freight services as well as some passenger services being already inaugurated. Prospects are of the brightest description for an active and remunerative business in both spheres, and no effort is being spared in equipping to meet it. Perhaps the most interesting development of the past month has been the acquisition by the Canada Steamship Lines of the fleet of the St. Lawrence & Chicago Steam Navigation Co.

The revival of wood shipbuilding on our Atlantic seaboard warrants passing notice, and, taken in conjunction with the activities of and demand for this class of vessel, it may not be amiss to infer that our Maritime Provinces of New Brunswick and Nova Scotia will achieve again at least a fair measure of the glory of accomplishment that the building of "wind jammers" brought them ere steel shipbuilding took pride of place. The shortage of "bottoms" of every construction and size is, of course, primarily responsible for the rejuvenation of the wood shipbuilding industry, although doubtless the high prices obtainable for such type craft is giving added impetus to the industry.

The propagation and development of steel shipbuilding and marine engineering is not, however, being allowed to lie dormant as a reference to the address delivered before the Canadian Manufacturers' Association in Montreal, by Col. Cantley, president of the Nova Scotia Steel & Coal Co., New Glasgow, N.S., amply proves. An abridged report of same appears in another section of this issue. Both the need for an up-to-date Canadian merchant marine and for its being in large part, if not wholly a Canadian product, are given ample vindication, and the parallel drawn and the results achieved through Government recognition and support of railroad and steel manufacturing enterprises is distinctly illuminating, well-timed and forceful as an argument.

The reference by Col. Cantley to Government support of our steel industries in years past is one that is easy of appreciation in times like the present, bringing vividly to our mind's eye the practically certain conditions that would have prevailed in Canada during these months of war—absence of munition and war supplies orders, had steel-making lacked the national recognition that has enabled it to place our Dominion on a production plane of world competitive degree. It is but natural to expect that what has been accomplished through Government support of railroad transportation and steel-making, will be procurable on an equal scale in the realm of shipbuilding.

Concerted action is, of course, necessary so that the proposition as outlined by Col. Cantley assume definite shape and become effective, and perhaps no better opportunity could have been secured than that provided by a meeting of the Canadian Manufacturers' Association, sectional although it happened to be. A large percentage of those present on the occasion of Col. Cantley's address had a more or less vital interest in what he had to tell them, and the fact that his keenness of perception in business matters generally and his dogged perseverance in pursuing an ideal to its logical end, may be taken as an earnest that the movement to support shipbuilding in Canada will not only continue to gather weight, but will begin to show results before long.

The dearth of freight carriers—lake and ocean, is of immediate importance to this Dominion, just as much so, as to any other nationality, and we look to see the authorities at Ottawa deal with the situation in such a way as to mitigate to the fullest extent possible the inconvenience thereby caused by stimulating shipbuilding on a generous scale on our lake and ocean borders.

Marine News From Every Source

Victoria, B.C.—The city council have accepted the tender of Messrs. Watson, Hall & Huntley, for repairs to the sea wall at Ross Bay.

Montreal, Que.—The Board of Control have awarded the contract for the St. Helen's Island ferry service to the Canada Steamship Lines, Limited.

Ocean Freight Rates Away Up.—Ocean freight rates on some commodities, particularly wheat, are nine hundred per cent. higher than at the beginning of the war.

Shipbuilding in Nova Scotia.—A large three-master schooner is being built at Liverpool, N.S., by James S. Gardner, and several are under construction at other Nova Scotia ports.

North Vancouver, B.C.—The Amalgamated Dry Dock & Engineering Co., if it secures certain concessions, will erect a dry dock and shipbuilding plant at an estimated cost of five and a half million dollars.

Sarnia, Ont.—The whole dock of the Northern Navigation Co., in this city, about 900 feet in length, will be rebuilt. Last year part of the structure was rebuilt, but now orders have been received to put in the whole length new.

Swedish Shipbuilding.—Returns show that 21 steamers, aggregating 26,351 gross tons, were launched from Swedish shipbuilding yards during last year. The output also included 17 motor vessels, of a total of 4,900 tons, and 12 sailing vessels.

Fort William, Ont.—When the new elevators projected are completed and running, Fort William and Port Arthur will be only a few thousand bushels behind Chicago in elevator storage capacity. Chicago to-day is stated to have within her harbor borders, elevators that have a capacity of about 51,000,000 bushels. When the three big elevators here are running, the capacity will be increased by 5,500,000 bushels for the both harbors, or a total of approximately 50,000,000 bushels.

Port Moody, B.C.—Boyd's Ltd., has secured a site 400 x 1100 ft., here and will erect a shipbuilding plant to cost $200,000. The plant will comprise a steel foundry, machine shop and woodworking plant. Provision will be made for launching three ships. Capt. Harry Mowatt will be manager.

The Panama Canal was reopened to traffic on April 15, with the passage of sixteen ships, seven northbound and nine southbound, including the transport Buford. The channel through Culebra Cut was in excellent condition and the passage of the vessels was without incident.

Shipping to Russia Improved.—Shipping facilities into Russia will be increased during the coming season by the opening of the new port of Soroka, on the White Sea, and the port of Nikolaievsk, at the mouth of the Amur River. The railroad from Petrograd to Soroka is now open for traffic.

New Type of Wharf.—It is reported that the first "double-decker" wharf shed at any American Southern State port has just been completed at Galveston. This shed is to be exclusively for cotton shipments; it has cost about $250,000, and adds about 500 000 square feet of fire-proof storage facilities to the port.

Marine Insurance Rates Up.—Insurance underwriters in New York have advanced from one per cent. to two per cent. the war risk rates on shipments from New York to Bordeaux and other ports on the Bay of Biscay. The rate to London has advanced one per cent within ten days and has now reached three per cent.

Ottawa, Ont.—Tenders for submarine cable will be received at this office until Monday, May 15, 1916, for 10 knots of single conductor submarine telegraph cable (107 lbs. copper and 150 lbs. gutta percha per knot), with sheathing of 12 No. 8 S.W.G. iron wires, to be delivered at Halifax, N.S. Specification and forms of tender can be obtained on application to the office of the general superintendent of the Government Telegraph Service at the Department of Public Works, Ottawa.

Toronto Harbor Improvements.—At a conference between the Board of Control and Harbor Commissioners on April 3 a decision was reached whereby the latter will spend $500,000 in improvements. Filling will be done at Humber Bay, Queen's Wharf, Hanlan's Point, Ward's Island, and the Royal Canadian Yacht Club. In addition to this, $2,000,000 will be spent in the Ashbridge's Bay industrial district.

Cost of Dredge Port Nelson.—Replying to Hon. Geo. P. Graham, the acting Minister of Railways said that the total cost to date of the dredge Port Nelson, which was built in Toronto and taken to Hudson Bay in 1913, has been $363,518. Since then the dredge has been at work for nine weeks—namely, during the summer of 1915. Mr. Graham asked for the quantity of material handled, but no specific information was given.

Navigation on St. Lawrence.—We are informed that as the result of negotiations between the High Commissioner in London, and the Imperial Government, the latter has promised to do everything possible to meet the wishes of the Canadian Government in increasing navigation on the St. Lawrence River. Steps have been taken to inform the different departments and the allied governments of this decision.

Shipbuilding in Scotland.—It is reported that several orders for new vessels have been placed on the Clyde lately, but in consequence of the unprecedented conditions the builders and owners have agreed on the system of payment known as the "time and line," which provides for a stipulated percentage of profit for the builder. The building of several Atlantic liners is said to be under negotiation on this basis, and it would seem really to be the only one that shipbuilders could consider in the circumstances.

Victoria, B.C.—The Dominion Government has been calling tenders for the erection of buoy, store and freight sheds, trackage and drainage, etc., on the marine wharf site. The plans for the proposed buildings cover a connected freight shed 147 feet by 30 feet. A commodious store shed is to be erected, and will be 108 feet by 36 feet. A buoy shed, measuring 80 feet by 40 feet, to which will be attached a shed 80 feet by 20 feet, for the use of carpenters, gas-buoy men and as machine shops, is also covered by the tenders.

Harbor Development in Newfoundland.—Owing to lack of tonnage and the consequent high freights now being charged by shipowners, the most modern and rapid mechanical equipment for expediting the discharging and handling of steamers at the harbors in Newfoundland, controlled by the Anglo-Newfoundland Development Company is to be given effect to as soon as possible, and schemes for the same are already being prepared by A. D. Swan, consulting harbor engineer, Montreal.

Ocean Tonnage Scarce—Ocean tonnage is growing more difficult to secure and rates continue to advance. There is no source for relief while war lasts, unless ships are speeded up. This can only be done by relieving port congestion, allowing for faster loading and discharge. When peace is signed, whenever that may be, it will mark the beginning of the battle of unarmed ships. Neutral countries will strive to hold the new trade; the warring nations to regain lost patronage. The advantage will lie with control of ships. England's merchant marine, though reduced, will still be in command of the seas. Should the Allies win, Germany will not be a serious factor in the world's shipping trade for years to come, for England has her eyes fixed upon Germany's great fleet of interned ships as part of war's indemnity.

REVIVAL IN WOOD SHIPBUILDING

SO great is the demand for Canadian tonnage that it has been found necessary to revert to the building of wooden vessels of the sailing type, a condition somewhat unique in the shipping world. When steel-built vessels supplanted the wooden craft, few of which have been constructed in recent years, it was never thought that the old-style craft would ever be revived. War has, however, changed conditions, and incidentally brought about a condition of affairs on the upper lakes that was never dreamt of before the war started.

A. B. MacKay, of Hamilton, a well-known vessel owner in Canadian marine circles, states that he has placed an order with a shipbuilder at Meteghan, Digby County, Nova Scotia, for the construction of a four-masted wooden vessel, to cost $75,000. The same firm has just laid keels for ten vessels of a similar type for other Canadian owners. These vessels will be used in the North and South America coastwise trade and in the West Indies service, and under the terms of the contracts they are to be delivered for service in October next. Their gross tonnage will be 1,200 tons.

The scarcity of Canadian tonnage occasioned by the transferring of some forty-five freighters from the upper lakes to salt-water service has created a keen and spirited revival in the shipping world for vessels of all types, many of which have changed ownership since the outbreak of the war. While many of the leading vessel owners have been prepared to place orders for the building of new vessels, it has been found almost impossible owing to the increased price of steel, the delivery of which would not be guaranteed within a limited time.

The consequence has been that the wooden vessel has found a ready market by reason of the fact that the timber is available, and the builders are in a position to guarantee deliveries in time to meet the demands of the vessel interests, hence the preference for the sailing craft under existing conditions. Mr. MacKay states that the schooners will be completed in every detail, and will be fully equipped with all the modern appliances necessary for the loading and unloading of cargoes.

LLOYD'S SHIPBUILDING RETURNS

IN consequence of the war it is not possible at present to publish the usual information regarding the shipbuilding industry throughout the world. The present returns are therefore confined to merchant vessels in course of construction in the United Kingdom.

Merchant Vessels Building

The returns compiled by Lloyd's Register of Shipping, which only takes into account vessels of 100 tons and upwards, the construction of which has actually begun, show that there were 424 merchant vessels of 1,423,435 tons gross under construction in the United Kingdom at the close of the quarter ended March 31, 1916. On December 31, 1915, there were 420 merchant vessels of 1,363,590 tons gross under construction, while on March 31, 1915, the figures were 471 and 1,587,467.

The tonnage now under construction in the United Kingdom is about 60,000 tons more than that which was in hand at the end of last quarter, but about 164,000 tons less than the tonnage building 12 months ago.

Of the merchant vesels being built at the end of December, 372 of 1,170,111 tons are under the inspection of the surveyors of Lloyd's Register, with a view to classification by this society.

Sizes of Vessels

Of the vessels listed, 21 are 10,000 tons and over—5 being between 10,000 and 12,000 tons; 5 between 12,000 and 15,000 tons; 7 between 15,000 and 20,000 tons; 2 between 20,000 and 25,000 tons; 1 between 25,000 and 30,000 tons, and 1 between 30,000 and 40,000 tons.

With the exception of vessels under 500 tons of which there are 157, the largest size is betwen 4,000 and 5,000 tons, of which there are 45, followed by 38 between 6,000 and 8,000 tons.

During the quarter just ended, there were commenced 54 steam and 1 sail vessels; while launches were 67 steam and 2 sail.

VESSEL PURCHASES AND PRICES

THE great scarcity of British tonnage is reflected in the abnormally high prices paid for second-hand steamers. Quite recently, the Cunard Steamship Co., bought three second-hand steamers and paid a higher rate per ton than they would have paid for new vessels before the war. In France, as in England, there is a famine in tonnage. Under certain conditions, French owners are now permitted to purchase steamers from English owners.

At one sale held recently, a German steamer which had been captured by a British warship and condemned in the Prize Court was offered. It was admitted by the auctioneer that certain overhauling would have to be done before she would be allowed to proceed to sea. The boat was originally purchased in the Prize Court for under $15,000, and for nearly fourteen months had been running under charter of the British Admiralty, proving a remunerative craft to her owners. The Government, probably in view of the repairs needed, had no further use for the vessel nor apparently had the owners.

The sale was duly advertised and it was whispered that French buyers were likely to bid. The first offer was one of $25,000 for the steamer, and the bidding rose rapidly in thousands when it was discovered that French buyers were actually in the market. At $100,000 the boat was knocked down.

Prices averaging $90 to $115 per ton have been the rule of the sales which have been negotiated privately this year, although $127.50 per ton was paid for the steamer Tello, built in 1907 and with a dead weight capacity of 1,900 tons. The purchase price for this boat was $242,500, yet only a few months previously she was sold for $148,500.

The steamer Anglo-California, of 10,500 tons dead weight capacity, and which was built at Sunderland in 1912 at a cost of $500,000, has recently changed hands for $1,075,000, while another boat, the Haboe, sold last year for $250,000, which was then considered a big price, has now been resold for $570,000.

Costing $200,000 to build in 1909, the Harlesden, a steamer of 7,350 tons, has just been bought for $650,000. Sold in 1914 for $45,000, the Olavarria has again changed hands, as much as $247,500 being paid for her last month. She is a boat of 3,670 tons dead weight and was built at Sunderland in 1889.

THE POSSIBILITIES OF SHIPBUILDING IN CANADA

A NOTABLE contribution to the literature on the possibilities of shipbuilding in Canada was made on April 19 by Col. Thomas Cantley, president of the Nova Scotia Steel & Coal Co., and vice-president of the Canadian Manufacturers' Association, at a dinner given by the Montreal Branch of the Association at the Canada Club. Col. Cantley discussed the shipbuilding problem as follows:

The Shipbuilding Problem

Marine transportation at the present time is a matter of vital interest both to Canada and the Empire. The losses of British merchant shipping tonnage during the past twenty months of this war have amounted to more than two and a quarter million tons—the losses during several months averaging over two steamers per day. We have recently lost more shipping in one week than the shipbuilding resources of Great Britain produces in three months. These losses, coupled with the transportation demands of Britain and the Allies, and the inevitable law of supply and demand, have caused freight rates and the value of ships to advance from five to fifteen times over those formerly paid. So long as the present war and the transportation problems arising out of it continue, no relief can be expected from outside sources.

On the Great Lakes Canadian shipping amounts to only a small fraction of the lake tonnage. On the ocean, Canadian ships carry less than one-tenth of the produce sent out of Canadian ports, while very large quantities of other Canadian products pass through American ports. It is estimated that, before the war, Canadians were paying over $50,000,000 yearly in ocean freights, almost all of which went into the pockets of foreign ship owners.

Overseas Trade Expansion

If we assume that there will be a very large volume of immigration to Canada after the war, doubtless a considerable proportion of this influx will settle on the land, principally in the West, and at a reasonable time thereafter there should and undoubtedly will be a very large increase in our exports of agricultural products. Of the four to five hundred thousand Canadians returning from the battle-front when the enemy is defeated, a large number, both by previous training and inclination, will expect to find employment in the various workshops of the Dominion.

The success of our railway transportation system has been due largely to the vigorous and resolute policy of our Governments in the matter of railway development, which contributed the Intercolonial Railway, and latterly the Transcontinental system—our investment in which exceeds $200,000,000. Public aid has been given to private railway systems to an even greater extent, and guarantees of bonds have been made to an amount closely approaching $300,000,000.

As regards marine transportation, we have had no such policy. We have constructed a canal system that since Confederation has cost us over $100,000,000, but the canals so constructed are open to our competitors and over four-fifths of the traffic passing through the Canadian canals originates in the United States, and less than one-third of the ships using the canals are Canadian. In addition to the expenditure on canals, Canada has spent something like $150,000,000 in aids to navigation on the Atlantic and Pacific coasts and on our inland waters.

Industrial Policy

Personally, I have but little faith in the success of any scheme for providing greater or more efficient transportation either through Government ownership, time charter or operation of a tramp steamer fleet, or by any other form of attempted control of ocean traffic by the Government. On the other hand the Dominion would be justified in making some considerable expenditure by way of aiding in the development of Canadian shipbuilding at the present time.

The iron and steel industry of Canada could never have reached the present output capacity save for the fostering influence of the combination of tariff protection and bounty, and I take it we have reached the position in Canada where even the most out and out "free trader" will admit that any sacrifice made by Canada to establish the steel industry has been fully warranted by the experience of the past eighteen months, for I assume that it will be agreed that if the iron and steel industry had not been developed in this country as it was, no munition business would have been possible in Canada to-day, and in that case the financial situation of the Dominion and the industrial condition in the large manufacturing centres would be quite different from what they are at this moment.

I am confident that when a return is made by the Minister of Finance it will be shown that the tax on the excess profits collected from munition and iron and steel manufacturers, will, before the war is ended, equal the entire total bounties paid out by the Dominion Government to iron and steel manufacturers from the inception of that policy in 1892 until the date when the bounties finally ceasesd.

Steel shipbuilding on a comprehensive scale can be developed if the Government of Canada is prepared to grapple with the matter in a broad and statesmanlike way. The measure of assistance which the country should extend to the shipbuilding industry is a matter for Government decision. The present bounty is entirely ineffective and out of date.

CANADA STEAMSHIP LINES

THE most important Canadian vessel deal to be put through since the formation of the Canada Steamship Lines is practically closed. The Canada Steamship Lines will take over the vessel property of the St. Lawrence & Chicago Steam Navigation Co., of Toronto, the steel steamers J. H. G. Hagarty, E. D. Osler, W. D. Matthews and Iroquois, all the boats owned by the latter Company being included in the deal. The price paid for the steamers, which are among the largest and best Canadian vessels on the lakes, was not given out, but at the figures that boats are bringing, it will run into considerable money.

The Hagarty, which is the second largest Canadian steamer on the lakes, has a carrying capacity of 10,000 tons. She was built in 1914, and is 579 feet keel, 58 feet beam and 31 feet deep. The Osler, which was built in 1907, is 491 feet keel, 56 feet beam and 31 feet deep. She came out in 1907. The Matthews, which was built in 1903, has a carrying capacity of 5,600 tons. She is 358 feet keel, 48 feet beam and 28 feet deep. The Iroquois, which was built in 1902, is the smallest boat of the fleet. Her capacity is 3,500 tons, and she is 247 feet keel, 43 feet beam and 25 feet deep. The big steamer W. C. Moreland, which is being rebuilt at the Superior yard of the American Shipbuilding Co., was purchased by the Canada Steamship Lines some time ago.

NOVA SCOTIA SHIPBUILDING ACT AMENDMENT

A BILL to amend Chapter 74 of the Revised Statistics of 1900 "Of the encouragement of manufacturing and shipbuilding by exemptions from taxation" proposes addition of the following:

"All land, buildings and freehold property in actual use, in connection with any manufacturing establishment in the province of Nova Scotia, established for the manufacturing of ships of iron or steel or any combination of metals of like character, or for manufacturing in iron and steel, shall be rated and assessed for the purpose of taxation for all purposes on a sum equal to the assessment therof immediately preceding the acquisition thereof for the purpose of such manufacturing purposes for a period of fifteen years from such acquisition.

"If the said land, building or freehold property, or any part thereof cease to be used for such manufacturing purposes then such land, buildings or freehold not so used shall be assessed at their actual value in the same way as other real property is assessed."

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

James A. Allan, formerly one of the chief partners of the Allan Steamship Line, died at Glasgow, April 17.

J. W. Norcross, vice-president and managing director of Canada Steamship Lines, Ltd., has been elected a director of the Canadian Vickers Co., of Montreal, Que.

Allan Jenkins, who was second engineer on the freighter Empress of Fort William, which was sunk on February 26 in the English Channel by a German torpedo or mine, has arrived home at Orillia, Ont.

Canada Steamship Line Officers.—The commanders of the steamers of the Canada Steamship Line Niagara fleet are: Cayuga, Captain, C. J. Smith; chief engineer, A. Mains; Chippewa, Captain, William Malcolm; chief engineer, H. Parker; Corona, Captain, B. A. Bongard; chief engineer, Joseph Kennedy. Toronto-to-Charlotte and Montreal division: Toronto, Captain, John J. Farrell; engineer, D. J. Leslie; Steamer Kingston, Captain, E. A. Booth; chief engineer, William Chipman. Toronto and Hamilton division, Modjeska, Captain, P. Walsh; chief engineer, A. McLaren; Macassa, Captain, J. Henderson; chief engineer, E. A. Price; Turbinia, Captain, B. W. Bongard; chief engineer, William Noonan.

Engineer J. Carmichael was the recipient of many congratulations on his recent visit to Liverpool. He had previously been received at Buckingham Palace by the King, who handed him the D.S.O. for special services in mine-laying. The distinction carries with it promotion. Mr. Carmichael is a Liverpudlian, having been born there 52 years ago. He served his apprenticeship with Messrs. James Jack, in which firm his father also served, and was nearly twenty years with Messrs. Chas. G. Dunn & Co., in whose steamers he started as a junior engineer, quickly rising to chief and commodore of their fleet. Subsequently he took up a shore appointment in Vancouver with the C. P. R. Pacific Coast Services. He superintended the building of the ill-fated Princess Irene, also the sister ship, s.s. Princess Margaret, in which latter vessel he is now serving. He was fortunate in being transferred to his present vessel from the Irene at almost the last minute.

D. Olivier, formerly ticket agent at Montreal for the Canada Steamship Lines, Limited, has been appointed city passenger agent.

R. Duguid, formerly superintendent engineer, has been appointed mechanical superintendent of the Canada Steamship Lines, with headquarters at Montreal.

Notice to Pilots—Pilots holding Masters' certificates and desiring to offer their services on the St. Lawrence above Montreal, are requested to call at the office of E. E. Horsey, foot of Brock Street, Kingston, or at the office of The Canada Shipping Co., No. 118 Board of Trade Bldg., Montreal, and sign a form of offer and undertaking prepared by the Canadian Lake Protective Association.

LICENSED PILOTS.

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio
Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

THE SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

GRAND COUNCIL, N.A.M.E. OFFICERS.

A R. Milne, Kingston, Ont., Grand President.
J. E. Belanger, Bienville, Levis, rand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
J. W. McDeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I., Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

INTERNATIONAL MERCANTILE MARINE

CONTROL of the International Mercantile Marine Co.—commonly known at the time of its formation by J. P. Morgan & Co. almost fifteen years ago—as the "Shipping Trust," and now in the hands of a receiver, has been acquired by the American International Corporation. The American International Corporation, formed by the National City Bank and allies a few months ago, has for its main object the promotion of American trade in foreign fields. The corporation already owns the Pacific Mail Steamship Co.

The ships of the International Mercantile Marine are operated by the White Star, Red Star, Dominion and Leyland lines, under the English flag, and by the American and Atlantic Transport lines, under the American flag.

1916 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince.	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie.	101 Clergy St.
Montreal.	5	Eugene Hamelin.	Jeamne Mancy Street	O. L. Marchand.	[illegible] Clark St.
Victoria.	6	John E. Jeffcott,	Esquimault. B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall.	Midland. Ont.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Blandon,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound.	10	John McLeod,	570 4th Ave.	J. Nicoll.	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. E. Wilson,	P.O. Box 204	Roy N. Smith,	Box 178
Halifax,	12	Geo. McDonald,	319 11th Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	29 Parrsboro Street	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	Alfred Roebuck,	22 Kent Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

SUEZ CANAL AND THE WAR

By J. Hay Thorburn

THE romantic and the historic interest connected with the Suez Canal is by no means at an end. What part it may yet play in international politics is, of course, only matter for conjecture; but there can be no doubt that it is a very valuable asset in the hands of the Allies; whether we and they will rise to its potentialities is another matter.

A canal which was designed by Rameses II., and again undertaken by Darius, but first completed under the Ptolemies, cannot but appeal to the imagination — a canal which existed for 1,400 years, and then fell into disuse—to be again revived by Napoleon I., who instructed the French engineer Pepere to report on it; nothing, however, was done until M. de Lesseps took it in hand. From 1849 to 1855 he was engaged in maturing his plans, then an international Commission sat upon it for some years, and at last work was started in 1860.

Canal Data and Statistics

It is 104 miles in length and the beds of three old lakes greatly facilitated operations. Lake Menzaleh is next to the Mediterranean; Lake Timsah, five miles long, in the centre; and the Bitter Lakes, about 23 miles long, next to the Red Sea. Both of the latter were dry before the waters of the Mediterranean and Red Seas began to flow in 1869, which converted them again into large inland lakes, and, in 1870, 486 vessels passed through the canal, while, in 1913, the traffic, which had gone on steadily increasing, totalled 4,979 vessels, with a tonnage of 19,758,040 tons. Of these 2,902 were British, of 11,887,170 tons; 771 were German of 3,317,593 tons; 244 were Austrian of 843,068 tons.

Besides this commercial traffic there were a large number of ships of war, the gross receipts for the year being $25,702,015. The cost of the whole undertaking, including harbours and enlargements, has been $120,000,000, and no great public work ever better justified the expenditure—except, perhaps, the Assuan Dam, but that involved only a small outlay compared with that of the canal.

Opposition to Canal Project

It is curious to recall the fact that in 1856 Lord Palmerston strenuously opposed M. de Lessep's project. He did not foresee the advantage it would be to British commerce, but was very much afraid of political complications with France. Whatever was lacking at that time was, however, amply redeemed in 1875 by Lord Beaconfield's brilliant stroke of statemanship in the purchase of 176,602 shares from the Khedive of Egypt for $20,583,110, which established our position—proved such a lucrative investment to the nation, being now worth $155,000,000—being a blessing to India, the East, and to our commerce; while in Egypt itself, step by step, it has brought peace and regeneration.

Looking back on these things one marvels at the opposition and contumely that was heaped on Lord Beaconsfield for his farseeing statesmanship by the Little Englanders, whose policy was that of "glorious isolation"— the surrender of Gilbraltar, Malta, the evacuation of Egypt, and to cut connection with our Colonies. Where would we have been to-day had such miserable counsels prevailed? We have no better concrete example of the difference between what a party politician and a statesman is than in the history of the Suez Canal.

German Influence at Empire Heart

We would, however, be committing a grave error if we were to suppose that the Little Englander party politician is extinct. On the contrary, he is very much alive, although he is lying low. Yet, every now and then, we find traces of his underground activity. Could anything be more scathing than the exposure of their operations which Mr. Hughes so frankly and courageously made the other day when he said that not only in Australia, but "This German taint ran like a cancer throughout the whole body of the British trade and commerce," and that he found "The German agencies, of whom he spoke, were situated not in Germany but in London"!

That is a serious indictment—of a Cabinet of 23 politicians—ostensibly carrying on the greatest war the world has ever seen, and at the same time German influences "are situated in London"! The country knows that this is the truth. Hertford has said so, the Colonies see it, and the Germans themselves openly boast of it. The country was never in greater danger than at this moment, and unless this pro-German cancer can be cut out of our constitution, the disease will prove fatal.

There are two ways of doing this—a right, a wrong—a constitutional and an unconstitutional way. Nobody, not even Socialists, would like to see mob law; but the problem before the country is, how are we to get rid of this canker of pro-Germanism in high places. It has got to be done, but who are to do it? The precious Cabinet of 23 won't do it. The House of Commons is a broken reed. If, then, it cannot be done constitutionally—the alternative is an ugly and dangerous one.

Colonial Interest in Suez Canal

The reader may not unnaturally say: What has all this to do with the Suez Canal? A little reflection will show that the action of the Mother Country is being very closely and anxiously watched by our Colonies. Mr. Hughes has told us how the Australian Commonwealth has rooted up German trade and traders. He has discovered that Germanism, instead of being rooted up here, has been protected and cringed to. Its emissaries are everywhere—in the Cabinet, in Government offices, in Parliament, in the Army, in the Press, and in the city and in trades councils. What a story Mr. Hughes will have to tell on his return! What, then, will be the effect on Australia, New Zealand, and the whole Pacific?

The first question that he will be asked on his return will be, What is going to be done about the Gate to the East? Is the Suez Canal to be open to the barbarians? They will say, "We have given our best and bravest blood to save the Empire; we have uprooted the loathsome cancer of Germanism, with its demoralising deadly influence. Is the Motherland going to allow it a free highway to the East—after all we have done for her?" What answer will Mr. Hughes be able to give?

The After War Settlement

The Suez Canal is therefore bound to play an important part of the after-the-war settlement. We have it in our power to say, "No German, Austrian or enemy vessel shall pass through it." In 1913 over a thousand of their vessels used it, and that is no negligible number. The Australians have the right to demand that this gate shall be barred, and I hope they will make their voice heard now. Unless they take up a strong attitude they will be sold, just as British interests at home will be. The great majority of the country at present unrepresented and voiceless in the Coalition, requires their help. This bloody war has brought sorrow and misery to myriads of homes. Is the brutalised Hun to be allowed entrance to our markets under a "moderate tariff" to enrich himself and prepare for another war?

What then? We must have a navigation law. The Suez Canal must be closed to the enemies of mankind. There must be local tariffs for each country's necessities—an Imperial tariff—a tariff for neutrals—and above and beyond all an enemy tariff. The Empire must come first, and it can and must come first, and it can and must be self-supporting and independent. The enemy is already preparing for this economic war, and we are not. Intrigue, bribery, social influence, and treason are all at work to lull us by false promises into inaction, and they will succeed unless we awake and set our house in order and clear out the cancer from our midst.—Liverpool Journal of Commerce.

VALUE OF THE PANAMA CANAL

THE world's trade routes, from the standpoint of British commerce and shipping, were surveyed in a lecture given recently in Liverpool by Professor Sargent, of the Chair of Commerce at London University. By means of diagrams, the lecturer showed the relative volume of the outward and homeward traffic from Great Britain on the various trade routes—to South America, North America, South Africa, India and Australasia.

South African Trade

So far as South Africa was concerned, he stated that the lack of balance as between our outward and homeward traffic created bad conditions of transport. Returned "empties" were not profitable either on railways or on ships. If it was going to cost you double through running a ship home empty, something had got to pay for that extra cost, because ships were run at a profit. The outward cargo must pay for the empty return voyage. The only alternative was to develop big cargoes from South Africa by the further development of her natural resources. South Africa, he thought, was going to be a big problem in the matter of handling shipping for some time to come.

Australian and Indian Trade

After discussing the Australian trade and the shipping and harbour questions associated with it he turned to the Indian Ocean, and pointed out as one phase of this traffic which must be considered if the Indian Ocean trade was to be understood, the relationship of the Mediterranean trade in coal. Many of the vessels engaged in this traffic in coal proceeded in ballast through the Suez Canal, converging, with ships from Cape Town, on India in order to pick up profitable cargoes to Great Britain. This export of coal, by providing work for tonnage helped to keep low the homeward rates to Britain and also—quite altruistically—helped to lower the homeward rates to Germany, because we must remember that a great proportion of the trade going to Antwerp and Rotterdam in normal times was German.

North and South Atlantic Trade

After examining the nature of the North Atlantic trades and pointing out that five-sixths of the weight of cargoes on the outward voyages to Brazil and the River Plate consisted of coal, Professor Sargent referred to exaggerated ideas as to the importance of the Panama Canal. Discussing the value of the canal from the point of view of both cargoes and distances, he urged that the Panama Canal was not going to alter Britain's big routes or upset her trade.

Comparing New York with Glasgow or Liverpool, New York was at a disadvantage represented by the total breadth of the Atlantic, say, about 2,500 miles. The East was 2,500 miles farther from New York via the Suez Canal than it was from Britain. What was going to happen when the Panama Canal was working? New York, instead of being 2,500 miles at a disadvastage in shipping, was going to be as near to Eastern China as was, Glasgow or other United Kingdom ports, but the whole of the Indian Ocean with the whole of its islands were untouched, even from the point of view of New York, by the Panama Canal. It was easier to get from New York to these ports through the Suez than through the Panama.

He was concerned with cargoes in his survey, and he did not think, he added, that his diagrams were going to be put hopelessly out of date because of the Panama Canal.

By-Water Magazine.—Among the contributors to the April number of the By-Water Magazine (Canada Steamship Lines) are H. B. Smith, president of the Northern Navigation Co., and director of the Canada Steamship Lines, Ltd., on "Our Threefold Duty"; J. I. Hobson, treasurer of the company, on "Freight in Relation to Net Earnings;" L. A. W. Doherty, freight traffic manager, on "Our Freight Services and the Savings They Effect;" E. W. Holton on "When the Doctor Took His Own Medicine;" a story by Britton B. Cooke, entitled "Ole Peter's Gull;" F. Percy Smith's second instalment, giving the history of the company, past and present; R. V. Robinson, general freight agent of the Northern Navigation Co., on "Soliciting Freight by Direct Advertising;" Peter Paton, purchasing agent, on "Another Phase of Co-operation;" Roy M. Wolvin, Winnipeg, on "Canada's Need: A Greater Ocean Marine;" and W. H. Snell, general passenger agent of the C. P. R., on "The Kindly Word as an Efficiency Promoter." The month's prize story, entitled "Beating Your Average," was written by Norman Manson, freight agent, Victoria Pier, Montreal. There is a good unsigned article on "Waterborne Freight in the Creation of Business and Prosperity," and an interesting article describing the annual meeting of the company on March 15. There are two pages of brief representative extracts of opinions given by various members of the public. The roll of honor shows how well members of the company have responded to the call for men to go overseas.

Captain Gilbert Johnston has been appointed consulting engineer of the Canada Steamship Lines, with headquarters at Montreal.

Catalogues

Homestead Valves.—A bulletin illustrating and describing various styles of valve made by the Homestead Valve Mfg. Co., Homestead, Pa. The essential points of these valves are dealt with and particularly with regard to the quarter-turn constructional feature.

Fittings.—The Detroit Valve & Fittings Co., Detroit, Mich., have issued catalogue No. 3 to the trade. The price list on straight size fittings has been revised and a price list added on all reducing sizes. These lists are based on the estimated average weights of the fittings and so figured that piece fittings take a uniform discount. This list includes malleable iron fittings for steam, gas and water, drainage fittings and specialties, malleable and grey iron castings.

Steam and Air Motors.—The Dake Engine Co., Grand Haven, Mich., have issued an attractive catalogue describing an interesting line of steam and air motors, hoisting engines, steering gears, capstans, windlasses, etc. The power-driven machinery dealt with in the catalogue is driven by the Dake square piston engine, which is fully described. Each type of machine is illustrated and featured, and the principal dimensions given for each size. The Dake marine line is dealt with in a separate section of the catalogue, and includes various types of power-driven deck machinery.

Steam Saving Devices.—An interesting line of steam saving and protective devices are dealt with in catalogue No. 18 which is being distributed by The Strong, Carlisle & Hammond Co., Cleveland, Ohio. The specialties include steam and vacuum traps, separators, pump governors and pressure regulators, stop valves and engine stops, etc. Each appliance is described fully with special reference to its principal features. Sectional views are given showing the general construction and the method of operation is also described; diagrams show some of the specialties installed and price lists with dimensions for the various sizes are included.

"Waterproof Graphite Grease" is the the title of a new 16 page booklet gotten out by the Joseph Dixon Crucible Co., Jersey City, N.J. This valuable little book explains fully, in a concise and clear way how many difficult lubricating problems have been overcome. It also deals with the care and up-keep of heavy, slow-moving machinery and parts that are exposed to unusual wear. Some of the subjects treated are lubrication of elevator plungers, the best way to handle wire rope, open gearing, dredging machinery, and rolling mill lubrication, the lubrication of sugar rolls, pulp and paper machinery

The Publisher's Page

By B.G.N.

I WAS talking a day or two ago to one of Canada's most prominent advertisers in the engineering field. The subject was advertising.

"We are sold up now for several months and I cannot see how we can very well increase our capacity or our facilities for turning out our product," said this successful manufacturer.

"In spite of this, however, we are going to continue our advertising week in and week out and year after year, and we are going to do more advertising if anything—certainly not less. We are not going to quit.

"I started in this business thirty years ago," he continued, "and at one time I personally knew every firm from whom we purchased material and supplies. As promotion came I lost touch with our transactions with these firms and in a comparatively few years I was signing checks payable to concerns which I had never heard of when I was purchasing agent.

"New firms are constantly being established, new factories being built, new men being placed in charge of them. It is to reach these men long before they acquire purchasing power that we are advertising so aggressively to-day.

"I want to reach the apprentices, the ambitious mechanics, the young fellows in the offices who some day, perhaps in the near future, may acquire authority and possibly own businesses of their own."

The advertiser in question said many other things regarding pertinacity of purpose in promoting prosperity through publicity. He preached as fine a sermon on advertising as one could wish—clear, convincing and bristling with incidents from his own experience as a successful advertiser. I would like to tell the whole story but there's sufficient meat in the part I have related to keep a thinking man busy and a busy man thinking. The moral of it is worth real money. I wish I felt at liberty to give you the advertiser's name—it would, perhaps, add strength to the story.

T. S. Hare, Limited

St. Catharines, Ontario

Lock No. 7, Welland Canal

Engineers' Supples — Compressor Jaws
Steel Cables — General Marine Supplies
Ship Chandlery

Anything required on a steamboat. Always open.

The Marine Engine Babbitt

—HOYT'S NICKEL GENUINE

A babbitt metal especially designed for use in MARINE ENGINES, Gas and Gasoline Engines, etc.

For heavy duty and high-speed work, is as perfect as an alloy can be made. It is exceedingly tough and durable, and runs cool and without friction.

A trial will make you want more. Send an order now.
Annual sales over $5,000,000.

HOYT METAL CO., Eastern Ave. and Lewis St., TORONTO, CANADA

New York, N.Y. London, Eng. St. Louis, Mo.

MITCHELLS LIMITED

142 Queen Street, GLASGOW, Scotland

Cablegrams: "IRONCROWN" Glasgow, Scotland

IRON AND STEEL MERCHANTS
ENGINEERS AND CONTRACTORS

STEEL PLATES and STEEL SHEETS

"SHIP" AND "BOILER" QUALITY

STEEL ANGLES.	IRON PLATES.
STEEL BARS.	HOOP IRON.
STEEL BEAMS.	ZINC SHEETS.
BAR IRON.	FIRE-BRICKS.

Special Sections.

The Otis Feed Water Heater and Purifier

will positively heat feed water to the boiling point without causing back pressure. It will separate oil from the exhaust and prevent a large proportion of ordinary impurities from entering the boiler.

Cleaned quickly and thoroughly in a few minutes. Will not foul up with scale, scum or sediment.

It is sold under a liberal guarantee of satisfaction or money back. If your engineer is having boiler troubles consult us for the remedy.

Stewart Heater Co.

35 Norfolk Ave. Buffalo, N.Y.

MARINE WELDING CO.

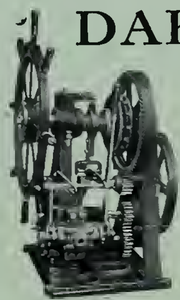
Electric Welding, Boiler Marine Work a Specialty,

Reinforcing Wasted Places, Caulking Seams and Welding Fractures.

Plants: BUFFALO, CLEVELAND, MONTREAL

HEAD OFFICE:

36 and 40 Illinois St., BUFFALO



DAKE ENGINE CO.

Grand Haven - Mich., U.S.A.

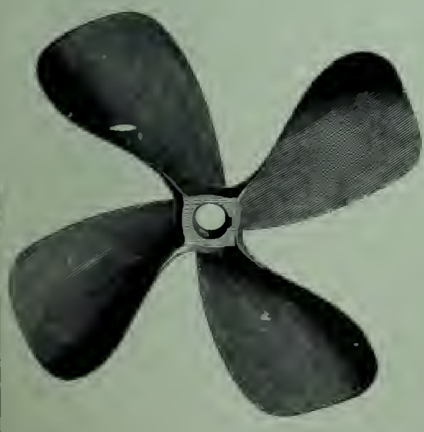
Manufacturers of

STEAM

Steering Engines	Cargo Hoists
Anchor Windlasses	Drill Hoists
Capstans	Spud Hoists
Mooring Hoists	Net Lifters

Write for New Catalog Just Out.

Toronto Agents: Wm. C. Wilson & Co.



Over 30 Years' Experience Building

ENGINES AND Propeller Wheels

H. G. TROUT CO.

King Iron Works

226 OHIO ST.
BUFFALO, N. Y.

HARVIE'S LANTERNS

PATENT

SHIPS' SIGNAL.

As supplied to the "Lusitania" "Mauretania," "Olympic," etc

CONTRACTORS to PRINCIPAL STEAM SHIP COMPANIES and BRITISH ADMIRALTY

EXCELLING ALL OTHERS IN BRILLIANCY OF COLOR, RANGE AND DISTANCE.

WM. HARVIE & CO., LTD.

24 McALPINE STREET, GLASGOW.

Illustrated Catalogue Free — *Established over Half a Century*

CIRCULATES IN EVERY PROVINCE OF CANADA AND ABROAD

MARINE ENGINEERING of Canada

A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World. Published by
The MacLean Publishing Co., Limited

MONTREAL, Eastern Townships Bank Bldg. TORONTO 143-153 University Ave. WINNIPEG, 34 Royal Bank Bldg. LONDON, ENG., 88 Fleet St.

Vol. VI. Publication Office, Toronto—May, 1916 No. 5

Icebreaker Launch Marks St. Lawrence Navigation Epoch

Staff Article

Just to what extent the work of the new and powerful ice-breaker "J. D. Hazen" will be able to compress the ice-bound season of navigation on the St. Lawrence River is at present more or less problematical. Her advent is, however, a step in the right direction, and, if followed up, cannot fail to effect in the feature indicated a very material improvement on the conditions hitherto existent on that great highway of trade and commerce.

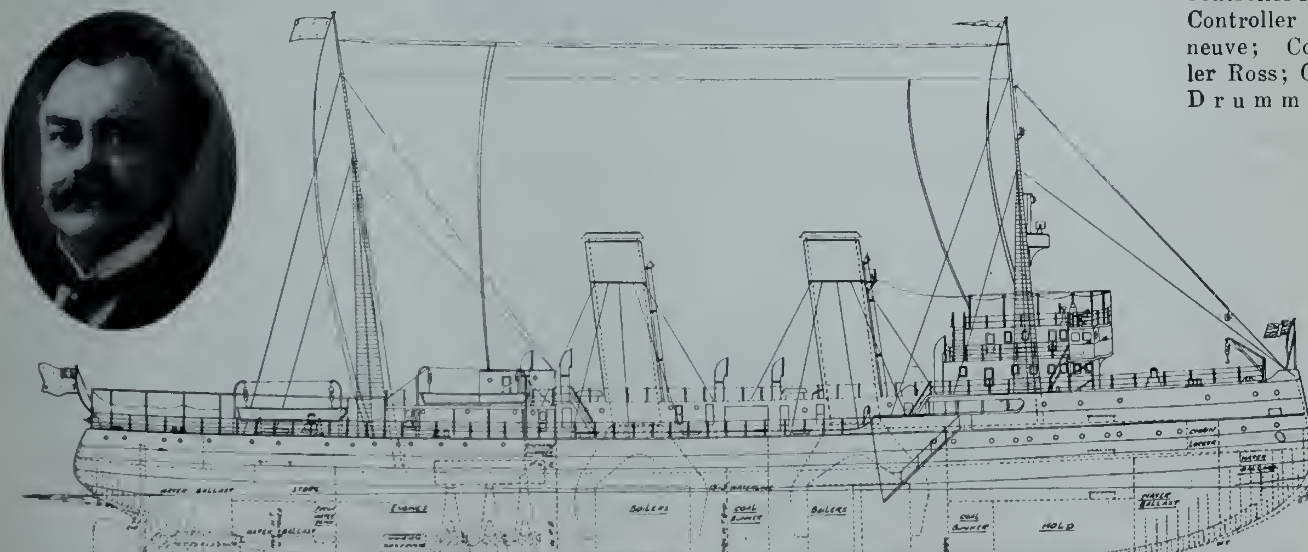
THE launch of the Dominion Government icebreaker, J. D. Hazen, on Monday afternoon, May 15, from the shipyard of Canadian Vickers, Montreal, was an event of more than ordinary importance. True it is that the major significance attaching to it appealed particularly to the residents of our Metropolitan City, and to those of the cities and townships located on and about the shores of our great ocean highway—the St. Lawrence River. Notwithstanding, the circumstances were such as to produce a stimulating effect even now as in the days to come, on the whole agricultural, industrial and commercial life of this far-flung Dominion.

The building and conspicuously successful launch of the J. D. Hazen in this war time, when other and just slightly more urgent service commodities must be given preference, is an achievement of which the builders may well be proud. Further it should be remembered that steel shipbuilding and marine engineering have never been over-robust in Canada—thanks in large measure to lack of interest, because lack of intelligent appreciation by responsible governments of not only our national requirements in the matter but of the latent possibilities in our manhood awaiting the opportunity to achieve something worth while in a world sense in these two spheres. Lack of skilled labor due to the intermittent nature of shipbuilding within our borders has always had to be contended with, and in recent months has become trebly acute through the absorption of our manhood for overseas Empire military service.

LADY BORDEN.
Wife of Canada's Prime Minister, and who christened the vessel.

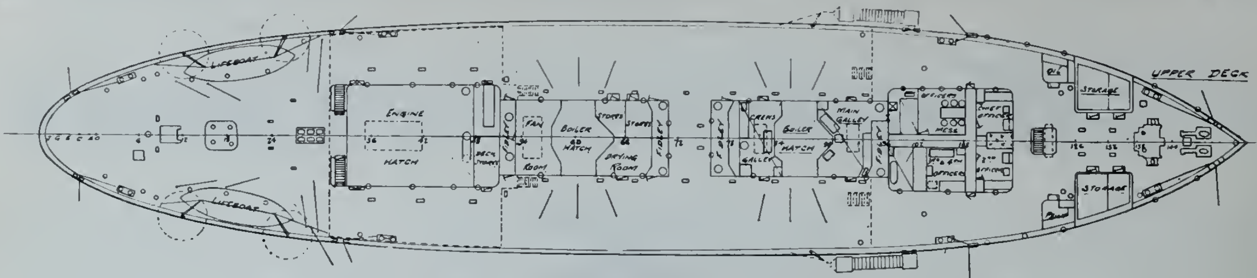
As befitted the occasion, the launch of the first real seagoing ship, not only from the plant of Canadian Vickers, but from the port of Montreal, a large and influential party of ladies and gentlemen was present on invitation of the vessel builders, among whom we noticed the following:—

Sir Robert and Lady Borden; His Honor the Lieutenant-Governor of Quebec and Mrs. LeBlanc; Mr. and Mrs. W. G. Ross; Ald. Hushion, representing the Mayor of Montreal, and Mrs. Hushion; Chief Justice Archibald; G. Bury, vice-president Canadian Pacific Railway; Brig-General Sir Alexander Bertram; Lady Williams-Taylor and Miss Brenda Williams-Taylor; D. Lorne McGibbon; Jas. Carruthers, director Can. Vickers; R. C. Smith, K.C.; Aime Geoffrion, K.C.; Mrs. R. Chaplin, Brig- General and Mrs. E. W. Wilson; Mr. and Mrs. J. G. Lewis; Sir Charles Gunning; Hon. and Mrs. C. J. Doherty; Serge de Liktascheff and Madame Liktascheff; Senator and Mrs. J. P. B. Casgrain; C. C. Ballantyne; Smeaton White; Miss de Salaberry; Mrs. G. W. Cook; J. W. McConnel; F. Orr Lewis, president Canadian Vickers; Brig-General A. E. Labelle; Farquhar Robertson; Mayor Seath; M. P. Fennell, jr.; Ludger Gravel; J. N. Cabana; Dr. W. H. Atherton; Dean Adams; Sir Herbert Holt; S. W. Ewing; ex-Controller Wanklyn; Hon. Jeremie Decarie; Sir William Petersen; Controller Ainey; Controller Villeneuve; Controller Ross; George Drummond;



CANADIAN GOVERNMENT ICEBREAKER "J. D. HAZEN," WITH PHOTO OF MINISTER OF MARINE AND FISHERIES INSET.

Hon. W. S. Fielding; ex-Ald. L. A. Lapointe, M.P.; Colonel Starke; P. V. G. Mitchell; W. G. Annable; Captain Bourassa; Lieut.-Col. Magee; Robert Reford; F. J. McClure; W. A. Coates; Sir John Kennedy; Ald. W. G. M. Shepherd; P. L. Miller, shipyard manager, Can. Vickers; Edgar McDougall; Herbert Ewan; Mr. and Mrs. J. H. Rodgers; John S. Leitch, Collingwood; O. E. Champagne; James French, New York, principal surveyor of Lloyd's Registry, United States and Canada; H. Driver, Secy. Can. Vickers; Thomas Hall; Cecil Doutre, commercial manager Can. Vickers, and Peter Bain, editor Marine Engineering of Canada, etc.



GENERAL ARRANGEMENT OF UPPER DECK, ICEBREAKER "J. D. HAZEN."

Lady Borden, wife of Sir Robert L. Borden, Canada's Prime Minister, performed the christening ceremony as the vessel began to move towards her native element, the ease and grace with which the little function was marked being indicative of the vessel's part in taking the water a few seconds later. Immediately following the launch, the J. D. Hazen was taken alongside the builders' wharf to receive her engines and boilers and be fitted out for service, the invited guests in the meantime adjourning to the shipyard molding loft which had been tastefully decorated for the occasion. Here refreshments were served, and some more than usually significant speeches made by F. Orr Lewis, president, Canadian Vickers, and by Sir Robert L. Borden, our Prime Minister.

Mr Lewis pointed out the now exceptional opportunity for Canada to start on the way to become a great shipbuilding nation, and the Premier in his response stated it was the policy of the Government to lend every reasonable assistance in competing with the long-established yards of older countries, including the United Kingdom.

At the end of Mr. Lewis' address, he presented Lady Borden, as a souvenir of the occasion, with a gold neck chain, to which was attached a specially large diamond. Lady Borden made graceful acknowledgement of the gift.

RT. HON. SIR ROBERT L. BORDEN,
Who was present at the launch and spoke at the reception following.

F. Orr Lewis in his address reminded his auditors that a few years ago the site of the building in which they were gathered had been a part of the River St. Lawrence, from which more than 36 acres had been reclaimed by dredging. He thanked Sir Robert and Lady Borden for coming, and paid a tribute to the present and previous Ministers of Marine and Fisheries, to the present and previous harbor commissioners and engineers of Montreal, and to P. L. Miller general manager, and his staff, for the zeal and great ability which had marked the construction and launch of the new icebreaker. He spoke of the work already accomplished by the shipyard plant in repairing one of His Majesty's cruisers, and in constructing ten other important vessels in a shorter time than had ever before been known.

Mr. Lewis pointed out that Canada has (potentially at least) in her steel, coal and timber all that is necessary to enable her to rival the results of which the Americans are so justly proud. Preparations he said should be made immediately to secure for Canada a portion of the enormous shipbuilding business which, as a result of war, will go to those ready to undertake it. After the war would be too late. John Leyland had placed the loss of British tonnage since the war began at 3,300,000 tons of all denominations.

"It is perhaps an open secret that when this yard was established, it was with the undertaking that as soon as we were ready we would have the building of naval ships," said Mr. Lewis. "Our alliance with one of the greatest, if not the greatest, shipbuilding companies in the world places us in the most favorable position to undertake the work, and if naval and commercial shipbuilding could proceed side by side, there is no doubt that within a short period of years the question of price, as between Canada and the older countries who have been building ships for generations past, would be satisfactorily solved."

GENERAL ARRANGEMENT OF FORECASTLE DECK, FLYING AND NAVIGATING BRIDGES, ETC., ICEBREAKER "J. D. HAZEN."

Premier's Speech

Sir Robert Borden in his speech referred to the great war as one not only between armies engaged but between the industrial resources of the Allies and those of the Central Empires. In both capacities Canada had surpassed not only the expectations of her people, but the expectations of the world outside. After eulogizing what Canadians had done on the battle field, the Premier also praised the patriotism, skill and adaptability of those who organized Canadian industries and managed them so that they have been of such benefit to the Empire.

"The ship which has just been launched to-day is an example of the efficiency of these works," said the Premier, "and also of their scope and the efficiency of the management. I congratulate most sincerely not only the company, but the whole Canadian nation that this ship has been turned out in the short time available. I believe she has been on the stocks some time, but the work on the ship launched to-day had to be postponed for important reasons which may not be mentioned here. It is possible that this ship may be applied to some purpose connected directly or indirectly with the carrying on of this war and the furnishing of supplies. If such should be the case, and indeed in any case, the company are to be congratulated for a work which will be in the cause of Empire and the Allied Nations."

Referring to Mr. Lewis' remarks on shipbuilding, Sir Robert spoke of the ancient pre-eminence of Canada in this regard, more especially to what had been done in his native province of Nova Scotia. He saw no reason why Canada should not go forward to the undertaking of building steel ships, and why she should not rival in the future the record made by Nova Scotia in the past in building wooden vessels.

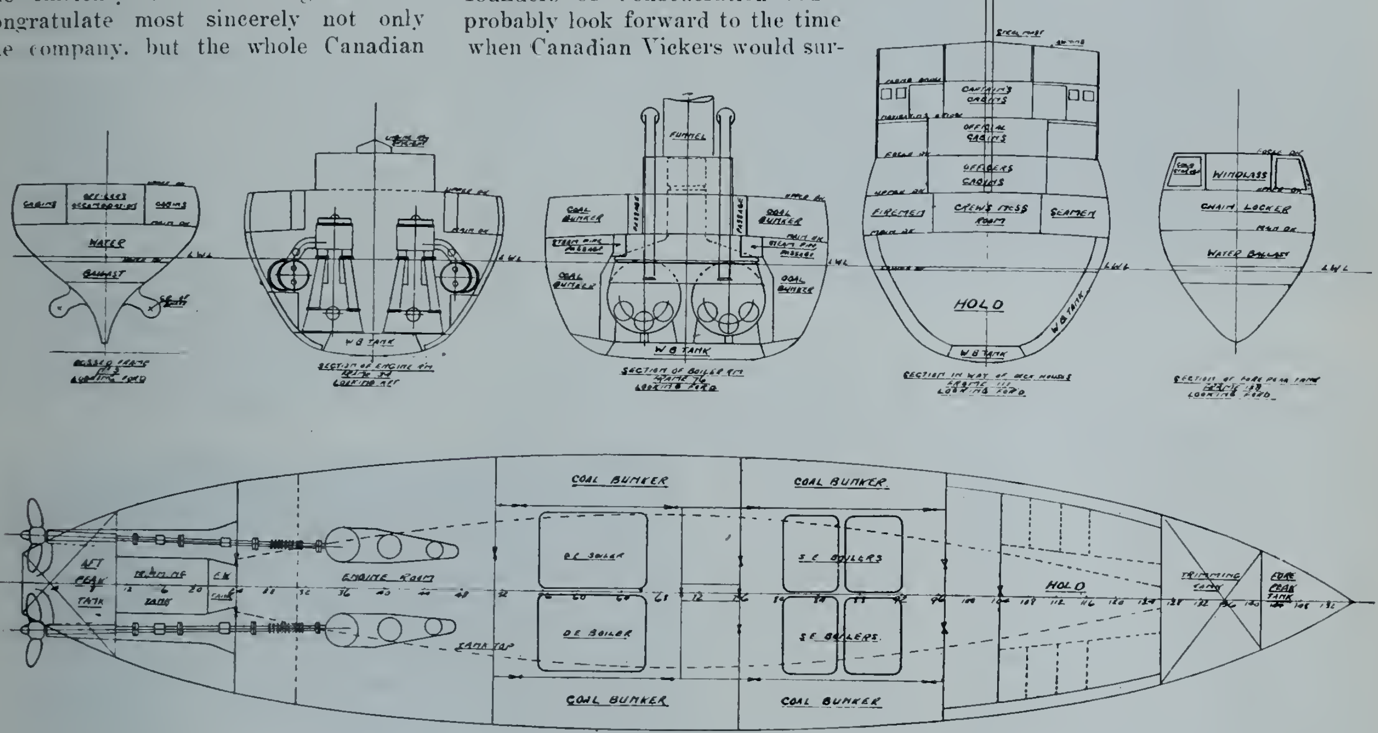
Sir Robert quoted a remark made to himself in Great Britain by the manager of one of the greatest shipbuilding concerns there, that, as the years roll by, the cost of building steel ships in Canada will more and more approximate to the cost in the United Kingdom.

"One man told me," said the Premier, "that in the next twenty years the cost in Canada will not be greater than the cost in the United Kingdom."

The Premier said that those inspired with the faith that inspired the founders of Confederation could probably look forward to the time when Canadian Vickers would surpass the parent from which it had sprung and when Canada would have a shipbuilding industry equally as great as that in the United Kingdom. "I am sure that both political parties are thoroughly in sympathy with that development," said Sir Robert, "and I am absolutely confident that both political parties in Canada will be willing to pledge themselves to give all reasonable assistance to help bring about that end."

The Premier then pointed out that other enterprises would derive benefit from a flourishing shipbuilding industry the requirements for building, fitting out and commissioning a vessel being many and varied. The development here of a large shipbuilding industry would also be a great asset to Canada and the Empire should another great war occur. He thanked Mr. Lewis for the splendid example given Canadians as to what could be accomplished with Canadian resources, coupled with the experience and knowledge which had been built up through such a long period in the United Kingdom. He referred, in closing to the hope of all that victory would come soon and that the pre-, servation of the liberty and institutions of Canada, the Empire, and the world would be assured by a peace at once honorable and triumphant.

Hon. C. J. Doherty, Minister of Jusetice, thanked the Canadian Vickers, Co., for the opportunity afforded those present of seeing a noteworthy event in Canadian annals. Mr. Orr Lewis responded briefly.

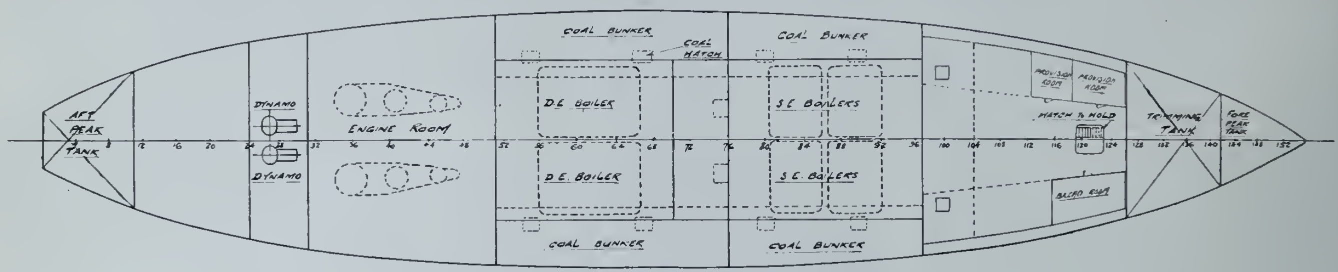


HOLD PLAN AND SECTIONAL ELEVATIONS OF ICEBREAKER "J. D. HAZEN."

In addition to those specially invited to the launching ceremony and subsequent reception, and who were conveyed to the shipyard by special train on the Harbor Commissioners railway tracks from the foot of McGill Street, several thousand more or less privileged people were admitted to points of vantage inside the shipyard from which a view of the icebreaker as she glided into the water could be comfortably had. Work in every department of the plant ceased at noon on the day of the launch to give the employees opportunity of being present at the unique function. A pleasing feature of the arrangements made for taking care of and giving guidance to the invited guests and others was the distribution of 85 members, 53rd Montreal Boy Scouts

(Vickers troop) under command of Scout-Master Costain, along the line of approach to the vessel while on the ways, and to the reception hall. Sixty of the boys are employed at the works, and the majority are sons of employees as well.

On conclusion of the whole proceedings the invited guests were taken by

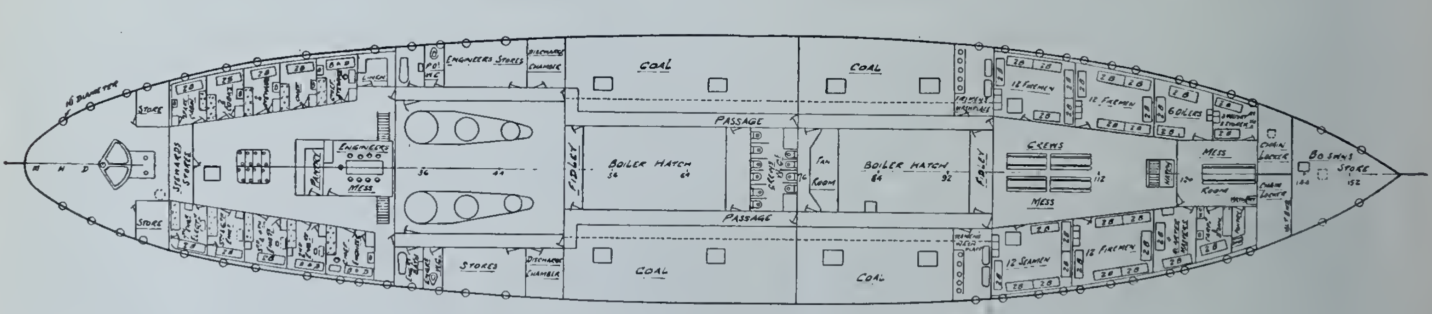


LOWER DECK PLAN, ICEBREAKER "J. D. HAZEN."

train to the opening ceremony in connection with the extension to Harbor Commissioners Elevator No. 1, concerning which an account is given elsewhere in this issue. It should also be added that each invited guest, during the reception proceedings was the recipient of a handsomely illustrated souvenir booklet, briefly descriptive of the new icebreaker.

Vessel Particulars

The hull, as is usual in vessels of this type is of extra strong construction, every advantage having been taken of the wide experience possessed by the builders to insure satisfactory service under exceptionally severe conditions. The vessel is intended for ice-breaking purposes only and will probably be laid up during the open season. Steel construction is adopted throughout the hull which is sub-divided into watertight compartments by seven transverse bulk heads to the height shown in profile. The hull bottom is of the double cellular type, and extends from frame 25 to frame 126, the space being used



MAIN DECK PLAN, ICEBREAKER "J. D. HAZEN."

for carrying water ballast, a portion of which, however, of about 90 tons capacity is reserved for feed water storage purposes.

The stem is formed of a massive steel casting, raked aft, and the stern is of the cruiser type which facilitates navigation amongst ice. Complete equipment is provided for pumping purposes, each compartment being fitted with steam and hand operated pumps. The rudder frame is an extra heavy steel casting, while the trunk is of .46 in. steel plate securely riveted to the stern framing, with cast steel stuffing boxes having brass glands. All side plates are 20 lbs. per sq. ft., the inner space being filled with well—seasoned fir closely fitted and bedded in white lead.

Watertight construction is used in the side bunker walls to the height of the upper deck, these, with the inner skin between the forepeak and the forward bulkhead, forming a double skin extending aft to the boiler room bulkhead. A 10 ft. deep ice belt is fitted at

> **Success to the "J. D. Hazen" and all who sail in her. May she prove a credit to her builders and to Canada, the land of her birth. —Lady Borden.**

the water line, extending the entire length of the hull, the thickness forward being $1\frac{1}{8}$ in., and 1 in. aft. Plating of $1\frac{1}{8}$ in. thickness is used in the forward part of the hull while from the bottom of the ice belt to the keel plate for some distance aft, a 1 in. thickness is used.

Two steel masts are fitted, the topmasts being of Oregon pine telescoped, and the whole supported by wire ropes galvanized and covered.

Propelling Machinery

Two sets of triple expansion surface condensing engines are fitted, the cylinder diameters being 28 in. 46 in. and 75 in. x 48 in. stroke. The valve gear is of the double eccentric link motion type, all wearing surfaces being extra large and well lubricated.

Forged steel is employed for all moving parts such as valve spindles and eccentric rods, while the connecting rods are of extra heavy construction to withstand the stresses resulting from shocks during ice-breaking operations in winter.

Particular attention has been given to the crank shafts which are forged from "fluid-compressed" steel, the webs being shrunk on to the shafts and crankpins, and secured by turned dowels driven half into webs. Each complete shaft is composed of three interchangeable lengths, connected by solid flanged couplings; the thrust and propeller shafts are of similar material. All working parts of the machinery possess a degree of strength varying from 35 per cent. to 60 per cent. in excess of Lloyds' requirements.

Boilers

These are of the Scotch type, two being double-ended and four single-ended units of 15 ft. 6 in. diam., the former 21 ft. and the latter 12' ft. long. The total heating surface amounts to 21,900 sq. ft. and the grate area, 560 sq. ft. The boilers operate under forced draft, and supply steam at a pressure of 180 lbs. per sq. in. enabling the engines to develop 8,000 indicated horsepower when running at a speed of 100 revs. per min. The bunker capacity is designed for 1,300 tons of coal.

Auxiliary Equipment

A complete electrical installation is fitted, the 110 volt, A.C. generator being in duplicate, and driven by compound high speed engines, running 500 revs per min. A 24 in. searchlight is provided for observation purposes, and a wireless equipment is to be installed by the Canadian Marconi Co.

Engine room communication with the navigation bridge is provided by Chadburn's (Ship) Telegraph Co., the instruments being of the latest type: illuminating, repeating, and tell-tale.

Ventilation, steam heating, hot and cold water services throughout are provided to withstand rigorous climatic conditions. Four 26 ft. lifeboats and one captain's cutter provide life-saving apparatus in compliance with law, for the ship's crew of 90 officers and men. Engineers' and stewards' quarters are on the main deck, the crew and petty officers being quartered on the forward part of the same deck, while officers' quarters and mess-room are located at the forward end of the upper deck casing.

Dimensions

Following are the principal dimensions of the vessels:

Length overall	292 ft.
Length between uprights	275 ft.
Breadth moulded	57 ft. 5 in.
Depth moulded	32 ft.
Draft mean	19 ft. 3 in.

Deadweight on above draft with coal stores and crew, about 950 tons.

As we go to press, information reaches us that the J. D. Hazen has been sold by the Canadian Government to Russia for the purpose of helping to keep that country's winter port throughout the coming throughout the comwinter. Fitting out to completion will therefore be rushed.

LAUNCH PROMPTS SHIPBUILDING AID DEBATE

ON a motion to go into supply in the House of Commons, Ottawa, on May 16, E. M. MacDonald, of Picton, brought up the question of shipbuilding in Canada. He referred to the statement of Sir Robert Borden at the launching of the new ice-breaker at the Canadian Vickers yard, Montreal, that the Canadian Government favored subsidizing the shipbuilding industry. It was not so long ago, said Mr. MacDonald, that the idea of building of steel ships in Canada had been proclaimed an absurdity by the Government. Now it had been demonstrated that as Canadian manufacturers could make shells, submarines and ice-breakers, in like manner they could make steel ocean-going vessels. The Pictou member did not favor assisting the construction of wooden vessels. In conclusion, he pointed to the present scarcity of tonnage as a reason for the immediate encouragement of shipbuilding, and said he had no doubt the scarcity would for a long time exist after the war was over.

P. L. MILLER, MANAGER CANADIAN VICKERS, LTD.

F. ORR LEWIS, PRESIDENT CANADIAN VICKERS, LTD.

Sir Robert Borden replied that he was not aware ability to build steel merchant ships had ever been questioned. A country with Canada's resources must ultimately engage in the construction of steel ships. Mr. MacDonald had appeared to confuse the development of a Canadian shipbuilding industry with the present scarcity of tonnage due to the war. Sir Robert said that he had found no one in Canada prepared to construct steel ships within a period which would render them useful in the present condition of vessel scarcity. He doubted whether it would be any advantage to begin the construction of steel vessels now when the cost was at its peak, in view of the fact that they would not be available when tonnage was most needed. After the war was over, the Prime Minister thought, there would be less cargo for vessels to carry, and owing to the release of vessels now interned there would be many more ships to carry it. Sir Robert said he had been informed that the cost of building steel ships in England and Canada would in twenty years be approximately the same.

Hon. Wm. Pugsley said that Canada ought to proceed at once to encouragement of shipbuilding, but unlike his confrere, he was in favor of assisting the construction of wooden vessels.

Sir Thomas White said that the tariff had evidently been framed to help the shipbuilding industry, but a protective tariff would not be sufficient. There would have to be a bounty embracing a period of years. The Finance Minister said that the Government was entirely in sympathy with the idea of encouraging shipbuilding in Canada.

Sheet Metal Elbows, Their Development and Laying Off-III

By J. W. Ross

In order to thoroughly understand the principles involved in the development of cylindrical and other forms, such as are met in sheet metal work, a considerable knowledge of geometry is desirable. Through the medium of these articles, the author places practical examples at the disposal of our readers, and the knowledge to be gained by a close and persistent study of the principles and methods employed will well repay the time spent.

ELBOW OF CLINKER COURSES

In Fig. 14 is shown the elevation view of a five-coursed 120-degree elbow of ½-in. plate. This system of fitting the courses is generally termed "telescopic" plating; it should be more correctly called "clinker" plating.

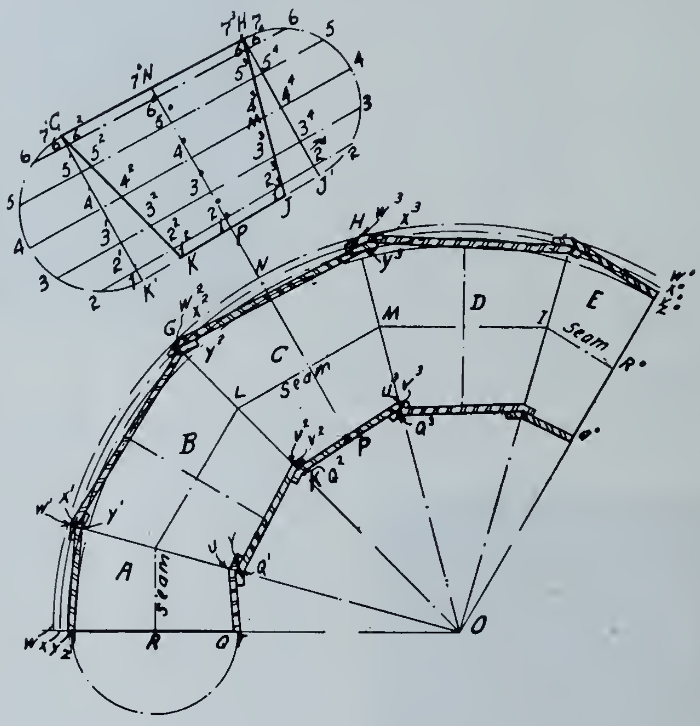
It will be observed that the end of one course fits over, whilst its other end fits in; thus each course will be conical in form.

Many platers prefer to lay this out by triangulation, which is generally too slow for most problems. Again, some prefer approximate methods which certainly give a quick layout, but much time is wasted and the work generally poor, when the courses are being fitted and lined up for riveting, very often the holes being unfair and completely "blind."

The method given below of developing this type of elbow is much superior and quicker in every way than that of triangulation or approximate methods. Triangulation will be dealt with in a forthcoming isue. The student may then use the method suitable to his own ideas. It was stated that each course was conical; therefore, it will be developed on the principle as described for cones—that is, by radial lines. The method of constructing the elevation view is different to the preceding problems.

Measure off OR, Fig. 14, equal to 36 inches, and RQ, RZ each equal to 9 inches; thus the inside diameter of the elbow will be 18 inches at ZQ, Fig. 14. With O as centre and OR as radius, strike the arc RR°. Construct the angle ROR° equal to 120 degrees. Mark off YZ, YX and XW each equal to the thickness of the plate. With each of these points as radii to the centre O, strike in the arcs ZZ°, YY°, XX°, and WW°. The mitre lines are obtained as previously explained.

Each of the end courses equals one, and each of the intermediate courses equals two. According to the drawing, the courses A and E equal two, while BCD equals 6, making the sum of 8. Now, 8 divided into 120 degrees equals 15 degrees. By dividing the arc WW° into 8 equal parts and connecting these points by straight lines to O, the mitre lines are located. Draw RS at right angles to ZRQ. With the dividers set to the distance OS, mark off the points OL, OM, and O1 on the mitre lines. Connect these points by straight lines, as S to L, L to M, M to I and I to R°; these lines will be tangent to the arc RR°.



FIGS. 14 AND 15.

To show a cross section of the plate thickness, connect Z to Y^1 and Y to X^1. Y^1 and X^1 are of course the intersections of the mitre line. So with the arcs YY° and XX_0. Similarly connect X^1 to Y^2 and W^1 to X^2; also proceed with the remaining lines that are drawn in, as shown on the arc ZZ°, YY°, XX°, WW°, Fig. 14.

The throat thicknesses are next drawn in. Mark off QT equal to the plate thickness. With dividers on S and distance SY^1 measure off SU^1, also SV^1 and SQ^1 equal respectively to SX^1 and SW^1. Connect Q to U^1 and T to V^1. In the same manner, with L as centre, the distances LY^2, LX^2, and LW^2 are transferred to LU^2, LV^2 and LQ^2 respectively. Connect V^1 to U^2 and Q^1 to V^2. Similarly proceed with the remainder of the construction.

By this method of construction, if the end courses EA were joined together they would conform to the courses B, C, or D. So if one of the intermediate courses is marked off, the end courses may be marked from the pattern.

The course C will, therefore, be developed; and to save confusion of the lines on this drawing the neutral lines of course C will be transferred over to Fig. 15. The heavy lines GHJK, Fig. 15, represent the neutral lines of course C, Fig. 14, or, which is equally the same, of the courses B and D. Parallel to the centre girth line PN draw from G the line GK^1, also from H the line HJ^1. Extend the line KPJ to the points K^1 on GK and J^1 on J^1H. Now, as will be seen, K^1GHJ^1 forms an ordinary frustum of a cone, so accordingly will it be developed. Bisect GK^1 at 4^1. With 4^1 as centre and 4^17—which is of course, the neutral radius—as radius strike the half-end view 147. Divide this into a number of equal parts, and number accordingly. Project these points to intersect GK^1 at right angle. Bisect HJ^1 as at 4^4. With 4^4 as centre and radius 4^47, strike the half-plan view 147. Divide this into the same number of equal spaces, as in the view through GK^1.

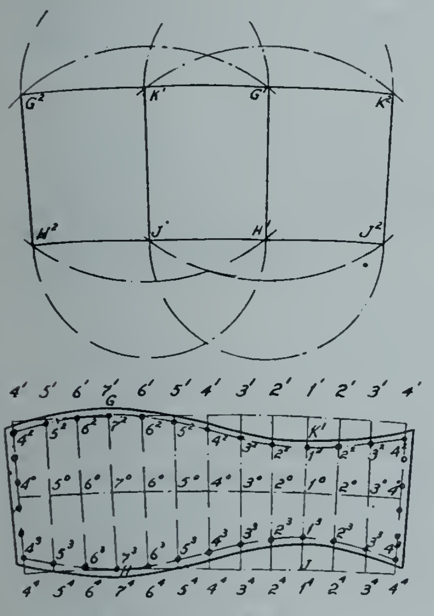
Number these points in the same consecutive order, and project lines from them to intersect HJ^1 at right angles. Connect points on GK^1 with corresponding points on HJ^1. The lines connecting these points will not be parallel, but will be radial, because HJ^1 is shorter than CK^1; GK^1, J^1K being part of a cone. Where these lines intersect the inclined lines GK and HJ, number as in Fig. 15.

For explanatory reasons only, the outline K^1GHJ^1 is transferred over to Fig. 16, as $J^1K^1G^1H^1$. With trammels or dividers on H^1 as centre and H^1K^1 as radius, strike the arc K^1K^2. With J^1 as centre and radius J^1G^1, strike the arc G^1G^2. With K^1 as centre, K^1G^1 as radius, strike the intersecting arc G^1G^2. Similarly with the same radius and G^1 as centre, strike the arc K^1K^2. Again, with K^1H^1 as radius, G^1 and K^1 as centres, strike the respective arcs J^1J^2 and H^1H^2. With J^1H^1 as radius and centres J^1 and

H^1, strike the intersecting arcs H^1H^2 and J^1J^2.

Draw an even curve through the points $G^2K^1G^1K^2$, Fig. 16, by the aid of a light wooden batten placed on the four points. In a similar manner draw in the curve through the points $H^2J^1H^1J^2$.

Again, for the benefit of instruction and to avoid a confusion of lines, Fig. 16 has been transferred over to Fig. 17, as shown by $4^14^14^1$ for the upper curve and $4^44^44^4$ for the lower curve. Measure off from and on each side of 4^1—of the centre line 4^14^4—along the curve 4^14^1 a distance equal to half the neutral stretchout of the diameter 1^17^1, Fig. 15, which equals half of $22 \times 3.14 = 34\frac{1}{2}$ inches. The total of the stretchout for $4^14^14^1$ will be 69 inches. Similarly the stretchout for the lower curve will be $56\frac{1}{2}$ inches; therefore, half of this stretchout measured along each half of



FIGS. 16 AND 17

the curve from the central point 4^4 will locate the whole stretchout as enclosed by the points $4^14^14^44^4$. Divide 4^1 and 4^4 each into 12 equal spaces—that is, six spaces at each side of centre 4^1 and centre of 4^4, which is the number of spaces each half plan view is divided into in Fig. 15. These points on Fig. 17 are connected by straight lines and numbered accordingly. The curved centre line 4^0, 4^0, 4^0 is drawn equidistant to the curves $4^14^14^1$ and $4^44^44^4$.

As PN, Fig. 15, is equidistant from the inclined lines GK and HJ, therefore the distances 1^01^2, 2^02^2, etc., are equal respectively to 1^01^2, 2^02^2, etc. As both sides of the centre line PN are alike it will only be necessary to take one set of measurements to be transferred over to Fig. 17. These distances be measured from and at each side of the centre camber line $4^04^04^0$, Fig. 17.

Set the dividers to distance 1^01^2, Fig. 15; transfer this over to 1^01^2 and 1^01^3, Fig. 17. Proceed similarly by transferring over from Fig. 15 the distances 2^02^2, 3^03^3, etc., to Fig. 17, as 2^02^2, $2\,2^3$, 3^03^2, 3^03^3, etc. An even curve drawn through these points locates the rivet line and these points also indicate the rivet centres if desired. Divide the seam rivet lines 4^24^3, 4^24^3, each into the same number of rivet spaces. Twice the diameter of the rivet hole, measured from the rivet line, will give a suitable lap. For caulking purposes in water or steam-tight work, one and a half times the diameter of the hole will be more suitable for laps, the rivet holes, of course, being spaced according to the class of work.

Fig. 17 shows the complete pattern for courses B C and D. If the plate be cut on the line $4^04^04^0$, Fig. 17, the upper part would be the pattern for course E and the lower for course A.

RE-OPENING OF THE PANAMA CANAL

WHILE the re-opening of the Panama Canal to vessels drawing up to 30 feet of water has just been announced, there is every indication, says the New York "Journal of Commerce," owing to the difficulties experienced by shipping when the waterway was closed to traffic last fall, that the use of the canal will not be resumed on a normal basis for some months to come.

The confidence which was once felt in the canal was destroyed by that experience, and with the services of vessels at their present high value, representatives of steamship companies say that they are naturally hesitant to place themselves in a position where a repetition of the delays with attendant money losses, even if traffic were only temporarily suspended, would be possible. The consequence is that those companies which depended for the maintenance of their service on the Panama Canal will not resume immediately, but will wait until the canal has been tested.

Lines which will send their ships through the canal at once are those maintaining services where the use of the canal means merely a shortening of the voyage. In this class are companies operating vessels from Atlantic ports of the United States to the west coast of South America. The temporary suspension of traffic would work great hardship on these lines, because of the delay in taking the longer course and the necessity to provision ships differently unless the canal is used, but the saving in expense is such as to warrant running the risk.

The Disappearing Propeller Boat Co. has been incorporated at Toronto, with a capital of $45,000, to manufacture boats of every description. Head office to be situated at Toronto. Incorporators: F. W. Callaghan, N. H. Wilson, and N. H. Brown, all of Toronto.

SAILING DISTANCES—NAUTICAL MILES, PACIFIC COAST

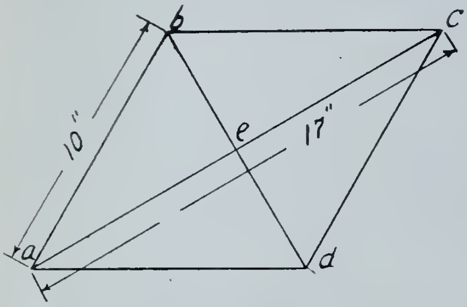
From	To Vancouver	To Victoria
	M	M
Aberdeen	14,680	14,600
Adelaide	7,753	7,673
Aden	10,727	10,647
	M	M
Amsterdam	14,439	14,359
	M	M
Antwerp	14,403	14,323
Auckland	6,205	6,125
	M	M
Barbados	12,238	12,158
	M	M
Belfast	14,327	14,247
Bombay	9,536	9,456
	M	M
Bordeaux	14,053	13,973
	M	M
Bristol	14,208	14,128
	M	M
Bueuos Ayres	8,336	8,256
Calcutta	8,719	8,639
	M	M
Cape Town	11,017	10,937
	M	M
Cardiff	14,188	14,108
	M	M
Cherbourg	14,143	14,063
Colombo	8,586	8,506
	M	M
Copenhagen	14,830	14,750
	M	M
Dundee	14,663	14,583
	S	S
Genoa	13,530	13,450
	M	M
Gibraltar	13,351	13,271
	M	M
Glasgow	14,409	14,329
	M	M
Grimsby	14,467	14,387
	M	M
Halifax	13,770	13,690
	M	M
Havana	13,774	13,694
	M	M
Havre	14,212	14,132
Hongkong	5,800	5,720
	M	M
Hull	14,479	14,399
	M	M
Leith	14,657	14,577
	M	M
Liverpool	14,317	14,237
	M	M
London	14,363	14,283
Madras	9,721	9,641
	S	S
Malta	13,060	12,980
	S	S
Marseilles	13,630	13,550
Melbourne	7,347	7,267
	M	M
Montevideo	8,276	8,196
	M	M
Montreal	14,490	14,410
	S	S
Naples	13,237	13,157
	M	M
Newcastle	14,567	14,487
	M	M
Plymouth	14,100	14,020
	S	S
Port Said	12,124	12,044
	M	M
Quebec	14,355	14,220
Rangoon	8,167	8,087
	M	M
Rio de Janeiro	9,214	9,134
	M	M
Rotterdam	14,415	14,335
	M	M
St. Johns (Nfld.)	13,707	13,627
Shanghai	5,230	5,170
Singapore	7,089	7,009
	M	M
Southampton	14,193	14,113
	M	M
Sunderland	14,554	14,474
	M	M
Swansea	14,170	14,090
Sydney	6,848	6,768
Valparaiso	5,938	5,858

Series of Practical Questions and Answers for Engineers

By "Artificer"

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals will be found a useful companion study. With a view to meeting the need of many of our lake and inland waterway engineers who, during the closed season of navigation, take positions in steam power plants ashore, questions relative to the latter department will also find a place in the series.

Question—A square 10 inches on a side, is forced into a parallelogram, the long diagonal of which measures 17 inches; what is the area of the parallelogram, and the percentage of reduction?



SQUARE AND PARALLELOGRAM QUESTION.

Answer—If the length of the long diagonal, a c equals 17 inches the length of the short diagonal or line, b d, can be found from the equation b e= $\sqrt{[(b\ c)^2-(c\ e)^2]} = (10^2-8.5)^2)=$ 5.267 inches.

Then as the several triangles are of similar shape and size, the area will equal the length of one of the diagonals multiplied by one-half the length of the other, or 17 $\times$ 5.267=89.539 sq. inches. The percentage of reduction from the original area of the square would be 100—89.54 $\doteq$ 10.46 or approximately 10½ per cent.

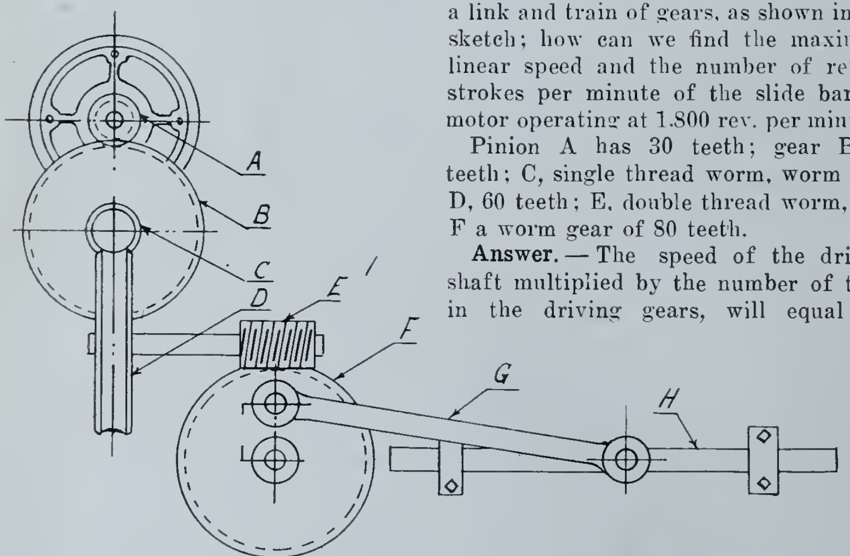
Question. — When installing a motor to drive a line of shafting, would it be better to drive from the end or the middle of its length?

Answer.—Under general conditions it is advisable to have the main driving pulley placed upon the shaft as near the centre of its length as possible so as to move evenly distribute the strain throughout the shaft. When the drive is from one end the torsion on the shaft is sometimes very great, where a heavy load is carried. However local conditions must be carefully considered, as it is sometimes impossible to follow a hard and fast rule, but in all cases better results are obtained if the heavy loads are kept as near the source of power as possible.

* * *

Question.—A motor operates a horizontal slide bar, through a link and train of gears, as shown in the sketch; how can we find the maximum linear speed and the number of return strokes per minute of the slide bar H, motor operating at 1,800 rev. per minute?

Pinion A has 30 teeth; gear B 80 teeth; C, single thread worm, worm gear D, 60 teeth; E, double thread worm, and F a worm gear of 80 teeth.

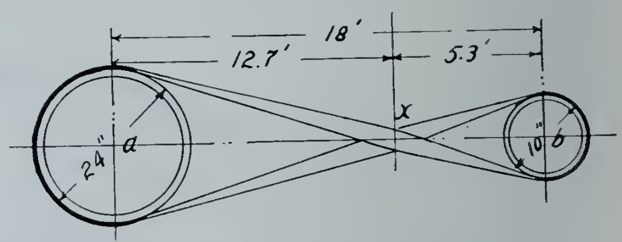


ILLUSTRATING SPEED OF SLIDE BAR.

Answer. — The speed of the driving shaft multiplied by the number of teeth in the driving gears, will equal the speed of the driven shaft multiplied by the number of teeth in the driven gears; thus, if X equals the speed of the gear F, then 1800 $\times$ 30 $\times$ 1 $\times$ 2 =X $\times$ 80 $\times$60$\times$80 or $X = \frac{1800\times30\times1\times2}{80\times60\times80} = \frac{9}{32}$ rev. per minute, or 1 revolution in 3 5-9 minutes.

The maximum speed of bar H, will be when link G is in the position shown. With the mechanism in this position the speed of bar will approximate $\frac{9}{32} \times \frac{12 \times 3.1416}{12} = .8836$ ft. per minute.

Number of return strokes per minute are equal to rev. of gear F, or 9-32 of a revolution per minute.



POINT OF INTERSECTION OF CROSSED BELTS.

Question.—How can we determine the point of cross on crossed belts when the pulleys are of different sizes?

Answer.—The crossing point X will always lie nearer to the smaller pulley. The distance x b. will be to the center distance a b, as the diameter of the small pulley is to the sum of the pulley diameters. For example, a pulley 24 inches in diameter is to be connected by a crossed belt to a 10-inch pulley, shafts being 18 feet apart; where will the point x fall?

(x b) : (a b) : : d : D + d or

(x b) : 18 : : 10 : 24 + 10 then

$$(x\ b) = \frac{18 \times 10}{24 + 10} = \frac{180}{34} = 5.3 \text{ ft.}$$

* * *

Question—Why are some alternating-current generators rated in kilovolt-amperes instead of kilowatts, and what is the difference between the two terms?

Answer—The kilovolt-ampere rating expresses the electrical output, while the kilowatt rating expresses mechanical or actual energy output. Kilovolt-ampere is the measure of the capacity of an alternating current generator just as horse power or kilowatt is the measure of the capacity of the engine or turbine driving the generator. Dealing with the capacity of the generator itself, it should be rated in kilovolt-amperes. Again when dealing with the prime mover and the actual energy output of the complete unit the rating should be in kilowatts. Under a certain ideal condition, the kilovolt-ampere output becomes identical with the kilowatt output. The conditions of operation met with in practice are, however, seldom ideal. They are usually so adverse, as a matter of fact, that the energy output is less than the electrical by many per cent. A generator operating with an output of only 100 k.w. in actual energy may be delivering current at a potential that would produce 120, 150 or 200 k.w. if the conditions of load were more favorable. In fact, the internal work in the generator itself would be less if delivering 120, 150 or 200 k.w. under the better conditions. The relation or ratio of kilowatts to kilovolt-amperes is expressed by the term the power-factor.

* * *

Question—For a small plant, which is the better system of ice-making, the compression or the absorption, and why?

Answer—In small plants, the compression system is preferable. It is less complicated and requires less water.

* * *

Question—Why is it that the load curve of an exciter does not more nearly parallel the load curve of the generator it is exciting?

Answer—The exciter load curve does not parallel that of the generator because the generator field requires considerable excitation at no load to maintain rated voltage at the generator terminals. Again, at a given load, greater excitation is required to maintain normal voltage when the power-factor is lower than is needed with unity power-factor, for the reason that the lagging armature current tends to demagnetize the fields.

* * *

Question—Should a valve in its travel open a full port to live steam?

Answer—No, because the ports are designed. so as to allow of a free escape of exhaust steam. and if a full port be given, or be necessary for live steam, then for exhaust, the port is not large enough.

* * *

Question—Why is it necessary to have a larger area of port for the exhaust, as compared with the live steam?

Answer—Because the live steam having done its work in the cylinder has fallen in pressure, and become naturally of greater volume, and requires a larger space or area for escape.

* * *

Question—What is the highest voltage at which alternating-current motors have been operated with satisfactory results?

Answer—The highest voltage used with success on synchronous alternating-current motors is 13,200 volts, and on induction alternating-current motors, 6,600 volts.

* * *

Question—Why is it that the starting torque of an alternating-current series motor is not as good as that of the direct-current series motor?

Answer—The starting torque of a series alternating-current motor is less than that of a similar direct-current motor, principally because it becomes zero twice each cycle, instead of acting continuously.

* * *

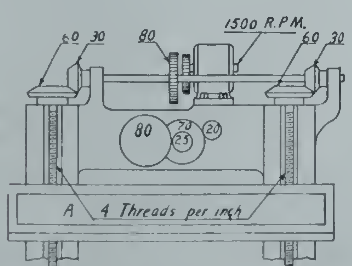
Question—Is exhaust steam operation practicable on a heating system designed for live steam operation, and vice versa?

Answer—In exhaust steam operation, it is necessary to have pipes of larger size because low pressure is carried. With live steam, the pressure can be carried high, and, therefore, smaller pipes may be used. There are two difficulties which may be encountered in trying to operate a heating system with exhaust steam which has been designed for live steam. In the first place there are many heating systems designed to operate on live steam which have not sufficient radiating surface to properly warm the building in extremely cold weather without raising the pressure from 10 to 15 lbs. or more. This cannot ordinarily be done when exhaust steam is used. Again, there are many heating systems poorly laid out or in bad repair which will not drain back the returns from all parts, unless a rather high pressure is carried. This second fault can usually, however, be corrected by installing a vacuum pump. There should be no trouble in operating with live steam a system designed for the use of exhaust steam.

* * *

Question.—With the motor running at 1,500 revolutions per minute, and the other dimensions as shown in the sketch, what time would it take to raise the cross bar A 3 feet?

Answer.—The speed of the driving shaft multiplied by the number of teeth in all the driving gears will equal the



speed of the elevating screws multiplied by the number of teeth in all the driven gears; or, taking x as the speed of the housing screws, we have $1,500 \times 20 \times 25 \times 30 = x \times 70 \times 80 \times 60$, or $x = \frac{1,500 \times 20 \times 25 \times 30}{70 \times 80 \times 60} = 67$ r.p.m. Therefore, the time required in raising A 3 feet would be $\frac{4 \times 12 \times 3}{67} = 2.15$ minutes.

* * *

Question.—Steam is expanded to 10 pounds absolute pressure, and it is desired to have the feed water at 130 degrees, the temperature of the injection water being 86 degrees, how many pounds of injection water, per pound of steam condensed, will be required?

Answer.—The total heat of steam at 10 pounds absolute is 1172.3 thermal units, therefore the ratio required is $\frac{1172-130}{130-86}$, or 23.7 to 1. The common allowance for engines with surface condensers is 24 to 30 times the weight of steam condensed, and for engines with jet condensers, from one-third to one-half the cylinder capacity.

* * *

Question.—A hydraulic elevator is operated by a piston 16 inches in diameter and 240 pounds per square inch of water pressure. There are two moving sheaves and two stationary sheaves, a single cable going to the car. What load can be lifted by the elevator?

Answer.—As the piston works against five cables, while the elevator is taken by one, the leverage ratio of the piston to elevator is 1 to 5. Area of piston $= 16 \times 16 \times .7854 = 201.06$ sq. ins. Total pressure on piston is $201.06 \times 240 = 48,254.4$ pounds. The load that can be lifted by the elevator, therefore, is $\frac{48,254.4}{5} = 9650.9$ pounds, or about $4\frac{1}{2}$ tons.

* * *

Question.—The crank arm of an engine is 13 inches long and the length of the connecting rod is 65 inches. If the engine be running under, and the pressure on the piston be $2\frac{1}{4}$ tons, what will be the greatest thrust of the crosshead against the upper guide?

Answer.—The forces acting on the piston in this case may be resolved into a vertical component and a horizontal component.

The vertical component is represented by 13 and the component in line with the connecting rod is 65. The horizontal component is $\sqrt{(65^2 - 13^2)} = 63.6$. This horizontal component actually is $2\frac{1}{4}$ tons, therefore the vertical component which acts against the guide is

$$4250 : 63.6 :: x : 13$$

$$x = \frac{4250 \times 13}{63.6} = 868,707 \text{ lbs.}$$

Nominal, Indicated, Brake and Shaft Horse Power Ratings

By James Watt

The accompanying article constitutes the substance of an essay which received a prize award from the Institute of Marine Engineers. The author, a graduate of the Institute, discusses in easily intelligible language the various systems and methods that have been and are employed in determining the horse-power of various prime movers, and, as a consequence, we believe a large section of our readers will find perusal of the article peculiarly helpful.

A PIECE of mechanism or a machine must in the first place be designed by the scientist—then the economist steps in and asks for a means of predicting or obtaining the output of the machine in order to compare the merits of the various designs. In the case of prime movers, several means have been adapted, according to the various conditions, to obtain the various outputs and efficiencies; the following are principal bases upon which such may be compared.

Nominal Horse-Power

New times demand new measures and new men, and so nominal horse-power, which in Watt's time conveyed some idea of the size and capacity of any engine, has now little more than historic interest. Prior to the introduction of the steam engine, the only power other than water was animal power. It was quite natural that when steam was introduced, the power of the new prime mover should be compared with that which it superseded. It was estimated that an average dray horse could do work at a rate of 33,000 ft. lbs. per minute, so Watt fixed this as a standard or unit which he called a horse-power. He wished also to be able to predict the power which a new engine would develop, so, as a result, he more or less standardized the chief features in the design, and so formed from observation the following more or less empirical rule:—

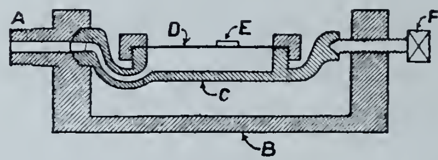
$$\text{Estimated or n.h.p.} = \frac{A \times 7 \times 128 \times \sqrt[3]{\text{stroke}}}{33{,}000}$$

Where A=area of piston in square inches.
7=mean effective pressure. (This was obtained by observation).
128 $\sqrt[3]{\text{stroke}}$=piston speed. (The engine was so designed to give this speed).

From this expression it is seen that the numerator gives the number of foot-lbs. of work done by the engine per minute, and by dividing by 33,000, the number of units of power or horse-power is obtained. This figure Watt called the nominal horse-power of the engine, and is really what is now known as the indicated horse-power. In this expression there are only two variables, the area and the stroke; the mean effective pressure and the piston speed are constants. Obviously, in due course, when higher pressures and increased piston speeds were used, great discrepancies took place, with the result that under modern conditions the n.h.p. according to the formulae is of no practical value. At the present day the term n.h.p. has almost fallen into disuse, except in a few cases where the expression has been more or less modernized, and often when these various rules are applied to the same engine, the results vary between wide limits.

Indicated Horse-Power

At the present day we still maintain the original idea of Watt regarding the capacity of an engine, but have altered it



DIAPHRAGM INDICATOR

A—Connection to engine cylinder. B—Main frame. C—Rocking case. D—Thin steel diaphragm. E—Small mirror. F—Adjusting pivot.

to suit the varying conditions, etc. In considering the actual horse-power developed in an engine cylinder, the following functions must be taken into account:—Mean effective pressure, i.e., the average pressure on the piston throughout the stroke; the length of the stroke; the area of the cylinder; the number of working strokes per minute. By multiplying these functions together the total number of foot-lbs. of work done per minute is obtained, and thus the expression can be condensed down to the well-known formula

$$\text{I.H.P.} = \frac{\text{P.L.A.N.}}{33{,}000}$$

Where P=Mean effective pressure (lbs. per sq. in.).
L=Stroke (ft.).
A=Area of piston (sq. inches).
N=Number of working strokes (per minute).

Determining the I.H.P.

To obtain the i.h.p. of an engine the various data must be first obtained. The piston area and the stroke are only matters of mensuration. The number of working strokes per minute can be obtained in various ways, e.g., by means of a counter or similar device. The mean effective pressure is obtained by means of an instrument called an indicator, of which there are many different designs, but they may all be tabulated under two headings:—(1)—Piston type; (2)—diaphragm type. The former consists of a small cylinder which can be connected to the main engine cylinder by means of pipes or such like. A small piston, whose motion is controlled by means of a spring, moves in this cylinder, and by means of suitable levers, etc., a magnified motion of this piston is given to a pencil which is placed in contact with a strip of paper attached to a cylindrical drum. This drum is given a motion corresponding to that of the main engine piston, but reduced to a practical size of from 2½ in. to 3½ in. in length. As a result of these two motions, which are at right angles, the pencil traces out what is known as an indicator card.

The diaphragm indicator is an optical instrument, and hence can be used in very high-speed work, as there are no inertia effects from delicate mechanisms. This instrument consists of a shallow cylindrical box pivoted. The top disc of the box is formed by a thin steel diaphragm to which is attached a small mirror, in the position shown in the diagram. An increase or decrease of pressure in the box will tilt the mirror slightly and thus alter the angle of reflection of a ray of light projected on the mirror. The box is given a rocking motion proportional to the displacement of the engine piston. These two motions being at right angles, the spot of light will trace out a diagram, similar to that of the piston indicator, which can be photographed or traced on a card.

Mean Pressure From Indicator Diagram

To obtain the average length of the pressure ordinates on the indicator cards, i.e., the mean effective pressure, several means can be adapted: the following, are however, the most common: (1)—By method of ordinates; (2)—By means of a planimeter.

By method of ordinates:—Using the atmospheric line on the card as a base line, draw two lines at right angles, one touching each end of the diagram. Divide the portion of the atmospheric line between these perpendiculars into say 10 equal parts, and at the mid-point of each tenth, draw perpendiculars, cutting the diagram. An easy and accurate method of obtaining the sum of these ordinates is by means of a piece of straight edged paper. First the length of one ordinate is marked on the papers edge, then the paper is moved and the length of the next ordinate marked adjacent to it. By continuing this a result is obtained. The total length is the sum of these ordinates and the mean ordinates of the diagram is total length divided by 10.

By means of a planimeter:—The different types of planimeters which can be used for this purpose are many and hence cannot all be described; the method of using the common area planimeter can, however, be indicated. The instrument is set in the usual way, and the tracer run round the diagram. The reading thus obtained is the area and when divided by the length of the card will give the length of mean ordinate.

In a piston type indicator various springs are used according to type and speed of engine under test. The stiffness of these springs is such that for a certain pressure on the indicator piston, the pencil has a vertical motion of say one inch. In the case of a diaphragm indicator a calibration line is usually put on the first cards. The length of this line corresponds to a certain known pressure, and thus a constant for that particular setting is obtained.

Brake Horse-Power and Shaft Power

It is rather difficult to differentiate between the terms brake horse-power and shaft horse-power. Numerically, they are equal, but the two different terms are applied to the two different methods of obtaining the same numerical result. In the first place the term brake horse-power can be applied when the useful output of the engine is measured by means of a frictional brake or similar contrivance. In the case of shaft horse-power the term can be applied when the useful output is measured by some apparatus other than frictional, connected or attached to the shaft, such as an electrical generator or torsion-meter. Owing to various mechanical difficulties, etc., it is not always possible to obtain the brake horse-power of an engine, especially a large one. There are many contrivances, however, by which this can be obtained, e.g., prony brakes, band brakes, dynamometers.

Brake Arrangement

A prony brake is only used for very small engines, and usally consists of two wood blocks clamped by means of bolts to the engine shaft. Attached to one block is a long lever, from the outer end of which can be suspended various weights. The principle of this apparatus is—that when the lever is floating between the two stops the engine is exerting an equal and opposite turning moment on the shaft.

Thus shaft horse-power=

$$\frac{W\ R\ N\ 2pi}{33{,}000}$$

Where W=suspended weight (lbs.), R =moment length of lever, N=revolutions per minute.

The arrangement for a band brake is usually applied to a fly-wheel. The principle involved is similar to that of a prony brake, but the method of obtaining the result is slightly different. Consider the initial state when the engine is at rest. If friction, etc., in the engine were eliminated and the weight of the rope and attachments neglected, the spring balance reading would correspond to the weight W. Now it is obvious that when the fly-wheel rotates in the direction indicated, the friction between the band and fly-wheel will tend to lift the weight W, thus the tension on the spring balance will be reduced. When a floating condition is reached it is obvious that the torque exerted by the brake equals the torque exerted by the engine. The brake torque=R (W—SB); where R=fly-wheel radius+half dia. rope (ft.), W=load weight (lbs.), SB=spring balance reading (lbs.)

Brake horse-power = torque×space =

$$\frac{R(W—SB)\ 2pi\ N}{33{,}000} N = \text{r.p.m}$$

There are several types of dynamometers, and they can best be classified under two headings:—(1)—Where the energy is absorbed by means of solid frictions. (2) Where the energy is absorbed by means of fluid friction. The former are not of much practical importance, but the latter can be applied to engines of any size.

In the case of fluid friction dynamometers, the principles involved in the various designs are similar, and the designs only vary in details. The essential features of this type of dynamometer are a series of discs or rotors keyed to a shaft which is coupled to the engine shaft. These rotors are enclosed in a case through which water is circulated. This case is supported on frictionless bearings, and has usually guide vanes fixed inside in order to increase the frictional resistance and thus carry a greater load. As these rotors are rotated, the fluid friction produced tends to rotate the case in the same direction. This is prevented by weights attached to a lever secured to the case. From this it is seen that when a floating condition is reached the turning moment of the engine is equal and opposite to that produced by the weights and lever.

This is B.h.p.= $\frac{2pi\ W\ R\ N}{33{,}000}$; where W= weights on lever, R=moment length of lever, and N=r.p.m.

The Torsion Meter

The shaft horse-power of an engine is symbolically equal to i.h.p. (frictional losses, etc., in the engine). One of the most convenient ways of obtaining the shaft horse-power of an engine is by means of a dynamo direct coupled to the engine shaft. The current generated may be absorbed in any convenient way, e.g., by a water load, or pumped into the mains. The output voltmeter and ammeter readings are taken and the engine output obtained thus:—

S.h.p.= $\frac{V\times A\times 100}{746\times y}$; where V = volts, A = amperes, y = per cent. efficiency of dynamo.

With the advent of the turbine a means of obtaining the output was devised in the instrument known as the torsionmeter. It is a well-known mechanical principle—that the angle of twist in a uniform shaft is directly proportional to the twisting moment applied, provided the elastic limit of the material is not exceeded.

The torsion-meter consists of a comparatively long uniform shaft coupled between the engine under test and the machine which is to supply the necessary braking load. The diameter of this uniform shaft is less than that of the engine shaft, so that the angle of twist may be large enough to be read with a certain degree of accuracy. Close to each end of the shaft are rigidly fastened two large circular discs. The outer edge of one disc is formed by a celluloid scale marked off accurately in degrees. The other disc has a cross-hair eye-piece rigidly fastened to it at the same radius as the scale. To simplify the reading a mirror is placed so as to reflect the image of the scale through the eye-piece outwards. The scale is also illuminated from the back to facilitate the reading of the same.

If the shaft be rotated at a fair speed a permanent ocular image of the hair on the scale will be obtained in the mirror. As a load is applied the shaft will twist and the hair will move relatively over the scale and a new reading will be obtained. The difference between the reading at rest and this will be the angle through which the shaft has twisted due to the load. The shaft having been previously calibrated, the twisting moment corresponding to this angle of twist is obtained and hence the shaft horse-power transmitted.

S.h.p. $\frac{=2pi\ T\ N}{33{,}000}$; where T=twisting moment in lbs. ft., N=r.p.n.

INAUGURATION OF NEW ELEVATOR EXTENSION

IMMEDIATELY following the launch of the new ice-breaker, "J. D. Hazen," from the shipyard of Canadian-Vickers at Longue Point, on the afternoon of May 15, and graced by the presence of the same distinguished party of invited guests, the $800,000 addition to Montreal Harbor Commissioners' Elevator No. 1, was formally opened. The ceremony took place on the mezzanine or sacking floor, Lady Borden giving the signal which set the machinery in motion and opened a bin valve, thereby permitting a continuous stream of wheat to fall on the moving conveyor belt underneath. In so doing she inaugurated the full activity of what is now the largest seaport elevator in the world, the new addition giving elevator No. 1 a total capacity of 4,000,000 bushels.

Starting-up Function

The machinery was started by means of two small flags, of which the staffs were covered with insulated copper. By crossing these and thus connecting the copper ends Lady Borden established a current which gave a signal down in the power room. The power room immediately answered by clanging a gong, and men stationed at the proper points through the building threw in the machinery clutches. Lady Borden then opened the bin valve and the elevator was in operation. Those present next walked over to the huge dray elevator near Shed 3, and were lifted to the second floor, where an enjoyable collation awaited them.

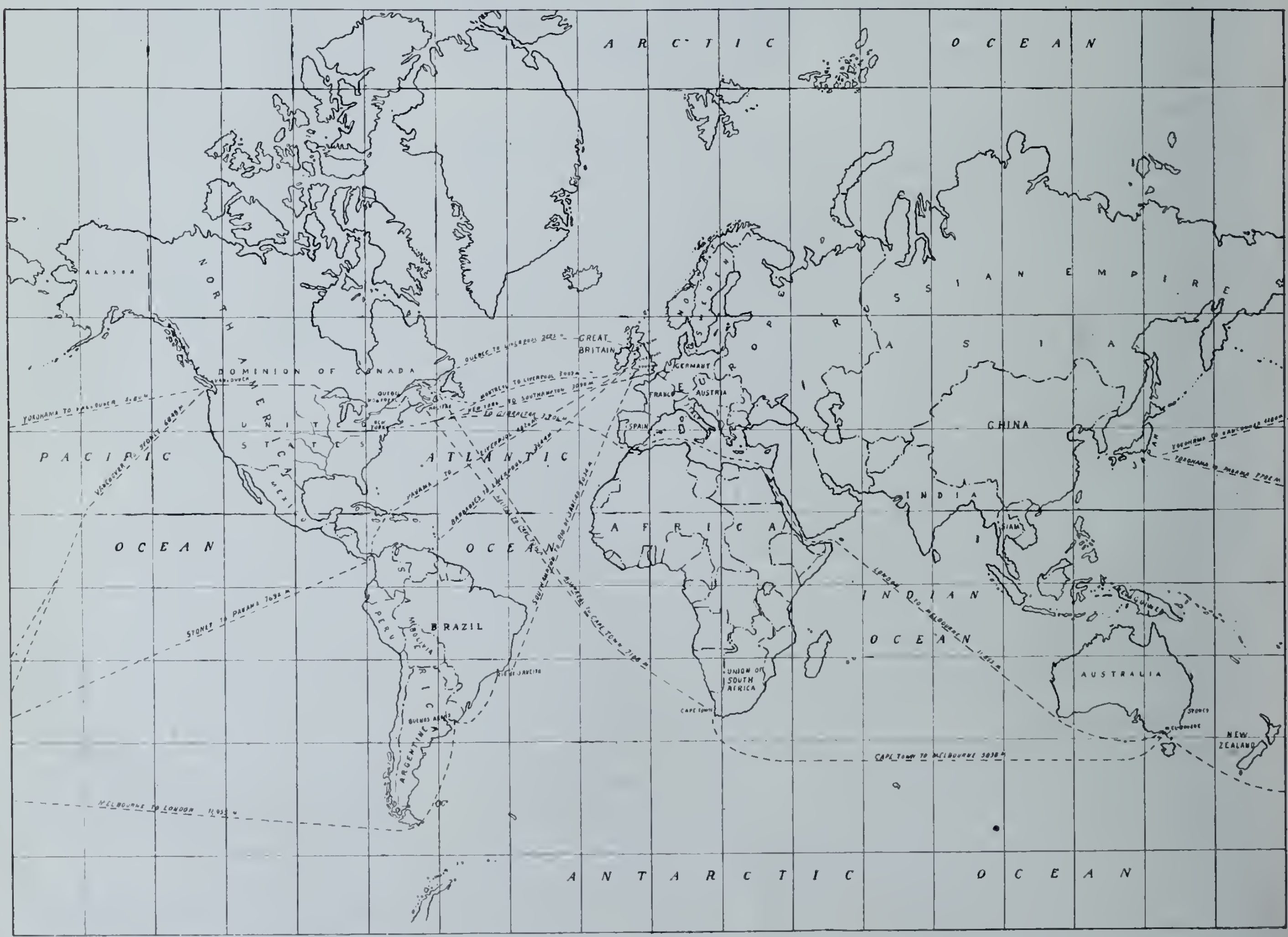
Presentation to Lady Borden

Here W. G. Ross, chairman of the Montreal Harbor Commission, addressed Sir Robert and Lady Borden, Lieutenant-Governor LeBlanc and Mrs. LeBlanc and the other guests. At the end of his address the occasion was signalized by the presentation to Lady Borden, by Mrs. W. G. Ross, of a magnificent silver tray with a striking representation of the new elevator engraved on it, together with the following statement:—"Presented to the Right Honorable Sir Robert Laird Borden, P.C., K.C.M.G., K.C., LL.D., Prime Minister of Canada, and Lady Borden, on the occasion of the opening of the extensions to Grain Elevator No. 1, Harbor of Montreal, Fifteenth May, 1916, by the Harbor Commissioners of Montreal. William G. Ross, President Farquhar Robertson, Brig.-General A. E. Labelle."

Mr. Ross stated in his address that the building would stand as one of the many monuments to business industry through the country. The contract for the extension, called for completion on July 15 next, but it had been completed two months ahead of time and at a cost about ten per cent. under the estimates. Grain from the elevator could be poured into the hold of any ship at its own berth in the greater portion of the harbor, and it could unload the largest lake steamer in $3\frac{1}{2}$ hours after its arrival. It could fill the largest grain ocean-carrier in seven hours.

The harbor facilities had developed very quickly from the time 10 years ago when half a million bushels made almost the total amount of grain handled. In 1914 Montreal handled more grain than any other seaport of North America, and already this year before navigation opened 5,000,000 bushels were dealt with, most of it being bagged and shipped by cars to St. John and Halifax. During the winter 41,152 cars were handled on Harbor Commissioners' railway, twice the number of any previous winter.

After Mrs. Ross had presented Lady Borden with the silver tray for the Harbor Commissioners. His Honor the Lieutenant-Governor of Quebec, expressed his



THE WORLD—MERCATORS PROJECTION— SHOWING PRINCIPAL STEAMSHIP ROUTES.

pride and pleasure at being present on the important and historic occasion.

Transportation Problems

Sir Robert Borden expressed his pleasure at seeing such development in the Port of Montreal as he had witnessed on his trip to the Canadian Vickers, to be present at the launching of the new ice-breaker. In connection with the launching he had been speaking of the industrial development of Canada, but the basic industry of Canada was agriculture, and the prosperity of Canada had to be built upon it. Her agricultural production could be immeasurably increased yet. Only one-tenth of the available fertile area of the West had been scratched, and the possibilities of expansion there confronted the Government with the pressing need of adequate transportation for the crops by water and by land, so that the grain would be taken in the most economical and efficient manner to the markets of the world.

Canals and railways were needed, and last, but not least, the development of the great national ports of Canada. He was pleased to be present at the opening of the greatest tidewater elevator in the world, and to see what he had seen. He prophesied a phenomenal development for the port in the next quarter century and he promised the cooperation of the Government of Canada for every reasonable purpose to secure the development needed. In Montreal what had been done was only the beginning of the great work intended in the future.

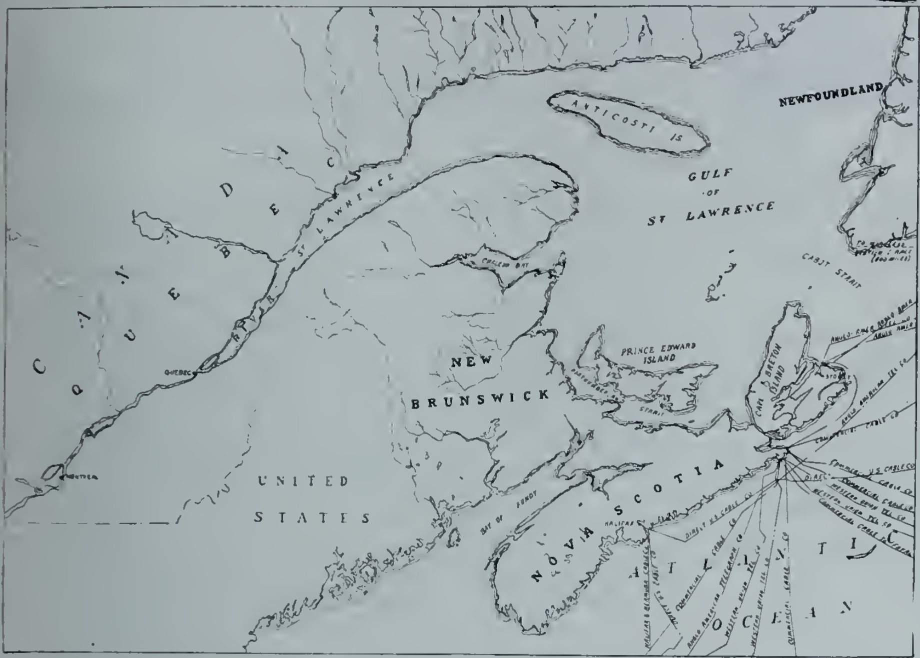


DIAGRAM SHOWING OCEAN CABLE STATIONS IN MARITIME PROVINCES.

OCEAN FREIGHT RATES

OCEAN rates are based on prompt acceptance, usually by wire, and unless so answered are void as to contract, except by special agreement. As steamship agents always base their calculations on cubic contents, be careful in asking rates on bulky or measurement goods, like machinery of all kinds, to be explicit as to weights and measurements. Mark and number each package, and be sure the invoice tallies with the shipment. If you desire shipment insured, say so in your advice to the steamship company or forwarder, otherwise it is taken for granted that these details have been attended to by the shipper or his representative.

Send your advice to the steamship company or forwarder promptly, so they can have the necessary time between arrival of shipment at port of exportation and departure of steamship to complete details.

Ocean rates are quoted as a rule in sterling ,with primage to be added. The following table shows in what space the usual export commodities stow:—

Gross Ton	Stowage Cubic ft.
Apples	90
Bacon	65
Beef	50
Butter	70
Cotton, pressed	130
Cotton, unpressed	200
Cheese	70
Flour in sacks	55
Wheat in bulk	48
Peas	45
Corn in bulk	50
Hops	260
Lard	65
Leather	120
Oilcake	46
Oats	72
Oil	60
Ore	18
Pork	50
Rosin	60
Syrup	44
Tallow	65
Machinery	65 to 250

SHIPPING RECEIPTS

WHEN steamship companies require any special form of receipt, blank forms should be obtained from them. If no special receipt is required, any ordinary form of receipt is sufficient. The marks and numbers (if numbered) on the packages should appear on the receipts, which should be arranged in duplicate, and the contents of the packages should be correctly described. The word "merchandise" should not be used. All receipts must be arranged in the name of, or be endorsed to, the party to whom the "bills of lading" are to be issued, and are returnable to the steamship company when "bills of lading" are issued.

DONALDSON LINE SS. "ATHENIA," TYPICAL OF CANADIAN OCEAN SERVICE.

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Vol. VI MAY, 1916 No. 5

PRINCIPAL CONTENTS

THE ENTERPRISE OF "SCOTIA"

ITS self-contained nature is an outstanding feature of the organization officially known as Nova Scotia Steel & Coal Co., but, more popularly so, simply as "Scotia." Resources, location and ultra-created facilities as regards raw material entering into almost every class and type of wood and metal product, and the ease with which these can be made available or brought, so to speak, to the door of the consumer, lead one to the not unreasonable conclusion that such a concern could not do otherwise than make good, irrespective of occupying a foremost place in the industrial life of the country to which it belongs.

It will be abundantly evident, however, that something more than resources, location, and ultra-created facilities have brought this big Canadian corporation to its to-day-place of prominence in a world sense. The grim determination of the human element has permeated the career of the organization for a generation or more, and with it has been coupled an intensive and well-directed energy, safeguarded at every turning by native caution and the vision to anticipate and take advantage of opportunity. In view of the foregoing, small wonder is it then, that, the announcement of establishing a shipbuilding plant in connection with its other activities at New Glasgow and elsewhere has aroused not only the keenest interest in business and commercial circles, but has earned as well the enthusiastic commendation of Canada's citizens generally, and that of the shipping and shipbuilding fraternity particularly.

New life as it were, has been given to the shipbuilding industry throughout the Dominion, and in saying so we refer to the construction of steel steamships. In recent years many and varied attempts have been made to enthuse our Governments at Ottawa on the subject of support for Canada's shipbuilding enterprises, but somehow, and very probably on account of the lack of backing by our big steel corporations and others, a more or less deaf ear was turned to the requests and pleadings. Irrespective, however, of past experiences, and because of a new set of circumstances prevailing as a result of the war, there has developed a new attitude to the shipbuilding industry by our commercial and industrial interests, large and small. In consequence, we find the Nova Scotia Steel & Coal Co. now engaged in the preliminaries attendant on the creation of a steel shipbuilding plant with a view to construction of their first vessel.

Nova Scotia in years gone by occupied a place of no mean order in the shipbuilding of the world, but had to forego the distinction when steel vessels began to supplant those of wood for long or short deep sea services. Most sanguine expectations as to the outcome of "Scotia's" new venture find ready expression, and if one might judge by the results achieved by "Scotia" in its other spheres, there is little doubt but that the success predicted will be fully realized. It may be, in addition, that the province of Nova Scotia will again attain to its former high place in world shipbuilding, thereby reviving its former glory and adding lustre to it because of a dual significance.

SHIP PLATES AND SHAPES PRODUCTION

A POINT worth noting in connection with the proposed subsidizing of shipbuilding in Canada is our ability to have the industry self-contained in so far as the principal materials—raw and finished—are concerned. Among the more important of the latter may be mentioned the ship's hull, tank, bulkhead and deck plating; frames, deck beams, etc. Plates for our ship, tank and boiler construction are for the most part imported from the United States, and naturally, with a stimulation of either or both industries, imports of these commodities would correspondingly increase. The establishment of a plate mill in Canada capable of dealing with the requirements of at least medium-sized vessels would, therefore, seem to be in order, and is doubtless receiving attention in the proper quarters.

It has, however, always been our understanding that a whole plate mill equipment, although not installed, and capable of rolling steel plates up to $1\frac{1}{4}$ inches thick by 10 ft. wide, is available at one of our leading steel plants, and, doubtless, if the subsidizing of shipbuilding on our lake and ocean shores is determined upon and put into effect, the above-mentioned mill will be pressed into service.

Marine News From Every Source

Halifax, N.S.—The Halifax Graving Dock Co., will erect a machine shop on their property here.

Ottawa, Ont.—The estimates of the Public Works Department include an appropriation of $600,000 for improvements to Toronto harbor.

North Vancouver, B.C.—A scheme is being considered by local interests which may result in a shipbuilding plant being established here.

Lock Gates Carried Away. — The steamer W. J. Averill, upbound on April 30, carried away two gates of Lock 8, Welland Canal.

Toronto, Ont.—The Toronto Harbor Commissioners are to erect a brick machine shop on the Don division near Mill street at a cost of $13,500.

Aletha Released. — The Donnelly Wrecking Co. had no difficulty in releasing the steamer Aletha, which ran ashore near Bath on the night of May 1, while en route to Picton on her first trip up the Bay of Quinte this season.

The "Hanna" Off Again.—The D. R. Hanna, which grounded near Little Rapids Cut early on the morning of May 20, got off, and after making temporary repairs, left on her trip up the lakes the same evening.

Port Arthur, Ont.—The Massey Steamship Co. has purchased the United States-owned steamers Panther and Caledonian, and will put them under Canadian register and in the Canadian lake service.

Sarnia, Ont.—The wrecker Manistique, of the Reid Wrecking Co., left here on May 18 for Livingstone Channel, lower Detroit River, to start wrecking operations on the sunken steamer Centurion, which sank the night before.

Port Arthur, Ont.—Fire recently damaged the pattern storage at the plant of the Western Dry Dock & Shipbuilding Co. The loss of the building is estimated at $25,000, but a large number of valuable patterns were destroyed.

Instruction in Submarine Building.—The Australian Minister for the Navy has selected a number of candidates desirous of proceeding to England for instruction in the building of submarines in order than they may be able to take up this work in the Australian Naval yards.

Ottawa, Ont.—The estimates include an appropriation of $100,000 for the construction of a pier at Port Stanley, Ont., and $32,000 to repair the piers at Port Burwell, Ont.

Chatham, Ont.—The announcement has been made by the Hon. Robert Rogers, Minister of Public Works, that the Government will take steps to dredge the River Thames to a depth of fourteen feet.

Yachtsmen Enlist.—About eighty Toronto yachtsmen have joined the Royal Naval Auxiliary Patrol Motor Boat Service, for which recruits are being enlisted by Commander F. P. Armstrong, R. N. V. R., at his office in that city.

Vancouver a Grain Port.—On May 19, for the first time, the machinery of the new Dominion Government grain elevator at Vancouver handled grain. Two cars of wheat were unloaded and stored, and Vancouver entered upon its career as a grain handling port.

Ottawa, Ont.—Supplementary estimates tabled in the House of Commons on May 2 include an additional $200,000 for Vancouver harbor, $200,000 for Fraser River improvements, and $20,000 for improvements to the lower Fraser. There is also a vote of $32,500 for telephone line extensions.

The Byrns Pneumatic Ship Raising Co., Ltd., has been incorporated at Toronto, with a capital of $40,000 to acquire by purchase patents of invention granted for apparatus for raising submerged ships. Head office, Hamilton, Ont. Incorporators, Harry Byrns and William F. Condon of Hamilton.

Newfoundland Seal Catch.—The sealing season which closed on April 30 was one of the most successful in years, according to reports received at Curling, Nfld. Notwithstanding the loss from the fleet of all but one of the steel steamers through purchase or impression for Admiralty service, the catch reached a total of 225,000 pelts. The total value is estimated at $750,000. Nine of the twelve steamers which took part in the hunt have returned to port, and the others are expected to arrive shortly.

Cobourg, Ont.—It is stated that the steamer Caspian, formerly on the route between Charlotte and the Bay of Quinte, has been withdrawn. The Bay route to Charlotte has long been in use and, if abandoned, will mean that travellers will have to cross the lake at either Kingston or Cobourg. This route was a feature of the Gildersleeve Lines for more than thirty years.

Insurance Against Peace Declaration.—London underwriters on May 23 charged 50 per cent. to insure against a declaration of peace between Great Britain and Germany before January 1. The rate indicates that in the underwriters' opinion the prospects for an early peace are better than two months ago, when the rate for the same risk was only 30 per cent.

Docks for Point Edward.—Grand Trunk engineers have been in the city for the purpose of taking depths of water in the river at Point Edward, where the company is to build a 1,000-foot dock and freight shed for the Port Huron & Duluth Steamship Line. These boats formerly landed in Port Huron, but the sheds there were destroyed, and Point Edward was picked as a better location for the new sheds.

Lloyds' Registry Appointment.—The Committee of Lloyds' Register have appointed James French, principal surveyor at Glasgow, to the position of principal surveyor for the United States and Canada, with his headquarters at New York. Mr. French, who served for a considerable time previously on the American staff of the Register, has already undertaken his new duties. He was among those present at the launch of the new ice-breaker, "J. D. Hazen."

Cunard Will Extend to Australia.—The Cunard Line officially announced on May 25 that a provisional agreement had been made for the amalgamation of the interests of the Cunard Co. and the Commonwealth and Dominion Steamship Lines. The arrangement with the Commonwealth and Dominion Lines will extend the Cunard influence to Australia and New Zealand. Shareholders of the Cunard Line will shortly be asked to sanction an increase of capital for the purpose of carrying out the amalgamation.

The "Centurion" Floated.—The steamer Centurion, of the Cleveland Cliffs Iron Co. fleet, which settled on the bottom just north of Bar Point light vessel and east of the lower end of Livingstone Channel on May 18, was floated two days later by the tugs A. C. Harding and Manistique. Accompanied by the Harding, the Centurion went on to Cleveland.

Five Inches More Draught.—A recommended loading draught of nineteen feet five inches has been approved for the Lake St. Clair channel dredging by the United States District Engineer. This draught is five inches more than has been the recommendation draught since the opening of the season. The dredging work is going along rapidly.

Two Freighters Launched. — Two freighters, the D. G. Kerr and a steamer destined for coast service, were launched at the Ohio yards of the American Shipbuilding Company, Cleveland, on May 6. The Kerr will carry 12,000 tons, while the small freighter, which is building for Norwegian interests, will carry 3,000. Both will be completed in June. The Kerr is 580 feet keel, 60 feet beam and 32 feet deep. The Norwegian steamer launched is known as No. 459 at the shipyard. She will be named later. She is 260 feet long, 40 feet beam, and 20 feet deep.

Port Arthur, Ont.—Reports from Port Arthur state that the Western Drydock & Shipbuilding Co. has received a contract for the construction of fifty motor boats for the British Government. Five carloads of steel recently arrived at Port Arthur to be used in the construction of two freighters, the contract for the construction of which was received by the company a short time ago. The Russian Government is also reported as placing a contract for the construction of six icebreakers, three of which will be built at the head of the lakes.

Quebec Pilots and Apprentices.—A bill has been introduced in the House of Commons, amending the Canada Canada Shipping Act as regards pilots and pilot apprentices in the Quebec Pilotage District, and providing that the number of pilots for that district shall not exceed 125, and that when the apprenticeship period of a pilot has been interrupted by sickness or other legitimate cause, he may be allowed to serve an additional period equal to the time lost, and if found otherwise qualified and entitled to a license, he may be granted such license after he has completed a full service period of seven years including the additional period.

Mercantile Losses in February. — The Bureau Veritas has published statistics concerning losses to the various mercantile marines during February on account of the war: During the month 47 ships of a total tonnage of 105,232 were lost. The loss of 26 ships of a total tonnage of 56,345 tons was due to submarines or mines, 9 ships of 16,165 tons to auxiliary cruisers, and one of 957 tons to a Zeppelin. England has been the greatest loser, 27 of her ships of a total tonnage of 58,000 tons having been destroyed. Other nations lost ships as follows:—France, 7 of 25,000 tons; Belgium, 4 of 6,710 tons; Russia, 2 of 4,108 tons, and neutrals, 7 of 10,000 tons.

To Restrict Sealing.—As a direct result of one of the most successful seal-hunting seasons on record, the Newfoundland Legislature has enacted restrictions designed to prevent the extermination of the animals in the waters about the Island. Large steel steamers, such as have been used extensively during the last few years, are now prohibited from engaging in sealing. Most of these vessels were sold to the Russian Admiralty last year for use as ice-breakers, but one, the Florizel, has brought in 46,000 pelts, the largest number ever secured by a single ship, and yielding a profit of $130,000. The new restrictions will make it impossible to use a vessel capable of carrying more than 25,000 pelts. The total catch for this season was 295,000 seals, valued at $650,000.

WIRELESS STATIONS, QUEBEC AND MARITIME PROVINCES

Stations	Range	
Belle Isle	250	miles
Pt. Amour	150	"
Pt. Riche	250	"
Harrington	150	"
Heather Pt.	250	"
Cape Ray	350	"
Fame Pt.	350	"
Clarke City	250	"
Father Pt.	250	"
Grindstone Is.	200	"
North Sydney	100	"
Cape Bear	150	"
Pictou	100	"
Glace Bay	3000	"
Sable Is.	300	"
Camperdown (Halifax)	250	"
Cape Sable	250	"
Partridge Is. (St. John)	250	"
Grosse Isle	100	"
Quebec	300	"
Three Rivers	150	"
Montreal	200	"

Bonus for Shipbuilding.—North Sydney, N.S., is going to make a bid for the establishment of a shipbuilding plant in the town. The council has adopted a resolution providing for the town furnishing a free site, tax exemption and other concessions tending to induce a company or persons to establish such a plant in the town; they even go so far as to offer a bonus.

C. N. R. and Cunard Lines.—Cunard representatives visited Bristol recently and were given a reception by the Lord Mayor and the public bodies on taking over the Canadian Northern shipping. The new service will be inaugurated by the sailing of the Principello for Montreal. William Phillips, European manager of the Canadian Northern, expressed appreciation of the treatment of his company by the Cunard officials.

May Subsidize Shipbuilding.—A subcommittee of the Cabinet is to be appointed shortly to deal with the question of the advisability and the means of Federal assistance for the development of the shipbuilding industry in Canada. This question was discussed on several occasions during the recent session, principally on behalf of the Canadian shippers, who have been encountering difficulties through the shortage of ocean tonnage. The appointment of a Ministerial Committee to deal with the question will be followed by a careful study of the problems surrounding the building up of a Canadian shipbuilding industry.

Sault Ste. Marie, Ont.—The freight steamer W. M. Moreland, which was wrecked on Keweenaw Point in the big storm of August, 1912, was towed up the lakes, stern first, on May 21, by the tugs of the Reid Wrecking Co., to Superior, where she will be rebuilt. The Moreland was 580 feet long, 58-foot beam, with a carrying capacity of 13,000 tons, and was built by the Interstate Steamship Co. of Cleveland, Ohio, in 1910, for Jones & Laughlin, of Cleveland, who owned her when wrecked. She was downbound with a cargo of iron ore, but was caught in the gale off Keweenaw Point, and had her bow pounded off on the rocks. She afterwards became the property of the Reid Wrecking Co., of Port Huron, which got her for salvage, and towed her to Port Huron. This company will now have her refitted again for Great Lakes traffic.

Launching of the "McGonagle."—In the presence of between 7,000 and 8,000 spectators the hull of the steamer Wm. A. McGonagle, a freight-carrying giant of the lakes, was dropped into a slip at the Ecorse yard of the Great Lakes Engineering Works at noon on May 20. Favorable weather conditions and the attraction of seeing the launching of the first ship of the 600-foot class turned out of a Detroit shipyard in nearly three years combined to make the affair of unusual interest. Mrs. McGonagle, of Duluth, wife of Wm. A. McGonagle, president and general manager of the Duluth, Missabe & Northern Railway, was sponsor. The McGonagle has been built for the Pittsburg Steamship Co. of Cleveland. The hull is of the Isherwood type. Her length over all is about 617 feet, the beam 60 feet, and depth 36 feet. When completed and ready for service, about July 1, the steamer will have a carrying capacity of 12,500 net tons of iron ore. She will be equipped with triple expansion engines, steam for which will be supplied by three Scotch type boilers.

S.S. "Kirby" Disaster.—The steamer S. R. Kirby broke in two and sank during a terrific storm on Lake Superior on May 8, with a loss of 20 lives. The tragedy occurred four miles off Eagle River, Mich. Joseph Murda, second mate, and Otto Lindquist, stoker, were the sole survivors. The Kirby belonged to the North-western Transportation Co., and was commanded by Captain David Girardin, jun., of Detroit. She was 294 feet long, and had a gross tonnage of 2,338.

River Thames Dredging.—Work will be started at once dredging the River Thames from Chatham to the mouth of the river. A letter was received on May 26 by S. B. Arnold, of the Chatham Board of Trade, from the office of Hon. Robert Rogers, stating that a dredge was now on its way to the mouth of the river to begin dredging. Prompt action has been taken by the Government as only a few weeks have elapsed since a deputation from the Board of Trade, City Council and business concerns in the city went to Ottawa to urge that dredging be undertaken.

B. C. Shipping Bill.—A wider application of the measure respecting shipping and providing for aid to the shipbuilding industry was indicated by Premier Bowser in the British Columbia Legislature on May 14, when consideration of the bill in the committee stage was commenced. As at present drafted, the limited number of ships to which aid can be granted, by way of loans to not more than 55 per cent. of the value of the vessel, is twenty, but the Premier stated it was intended to increase this number to twenty-five. Good progress on the bill was made, the Premier readily consenting to Mr. Brewster's request that later, if desired, certain sections which the opposition might desire to consider further would be returned.

Tank Steamer Launched.—At noon April 29, the Collingwood Shipbuilding Co. successfully launched another tank steamer, the second of an order of five placed by the Imperial Oil Co. This steamer, which was named Iocolite by Miss Frances Mayer, daughter of the vice-president of the Imperial Oil Co., is intended for traffic on the lakes, and will be equipped with the latest appliances for rapid handling of oil cargoes, gasoline and lubricating oils. The owners were represented by Walter C. Teagle and J. Mayer, president and vice-president; J. L. Englehart, director; while Captains Henderson, of the Marine Department, and J. B. Foote, insurance adjuster, were also present. The new steamer will go into operation in the course of a few weeks. The principal dimensions of the new vessel are as follows:—Length, 258 feet; beam, 43 feet; depth, 18 feet. It is anticipated that she will be ready for service early in June, and she will be commanded by Captain Norman Scott.

LAKE BUSINESS GOOD

THE freight business so far has been much larger than anticipated, while the passenger business compares most favorably with that of a year ago, according to E. W. Holton, general passenger agent of the Northern Navigation Co. section of the Canada Steamship Lines. The steamers Huronic and Harmonic have made their initial trip from Sarnia, Ont., to Port Arthur and Fort William, on Lake Superior. Both steamers encountered considerable ice in St. Mary's River and in White Fish Bay, but because of their size easily ploughed through it. During the spring season the Huronic and Hamonic will leave Sarnia on Wednesdays and Saturdays, and on the return trips will leave Port Arthur on Saturdays and Tuesdays respectively. The spring schedule will be effective until June 10, when Detroit will again become the southern terminal of the Northern Navigation Co. In addition to the Huronic and Hamonic, the Noronic will make weekly cruises to the north. After June 10th Duluth will be the northern terminal of the steamship line.

WIRELESS STATIONS, BRITISH COLUMBIA, YUKON AND ALBERTA

Stations	Range
Prince Rupert	250 miles
Dead Tree Pt. (Queen Charlotte Is.)	150 "
Ikeda Hd.	250 "
Triangle Is.	350 "
Estevan Pt.	500 "
Paschena Pt.	300 "
Victoria	250 "
Pt. Grey (Vancuover)	150 "
Cape Lazo (Comox)	300 "
Alert Bay	300 "

WIRELESS STATIONS, ONTARIO PROVINCE

Stations	Range
Kingston	300 miles
Toronto	300 "
Port Burwell	300 "
Point Edward (Sarnia)	300 "
Tobermory	200 "
Midland	300 "
Sault Ste. Marie	30 "
Port Arthur	300 "

TO BUILD VESSELS IN B. C.

CONTRACTS were awarded on May 19, to the Wallace Shipyards of North Vancouver for the construction of three steel vessels, the hulls to cost about $400,000. Machinery, which will include large oil engines, will be additional. The boats are to be used in the lumber carrying trade from British Columbia ports, and are to be built under an interest guarantee of the British Columbia Government.

H. W. Brown is in charge of the contracts, and associated with him are H. M. Wolverin, a Great Lakes transportation man; James Carruthers, president of the Canada Steamship Lines; G. W. Norcross, of Montreal, vice-president and managing director of the Canada Steamship Lines; James Whalen, of the British Columbia Sulphite Co., and president of the Western Drydock & Shipbuilding Co., of Port Arthur; M. J. Haney, of Toronto, capitalist and contractor, and Sir Trevor Dawson, managing director of the famous Vickers Ltd., of Great Britain.

CUNARD CO. AND C. N. R.

IN connection with the acquisition of the ships of the Canadian Northern Steamship Co. by the Cunard Line, it is announced that a very close working arrangement has been concluded between the Canadian Northern Railway and the Cunard Co. The railway, throughout territory covered by its lines, will direct its efforts in favor of the Cunard Line, while the latter will work in favor of the railway.

It is understood that negotiations have been carried on for several months looking to the completion of the foregoing agreement. Additional interest is lent to the agreement by reason of the fact that a steamship service on the Pacific is also under consideration. D. B. Hanna, of the C. N. R., states that the full effect of the agreement would not be noticed until after the war, although it comes into operation at once.

The boats taken over by the Cunard Co. are the Royal George, the Principello, the Campanello and the Uranium. The Royal Edward, a sister ship of the Royal George, was torpedoed in the Mediterranean last year whilst transporting British troops to the Dardanelles. The text of the announcement issued on May 5 is as follows:—

"An agreement of great importance to the development of trade and passenger traffic with Canada has been concluded between the Canadian Northern Railway and the Cunard Steamship Co. The agreement provides for a very close working arrangement between the two parties. The Cunard Co. will take over the steamers owned and controlled by the Canadian Northern Railway which were running before the war from Avonmouth and Rotterdam, and will maintain service between Canada and ports in the United Kingdom and on the continent."

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Citizens and Officers Entertained.—The C. P. R. officials, through J. A. Byrom, superintendent of the lake fleet, entertained a large party of citizens of the town and the officers of the 147th Battalion with a sail down Owen Sound on April 29, on the steamer Assiniboia. A run was made out past Griffith's Island into the Gap and return. The band of the 147th Battalion provided a select concert programme during the afternoon.

W. G. Ross, president; Farquhar Robertson and Brigadier-General Labelle, Harbor Commissioners, expressed themselves as entirely satisfied with the men of the Montreal harbor police recently reviewed by them. Captain Coleman, Deputy Chief Gratton, and Sergeant Stevens were complimented on the appearance of the men. Deputy Chief Grandchamps represented the Montreal police force at the inspection. Captain Bourassa, harbor master; Major David Seath, secretary; M. P. Fennell, assistant secretary, and F. W. Cowie, chief engineer, were also present.

Captain Alexander McNab, sailing master of the Government steamship Lambton, met a tragic death through falling into the water from the gangplank of his vessel on May 3. In falling he struck his head, and though he was in the water less than two minutes before being rescued, he succumbed to shock. Capt. McNab was one of the many Highlanders from the west coast of Scotland who settled in the Owen Sound section of Ontario, and who have furnished more lake mariners than any other nationality. He sailed on several of the early lake passenger steamers before railway connection affected traffic on the north shore. He was an officer on the C. P. R. steamships, and later was in command of a big lake freighter. Three years ago he was given command of the steamer Lambton, in the Government lighthouse construction service.

Minor Water Masters.—C. W. Archer, Art. F. Thompson and Chas. Fullerton, all of Muskoka Lakes, were successful candidates this spring at the examinations held for Minor Water Masters. They received their preparatory instruction from Captain Geo. S. Laing, retired shipmaster, Toronto.

LICENSED PILOTS.

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio
Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

THE SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

GRAND COUNCIL, N.A.M.E. OFFICERS.

A. R. Milne, Kingston, Ont., Grand President.
J. E. Belanger, Bienville, Levis, rand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
J. W. McDeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I., Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

Captain James Butler Waterston, who lived in Toronto for many years, died at the residence of his son, Montreal, on May 21. He was ninety-two years of age, and a frequent contributor of lively sea items to the press. Captain Waterston had sailed the seven seas, having commanded for years the famous clipper ships which sailed around the Horn. He carried the famous Light Brigade to the Crimea, and went over the battlefield the day after the battle. He was captain of a transport carrying soldiers to India at the time of the Mutiny. He was born at Leith, Scotland, but had lived in Canada many years. He came of a great seagoing family, and several ancestors commanded vessels in action a hundred years ago. He was buried from the residence of his daughter, Mrs. Nichols, Toronto, many acquaintances paying their last respects.

Captain Toussaint Bourassa, harbor master of Montreal, was the recipient of congratulations from a host of friends recently on the completion of a quarter century in the Montreal Harbor service. For 22 years he was deputy harbor master, and on June 15th, 1914, he became harbor master when Capt. L. A. Demers was made Dominion Wreck Commissioner. Captain Bourassa was deputy from May 3rd, 1892, until 1898, under Captain Thomas Howard; from 1900 to 1912, under Hon. James McShane, and for two years under Captain Demers. From 1898 to 1900 between appointments he was in sole charge of the harbor, and since August, 1914, he has been in a similar position, as his assistant, Captain Frank I. Symons, R.N., was called to the colors. The captain was born in Laprairie, Que.

Presentation.—Joseph F. Dolan, who has so efficiently filled the position of general agent in Boston of the Canada Steamship Lines, was entertained to a

1916 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Colliugwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jeamne Mancy Street	O. L. Marchand.	[illegible] Clark St.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall,	Midland, Ont.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Blandon,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John McLeod,	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	[illegible] London St. W.
Midland,	12	Geo. E. Wilson,	P. O. Box 204	Roy N. Smith,	Box 178
Halifax,	12	Geo. McDonald,	319 11th Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	29 Parrsboro Street	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	Alfred Roebuck,	22 Kent Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

If any advertisement interests you, tea and keep with letters to be answered.

luncheon at the Crawford House, Boston, by friends and transportation lines' representatives on May 2, following which Howard M. Fletcher, passenger agent of the Santa Fe Railway, on behalf of the gathering, presented Mr. Dolan with a silver tea set and engrossed resolutions testifying to the high regard in which he was held. Mr. Dolan has retired from the company to engage in business in Montreal. He started in the steamship business in Toronto in 1893 as city passenger and ticket agent of the Richelieu and Ontario Navigation Co. From there he went to the senior office at Montreal in 1901 as passenger agent and stock transfer agent. In 1913 he was promoted to Boston as district passenger agent of the R. & O. lines, and the following year he was made general agent, passenger department, of the Canada Steamship Lines, in charge of New England and Maritime Provinces territory.

MONTREAL SAILORS' INSTITUTE ANNUAL

IN the course of the presentation of the fifty-fourth annual report of the board of management of the Montreal Sailors' Institute, before a large number of citizens and sailors recently, it was made apparent that this institution has been during 1915 at once a home, club, church, bank, post office, money exchange office, inquiry bureau, employment bureau and a friend in need to a large number of the sailors who have visited the port. There were not so many as in other years, because the tonnage coming to the port was greatly reduced, and because the sailors found much greater difficulty getting out from and back to their ships in this time of war restrictions. The decrease in the number of seamen coming to the port was about 29 per cent.

However, there was an aggregate attendance of 31,035 seamen at the institute. There were 99 religious services and 19 temperance meetings with good attendance. At the 29 concerts there was a total attendance of 7,930. Nearly 210 distressed seamen were aided, and 197 comfort bags were given away. During the year the sick were visited, friends at home kept posted as to the progress of the sick ones, and those who died were given Christian burial.

Regret was expressed for the fine vessels and the splendid sailors lost since last year, and also for the passing of such subscribers to the institute as George Hague, Robert Munro, Robertson Macaulay, Harry Stikeman, Jonathan Brown and Miss Annie J. Jack.

The reports were presented by J. Ritchie Bell, the manager of the Institute. Mr. Reford also welcomed the sailors back to the port and paid a tribute to the work being done by the seamen. A program of music followed.

Canadian Vessel Captains and Chief Engineers

Through the courtesy of the various Steamship Companies, we are enabled to give a list of 1916 season vessels, together with the names of their principal officers.

C.P.R. DETROIT RIVER CAR FERRIES, WINDSOR, ONT.

Vessel.	Captain.	Chief Engineer.
Ontario	R. Brown	C. A. Sullivan

CANADIAN PACIFIC CAR AND PASSENGER TRANSFER CO., PRESCOTT, ONT.

Vessel.	Captain.	Chief Engineer.
Charles Lyon	W. Henry	L. Black

CENTRAL CANADA COAL CO., LTD., BROCKVILLE, ONT.

Vessel.	Captain.	Chief Engineer.
Samuel Marshall	W. A. Tullock	J. R. Ferguson

DEER ISLAND AND CAMPOBELLO STEAMSHIP CO., LTD., ST. STEPHEN, N.B.

Vessel.	Captain.	Chief Engineer.
Viking	F. Johnson	F. H. Rowe

GLOUCESTER NAVIGATION CO., LTD., CARAQUET, N.B.

Vessel.	Captain.	Chief Engineer.
Beaver	F. Hache	E. H. Haviland

GRAND MANAN STEAMSHIP CO., LTD., GRAND MANAN, N.B.

Vessel.	Captain.	Chief Engineer.
Grand Manan	N. S. MacKinnon	J. F. McGray

CANADA ATLANTIC AND PLANT LINE STEAMSHIP CO., HALIFAX, N.S.

Vessel.	Captain.	Chief Engineer.
Evangeline	F. H. Hawes	Jas. Smith
Halifax	H. Doyle	R. Mackay

BATHURST LUMBER CO., LTD., BATHURST, N.B.

Vessel.	Captain.	Chief Engineer.
Betty D.	A. Hains	G. Howland
Nipisignit	A. Martin	L. Spragg

CHICAGO, DULUTH AND GEORGIAN BAY TRANSIT CO., CHICAGO, ILL.

Vessel.	Captain.	Chief Engineer.
North American	G. M. Cummings	J. F. Buritz
South American	C. M. Haight	C. H. Menmuir

CANADA ATLANTIC TRANSIT CO., LTD., MONTREAL.

Vessel.	Captain.	Chief Engineer.
Arthur Orr	John Simons	D. E. Mance
Geo. N. Orr	H. Jaenke	J. B. Wellman
Kearsarge	W. Baxter	A. P. Williams

FARRAR TRANSPORTATION CO., LTD., TORONTO.

Vessel.	Captain.	Chief Engineer.
Collingwood	John Ewart	D. McLeod
Meaford	....	T. W. Verity

GASPE AND BAIE DES CHALEURS STEAMSHIP CO., LTD., QUEBEC, QUE.

Vessel.	Captain.	Chief Engineer.
Gaspesian	Jos. Vezina	N. Protomastro
Percesien	L. D. Morin	Jos. Ruel

GRAND TRUNK PACIFIC STEAMSHIP CO., LTD., VANCOUVER, B.C.

Vessel.	Captain.	Chief Engineer.
Prince Albert	W. S. Morehouse	R. Bell
Prince George	D. Donald	I. O. Haudy
Prince John	C. W. Wearmouth	A. S. Munro
Prince Rupert	D. Mackenzie	D. G. Ferrier

GRAND TRUNK RY. DETROIT RIVER CAR FERRIES, WINDSOR, ONT.

Vessel.	Captain.	Chief Engineer.
Great Western	M. Bausette	Jos. Ladds
Huron	O. Lalonde	A. Cook
Lansdowne	John Jackson	W. Belsom

CAPE BRETON ELECTRIC CO., LTD., SYDNEY, N.S.

Vessel.	Captain.	Chief Engineer.
Electronic	I. H. Lewis	B. Dixon
Hygeia	J. Brown	A. Tulke
Peerless	A. McLeod	J. B. Weeks

COAST STEAMSHIP CO., LTD., VANCOUVER, B.C.

Vessel.	Captain.	Chief Engineer.
British Columbia	G. Foellmer	J. Ellison
Celtic	J. Finlay	H. Buxton
Clansman	M. F. MacDonald	H. Nissen
Fingal	R. W. H. Lloyd	H. Spencer

DARTMOUTH FERRY COMMISSION, DARTMOUTH, N.S.

Vessel.	Captain.	Chief Engineer.
Chebucto	J. Hare	W. Case
Dartmouth	W. Jennex	A. McLeod
Halifax	C. Ozon	S. Stevenson
	N. Allen	

CANADIAN NORTHWEST STEAMSHIP CO., LTD., TORONTO.

Vessel.	Captain.	Chief Engineer.
Atikokan	W. J. Brown	J. H. Louden
George A. Graham	J. A. Ewart	H. C. Harrison
Palpoonge	P. McIntyre	H. H. Moore
Thunder Bay	H. Finn	....

ALGOMA CENTRAL STEAMSHIP LINE, SAULT STE. MARIE, ONT.

Vessel.	Captain.	Chief Engineer.
Agawa	J. A. Brown	J. L. Smith
J. Frater Taylor	R. H. Boyle	L. B. Cronk
Thos. J. Drummond	A. McIntyre	W. T. Rennie
W. C. Franz	W. C. Jordan	G. Sylvester

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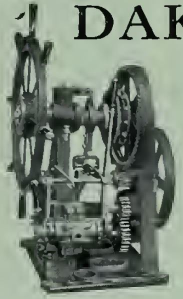

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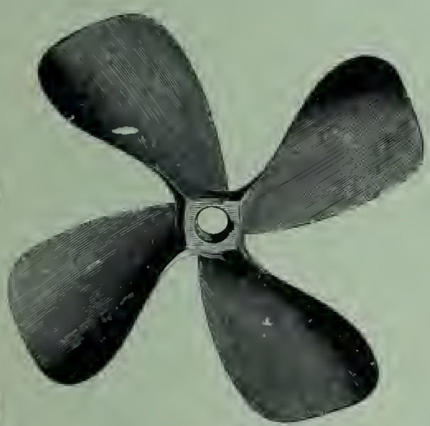

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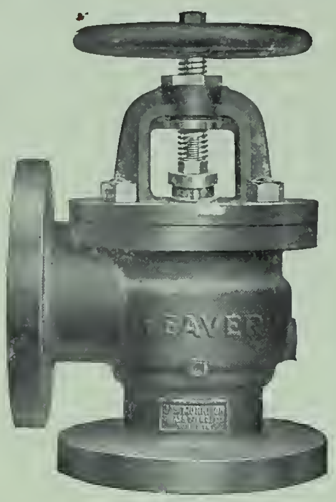

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Shipping Facilities at Canada's Principal Ocean Ports

Staff Article

Events of the past two years have amply demonstrated the ability of this country to contribute largely to the world's trade in manufactures as well as produce. Had the war not intervened, the marine activity of various ports would have materialized to a much greater extent than they have, but the present rate of development of industry and agriculture promises to tax even all projected developments to their full capacity in a few years.

DURING the season 1915 there arrived in the port of Montreal 815 sea-going vessels, with a tonnage of 2,261,374 tons. In view of the conditions prevailing in regard to maritime commerce such an amount of shipping must be considered very satisfactory, as, despite the requisition and retention by the British Admiralty of large portions of fleets regularly plying to this seaport, the tonnage mentioned is but 14 per cent. less than in 1914, which was 2,755,518, while the number of vessels dropped 101 from 916, or about 11 per cent.

This reduction in tonnage was doubly unfortunate for Montreal, as the phenomenal grain crop of that season, most of which would under normal conditions have passed through that port, was diverted to other channels. Such an occurrence is recognized as being due entirely to the existing state of hostilities in various parts of the world, and in due course the port of Montreal will again resume its consistent growth as the premier seaport of the Dominion of Canada.

VIEW OF HARBOR OF MONTREAL AS IT APPEARED IN THE YEAR 1830.

Early Development

From 1865, when the ship channel between Montreal and Quebec was deepened from 16½ ft. to 20 ft., until 1888, when a depth of 27½ ft. had been attained, the burden of the waterway had been carried by the Montreal Harbor Commission, who had paid the interest on the entire capital cost out of the harbor revenues. At this stage the policy was adopted of classing the ship channel with canals and other navigational works, resulting in the channel with all its dredging plant and staff being taken over by the Department of Public Works of the Dominion.

Since that time the energies of the Harbor Commission have been devoted to the perfecting of facilities in the way of plant, equipment, trackage, warehouse and dock accommodation, with results which have had no small influence on the development of Canadian overseas trade.

Grain Elevators

Chief amongst the many interesting features of the port is the elevator accommodation. Prior to 1910 the export grain handling equipment in Montreal harbor consisted of a 1,000,000-bushel elevator owned and operated by the Montreal Warehousing Company ;two obsolete wooden elevators owned by the Canadian Pacific Railway, since torn down; and a fleet of floating transfer elevators of miscellaneous construction and varying age and efficiency.

VIEW OF HARBOR OF MONTREAL IN 1872 SHOWING SAILING VESSELS.

Early in 1910 the Harbor Commissioners of Montreal determined to erect a new grain elevator of the highest class and most modern type, to have a capacity of 1,772,000 bushels, but in 1911 it was found that this extra storage room would be still insufficient to meet the needs of the port, and an extension was begun. The entire plant, known as Elevator No. 2, with a total capacity of 2,622,000 bushels, was put in operation in 1912.

The grain business increased so much as a result of the additional equipment that the construction of a 1,500,000-bushel addition to No. 1 Elevator was commenced in the spring of 1913, and was in operation at the beginning of 1915 season. Still another addition to No. 1 Elevator was required, and construction was started early last year on the completion of which the total capacity of the port will be:

No. 1 Elevator	4,000,000	bushels.
No. 2 Elevator	2,622,000	"
Grand Trunk Elevator	2,150,000	"

The full significance of such accommodation and the necessary equipment is realized from the following facts:

Grain can be delivered to ocean vessels at the rate of 75,000 bushels per hour.

GRAIN ELEVATOR NO. 2 AND MARINE TOWER JETTY.

Harbor Railway Terminals

The operation of the railway terminals has proved to be one of the most important and successful features of the development of the port of Montreal. These terminals extend from Victoria Bridge to Longue Pointe, a distance of seven miles, extending through the adjoining cities of Montreal and Maisonneuve, with a total track mileage of

OCEAN GRAIN VESSELS LOADING AND WAITING FOR BERTHS. WINDMILL POINT.

Grain can be received from lake vessels and barges at the rate of 40,000 bushels per hour.

Grain can be received from cars at the rate of 36 cars per hour.

44.9 miles. The matter of providing through railway connection from all parts of the harbor to all the trunk lines of the country began to receive attention in 1914, since when there has been remarkable development in the industrial business between manufacturing establishments on the water front, and the Canadian railways. As a result of the Commissioners' policy, coal, raw materials, supplies and manufactured goods are shunted into the industries, while manufactured goods and completed articles are shipped out to all points of the country on to the steamships in the harbor.

The rates charged for this service are so moderate, and the results so satisfactory, that an urgent demand has sprung up for immediate extension of the harbor terminals to new sites, and to the industrial wharves which are being specially constructed.

Shipbuilding and Repairing Facilities

Perhaps the most important factor in the development of the port, next to harbor accommodation, has been the provision of shipyard facilities for the prompt and efficient performance of repairs to either hull or engine. After a considerable amount of construction work, a site was prepared, which includes thirty acres of filled land for shipyard purposes with about six acres additional right-of-way for harbor tracks and roadway. The shipyard site is owned and operated by Canadian Vickers.

A prominent feature of the equipment is the "Duke of Connaught" floating dry dock, which was built at the Barrow works of Vickers, and towed across the Atlantic in September, 1912. The maximum capacity of the dock, which is in three sections, is sufficient for docking ships up to 25,000 tons displacement, and up to 700 ft. in length. The value of such a unit as part of the port equipment is being increasingly recognized each year, a total of twenty-four vessels being docked and repaired during season 1915.

The shipbuilding berth is 500 ft. long, with a clear width of 116 ft. It is entirely enclosed so that work may be carried on continuously, despite the rigors of a Canadian winter. Engine and boiler shops, electrical construction department, with brass and iron foundries, enable repairs of any magnitude to be performed on vessels of all sizes and propelling machinery of any existing type, be it turbine reciprocating, or internal combustion engines.

MONTREAL HARBOR, SHOWING SHEDS NO. 24 AND 25, ALSO RAILWAY TERMINALS JUST COMPLETED.

Safety and Insurance Aspects

Any reference to the port of Montreal would be incomplete did it not contain mention of the efforts made to insure the safety of navigation on the River St. Lawrence. While certain reductions have occurred since 1900, when the basis of rates at present in force was fixed, they still remain at a figure which is unduly high, having regard to the adequate dry dock accommodation in the river, the provision of which removed the last substantial argument against low insurance rates.

In November last an important conference was held between the Commissioners and representatives of British marine insurance companies, the discussion touching upon the great works of improvement accomplished by the Canadian Government through the Department of Marine and Fisheries, in deepening and widening the channel and establishing magnificent aids to navigation, and operating the signal service system, and all other means whereby the hazards of navigation in the St. Lawrence have been greatly lessened in the last few years. The degree to which such efforts have been carried will be understood from the fact that since 1900 Canada has spent $70,000,000 on the St. Lawrence route, the results showing up very clearly in the steady decrease in losses and accidents. The value of the St. Lawrence route to Canada's deep inland water connection with interior points was demonstrated during last season, when about 30,000 tons of nitrate of soda from Chile were transhipped at Montreal en route to the Western States, this being the only break in continuity over the entire distance of 10,500 miles. Among other features of note in the grain trade of Montreal during 1915 were the following: The shipment of 100,000 bushels of grain to New Zealand—the bagging of 2,800,540 bushels of grain at Elevator No. 2—the receipt of the first car of grain over the new Canadian Northern Transcontinental line, on Nov. 18, 1915—the receipt of the first car of grain over the Grand Trunk Pacific, the National Transcontinental Railway, and the Grand Trunk System on Nov. 25, 1915. These facts alone justify Montreal's claim to be considered the premier port of Canada.

DRY DOCK AND SHIP REPAIRING PLANT, CANADIAN VICKERS, LTD.

VANCOUVER, B.C.

In olden days, the harbor of Vancouver was described as the finest great harbor that indents the coast of British Columbia. Vancouver is the

VANCOUVER HARBOR, LOOKING UP, WITH C.P.R. NEW DEPOT IN FOREGROUND.

principal port of Canada on the Pacific coast and in addition to being the western terminus of the Canadian Pacific Railway is also served by the Great Northern line from Washington State, and the Canadian Northern Railway which recently completed its transcontinental line. Steamboat connection is provided

VANCOUVER HARBOR, SHOWING AUSTRALIAN AND ORIENTAL BOATS AT PIER "A."

by the Grand Trunk Pacific with Prince Rupert, the terminus of that railroad and the Pacific Great Eastern line of steamships also operates to the harbor.

The harbor is administered by a harbor commission with three members, empowered by an Act of Parliament, of May, 1913, and consists of an outer, central and industrial harbor. These are located a few miles northeast of the mouth of the Fraser River, the outer harbor stretching east and west a distance of six miles, by five miles wide, and connecting with the central harbor through the First Narrows which are from 35 to 72 feet deep at low water and about 500 feet wide. The central harbor is five miles long with a maximum width of two and a half miles, and is connected with the industrial harbor by the Second Narrows, 450 feet wide.

From the Second Narrows to Port Moody is a distance of about nine miles, the entire foreshore and navigable water forming part of the harbor of Vancouver. Already many industries are established on both shores, the location being conveniently situated with regard to shipping facilities, and adequate transportation facilities insure its future as Vancouver's manufacturing centre.

Some idea of Vancouver's potentiality as a port may be gathered from the fact that there are 98 miles of water front, nearly all of which is suitable for industrial and commercial purposes, with deep water and an almost entire absence of submerged rocks, shoals and other dangers to interfere with navigation.

Trade Capacity

Exports for the year ending March 31, 1915, amounted to 795,908 tons, consisting principally of lumber, fish and minerals. The shipping operations involved shipping arrivals totalling 7,668 coastwise vessels aggregating 3,305,458 tons and 1,463 foreign vessels aggregating 1,692,314 tons.

PRINCE RUPERT, SHOWING G.T.P. DRY DOCK AND SHIPBUILDING PLANT.

In normal times shipping facilities are of an ample nature; the Royal Mail steamers of the Canadian-Australian Line carry passengers and freight to and from the Antipodes on a 21-day schedule, the Blue Funnel boats, the largest freighters afloat, ply around the world, and a fleet of big vessels of the Andrew Weir Line, maintain a regular schedule between Vancouver and the Orient. Freight communication is provided between New York and Vancouver by a line of British vessels, and the Harrison Line, and a service to Antwerp places Vancouver in direct touch with the ports of Europe. The East Asiatic Co., the American Hawaiian Steamship Co., the Canadian-Mexican Pacific Steamship Co., the Pacific Coast Steamship Co., and many smaller shipping concerns are engaged in trans-pacific and coasting trade.

Future Developments

Provision for the future is under consideration, as is evidenced by the acquisition of an 80-acre site for a dry dock by a company subsidized by the Government. Among other improvements being carried out by the Govern-

PRINCE RUPERT, SHOWING GENERAL VIEW OF HARBOR.

ment is a reinforced concrete wharf, 800 ft. long with a frontage of 300 ft., and a depth of 35 ft. at low water. This wharf will be equipped with two sheds 800ft. long by 80 ft. wide, of the most modern type, and with up-to-date appliances for loading and discharging purposes, the operation of the plant being expected to devolve on the Harbor Commissioners.

A grain elevator recently completed has a total capacity of 1,250,000 bushels, receiving at 20,000 bushels per hour, and loading at 60,000 bushels per hour.

PRINCE RUPERT, B.C.

TEN years ago the site of Prince Rupert was little short of a wilderness of timber-covered land, the only means of ingress and egress being by boat. As the terminus of the Grand Trunk Pacific Railway it came into existence about eight years ago, and now has a population of 6,000 people.

A total wharf frontage of 1,685 feet has now been constructed and a floating dry dock with accessory plant enables general repair work to be undertaken on a large scale. When operated as a unit, the dry dock has a lifting capacity of 20,000 tons, which is the combined capacity of the two end units of 5,000 tons each and the centre unit of 10,000 tons. The accessory plant consists of foundry, boiler shop, machine shop, ship shed and carpenter's shop, with full equipment of cranes, power house, etc.

Prince Rupert occupies an excellent strategical position in regard to the Orient, being 500 miles nearer the East than any other terminus on the Pacific seaboard of the Dominion.

HALIFAX, N.S.

HALIFAX is situated on the Atlantic seaboard of the Province of Nova Scotia. It has a population of over 45,000 and possesses numerous industrial establishments in addition to being a Government naval station and the capital of the province. The favorable nature of the city's location in regard to supplies of raw material and distributing facilities in the shape of railway communication and shipping routes has been responsible for much of the manufacturing activity which prevails here.

Natural Advantages.

As an export point it enjoys considerable advantages in the matter of distance over other ports in the Maritime Provinces and in the United States. It is several days nearer Cape Town than New York is, and in normal times enjoys steamship communication with the leading seaports of Europe, South Africa, Australasia, West Indies, etc.

At the present moment construction is proceeding on new ocean terminals for the Canadian Government Railways. When completed there will be provided a passenger station building, abutting on a landing stage 2,000 feet long, the entire facilities of which will be devoted to the handling of passengers and their baggage, mail and express business, and ordinary cargo, the different classes of business being handled in rotation at specially equipped sections of the stage.

Future Developments.

The railway station accomodation is planned on a very complete scale with ample provision for handling large volumes of immigrant traffic. It is known as Halifax City Station and is designed to handle local passenger traffic in addition to steamship passengers.

Freight traffic is being taken care of by the erection of four new piers to replace smaller existing ones. The first of these was commenced in the fall of 1911, and was recently completed, having a length of 686 ft. and width 235 ft. The pier rests on 1,550 concrete piles, each 24 in. square, by 75 ft. long, this being the distance from rock bottom to track level at a height of 15 ft. 8 in. above extreme low water. The cost of the pier is approximately $690,000, while the building which is 677 ft. long by 198 ft. wide will cost about $333,000, not taking into account the cost of fitting temporary offices and rooms for use by officials, immigrants and regular traffic pending the completion of the railway station and passenger pier previously referred to.

VICTORIA, SHOWING GENERAL VIEW OF HARBOR.

VICTORIA, B.C.

THE capital of British Columbia is Victoria, situated at the southern end of Vancouver Island and having a population which advanced from 20,000 five years before to 65,000 in 1913. The principal industry is lumber, exports consisting chiefly of lumber, coal, whaling products, fish and fruits.

The entire dock development has been due to private enterprise, although a

Harbor Master, appointed by the Department of Marine and Fisheries is in charge of the movement of vessels in the port. Extensive developments are in progress at the present time including a 2,500 ft. breakwater and two large docks, the former sheltering a 90 acre area, while the latter will provide room for future traffic increase, having a berthing space of about 1,000 feet with a depth of 35 feet at low water.

Owing to the fact that most of the cargo is distributed throughout the island by coaster, the great bulk of the business is transferred direct from deep sea steamer to coaster, no railway connections are necessary at the wharves, local business being handled by motor transport from dock to destination.

Shipping Facilities,

Building and repair work is handled by at least five firms, one having a cradle 280 ft. long by 60 ft. beam which provides dry dockage for vessels up to 3,000 tons, and another having a cradle 150 ft. long by 35 ft. beam. Modern machine shops and foundries in various establishments enable marine repair work to be efficiently handled.

Esquimalt.

Four miles from Victoria is Esquimalt Harbor where the Government naval establishments are located. Here is located the yard of Yarrow, a branch of the well known British firm, in close proximity to which is the site of the new Government dry dock. This dock is to be proceeded with in the near future and will be 1,150 ft. in length, by 120 ft. in width, superseding the present graving dock of 480 ft. length which is not adequate for large boats berthing here for repairs.

ST. JOHN, N.B.

ST. JOHN, New Brunswick, is one of the busiest and most progressive of the Maritime cities of Canada. In furnishing troops, in manufacturing munitions, and in shipping grain and other supplies to Great Britain and the allies, St. John since the war began has done splendidly, eclipsing all previous records.

During the month of March, 1916, 109,-225 tons of supplies were shipped through the Port of St. John to the United Kingdom and French ports. For the fiscal year ended March 31, 1915, the total value of exports through St. John amounted approximately to $45,000,000, as compared with $22,000,000 the previous year. For the fiscal year ended March 31, 1916, the total export values were $120,042,590, (an actual increase over the previous year of $76,169,658—a magnificent showing. The ocean tonnage through St. John in 1916 amounted to 179,361 tons, as compared with 82,143 tons in 1915.

The industrial plants of the city, including the lumber and pulp mills, cotton factories, sugar refinery, machine works, iron foundries, brush factories, nail plants, edge tool works, and leather factories, have been exceptionally busy. To some extent, these industries have been stimulated by war orders, but there are many in which the old lines are furnishing ample work. The manufacturing firm of T. McAvity & Sons have just broken ground for one of the largest iron and brass foundries in the lower provinces. The plant will be located in the eastern part of the city near the I. C. R. track. Under the agreement with the city the firm will have to spend at least $100,000 the first year. As the firm have contracts which must be filled by August, a very large portion of the works will have to be erected this year.

Harbor development work is proceeding at East St. John, and it is expected that the comprehensive scheme of development on the West Side, which was suspended soon after hostilities began, will be resumed this summer. There is a possibility of a revival of wooden shipbuilding as well.

St. John is looking for a big influx of immigrants after the war is over. The provincial government is preparing ready-made farms for these immigrants and for returned soldiers who may want to take up agricultural work. St. John was the first city in Maritime Canada to adopt the daylight saving plan, as it was the first to adopt the commission form of government and the town planning system. A plebiscite on the repeal of the commission form of government was recently taken, resulting in a larger vote in its favor than when it was first introduced.

When the Port of Halifax was opened, 1895-96, the total sailings for the season were less than one-half the sailings for the month just closed. Owing to the closing of the St. Lawrence River to navigation during the winter months considerable business accrues to both St. John and Halifax. The winter season extends from December 1 to April 30, and receipts for the season just closed amounted to $81,319.37, an increase of about 30 per cent. over 1914-15. During the same period sailings aggregated 206, an advance of 53 over last season.

MARINE INSURANCE

THE shipper can arrange to have his insurance to attach from the time his goods are receipted for by the vessel — either sail or steam — or her agents, and to continue the risk after discharge at port of destination until delivered to the consignee; but this arrangement must be specially made, because the ordinary policy of insurance covers the risk only when the goods are actually laden, and terminates with discharge of the goods at port of destination. Should the vessel on which the goods are shipped be diverted from her voyage to an extent that the voyage is considerably extended (as, for instance, through the closing of the Panama or Suez Canals), shippers should make certain that their shipments are covered by their marine insurance policies for the extended voyage. Exceptional risks which are not incorporated in the policy may be provided for; this also must be a matter of special agreement when making the insurance.

It is assumed that, unless specified to the contrary, all goods are shipped "under" deck; therefore, when goods are shipped "on" deck, it must be so stated in the application for insurance. Goods laden on deck are insured free of claim for damage arising from exposure to the elements.

The ordinary policy of insurance excludes claims for damages or what is termed "particular average" on certain classes of goods, such as grain, etc. When it is desired to insure such goods subject to "particular average" it must be specially provided for in the application for insurance.

Free of "particular average" under 5 per cent. means that no claim for partial loss or damage will be allowed by the insurance company unless the actual loss or damage amounts to 5 per cent. or more of the amount for which the shipment has been insured, as set forth in the policy.

In marine insurance, the amounts recoverable as a total loss if not declared, i.e., under an open policy, are: For "merchandise," the prime cost, including the expense of shipment and the premium and charges of insurance; for the ship, its value at the outset of the voyage, including the outfit, stores, and provisions for the crew, their advance wages, and the premium and charges of insurance; for freight, the gross amount of freight expected, together with the premium and charges for insurance. As a claim for total loss cannot extend beyond the full amount insured in the policy, the documents required to substantiate such a claim must be supplied to the underwriters free of charge. These documents are:—(a)—protest; (b)—set of bills of lading (endorsed, if necessary, so as to be available to the underwriters); (c)—policy or certificate of insurance (endorsed, if necessary); (d)—assignment of interest to the underwriters. This last document is of considerable value in the event of salvage refunds in the case of salved goods, as any claim for salvage expenses will be sent direct to the underwriters.

Sheet Metal Elbows, Their Development and Laying Off-IV

By J. W. Ross

In order to thoroughly understand the principles involved in the development of cylindrical and other forms, such as are met in sheet metal work, a considerable knowledge of geometry is desirable. Through the medium of these articles, the author places practical examples at the disposal of our readers, and the knowledge to be gained by a close and persistent study of the principles and methods employed will well repay the time spent.

180-DEGREE ELBOW

FIG. 18 shows the elevation and cross-section of a 7-piece U-shaped elbow of 180 degrees plated with inner and outer courses.

Mark off the inside diameter, CD, 23½ inches, and the outside 24½ inches, thus making the neutral diameter 24 inches. Measure off D to O equal to 21 inches. With O as centre and the inside diameter at C as radius, strike the arc CC^1. Again with O as centre and the inside diameter at D as radius strike the semicircle DD^1. Divide the semicircle CC^1 into 12 equal parts. As the elbow is made up of seven courses, each part will then be equal to 180 degrees÷12 equal to 15 degrees. At the points located draw in the radial lines as AO, LO, NO, PO, JO, KO. Draw in plate thickness from C and D to the mitre line AB, and at right angles to the line CDO. Draw in the thicknesses LN and L^1N^1 of the course J with the inside diameter tangent to the two semicircles CC^1, DD^1, respectively. This may also be done by using O as centre and the thicknesses A and B as radii (course R), marking these distances off on the radial lines from O as centre, and locating the thicknesses at LNPJK, also $L^1N^1P^1GM$. Connect these points by lines representing the plate thickness for the inner courses, also draw in the outer courses as shown in Fig. 18.

With centre 4^1 and the neutral point 7 as radius, draw in the half section plan view 741. Divide this into a number of equal parts. From these points draw in the construction lines—through and at right angles to CD—to the mitre line AB. Number as specified.

Calculate the stretchout of the neutral diameter 7 1, which is 24 × 3.14 equals 75.36, or nearly 75⅜ inches. Measure off this distance along the line FCDF, Fig. 19. Divide this into twice the number of equal parts as in 7 4 1, Fig. 18. Raise perpendiculars from these points and number accordingly. Transfer all the distances from course R in a similar manner as explained in previous problems. Fig. 19 shows the whole pattern for R and Y courses, and the half pattern for courses J and V.

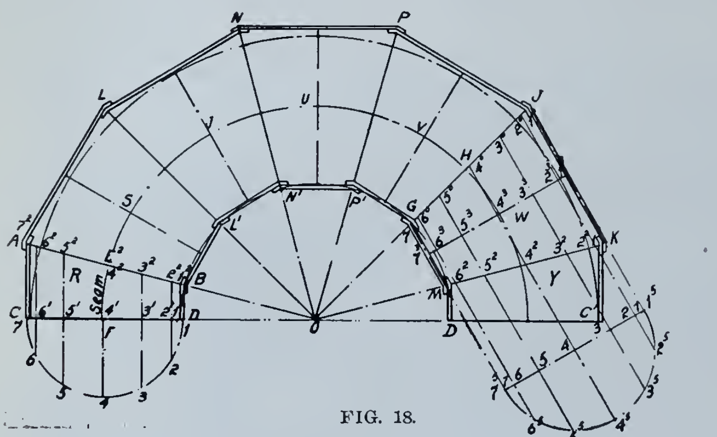


FIG. 18.

FIG. 19.

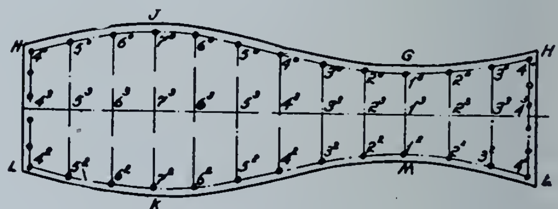


FIG. 20.

The courses S, U, and W are outside courses and require to be developed as such. For sake of clearness the centre girth line 7^31^3 of course W is projected to 7^51^5. Centre line HL is extended to 4 4^5; with 4 as centre and the neutral radius of course W, which is 4^57^5, draw in the neutral half-section plan view of course W, as $7^54^51^5$. Divide this semi-circle into an equal number of parts. From these points draw lines parallel to JK and $HL4^5$, to their intersections on JHG. Number these lines as shown, and then calculate the stretchout. The inner course is 75⅜ ins.; an easy fit is desired for the outer course, therefore to this measurement add on 6½ times the plate thickness. The stretchout for the outer course will equal 75⅜ $+(6\frac{1}{2}\times\frac{1}{2}) = 78\frac{5}{8}$ inches. Measure this distance off along the line $4^34^34^3$, Fig. 20. Divide into twice the number of equal parts as are used in the half section view 7 4 1, Fig. 18. Draw perpendiculars through these points. Number as shown, so that the longitudinal seam will be located at HL, Fig. 18, when the course is rolled up.

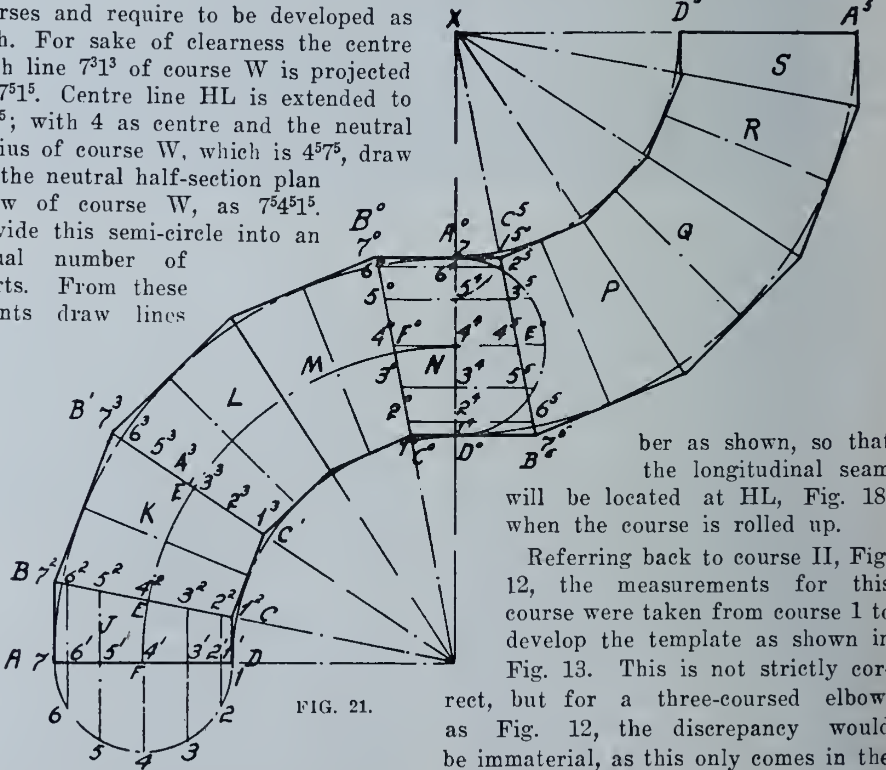


FIG. 21.

Referring back to course II, Fig. 12, the measurements for this course were taken from course 1 to develop the template as shown in Fig. 13. This is not strictly correct, but for a three-coursed elbow, as Fig. 12, the discrepancy would be immaterial, as this only comes in the one course. In an elbow of several courses this difference would be proportionate to the number of courses and the thickness of plate used.

It will be noticed in Fig. 12 that the distance BC is slightly longer than AB and that JH is shorter than JK. This appreciable difference coming in each of the three courses, S, V, W, would not be conducive to accuracy. With this defect pointed out, the template, Fig. 20, will be developed from the construction lines on course W, Fig. 18, which are drawn in for this purpose.

With dividers set to the distances $7^3 7^0 6^3 6^0$, etc., Fig. 18, transfer over to $7^3 7^0$, $7^3 7^2$, $6^3 6^0$, $6^3 6^2$, Fig. 20, similar to the preceding problems. Fig. 20 shows

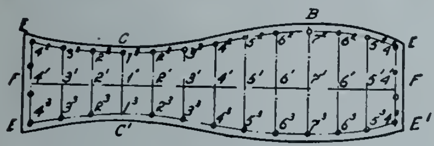


FIG. 22.

the complete template with laps added and rivet holes marked in. It is again repeated that it is not necessary to draw in the full elevation view as shown in Fig. 18, unless desired. All the necessary information can be obtained by calculating the mitre line and on this drawing in the construction lines as shown by course R, and the construction lines of course W, drawn on course S. Therefore all that need be drawn will be courses R and S.

Double Elbow

Fig. 21 shows a double elbow of 9 courses. It is drawn out in full elevation to illustrate the method of obtaining the development of course N.

Measure off AD 18 inches, and OD 22 inches. With centre O and radii OA and OD strike the quadrants AA^0 and DD^0. Draw A^0D^0O at right angles to ADO. With radius OA, mark off the point X on the extended line OD^0A^0X, from the point D^0. With the same radius and X as centre, draw the quadrant D^0A^5; also

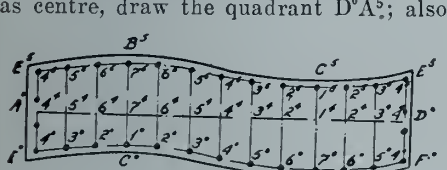


FIG. 23.

with X as centre and XA^0 as radius draw in the quadrant A^0D^5. XD^5A^5 is parallel to ADO and at right angles to XA^0D^0O. Divide the quadrants AA^0, D^0A^5 each into 8 equal parts and connect these points to their respective radial points O and X. Draw in the outline of the pipe similar to preceding problems. Fig. 22 shows the whole templet for courses KLMPQR, and half of this templet will be the pattern for courses J and S.

Course N will now be developed. On neutral diameter A^0D^0 strike the half-section view $A^0E^5D^0$. Divide this into the same number of parts as course J. Draw construction lines from these points parallel to B^0C^5 and C^0B^5. Number as shown. The stretchout of the diameter A^0D^0 is equal to the stretchout of the diameter AD, course J, which is 18×3.14 equals $56\frac{1}{2}$ inches. Measure off $A^0 4^4, D^0$, Fig. 23, equal to $56\frac{1}{2}$ inches and divide this line into 12 equal spaces, which is twice the number in the half sectional view $A^0E^5D^0$, Fig. 21. Draw perpendiculars through these points. With the longitudinal seam on $4^0 4^5$, Fig. 21, number accordingly on Fig. 23. With dividers set to $4^4 4^0$, Fig. 21, transfer over to Fig. 23 as $4^4 4^0$; reset the dividers to $4^4 4^5$, Fig. 21, and transfer over to $4^4 4^5$, Fig. 23. Similarly transfer all the rest of the measurements over to Fig. 23. The complete templet is shown in Fig. 23 with rivet line in rivet centres and lap allowances drawn in.

WALLACE SHIPYARDS, VANCOUVER, B.C.

WHILE some details have yet to be fixed, the Wallace Shipyards, Vancouver, may be said to have leased the large waterfront fill on D. L. 265 for the construction of the majority, if not all; of the four ships for which they have secured contracts. Three of the boats will be of wood and the fourth a steel vessel. Preliminary work on the fill will be commenced at once, and already a quantity of material has been laid down in readiness for initial operations.

The fill, which is a conspicuous object, even from the Vancouver waterfront, measures 670 feet from north to south. The work of reclamation was carried out about three years ago by the Lonsdale Estate at a cost of $125,000, and since that time has been held by the owners awaiting a deal such as has just taken place.

That the city authorities will cooperate with the Wallace yards in removing all obstacles to the progress of the new shipyards is the statement made by Mayor Hanes. About 2,000 feet of three-quarter-inch piping has been laid as a temporary water connection till the permanent main can be put down. The shipyard plans show that four launching slips will be available.

YARROW'S, ESQUIMALT, B.C.

RECENT work carried out at Yarrow's shipbuilding yard at Esquimalt, B.C., is indicative of considerable activity. In addition to a great deal of foundry work carried out for the Victoria Chemical Co. and others, the following list covers vessel overhauls and repairs, etc:

Steel sternwheeler under construction.

Sir John Jackson's hopper SS. Hercules No. 7, docked on slipway, underwater portion of hull cleaned and painted, and some damaged shell plating repaired.

C. P. R. SS. Princess Charlotte docked in the Dominion Government drydock; underwater portion of hull cleaned and painted.

Salvage steamer Alaskan docked on the slipway; underwater portion of hull cleaned and painted, and some hull and engine repairs executed.

Collier SS. South Pacific docked in the Dominion Government drydock; underwater portion of hull cleaned and painted.

C. P. R. SS. Princess Alice docked on slipway; underwater portion of hull cleaned and painted, together with small hull repairs.

Dredging fleet vessels tug Point Ellice, dredge Ajax and dredge Victoria docked on slipway for annual overhaul and repairs.

C. G. S. Newington locked on slipway; underwater portion of hull cleaned and painted.

Cable ship Restorer; the installation of oil fuel burning system completed.

Union Steamship vessels SS. Camosun; extensive bottom damage repairs carried out, together with engine overhaul.

SHIPYARD AT VICTORIA, B.C.

THE immediate benefit which Victoria will derive by reason of the passage of the Shipping Bill, recently approved by the Provincial Legislature, has been demonstrated in the completion of negotiations between the Provincial Government and the Cameron & Genoa Mills Shipbuilders, for the lease by the latter of two acres of waterfrontage property on the west side of the inner harbor, just south of Point Ellice bridge, whereon will be erected a modern shipbuilding plant. Work on the building of two ships will commence at once. Two ships will be laid down as soon as the facilities are ready and the company has assurance that it will receive contracts for two more. When the yard is in full operation it will give employment to 300 men, of which a large proportion will be skilled.

The company anticipates that fifteen wooden vessels will be constructed within the term of the lease of the shipbuilding site from the Provincial Government on Songhees Reserve. The type of vessel to be constructed will be a standardized carrier of a capacity of 1,500,000 feet of lumber and will cost, with machinery, approximately $170,000.

WHERE a shipment is made to a foreign port, with transshipment at an intervening port, the risk of transshipment is borne by the shipper and not by the carrier, except where gross negligence on the part of the carrier can be proven.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

S.S. "ENNISBROOK" STRANDING

A FORMAL investigation into the causes which led to the grounding of the S.S. "Ennisbrooke," off Glace Bay, on the Cape Breton coast, on May 15, 1916, was held in the Court House, Sydney, N.S., on May 23, 1916, Captain L. A. Demers, F.R.A.S., F.R.S.A., Dominion Wreck Commissioner, presided and was assisted by Captain R. MacDonald and Captain A. J. Morrison, acting as nautical assessors. The master's interests were looked after by Hugh Ross, K.C., of Sydney.

Master's Evidence

Captain James Roger Vickers, the first witness examined, stated that he was 31 years of age; that he held a master certificate of competency No. 036885; that he had been in command of the "Ennisbrook" for the last two years; that this was virtually his first mishap since he had been master; that the Ennisbrook was a steel ship of 2,122 tons net and 3,382 tons gross, and carried a crew of 24 all told, including two certificated officers and three engineers. Her speed was 9 knots, and she was a single screw, schooner rigged vessel with compound engines. She was supplied with all necessary instruments for the purpose of navigation, there being two compasses of the Era type, both of which were practically correct. The deviation book which was produced, showed that frequent observations had been made, and that the compasses were carefully watched and attended to, the greatest deviation being about two degrees. The vessel owners are the Brook Steamship Company, of London, England.

Captain Vickers stated that he left Quebec at 1 a.m. on May 13, experiencing clear fine weather up to the time of grounding; that his cargo consisted of grain consigned to Hull, England; that when leaving Quebec the intention was to bunker at Sydney, although he had the option of going to Louisburg; that after passing Cape North, and steering a course which would clear Scatarie, and keeping the ice on his starboard side, he decided to make for Louisburg on acount of the ice. After a while, seeing clear water near the entrance to Sydney harbor, and without calculating the influence of the tide and wind on the ice, a course was shaped there, deviating as necessary from that course to enter leads in the ice. The wind was northerly and tending to push the ice field towards the Cape Breton shore and the entrance to Sydney harbor. He altered the course, or rather gave orders to port the helm, with the intention of steaming into the ice, but the ship grounded and forged ahead on a shelving rock, two-thirds of her length, at about 7.15 p.m., at a place called Table Head.

At the time of the grounding he averred that the ship was going about three knots through the water, and was heading N. 5S. W. The engines were put full speed astern and the tanks and around the ship sounded. It was found that there was no leakage. The soundings outside. showed 18 feet of water forward, while the vessel was supposed to be drawing 20 ft. 4 in. forward and 21 ft. 2 in. aft.

He stated that at 4.30 the next morning the engines were put full speed astern, and kept going for a few hours; that, at 10.30 a.m. on May 17, cargo was discharged into the hold of a Norwegian sealer, and later some 300 tons of cargo were jettisoned; that the following vessels were requisitioned, the Margaret, Stadacona, Douglas H. Thomas, Maggie M. and Stanley, and finally the ship was floated off at 8.15 on May 18. He then proceeded to Sydney.

First Officer's Evidence

The first officer, Thor Asnonson, stated that he was 52 years of age; that he held a Board of Trade certificate of competency as master: that he had been master of ships twice for short periods; that he was on deck when the vessel grounded, and had been on the bridge from 6 p.m. He averred that had he been master he would not have undertaken the navigation of the vessel in that particular locality. He had doubts but never communicated same to the master, giving as a reason, that he feared to offend by making suggestions.

The second officer and wheelsman were examined, but they failed to enlighten the court. The chief engineer informed the court as to the movements of the engines when the ship grounded and after, the second engineer corroborating his statements.

Court Finding

The court having carefully weighed the evidence, finds that the master, R. J. Vickers, in navigating his vessel from Cape North to the place of grounding, showed absolute lack of judgment in view of the conditions existing. He had clear weather with light northerly winds from the time of passing Cape North, with clear water on his port side and on his starboard side. Ice was bordering the shores of the Cape Breton coast, and the current, if the slightest trouble had been taken to ascertain it, would have been found to run in a southeasterly direction. Both current and wind were influencing the ice.

His intention in the first place was to go to Sydney for bunkering; but on the way down from Cape North, he found so much ice in-shore that he changed his idea, and decided to go to Louisburg, as there was a clear passage to that port. After passing, or in the neighborhood of Glint Island, when the ice was all on his starboard side in masses, with clear water in-shore, he thought he could make Sydney, and retrace his steps in order to reach that place.

It has been stated in the course of evidence that clear water was ahead of him, and with the direction of the wind it might have directed him to think and to know that the coast adjoining the Louisburg Harbor would be free of ice and open to navigation. His compasses were said to be correct and proved to be so, therefore the accident cannot be attributed to that.

We note by his evidence, and that of the mate that prior to the grounding the vessel was supposed to be about a mile distant from shore. In view of the fact that the master and mate were strangers to the locality, and also owing to the masses of ice which were on their weather side and closing down gradually, it was a most unwise, and we must say, careless piece of navigation to bring the ship in such close proximity to land unknown to them, even after cursory observations had been made to ascertain the position of the vessel, although these are plotted on the chart produced in court.

The court notices that after the vessel grounded every method possible to free her from her dangerous position was adopted, and the court has no criticism to make on this point, but it certainly condemns the procedure of the master prior to bringing his ship into the dangerous position in which he did.

The master's belief that he chose Sydney in order to save time, when he thought he could make it, proves a fallacy, and cannot be accepted as an excuse, as with the undoubted possibility of having to navigate slowly through the ice which was chasing him, he would have lost more time than if he had taken his course and kept on for Louisburg, even if his bunkering would not have been done before the next morning.

In view of the fact that the ship was released from her position only slightly damaged; that very little cargo has been jettisoned; also in view of the condition of things created by the war, which has caused a scarcity of men in this calling, we do not wish to cause delay with such a valuable cargo, the court will not deal with the master's certificate; but severely censures and reprimands him for his lack of judgment both in entering the ice, and careless navigation in approaching so near to a shore unknown to him, especially under the difficulties which would have been apparent to even those not accustomed to the sea.

With regard to the first officer, his position on the bridge was one which required tact. There was a feeling within him that as the master was on the bridge it was not proper for him to suggest or to advise. The court, whilst admitting in part such a statement, still has in mind, that the mate, being a much older man in the profession than the master, could have called the attention of his chief to the difficulties which would be experienced, without fear of giving offence. However, as we see that the first officer was guided by the best intentions, we simply caution him that in such circumstances it well behoves him, and all those occupying that position, to take such steps as will indicate to courts of investigation that they have done their part towards preventing possible disaster.

SIGNALLING AT SEA

A METHOD of estimating distances at sea in fog or thick weather, which is partly electrical in character, was described before a recent meeting of the Royal Society by Prof. J. Joly. The system depends for its successful operation upon the different velocities of disturbances in different media. If aerial and submarine signals are simultaneously emitted at a lighthouse station or lightship, the lag of the aerial compared with the submarine sound is about 4.3 seconds to the nautical mile. An approaching ship picking up the signals and measuring the lag to an error even of one second, becomes aware of her distance to less than one-quarter of a mile.

Similarly, wireless signals and submarine signals, or wireless and aerial signals, may be used. If the faster moving signals be sent out in groups, the individual signals being spaced to regular intervals, say, of one second, and the lower moving signal be always emitted simultaneously with the first signal of a group, the navigator has only to count the faster signals till the slower signal reaches him in order to estimate his distance from the signal station. In this case the signals themselves tell him his distance, and no actual time measurements are required on board ship. It is shown that this system enables the mariner to determine his position completely under all circumstances which may arise.

Prof. Joly demonstrated how an extension of this method could be applied to the problem of avoiding collision in fog. It was pointed out that if vessels possess the means of emitting a loud and crisp sound signal which can be sent out simultaneously with a wireless or a submarine signal, the determination of distance rendered possible thereby, along with wireless information as to course and speed, will enable the navigator on each ship to determine with certainty, first, whether there is risk of collision, or whether there is no risk; and second, the point upon his own course, and the moment at which collision is threatened.

The solution of the problem is based upon the fact that at each instant the rate of mutual approach is the maximum if the ships are advancing so as to collide. A simple geometrical construction, which, by its character, is unlikely to involve error, enables the mariner to solve the problem immediately the signals are received.

REQUIREMENTS OF THE CONDENSER AIR PUMP

IN order to obtain a good and reliable vacuum in a condenser the following conditions are actually necessary:—An ample supply of cooling water for condensing the exhaust steam. Rapid condensation of the exhaust steam. Rapidity in removal by the air pump of the air leaking through the joints of the exhaust system and into the condenser.

The rapidity with which the steam is condensed on the tube surface depends among other things, on the amount of air contained in the condenser, and in order to obtain the maximum efficiency of the cooling surface, this must be reduced to a minimum. The air pump, whose function it is to deal with the contents of the condenser, should be capable of removing as rapidly as possible the air leakage. This air leakage in any condensing plant should be reduced to a minimum by careful making of all the joints in the system, but so long as leakage exists in any form, the vacuum obtainable depends to a great degree on its removal by the air pump.

For a given condenser vacuum, the temperature of the entering steam depends almost entirely on the absolute pressure corresponding to the vacuum but the temperature of the condensate and vaporized air, which is dealt with by the air pumps, is dependent on the proportion of air contained in the condenser space at the air pump suction. The greater the quantity of air, the lower the temperature of the condensate and therefore the larger the temperature loss in the condenser. The resultant pressure in a condenser is equal to the sum of the air and vapor pressure, and is dependent on the temperature of the condensed feed water, and therefore for a given vacuum it is necessary to reduce the air pressure to a minimum in order to obtain a temperature of feed water approaching that corresponding to the vacuum.

With the ordinary wet air pump which deals with both the feed and air mixture, it is necessary in the case of high vacuum to cool the contents before entering the pump, otherwise the capacity of the pump would generally become excessive; but this cooling constitutes a thermal loss, and in order to avoid this it is now the general practice in all high vacuum plants to provide separate pumps, one for dealing with the feed water only, which is usually called the wet pump, and the other for the air and vapor mixture, which is called the dry pump. With this arrangement the air volume can be reduced in the dry pump by means of a cold water spray without any cooling of the feed water, and thereby increases the efficiency of the condensing plant.

The principle described of separate pumps has been the common practice for many years, advised by G. J. Weir, of Cathcart, Scotland, and it has proved universally satisfactory.

BILLS OF LADING

THESE should be arranged on the steamship company's blanks and the description of the goods should correspond exactly with the receipts issued by the company to the shipper. These receipts should be attached to the "bills of lading" when the latter are presented to the company for signature. The "bills of lading" should be made out in exact accordance with the requirements of the steamship company. Bills of lading will not be signed until the prescribed form of "Shippers Export Declaration" is in the hands of the steamship company. "War tax" stamps are not required on ocean bills of lading.

Lunenburg, N.S.—John McLean & Sons expect to start work shortly on a steamer intended to replace the wrecking steamer Bridgewater.

Series of Practical Questions and Answers for Engineers

By "Artificer"

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals will be found a useful companion study. With a view to meeting the need of many of our lake and inland waterway engineers who, during the closed season of navigation, take positions in steam power plants ashore, questions relative to the latter department will also find a place in the series.

Question.—In transforming a rotary motion to a reciprocating motion, with a crank 12 inches long and a connecting rod 4 feet long, what would be the position of the crank pin when the cross-head is in the middle of the stroke, and also the angle formed by the connecting rod and the centre of motion?

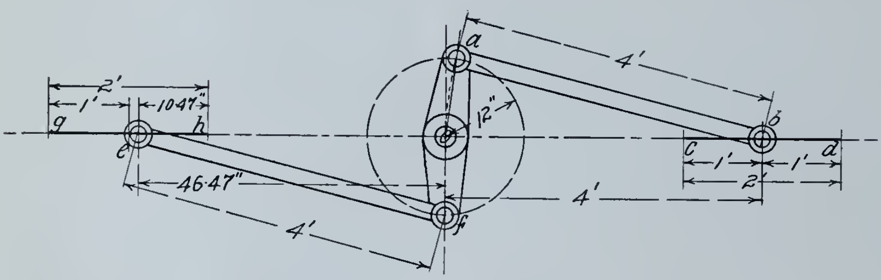
Answer.—With (o) as the centre of rotation, the distance to the centre of cross-head slide (c-d) will be equal to the length of the connecting rod, or 4 feet; therefore, when the cross-head is in the middle of its stroke the crank pin will be in the position shown at (a), or the intersection of the arc a o with the crank pin circle. Then the triangle a b o will be an isosceles triangle with two legs of a length equal to the length of the connecting rod, or 4 feet. To find the angle formed by the rod and centre of motion use the formula

$$\text{sine} = \frac{\text{side opposite}}{\text{hypotenuse}} = \frac{6}{48} = .12500, \text{ then}$$

angle corresponding equals 7 degrees 11 minutes; therefore, the angle required will be twice this, or 14 degrees 22 minutes. If the crank is midway between the front and rear dead centres, then the cross-head will be closer to the crank end of the slide. To find its true position graphically proceed as follows: With the crank in the position f, a trammel of 4 feet will cut the centre line of slide at the point e. To find this point by calculation, as the lengths e f and o f are known, we find the distance e o by the formula $\sqrt{[(e\,f)^2-(o\,f)^2]}=\sqrt{(48^2-12)^2}=\sqrt{2160}=46.47$ inches; then, as the distance o b is 36 inches, the distance h e will be $46.47-36=10.47$ inches, and the angle o e f will be found from the formula:

$$\text{sine} = \frac{\text{side opposite}}{\text{hypotenuse}} = \frac{12}{48} = .25000,$$

and angle equals 14 degrees 29 minutes.



Question.—In a ball governor when in operation on a steam engine, what are the opposing forces at work?

Answer. — Centrifugal force due to the revolving of the balls, which tends to make them pull apart from their pivot, and the force of gravity which tends to keep them in the position occupied when the governor and engine are at rest.

* * *

Question.—What purpose does a flywheel serve outside of its utility for a belt, rope or chain drive, when attached to the crank shaft of a steam engine?

Answer.—It stores up the energy developed in the engine cylinder up to the point of cut-off, and gives same out again during expansion, thereby enabling the engine to maintain a steady and uniform speed, and contributing to the absence of jar when the crank is passing the centres.

* * *

Question.—What precautions should be taken to prevent accidents from bursting water gauge glasses?

Answer—To prevent avoidable accidents from bursting gauge glasses they should be of good quality, and the fittings should be in line. When putting in a glass it should be placed in the recess of the bottom fittings and the gland screwed up; then, after it is secured in the top fitting in a similar way, it should be possible to turn the glass by hand. The systematic renewal of gauge glasses every six months or so, instead of waiting until they break is very good practice.

* * *

Question.—Explain the action of an injector, when feeding a boiler.

Answer.—At first sight, the action of an injector seems to be a paradox, since water is delivered into the boiler against a pressure equal to or greater than that of the steam operating the injector. The explanation is as follows. The velocity of an issuing jet of steam is many times greater than that of a jet of water issuing under the same pressure, and, if steam, while issuing from a boiler, be condensed, but not reduced in velocity to that of water issuing under the same pressure, it is then capable of overcoming the pressure of the water in its own boiler. This is exactly what takes place in the injector. The steam on entering, passes through the cones and is condensed on coming into contact with the feed water, without losing its velocity, further than that due to friction in the passages. The vacuum formed by the condensation of the steam causes more water to flow into the injector, and this feed water is carried on by the force of the condensed steam jet into the boiler. The velocity of the steam jet is much reduced by imparting a high velocity to the feed water, but as it is not reduced nearly so low as that of a jet of water issuing under the same pressure, sufficient momentum is imparted to the feed water to lift the boiler check valve.

* * *

Question.—On completing the installation of a new ice plant equipment, what is the usual procedure to be followed in testing out same before it goes into operation.

Answer.—The usual test pressures for high and low sides are 350 and 50 pounds per square inch of air respectively. The pressure should be pumped up by stages, stopping intervals between being in order for cooling down purposes. Once the total pressure is reached, the system should be allowed to cool down entirely before a pressure drop indicates a leak somewhere. Water should be run over the condenser for cooling down. All joints should be soaped to aid in locating leaks, and supplementary to this about an ounce of oil of peppermint should be injected into the system. Pull a vacuum on the suction side and note if it holds, after which follow with a second pressure test. All air should be pumped out of the system before charging with ammonia.

* * *

Question.—In a steam power plant with reciprocating engines and surface condensers installed, it of course becomes necessary to furnish "make-up" water for boiler feed, due to unavoidable losses from leakage, etc., throughout the system. Should the "make-up" be delivered direct into the condenser or into the air pump hot-well-

Answer.—The make-up water should be delivered to surge tanks that supply the heaters, or to a hot-well into which the condensate is discharged, to be pumped later into heaters, or if heaters are not used, to be pumped directly into the boilers. No advantage is gained by discharging water into the surface condenser rather otherwise since the main object is to pump the water obtained from the condensed steam out of the condenser. The disadvantage of putting "make-up" water into the condenser is that the air pumps are required to handle the air admitted with the water and to do the additional work of pumping the "make-up" water out of the condenser against a vacuum. Should the make-up required be 10 per cent., it would mean that the condensate pump would have to do 10 per cent. more work in order to remove this water from the condenser and discharge it into the hot-well. Furthermore, when make-up water is admitted to the condenser shell it is difficult to provide satisfactory means of controlling the amount so admitted, a problem not presented when the water is put into the hot-well or a heater.

* * *

Question.—What is the function of a fusible plug as fitted to steam boiler furnaces and fireboxes; of what does it consist, and how does it accomplish its purpose?

Answer.—Fusible plugs provide a valuable safeguard against serious explosions and collapse of furnace crowns due to low water. They should be fitted directly over the fire in all straight furnaces and in the crowns of all fire-boxes. A fusible plug consists of a metal cone, as small as practicable, held in position in a conical cap by an alloy ring of low melting point. Should the crown of the furnace become overheated through want of water, the alloy melts before there is any serious danger, the cone drops, and the escaping steam puts out the fire. Fusible plugs are not reliable unless they are kept perfectly clean on both sides. They should be examined at each cleaning time, and the fusible metal renewed periodically. One leading railway company makes a practice of renewing, monthly, the fusible metal of the plugs in the fire-box crowns of their locomotive boilers, while insurance companies dealing with stationary boilers recommend renewal at intervals, varying from one to two years, depending on the nature of the feed water and other local circumstances. Most types of plugs are now fitted with a cap that can be easily renewed, therefore a number of spare caps should be kept to prevent delay in the event of a plug melting.

* * *

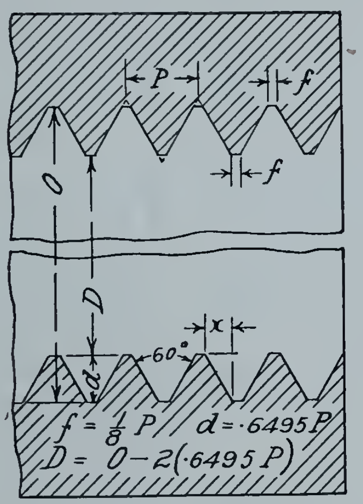
Question.—Are some brushes designed to operate with the commutator running towards the "toe" instead of towards the "heel?"

Answer.—Yes; differences in practice in this regard are due to differences in mechanical conditions. Brushes vibrate less in some cases when the direction of the inclination of the brush with respect to the direction of rotation is changed.

* * *

Question.—Without the use of a table how can the bore of a hole be calculated for the standard United States thread?

Answer.—As shown in the sketch, the flat on the top and bottom of the thread



is equal to ⅛ of the pitch; therefore, the distance x will equal the pitch minus twice the flat or ¼ of the pitch. Then to find the depth use the formula, side adjacent = cotangent × side opposite, or 1.73205×⅜P; for example, to find the bore for a 4-inch diameter, 3-thread U. S. screw. The depth would be 1.73205 × ⅜P, or 1.73205 × ⅜×.333 = .2163 inch. Then bore would be 4 — (.2163×2) = 3.5674 inches. From the above a formula may be derived which will simplify the operation, thus—1.73205×⅜P = .64952P, which multiplied by two will give the total amount to be deducted from the diameter of the bolt or male thread.

* * *

Question.—With a belt speed of 380 feet per minute on a 9-inch cone pulley, and a gear ratio of 8 to 1 between the cone and the spindle, what time would be required to travel over a 9¼-inch diameter shaft, 27 inches long, with 1-16-inch feed; and what would be the cutting speed in feed per minute?

Answer.—With a belt speed of 380 feet per minute the speed of the cone pulleys would be 380 divided by the circumference of the pulley in feet or $380 \div \left(\frac{9}{12} \times 3.1416\right) = 118.8$ rev. per min.

With a gear ratio of 8 to 1 the speed of work or lathe spindle would be $118.8 \div 8 = 14.85$ revolutions per min. The cutting speed would be number of revolutions multiplied by the circumference, or $14.85 \times \frac{9.25 \times 3.1416}{12} = 35.9$ ft. per minute.

Time required to travel over 27 inches of shaft will be the length divided by the feed, and again divided by the revolutions, or $\frac{27 \div 1\text{-}16}{14.85} = \frac{27 \times 16}{14.85} = 29.09$ min., practically one-half hour.

* * *

Question.—(a) Are alternating current motors built for 220 volts at 500 horsepower rating? (b) Are steam turbo-generators of 2,000 k.v.a., 3-phase, 60-cycle capacity built for as low a voltage as 220 volts? If so, what is the relative cost of such a unit? (c) Would it be cheaper to generate at 2,200 volts and step down to 220 than to purchase the low-voltage generator?

Answer.—(a) There is little or no demand for motors as large as 500 horsepower for voltages as low as 220. (b) Turbo-generators of 2,000 k.v.a., 60-cycle, 220 volt, 3,600 r.p.m., have been built for special applications, usually for supplying low-voltage rotary converters. The cost of the low-voltage generator will be a little higher than a similar 2,400 volt generator on account of the cost of the heavy copper armature cross connecting straps and leads, but this difference will not begin to pay for the transformers. (c) A 2,400 volt generator and step-down transformers would be the best scheme if the current must be transmitted more than 100 feet from the generator.

* * *

Question.—With a tensile strength of 60,000 lbs. per sq. inch. and a factor of safety of 5, what would be the limit of load on a ⅝ rod?

Answer.—With the above safety factor of 5, the limit of load would be 60,000 lbs. divided by 5, or 12,000 lbs. per sq. inch. For a ⅝ rod this would represent a load of $12{,}000 \times \frac{5}{8}^2 \times .7854 =$ 3684 pounds.

* * *

Question.—What is the difference between the terms stress and strain?

Answer.—Stress is that force within a body which resists the action of an externally applied force; while the strain is the deformation, or change of shape, produced by the applied force, and is proportional to the stress within the elastic limit.

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Vol. VI JUNE, 1916 No. 6

PRINCIPAL CONTENTS

A BOOST FOR CANADIAN SHIPBUILDING

THE North Sea battle, among other things, should give a decided impetus to the encouragement and development of shipbuilding in Canada. An appreciable dent has been made in our naval fighting machine, more so than any of us were prepared for, and while the ultimate ability of the latter to maintain its superiority is well beyond question, we may not be insensible to the fact that any immediately projected mercantile shipbuilding programme in Great Britain has received a substantial setback for some time to come.

It would be well for our Canadian business and public men to ponder over not only the recent happening, but to become awake to the fact that it is not by any means the last of its kind. There is a meantime serious shortage of merchant shipping the world over, and, while the war lasts, the shortage volume in the nature of things cannot but increase. However much we may desire it otherwise, there must also ensue a diminution of our naval fighting strength from time to time, and to readjust same it is readily apparent that Government control of British shipyards will continue effective.

As hinted in Sir Robert Borden's speech at the launch, the ice-breaker "J. D. Hazen" is to be pressed into service on behalf of the Allies. She, in a word, is to be diverted from her original purpose, and, in so determining, our action is altogether praiseworthy; but why stop there? In the case of the ice-breaker disposal we have undoubtedly made a sacrifice, for we had looked forward to her work on the St. Lawrence as influencing our trade and commerce to a material extent. On the other hand, the development and encouragement of shipbuilding on our ocean waterways and ocean shores would essentially be void of sacrifice, while the resultant product would be equally and perhaps more valuable to our Allies, and at the same time of untold benefit to ourselves, industrially and commercially.

SHIPBUILDING IN CANADA

IT is not to the question of whether the vessels built by Canadian shipbuilding plants now or in the immediate future would contribute to the relief of the war-created shipping stringency, but rather the taking of steps towards our future national commercial ascendency that Sir Robert Borden and his Government should turn their attention and be prepared to give national help and active support. The fostering of shipbuilding in Canada is perhaps at the moment the livest topic in the realm of public opinion from our Atlantic to our Pacific Coast, and it is just sufficiently deep-rooted as to be unmoved by shallow excuse or unnecessary parleying.

There is a widespread desire that Canada should not only possess a larger merchant marine, but also that she should play the major part at least in producing it. All who are in accord with a shipbuilding propaganda do not of course fully appreciate what is involved. It may not be too clearly apparent to many that construction costs in Great Britain in pre-war days were very much lower than those in Canada, relative to both wages and material, and that the Motherland was our real and only competitor, the vessels built by her entering Canada duty free. To stimulate Canadian shipbuilding by a tariff enactment against Britain and admit at the same time materials of construction, duty free, are directions in which public opinion is not likely to express itself too favorably. The opposition of our manufacturers generally would not fail to assert itself, and not without good reason, as the altogether free importation of shipbuilding commodities would hinder rather than help thereby the myriad industries auxiliary to the prosecution of shipbuilding and marine engineering on a comprehensive scale.

Shipbuilding is wanted to be firmly established on our shores as much for the sake of our general industrial enterprises as for its own; therefore, the plan or scheme for its encouragement must embody that provision. A bounty as proposed by Col. Cantley in his recent address before the Canadian Manufacturers' Association at Montreal, seems therefore the only reasonable solution to meet fully the situation in its diversity.

MARINE NEWS FROM EVERY SOURCE

Car Ferry Sold.—The car ferry, Pere Marquette No. 5, which has been operated between Milwaukee, Ludington and Manistee for the past eight years by the Pere Marquette Line, has been sold to Sydney, N.S., interests, it is announced. The boat will be used on the Bay of Fundy.

Peace River, Alta.—The river steamer "D. A. Thomas" was launched here recently for service between Hudson's Hope and Vermilion, a distance of 600 miles. The steamer is 200 ft. long by 48 ft. beam, and is driven by a 700 h.p. steam engine. She is constructed of B. C. pine, cost $100,000, and has accommodation for 250 passengers.

New Docks for Windsor.—Plans have been submitted to the Canadian Marine and Fisheries Department by the Detroit and Windsor Ferry Co. for new docks at the foot of Ouellette and Ferry Avenues, at a cost, it is estimated, of from $125,000 to $150,000. Work will be started, it is expected, shortly if the Government accepts the present plans, with possibly a few minor changes.

Notice to Mariners.—The following notice to mariners has been issued by the superintending engineer of the Welland Canal:—"On and after the 1st June, 1916, and until further notice, no vessel will be allowed to enter and pass down through the Welland Canal drawing more than fourteen feet four inches of water, and no vessel will be allowed to enter and pass up through the Welland Canal drawing more than fourteen feet of water."

Halifax, N.S. — It is reported that three shipbuilding concerns have sent inquiries to the Board of Trade as to the property and bonuses available for the erection of shipbuilding plants in this city. The matter will be taken up at once with these concerns, all of which are British. Halifax has been on record for years as willing to give a bonus to a steel shipbuilding plant, and a syndicate of local men is holding a valuable property for such a plant. The local Board of Trade has been advertising this in the British newspapers.

The Sorel Shipbuilding & Coal Co., has been incorporated at Ottawa with a capital of $100,000 to carry on business as shipbuilders and repairers, etc., at Sorel, Que. Incorporators, W. H. McKeown, G. E. Chartand, L. C. Herdman all of Montreal.

Schooners to Ocean Trade.—The coal schooners Ford River, Keewatin and Charley Marshall have been sold for trade on the Atlantic coast, says a Kingston, Ont., dispatch.

"Keewatin" to New Orleans.—It is reported that the Keewatin, which has been engaged for many years bringing coal from Oswego to Belleville, is to be taken to New Orleans, where it will be used in trade around the river and gulf.

The St. John Dry Dock & Shipbuilding Co., has been incorporated at Ottaway with a capital of $1,000,000 to carry on the business of a general contracting construction and developing company for the construction and equipment of public works. Head office to be situated St. John, N.B. Incorporators, R. T. Heneker, H. B. Chauvin and H. E. Walker all of Montreal

Ottawa, Ont.—The Public Works Department has under consideration the matter of the approval of plans for the construction of a canal between Lake St. Francis and Lake St. Louis by the Beauharnois Light, Heat & Power Co. The proposed scheme involves a considerable development and, in all probability, will eventually result in the closing of the Soulanges Canal, in which case navigation would be diverted to the new canal between Lake St. Francis and Lake St. Louis. The Soulanges Canal is only ten or twelve feet deep, while the proposed Beauharnois Canal would be twenty-two feet.

Social Hostess Aboard Ship.—H. H. Gildersleeve, manager of the Northern Navigation Co., announces that a social hostess will be aboard the Noronic, Hamonic, and Huronic, the three palatial steamers of the company. The social hostess is found aboard some of the Atlantic passenger steamers, but it is said the Northern Navigation Co. is the first steamship line on the Great Lakes to provide expert aid in arranging entertainment and amusement for the guests.

The Siemens Co. of Canada have received a $21,000 order from the Dept. of Public Works, Ottawa, for 17¼ knots of deep sea type submarine cable for Government telegraphs.

"City of Midland" Raised.—The hull of the steamer City of Midland, which was burned last March and sank alongside the G. T. R. wharf at Collingwood, Ont., was successfully floated on June 10. It now lies by the drydock, where temporary repairs will be made, preparatory to remodelling into a tow barge or scow.

Vancouver, B.C.—The first steel, ocean-going cargo steamer to be constructed in British Columbia will be built at the Wallace Shipyards, North Vancouver. Work will be commenced at the end of June or beginning of July, and the vessel is to be delivered early next year. The steamer is for the firm of Dingwall, Cotts & Co., Pacific Building, Vancouver, and also of London, England, who, through their Vancouver manager, John Eadie, placed the contract and signed it up. The steamer to be built will be 315 feet long and 45 feet beam. She will have a carrying capacity of 5,000 tons and a speed of nine and a half knots. The plans show her to be a single deck, single screw steamer, with two boilers, triple-expansion engines, eight winches, and four big hatches. She will be built to Lloyd's highest classification under special survey. The vessel will have four watertight bulkheads, and wood for hull and deck will be British Columbia fir.

WHITE STAR-DOMINION LINE NEW OFFICES

EARLY during the present month, the White Star-Dominion Line moved into their new and well-appointed offices in the McGill Building, corner of McGill and Notre Dame Streets, Montreal. The new quarters are both spacious and excellently furnished, large plate-glass windows also fronting on two of the principal business thoroughfares of the city. The well-known and characteristic double flag flying at the peak is painted on each of the large windows on both streets, while the names of the White Star, Red Star, White Star-Dominion, the Atlantic Transport, Leyland, Panama-Pacific and American lines, whose business will be looked after in these offices ,are also inscribed on the windows above the flags.

The entrance to the offices is on McGill street, two doors to the left of the entrance to the McGill building, admitting to the public space, where upholstered benches, a circular writing table with four chairs arranged around a large central column, and mahogany counters both to the right and straight ahead, mark the line of demarcation between the company's customers and the company's employees. The floor is of gray Tennessee marble, and all the woodwork, including the partitions shutting off the offices to the managers and the stenographers, is in solid mahogany. The top half of the inner walls of these offices is of plate glass, so that noises are shut out, while the good effect, given by the original proportions of the great room are retained by use of the practically invisible glass.

The heavy, handsome antique bronze electroliers fit in with the appointments everywhere, while inside the counter every arrangement is made to make the securing of tickets, tags and plans for every one of the immense fleet of steamers so convenient that no time will be lost passengers in searching for them. The panels of frosted glass in the managers' room, the conventional designs in the panels of the mahogany counters and the great oil painting of representative steamers in the various fleets managed by the company, give a final touch of dignity to the whole appearance of the offices. The cloak room has individual all-steel lockers for the office staff, while the store rooms, advertisement room and lavatories are in the basement.

WELLAND SHIP CANAL PROGRESS

THAT, notwithstanding the war, most satisfactory progress has been made on the four sections of the Welland Ship Canal, which have already been contracted for, and that three at least of these sections will be finished within the four-year schedule, the work having been started in 1913, was the statement of Chief Engineer J. L. Weller, who planned and is in charge of this undertaking, which will cost Canada $60,000,000 or $70,000,000. Fifty per cent. of the contracts on Nos. 1 and 2 sections are completed.

On No. 3 section, at Thorold, which is the largest section, having three double locks, and which contract costs the sum of $10,000,000, only about 25 per cent. of the work is finished. This section, Mr. Weller says, will not be finished on schedule time, but will run along into 1918 at least. The work there is proving very heavy, it being necessary to blast through the solid rock down 80 feet. The blasting is about finished for the first pair of locks, which will be bigger than those of the Panama Canal. It was on this section that the strike occurred recently, but the majority of the men are back at work.

Section 4, between Allanburg and Thorold, has not yet been let, but section 5, at Allanburg, is half completed.

SAILING DISTANCES—NAUTICAL MILES—ON ATLANTIC COAST

From	To Halifax	Montreal	Quebec
Aberdeen	2,529	2,765	2,630
	S	S	S
Adelaide	12,105	12,626	12,491
	S	S	S
Aden	5,968	6,491	6,356
Amsterdam	2,795	3,317	3,182
Antwerp	2,759	3,281	3,146
	H	H	H
Auckland	11,634	12,254	12,219
Barbados	1,903	2,715	2,580
Belfast	2,361	2,645	2,510
	S	S	S
Bombay	7.618	8,141	8,006
Bordeaux	2,647	3,169	3.034
Bristol	2,462	2,977	2,842
Buenos Ayres	5,701	6,421	6,286
	S	S	S
Calcutta	9,260	9,783	9.648
Cape Town	6,423	7,108	6,973
Cardiff	2,442	2,957	2,822
Cherbourg	2,514	3,036	2.901
	S	S	S
Colombo	8,060	8,583	8,448
Copenhagen	3,003	3,239	3,104
Dundee	2,586	2.822	2,687
Genoa	3,519	4,042	3,907
Gibraltar	2,671	3.194	3,059
Glasgow	2,408	2,693	2,558
Grimsby	2,823	3,345	3.210
Halifax	...	872	737
Havana	1,620	2,475	2.340
Havre	2,680	3.102	2,967
	S	S	S
Hongkong	11.046	11.569	11,434
Hull	2.835	3.357	3.222
Leith	2,613	2,849	2,714
London	2,719	3,241	3,106
	S	S	S
Madras	8,609	9,132	8,997
Malta	3.656	4,179	4,044
Marseilles	3,361	3,884	2,749
	S	S	S
	12,413	12.936	12,801
	C	C	C
Melbourne	12.393	12.916	12.781
Montevideo	5.586	6.306	6,171
Montreal	872	...	135
Naples	3.641	4.164	4.029
Newcastle	2,923	3,445	3.310
Plymouth	2.035	2.944	2,909
Port Said	4.571	5.094	4,959
Quebec	737	135	...
	S	S	S
Rangoon	9,263	9,786	9,651
Rio de Janeiro ...	4.611	5.331	5,196
Rotterdam	2.771	3.293	3,158
St. Johns (Nfld.)..	540	1,025	890
	S	S	S
Shanghai	11,789	12,312	12,177
	S	S	S
Singapore	9.606	10.129	9,994
Southampton	2.540	3,062	2.927
Sunderland	2.910	2.897	2.762
Swansea	2.424	2.923	2.788
	S	S	S
Sydney	12,896	13.419	13,284
	C	C	C
	12,858	13.381	13,246
	M	M	M
Valparaiso	8.200	8.920	8,785
	M	M	M
Vancouver	13.770	14.490	14.355
	S	S	S
Yokohoma	12,508	13.031	12,896
	S	S	S
Zanzibar	7,688	8,211	8,076

S.—Via Suez Canal. C.—Via Cape Town. H.—Via Cape Horn. M.—Via Straits of Magellan.

EMPRESS OF IRELAND CLAIMS

IN the claims arising from the sinking of the C. P. R. liner Empress of Ireland by the Norwegian collier Storstad in the St. Lawrence River a little over two years ago, W. Simpson Walker, K.C., registrar of the Admiralty Court, made his final award in June 2. The claims totalled $3,069,482, and the amount available to meet these was $182,242, received from the sale of the Storstad. The costs amounted to $28,140, so there were $154,102 for distribution.

Mr. Walker orders the distribution as follows: Canadian Pacific Railway Company, owners of the Empress, $43,974; relatives of victims of the disaster, $110,128. The individual amounts in the latter case vary from $8,000 downward to $3,000. All claims for personal loss were dismissed by the registrar.

LACHINE CANAL MAY TRAFFIC

BECAUSE shortage of available tonnage has greatly curtailed the amount of coal being brought up to Montreal and St. Lawrence ports by ocean and coasting steamers from the Maritime Provinces, the May returns for the Lachine Canal show an increase of 100,890 tons of coal in the amount brought down from American ports as compared with the coal brought down for the same month in 1915.

This coal has been an absolute necessity for many firms who are now running their factories day and night, but it has also had the effect of limiting to a certain extent the lake vessel tonnage available for bringing wheat down to Montreal from the Upper Lakes. This tonnage had already suffered a notable diminution because of the vessels suitable for ocean navigation which had been tempted to abandon the Lakes for the more profitable business at sea.

So far as the Canadian West was concerned, the situation was saved last year by American vessels, which rushed all the wheat they could to American lake ports, whence it was taken by rail to American Atlantic ports to swell their returns as to wheat exports. The Canadian railroads have also done yeoman service in sending long caravans of trains eastward laden with grain, and these trains are estimated to have brought more grain to the elevators of the harbor commissioners than have the boats, even though in normal times the greater part of the grain passes first through the Lachine Canal.

Grain Carried

The amount of wheat which came through the Lachine Canal in May this year is less than a quarter of what it was for the same month in 1915. The figures are as follows: May, 1915, 8,632,-508 bushels; May, 1916, 1,865,468 bushels; a decrease of 6,767,040 bushels.

The total amount of grain which came through the canal in May for 1915 and 1916 respectively was 11,480,252 bushels and 4,068,227 bushels, an advantage for 1915 of 7,412,025 bushels of grain. The only increases shown were in the cases of barley, of which 487,206 bushels came through the canal, against 114,863 bushels in May, 1915, and rye, of which 132,000 bushels came through into Montreal, as against none at all in 1915 for May. Other figures for May, 1915 and 1916 respectively, are as follows: Corn, 415,041 and 185,340 bushels; oats, 2,200,840 and 1,298,615 bushels; flaxseed, 117,000 and 99,598 bushels; decreases in every case. This decrease occurs at a time when there is lots of wheat to ship and the port in a splendid position to handle it.

The total coal received in the harbor through the Lachine Canal last month was 245,842 tons, as against 144,952 tons in May, 1915, or an increase of 100,890 tons.

General Produce

In the statistics of produce carried there are decreases in every item except cheese, which increased from 15,498 boxes in May, 1915, to 18,649 boxes of cheese in May, 1916, an increase of 3,151 boxes. In other items the disparity is most startling in the case of flour where 22,639 sacks were brought down the canal in May, 1915, and none came last month. Figures for May in the two years being considered were as follows for the other items: Eggs, 4,469 cases in 1915 and 4,186 cases last month; butter, 567 packages in 1915 and 308 packages last month; apples, 83 barrels in 1915 and none last month.

Vessel Trips

In considering the number of trips made by vessels through the Lachine Canal the following figures show a steady diminution ever since the year 1913 for May: 1910, 1,256 trips; 1911, 1,173 trips; 1912, 1,051 trips; 1913, 1,307 trips; 1914, 1,292 trips; 1915, 1,070 trips; and 1916, for May, 968 trips. Thus, the surprising result is shown that the Lachine Canal was used by fewer vessels last month than it had been for the same month six years ago or any year since.

"SOO" CANAL TRAFFIC

THE statistical report for May of traffic through the canals at Sault Ste. Marie, Michigan and the Sault, Ontario, shows the heaviest traffic for one month yet received; 10,164,562 tons passed through the American Canal, and 2,128,914 through the Canadian.

Iron ore, grain and wheat continue to head the shipping list, showing a tremendous increase over May of last year of the former. May, 1915, showed a 4,906,788 tons, as compared with 8,144,555 tons in 1916; grain, 5,497,071 in 1915, against 15,837,114 in 1916; wheat, 13,267,497 in 1915, against 37,333,403 in 1916.

Soft coal also shows an increase—1,248,447 tons in May of last year, and 2,075,552 this year; 1,756 passengers passed through on steamers, an increase of 412 over May last year; 3,215 vessels were locked through, 776 of them through the Canadian Canal. The tonnage locked through the canal for the past month was more than the total amount handled in a season through the canals 24 years ago. Of iron ore, nearly twice as much was handled last month as in that year, and 82,646 tons more than in the entire year of 1895. As many lockings were made during May as in 1894.

LLOYD'S REGISTRY RETURNS FOR 1915

THE total addition of steam tonnage during the year has been 1,461,816 tons gross; of sailing tonnage, 61,934 tons gross; or, in all, 1,523,750 tons gross. Of the tonnage added to the Register about 51 per cent. consists of new vessels, practically all built in the United Kingdom. The gross deduction of steam tonnage from the Register amounts to 1,452,679 tons; and, of sailing tonnage, to 82,222 tons; or, in all, to 1,534,901 tons. Nearly 19 per cent. of this deduction is due to ordinary sea casualties, breaking up, dismantling, etc., and 53 per cent. to war losses.

Tonnage Sold

The tonnage sold to foreign owners during 1915 is returned at 232,949 tons, or about 15.2 per cent. of the gross deduction. The steam tonnage deducted on this account is 194,406 tons, and the sailing tonnage 38,543 tons. The total tonnage deducted under this head is 389,800 tons lower than the average for the previous four years. The countries which have acquired the largest amount of tonnage from the United Kingdom within the year under review are the United States (88,348 tons), Norway (38,623 tons), and Greece (30,279 tons). About 12.9 per cent. of the tonnage removed from the Register because of foreign transfer was built before 1890; about 24 5-6 per cent. during the years 1890-1899; and nearly 43 per cent. during the years 1900-1909. In addition to the tonnage transferred to foreign flags, 39,307 tons have been transferred to British Colonies during 1915, as compared with 68,265 tons in 1914, 44,437 tons in 1913, 87,281 tons in 1912, 37,374 tons in 1911, and 65,120 tons in 1910. It will be understood that new vessels built in the United Kingdom directly for colonial and foreign owners are not included in these figures.

On the whole, during 1915, the number of steamers on the Official Register of the United Kingdom has decreased by 86, but the tonnage has increased by 9,137 tons, while the number of sailing vessels has decreased by 182, and the tonnage by 20,288 tons. The total number of vessels on the Register has, therefore, decreased by 268, and the total tonnage by 11,151 tons during the year.

New Vessel Classification

During 1915, 417 new vessels of 968,533 tons, have been classed by Lloyd's Register. Corresponding with the general movement of the shipbuilding industry the present figures show a decrease of 768,198 tons on those for 1914. Of these vessels, 404 of 965,744 tons are steamers, and 13 of 2,789 tons are sailing vessels. With the exception of 5 small wood vessels of 293 tons, the material nsed in the construction of the whole of the tonnage classed was steel. The output of sailing tonnage is so small as to be practically negligible. The percentage of sailing tonnage to the total tonnage classed for 1915 is 0.29, as against 0.32 for 1914. For the five years, 1909-1913, the mean of the yearly averages was 0.92 per cent.

A large number of vessels of special design were classed during the year. These comprised 15 vessels built on the longitudinal system of construction, with a total tonnage of 97,295 tons; 40 vessels, of 50,865 tons, for carrying petroleum in bulk, most of which are built on the longitudinal system, and are included in the preceding figures; 6 steamers fitted with steam turbine engines, 5 of which have geared turbines; 1 steamer fitted with a combination of reciprocating engines and steam turbines, and 9 large vessels with oil engines; together with other steamers intended for channel and coasting purposes and numerous vessels of various special types, such as yachts, dredgers, river steamers and barges, motor vessels, tugs, and fishing vessels. The average size of the steamers classed during the past year is 2,390 tons.

During 1915, 38 steamers of over 7,000 tons each have been classed as compared with 52 in 1914, 45 in 1913, 25 in 1912, 26 in 1911, 28 in 1910, 17 in 1909, and 17 in 1908. Six of the steamers classed during 1915 were over 10,000 tons each, the largest being the steamer "Orbita," of 15,678 tons. Of the tonnage classed during the year, 679,178 tons, or about 70 per cent., have been built in the United Kingdom. Among foreign countries, the United States contributed the largest amount of tonnage (104,723 tons), then follow Holland (63,092 tons), Japan (54,997 tons), and Denmark (24,712 tons). This return includes a statement showing the countries for which the tonnage that has been classed was built. The tonnage built for the United Kingdom was 599,913 tons, and 368,620 tons for other countries. Among the latter the United States lead with 105,464 tons; then follow:—Holland, with 60,369 tons; Japan, 54,997 tons; and Denmark, 30,470 tons.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

James Carlton Eckliff, president of the Eckliff Automatic Boiler Circulator Co., died at his home, 30 Melbourne Ave., Detroit, Mich., on May 9.

Thomas Muir Nairn, for many years superintendent of the Donaldson Steamship Line, died at his home, Notre Dame de Grace, Montreal, on June 6.

Steamship Directors Elected.—At a recent special meeting of the shareholders of the St. Lawrence & Chicago Steam Navigation Co., the following Board of Directors was elected:—James Carruthers, J. W. Norcross and Horace Smith, of Montreal; M. J. Haney, J. H. G. Hagarty, Aemilius Jarvis and A. A. Wright, of Toronto; J. P. Steadman, of Hamilton. At a subsequent meeting of the new board, J. W. Norcross was elected president and M. J. Haney vice-president, succeeding W. D. Matthews and Sir Edmund Osler. James Carruthers is president of the Canada Steamship Lines, M. J. Haney vice-president, and Messrs. Steadman, Jarvis and Norcross are directors.

Captain John Simpson, veteran Canadian navigator and shipbuilder, died on June 3 at this home, Owen Sound, Ont., in his ninety-first year. He was born in the Bay of Quinte district near Belleville. When twelve years of age he began his career as a sailor and visited many parts of the globe before the mast on clipper ships. After he became captain he was master of sailing ships on the Great Lakes and had all the experiences which come to the navigator before steam supplanted canvas. During the winters he learned shipbuilding with his uncle, a notable shipbuilder of Oakville, Dennis Potter, and it was in the ships he built rather than the ships he sailed that he will fill a position in Canadian navigation affairs. He came to Owen Sound in the fall of 1874 to build the steamer City of Owen Sound for A. M. Smith & Co., who had purchased the burned hull and machinery of the City of London some time previously.

LICENSED PILOTS

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio. Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York. **Secretary**—M. R. Nelson, 1184 Broadway, New York.

SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

SHIPMASTERS' ASSOCIATION OF CANADA

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

GRAND COUNCIL, N.A.M.E. OFFICERS.

A. R. Milne, Kingston, Ont., Grand President.
J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I., Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

The Trill Indicator Co., of Corry, Pa., has issued a new 56-page, complete and up-to-date publication on engine indicators and indicating. The book is copiously illustrated and describes in detail the construction and purpose of the several parts of both the outside and enclosed spring types of indicators, including indicator reducing motion. Considerable space is given to discussion and data on indicator springs also full instructions on indicating and interpreting cards from all types of engines, high pressure steam, gas and fuel oil engines, triple-expansion and compound engines and ammonia compressors. Detailed instructions are given on the application and use of the indicator and the planimeter, with easily understandable instruction on the few arithmetical calculations that are necessary. There are 15 pages illustrating and discussing the characteristic diagrams of the several types of engines, including the latest four-valve engines of the new poppet valve type, the Uniflow engine, high compression two-cycle oil engine and the Diesel engine, also a large number of faulty diagrams, illustrating the common faults of engines. A copy of the book will be sent upon request.

THE EDUCATION OF A MARINE ENGINEER

AT a meeting of the Liverpool Engineering Society on February 9, J. B. Jeffrey opened a discussion on the above subject. He explained that he had completed his education in Germany and and had also served his apprenticeship in one of the largest shipbuilding yards in that country, and proceeded then to make a comparison of the systems of training for seagoing engineers in Great Britain and in Germany.

What the German lacked in mechanical genius, he said, was made up for to

1916 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	John Oshurn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jenne Mance Street	O. L. Marchand,	93 Fifth Ave., Lachine, Que.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th Street E.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charhonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	176 King Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	J. A. Rowe	29 Parrshoro Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Amhrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

a great extent by the right sort of educational food supplied at the proper time. The German boy, for instance, leaves the lowest grade school, "volks schule," at the age of fourteen, and he has then the choice between going to a technical school for three years before his workshop training begins, or to a continuation school until the commencement of apprenticeship. In the latter case he enters the works at the age of fifteen. He is taken to his bench and given a tool drawer containing a complete set of tools. He is placed between trained mechanics, and his time in each department is strictly regulated. Up to the age of eighteen he has half an hour off every afternoon for rest.

During the period of apprenticeship he is compelled to attend the Gewerberschule (trade school) for at least eight hours weekly, summer and winter. Any apprentice who misses school without a reasonable excuse is immediately censured by his employers, and a repetition of the offence leads to the cancellation of his indentures. The workshop training occupies three years, and the youth can then go to sea as "assistant." After two years' service afloat the youth presents himself for his "dritte patent" (third-class certificate), and he is then eligible for a junior engineer's position in charge of a regular watch.

Another course is open to the apprentice after his three years' workshop training, that is, he can take two years' training at a technical school, which brings him on to the military service age, so that he is several years late in going to sea, unless he manages to get into the navy.

The author then criticized the system of training marine engineers in Great Britain, which, he said, left much to be desired. Marine engineering at the present time required a man to be more than a more mechanic, and he considered five years in the workshop was too long. He emphasised the necessity for the marine engineer to have a wider knowledge of the electrical side of engineering. The attendance at a technical school for a stipulated number of hours per week should be made an essential part of the terms of apprenticeship. At the end of three years' workshop training it should be possible for any apprentice to take a higher course of technical training at a low cost before going to sea, this training being such as will fully cover the requirements of his future vocation. Electrical engineering, naval architecture and chemistry should be given prominence in the curriculum.

We are indebted to The Engineer, London, England, for the foregoing interesting abstract.

Canadian Vessel Captains and Chief Engineers

Through the courtesy of the various Steamship Companies, we are enabled to give a list of 1916 season vessels, together with the names of their principal officers.

MONTREAL AND CORNWALL NAVIGATION CO., CORNWALL, ONT.

Vessel.	Captain.	Chief Engineer.
Britannic	A. Anderson	N. Marchand

PEMBROKE TRANSPORTATION CO., PEMBROKE, ONT.

Vessel.	Captain.	Chief Engineer.
Oiseau	Jos. Tessier	J. Trottier

PENNSYLVANIA-ONTARIO TRANSPORTATION CO., CLEVELAND, OHIO.

Vessel.	Captain.	Chief Engineer.
Ashtabula	C. F. Meyers	S. M. Sylvester

STEAMER PREMIER, SAULT STE. MARIE, ONT.

Vessel.	Captain.	Chief Engineer
Premier	W. Hyland	John Bilmore

VICTORIA NAVIGATION CO., THURSO, QUE.

Vessel.	Captain.	Chief Engineer.
Victoria	F. Elliott	P. Belanger

WESTERIAN TRANSPORTATION CO., OTTAWA, ONT.

Vessel.	Captain.	Chief Engineer.
Westerian	A. Lefebvre	M. Marchand

WINDSOR AND PELEE ISLAND STEAMSHIP CO., PELEE ISLAND, ONT.

Vessel.	Captain.	Chief Engineer.
Pelee	J. N. Sheats	....

CITY OF THREE RIVERS, QUE.

Vessel.	Captain.	Chief Engineer.
Le Progres	N. W. Lewis	A. Frenette

VALLEY STEAMSHIP CO., ANNAPOLIS ROYAL, N.S.

Vessel.	Captain.	Chief Engineer.
Granville	C. W. Collins	James McCullough

VANCOUVER TUG AND BARGE CO., VANCOUVER, B.C.

Vessel.	Captain.	Chief Engineer.
Clayburn	H. Jones	A. McGuire
Dola	W. J. Verge	W. McGuire

UNITED STATES AND DOMINION TRANSPORTATION CO., CHICAGO, ILL.

Vessel.	Captain.	Chief Engineer.
America	E. C. Smith	F. McMillan
Easton	G. Exe	....

J. F. SOWARDS, KINGSTON, ONT.

Vessel.	Captain.	Chief Engineer.
H. N. Jex	M. M. Shaw	W. McCabe
Shanly	J. F. Sowards	John Maloney

SPARROW LAKE STEAMER LINE, SPARROW LAKE, ONT.

Vessel.	Captain.	Chief Engineer.
Glympse	A. F. Stanton	G. T. Stanton
Lakefield	F. Stanton	W. Tracey

PENINSULA TUG AND TOWING CO., WIARTON, ONT.

Vessel.	Captain.	Chief Engineer.
Crawford	W. M. Tyson	R. H. Isbester
Homer Warren	F. Wood	W. C. Fox

PORT COLBORNE TUG CO., PORT COLBORNE, ONT.

Vessel.	Captain.	Chief Engineer.
J. V. O'Brien	D. McGrath	W. Bush
Meteor	John McGrath	W. Taylor

NIAGARA, ST. CATHARINES AND TORONTO NAVIGATION CO., ST. CATHARINES, ONT.

Vessel.	Captain.	Chief Engineer.
Dalhousie City	J. W. Maddick	J. H. Brown
Garden City	G. Blanchard	H. R. Welch

ONTARIO CAR FERRY CO., MONTREAL.

Vessel .	Captain.	Chief Engineer.
Ontario No. 1	S. McCoig	D. L. Smith
Ontario No. 2	F. D. Forrest	J. A. Nicoll

OTTAWA RIVER NAVIGATION CO., MONTREAL.

Vessel.	Captain.	Chief Engineer.
Duchess of York	....	E. Piche
Empress	A. Blondin	A. L. DeMartigny

PRESCOTT AND OGDENSBURG FERRY CO., PRESCOTT, ONT.

Vessel.	Captain.	Chief Engineer.
Miss Vandenburg	H. Black	W. J. Jenks
	S. J. Delaney	

NORTH VANCOUVER FERRY CO., NORTH VANCOUVER, B.C.

Vessel.	Captain.	Chief Engineer.
North Vancouver No. 1	W. Fatke	I. N. Kendall
North Vancouver No. 2	R. R. Spicer	D. Becker
North Vancouver No. 3	W. J. Sprackton	J. W. Whitworth

QUEBEC TRANSPORTATION AND FORWARDING CO., QUEBEC, QUE.

Vessel.	Captain.	Chief Engineer.
Florence	V. Gendron	S. Legendre
J. H. Hackett	Jos. Thibault	A. Legendre
Margaret A. Hackett	M. Allison	O. Croteau

TERMINAL STEAM NAVIGATION CO., VANCOUVER, B.C.

Captain.	Captain.	Chief Engineer.
Ballena	J. A. Cates	A. Pirie
Bowena	F. W. Gilbert	W. E. Brown
Britannia	J. W. Cates	A. Coole

VALLEY CAMP COAL CO., MIDLAND, ONT.

Vessel.	Captain.	Chief Engineer.
Marida	H. L. Jones	J. O'Connor
Stewart	J. P. McCarthy	W. C. Houston
William S. Mack	W. Ferguson	W. J. McSweeney

ST. LAWRENCE AND CHICAGO STEAM NAVIGATION CO., TORONTO.

Vesel.	Captain.	Chief Engineer.
E. B. Osler	C. E. Robinson	W. Robertson
Iroquois	J. H. Hudson	J. E. Readman
J. H. G. Hagarty	S. Hill	C. Robertson
W. D. Matthews	W. Cunningham	W. Harwood

ROYAL MAIL STEAM PACKET CO., HALIFAX, N.S.

Vessel.	Captain.	Chief Engineer.
Caraquet	W. H. Lainson	W. Hobson
Chaleur	T. A. Hill	J. Bassett
Chaudiere	F. Willan	A. L. Bennee
Chignecto	C. Adam	G. H. Madge

PORT HURON AND SARNIA FERRY CO., PORT HURON, MICH.

Vessel.	Captain.	Chief Engineer.
Hiawatha	E. M. Thomas	H. Myers
James Beard	G. Waugh	W. Winterhalter
Liuden	W. J. Cowles	E. Wehner
O. D. Conger	W. S. Major	R. Cameron
Pawnee	Jas. Cassin	F. Cadotte

REID WRECKING CO., SARNIA, ONT.

Vessel.	Captain.	Chief Engineer.
J. M. Diver	W. Glass	G. Green
James Reid	F. Sennett	J. W. Roberts
Manistique	W. C. Sparling	R. Campbell
S. M. Fischer	A. J. Bonnah	D. Reed
Sarnia City	G. Hindman	Jas. Hopwood
Spokane		A. Cascadin

OTTAWA TRANSPORTATION CO., OTTAWA, ONT.

Vessel.	Captain.	Chief Engineer.
Dolphin	Z. Lavigne	N. Lavigne
Florence	E. Lefebvre	A. Madore
Glen Allan	A. Clark	....
Hall	J. C. Barclay	John Drury
Ottawan	A. Mallette	D. Moranville
Scotsman	E. Francoeur	V. Lavigne
Sir Hector	W. Mainville	James Schyrer

NORTHERN NAVIGATION CO., SARNIA, ONT.

Vessel.	Captain	Chief Engineer
City of Midland	E. Walkinshaw	J. Osburn
Germanic	F. G. Moles	S. Burgess
Hamonic	A. L. Campbell	John Smith
Huronic	A. M. Wright	J. McLeod
Noronic	R. D. Foote	S. Brisbin
Rochester	....	....
Saronic	J. D. Montgomery	A. W. White
Waubic	G. W. Kinnee	S. Beatty

UNION STEAMSHIP CO. OF BRITISH COLUMBIA, VANCOUVER, B.C.

Vessel.	Captain.	Chief Engineer.
Camosun	A. E. Dickson	A. Beattie
Cassiar	G. Gaisford	P. J. V. Farina
Cheakamus	J. Cockle	J. F. Wilson
Chelohsin	J. F. Edwards	G. H. Foster
Comox	J. Brown	A. T. Roy
Coquitlam	N. Gray	J. Hogan
Cowichan	C. Moody	L. P. Thomas
Venture	J. Park	C. Arthur

MONTREAL TRANSPORTATION CO., LTD., MONTREAL.

Vessel.	Captain.	Chief Engineer.
Advance	J. V. Norris	M. J. Sherman
Bartlett	A. Lepine, Jr.	J. P. Lappnu
D. G. Thomson	....	G. Henderson
Emerson	W. J. Murphy	J. G. Lamourenx
Glenmount	W. H. Norcott	D. Cameron
H. F. Bronson	L. Mallan	....
India	J. Reoch	F. H. Brian
Kinmount	W. F. Young	R. G. Gibson
M. P. Hall	T. Lepine	H. Paus
Mary	H. Desgroseillier	....
Rosemount	L. G. Dixon	M. Dickson
Simla	C. E. Coons	D. S. Symons
Stormount	W. H. Blackler	R. Downie
Windsor	J. Doyle	A. Dunn

VESSEL FOR SALE

Steel hull, former side-wheel passenger steamer "Picton," in first-class condition; hold clear and decked over; all machinery removed; carrying capacity approximately 600 tons. Length, 190 ft.; breadth, moulded, 28 ft.; depth moulded, 13 ft.; draught forward, 7 ft.; draught aft, 8 ft. Apply Lake Simcoe Ice Supply Co., Limited, Toronto.

CIRCULATES IN EVERY PROVINCE OF CANADA AND ABROAD

MARINE ENGINEERING of Canada

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Canadian Shipbuilding and a Canadian Merchant Marine

By Col. Thomas Cantley *

The accompanying article embodies the substance of an address delivered at the recent Canadian Manufacturers' Association Convention in Hamilton. It is noteworthy because of its intelligent discussion of the dual subject of "Canadian Shipbuilding" and a "Canadian-owned Merchant Marine." The reasoning adduced is that derivable only from a broad, personal outlook and from a close personal study of past and present records of commercial and maritime countries. In the data given, there are not only all the elements constituting a stirring appeal for national action, but a wealth of educative matter that will rally support for the latter accomplishment with the least possible delay and the greatest effectiveness.

PERHAPS no enterprise, manufacturing or otherwise, is more vital to the Dominion of Canada to-day, and will become more so at the close of the war, than that of a well developed shipbuilding industry sufficient to meet fully our export requirements of agricultural, timber, mining and manufactured products. Our experience during the last year and a half should waken us to the danger that we run and the homage that we pay by dependence on foreign or other than Canadian ocean transport.

Our Atlantic Port Advantages

Our mail service has been interrupted, delayed and in a general way is poorer and less efficient than it was a generation ago. This is owing largely, of course, to so many British passenger liners being requisitioned by the Admiralty, but intensified by the fact that the passenger traffic of the Atlantic has been largely monopolized by the port of New York, notwithstanding the fact that Halifax, as recent events has amply proved, is an all-important national port from both a military and naval standpoint. It is ice-free, the safest on the whole Atlantic seaboard, the most commodious, the most certain and easy of approach, nearer to Southampton than is New York by about 680 miles, and 580 miles nearer to Liverpool—the shortened distance being an economic advantage of no small moment in these days of 40,000 and 50,000 ton, and 20 to 24-knot Atlantic liners. The shorter sea voyage means a saving of time to passengers, and is an all important matter as regards express freight and perishable commodities.

Our Resources Export Possibilities

If a free pathway across the seas is the first condition of the Empire's existence, as our Premier a few months ago so tersely told us, then it naturally follows that a national service of ships, both passenger and freight, to use this pathway is next in importance. Surely, then, it is time that both Canada and Great Britain became independent of foreign ports for the handling of its passenger, mail and freight traffic. In Canadian bottoms should be carried the product of this Dominion, and there should also be provided the ferry for bringing to our shores the enormous immigration which after the war will be lured to Canada by its wide diversity of opportunities.

Of the latter, mention may be made of the fishing possibilities, mining and timber resources of the Maritime Provinces; the market and truck garden possibilities of the Eastern Townships and other portions of Quebec, the stock-raising, and manufacturing possibilities of Ontario, the illimitable wheat fields of the Great Canadian West, and the mining, lumbering and fishing possibilities of British Columbia. The expansion of the Dominion from these and other sources must needs call for an ever increasing mercantile marine service. The export and import trade to and from the British Empire, our present Allies, and neutral nations of not only Europe, but the Orient, opens up a boundless prospect of big foreign business.

Our Foreign Shipping Dependence

Looking backward, it is perhaps difficult to understand why the Mother Country, and the Dominions composing the Empire, have for years been content to rely to so large an extent on Germany and the Scandinavian countries, for the transport of their passengers, mails, agricultural and manufactured products, and by so doing have thus played into the hands of their enemies and competitors. It may be said that this is one of the "after-the-war" problems—but even so it should nevertheless be tackled now. An efficient mercantile marine commensurate with Canada's requirements cannot be built in a day, or indeed in a decade, and it behoves us in Canada to view the situation fairly, meet the issue squarely and deal with it effectively.

U. S. Shipbuilding Growth and Decline

Perhaps at this point a short resumé of the growth and decline of the shipbuilding industry in the United States may be helpful in formulating a policy which we in Canada might adopt, looking to the fostering, growth and upbuilding of a strong, virile, shipbuilding and ship-owning industry. In looking into the experiences of our neighbors, we find that since 1789 the home trade of the United States on ocean, lake and river has been reserved for American vessels, and under this policy their coastwise tonnage had increased from 68,607 tons in 1789 to 6,852,536 tons in 1914. This, however, applies only to the home trade of the United States, as with the shipping registered for trade overseas it is very different.

U. S. Shipping Aids Granted

The first aid given American shipping was in 1789 when a discount of 10 per cent. was allowed off the Customs duty on all goods imported in ships built and owned by American citizens, and later a further Customs discount was granted on specific articles. In 1794 this aid was changed in form, but not in principle—the discount being abolished, but a surtax of 10 per cent. was added to the duty on all goods carried to the United States in foreign ships. As a result of these preferences, American tonnage registered for overseas commerce increased from 123,893 tons in 1789 to 411,438 tons in 1792. In 1800 this tonnage had further increased to 667,107 tons, and in 1810 to 981,019 tons. Thus national encouragement of the industry had quickly produced a growth and efficiency rather remarkable.

U. S. Shipping Aids Withdrawn

In 1815 the United States withdrew its surtax duties as against British ships in direct trade with the United Kingdom. Commercial treaties were entered into with Britain and other foreign Governments between 1815 and 1850 whereby ships of either nation were admitted on terms of equality into the ports of the other, so far as tariff and tonnage duties were concerned. In other words, the encouragement or preference given United States shipping in the early years of the American Republic was abandoned.

Further, about this time pressure was brought to bear on the American Government from the inland and agricultural sections of the country to withdraw the shipping aid and preference. This short-sighted, narrow, sectional and mistakenly selfish policy was effective,

*President, Nova Scotia Steel & Coal Co., and Canadian Manufacturers' Association.

although the merchants and shipowners who understood the situation protested strongly against such action. Notwithstanding the above, American shipping continued to grow slowly until 1850, the registered tonnage then being 1,435,694 tons, carrying 72.5 per cent. of the American overseas trade. Up to this time, of course, the competition had principally been in wooden ships. Steamboats were, however, gradually coming into use. Fulton created an efficient steam propelled vessel in 1807, but it was not until 1830 that steam vessels appeared in the American coasting trade. Iron ships were built at Bangor, Maine, in 1844 for the New England coast service.

British Subsidies

It was during this period that Great Britain invoked a new form of mercantile marine encouragement. In 1834 a subsidy of $85,000 a year was given to a British steamship company plying steam packets to Rotterdam and Hamburg, and another subsidy of $150,000 to a packet service to Gibraltar. This form of assistance was found to be so valuable in their influence on the then new art of steamship and engine building in the United Kingdom that in 1838 the British Government offered a large subsidy for a steamship service across the North Atlantic. In 1839 Sir Samuel Cunard secured a subsidy of $425,000 a year for a steam line from Liverpool to Halifax and Boston. This, it is understood, amounted to about 25 per cent. per annum on the cost of running the Cunard Line, and was given with the plain intention of establishing firmly in English hands the trans-Atlantic traffic. Other British shipping firms also secured subsidies for lines to South America and to the East Indies, and in a few years British subsidies totalled from three to four million dollars annually.

American Subsidies—Collins Line

For a time the American Government met British subsidy with subsidy. As an offset to the Cunard subsidized line, the American Government in 1847 concluded an agreement with the Collins line of trans-Atlantic steamers for a subsidy of $385,000 a year. When, later, the Collins Company built steamships larger than those of the Cunard, this subsidy was increased to $858,000 a year—the Cunard Company at the same time receiving $856,000 annually from the British Government. Under the impulse of these mail subsidies, American ocean steam shipping rose from 16,068 tons in 1848 to 115,045 tons in 1855.

Decline of American Shipping

Unfortunately for the American shipowners this beneficial policy on the part of the American Government was not continued. It has often been asserted that the decline in American ocean shipping began with the Civil War in 1861. This, however, is only a very superficial view, as the Civil War was only an incident in the decline. In 1855, or six years before the war, shipbuilding in the United States fell from 583,450 tons in that year to 156,602 in 1859. The causes of the decline were in part economic, but in much larger part political. In 1856 the American Government reduced the Collins mail subsidy from $856,000 to $385,000 (the Cunard line were then receiving $856,000). In spite of this drastic reduction the Collins line continued in the service, but the British competition was too keen, and they were forced to quit the field.

Just here it might be noted that in 1860-61, when the American Government were withdrawing assistance from their shipping, Great Britain was expending $1,537,223 in the encouragement of steamship building and mail communication with all parts of the world. France, following the British example, in 1858 offered subsidies of $620,000 a year for a line from Havre to New York, and further large amounts for other lines. About the same time Germany began to subsidize the North German Lloyd on the routes from which the American merchant ships had disappeared.

For a short time after the Civil War, American ocean shipping actually increased, the registered tonnage in 1867 being 1,515,648 tons. It remained at about the same figures for a decade thereafter, but in this same period the proportion of American imports and exports carried in American vessels decreased from 33 to 26 per cent. In 1898 the registered tonnage had fallen to 726,213 tons, or less than half of what it was 31 years previously, and the proportionate carrying capacity to 8 per cent. From 1898 there was a gradual yearly increase, and in 1914, at the outbreak of the great war, this tonnage totalled 1,066,288 tons, although still carrying only about 8 per cent. of the American imports and exports.

In 1891 the U. S. Congress passed the Ocean Mail Act, providing subsidies for postal lines, and, while the subsidies paid under this Act have not been large, totalling in 1914 $1,039,360, of which $673,998 was received by the American Transatlantic service, this aid has proven to be of substantial value to the American mercantile marine.

Panama Canal Act

The Panama Canal Act of 1912 changed the traditional policy of the United States by offering free registry for the overseas trade to American-owned foreign-built vessels not more than five years old. This policy up to 1914 had not been successful. Shortly after the outbreak of the present war, in August, 1914, the U. S. Congress passed an amending Act whereby American-owned foreign-built vessels could be admitted to American registry irrespective of age. At the same time the President was authorized to suspend the requirements of law that the officers of foreign-built vessels should be American citizens, and to exempt the ships in question from compliance with American inspection and measurement laws and regulations. Even this has not had the desired effect.

Comparative Wages Paid

The wide difference in wages and maintenance between American and foreign vessels is one of the chief difficulties encountered, and this is clearly illustrated in the table below, which details the comparative wages in 1914 on American and British cargo steamships of about 5,000 tons capacity.

	American. Wages per month.	British. Wages per month.
Master	$175	$100.00
First officer	90	63.18
Second officer	70	43.74
Third officer	60	....
Carpenter	40	31.59
Boatswain	35	29.16
Quartermasters (2)	35	....
Sailors (5)	30	24.30
Chief engineer	150	97.20
First assistant engineer	100	68.04
Second assistant engineer	90	48.60
Third assistant engineer	80	....
Oilers (3)	40	....
Donkey men (2)	40	31.50
Firemen (4)	35	29.16
Coal passers (2)	30	....
Steward	60	38.88
Cook	45	34.02
Messmen	20	15.00
Cabin boy	20	....

Total American crew, 32 men. Total American payroll per month $1,655

Total British crew, 27 men. Total British payroll per month $994.66

Undoubtedly wages have increased rapidly during the last two years, but the proportion is still about as above. To meet the higher cost of operation and maintenance it has been recommended to the American Government that graded subsidies be granted sufficient to offset the difference in cost of operation between American and foreign vessels, with the condition that these vessels should be so constructed as to render efficient service as transports, etc., in time of war.

Foreign Subsidies

In the fiscal year 1914, the United States paid as subsidies to American steamers under contract the sum of $1,089,361. The following table gives a summary of the amounts paid by way of subsidies, mail pay, bounties and other means to the mercantile marine of the European nations. The figures are for 1909, being the latest officially available:

British Empire	$9,689,384
France	13,423,737
Japan	5,413,700
Italy	3,872,917
Spain	3,150,021
Austria-Hungary	2,984,530
Germany	2,301,029
Russia	1,878,328
Norway	1,102,143
Netherlands	880,011
Sweden	277,752
Denmark	145,000
Belgium	55,970
Portugal	50,000

The growth of German shipbuilding was brought about by application to it of the general protective system of the country, and partly by liberal subsidies. As a result, within 25 years the net tonnage of the ships registered in the two ports of Bremen and Hamburg had increased from less than 230,000 tons to nearly 2,000,000 tons. In addition to subsidies, Germany grants preferential rates on her State railways on cargoes to be carried in German ships.

France ten years ago established a shipbuilding bounty equivalent to $28 per gross ton for steel steamers, this rate being subjected to a gradual reduction of roughly $1 per ton yearly—the present bounty paid being $19.50 per ton.

In Austria a bounty of $8 per gross ton is paid on all steel steamers constructed in that country.

The steel shipbuilding bounty paid in one year in France exceeded $2,000,000; Japan the same year paid total bounties of $997,700; Italy, $886,266; and Austria-Hungary, $850,000.

Largely as a result of the special aid given the shipbuilding industry by the different maritime nations, the growth of the various merchant fleets has been remarkable. The following table from the records of Lloyd's Register for the years 1895 and 1915 illustrates the growth as shown on table opposite.

	1895. Tons.	1915. Tons.
Great Britain	13,242,630	21,045,049
United States	2,164,763	5,368,194
Austria	394,970	1,055,719
Denmark	[illegible]6,714	826,181
Holland	446,861	1,496,455
France	1,094,752	2,319,438
Germany	1,886,312	5,459,296
Italy	778,941	1,668,296
Japan	301,101	1,708,386
Norway	1,659,012	2,504,722
Russia	487,681	1,053,818
Spain	554,238	898,823
Sweden	497,877	1,118,086
Canada (1894 to 1914)	868,624	932,422

British Columbia Marine

British Columbia has already taken a forward step in the development of a mercantile marine by the introduction in the local Legislature of a bill to encourage the building and operating of British Columbia ocean carriers. This measure provides for the lending of 55 per cent. of the cost upon vessels hereafter built in the province and used exclusively in carrying products to and from British Columbia ports. The loan shall not be for more than 55 per cent. of the ascertained value of the vessel, construction of which shall be commenced and completed within twelve months of the coming into force of the Act, the purpose being for the carriage of freights upon ocean routes. Loans are to bear interest at the rate of 6 per cent., payable half-yearly.

In further aid of the shipbuilding industry of the province a subsidy is to go to the owner who actually pays for the construction of ships, or to his assignees who actually operate them, but not to any middleman or promoter, and up to a number not exceeding twenty ships, in ten annual instalments, so computed as to bring the net earnings of the ship up to 15 per cent. on the actual cost, but never more than five dollars a ton dead weight capacity, the initial instalment to be paid in the first year after peace is declared. Shipbuilding plants may be aided by the guarantee of securities for not over 55 per cent. of the actual cost of the plant. A commission is appointed to supervise the administration of the Act.

It is reported that, as a result of this aid, the Wallace Shipyards of North Vancouver have booked orders for the construction of three steel vessels, the hulls to cost about $400,000. The boats are to be used in the lumber carrying trade from British Columbia ports, and are to be built under an interest guarantee of the British Columbia Government.

Suggested Shipbuilding Commission

Some time ago the New York Chamber of Commerce, a very influential body, put forward a scheme which it thought might well be adopted as the shipbuilding policy of the United States, and Sir George E. Foster, Canadian Minister of Trade and Commerce, in discussing the question of ocean transportation in the House of Commons, on April 26, outlined this scheme, and commented on the way it might be applied to the Canadian problem. Sir George Foster's translation is somewhat as follows:—

The Dominion of Canada would appoint a commission, consisting of, say, three members of the Cabinet, whose departments are interested—say, Commerce, Navy and Finance. The Government side of that commission would be the Ministers of these three departments. Add to these a naval instructor and three practical and experienced men in shipping matters, selected by the Government, and you have the commission which would operate in Canada. That commission would have general oversight and direction of the classes of vessels to be built under the scheme, how they should be manned, everything in connection with them, and to the extent that it would be possible, the regulation of the rates as well. The commission would then be empowered to enter into contracts with shipbuilding companies to build according to the plans and regulations laid down in Canadian shipyards, and the shipbuilders would be allowed the difference between the cost of construction in Canada and in European ports, that difference having been carefully ascertained by the commission.

Nature and Duration of Subsidy

The object would be to enable Canadian shipowners to have their ships built in Canada at exactly the same cost as if they had them built in a European plant. If this tonnage could be built in a European plant at a certain percentage per ton cheaper than in Canada, then the subsidy for construction would be that difference in cost, whatever it was, so as to put the Canadian shipowner on an equality in the after competition with those having ships built in European shipyards. The time to carry this out would be limited to a period of, say, ten years, during which the operation of building would go on.

The commission would then be empowered to enter into contracts with the shipowners, when the ships were built, and to guarantee to the owners the difference in cost of operating the ships under the Canadian flag and under a European flag, that subsidy to continue for the life of the ship. The commission would ascertain the difference in cost of construction and operation and pay that difference alone. In that connection the Government would place at the disposal of the commission the sum of $15,000,000 or $20,000,000, and empower the commission to guarantee the bonds upon the ships built up to 50 per cent. of the value of the ships. Such bonds would be 5 per cent. bonds, and the Government commission would get one-half of 1 per cent. on these bonds returned to its treasury for its work and its supervision.

Such is the plan of assistance outlined by Sir George E. Foster, and, while we think a simpler method would meet the case, we note with pleasure that the matter has had the attention of our hard-working Minister of Trade and Commerce.

Steel shipbuilding can be developed on a broad, comprehensive and permanent scale, provided the Government of Canada deals with the matter on statesmanlike and real business lines. Ten to fifteen years will be necessary to build up an organization of skilled workmen, possessing the necessary experience to enable us to compete successfully with foreign countries, and during this adolescent period the fostering influence and stimulation of Government protection must be afforded. If ships built outside of Canada, either in Great Britain or in the other overseas Dominions, are to be admitted free to Canadian registry and trading (and we cannot well refuse such), then at least an amount equal to the duty imposed on the material entering into the Canadian-built ships should be returned to the builders.

The Japanese Policy

After consideration of the various policies adopted by practically all civilized nations, it would seem to us that in view of the present situation in Canada, perhaps the system adopted by Japan is that best calculated to meet our needs at the present time. During the twenty years the commercial fleet of Japan has increased from 360,695 tons to something like 1,500,000 tons. Practically all the ocean mail ships acquired by Japan in the last five years have been built at home, and these are vessels of some 8,000 to 13,500 tons cargo capacity. This large increase in tonnage was brought about by a shipbuilding bounty of $10 per ton for steel steamers over one thousand tons gross, and where these were engined with Japanese built machinery $2.50 per indicated horsepower was added to the bounty. The splitting up of the bounty as to hull construction and machinery enabled the Japanese Government to, in effect, give a larger bounty to the faster and higher powered boats necessary for passenger and mail service. Whatever system of encouragement is adopted by bounty or otherwise, should be for a stated period of years, not less than ten and not exceeding fifteen.

Marine Insurance

The next requisite to a successful Canadian shipbuilding and shipowning industry is that of marine insurance. A great deal has been heard in the past half dozen years as to the alleged unfair treatment of Canada by both Lloyd's and the British insurance companies in the matter of St. Lawrence and B. N. A. marine insurance rates, and Canada has had ample and grave reason for dissatisfaction in that connection. The fact is capable of ample demonstration that Norwegian shipping, through their system of mutual marine insurance, which has been in effect for many years, have covered all their risks, including B. N. A. and St. Lawrence trading, with an average premium rate of slightly under five per cent., and this has prevailed not for one year or a few years, but over a period of more than a decade. This rate is approximately one-half that charged a similar type of tonnage when engaged in like traffic by Lloyd's and British marine underwriters on vessels engaged on B. N. A. and St. Lawrence trade.

This difference in the cost of marine hull insurance is practically a profit in itself, and when there is added to it a very great difference in the cost of cargo insurance, as compared with the American Atlantic ports of Portland, Boston, New York, Philadelphia, and Baltimore, these differences run up into really enormous figures. A mutual insurance scheme on lines somewhat similar to that of Norway might be brought about by a marine insurance board or corporation, on which would be represented the Canadian Government, the Shipping Federation, a representative of the combined Boards of Trade of Halifax, St. John, Montreal, Toronto and Winnipeg.

The experience of Norway and other countries who have adopted a mutual system of insurance and the rates of premium, which experience has shown to be necessary over a period of years, might be taken as a basis for a scheme of this character. One essential would be that all steam vessels engaged in the coasting or foreign trade, built to Lloyd's, British Corporation, or Bureau Veritas classification, would be eligible for and compelled to take out marine insurance to the extent of not less than 75 per cent. of the vessel's value—the premium being variable as to age, character and equipment of the ship. All Canadian tonnage could be grouped in, say, three or four scales of classification for insurance purposes. All Government vessels engaged in lighthouse, patrol, and such service to be included.

Harmful Legislation

It is also essential that the shipping interests should not be handicapped by visionary or vexatious legislation affecting the manning or working of our merchant tonnage. The bedevilling influence of American legislation in this connection has perhaps done more than anything else during the last decade to prevent the expansion and successful operation of the American mercantile marine.

Inspection

In the matter of classification and inspection, Canada stands to-day in an anomalous position. A ship is built in the United Kingdom, has passed Lloyd's and Board of Trade inspection, and carries certificates to this effect, notwithstanding which on entering Canadian trade she is forced to undergo Canadian inspection at a needless loss of time and considerable expense. A reciprocal arrangement must be arrived at whereby British, Overseas Dominion, and Canadian certificates as regards seaworthiness and efficiency shall be mutually accepted in all British Dominions. To continue as we are doing in this connection is idiotic in the extreme, and calls for prompt remedy by those responsible.

Canadian Mercantile Marine

The merchant marine, the building and operation of which is or should be a great national industry, is quite as deserving as any other Canadian industry of the friendly interest of the Canadian people and the intelligent consideration of our Government. The successful operation of an adequate Canadian merchant fleet is as vitally important to the prairie farmer as to the Ontario and Maritime Province manufacturers. Every mercantile nation in the world, carrying on an export business of any moment, demands a suitable fleet of its own nationality. Great Britain's merchant fleet of necessity antedated its overseas trade. Germany, when it first began to look abroad for markets, refused to depend upon British ships, but sought at once the creation of a German merchant fleet. France, laboriously wrought its own merchant marine, and Japan, the latest of commercial powers, secured its ships first and its trade afterwards. Not one commercial nation—save the United States—has ever been willing to trust its foreign trade transport service to competitors—the instinct of self-preservation forbids such a policy.

We in Canada have a great coast line with ice-free harbors on both our Atlantic and Pacific shores, and numerous sites suitable for the establishment of shipyards. We can to-day supply almost all the raw material required, and granted sufficient encouragement, can produce all of it within a year. Taken in conjunction with the present abnormal demand for ocean tonnage, and the almost certainty that this will continue for several years at least, all these things constitute an opportunity for Canada which it would be folly to now neglect.

To profit by these favorable circumstances it will be necessary to move quickly. If the Canadian Government will at once announce a comprehensive, broad and effective policy, granting sufficient encouragement to shipbuilding, we believe that the whole country, from the Atlantic to the Pacific, including all the territory that lies between, would approve their action. Never before was the necessity so great or the opportunities for meeting it so exceptional. Let us have action.

LIABILITY OF STEAMSHIP COMPANIES

THE liabilities of a steamship company are defined by special Act in force, as a rule, in most commercial and industrial countries. In general, this Act declares, among other things, that "if the owner of any vessel transporting merchandise or property to or from any port in the country to which the Act applies, shall exercise due diligence to make his vessel in all respects seaworthy and properly manned, equipped and supplied, neither the vessel, her owner or owners, agent or charterers, shall become or be held responsible for damage or loss resulting from faults or errors in navigation or in the management of said vessel; nor shall the vessel, her owner or owners, charterers, agent or master be held liable for losses arising from damages of the sea or other navigable waters, acts of God or public enemies, or the inherent defect, quality of vice of the thing carried, or from insufficiency of package, or seizure under legal process, or for loss resulting from any act or omission of the shipper, or owner of the goods, his agent or representative, or from saving, or attempting to save, life or property at sea, or from any deviation in rendering such service."

NORTH SEA DROLLERIES—DESTROYING AN ENEMY MINE.
—Courtesy Syren and Shipping.

The statute applies to coastwise shipping as well as to shipping between domestic and foreign ports. The carrier is still liable for damage arising from negligence in loading, stowage or the proper delivery of the cargo. As to other matters, it is bound simply to supply a seaworthy boat and officers and crew chosen with reasonable care. For negligence of officers and crew in navigating the vessel the owners are not liable.

FORWARDING AGENTS

DURING the war in Europe the services of the forwarding agent and freight broker are invaluable. Being right on the spot and in constant touch with the steamship companies, they are able to obtain for shippers the current freight rates (which are liable to sudden fluctuations); to arrange for freight room on outgoing steamers, prepare the bills of lading, consular invoices and other documents for a nominal charge, and attend to the details connected with transferring the shipments from railroad cars to alongside steamer or dock. The Exporters' Encyclopedia, published by the Exporters' Encyclopedia Co., Maritime Exchange Building, 78 Broad Street, New York, will enable the shipper to check the routing, consular charges and other expenses with which he is billed, thus insuring him against errors. The forwarder occupies a very responsible position toward the shipper, and great care should be used in the selection of responsible concerns.

Manufacturers who consign their goods to a forwarding agent or a steamship company for shipment must comply strictly with the regulations of the country for which the shipment is destined, as to marking, weighing, packing, etc., and should advise their agent as to the number and character of the packages forwarded, the marks and numbers (if any) on same; the weights, both gross and net (in pounds or kilos, as the regulations may state), the nature of the contents of every package and the value of the different kinds of goods; whether to consign "direct" or "to order"; whether to effect insurance (stating the amount); whether or not to prepay freight and change (if optional); also what disposition to make of the bills of lading and consular invoices (if any), when issued.

The shipper should always send to his forwarding agent the "original" railroad bill of lading, as otherwise the latter may not be able to identify the goods when notified of their arrival by the railroad company, thus incurring delay in shipment and, possibly, storage charges.

HIGH PRESSURE STEAM PIPING

AT the recent annual meeting of the American Society of Mechanical Engineers in New York, considerable interest centred round the methods of installing high-pressure steam-piping systems of large central stations. During the discussion reference was made to the practice of fusing together the lap flanges of pipes to avoid the blowing out of gaskets and steam leakage.

It was pointed out that one large concern, the Commonwealth Edison Co., of Chicago, is now doing this at its Fisk Street station. Fused flanges are being used between the steam header and the turbine. Instead of using the customary copper-asbestos gaskets inserted between the flanges, the flanges are drawn up face to face and bolted rigidly together. The edges are then welded together. The thickness of this weld is quite small, since the intention is not to increase the mechanical strength of the joint, but to enable the elimination of gaskets. The welding of flanges in this manner has proved satisfactory, since there are no gaskets, and there is entire absence of leakage.

Sheet Metal Elbows, Their Development and Laying Off-V.

By J. W. Ross

In order to thoroughly understand the principles involved in the development of cylindrical and other forms, such as are met in sheet metal work, a considerable knowledge of geometry is desirable. Through the medium of these articles, the author places practical examples at the disposal of our readers, and the knowledge to be gained by a close and persistent study of the principles and methods employed will well repay the time spent.

ELBOW AND OVAL-SHAPED CROSS-SECTION

FIG 24 shows elevation and cross-section plan views of a five-piece 90-degree elbow, the cross-section plan being shaped oval fashion, with two flat sides.

The elevation and mitre lines are drawn as in preceding problems. The

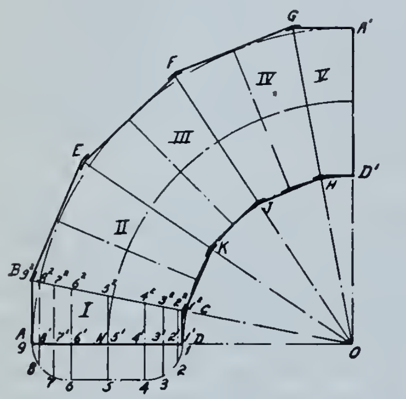


FIG. 24.

neutral diameter AD is equal to 24 inches and the radius OD to 27 inches. Divide AD into 4 equal parts as $6^1 5^1 4^1$. With 6^1 as centre and 6^1A as radius strike the neutral quadrant A6. Also with 4^1D as radius and 4^1 as centre draw the quadrant D^4. Draw the line 6 5 4 parallel to AD and tangent to the two quadrants. The half cross-section plan is shown hy A654D. Divide the quadrants A6 and D4 each into the same number of equal parts, projecting these points—through and at right angles to AD—to the mitre line BC. Number all points in consecu-

FIG. 26.

tive order and in relation to each intersecting line.

FIG. 27.

Twice the length of the flat side 6 5 4 added to the circumference of the circle

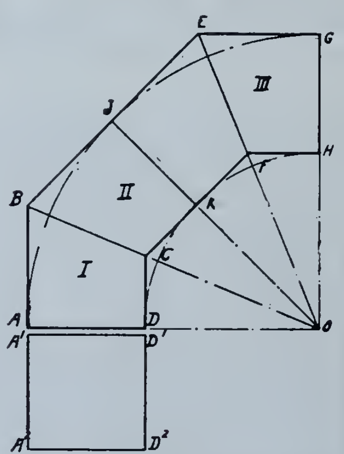


FIG. 28.

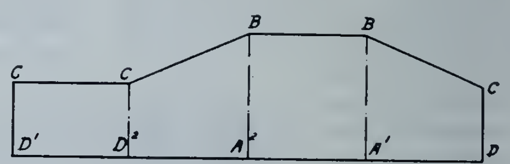


FIG. 29.

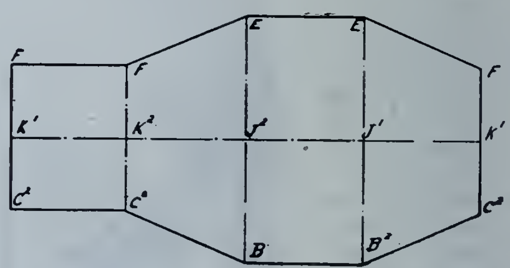


FIG. 30.

obtained from its diameter by the combined radii of the two quadrants as $A6^1$ and $D4^1$ will equal the stretchout of the plate, which equals $(2\times12)+(12\times3.14)$ equals 24+37 11-16, equals 61 11-16 in. Measure 61 11-16 inches along the line $N5^1N$, Fig. 26. Bisect at 5^1. Measure off $5^1 6^1$ and $5^1 4^1$, Fig. 26 equal to 5 6 and 5 4, Fig. 24, which equals 6 inches each. Measure of $6^1 6^1$ and $4^1 4^1$, Fig. 26, each equal to the quarter circles 9 6 and 1 4, which is 9 27-64 inches. The end distances, $5^1 6^1$ and $4^1 5^1$, are then each equal to 6 inches. Divide $6^1 6^1$ and $4^1 4^1$, Fig. 26, each into twice the number of parts as in each quadrant 9 6 and 4 1, Fig. 24. Through these points erect perpendiculars, and number accordingly. Transfer the distances as $9^1 9^2$, $8^1 8^2$, etc., Fig. 24, over to their corresponding numbers on Fig. 26.

Fig. 26 shows the full pattern for courses I and V and the half pattern for course III, laps, etc., to be drawn in.

Courses II and IV are developed similarly to course W, Fig. 18, using the neutral diameter and cross-section similar to course I, Fig. 24. The stretchout for courses II and IV will he equal to 61 11-16 + 7 times the plate thickness for a slack fit. The pattern is shown in Fig. 27.

Elbow with Square Section

Fig. 28 shows the elevation and square section plan view of a 3-course 90-degree elhow. The neutral diameter AD equals 24 inches and DO 27 inches. The elevation and mitre lines are in the usual manner. $A^1D^1D^2A^2$ shows the plan view. The stretchout is equal to the sum of all the sides of the neutral section. Measure off D^1D^1, Fig. 29, equal to 4×24 inches, which equals 96 inches. Divide this into 4 equal spaces representing the 4 sides of the square. Erect perpendiculars through these points as shown by $D^1D^2A^2A^1D^1$, Fig. 29. Make D^1C, D^2C, Fig. 29, each equal to the length DC, Fig. 28. Also measure off A^1B, A^1B, Fig. 29, each equal to AB, Fig. 28. Connect these points with straight lines as shown in Fig. 29.

The templet without laps for courses I and III is shown in Fig. 29. Fig. 30 shows the pattern for course II and is self explanatory if the preceding problems have been thoroughly understood.

FREIGHT RATES

CONTINUAL fluctuations make it impossible to indicate any standard freight rates. Some shipping companies issue freight tariffs, showing rates for different classes of freight to their ports of call, hut as these tariffs are always subject to change without any notification, it is advisahle to apply directly to the companies or to responsihle freight hookers for rates at time of shipment, always indicating the weights, cubic measurement, and character of the merchandise. During the war in Europe, freight rates are liahle to violent fluctuations, owing to the scarcity of neutral tonnage, liability to seizure, etc.

While the freight rate on ordinary cargo is based on either weight or measurement, what is called "special cargo," such as revolvers, jewellry, boots and shoes, and goods of an unusual value according to bulk, have always to pay an 'Extra Rate', based on a small percentage of the value, in addition to the regular freight rate. This extra change is made because of the necessity of special storage for its protection. In some cases cargo of this character is delivered specially to the Captain personally, and is placed under the care of the purser or some other responsible officer of the ship. The extra rate may vary anywhere from one per cent. to three and one-half per cent. of the value of the shipment. Sometimes, the extra charge is made on the basis of so much extra per 40 cubic feet, and sometimes on the basis of so much ad valorem, whichever produces the most revenue for the steamship company.

EXPLANATION OF COMMERCIAL TERMS

C. F. OR C. A. F. (Cost and Freight), means that the seller furnishes the goods and pays the freight—no other expenses, to place of delivery as agreed, all risks while goods are in transit being for account of the buyer.

C. i. f. (Cost, Insurance and Freight), means that the seller furnishes the goods, pays the freight and insurance to point of delivery, all other risks while goods are in transit being for account of the buyer.

F. o. b. destination, means that the seller pays all costs and assumes all risks until the goods reach the place of delivery as agreed.

F.o.b. steamer, means that the seller is to deliver the goods aboard the steamer in proper shipping condition, all subsequent risks and expenses being for account of the buyer.

F. a. s. steamer, means that the seller is to deliver the goods alongside steamer on lighter, or on the receiving pier of the steamship company in proper shipping condition, all subsequent risks and expenses are for account of the buyer.

HEAVY PACKAGES

UNLESS otherwise stated it is understood that the freight rates quoted by not exceeding 2 tons weight. When packages exceed this weight provision must be made by the shipper either to put the pieces aboard the steamer through direct arrangement with a hoisting company or to arrange with the steamship company for freight rates to include the hoisting charges. Similar extra charges are liable to be made at the post of destination or at transshipping points, so that shippers should be careful to find out when shipping heavy pieces just what the freight rate covers.

DISTANCES IN NAUTICAL MILES

THE distances given in nautical miles indicate the shortest practicable routes when steaming from New York (the Battery), and are those furnished by the Hydrographic Office, Washington, D.C.

Destination	Nautical Miles
To Quebec	1321
" Charlottetown, P.E.I.	832
" Halifax	596
" Portland	349
" Boston	305
" Philadelphia	235
" Baltimore	404
" Newport News	281
" Charleston	627
" Savannah	700
" Key West	1128
" New Orleans	1711
" Mobile	1658
" Puerto Mexico	1944
" Colon	1974
" Habana	1186
" Saint Thomas	1434
" San Juan (P.R.)	1407
" Port Castries (St. Lucia)	1747
" Barbados	1829
" Georgetown	2217
" Pernambuco	3698
" Bahia	4089
" Rio de Janeiro	4770
" Montevideo	5757
" Buenos Ayres	5871
" Punta Arenas (Sandy Pt.)	6947
" Fastnet (Winter season)	2776
" Fastnet (Summer season)	2903
" Queenstown (Winter season)	2840
" Queenstown (Summer season)	2967
" Liverpool (Winter season)	3071
" Liverpool (Summer season)	3198
" Bishop's Rock (Winter season)	2907
" Bishop's Rock (Summer season)	3016
" Plymouth (Winter season)	3006
" Plymouth (Summer season)	3115
" Havre (Winter season)	3165
" Havre (Summer season)	3274
" Gibraltar	3219
" Fayal	2098
" Funchal	2765
" Las Palmas	2965
" St. Vincent	2914
" Bermuda	681

INTERNAL COMBUSTION ENGINE ATTENDANTS

THE desirability of making provision for the certification of watch-keeping engineers in vessels where the driving power is other than steam has been under discusion for some time in view of the introduction of the gas and oil or spirit-operated engines into the mercantile marine service, and the British Board of Trade is about to issue instructions to the examiners and candidates setting forth the regulations to be observed with regard to the granting of these certificates, which will not be available for steam unless so endorsed. The present steam certificate may be endorsed on compliance with the regulations now proposed, to officially qualify the holder to take charge of internal combustion engined vessels.

For the second engineer's certificate the conditions of apprenticeship service are to be similar to those for steam, save that two years of the time must be spent in a workshop where internal combustion engines are built or repaired, and other two years in the machine shops where the details of these engines are made, with the alternative of the technical college training, the allowances for time in each of these to be the same as given for steam engine service. As there are many engineers who served their apprenticeship in steam engine works, now engaged in works where internal combustion engines are made or repaired, the qualifying service may be reckoned and would be accepted, even if the apprenticeship has been served wholly or in part in steam engine works.

The qualifying sea service period will be eighteen months in regular watch on internal combustion engines, the same period as now rules for steam in a foreign-going vessel of specified horsepower. The chief engineer's certificate will also be based upon the eighteen months' sea service as a senior engineer-in-charge of the watch of a foreign-going vessel, fitted with internal combustion engines of specified horse-power. In the event of service afloat having been in coastal service vessels, a similar extension of time will be necesary, as is the case with regard to steam. The regulations will doubtless contain alternatives or modifications from set rules, so that those who have been engaged on internal combustion or motor engines of an approved class may be accepted in the event of the possession of certain approved qualifications. — The Marine Engineer.

SLINGING A LOAD

THE method of attaching a sling to a load should always be delegated to a reliable and experienced man, and whether one or more slings are to be used will depend not only on the weight of the load to be lifted, but also on its shape. In placing a sling on a load, care should be used to see that the load is evenly distributed on the two sides of the hoisting hook and also that the turns of the sling do not overlap, thereby throwing an excessive stress upon one part of it.

The stresses that are thrown upon slings and ropes vary a great deal with conditions, and they are often influenced to a marked degree by circumstances, which the casual observer might consider trivial and unimportant. In particular the inclination or obliquity of the sling, in those parts which lie between the supporting hook and the points at which the sling first touches the load, must be carefully considered, as it is a highly important feature in connection with safety.

The Thor Ironworks, Toronto, have been awarded a contract for the construction of a steel boat 261 feet long for the Great Lakes Transportation Co.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

S.S. "STORMOUNT" STRANDING

A FORMAL investigation was held in the Customs House, Halifax, N.S., on June 27, before Capt. L. A. Demers, F.R.A.S., F.R.S.A., Dominion Wreck Commissioner, assisted by Commander E. Wyatt, R.N.R., and Lieutenant Commander G. C. Holloway, R.N.R., acting as Nautical Assessors, into the causes which led to the stranding and loss of the s.s. "Stormount," on Gull Ledge, off Marie Joseph Island, on the Coast of Nova Scotia, on June 20, 1916. The "Stormount" was owned by the Montreal Transportation Co., and was on a voyage from Philadelphia, U.S.A., to Sydney, Cape Breton.

Finding

The Court having carefully inquired into the e ivednce adduced, finds that the master, William Henry Blackler, eliminated from his observations the following facts: That his ship was light; that the swell coming from the southerly direction tended to throw the vessel inshore; that the current affected the speed of his ship, and that he knew of the unrealibility of his log. He nevertheless shaped a course passing close to the buoys, within a quarter of a mile, and steered a course absolutely too fine, making no allowances for the elements which were operating to bring his ship inshore.

He also ignored the ordinary precaution of his vessel. Instead he kept on at ships in thick weather, to take frequent soundings in order to ascertain the position of his vessel. Instead he kept on at half speed, which under the circumstances was too great on such a coast and especially in the particular vicinity.

It does appear, and the evidence goes to show, that a "rule of thumb" system prevailed on board the vessel. While it is shown by the log book that some observations to ascertain the errors of the compass were taken, we find that they were not frequent enough for the purpose of safe navigation. The Court deprecates the fact that only the master seemed to assume the navigation of the ship, and did not insist upon his officers making themselves acquainted with the courses, compasses, etc.; the officers being kept on the bridge purely as look out men.

In view of the circumstances attending this casualty, where, so far as the Court understands, the ship may become a total loss, and in view of the almost careless manner in which the vessel had been navigated by the master, it cannot in all justice, do otherwise than suspend his certificate— No. 318, Newfoundland—for the balance of the present calendar year.

TUG "FRANK C. BARNES" FOUNDERING

A FORMAL investigation held in the Deputation Waiting Room, City Hall, Toronto, on July 5, before Captain L. A. Demers, Dominion Wreck Commissioner, assisted by Captain James B. Foote and Captain James McMaugh, acting as nautical assessors, into the causes which led to the foundering of the tug "Frank C. Barnes," on November 2, 1915, whereby all hands were lost, at or near a place or point on Lake Ontario, known as Point Peter. The investigation was instituted at the request of Miss Janet Cummings, sister of the late engineer of the "Frank C. Barnes," through her counsel, Mr. J. A. Rowland, on the ground that the vessel was unseaworthy when she sailed.

H. W. Cowan, operating manager for the Canada Steamship Lines, stated that the equipment and general operations of vessels came under his supervision; that in May, 1915, the tug "Frank C. Barnes" was purchased as an aid to other tugs in performing harbor work; but not needing the vessel for that season she was brought from Port Arthur to Port Colborne, and tied to a dock until late in October, when Captain Herbert LaRush, one of the most efficient masters in their service, was ordered to take her to Sorel, Que., where it was intended that she should undergo a thorough overhauling. The instructions he issued to his representative at Port Colborne, through his assistant, Mr. Ruel, who also issued direct instructions to the master, were to the effect that the vessel was to be taken to Sorel, the master being left absolutely free to choose the date of departure. There was no hurry to reach Sorel. He averred that the company had made it a point to leave these questions to the master of the ship, who they claim is the man who best knows when and how the vessel should be sailed. The general order to fit the vessel, which was issued to Captain LaRush, included the clearing of the vessel at the Customs House.

With regard to the fact that the boat had not been officially inspected for two years, he stated that he was absolutely ignorant of that particular, as this was left to the master and the collector of customs. He assumed that when the tug was bought she carried the certificate of inspection, and that it was the master's duty to enquire, as his orders were to fit the vessel for the journey. A copy of a letter to Captain LaRush, which confirms the previous statement, was submitted as an exhibit.

Finding

Having carefully reviewed the evidence, the court finds that notwithstanding the fact revealed that the Tug. "Frank C. Barnes," was old, and in need of repairs to her hull, there is nothing to show that, under the circumstances, the Canada Steamship Lines, through its representatives, is in default for neglecting to take precautions to ensure the safety of the crew. The tug had been purchased in May, and tied at the docks in Port Colborne, until such time as an opportunity offered to send her to some port for repairs in order to commission her as an aid to other tugs for the present season in harbor works.

The master was an able, intelligent, competent man, and in taking command of the tug to bring her to Sorel he was left free to use his own judgment in navigating her. Since he left without remonstrating, it shows that he did not apprehend any possibility of disaster through her possible unseaworthiness. In the absence of evidence on the crew's side, the court accepts the statements of the representatives of the owners of the tug, that the master requisitioned for articles needed for the trip, which were allowed, and delivered without question.

As to the equipment and life-saving appliances it is said that there were at least one circular buoy and several life belts, one of which was found on the beach not far from the place where the engineer's body was recovered. There was also a metal life boat for which two oars were supplied before leaving Port Colborne. As there is no law governing the inspection of hulls of tug boats, the court cannot examine any official record; but must accept the statement given that the vessel needed repairs. Whilst in dock from May to November the vessel was not leaking to any extent, requiring only a little pumping once daily.

On the day of the departure of the

tug, the weather appears to have been anything but threatening; yet subsequently a fresh breeze sprung up from the westward, which increased in intensity, until the records of the Meterological office show that on the morning the "Frank C. Barnes" disappeared the wind had a velocity of 31 miles an hour, causing a heavy sea.

Analyzing the facts and reports submitted, and in view of the weather conditions existing, when larger vessels had to retrace their steps and seek shelter, the court cannot arrive at any other conclusion than that either one of two causes could have brought about the disaster, viz.: either the "Frank C. Barnes" shipped a sea from over the stern, or she broached to, and whilst in the trough of the sea, capsized. Consequently, the court holds both the owners of the "Frank C. Barnes" and her master, Captain LaRush, and her engineer, A. McG. Cummings, blameless, and finds that this disaster can be attributed to unforeseen and unavoidable circumstances, in fact, to an act of God. The court expressed its sincere sympathy with the relatives of those who unfortunately lost their lives.

NEW MOTOR LIFEBOAT

ONE of the future equipments of large passenger ships will, it is evident, be motor lifeboats, and a practical indication of this was recently given by the delivery of one of these craft to the Canadian Pacific Ocean Services, for placing on board one of their steamers. This boat has been built by J. Crichton & Co., at their Saltney, England, shipyard, and was delivered recently. The designer is Mr. Barnet, of G. L. Watson & Co., Glasgow. The dimensions are 30 feet by 9 feet by 4 feet.

The type of construction is double skin diagonal planking. The space below the water-tight deck, which extends fore and aft, is completely filled, except in way of motor, with air cases. Both in the bow and stern, short flush decks are fitted, and the spaces so enclosed bulkheaded off, and also fitted with air spaces. Fore and aft under the thwarts further air cases are fitted. Outside buoyancy is provided for by a belting of cork covered with canvas, extending all round the boat. Two large watertight relieving trunks are fitted, one on each side amidships with relieving valves. In addition a hand pump is fitted with pipes connecting to each watertight compartment. A heavy cast iron keel fitted makes the boat self-righting. Two masts and sails, with usual equipment, complete the outfit of the hull.

Engine Features

The engine is by Norris, Henty & Gardners, Tower Building, Liverpool, and is of the well-known "Gardner" three cylinder type, developing 22½ b.h.p. on petroleum, or 25 b.h.p. on petrol. There are several special features about the engine, the principal being:—

(1)—That it is arranged to start up on paraffin without the use of petrol or other spirit, the engine being fitted with "Gardner" silent vapourising lamps.

(2)—That it is arranged to start up on petrol, and after about three minutes on this fuel it can switch over and run entirely on paraffin.

(3)—The engine is completely housed in a watertight steel casing worked into the structure of the boat, with a separate watertight compartment at the after end conaining reverse gear.

(4)—All controls of engine and reverse gear are just aft of the engine housing, and by means of yoke lines led from the rudder head to this position, the lifeboat may be operated and manoeuvred by one man.

(5)—The speed obtained with the boat was about 8 knots, but there is an ample reserve of power in hand for towing purposes. In fact, this boat is quite capable of towing several ordinary ship's lifeboats.

Before delivery severe tests were made, both for self-righting and stability qualities, all of which were gone through with every satisfaction. The boat is a fine model, and, with a full complement of men on board, showed nice freeboard. It is anticipated that many others of a similar type will be supplied.

BRITISH SAILORS' RELIEF FUND.

IN a small, artistic pamphlet, the cover of which shows the British Grand Fleet plowing its way through the deep and a few aeroplanes high in air, the British Sailors' Relief Fund of Canada makes its appeal. The title of the pamphlet, "The People of Canada Grateful," is the text for the appeal and the expression at the same time of the reason why this fund is being collected. The appeal reads in part: "The wording on the cover of this little pamphlet expresses the feelings of the citizens of Canada towards the British navy and the brave men who man her fleet, as well as the seamen of the merchant ships. This fund is established to show to a small extent the appreciation of Canada in the only way that is possible at the present time, namely, the donation of money subscribed to the various patriotic funds occasioned by the war. The time has now arisen to add to her numerous gifts a fund that will even in a small way assist the people of the Mother Country in caring for the wounded and sick and orphans of her brave seamen.

"It is not easy to realize the immensity of the task that has been imposed on British seamen, who, no matter in whatever capacity, whether serving in the fleet, on transport service, mine sweepers, patrol duties or merchant ships, have performed their duties in a manner that has aroused not only the admiration of our own country, but the world at large. Without their services and devotion Canada would have been at the mercy of a relentless enemy, her trade and commerce ruined, and her people for generations required to pay tribute and feel the result of domination. Let us determine that every British sailor who suffers in the cause of the Empire and Canada shall feel that the hearts of his fellow-countrymen everywhere in the world are with him.

Hearty Canadian Support Assured

"These are some of the considerations that have led up to the foundation of this fund for seamen, and if Canada, by a generous subscription towards the care and relief of these bulwarks of the Empire, can in some measure express her gratitude and thanks, it will go to show not only the people of the Empire, but the world at large, how mindful this country is for those who are fighting its battles.

"In undertaking the raising of the British Sailors' Relief Fund, it is realized that the heartiest support and cooperation of all classes of Canadian people are necessary to make it a success. Those who have undertaken the organization of the fund are devoting a large amount of time and energy to the work. Prominent members of Parliament, professional and business men of Canada have already pledged their active support to the fund, and a good start has already been made with the subscription list. It is very desirable that the funds be given the very widest support throughout Canada, not only that a large amount of money may be raised, but in order that we may illustrate that the whole Canadian people are ready to show their appreciation for the splendid work that the British seamen are doing for them."

An office has been opened in the Montreal Harbor Commission administrative building for the receiving of subscriptions. M. P. Fennell, honorary secretary of the fund, will make a tour of various towns and cities in the Maritime Provinces with a view to organizing the campaign in these places. R. L. Werry will assist him in his secretarial duties.

A good start was made on the opening of the subscription list, something like $35,000 being immediately forthcoming, made up as follows:—W. G. Ross, president Montreal Harbor Commission, $10,000; Bank of Montreal, $10,000; James Carruthers, $5,000; Dominion Steel Corporation, $5,000; Robert Reford, $5,000.

THE SHIPPING OUTLOOK

AT the recent meeting in London of the Royal Mail Steam Packet Co., Sir Owen Philipps, the chairman, among other things, said:

"Many smaller shipping companies owning tramp steamers have recently been paying very large dividends, as a result of the high rates of freight obtainable in the open market, but the steamship companies with which we are allied carry on regular ocean services at relatively low rates of freight compared with tramps. They are all well-managed concerns, with their vessels properly written down in their books, and I believe that when times of stress again arrive for the shipping trade, as they are certain to do, these allied companies will be found in such a sound financial position as will enable them to continue paying steady dividends through times of depression."

Canadian-West Indies Service

Reference was made to improving trade conditions in Argentina and Brazil, which promised greater business for steamship services. He spoke afterwards of the Canadian-West Indies service as follows:—

"The fortnightly passenger and cargo service which was started two years ago between Canada and the British West Indies, under a contract with the Dominion Government of Canada, has, I am pleased to say, been conducted without interruption throughout the war. Since the termination of the mail services between the United Kingdom and the West Indies, and between the West Indian Islands, this Canada-West Indies service has not only served as an inter-colonial link between the Islands, through arrangements with the Canadian Government for additional calls, but has also provided a regular connection between Great Britain and the West Indian Colonies, via Canada. The service has done much to develop commerce between Canada and the British West Indies, and has secured a considerable volume of West Indian trade for Canada which would otherwise have been secured by the United States.

"If I may be allowed to do so, I would like to remark here that the success which has followed the establishment of this service has more than justified the most sanguine expectations of the Canadian Minister of Trade and Commerce, the Hon. Sir George Foster, to whom its initiation was largely due, and who has always taken a great personal interest in the development of trade relations between the great Dominion and the British West Indies, by which he has rendered Imperial service of no small importance.

Shipping Generally

On the subject of shipping generally, Sir Owen said: "The value of British vessels lost from August, 1914, to the end of April, 1916, namely, 21 months, has been less than $8\frac{1}{2}$ per cent., which is less than 5 per cent. per annum. What is much more important, however, is the practical cessation for so long a period of nearly all mercantile shipbuilding, for, although there are a large number of mercantile steamers building, they are as a matter of fact, making very slow progress. It is recognized on all hands that the position in regard to our depleted mercantile tonnage calls for urgent remedy.

The assistance rendered to our Allies in the carriage of necessaries and the large requirements of the British Government for our own needs have led to a very serious restriction of tonnage available for our own commercial requirements, and this shortage has been further accentuated by the depredations of enemy submarines. The sequel is a lack of ships to carry our necessary commerce, and this has bred a scarcity of supplies in Britain, with an inevitable advance in prices, which seriously menaces the activities necessary in prosecuting the war.

Call for Ships

"The remedy for this condition of things is ships, and more and more ships, earmarked for our commercial needs. While we recognize that the first call on all the available material and skilled labor of the country must be for munitions and the naval and military requirements of ourselves and our Allies, the building of commercial tonnage must be considered as only secondary in vital importance to these needs.

The Government will, no doubt, use every effort to speed up facilities for the building of commercial ships consistently with our more pressing needs. At the same time, every encouragement should be given to capital to acquire foreign tonnage, wherever possible, to add to the British registry, and to get ships for commercial use constructed in foreign yards, during this time of abnormal stress. This cannot be done without immense capital outlay, owing to the present very high price of tonnage; hence capital will need such special facilities or encouragement from the Government in the shape of modified taxation, or otherwise, as will encourage it to embark upon expensive remedies of this nature, for the amelioration of the national position. I hope, now that we are beginning to organize our national resources more fully and completely, steps will soon be taken to expedite the completion of tonnage building, and that arrangements will be made to repair the wastage of war. This matter is pressing, and ought to be dealt with immediately."

TUBE SCRAPER

THE tube scraper illustrated, and known as type K.C., is a product of the Babcock & Wilcox Co., Toronto, Montreal and London, England, and forms an accessory to their well known water-tube boilers. A special claim made for this scraper is its efficiency in dealing with hard scale. The scraper is attached to a length of wrought iron tubing screwed $\frac{3}{4}$ in. gas thread, which in turn is connected to a water supply by means of a rubber hose for conveying a small stream of water through the centre of the tool, in order to cool the cutters and wash away the scale removed. A small tap is fixed between the wrought iron tubing and the hose for regulating the water supply. The cutting edges of the rollers are of a radius to suit the size of tube, being contained within a circle the same diameter as the inside diameter of the latter. It will be seen, therefore, that, when all scale has been removed, the rollers will not cut into the surface of tube. To operate, remove the hand-hole caps, insert the scraper, turn on the tap at the top end of handle, and allow the water to flow. At the same time, move the scraper up and down the tube, slightly twisting the handle while doing so, until the apparatus comes out at the bottom of the tube. Twice down should be sufficient to thoroughly clean the tube it is claimed.

TUBE SCRAPER FOR B. & W. WATER TUBE BOILERS

VALVE RE-SEATING MACHINE

WHILE the Dexter Valve Re-seating Machine is not by any means a new appliance, recent developments and improvements in its construction have given it a wider range of usefulness in various branches of engineering, repair and overhauling.

When this device was first designed, it was then only contemplated to reseat globe type valves; other types of valves had not been considered. However, the success attained in their original purpose, encouraged the makers to further develop the apparatus, until at the present time the variety of uses to which it can be adapted is almost without limit.

Fig. 1 illustrates the latest improved type of machine for re-facing valves from 3 to 6 inches. It is shown operating on a flat-seated valve. The general construction of the various sizes is more or less identical, but, in the case of this and the larger sizes, special provision is made to reduce the power required to operate the cutter.

Where the small sizes are direct driven by means of the power handle secured to cutter spindle, the larger size machines, as shown in Fig. 1, are operated by bevel gears, running in special brackets; the gear ratio and bracket construction being, of course, suited to the size of the machine.

The jaws of the universal chucking arrangement can be adapted to either internal or external use, the long sleeve in which the cutter spindle revolves, in-

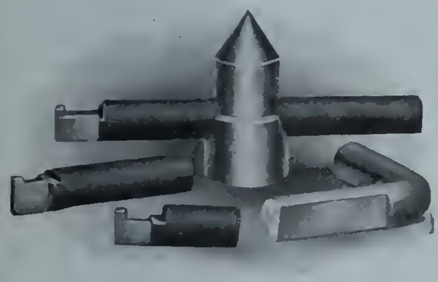


FIG. 2. CUTTERS FOR CHANNELING WORN VALVE SEATS.

suring the utmost rigidity, even on the heaviest work. The faces of the cutters are so constructed, that all possibility of chatter is entirely eliminated, resulting in a clean smooth finish.

After a valve has been re-faced a number of times, there arises the possibility of cutting into the uneven portion of the metal surrounding the valve seat. To overcome this, and at the same time extend the life of the valve, the attachment shown in Fig. 2, has been designed. By this simple device, a channel is cut around the old seat leaving a new ridge for further facing. By removing the sleeve and cutter spindle from the universal chuck, and securing same in a special frame as shown in Fig.

FIG. 1. MACHINE FOR RESEATING VALVES FROM 3 IN. TO 6 IN.

3, the valve disc can easily be re-cut. Both the adjustment and operation are quite simple. With one setting of the head, a crowning face can be cut, and, by feeding forward on the knurled nut, a 45-degree angle can be cut. Again, by utilizing the feed nut of the machine, a true surface can be turned parallel with the axis of the spindle.

While this device was originally designed for a special purpose, it may be adapted to many jobs ordinarily performed in a small lathe. A larger size suitable for the heavier work is also constructed. Darling Bros., Montreal, are the sole manufacturers in Canada of these valve reseating machines.

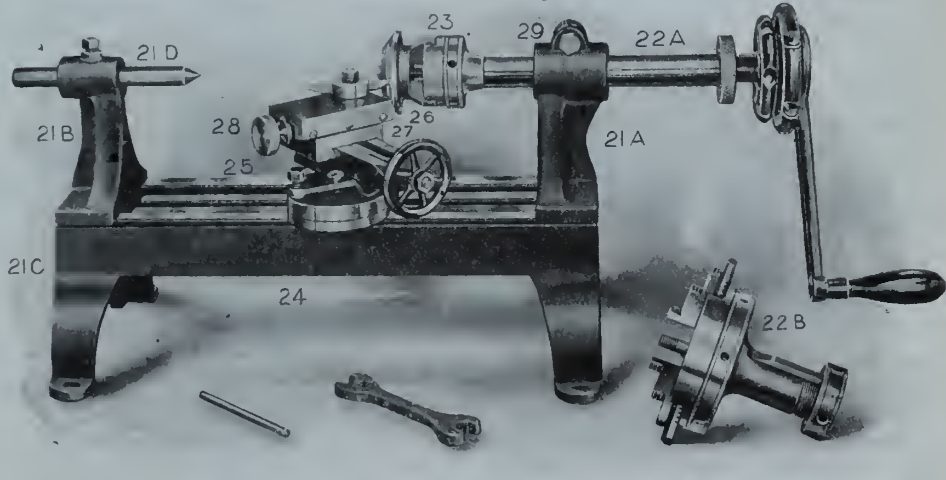


FIG. 3. RE-MACHINING DEVICE FOR WORN VALVES.

MACHINE TOOLS ON BOARD SHIP

THE amount of damage to both fleets engaged in the recent sea battle draws attention incidentally to the use of power-driven tools on warships for effecting a multitude of repairs or alterations. Although it is not permissible to mention how far the British navy is equipped in that respect, one is at liberty to state that the ships of the world fleets as a rule are inadequately supplied with power-driven tools.

No doubt this applies more particularly to the mercantile marine, but facts give it force in relation to the warships of a number of Powers, and it may not be an exaggeration to affirm that the majority of modern steamships are deficient in tools of a character suitable for a long and economical range of work.

In many instances a nondescript lathe constitutes the "plant," and a current paragraph reports that the captain and crew of a broken down steamer had nothing more effective than chisels with which to plane or otherwise treat a new steel mast. One writer considers that a lathe, drilling machine, and high-speed grinder (capable of separate use) should be part of a ship's equipment, and he mentions several incidental items as very useful additions. So much damage has been done to the world's shipping by the war that the value of machine tools on a ship is now beyond question. There ought to be no difficulty in arranging that some of the men on board are capable of using such tools.

Series of Practical Questions and Answers for Engineers

By "Artificer"

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals will be found a useful companion study. With a view to meeting the need of many of our lake and inland waterway engineers who, during the closed season of navigation, take positions in steam power plants ashore, questions relative to the latter department will also find a place in the series.

Question.—What is the capacity, in cubic inches, of the British Imperial gallon; also that of the U. S. gallon?

Answer.—The standard unit measure of capacity for the British Imperial gallon, for either liquid or dry material, is that of ten Imperial standard pounds of distilled water having a temperature of 62 degrees, weighed in air of the same temperature, and with the barometer at 30 inches; the water to be weighed with brass weights. While the weight of a cubic foot of water is usually considered to be approximately 62½ pounds, several authorities give the weight as being 62.355 pounds. From this the Imperial gallon will contain $\frac{1728 \times 10}{62.355} = 277.123$ cubic inches. However, the value generally used is that of 277.274, which for all ordinary purposes is sufficiently accurate.

The U. S. gallon weighs 8.345 pounds, and a cubic foot of water at 39.2 degrees F. is 62.425 pounds. The contents of the gallon will, therefore, be $\frac{1728 \times 8.345}{62.425} = 231$ cubic inches.

* * *

Question.—What should the ballast of an accumulator weigh to maintain a pressure of 350 tons on a 24-inch piston, and what would the pressure be per square inch?

Answer.—To exert a pressure of 350 tons at the press, it is obvious that the source of power—or the weight of the accumulator—must equal that at the press. To calculate the pressure per square inch, the total pressure must be divided by the area of the piston, thus:

$$\frac{350 \times 2000}{24 \times 24 \times .7854} = 1538 \text{ pounds per square inch.}$$

* * *

Question.—What is the method used when squaring a mixed number, such as 9¾?

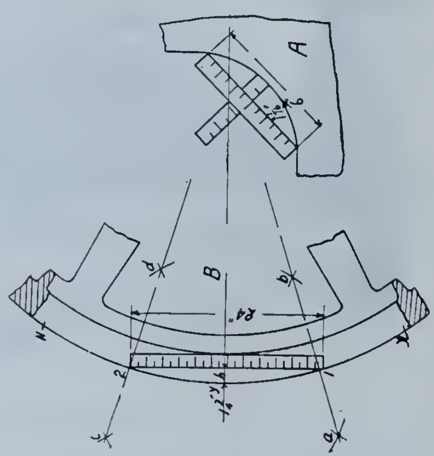
Answer.—The squaring of mixed numbers may be accomplished in several ways. The method generally adopted is to multiply the number by itself, as is done in the case of whole numbers; by the fractional method you first convert the number to an improper fraction. To do this, multiply the whole number of the fraction by the denominator and add on the numerator; the number thus obtained will be the numerator of the desired fraction, and of the same value as the mixed number, thus: $(9 \times 4) + 3 = 39$, and 39 over 4 will give $\frac{39}{4}$, and $\frac{39}{4} \times \frac{39}{4} = 95\,1/16$. The best method, however, is to convert the mixed number to a decimal, and proceed as in whole numbers, thus: 9¾ equals 9.75, and this multiplied by itself gives 95.0625. Another method may be applied, that of using the formula $(a+b)^2$, which is resolved into $a^2+2ab+b^2$, where (a)= the whole number, and (b)=the fraction, thus $9 \times 9 = 81$, $2 \times 9 \times 3/4 = 13\frac{1}{2}$, $3/4 \times 3/4 = 9/16$, total 95 1/16.

No set rule can be recommended for the squaring of mixed numbers, as the latter may require to be solved by different methods. The nature of the question, however, will generally indicate the best way of arriving at a solution.

* * *

Question.—When the centre of an arc is not available, as in a large fillet or broken wheel, how can the radius of arc or diameter of wheel be determined?

Answer.—A good rule to calculate the diameter of a fillet when only a section of the circumference is available is



to divide the sum of the square of the height and the square of half the chord by the height. For example, in the sketch of the fillet shown at A a six-inch rule is laid across the fillet and the height of the opening is found to be 1 1-16 inches. From the above rule the diameter would be $\frac{3^2+1.0625^2}{1.0625} = \frac{10.129}{1.0625} =$ 9.533 inches.

The same rule applied to the flywheel section shown at B would be

$$\frac{12^2+1.75^2}{1.75} = \frac{147.06}{1.75} = 84.04 \text{ inches.}$$

The centre of the arc can be determined graphically by selecting three points on the circumference, as x, y, z. Bisecting these distances as shown, the intersection of the produced lines will be the centre of the arc or circle of the original wheel.

* * *

Question.—What is specific gravity, and how can it be used to calculate the weight of different substances?

Answer.—The specific gravity of a body is the ratio between its weight and the weight of a like volume of distilled water at a temperature of 39.2 deg. F. To find the weight of any liquid or solid, when its specific gravity is known, multiply the specific gravity by 62.5, the weight in pounds of a cubic foot of water. For example, if the specific gravity of cast iron is known to be 7.21, the weight of a cubic foot would be $7.21 \times 62.5 = 450.6$ pounds; or weight per cu. inch would be $450.6 \div 1728 = .26$ pounds or 4.16 ounces.

* * *

Question.—What are the design, constructional and operation features peculiar to the Una-flow, and to what extent is it being installed as a prime mover?

Answer.—Patents for the first engine embodying the principle of the flow of steam in but one direction through the cylinder were taken out in England as early as 1885, but the first successful engine was not built until 1909, when J. Stumpf, a German inventor, introduced a Una-flow engine at Brunn, Austria. The engine met with success from the first and at the end of July, 1911, over 500,000 horsepower was being developed in Una-flow engines in Europe. The use of this engine has spread to practically all lines of work and to-day the Una-flow type is being used on locomotives, in marine service and for driving rolling mills. The development, however, has been closely confined to Europe, and only until the past few years have American manufacturers undertaken the construction of these engines. The cylinder of the Una-flow engine differs from that of other steam engines in that the exhaust ports are at the center of the cylinder. Exhaust takes place when the piston is at approximately nine-tenths of its stroke. The live steam is admitted through poppet valves at the ends of the cylinder, and the heads are so designed that the steam before entering the cylinder passes through chambers in the heads, thereby jacketing them. This arrangement of the flow of steam reduces the losses usually caused by initial condensation, and it is to this feature that the engine owes its high efficiency. The Una-flow engine, due to its capacity for wide temperature ranges, is able to carry expansion from boiler pressure down to condenser pressure without the necessity of compounding but with the same steam economy of a compound engine. The mechanical efficiency varies from 85 to 92 per cent. The principal advantage, however, lies in the fact that a great overload may be carried with only a scarcely noticeable increase in steam consumption.

* * *

Question.—What is the function of the air vessel as fitted on the discharge line of boiler feed and various other type pumps?

Answer.—An air vessel in its upper portion maintains a cushion of air which absorbs all shock or knock from the operation of the pumps, and prevents same being communicated to the solid mass of water in the piping.

* * *

Question.—What do we understand by an expansion joint, and under what circumstances are they necessary? What attention do they require, and of what materials should the working surfaces consist?

Answer.—Expansion joints are used when there are no long easy bends in the piping to take up expansion when under steam. They are generally of the ordinary stuffing box form, i.e., a stuffing box on one pipe end, into which the other pipe slides. Packing is put in, and the gland screwed up in the usual way to prevent steam escaping. They require attention from time to time, so that the gland does not get set fast or the packing be burnt away. The working surfaces in the box and gland should be brass bushed in the ordinary way.

* * *

Question.—To find the minimum lift of a safety valve in order to give an area of escape for steam equal to the area of the valve.

Answer.—Lift required equals area of valve divided by its circumference, which, in other words, is the diameter of the valve divided by 4. Arranged as a formula, where L represents the lift required, and D the valve diameter—both in inches, we get $L = \frac{.7854D^2}{3.1416D} = \frac{D}{4}$. Assuming a valve diameter of 4 inches, the required lift by formula would be one inch, found as follows:—

$$L = \frac{.7854 \times 16}{3.1416 \times 4} = \frac{12.5664}{12.5664} = 1 \text{ inch.}$$

* * *

Question.—To find the cubic feet of water blown out per minute through a rivet or other hole in a boiler, the pressure in the latter and the diameter of the hole being known.

Answer.—Multiply the square root of the pressure by 2½ times the hole diameter squared. Thus, $2.5d^2\sqrt{P}$ = cubic ft. of water blown out per minute. With boiler pressure of 100 pounds per sq. inch and a hole of 1½ inch in diameter, the water blown out per minute would equal

$2.5 \times 1.5^2\sqrt{100} = 2.5 \times 2.25 \times 10 = 56.25$ cub. ft.

* * *

Question.—On what does the strength of the furnace tube in an internally fired boiler depend to sustain satisfactorily such pressure as it may be subjected to, irrespective of the quality of the material?

Answer.—Length, diameter, and plate thickness squared are combination factors. The greater the length, the weaker the tube; the larger the diameter, the tube is correspondingly weaker, and the thicker the plate, the stronger the tube in proportion to the square of the thickness.

* * *

Question.—Is any special apparatus required or procedure involved in drilling holes through glass? I am led to believe so.

Answer.—Drilling holes in glass is more or less a simple matter, a good steel drill moistened with diluted sulphuric acid, or with turpentine in which a little camphor has been dissolved, ensuring a satisfactory job.

* * *

Question. — What tests other than those of color and odor can be applied to determine the quality of hydro carbon lubricating oils?

Answer.—Color and odor tests are generally sufficient for men with large experience to arrive at a decision. Other tests, and those which will be more convincing perhaps to the uninitiated are as follows:—(1)—The oil should not solidify at a temperature exceeding 32 degs. Fah. (2)—It should show no percentage of evaporation due to exposure. (3)—It should have no odor except that of petroleum. (4)—Its color should be only slightly florescent and perfectly clear. (5)—It should not saponify if treated with an alkali. (6)—It should have a flash point of not less than 350 degs. Fah.

* * *

Question.—What is understood by the phrase "mean effective pressure," and how is it determined?

Answer.—Mean effective pressure is the average pressure acting on the piston of a steam engine during its entire stroke and causing motion. The amount of it is determined in a practical manner from the indicator diagram, the procedure being as follows:—Divide the diagram longitudinally into 10 equal spaces, then measure the width between each of the spaces by the diagram scale, add all the measurements together and divide the total by ten. The answer will be the mean effective pressure. The latter can be calculated theoretically, but the result is only approximate, it being difficult to allow satisfactorily for cylinder clearance, losses by radiation, condensation and friction. The indicator diagram method is easily the more accurate.

* * *

Question.—We speak of so many "inches of vacuum" in the condenser; what then is meant by say 20 inches of vacuum, and what does that tell us regarding absolute pressure of contained vapor?

Answer.—Vacuum is usually measured by inches height of a column of mercury, two inches of mercury equalling one pound pressure per sq. inch; thus 20 inches of mercury means 10 pounds pressure per sq. inch. If we find 10 lbs. or 20 inches registered on the vacuum gauge, it shows that there is a vacuum equal to 10 pounds per sq. inch acting at the exhaust side of the engine piston, or from absolute zero, a pressure of vapor exists in the condenser equal to the difference between the barometer and the vacuum gauge. Thus, if the former stand at 15 lbs., the pressure of vapor in the condenser will be 15 minus 10 = 5 lbs.

* * *

Question. — What is the maximum pressure usually found in the compressors of CO_2 refrigerating machines?

Answer. — The maximum pressure varies with the temperature of the condenser water. It runs from 850 lbs., in temperate zones to over 1000 lbs. per sq. inch in hot climates, the variation being due to the fact that carbonic acid and gas is more difficult to liquefy than is ammonia.

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Vol. VI JULY, 1916 No. 7

PRINCIPAL CONTENTS

EXPORT TRADE DEPENDENT ON A MERCHANT MARINE

TO effectively develop and maintain any worth-while export business, something more than the ability to secure orders and possession of the necessary manufacturing capacity are required. It is for the most part overlooked that prompt and dependable transportation facilities should be available, also that their control be in the nature of a domestic, and not foreign, vested interest. Concurrently with the preparations to distribute our products of the field, the mine and factory over the markets of the world, strenuous effort should be made towards the creation and upbuilding of a powerful merchant marine, the individual constituent of which would be of Canadian manufacture and Canadian manned.

While it is probably true that even if we had possessed a fair sized fleet of Canadian-owned sea-going ships, many of them would in the past month have been commandeered and few, if any, would even now have been available for our export requirements, yet we do not get away from the fact that we have been dependent for ocean transport on foreign built and foreign owned vessels. Again, unless some real action is now taken we will be just so much more at the mercy of foreign shipowners as will make well-nigh impossible an export trade worth the name.

It is not realized that Canada's possession of a merchant marine of the greatest possible proportions will furnish the basic stimulus to her industrial development in both domestic and foreign markets, and that while its revenues will be altogether Dominion-accruing, its services and activities need not be Dominion-dependent, but of world-wide scope.

Canadian built, manned and owned ocean-going vessels as the result of Canadian enterprise are the medium through which our farmers, our merchants and our manufacturers can most surely and effectively lay hold of the trade requirements of other countries and in view of the trade war which is generally anticipated when the thirst for blood has been sated, there is little doubt that those countries with the more ample ocean transport will reap the more ample benefit.

We have neither controlled shipbuilding plants nor are any measures in force or likely to be so, prohibiting their further establishment. We are, however, lacking first of all in vision, and as a natural result, enterprise is also lacking. It may not, however, be inferred that everybody is asleep, so to speak. Here and there bright and keen minds are alert and active, and if we judge rightly their numbers are increasing and their influence is becoming more powerful and wider in scope.

In spite of the fact that recruiting has in some measure restricted the output of coal from the mines in the Maritime Provinces, the reduced quantity cannot be shipped for want of "bottoms." As a result, the City of Montreal with its myriad factories is dependent to a large extent for its fuel supply from American centres, via, lake and canal waterways. Such a condition ought not to exist one day longer than necessary, and its remedy like that of the preparation for prosecuting Canadian export trade on sane and business-like lines lies in our creation and development of an ocean port and waterway shipbuilding industry. The more intensely the latter is propagated and the more firmly established it in time becomes, the more sturdy will also be the growth of a seafaring community.

The creation and establishment of even a moderate-sized shipbuilding plant involves considerable capital investment, outstripping in this respect most specialized industries. The scope of its product is correspondingly wider, and as a developer of other industries and crafts it is without a peer. Cost of production—labor cost comparatively, has always been urged as a good and sufficient, and possibly the only, reason, why shipbuilding should not be encouraged on our shores. Government after government have taken up this attitude, and strange to relate, when comparative costs may be said now to synchronize, and merchant shipbuilding in the world's premier centre has for obvious reasons and during many months, been reduced to an absolute yet undesirable minimum, the present administration still busies itself casting about for excuses to bolster up an untenable position, instead of bringing to the subject the measure of intelligence and consideration it deserves, and taking a hand in formulating a basis of national support.

Marine News From Every Source

Port Arthur, Ont.—The contract for the new 300,000 bushel elevator has been let to Barnet & McQueen.

Halifax, N.S.—Work is being pushed hard on these terminals in order that three berths at least may be complete for shipping this autumn.

Record Cargo.—The steamer W. Grant Morden cleared from Port Arthur, Ont., on the night of July 16, with the record cargo of 490,720 bushels of wheat for Port McNicoll.

Ottawa, Ont.—A contract has been awarded by the Department of Public Works, Ottawa, to Roger Miller & Sons, Toronto, for lock gates and equipment at East River Locks.

Ottawa, Ont.—The Toronto Harbor Commission have deposited with the Public Works Department, for approval, plans of the bastion seawall to be built at the mouth of the Humber River.

Port Dover, Ont.—Plans have been prepared by the Department of Public Works for harbor improvements here estimated to cost $250,000. It is proposed to establish a car ferry service.

St. John, N.B.—The Maritime Dredging & Construction Co. has been awarded the contract for the erection of a second retaining wall and for reclamation work in the new dock arêa at West St. John.

Hamilton, Ont.—A dry dock and shipbuilding plant is being considered by the Harbor Commission in cónjunction with the Canada Steamship Lines. The initial outlay calls for an expenditure of from $250,000 to $350,000.

Three Rivers Wants Shipyard.—On behalf of Three Rivers, Que., Col. Pelletier, agent-general for Quebec, in London, has approached several shipbuilders with offers of a free site and exemption from taxation, but so far without response.

M. Beatty & Sons, Ltd., Welland, Ont., have been awarded a contract by the Dominion Bridge Co. for two hoisting engines and two vertical boilers, for use at the Intercolonial Railway Car Ferry Terminals, Carleton Point, P.E.I., and Cape Tormentine, N.B.

Sarnia, Ont.—The wrecker "Favorite" of the Great Lakes Wrecking Co., along with the tug "Michigan", has succeeded in raising the overturned steamer "Chas. Price" sufficiently to enable them to bring her three miles closer to the mouth of the St. Clair River.

British Columbia Builds Ships.—Discussing British Columbia's shipbuilding proposals, Sir Richard McBride says that five keels have been laid in Vancouver, two at Westminster and three at Victoria, all good sized vessels, which will sail via the Panama Canal to Europe.

Sarnia, Ont.—Customs returns for June of this year are the largest in the history of the port. The total receipts show an increase of $61,803.48 over May, and are three times as large as for the corresponding month of last year. The leading article on which duty was paid was coal.

Motor Patrol Service.—A school of instruction for candidates for the Royal Naval Auxiliary Patrol Service is being opened in the Jarvis Building, 103 Bay Street, Toronto. Captain Stinson, of the Canada Steamship Lines, is instructor, and a nominal fee will be charged for the course.

Hull of Majestic Raised.—The Reid Wrecking Co. has raised the hull of the steamer Majestic, of the Northern Navigation Co., which burned to the water's edge and then sank in shallow water in Sarnia Bay last Fall. An examination will be made of the hull, and if possible it may be rebuilt.

Levis, Que.—The steamship G. R. Crowe, which recently came down in two sections from the Great Lakes, is in dry dock here, being put together for ocean service. The Crowe is a steel screw steamer of 2,940 gross tonnage, and belongs to the St. Lawrence & Chicago Steam Navigation Co.

M.Beatty & Sons, Ltd., Welland, Ont., have been awarded a contract by the St. Maurice Construction Co., for the supply of an 8 by 12 triple drum hoisting engine with boom swinger, and one 37 h.p. double drum electric hoist for use on the construction of the St. Maurice River Dam near Sanmaur, Que.

Kingston, Ont.—A new tug, built at the Davis drydock here for the Hudson's Bay Co., was successfully launched on June 22. The tug is 36 ft. long, 9 ft. 6 in. beam, and has a draught of 4 ft. 6 in. She is equipped with a 32 h.p. three-cylinder "Wolverine" engine, and will use either gasoline or kerosene.

Toronto, Ont.—The steamers Wahcondah and Fordonian, lake freighters of the Canada Steamship Lines, have been requisitioned for the transatlantic trade. Both steamers, which are Welland Canal size, were constructed in Great Britain within the past ten years. Since their arrival in Canada they have mostly been engaged in the Upper Lake service.

Toronto, Ont.—The Board of Control have recommended, at the request of General Manager E. L. Cousins, on behalf of the Harbor Board, and subject to the sanction of Finance Commissioner Bradshaw, the authorization of general debentures to the amount of $1,500,000 to raise money to carry on the harbor improvements. This is the balance of the amount guaranteed by the city, the amount already raised being $3,500,000.

New Westminster, B.C.—Preliminary work in connection with the establishment of modern shipbuilding yards on Poplar Island, in the Fraser River, has been commenced by the Westminster Marine Railway Co. The company propose establishing a $70,000 plant on the island, of which the modern machinery alone will cost $15,000. Ways will be built capable of handling the largest vessels in the coast trade. The company is making preparations to build two auxiliary schooners to be used in the lumber-carrying trade.

Can. Merchant Marine.—The Dominion Government is investigating the possibilities of a Canadian merchant marine. It is thought that a resort will be made to bond guarantees, and subsidies may be granted to equalize the difference between the cost of construction between Great Britain and Canada. However, no definite policy has been arrived at. No doubt the first move will be to extend the Government freight carrying service between Halifax and Liverpool in conjunction with the Government-owned land service by the Intercolonial and National Transcontinental Railways.

Will Build More Ships. — Both the American and British interests which will be represented on the new board of direction of the International Mercantile Marine Co. favor a plan to build new ships out of earnings. Tentative plans under way call for the construction of a large number of ships out of the cash reserves of the company. Such a plan, it is contended, will mean more in ultimate gain for both the preferred and common stock than a hasty payment of back dividends on the preferred. No contracts have been let but it is proposed to build the new ships in England.

International Mercantile Marine.—The British Government has approved Harold A. Sanderson, E. C. Grenfell, of Grenfell, Morgan & Co., and Lord Pirrie, of Harland & Wolff, Belfast, as British nominees to the directorate of the reorganized International Mercantile Marine Co. Two British directors who will not appear on the new board are Charles F. Torray and J. Bruce Ismay. J. P. Morgan & Co., announce that J. P. Morgan and Charles Steel will represent them on the new board. Preferred stockholders are urging James N. Wallace to represent them, in addition to F. W. Scott, Harry Bronner, Charles H. Sabin, and either Albert Rathbone or George W. Davidson, and both, in the event of Mr. Wallace's refusal.

Refloating of S.S. Stormount.—Contrary to expectations there are now good prospects that the Mostreal Transportation Co.'s steamer Stormount, which went on the Gull Ledge, Guysboro Coastline, June 20, will be refloated. A few hours after the steamer ran ashore the captain and crew were forced to abandon her, as she was lying in a dangerous position, and it was feared she would go to pieces, as she was pounding quite heavily. She was hard and fast on the rocks four miles off shore. Wrecking boats have been working since the mishap occurred, and report that the steamer can be saved. At the time of the wreck the Stormount was on her way from Philadelphia to Sydney to load coal for the St. Lawrence. She is of 1,955 tons gross.

Canal Headgates Carried Away. — The head gates of lock 12. Welland Canal, were carried away by the old wooden steamer India of the Montreal Transportation Company's line at 8.30 on the morning of June 29, causing $5,000 damage to the canal and in addition inundating the surrounding country with water from the level above. Confusion of signals is given as the cause of the accident, the engines being started ahead at faster speed after Capt. Roach had endeavored to call for reverse. Several holes were punched in the bow of the steamer, and Lockmaster John Clark was carried over the bank by the water and received a ducking. Locktender Hilton of lock 11 was swept over the back into an adjoining field. landing against a barbed wire fence and had a narrow escape for his life.

Standardized Ship Building.—Details of the scheme for the building of standardized ships at Chepstow, Monmouth, England, are announced. The enterprise will have an initial capital of £100,000 sterling, which has already been subscribed. The stockholders are all large shipping companies, including the Peninsular & Oriental, the New Zealand Shipping Co., the Orient Steam Navigation, the Furness-Withy the Shire Line and the Federal Steam Navigation Co. No public issue of stock is contemplated. The head of the new enterprise is James Caird, President of Turnbull, Martin & Co., and director in numerous shipping and allied companies. A site has been obtained on the River Wye, and the plans provide for a plant capable of building ten large ships at the same time, all to be of a standard type of 8,500 tons. All the parts of the hulls and engines will be standardized.

OCEAN FREIGHT RATES

IN steamship circles it is believed that steamship freight rates of tramp boats in coastwise service and trans-Atlantic vessels, have reached the end of a temporary decline, and that there will now be an upward trend. This is naturally the dullest season of the year in waterborne traffic, but Maritime authorities are of the opinion that with the turn of the corner in freights they are likely to stiffen suddenly, due to the law of supply and demand. When cotton and grain begin to move within the next few weeks earnings should be notably affected through improvement in rates.

It is quite probable that the British Government may shortly call on the United States for further grain shipments. Twelve pence per bushel is quoted for carrying grain from Boston to Glasgow, a rise of 2d over that recently prevailing. On traffic to Liverpool, a rate of 61 cents per hundred pounds is asked on oil cake, as against 45 cents recently, while the published rate on tobacco is $2.50, against $2 previously.

Even the recent rates have, of course, been extremely satisfactory as compared with those prevailing at the outbreak of the war. Below are compared trans-Atlantic freights, which constitute a certain index-basis for steamship prosperity, for the dates mentioned, the charges given being those for transportation from Boston to Liverpool (per hundred pounds except where otherwise noted):—

	To-day.	High. Points, March, 1916.	Before War, July, 1914.
Grain, per bush ..	$0.20	$0.48	$0.04
Provisions	1.25	1.25	0.23
Pail, lard	1.31	1.31	0.28
Hard lumber	1.50	1.50	0.17
Butter	1.75	2.00	0.34
Oilcake	0.61	1.00	0.12
Cotton	1.00	2.50	0.12
Tobacco	2.50	3.00	0.31

AUSTRALIA BUYS FREIGHTERS

W. M. HUGHES, Premier of Australia, who has been in London for some time past, has solved the difficulty of a dearth of ships for moving the Australian harvest by going into the market and purchasing 15 large steamers, which will be renamed and operated by the Australian Government as the Commonwealth Government line. The vessels purchased are the Strathendrick, 4,379 tons; Strathavon, 4,403 tons; Strathairly, 4,326 tons; Strathleven, 4,396 tons; Strathdee, 4,409 tons; Strathspey, 4,432 tons; Strathgarry, 4,398 tons; Strathdeg, 4,338 tons; Strathesk, 4,336 tons; Strathearn, 4,419 tons; Ardangorm, 3,570 tons; Ardanmohr, 4,554 tons; Vermont, 4,271 tons; Daltonhail, 3,534 tons; and Kirkoswald, 4,021 tons. The price is believed to approach ten million dollars. The ten Strath ships, were purchased from Burrell & Son.

British shipowners ask what their position will be in competition if these Australian State-owned boats are to be exempt from British income tax and excess profits of taxation. Also, have the British Government who now control all shipping, finally assented to do the same with Canada and the other Dominions that contemplate similar semi-Socialistic adventures? Many of these vessels are now employed on Government war business, and they cannot be available for Australian wheat cargoes until the Imperial Government has done with them.

Australia's purchase of a fleet of fifteen steamers to handle its wheat crop is not at all likely to be emulated by the Canadian Government. The conditions which obtain in the two Dominions being reckoned wholly different. At one time Canada had some difficulty in securing the necessary ocean tonnage, but this has been largely overcome until now. Between twenty and twenty-five million bushels per month are going forward.

On the other hand, Australia's crop movement has been greatly retarded, if not prevented, because of inability to secure ships. The trip is usually long with little offering by way of return cargoes, while the rate quoted by the Commonwealth Government was low, at a time when tonnage is scarce, anyway. These conditions necessitated the State-owned fleet now acquired.

A Canadian merchant marine has been suggested, and may come as a future development, but the grain crop is already being moved with reasonable expedition and sufficient ships for the purpose have, so far, we understand, been available.

CANADIAN PACIFIC OCEAN SERVICES

ALL the steamers of the Canadian Pacific Ocean Services are again in commission on their old route, and it is needless to say their return has been welcomed by travellers and shippers alike throughout the whole of the Far East. The resumption of this service has brought about certain changes in the personnel of the executive staff of the Company in China and Japan. The following list of changes has been furnished.

J. W. Wallace, appointed to general agent, Hong Kong Territory; Hong Kong, China, Straits Settlements, and India; relieving D. W. Craddock, who goes on leave of absence.

L. E. N. Ryan, of Samuel, Samuel & Co., Yokohama, appointed agent, Shanghai, relieving H. Thomas, acting agent, resigned.

A. J. Blaisdell, of St. Louis, appointed general agent, Passenger Department, Territory Shanghai and North China; new position.

T. G. Turnbull, appointed passenger agent, Shanghai.

P. D. Sutherland, appointed general agent, Passenger Department, Hong Kong new position.

J. R. Shaw, appointed passenger agent, Manila.

F. M. Flanagan, appointed passenger agent, Kobe.

BUILD SHIPS AT PRINCE RUPERT

M. P. COTTON, contractor, of Vancouver, and H. H. Hansard, solicitor for the G. T. P., have been to Prince Rupert, where they inspected the dry dock and shipbuilding plant. Mr. Cotton represents a shipbuilding syndicate, which, if satisfactory arrangements can be made, will lease the G. T. P. plant at Prince Rupert for the purpose of building freighters to be operated by the company. It is proposed to build the ships of steel, and it is understood that application has been made under the Government's legislation to aid shipbuilding, for assistance in the building of four of these ships, which will be about 5,000 tons each.

SEQUEL TO "EMPRESS" WRECK

LIONEL KENT has failed in his action to recover from the Canadian Pacific Railway Co. $559 compensation for the loss of his luggage, which went down with the Empress of Ireland, after collision with the collier Storstad in the Gulf of St. Lawrence, on May 29, 1914. Mr. Kent was one of the passengers rescued from the wreck. Judgment nonsuiting him has been rendered in the Superior Court, Montreal.

"The contract between the parties," Justice MacLennan said, "was printed on the ticket, which plaintiff received before sailing. The contract provided that if the company defendant used all reasonable means to ensure that the vessel was sent to sea in a seaworthy state defendant would not be liable for loss or injury to the passenger or his baggage arising from, amongst other things collision. Defendant has proved that the Empress of Ireland went to sea in a seaworthy state and that it was lost at sea after collision. The conditions of the contract were legal, and plaintiff, therefore, has failed to establish his claim." The judge cited the decisions in several other cases.

MANNING OF VESSELS

THE passage of the Seaman's Bill by the United States Congress has been followed by a new arrangement between Canada and United States authorities regarding the treatment of Canadian shipping in United States ports. The new legislation on the other side lays down very stringent rules regarding the manning of vesels trading into or out of the ports of the United States.

Where, previous to the passing of this law, there was no requirement with respect to the number of able seamen to be employed on those vessels, the new law declares that forty-five per cent. of the deck hands must be able seamen, and definite information is given as to what constitutes an able seaman under the Act. He must be nineteen years of age, must have served eighteen months on shipboard, and must have sundry technical qualifications, all of which are enumerated. There are also a number of regulations dealing with the physical fitness of men employed on these vessels, badly impaired vision, color blindness, deafness, tuberculosis, or any one of a variety of other ailments which are made sufficient for certification of incompetency.

As these regulations would affect vessels of Canadian register trading in United States ports, both in the coastal and lake trade, the Department of Marine here has made arrangements with the Washington authorities for the recognition of able seamen certificates granted in Canada. These certificates are provided by the Canadian Collectors of Customs to seamen who have qualified under the provisions of the United States legislation.

MOTOR BOATS FOR CHINA

A RECENT number of Shipping and Engineering contains an excellent article upon the growing demand for motor boats to ply upon the inland waters of China. The writer of the article states in part as follows:—The export of marine motors from Great Britain to China has, owing to the war, for the present come to an end, and the trade is now entirely in the hands of American manufacturers. These engines are turned out in 1, 2, 3, 4 and 6-cylinder models, ranging in power from 5 B.h.p. to 110 B.h.p. The motors that have undoubtedly taken the greatest hold on the markets of China, are those which are sold in stationary sets of 3 to 11 h.p., and marine sets from 3 to 50 h.p. A still smaller size is the 2½ h.p. detachable motor which, working with magneto, has found great favor for use with light skiffs and ship's boats.

The larger sets have now been adapted to operate on kerosene, an improvement that adds a great deal to their utility in outports where petrol is difficult to obtain. The paraffin engine is the one that will be most used in China, because of the ease of obtaining fuel in almost any little village at which the boat may happen to stop. Again the simplicity of design of this type makes it a motor that can be operated with safety by the untrained Chinese.

Simplicity of construction and manipulation is one of the principal requirements of a motor intended for the Chinese market. It must be borne in mind by the manufacturer, that his engine is likely to run with the minimum of operative intelligence for long periods without an overhaul, and it might possibly require, in motors intended exclusively for the Chinese market, some small sacrifice of efficiency or lightness, in order to produce an engine that will be proof against the misuse it would probably receive.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Captain Archibald Reid, for many years Lloyd's surveyor at Montreal, has resigned.

W. J. Alderson, has been appointed Lloyd's engine and ship surveyor for the ports of Montreal and Quebec.

D. O. Lesperance, ex-M. P.; D. H. Pennington and Alfred S. Gravel have been appointed harbor commissioners of Quebec City. Mr. Lesperance will be the chairman.

J. McGregor, superintending engineer of the Halifax Ocean Terminals, has obtained leave of absence from the railway department to go to the front. Mr. McGregor will be chief engineer of the railway construction battalion commanded by Col. J. W. Stewart, with the rank of Major.

Captain Wm. Mathews, master of the schooner, "General Laurie," of Lockeport, N.S. is to receive a silver souvenir from the King of Norway, in recognition of the services rendered the master and the crew of the Norwegian barque "Forth," of Sandefjord, lost on the 27th September, 1915.

Captain J. E. Bernier, the Canadian explorer, sailed for the Arctic on his own ship, the Guide, on Dominion Day. The Captain expects to be away fifteen months. Supplies for the Esquimaux of a variety kind were carried in quantity. He expected to reach Baffin's Islands in a month or six weeks. Whether he will press on further north will depend on ice conditions.

Captain Eugene McCormick, mate of the Canadian lightship Falken, which is stationed at the Southeast Shoal, Lake Erie, died at his home, Amherstburg, on July 5. His illness is said to have resulted from exposure and hardship while bringing the lightship from her station to Amherstburg in December, 1914. The boat arrived with the pilot-house windows broken by the sea, and the hull and upper works heavily coated with ice. Capt. McCormick was born on Pelee Island in 1849. He was master of the steamer Imperial for twelve years before that vessel was succeeded on the Windsor-Pelee Island route by the steamer Clarke.

LICENSED PILOTS

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio. Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

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Secretary—M. R. Nelson, 1184 Broadway, New York.

SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer,** J. R. Binning, Montreal.

SHIPMASTERS' ASSOCIATION OF CANADA

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

GRAND COUNCIL, N.A.M.E. OFFICERS.

A. R. Milne, Kingston, Ont., Grand President.
J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I., Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

Sir Edgar R. Bowring, head of the British steamship firm of Bowring & Co., arrived at New York, June 23, on board the White Star liner Adriatic. Among his other engagements while on this side of the Atlantic will be a visit to Canada on business connected with his steamship interests. Asked as to his views on a possible early break in ocean rates, he expressed the opinion that the easing of the freight market recently noted was due to a readjustment of Government controlled cargoes and ships, tending to better systematize the handling of the numerous imports England is receiving from the British Colonies and the United States.

Captain Blanchard Henry, commanding the transport Ionian, has been especially mentioned by the Admiralty for work in the evacuation of the sick and wounded from the Gallipoli Peninsula. Captain Henry carried out responsible duties, say the Lords of the Admiralty, "with devotion, zeal, readiness, resource, and dispatch, never known to have been equalled." Captain Henry's home is Montreal, and he has seen thirty years service with the Allan line. He commanded a transport carrying some of the original Canadian contingent to England. He holds a medal for transporting troops during the South African War.

1916 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	John Oshurn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jenne Mance Street	O. L. Marchand,	93 Fifth Ave., Lachine, Que.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th Street E.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoli,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	176 King Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	J. A. Rowe	29 Parrsboro Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

Book Reviews

The World's Flags at a Glance is the title of an interesting little book published by George Philip & Son, 32 Fleet street, London, England. Price 25c net. The book contains representations of over 500 flags, in colors, of various countries throughout the world, including the house flags of shipping companies and yacht clubs, etc. It also contains considerable interesting descriptive matter covering the various forms of flags and their origin. The book contains 45 pages with a complex index.

The Shipping World Year Book, 2,010 pages 7¼ in. x 4½ in., edited by Major E. R. Jones, and published from the "Shipping World" offices, London, England. Price 11s. ($2.75) net. The 1916 or thirtieth edition of this year book contains, as in former years, much valuable information for all interested in shipping. It is a very useful publication for shippers and merchants trading in all parts of the world, and is also a very handy book of reference as the information given covers a wide field. The war has of necessity made the compilation of this work no easy task, as it has effected profoundly the commercial and shipping interests everywhere. This circumstance, however, has not detracted materially from the value of the book, as it has been brought up-o-date as far as possible from available data. The book is arranged in three sections, the first or general section deals principally with matters affecting navigation and shipping contains a digest of merchant shipping acts. alien and factory acts, customs, regulations, etc., also numerous tables embodying much valuable information. This section has been revised and some pages rewritten owing to restrictions imposed by the war, while new features have been added to bring the matter up to date. The second section is devoted to a port and harbor directory of the British Isles, the Overseas Dominions and Foreign Countries. The geographical location of each port is given, together with particulars regarding water levels, anchorages, harbor dues, port officials, etc. The third section gives the customs tariffs of all nations brought up-to-date as far as possible under the present conditions. The tariffs of enemy countries have of necessity been left as they were in the 1915 edition, but considerable changes have been made in the Australian tariff, and also in that of the United Kingdom, the latter being entirely a war emergency measure. There is also a new map of the world showing trade routes, ports and coaling stations, etc. The book is of particular value now in view of the proposals which have been made to develop trade within the Empire and with our Allies. It is printed in clear type, has a very complete index.

Canadian Vessel Captains and Chief Engineers

Through the courtesy of the various Steamship Companies, we are enabled to give a list of 1916 season vessels, together with the names of their principal officers.

HALL AND ELIGH, OTTAWA, ONT.

Vessel.	Captain.	Chief Engineer.
Roberval	P. Eligh	P. Trottier

INSULAR STEAMSHIP CO., WESTPORT, N.S.

Vessel.	Captain.	Chief Engineer.
Westport III.	St. Clair Cann	C. Barnes

INTERNATIONAL TRANSIT CO., SAULT STE. MARIE, ONT.

Vessel.	Captain.	Chief Engineer.
Algoma	F. Frech	C. Innes

KEENAN TOWING CO., OWEN SOUND, ONT.

Vessel.	Captain.	Chief Engineer.
Keenan	J. Rutherford	W. Owens

LA HAVE STEAMSHIP CO., WEST LA HAVE, N.S.

Vessel.	Captain.	Chief Engineer.
Trusty	J. Crouse	A. Zwicker

LAKE ERIE NAVIGATION CO., WALKERVILLE, ONT.

Vessel.	Captain.	Chief Engineer.
Marquette and Bessemer No. 1	J. A. Patterson	H. Culp

MARITIME STEAMSHIP CO., BLACKS HARBOR, N.B.

Vessel.	Captain.	Chief Engineer.
Connors Bros.	E. H. Warnock	G. Cowie

MARQUETTE AND BESSEMER DOCK AND NAVIGATION CO., WALKERVILLE, ONT.

Vessel.	Captain.	Chief Engineer.
Marquette and Bessemer No. 2	John Vanbuskirk	T. Elliott

MIDLAND TRANSPORTATION CO., MIDLAND, ONT.

Vessel.	Captain.	Chief Engineer.
C. W. Chamberlain	B. W. Morgan	W. Malcom
Onaping	A. Cuff	G. Lamb

LAKE SIMCOE NAVIGATION CO., TORONTO.

Vessel.	Captain.	Chief Engineer.
Modello	L. Johnston	....
Otonabee	W. Williams	T. A. Cooley

THE LEVIS MARITIME AND INDUSTRIAL CO., LEVIS, QUE.

Vessel.	Captain.	Chief Engineer.
Champion	D. Leamy	C. Barras
Frontenac	Jos. Plante	P. Plante

GRAND TRUNK AND WABASH RY. DETROIT RIVER CAR CARRIES, WINDSOR, ONT.

Vessel.	Captain.	Chief Engineer.
Detroit	R. Aikin	H. Lawry
Transfer	G. Honner	W. Taylor
Transport	W. Norvell	F. Robinson

ISLAND TUG CO., CHARLOTTETOWN, P.E.I.

Vessel.	Captain.	Chief Engineer.
Fred M. Batt	W. M. Snow	G. H. Beers
Harland	J. T. McLaine	A. Roebuck
Islander	John McIsaac	W. A. McEachren

MAGNETAWAN RIVER AND LAKE STEAMBOAT CO., BURKS FALLS, ONT.

Vessel.	Captain.	Chief Engineer.
Armour	J. Mortimer	R. Dunn
Glenada	W. Kennedy	J. Kennedy
Gravenhurst	S. Creswell	M. Pritchard
Wanita	W. Keetch	C. Rasplant

F. E. HALL AND CO., MONTREAL.

Vessel.	Captain.	Chief Engineer.
Byron Whitaker	R. McLeod	F. Patterson
Compton	B. Bowen	L. Smith
Robert R. Rhodes	W. H. Ransom	F. A. Collier
Stanstead	E. Groulx	M. J. McFaul

KEYSTONE TRANSPORTATION CO., MONTREAL.

Vessel.	Captain.	Chief Engineer.
Keybell	L. Beaupre	E. W. Sparling
Keynor	J. Martin	J. Robertson
Keyport	J. Mullen	R. J. Muchmore
Keyvive	G. Bunting	Jas. Boak
Keywest	A. Barrett	W. H. Jennison

GREAT LAKES DREDGING CO., PORT ARTHUR, ONT.

Vessel.	Captain.	Chief Engineer.
A. F. Bowman	H. Gehl	B. Debehardi
E. C. Whalen	J. Friday	C. Saunders
Edward Fiske	J. McGinnis	J. Bennett
J. D. Morrison	N. McLeod	N. Taylor
P. Gorman	T. Strong	D. Moore
Thos. Fisher	H. Friday	T. McHugh

GREAT LAKES TRANSPORTATION CO., MIDLAND, ONT.

Vessel.	Captain.	Chief Engineer.
Calgary	....	R. G. Walker
Glenfinnan	W. E. Linton	C. McWilliams
Glenfoyle	J. H. Crocker	J. P. Davidson
Glenlivet	F. Burke	G. Price
Glenlyon	A. Hudson	D. A. Sinclair
Glenmains	....	F. H. Brickenden
Glenshee	W. Levigne	F. Goodwin
Major	S. Carson	P. Eagles
Toiler	F. A. McMann	E. Scott

PROGRESSIVE STEAMBOAT CO., LTD., VANCOUVER, B.C.

Vessel.	Captain.	Chief Engineer.
Harry S.	J. R. Grauer	G. Denuis
Maagen	A O. Clampitte	O. Sherbruge
Progressive	T. T. Edwards	G. Dixon
Pronative	A. Lewis	O. Mathieson
Senator	H. Grauer	A. Toren

IMPERIAL OIL CO., SARNIA, ONT.

Vessel.	Captain.	Chief Engineer.
Imperial	H. C. Minnett	G. E. Down
Imperoyal	J. Wilkie	J. Smith
Iocolite	....	A. R. Fleming
Iocoma	G. T. Cross	C. Amburg
Royalite	N. McL. Scott	A. M. Davidson
Samalite	G. Finley	E. Condon

MATTHEWS STEAMSHIP CO., TORONTO.

Vessel.	Captain.	Chief Engineer.
Easton	D. N. Laroche	J. T. Myler
Edmonton	C. R. Albinson	F. A. Pringle
Malton	W. J. Moles	G. H. Finn
Masaba	J. A. Smith	W. Whipps
Riverton	H. Maitland	J. G. Fisher
Steelton	W. J. Kirkwood	J. A. McGill
Yorkton	R. Alexander	D. McKenzie

GEO. HALL COAL CO. OF CANADA, OGDENSBURG, N.Y.

Vessel.	Captain.	Chief Engineer.
W. D. MacTier	S. V. Anderson	Jas. Estes
Adrien Iselin	D. Hourigan	E. A. Barker
F. P. Jones	H. M. Russell	W. Thomson
Fred Mercur	S. J. LeBean	B. J. Manwaring
Geo. L. Eaton	W. A. Russell	W. J. Brown
John Rugee	H. Russell	J. W. Cline
L. W. Robinson	J. J. Powers	R. Jardin
Phenix	D. A. Kiah	E. A. Hyatt

REID, NEWFOUNDLAND CO., ST. JOHN'S, NFLD.

Vessel.	Captain.	Chief Engineer.
Argyle	G. O'Reilly	T. Moysk
Clyde	J. Knee	J. Pollock
Dundee	D. Blandford	H. Crawford
Ethie	N. Day	P. Burton
Glencoe	A. Blandford	F. C. Barnes
Home	S. Harbin	J. Cunningham
Kyle	L. Stevenson	J. MacFarlane
Meigle	J. Goobie	John MacFarlane
Sagona	B. Taverner	J. Buckingham

CANADA STEAMSHIP LINES, MONTREAL.

Vessel.	Captain.	Chief Engineer.
Kenora	S. H. Cook	Jas. Kelly
Kingston	E. A. Booth	W. Chipman
Laurentian	Jos. Boucher	E. Cantin
Longueuil	....	H. Noel
Louis Phillippe	H. Mandeville	A. Chayer
Macassa	J. Henderson	E. A. Prince
Mapleton	R. A. McLellan	A. E. House
Martian	J. F. Davis	R. Foote
Midland King	P. McKay	Jas. McGregor
Midland Prince	Jas. Tyndall	J. A. Pickard
Modjeska	P. Walsh	A. McLaren
Montreal	F. X. LaFrance	N. Beaudoin
Murray Bay	Jos. Latour	A. Charbonneau
Natironco	W. Beatty	G. McDonald
Neepawah	J. Aikman	W. Donahy
New Island Wanderer	W. C. Hudson	....
Quebec	Jos. Rinfret	J. Matte
Ramona	E. M. Charlebois	....
Rapids Prince	S. Putnam	G. M Hazlett
Rapids Queen	J. P. Stephenson	J. E. Kane
Renvoyle	J. Harrison	....
Rosedale	H. J. Aitkens	G. H. Dryburgh
Ste. Irenee	W. Gagne	O. Bonin
St. Lawrence	John Bertrand	B. F. Farrell
Saguenay	Jos. Simard	A. Godin
Sarnian	D. W. Burke	I. J. Boynton
Saskatoon	N. McGlennon	J. McKellar
Stadacona	H. J. Page	W. W. Norcross
Strathcona	J. Clarke	J. Douglas
Syracuse	....	A. F. Hamelin
Tadousac	Jos. Dugal	G. Gagnon
Tagona	J. Snowden	W. Taylor
Thousand Islander	C. H. Kendall	W. H. Willix
Three Rivers	A. Mondor	C. Gendron
Toronto	J. J. Jarrell	L. J. Lealie
Turbinia	B. W. Bongard	W. Noonan
W. G. Morden	N. Campbell	R. Chalmers
Wahcondah	Jas. Woolner	W. A. McLaren
Wiley M. Egan	N. Hudgins	....
Winona	C. O. Allen	J. J. Palmer

CIRCULATES IN EVERY PROVINCE OF CANADA AND ABROAD

MARINE ENGINEERING of Canada

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THE NEW TERMINALS AT HALIFAX, N.S., AS THEY WILL APPEAR ON COMPLETION.

Ocean Terminal and Port Development at Halifax, N.S.

By A. J. Campbell

The effort now being put forth to supplement the natural advantages which Halifax as an ocean port possesses is, although somewhat tardy, visible and tangible evidence that we have now become fully awake to the trade and commerce possibilities in Europe and elsewhere that its all-the-year-round value and facilities not only render available, but that as a matter of fact place all other Atlantic ports on this Continent under a handicap in many respects.

THE port of Halifax has long been regarded by naval and military experts as the key to the strategic situation in the north Atlantic. In commercial circles a similar opinion is now gaining ground. In suitability of alignment, in width and in depth, the harbor is unrivalled by any competing port on the Atlantic coast of North America. The entrance to the harbor is broad and for fully one-half mile of its width is over sixty feet in depth at L.W.O.S.T. The harbor requires no maintenance, is visible and almost straight throughout a length of seven miles from the entrance light.

A Natural Harbor

The natural protection and the average low range of tide of five feet, render open piers and tidal basins satisfactory. No such appliances as gates or locks are needed. Ships may enter and leave at any time of day or night with equal facility. The harbor is so easy to navigate—so free from bends and currents—that the largest vessels can enter and leave under their own steam. Recently some of the largest liners afloat, entered, docked and left the port under their own steam and with no assistance from tugs.

The advantageous geographical position of Halifax is evident to anyone who has studied the map. The harbor while contiguous to the North Atlantic route to Europe is sufficiently removed from the open shores of the ocean for ample protection. At the same time it is open all the year and is 250 miles nearer to Europe than any other port on the mainland of America. All vessels plying between Europe and such important ports as New York, Boston, Philadelphia, Portland and St. John pass close to Halifax, particularly in winter, and it is therefore most favorably situated as a port of call on the North Atlantic. When the proposed All-Red-Route was being actively discussed, Halifax was regarded on all sides as the best situated terminal point on the Atlantic. Different writers have pointed to its convenient situation on the probable main route from Europe to the Panama Canal. Halifax is the nearest Canadian port and is also nearer than Boston, New York or Philadelphia to seaports on the East Coast of South America, Mediterranean ports and seaports on the West coast of Africa.

Important Trade Route Terminal

By far the most important trade route in which Canada and the United States are interested is that between Europe and North America via the North Atlantic Ocean. Most of the exports of the natural products and manufactures of North America and Europe as well as a fair proportion of these originating in Asia and Africa are carried over this route. The ships employed thereon have long been the largest, fastest and best equipped in the world, and they have steadily increased in numbers and size with the development of the world's trade. Twenty years ago a 10,000 ton liner was considered very large. Now ships of 60,000 tons are in service and plans for larger ones are in progress.

Ship Sizes and Harbor Accommodation

It is well known that a more rapid increase in the dimensions of ships has been prevented only by the great expenditure and the length of time necessary for the preparation of harbor and dock works of correspondingly increased dimensions. Indeed all the largest ships of to-day are much shallower than they should be for economical construction and operation. Most of the great ports of the world are situated several miles up a tidal river or estuary and the deepening and widening of the harbors and the dredging of their approach chanels are slow and costly operations. The port of Halifax is certainly an outstanding exception. This natural harbor is free from littoral drift at the entrance and, as it has no large river entering, it is exempt from silting or bar formation.


VIEW OF THE HARBOR—CELLULAR CONCRETE BLOCKS IN FOREGROUND.

Almost from the founding of Halifax in 1749, the matter of wharfage and terminal facilities has been one of constantly recurring urgency. In recent years the principal wharfage facilities have been provided by a number of timber piers constructed at the Northern portion of the water-front known as the "Deep Water Terminals." In addition a reinforced concrete pier has been erected there, a description of which has already appeared in these columns. Even with this addition, it was felt that sufficient provision was not made for the existing and prospective needs of the port. In the last decade there has been not only a marked increase in the dimensions and speed. but also in the class of ships employed between Canadian and European ports. and there is every prospect that this improvement will keep pace with the phenomenal development of Canada which is looked for after the war.

Initiation of Development Scheme

Plans for a comprehensive scheme of terminals were begun by the Dominion Government in the summer of 1912. After an exhaustive survey of the situation, four alternative plans each with its own advantages and disadvantages were presented by the engineers employed. These gentlemen were F. W. Cowie, B. Sc., M. Inst., C.E., of the Montreal Harbor Commission as consulting engineer, and James McGregor, A M. Inst, C.E., A.M. Can. Soc. C.E. as president and superintending engineer Mr. McGregor had previously been with the Canadian Pacific Railway on construction work in Western Canada and also had considerable experience in the building of terminals in some of the largest ports of the world.

After consideration and comparison of the plans submitted, it was finally decided to adopt a site on the western shore of the harbor and nearer to the ocean than any of the old piers. The site extends southward along the water front for a distance of one and a quarter miles. This location was considered to be the most desirable with regard to the city population and industries ,and sufficient ground was taken for the extensions of the future. The adopted scheme of piers, basins and railway terminal facilities was prepared with a view to a progressive development extending over a period of years so that the future traffic requirements of the port may be fully met for a very long time to come.

Tenders were publicly invited for the construction of the first and most important unit of section of the dock works on September 2, 1913. The contract included the dredging of the harbor and basins, filling of reclaimed areas for quays, the construction of one and a quarter miles of concrete and granite masonry quay walls, concrete substructures for the transit sheds and buildings, sewers and other incidental works. The tender of the well-known firm of Foley Bros., Welch Stewart and Fauquier amounting to $5,250,000 was accepted.

Construction Work Begun

The contractors began work in March of 1914 and operations have continued since that time. The great depth of water and the somewhat unusual nature of the work required the use of a large amount of specially designed plant. Eighty-five acres of the shore land were expropriated, which with 115 acres reclaimed from the harbor makes a total area of 200 acres available for the terminal yards, quays, piers, etc. The area of water to be occupied by shipping inside the new pierhead line will be sixty-two acres. The distance between the pierhead lines and the opposite shore of the harbor is one mile and the depth of water seventy feet at L.W.O.S.T. In front of the terminal site there is therefore provided by nature free of cost a magnificent canting station one mile square and at least seventy feet deep perfectly protected from the ocean and remarkably free from winds and currents and an ideal situation for the turning and manoeuvring of ships of any pres-


CLOSE VIEW OF THE CELLULAR REINFORCED CONCRETE BLOCKS.

ent or proposed length, breadth, draught, or displacement.

The quays and piers were planned to provide twenty-seven berths for ships varying in length from 500 to 750 feet each, but ships up to 1200 feet in length can be accomodated with equal facility. Provision is also made for the berthing of coasting vessels and other smaller craft. The basins are suitably arranged for ships to pass in and out. and for the use of coal and other barges alongside.

Meantime Scope of Undertaking

The first unit of the docks now under construction will include the Bulkhead Passenger Landing Quay, North Quay of Basin No. 1, and the Bulkhead Quay of Basin No. 2, and will provide berthage with sheds etc., for nine ships of the Alsatian type. All these structures together with the breakwater have been carefully laid out along orthogonal lines to simplify construction and so as to concentrate within a comparatively small area a maximum of quay space and berthage with ample transit sheds and buildings, and with convenient and adequate truckage and paved driveways to each berth. The piers and basins are laid out at right angles to the shore line, and also to the direction of maximum fetch and exposure.

The breakwater at the extreme south protects all the piers and basins to the north of it from the south and southeast which are the only directions from which seas of any weight can enter the harbor. With the exception of Basin No. 1, all the piers and basins will be of the same dimensions and area. The basins are widened out towards the harbor and the piers toward the land, thus effecting a saving in cost of construction and affording extra width where most required. It is expected that three berths in Basin No. 1 will be ready for use next winter and that two temporary wooden sheds will be ready for use on the north quay of same. The excavation of the railway yards at the dock is well advanced, and sufficient trackage will be provided there next winter to deal with the traffic to and from the three berths at Basin No. 1.

THE MOBILE PNEUMATIC CAISSON EMPLOYED.

Bulkhead Passenger Landing Quay

The Bulkhead Passenger Landing Quay will be 2006 feet long, sufficient to accomodate three ships 650 feet long or two ships 1000 feet long. It is situated at the north end of the works nearest to the centre of the city and adjoining and directly connected with the Union Passenger Station to be constructed. Each of the five piers and six basins will be 1250 feet long and will taper from 320 to 360 feet in width. The piers are designed for four 600 feet ships, two on each side, or for two ships each up to 1200 feet long, one on each side and with no part of either ship projecting beyond the pierhead line. The basins will have a minimum depth of forty-five feet at L.W.O.S.T. This is five feet deeper than that provided at New York or Southampton and ten feet deeper than at Boston. The rubble mound breakwater at the seaward end has a quay wall on the inner side 1205 feet long and an open rip-rapped slope on the outer or seaward side protected with heavy blocks of rubble.

Quay Wall Features

Quay walls of concrete and granite will be constructed along the lines of the bulkhead landing quay, basins and piers, while the areas between the respective walls, and between the walls and the shore, will be filled in with materials from the railway excavations, dredged materials from the basins, and materials secured by dredging from the eastern side of the harbor. About one-third of the total length of quay wall is constructed and about sixty per cent. of the foundation work for the remainder completed. The dredging of the basins and for the quay walls is ninety per cent. completed. This dredging was done by means of a dipper dredge with a seven cubic yard bucket to a depth of forty-five feet below low water. At greater depth the dredging was done by a very heavy orange peel bucket of five and one-half cubic yards capacity. The rock in the basins and under the quay walls was drilled by Keystone well

CELLULAR CONCRETE BLOCK BEING PLACED IN POSITION.

drills, blasted with dynamite, and afterwards dredged. The method employed in constructing the quay wall is described by Mr. McGregor as follows:—

The quay wall is for the most part founded on solid rock but where the depth of rock exceeds 55 feet below L.W.O.S.T. a broad rubble mound foundation is used, the top of which will be at 45 feet below L.W.O.S.T. The walls are constructed of cellular reinforced concrete blocks each about 31 ft. by 22 ft. by 4 ft.1½ inches, with outside walls and partitions 8 inches thick, each block weighing about 62 tons. All the cells in the bottom blocks and the front and centre cells only of all the other blocks are filled with concrete. The remaining cells are filled with rock, sand and gravel from the excavations. The cellular blocks at the front reach to a height of 1 foot below extreme L.W.L., and at 4 ft. 8 in. back from the face they are continued with narrower blocks up to 1 foot above H.W.L.

Above this the construction is of rubble concrete faced with cut granite masonary begining with a heavy corbel course and finishing with a granite coping 3 ft. wide and 16 inches deep, with the exposed arrises rounded to 2½in. radius. The joints are secured with secret steel dowels. The back of the wall is made vertical to simplify the blocks carrying the front columns of the transit sheds, and to provide width on top to carry the permanent railway track as well as the temporary construction tracks for the block setting machines which will lay the blocks by the "Over End" system. These travel outward upon the blocks as they are placed, and so eliminate the use of temporary staging of floating plant. The front of the walls is made vertical and the toe projection reduced to a minimum to suit the almost rectangular midshop section of modern large vessels.

The walls will be built in lengths of 22 feet, each length consisting of a vertical stack of 13 cellular blocks. In this way the block setting is very simple, and allowance is made for settlement and expansion and contraction. The vertical joints between the stacks are made with vertical reinforced concrete key posts 14 ins. by 14 ins. in section, which also act as guides in adjusting and setting the blocks. The bottom was cleaned and made ready for the mass concrete by means of a self-submerging raising and floating steel and timber diving bell specially designed for this work. This diving bell or mobile pneumatic caisson has a working chamber 38 ft. by 26 ft. by 8 ft.; has separate man and material shafts and air locks, and can work safely with compressed air to a depth of 55 feet of water. It is lighted with electricity and provided with high pressure air and water systems for drilling and cleaning the foundations.

VIEW OF CUTTING SHOWING TEMPORARY BRIDGE FOR STREET.

Transit Sheds

The transit sheds on the quays and piers will be built of steel and concrete. Each will be 100 feet wide and will be fully equipped with the best mechanica appliances, water supply and fire protection, offices, coaling facilities, grain conveyors, railway tracks, paved roads and teamways etc. Cargo sheds will be provided at the passenger landing quay where also special appliances and facilities will be installed for the expeditious landing of passengers, baggage, mails and express freight from the ships to the trains, and vice-versa. A large terminal grain elevator with ample trackage and fully equipped with belt conveyors and spouts will be erected .

Railroad Connections

To obtain the necessary railway connection for the new terminals, an extension of the Intercolonial Railway is necessary. After the comparison of several alternative lines in tunnel and in the open, and at various elevations, it was decided to extend the railway in the open from Fairview, via the east side of the North West Arm. The contract for construction was awarded on July 2, 1913, to the Cook Construction Co., and Wheaton Bros. The tender amounted to $1,500,000. Work was at once begun at both ends of the line and has since proceeded slowly but surely through the heavy rock cuttings. The contractors have a well-organized force and an efficient plant in use, including five complete steamshovel outfits. The contract included the filling in with materials from the railway cuttings and the formation of a new terminal freight yard at Bedford Basin, grading of a portion of the ocean terminals, and the formation of the rubble mound breakwater also with rock excavated from the cuttings and yard areas. This breakwater will be completed during the present summer .

The new railway line which is about five and a half miles long will be double-tracked throughout and sufficient right-of-way has been acquired for four tracks should more become necessary. The construction of the culverts and bridges of a permanent character is being proceeded with. Grade crossings have been entirely eliminated. In the location of the railway along the beautiful Arm and through one of the finest residential districts of Halifax, care has been taken to preserve as far as possible the natural scenery. The cut is now practically ready for the rails and it is expected that track laying and ballasting will be begun this summer, so that the railway connections will be ready for use in connection with the three berths next winter. The work of trimming off the sides of the cutting is at present in progress. Over two million cubic yards of material have been excavated and transported to be used as fillings elsewhere. An eighty-five pound rail will be laid .

Freight and Passenger Arrangements

All freight trains to and from Halifax will be cared for at a new Freight Receiving, Classifying and Departure Yard. This yard is being constructed on an area that has been reclaimed from Bedford Basin by filling in, and has a length of one and a quarter miles. The filling in is nearly completed and the track laying and ballasting of the whole yard will be ready in time for next winter's traffic. All freight cars will be moved between this new freight yard, the Ocean Terminals, the city freight yards and sheds, by switching and transfer engines.

The general scheme for the Passenger Terminals consists of a large passenger station building shaped like the letter

T—the foot of the T being at the shore end and the head on the landing quay. The shore end will provide accommodation for the local Halifax traffic, and will contain the ticket offices, baggage and parcel checking rooms, restraurant and lunch rooms, retiring rooms with toilets, and, on the upper floors, office space for the railway and steamship lines. The shore end of the building will face on a plaza 400 feet in depth. Upon the northern end of the landing quay the top portion of the T-shaped building will be placed. Passengers disembarking from the steamships will enter the building at the second storey level and will be distributed in the usual way for Customs examination. The baggage will be transferred, after examination, by means of chutes, or elevators to a distributing baggage room below, from which it will be routed to cars according to destination.

Mails will be conveyed directly from the steamships to the lower level where they will be loaded on cars. Passengers pass conveniently into an apartment between the steamship station and the Halifax City station, forming the stem of the letter T. This is a booking hall containing ticket offices for the various railway, and steamship lines where passengers may quickly and easily obtain railway tickets and baggage checks. They can then either step into the train concourse or into a waiting room.

Train Concourse

The train concourse is designed for the common use of the Halifax City traffic and the steamship passenger traffic. The floor of this room is placed level with the second story of the steamship passenger level and is also at the same level as the ticket lobby floor of the Halifax City station. The passenger platforms of the train shed are placed at a level midway between the train concourse and the baggage room beneath. Passengers will reach the passenger platforms from the train concourse level by means of easy inclines instead of stairways. Separate inclines and separate trucking platforms for baggage trucks are provided. A portion of the building will be reserved for the immigration service. These rooms are not directly connected with the other portions of the station building.

Miscellaneous

The other general arrangements include a separate power house for the furnishing of heat, light, and power for all the buildings. A large passenger coach-yard fitted with buildings for cleaning coaches and equipping dining and sleeping cars will be provided immediately adjoining the passenger station. A broad subway for vehicular traffic will be constructed to pass under the freight and passenger tracks connecting with a broad-paved roadway leading to all the steamship berths and the main city thoroughfare. The grading for the site of this building is now in progress, and construction will be begun at an early date .

GUN ABOARD DOES NOT AFFECT STATUS.

THE fact that a merchant ship is armed with a gun with which to defend itself does not change its character so as to permit men engaged as crew to refuse to go on board and serve, even though the contract they have signed are the ordinary pre-war Articles relating to merchant ships.

This was the effect of a judgment handed down recently by Judge Leet in the case of five firemen who refused to board a ship sailing from Montreal to England. The men were sentenced to ten days each in jail, His Honor remarking that he wished to be lenient under the circumstances, and that he believed that the men had probably acted in good faith. The men were engaged in New York through agents of the steamship company, it having been found impossible to get the necessary complement locally. This is the first case of the kind to be tried in Canada.

Judge's Summing Up.

His Honor remarked at the outset that the charge of desertion against the men could not stand, for it had been shown that they were under surveillance from the time of their arrival here. The other charge was of refusing to go on board the ship. The judge reviewed the facts of the case, the hiring of the men in the United States, their arrival here, the non-arrival of their baggage, and its subsequent appearance as a result of efforts on the part of the shipping company.

"The only question was to decide whether the fact that the ship was armed makes any difference," he continued. "I have no experience in marine matters, and do not know much about the law regarding the arming of a merchant ship for defensive purposes. It is a question whether the carrying of this gun would change the nature of the boat, or make such a difference in the condition of affairs as would allow the men to refuse to carry out their contract. Certain facts connected with the case are matters of common knowledge. These men knew, must have known, that there was war between Great Britain and Germany, and that every vessel leaving a Canadian port was in danger, that it might be overhauled by a German cruiser or submarine, captured or sunk. That is a fact that is so public that everybody must know of it. If they were willing to come and take service on a merchant ship, then the fact that it was sailing from a Canadian port would make no difference.

"From the evidence given, and the authorities cited," continued His Honor, "I do not think that it does make any difference that the ship carried this gun." He remarked on the means of protection which would be afforded the ship across to England.

"I, therefore, come to the conclusion that because it carried one gun for the purpose of defence is not a reason for declining to go on board. They knew, when engaged in New York, that Canada was a British country, and that the ship was going to England and return. All the risks of the trip were appreciated, and I cannot see that the fact that the ship carried a gun made any difference in the agreement, or added to the risk, or allows a pretension to claim that the engagement was made under false pretences. I have, therefore, to find that you are guilty."

In regard to the penalty, the court pointed out that the ship had sailed short five of its crew because of the action of the accused, and the result would perhaps be serious to the ship, and in any case mean more work for those on board. However he felt that the men had acted in good faith, and their side of the case had been put by their spokesman in a sincere manner, and under the circumstances he would not be severe. Sentence of 10 days followed.

CUSTOMS AND INLAND REVENUE

NEW records have been the order of the day in the monthly returns of customs and inland revenue receipts for the port of Montreal for the past year. The receipts for the past month are no exception. The customs receipts total $2,694,761, almost a million dollars in excess of the total for the same month last year; the inland revenue receipts total $975,000, about $35,000 in excess of the month of July last year. The biggest day in customs receipts for the past month was the 27th, when $173,130 was collected.

That these big figures are not spasmodic, but rather the result of a steady growth, is evident by a casual glance at the results for the past year or so. Every month has shown an improvement of nearly a million, and at times more than a million, over the corresponding month of the preceding year. The record month for the port in customs was May last, with $3,226,128; this being the month in which navigation opened naturally caused it to go higher than other months, but it is a million over the month of May in 1915. The smallest month in 1916 is February, with a total of $2,329,973, but $700,000 more than February, 1915.

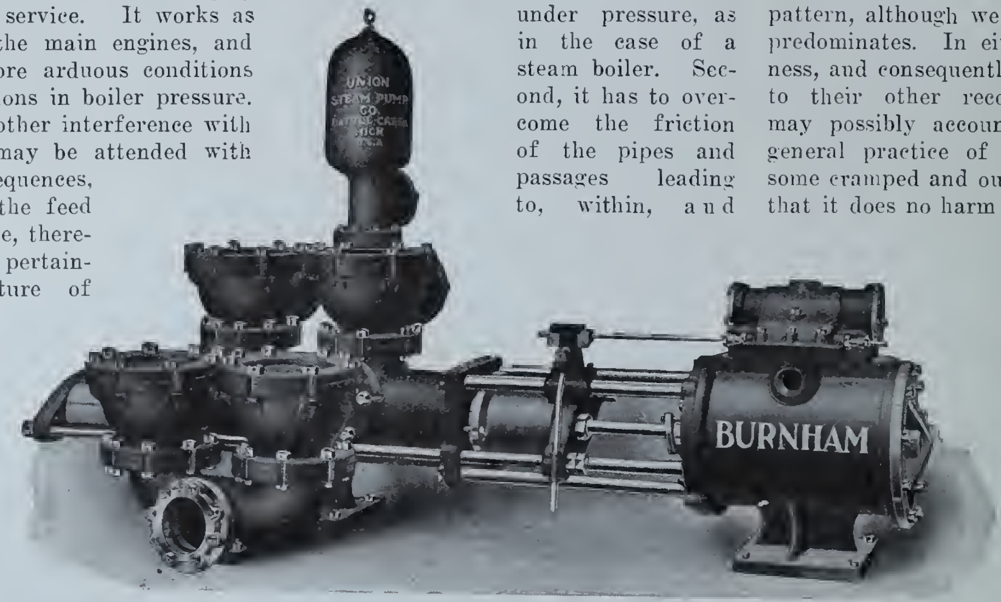
Steam Driven Auxiliaries of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that steam-driven auxiliaries aboard ship continue to increase in number, and that they are being designed and constructed to meet in the most effective manner, both ordinary and special service applications, this series of articles describing and illustrating at least the more important types of such apparatus seems to us more or less timely, both from the point of view of familiarizing engine and boiler room staffs with the products of different manufacturers, and that of their acquiring a closer intimacy with specific detail arrangement relative to operation, maintenance and periodic overhaul.

BOILER FEED PUMPS

THE first consideration in a boiler feed pump is that it be thoroughly reliable in service. It works as continuously as the main engines, and usually under more arduous conditions as regards variations in boiler pressure. A breakdown or other interference with the boiler feed may be attended with very serious consequences, whether due to the feed pump or otherwise, therefore everything pertaining to this feature of steam plant equipment should be characterized by certainty of action, economical operation, excellence of design, workmanship and material, simplicity of arrangement and easy access to all working parts.



"DARLING BROS." OUTSIDE PACKED, PLUNGER PUMP POT VALVE PATTERN.

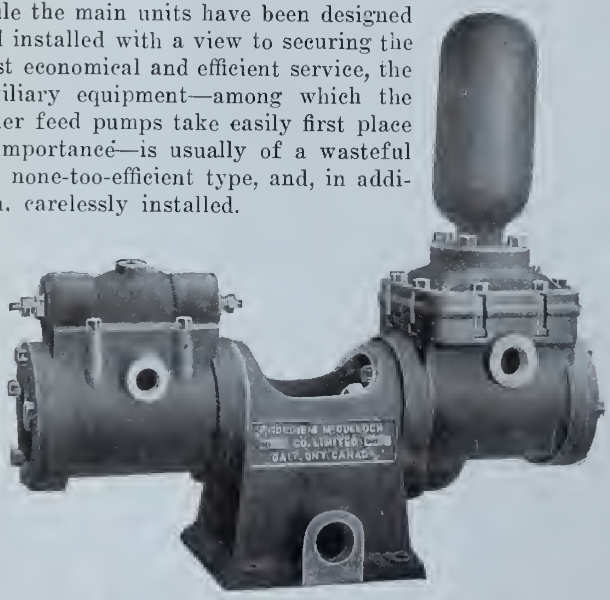
In all power plant installations, whether afloat or ashore, there exists to a lesser or greater extent the anomaly that while the main units have been designed and installed with a view to securing the most economical and efficient service, the auxiliary equipment—among which the boiler feed pumps take easily first place in importance—is usually of a wasteful and none-too-efficient type, and, in addition, carelessly installed.

The work to be performed by any type pump may be considered as of three kinds:—First, it has to overcome the head to be pumped against, as when it discharges against an ordinary head of water, or what amounts to the same thing, when it discharges against a fluid under pressure, as in the case of a steam boiler. Second, it has to overcome the friction of the pipes and passages leading to, within, and from itself. Third, it has to exert a pressure to cause the discharge to take place at some required velocity.

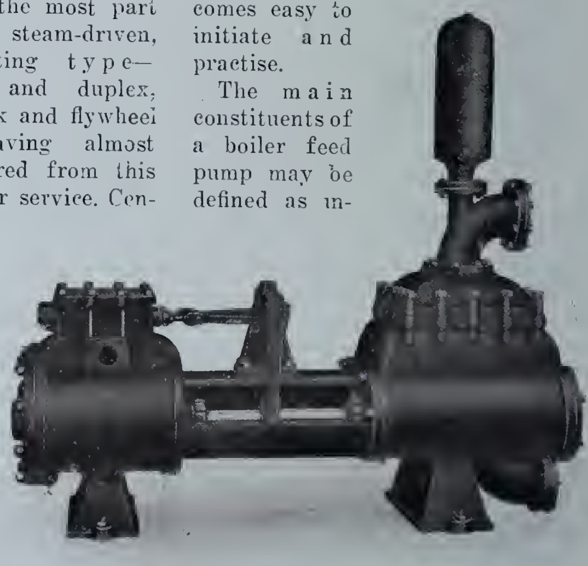
Boiler feed pumps are for the most part of the steam-driven, direct-acting type—simplex and duplex, the crank and flywheel type having almost disappeared from this particular service. Centrifugal, or, more properly speaking, turbine pumps, are finding a sphere of usefulness in boiler feeding, being driven either by steam turbine or electric motor.

Steam-driven, direct-acting, boiler feed pumps, whether simplex or duplex, are built of both horizontal and vertical pattern, although we believe the former predominates. In either case, compactness, and consequently space-saving, add to their other recommendations, and may possibly account for the almost general practice of installing them in some cramped and out-of-the-way corner that it does no harm to fill, but that nothing appears to fit in so perfectly as does a boiler feed pump. This, of course, is not as it should be, either in justice to the pump mechanism and its maker, or to the scheme of plant efficiency which should be existent. Neglect, wilful or through indifference, due to the unit being more or less out of sight, and, therefore, more or less out of mind, until something happens, becomes easy to initiate and practise.

The main constituents of a boiler feed pump may be defined as involving a steam and water end, all makes and types, of course, being included in the definition. In the simplex type the steam end is em-

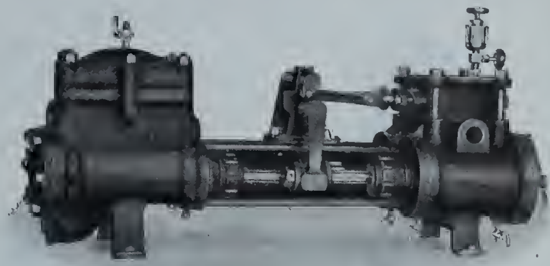


"GOLDIE & McCULLOCH" SIMPLEX PISTON TYPE BOILER FEED PUMP



"SMART-TURNER" DUPLEX, PACKED PISTON PUMP.

"SMART-TURNER" DUPLEX, OUTSIDE END PACKED PLUNGER PUMP WITH POT VALVES.



"SMART-TURNER" DUPLEX, PACKED PISTON PUMP

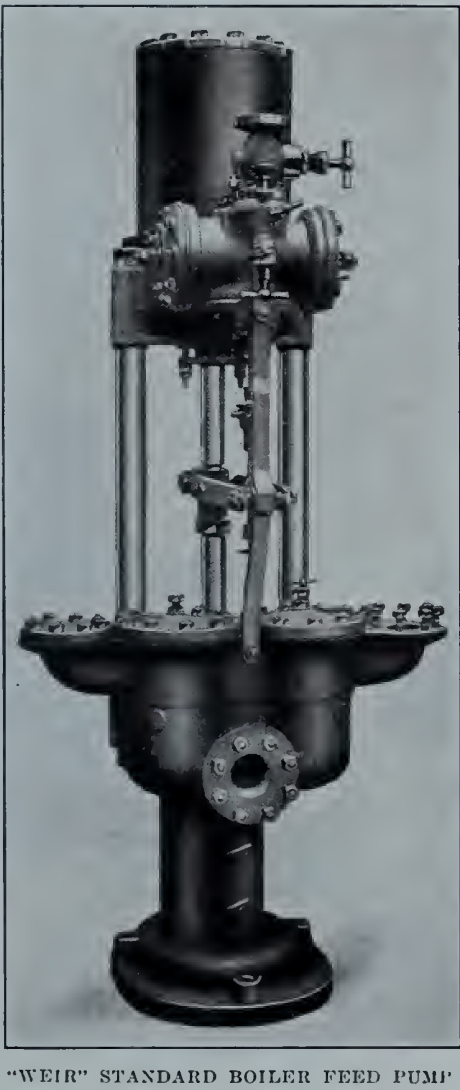
bodied in a single cylinder, the water or pump end being similarly constituted. In the duplex type, on the other hand, a combination of two steam cylinders operates on a combination of two water cylinders. Applicable to both of the foregoing is the compound and triple expansion arrangements, consisting of high and low, and high, low and intermediate pressure steam cylinders respectively, placed tandem fashion. In these latter designs it may be mentioned at this stage that the purpose is to use the steam required for operation expansively.

Water ends of boiler feed pumps may be either of the piston or plunger type, arranged double-acting in all cases. Relative to the plunger type, the pump may be known as either outside centre packed, or outside end packed. For the most part steam and water ends of different makes vary in their constituent design and detail, as a consequence the operative and connecting mechanisms vary correspondingly. All, however, are designed and manufactured with a view to attaining the same comprehensive service ideal; it is not, however, within the scope of this series of articles to make comparison or draw distinctions.

Boiler feed pumps, as indeed all pumps of the reciprocating type, should embody to the fullest extent possible the features of moderate speed, quiet operation, absence of a dead centre, the ability to start up from any part of the stroke, uniform length of stroke with varying speeds and pressures, most economical steam consumption possible, minimum clearance spaces, strength and suitability of material of their make-up to withstand the service pressures to which they are subjected, and to keep tear and wear at a minimum, etc.

In a subsequent article the more prominent designs and types of boiler feed pumps being manufactured for power plants, large and small, will be individually described and illustrated, the latter, for the most part by means of sectional drawings, so that readers may become thoroughly familiar with the various details and mechanisms entering into each complete unit. The component parts of boiler feed pumps are in the main delicate of construction, adjustment and handling, and it is not beyond the range of possibility that a new interest may be awakened and a more intelligent conception of their care and treatment be the immediate result of perusal of the featured products of the various makers.

Before entering on this phase of our subject, however, it seems meet that operators and others concerned should become conversant with the guidance and instruction offered by manufacturers, particularly relative to installation, operation care, adjustment and trouble investigation of boiler feed pumps. It may be said that there is complete unanimity of advice on these various points ,and specific instruction is always available with reference to details of individual pump products.



"WEIR" STANDARD BOILER FEED PUMP

Installation and Other Features

When installing a boiler feed pump, it is always desirable that the pump should be located so that the water will flow into the pump. This feature is absolutely essential in the larger sizes and 'where hot water is to be handled', because a pump cannot lift hot water by suction.

It is recommended that a boiler feed pump should not be run faster than 35 ft. per minute, and it is much more desirable to run the pump 20 or 25 ft. per minute. This not only gives the engineer a large reserve capacity should he have to force his boiler in case of emergency, but it prolongs the life of the pump and decreases the repair bill.

It is also desirable to locate the pump as near the source of supply as possible. If a feed water heater is used, put the pump within two or three feet of the heater, or if not possible to do this, raise the heater three or four feet above the pump so that you are positive that there is sufficient head of water to overcome the frictional resistance of the suction pipe and make the water flow into the pump.

For general service, such as handling cold water, it is permissible to run the pump at a much higher speed than given rated capacity. The speed will depend on the material handled. If the liquid handled is clear, cold water, the pump may run from 75 to 100 feet per minute. If the water is warm, it must run more slowly, or if the suction lift is high, the pump should not be expected to run at maximum speed. In no case should the pump be expected to lift water by suction more than 22 feet.

The suction pipe should be as straight as possible, and as free as possible from bends and elbows, but, where these cannot be avoided, the suction pipe should be made one or two sizes larger than the pump suction, and a suction air chamber should be installed. This usually consists of a vertical length of pipe no smaller than the suction of the pump and from 4 to 6 feet high, capped over at the top and provided with a pet cock to insure that it is filled with air.

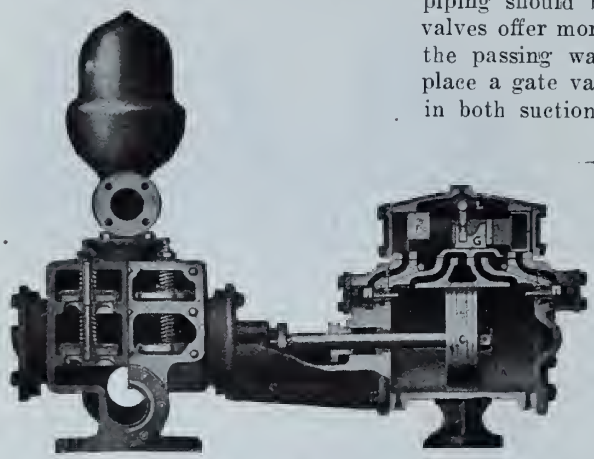
though this pet cock need not be left open. The office of this suction air chamber is to keep a continual flow of water passing through the suction pipe. The water will surge into the suction air chamber when the pump reverses, thus avoiding water hammer, which

be larger as the friction due to the excessive length will partly overcome the head due to the vacuum and prevent a full supply of water. Give the suction pipe a uniform grade of about 6 inches per 100 feet towards the supply source.

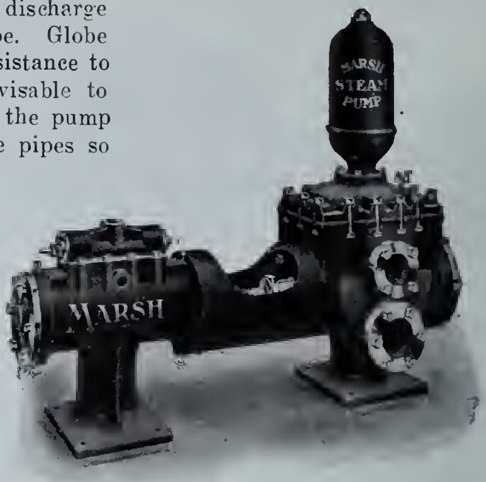
All valves in suction and discharge piping should be "gate" type. Globe valves offer more frictional resistance to the passing water. It is advisable to place a gate valve at or near the pump in both suction and discharge pipes so

not required for a time. Take off the covers and oil the slide valves, piston, etc.

Don't let things hang. If you see there is something the matter, find out what it is at once and get it put right.



SECTION THROUGH "A. S. CAMERON" SIMPLEX DOUBLE-ACTING PISTON TYPE BOILER FEED PUMP.



"MARSH" SIMPLEX, PISTON TYPE, BOILER FEED PUMP.

might cause trouble to the pump or to the pipes.

The discharge pipe should be large and free, but this is not as essential as it is with the suction pipe.

Blow out steam pipe thoroughly before connecting up your pump. Any dirt or rubbish carried into a steam cylinder will cut and wear it away.

In cold weather, open the drip cocks to drain the steam and water cylinders, otherwise they may burst if allowed to freeze.

Suction pipe must be absolutely tight, and it is always well to use a foot valve and strainer.

Do not use tallow in the steam cylinder, but a little of the best refined mineral, sperm or lard oil. Any oil that corrodes or gums the working parts is unfit for use. Oil steam end just before stopping pump.

Keep stuffing boxes full of good packing, well oiled, and just tight enough to prevent leakage without excessive friction.

See that the pump has always a full and steady supply of water.

If the pump commences to run badly, make sure that the water end-valves and piping are right before examining the steam end.

In running piping to or from the pump, avoid all possibility of the formation of air pockets.

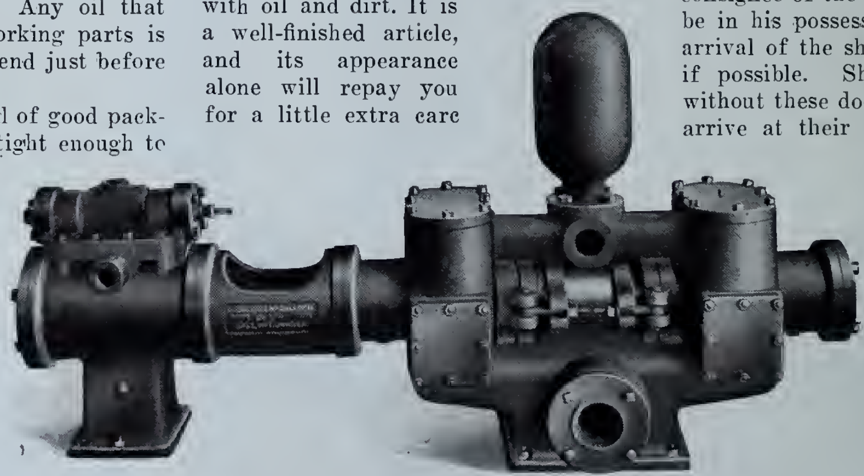
The suction pipe should in no case be smaller than that given by the maker of the pump. If the pipe is long, it must

that the pump may be isolated if need be for examination.

A relief valve of ample size, and set at slightly higher pressure than that against which the pump operates, should be placed between the pump and any shut-off valve in the discharge line, in order to avoid damage to the pump if the latter is started up with the feed check or other shut-off valve closed.

Pump valves should be examined occasionally to see that they are seating properly. Foreign substances are apt to be drawn up through the suction pipe and become lodged between a valve and its seat, causing leakage and a corresponding reduction in pump capacity.

Don't let your pump get covered up with oil and dirt. It is a well-finished article, and its appearance alone will repay you for a little extra care in keeping it neat and clean.



"GOLDIE & McCULLOCH" OUTSIDE PACKED, PLUNGER TYPE, BOILER FEED PUMP.

Don't expect the pump to feed quietly with the water in the supply tank partly below the top of the suction pipe, or if the pump is otherwise drawing air.

Don't leave the pump to rust if it is

READERS' QUERIES FOR READERS' ANSWERS

WHY will water that has been subjected to heat freeze quicker than that which has not been heated?

Why does water that has been heated take more heat to reheat it again?

Explain why atmospheric humidity affects people when the temperature is high, such as in the case of sunstroke? Does it have any effect in a low temperature?—Subscriber.

FORWARDING OF DOCUMENTS

BILLS of lading and consular invoices should be forwarded promptly to the consignee of the goods, so that they may be in his possession at the time of the arrival of the shipment, or even before, if possible. Should the consignee be without these documents when the goods arrive at their destination, they might have to be stored at his expense and risk, or he might be compelled at an inconvenience to give a bond for the production of the papers. When consular invoices are not required, shippers should forward to the consignee itemized invoices, showing the quantities, brands, grades, prices, etc., of the different goods, for the purpose of entering same at the Custom house abroad. Attention to such matters facilitates to a great extent clearing operation.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

S.S. "ARACHNE" STRANDING

A FORMAL investigation was held in Quebec on July 19 and 20, 1916, before Captain L. A. Demers, F.R.A.S., F.R.S.A., Dominion Wreck Commissioner, assisted by Commander E. G. V. Eliott, R.N.R., and Lieutenant James A. Murray, R.N.R., acting as nautical assessors into the causes which led to the stranding of the S.S. "Arachne," near Point Plate, Miquelon Island, on June 20th, 1916.

C. A. Duclos, K. C., appeared on behalf of the owners of the vessel, Messrs. Rickinsons Sons & Company, of West Hartlepool, and her master and officers.

The master, G. R. Sergent, deposed that he had been to sea for thirty years and never had an accident; that the S.S. "Arachne" was a steel built, schooner rigged, single screw vessel of 2,471 tons net, and 3,898 tons gross, of a speed of $10\frac{1}{2}$ knots loaded; that she was bound from Montreal with a cargo of wheat in bulk and bags, and was drawing 22 ft. 9 in. forward, and 23 ft. 7 in. aft.

He stated that he took his departure from Bird Rock, the weather then being hazy. He deposed that the course he laid down would allow him to pass clear of the Miquelon Group; that during the afternoon of the 19th June, he took several casts of the lead on Burgeo Bank, which gave him from 45 to 70 fathoms of water, and from that he came to the conclusion he was passing over the bank, and, therefore, that his course was a correct one, and followed on the same course.

In the meantime throughout the day and up to the time of the stranding the weather was thick intermittently; but at no time was it clear enough to allow him to see objects at a great distance for any length of time. However, no more casts of the lead were taken. At 6.15 a.m. on June 20 the vessel grounded. After the soundings had been taken on board and around the vessel he determined that she could not be floated without assistance, and proceeded to St. Pierre Miquelon for aid, and on his return 800 tons of grains were jettisoned and 1,200 tons put into lighters, and with the assistance of some other vessels they succeeded in releasing the vessel some eight days later.

The mate, second officer, wheelman and engineer also gave evidence corroborating the master.

Finding

After considering the evidence very closely and carefully the court came to the conclusion that the navigation of this vessel was not conducted with all the prudence that was required.

Whilst some criticism may be attached to the methods of the master when he sighted Bird Rocks to assume approximately that he was a distance of four or five miles off, from hearing the fog horn and seeing the light, although he did not take a four point bearing, or even a two point bearing, or consult the log, in view of the weather conditions, the court thinks that more precautions should have been exercised to obtain the position of the ship by a cast of the lead.

However, this did not contribute to the big deviation which was found in the course the ship had steered.

After steering a certain course for a certain distance with a view of making Cape Ray abeam, or more or less abeam, he did not see Cape Ray, although he estimated he could see about 10 miles, and his course would bring him that distance off that point. His evidence in this respect was contradicted by the mate, who said he could not see more than four or five miles at that time.

When off the Burgeo Bank, as he assumed, he took several casts of the lead; but in taking them he did not consult his log at intervals to ascertain the distance he had covered, and therefore the efforts he made in that line did not carry with it the necessary information as to the position of his ship, because had he taken those casts and carefully ascertained the distance between each, he would have found his vessel was to the north of the bank, whilst he assumed he was passing through the bank which would have given him a safe distance off the Miquelon Group.

Where the court places considerable importance is from this point up to the time of the stranding, he kept his vessel at full speed or practically full speed, which was foolhardy behavior on the part of the master in view of the state of the weather existing, for two reasons, firstly, on account of the thick weather and the probabilities of meeting sailing vessels and fishermen, which abound in that vicinity; also owing to the fact that an observation deviation on that course had not been obtained for twelve months it was certainly wrong for him to assume that the course he was steering was proper, and from that point until he would find that he was past the Miquelon Group, it was elementary for him to diminish the speed of his vessel and take casts of the lead frequently thereafter. However, such was not done.

Therefore, in view of the conduct of the master in this matter, and taking into consideration his long service without an accident; also his frank confession of the facts as they occurred, without any attempt at prevarication, the court will show its appreciation of such evidence and his long and good record, by not retaining his certificate; but centure and reprimand him severely for the non-accomplishment of these navigational principles, which although ordinary are necessary.

STRANDING S.S. "TYNE"

A FORMAL investigation into the causes which led to the stranding of the SS. "Tyne" on Twelve Foot Patch, Old Proprietor Island, Grand Manan, on July 23rd, 1916, was held in the Court House, St. John, N.B., on July 28th and 29th, 1916, before Captain L. A. Demers, F.R.A.S., F.R.S.A., Dominion Wreck Commissioner, assisted by Captain A. J. Mulcahy and Captain James Hayes, acting as nautical assessors.

The first witness examined was Captain Herbert William Robson, master of the S.S. "Tyne," who deposed that he holds a master's certificate, N. 002336; that he has been in command for three years; that his vessel is steel built, single screw, with triple expansion engines, capable of a speed of 10 knots; that she is owned by the Royal Mail Steam Packet Company, and has a registered tonnage of 1,820, and gross tonnage of 2,909; that she carried a crew of 32 men, including three deck officers and four engineers.

He stated that the vessel had gone to Herring Cove, from Sydney, N.S., to load lumber for a French port, under Admiralty orders; that she left Herring Cove at 4.20 p.m. on July 22nd, shaping a course to pass Terre Haute; that there was an error of 23 degrees W, on the compass, which was applied; that he estimated he passed 1 mile or $1\frac{1}{2}$ miles off Terre Haute, as he saw the land and heard the horn; but he did not take a cast of the lead to ascertain the exact distance off.

Other witnesses, including the first officer and wheelman were examined, such as the second and third officers, engineer and look out man, who all verified the testimony of the master.

Finding

The evidence in this matter having been carefully reviewed and weighed, the court has come to the conclusion that the master, H. W. Robson, did not adopt all the prudence that was required in navigating his ship, taking into consideration the fact that he was a stranger in these waters, and that he sailed from a port outward bound, with a state of atmosphere which prevented him from seeing at a very great distance, and owing to the direction of the wind at the time he should have anticipated that it would become denser.

He was in default on two points, which we call grave errors of judgment, viz., firstly, to have left port without streaming his log, no matter what condition he found it to be in. The fact that the instrument was on board, even though it was found to be erratic on previous voyages, it was his duty to have ascertained the amount of error, and either add or subtract from his calculations accordingly. To navigate a vessel, meeting conditions existing in the Bay of Fundy, such as tides, by basing himself only on the number of revolutions the ship was making, nothwithstanding the fact that he stopped occasionally to take soundings, is not a very reliable method to adopt.

Some time before the stranding a cast of the lead showed 100 fathoms, and a few hours later 27 fathoms were found, and the ship proceeded at half speed until another cast showed 8 fathoms, when the vessel was stopped, although the engines were not reversed.

At this point we think the master erred greatly in judgment in not going full speed astern on his engines the moment the 27 fathoms were found, which indicated the water was shallowing rapidly. Had he done so this mishap most likely would have been avoided.

The court decided to meet the justice of the case by reprimanding and severely censuring the master for failing to adopt the precautionary measures mentioned above.

The court does not attach any blame to the officers.

"WARTENFELS"—"LUCILLE M. SCHNARE" COLLISION

A FORMAL investigation was held in the Court House, Quebec, on June 30th, 1916, before Captain L. A. Demers, F.R.S.A., F.R.A.S., Dominion Wreck Commissioner, assisted by Commander E. G. V. Eliott, R.N.R., and Lieutenant James A. Murray, R.N.R., acting as nautical assessors, into the causes which led to the collision between the S.S. "Wartenfels" and schooner "Lucille M. Schnare," on June 18th, 1916, at a place five to seven miles south of Cape Pine, Newfoundland, resulting in the sinking of the schooner and the loss of one life.

Messrs. A. R. Holden, K.C., and C. A. Pentland, K.C., represented the SS. "Wartenfels," and her masters and officers, and Mr. Humphrey Mellish, K.C., of Halifax, appeared on behalf of the schooner "Lucille M. Schnare," her owners and crew.

The master of the "Lucille M. Schnare," Artemus Schnare, testified that he held no certificate, although he was master of the aforesaid schooner; that he was also part owner of the vessel; that the 'Lucille M. Schnare" was a new vessel on her first trip to the Banks; that she was built of wood, of 93 tons, carrying a crew of 19 men all told.

The vessel had ballast, stores and bait, and was bound for the banks.

Captain D. C. McKenzie, of the SS. "Wartenfels," testified that he holds an extra master's certificate, No. 034819; that his vessel is owned by the Admiralty and inward bound, light, to load for the Admiralty; that her new tonnage is 2,835, and her gross 4,511; that she is a steel built screw, of a speed of 11 knots; that she carries a crew of 79, including three properly certificated officers, and five engineers; that she was supplied with all the necessary instruments for the navigation of the vessel, and that the compasses had very little error.

The other witnesses whose testimony was heard corroborated the more important statements of the foregoing witnesses.

Finding

The evidence being carefully reviewed, discussed and weighed, the court cannot arrive at any other conclusion than this collision was unavoidable, and therefore no blame is attached to anyone for its happening.

To arrive at such conclusion the court based itself on the following essential points of the evidence. The steamer at the time and prior to the collision, in fact for four hours before, had been going at various speeds from half to slow. The condition of boilers and tubes, which were under repair at the time, precluded the application of high pressure of steam equivalent to the ordered speed, which under favorable conditions of boiler efficiency would have given higher speed under a half speed or slow order.

That the fog signal was sounded at regular intervals has been proven by the evidence of at least one witness of the schooner, and that the fog was intermittent in its density has been amply proven by both sides. The discrepancy or contradiction is shown only when the vessels collided. On the steamer's side it is averred that the fog was so dense that the schooner appeared in sight, and the collision happened almost simultaneously. Whereas, the schooner's evidence is to the effect that they could see ahead from 300 to 800 feet. The court in this instance will accept the evidence of the steamer, as counsel for the schooner quite properly advanced the theory that it is a difficult matter to judge distances in a fog when you have no object in view. Also the court is aware through many experiences that objects will loom very large in certain stages of fog.

This reflection brings us to the evidence of the schooner, which mentions that a good deal of foam was seen at the bow of the steamer, which, under the speed she was traveling, could not have been great, but under fog conditions would be magnified.

The evidence of the steamer is to the effect that one blast—a frantic one—was heard from the schooner immediately prior to the collision.

The steamer's whistle was heard seven minutes before the collision, so the schooner's witnesses state, and on the port bow; also their fog horn was in constant operation following the letter of the regulations.

Another witness whose evidence in this respect is more reliable, is Arthur Schnare, who was on the look out with the man operating the horn. He stated that the fog horn was placed on the barrel of the windlass, the top of the barrel being but half the height between the deck and the top of the rail, the placing of the horn as averred would prevent the sound from reaching out, by meeting an obstruction such as the rail or the knight heads, therefore reducing its power and penetrating efficiency to a minimum, no matter if the horn was facing forward or towards the sides.

What it was humanely possible to do on the part of the steamer was done. Nothing in the evidence raises a faintest doubt of that fact. As soon as the schooner's form loomed up a hard to port helm order was given and executed, whilst the engines were ordered full speed astern; but the collision happened nevertheless, with the disastrous effect narrated.

The evidence on both sides shows that the schooner sank under the bow of the steamer, indicating that the steamer had not gathered sternway under the full astern order, but remained in the gap or wound, practically, or close to.

The officers and crew of the steamer did what was necessary to do in such circumstances, by placing ropes over the side to enable the schooner's crew to clamber on board. The boats were ready to be lowered but were not required, as two of the schooner's boats were safely launched.

The rules of the road are applicable to both sailing and steam vessels. With the former it is required that in thick weather sails shall be reduced, this being equivalent to a reduction of steam pressure on a steamer.

Captain Schnare states that he saw the steamer heading for his vessel on the port bow; but never made an attempt to alter his helm, though he saw a collision was inevitable or at least imminent, backing his behavior on the fact that the rules of the road state that steamers have to keep out of the way of sailing vessels, Art. 20,—which is a right and proper interpretation; but he seems to have forgotten that the same rules, in another clause, Art. 21, plainly say and direct a movement on the part of the sailing vessels when a collision is inevitable.

Hence, for the above reasons, and after a careful analysis of the evidence, the court cannot find any cause for condemning either side.

S.S. "ENGLISH MONARCH" STRANDING

A FORMAL investigation was held in the Court House, Sydney, N.S., on August 1, 1916, before Captain L. A. Demers, F.R.A.S., F.R.S.A., Dominion Wreck Commissioner, assisted by Captain A. J. Morrison and Captain R. Macdonald, acting as Nautical Assessors, into the causes which led to the s.s. English Monarch touching on or near Bird Rock on July 24, 1916.

Mr. Hugh Ross, K.C., of Sydney, appeared on behalf of the Master, R. H. Potter.

The Master, Captain R. H. Potter, deposed that he had been Master of this vessel for 8 months; that she was a steel built, single-screw vessel with triple expansion engines, capable of a speed of 10.5 to 11; that she carried a crew of 38 as a rule, but this voyage they were two men short; that she had two duly certificated officers and three engineers; that she was 3,206 tons register and 4,947 tons gross; that prior to joining this vessel he was in command of the Scottish Monarch, which was torpedoed by a German submarine, with a loss of 12 men, after a fight.

He stated that the first officer is a competent man; that he had a mixed crew. He narrated the difficulties which shipmasters had to contend with in surrounding themselves with good sailors. He affirmed that the ship was supplied with all necessary nautical instruments; that the log which was used was in good condition and reliable; that his compasses were found to have varied very little and frequent observations were taken to check them.

The second engineer testified as to the entries made in the log, and said the shock was great when the ship struck; but did not notice if the ship listed.

Finding

The evidence as given has been carefully weighed and considered and the Court finds that the Master, from the time he left Father Point and until he reached Fame Point, navigated his ship in a careful manner; that he took a four-point bearing and obtained his proper position off Fame Point; that the weather became thick shortly after and he steered a course which would have brought him some ten miles from Bird Rock on the north side.

Being a stranger on this Coast, he received advice and counsel from experienced navigators, who are acquainted with this neighborhood, and he was warned to be careful of a possible current which might throw him off to the north of his course leading to Bird Rock. He followed this advice to a certain extent, but had he been left to his own devices and read the Sailing Directions, he would have found that there is a current from Cape Race flowing into Cabot Strait, which has a tendency to bring vessels to the south instead of to the north, to the shores of Newfoundland.

Basing himself on the advice received he followed a course which he thought was proper, going at a speed of which he claims was reduced owing to foggy conditions of the weather,—some two or three revolutions less than full speed,—and which he stated was better in order to be able to have to a certainty the distance covered by the vessel. A good look-out was kept and the vessel's fog whistle was kept going at regular intervals.

However, the main point at which the Court directs its criticism, is the fact that when the master was informed by the mate that a sounding of 19 fathoms was found, he did not stop his ship, go full speed astern and return in the direction from which he came until he deepened his soundings, and then navigated cautiously until he ascertained exactly his position.

The moment he heard the fog horn it was a natural impulse for him to starboard his helm in order to keep away from the object which was a danger to him.

In this he erred in judgment, but as it seems to have been done on the impression of the moment the Court cannot find that this error is a culpable one.

On the other hand his error of judgment is not stopping his ship and going full speed astern when he obtained a cast of 19 fathoms, was one which the Court cannot overlook. In view of these facts and his clean record, the Court is not ready to deal with his certificate, but severely reprimands and censures him for not having brought his vessel to a standstill when the cast of 19 fathoms was obtained. The Court may add that owing to the conditions prevailing it seems to be very difficult for a master of a ship to select an absolutely competent crew.

CANADA AND U.S. SEAMEN'S ACT

THE recently passed American Seamen's Act has resulted in a new arrangement between the Canadian and United States authorities regarding the treatment of Canadian shipping in United States ports. The new law, applying to all vessels which depart from any port of the United States, provides among other things that a percentage of the vessel's deck crew running from 40 to 65 per cent. shall be of a rating not less than able seamen, and makes provision also regarding the definition of able seamen and their physical fitness.

The Dominion Department of Marine and Fisheries first issued a circular to steamship inspectors, collectors of customs, and owners and masters of vessels, calling attention to the provision of the United States measuring and enjoining the exercise of care in the selecting of deck crews to insure compliance with the requirements of the American Act in case of a muster of the crew in United States ports as provided in the new statute.

Later the same department issued instructions to collectors of customs and others concerned, providing that an applicant for the position of able seaman would require to present to the collectors of customs declarations to the effect that he was of the full age of nineteen years or upwards, had served at least eighteen months on deck at sea or on the inland or minor waters of Canada, on a vessel of 100 tons gross or upwards, including decked fishing vessels. A certificate by a duly qualified medical practitioner to the effect that the applicant had passed the physical examination as prescribed by the United States Act was also required. The various forms required were also attached.

Upon the presentation of the declarations and certificates mentioned, collectors of customs are authorized to issue applicants certificates of qualification as able seamen for presentation at United States ports when necessary.

SHIPPERS should appreciate that it is quite useless to mark in English only such expressions as "handle with care," "this side up," etc., on packages intended for foreign countries where English is not spoken or understood by those who will handle the freight. If any such instructions are necessary, they should be stated in the language of the country for which they are destined, as well as in English.

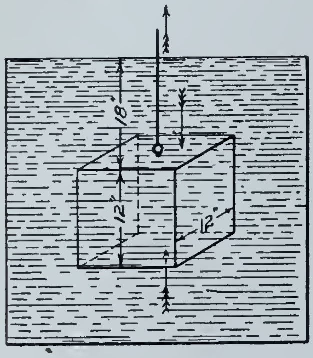
Series of Practical Questions and Answers for Engineers

By "Artificer"

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals will be found a useful companion study. With a view to meeting the need of many of our lake and inland waterway engineers who, during the closed season of navigation, take positions in steam power plants ashore, questions relative to the latter department will also find a place in the series.

Question.—How is it that a body weighs less when submerged in water than when suspended in the air?

Answer.—If the specific gravity of the body is less than that of the liquid in which it is placed, the body will be only partly submerged, the displaced water being equal to the total weight of the floating body. When the specific gravity is greater than the water, it will be necessary to exert a force (as shown by the



upper arrow) to keep the body from sinking to the bottom. Now, it is quite clear that the pressure of the water upon the sides of the block shown in the sketch will equalize each other, but the pressure on the bottom tending to lift the body will be greater, due to the larger head. The pressure acting downwards will be $12 \times 12 \times 18 \times .03617 =$ 93.75 lbs., and the pressure acting upwards is $12 \times 12 \times \times 30 \times .03617 = 156.25$ lbs. Then the difference in this case will be the weight of the water displaced, or 156.25 minus 93.75 equals 62.5 lbs., which is the approximate weight of a cubic foot of water.

* * *

Question.—In the operation of a block and tackle, having a combination of pulleys, the weight is raised one foot while the free end passes through six feet. What force would be required to raise a weight of 350 pounds?

Answer.—From the above question it is seen that there are six ropes supporting the weight, therefore, the weight and the force applied will be in the same ratio as the supporting ropes and the free end, or 6 to 1. Then the power required to raise 350 pounds will be 350 divided by 6, or 58½ pounds.

* * *

Question.—We desire to change the volume of a flue to twice its present capacity. It is now 8 inches in diameter, and requires to be changed to one of oblong cross-section, the width being 8 inches. What must be the length?

Answer.—The area of the 8-inch diamter pipe will be $8 \times 8 \times .7854$, or 50.2656 square inches. Twice this will be 100.53 square inches. As this will be the area of the oblong flue required, the length will be the area divided by the width, or 100.53 divided by 8 equals 12.57 inches.

* * *

Question.—What are understood by the phrases "high duty" and "low duty" as applied to steam pumps?

Answer.—In a "high duty" pump, provision is made for expansive use of the steam by which the pump is operated; on the other hand in what is known as a "low duty" pump, boiler pressure steam or its equivalent is carried throughout the full piston stroke.

* * *

Question.—How would you increase the power derived from a throttle governor engine?

Answer.—There are two ways of doing this, namely, increase the speed and increase the mean effective pressure. As the governor is usually set to operate at its best working position, it is best not to change its speed from that for which it was designed. The better way is to increase the size of the pulley which drives it so that, while the engine would go faster, the governor would rotate at the same speed. To increase the power at the same speed, the throttle would have to open wider. This could be done without altering the working position of the governor by adjusting the throttle valve stem. The mean effective pressure can be increased slightly by decreasing the lead which will retard the point of cut-off.

* * *

Question.—What is the difference between a tube and a pipe?

Answer.—A tube is indicative of surface, a pipe of area. Example—A 3-inch tube will measure 3-inch outside diameter, while a 3-inch pipe will measure 3-inch inside diameter.

* * *

Question.—Are two 4-inch pipes equal in area to one 8-inch pipe?

Answer.—No. The 8-inch has an area double that of two 4-inch pipes. Doubling the diameter, therefore, increases the area fourfold.

* * *

Question.—A feed pump has to discharge 1,925 pounds of water per minute against a pressure of 90 pounds per sq. inch, and the area through the valves is 2 sq. inches; neglecting friction and loss from restricted discharges, etc., what would be the horse-power required?

Answer.—Since the fluid is water, the head corresponding to 90 pounds pressure equals 90×2.31, or 207.9 feet. The discharge per second will be $\frac{1,925}{60}$, or say 32 pounds, and since a cubic inch of water weighs .036 pounds, the discharge will equal $\frac{32}{.036}$ or 900 cubic inches per second. Also, since the area through the valves is 2 sq. inches, the velocity will be $\frac{900}{2}$, equal to 450 inches per second, or 37.5 feet per second, and the head necessary will be $\frac{37.5^2}{64}$ or 22 feet. The total head in feet will be 230 and the horse-power will be $\frac{1925 \times 230}{33000}$ or 13.4

* * *

Question.—An air pump having a piston 10 inches in diameter is designed to work against a pressure of 15 pounds per square inch. The pump piston is operated from the end of a lever, the other end of which is pivoted to the engine frame, and the engine crosshead is attached at a point 12 inches from the pivot. If the total length of the lever be 32 inches, what force must be exerted upon it by the crosshead?

Answer.—Area of air pump piston is $10 \times 10 \times .7854 = 78.54$ sq. in. Total pressure upon air pump piston is $78.54 \times 15 = 1178.1$ pounds. The distance of air pump connection from the fulcrum is 32 inches, and the distance of the crosshead connection from the fulcrum is 12 inches. Force exerted by crosshead is, then, $\frac{1178.1 \times 32}{12} = 3141.6$ pounds.

Question.—A safety valve is 3 inches in diameter; the lever is 24 inches long and weighs 15 pounds, its centre of gravity being 13 inches from the fulcrum. The weight of the valve and valve stem is 12 pounds, and the centre line of the valve is 4 inches from the fulcrum. If a weight of 70 pounds is hung on the end of the lever, at what pressure per square inch will the valve commence to blow off?

Answer.—First calculate the area of the valve, thus $.7854 \times 3 \times 3 = 7.068$ sq. in. The forces holding the valve down on its seat are three in number:

(1)—The weight, 70 lbs., multiplied by its 24 inches distance from the fulcrum.

(2)—The weight of the lever, 15 lbs., multiplied by the 13 ins. distance of its centre of gravity from the fulcrum.

(3)—The weight of valve and stem, 12 lbs., multiplied by their distance, 4 ins., from the fulcrum.

The above three moments act downwards, and their sum must be equal to the upward moment due to the total pressure on the valve, multiplied by its distance, 4 ins., from the fulcrum.

Call the boiler pressure P pounds per square inch. Then

$$P \times 7.068 \times 4 = (70 \times 24) + (15 \times 13) + (12 \times 4) = P \times 28.272 = 1680 \times 195 \times 48 = 1923$$

$$P = \frac{1923}{28.272} = 68 \text{ pounds.}$$

* * *

Question.—What is meant by hard and soft scale and how should each be treated?

Answer.—Hard scale is composed of the sulphates of lime and magnesia. These are dissolved in the water when cold, but settle in the form of a very hard limy coating on the tubes and shell at a temperature of about 300 degs. F. By adding the proper amount of soda ash to the feed water these materials are precipitated as a sludge which may be blown out. Soft scale is composed of the "carbonates" of lime and magnesia. These begin to settle in the form of a soft mud at about 200 degs., and are gotten rid of by frequent blowing off.

* * *

Question.—How is it that a pump will force water into a boiler against a pressure equal to or greater than the steam which runs it?

Answer.—The area of the steam piston is always greater than the area of the pump plunger so that if the pressure per sq. inch on piston and plunger be the same, the total pressure will be greater on the steam end than on the water end.

* * *

Question.—In a differential chain hoist, the large sheave of which is 10 inches in diameter and the small one 8 inches, what weight on the hook would be equivalent to 60 pounds on the chain?

Answer.—The chain winds up on the 10-inch sheave and unwinds off the 8-inch. The difference between these two diameters is 2 inches. The radius of the 10-inch wheel represents the power arm of the lever and the radius of a 2-inch sheave represents the work arm, and the load that can be lifted is $\frac{5 \times 60}{1} = 300$ pounds. On account of the loop in the chain this forms practically half of the actual load. The load on the hook balanced by the pull of the chain, neglecting friction, is, therefore, $300 \times 2 = 600$ pounds.

* * *

Question.—Why is it wrong to feed much cold water or to let much cold air into the furnace and over the fire?

Answer.—Some parts of the boiler become much colder than others; the expansion of the different parts is unequal and the strains set up are always sufficient to tear the material. Comparatively small changes of temperature will, if often repeated, produce leaky joints, rivets, etc.

* * *

Question.—How would you proceed to set the slide valve of a simple engine?

Answer.—Two separate things are necessary:

(1)—Centralize the valve motion. That is, adjust the length of valve rods until the valve moves centrally about its seat—as much to one side of the ports as to the other.

(2)—Set eccentric to give correct angle of advance. This requires placing the engine on the dead centre which should be accurately done. If eccentric is keyed or otherwise permanently fastened, it is simply necessary to set the valve for equal leads or, in the case of a vertical engine, the lead is made a little greater at the bottom than at the top.

* * *

Question.—A system of pulley blocks is used to lift a weight of three tons, and if the number of sheaves in the blocks is such that 16 feet of slack is gained for every foot the weight rises, what power will be required if friction be neglected?

Answer.—Three tons is equal to 6,000 pounds; therefore, the pull required will equal $\frac{6000 \times 1}{16}$ or 375 pounds.

* * *

Question.—The force necessary to upset a ¾-inch rivet hot is 120,000 pounds. The rivet sets of a hydraulic riveter are 40 inches to the one side, and the toggle pins are 24 inches to the other side of the pivot pin. If the cylinder be 12 inches in diameter and the toggle give a reduction of 4 to 1, what hydraulic pressure would be required to do this work?

Answer.—Force required at the toggle pins is $\frac{120,000 \times 40}{24} = 200,000$ pounds.

Area of 12-inch piston is $12 \times 12 \times .7854 = 113.1$ sq. ins. Actual force on piston required $= \frac{200,000}{4} = 50,000$ pounds.

Pressure per square inch $= \frac{50,000}{113.1} = 442.08$. A pressure of about 500 pounds would be used for this work.

* * *

Question.—If a man raises a weight of 900 lbs. 150 feet in fifteen minutes, by means of a winch, how much work has he done, and what part of a horse-power would this be equivalent to?

Answer.—Foot pounds per minute $= \frac{150 \times 900}{15} = 9000$ foot pounds of work.

No. of horse-power $= \frac{9000}{33000} = \frac{3}{11}$ horse-power.

* * *

Question.—An engine makes 120 turns per minute, and is to drive a dynamo at 1,200 r.p.m. through a counter-shaft which is to run at 450 r.p.m. Engine fly-wheel is 8 ft. and dynamo pulley is 10 inches in diameter. What must be the diameters of the driving and driven pulleys on the counter-shaft?

Answer.—Size of driven wheel on counter-shaft is $\sqrt{\frac{8 \times 12 \times 120}{450}} = 25.58$ ins. dia., or, say, 25-inch pulley.

Size of driving pulley on counter-shaft $= \frac{10 \times 1200}{450} = 26.6$, or, say, 27-inch pulley.

* * *

Question.—Two shafts of equal size are connected by spur gears, the driver having 200 teeth and the driven 240 teeth. If the driven shaft become jammed and the power were sufficient, which shaft would most likely be broken?

Answer.—The radii of the gears are directly proportional to the number of teeth they contain. The ratio of the radii to each other is, therefore, 240 to 200, or 6 to 5. The driven shaft would, therefore, be first twisted off, and to be of equal strength the driven shaft should be one-sixth stronger.

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A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World.

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Vol. VI AUGUST, 1916 No. 8

PRINCIPAL CONTENTS

AFTER WAR TRADE AND MERCHANT MARINE SUPREMACY

ONE phase of the after-war world trade and commerce possibilities that is being given much less attention than it deserves is that relating to the comparative strengths, or more properly speaking, deadweight carrying capacities, of the then British and German merchant fleets. Due to the fact that the bulk of Germany's mercantile marine has been harbor-locked in her own and in neutral ports since the war started, tonnage losses through sinking and capture by Allied ships of war may be said to be almost negligible. It is computed, on the other hand, that Great Britain's merchant fleet alone will at the end of the present year be in round figures something like 4,000,000 tons less than its total on the outbreak of hostilities.

A twofold cause has been and still is in operation towards such a development, i.e., the maintenance of her international trade and the precedence given war vessel over merchant vessel construction. In the case of the former it was naturally to be expected in view of the risks encountered that a large percentage of merchantmen of various types and tonnages must succumb in the struggle with even less ruthless enemy submarine warfare than what has actually been experienced. As regards the displacement of merchant shipbuilding by that of ships of war, while it may be possible that less drastic measures would have sufficed, our sea supremacy being so intensely vital, erring on the safe side has had everything to commend it.

Reference has been made in these columns on former occasions to the practically certain trade war which will ensue immediately that on the battlefields of Europe is halted. We, as already indicated, will enter the struggle with a handicap equivalent to 4,000,000 tons less shipping available, and, for that matter unprocurable for possibly a decade thereafter to come. Germany's merchant fleet as we have already observed will be practically intact, and ready to start operations, and having been in pre-war days our most formidable rival both as regards shipbuilding and shipowning, she, unless steps be taken otherwise, cannot fail to assume pride of place in international trade. Irrespective of the preservation of her pre-war merchant fleet with the exception of some 300,000 tons, she is reputed to have added, and to be still adding, materially to what, with the deduction of the above amount, may still be reckoned as an already respectable total of 5,250,000 tons.

It is computed that to make good Britain's 4,000,000 tonnage loss, ten years will elapse following the declaration of peace, and even then her normal annual output would have to be increased from 1,370,000 tons to 1,770,000 tons. The outlook, it must be admitted, is anything but reassuring, and when it is remembered that we will have to depend largely on our export trade to meet the cost of the war, and that arrangements have been made to blacklist entirely everything that savors of German origin, it becomes absolutely essential that we have on the sea a merchant marine as effective as that of its naval confrere, and as capable of victorious achievement as our armies now in the field.

To wait ten years to bring our shipping back to normal, is on the face of it ridiculous, for not only would Germany have been able to take advantage of the psychological moment, but she would, in the nature of things, at least be able to compete with us in producing new shipbuilding tonnage. As a remedy, and of course it must be a drastic one, it has been suggested that peace terms embody "a ship for ship" clause; incidentally, a money indemnity is thereby flouted. From every viewpoint, there will be few who will be found antagonistic to the proposal. We are familiar with the Old Testament dispensation which demands "an eye for an eye," a "tooth for a tooth," and "a life for a life," and making all due allowance for our living in a Christian era, the claim of "a ship for a ship" may easily both be pressed and satisfied.

Submarine piracy has deprived us of some of our largest and greatest masterpieces of naval architecture and marine engineering, as well as of a host of merchant vessels of varied type and size, and only by our demanding "ship for ship," in its type, tonnage and appointments, or their equivalent, will Germany be made to realize that she has been a party to submarine piracy.

MARINE NEWS FROM EVERY SOURCE

Vancouver, B.C.—The Wallace Shipyard No. 1 is busy making preparations for the construction of a steel steamer for the Kishimoto Steamship Co., of Osaka, Japan.

Victoria, B.C.—The keel of the first of the three ships under construction by the Cameron-Genoa Mills Shipbuilders, was laid down at the new plant on July 29. The keel is 225 feet in length over all.

Montreal, Que.—The work of strengthening by steel piles the coffer dam which has been built at the break in the weir waste of the Lachine Canal is progressing favorably and traffic has been resumed.

The Taylor Engineering Works, of Vancouver, B.C., has received the contract for supplying two 160 h.p. Bolinders crude oil engines for the Cameron-Genoa Mills Shipbuilding Co., and six engines of the same type for the Wallace Shipyards.

Two Russian Ports.—In 1915, more than half of Russia's exports, and nearly half of her imports, passed through the port of Archangel, on the White Sea. Imports at Vladivostok rose from 19 million rubles in 1913 to 301 millions in 1915.

The Quebec Shipbuilding & Repair Co. has been incorporated at Ottawa, with a capital of $40,000, to build and repair ships of every description. Incorporators: W. R. L. Shanks, F. G. Bush and G. R. Drennan, all of Montreal, where the head office will be located.

Vancouver, B.C.—A. Wallace, head of the Wallace Shipyards, states that the contracts had been signed for the construction of three more auxiliary schooners for the H. W. Brown Co. This makes six schooners to be built at the Wallace Yard No. 2.

The Vancouver Dredging & Salvage Co., have succeeded in floating the Japanese steamer Kenkon Maru, No. 3, which ran ashore near Mayne Island on January 12. The vessel has been placed in drydock at Esqumalt, B. C., and will be repaired by the Victoria Machine Depot.

Marine Insurance Revenue.—Twenty-three British Insurance companies in 1915 received $63,500,000 in marine insurance premiums, and paid claims amounting to $36,300,000, the loss ratio thus being about 57 per cent., against a ratio the previous year of 61½ per cent.

The Canada Steamship Lines' steamer "Moreland" is being rebuilt at Duluth, Mich. The Moreland was wrecked in 1912 on Saw Tooth Reef, Lake Superior, and her stern, the only portion left intact, is being fitted to a new forward part, which will make the new steamer over 600 feet in length.

Sarnia, Ont.—The American Government will start work in the near future to spend $83,000 in opening the American side of the St. Clair River at this point. At the present time the Canadian side is used by all big boats and the new cut will have a depth of 21 feet and will be 450 feet in length, with a width of 400 feet.

C. S. L. New Freighter.—Announcement is made in Detroit, Mich., that a new six hundred foot steamer being brought out for the Canada Steamship Lines, at the Superior yard of the American Shipbuilding Co., will be named after Sir Trevor Dawson, managing director of Vicker's, London. The boat is expected to go into commission some time next month.

Chatham, N.B.—The trial trip of the new pilot motor schooner, Admiral Beatty, built at the Miramichi Foundry Shipyard, was held recently. The boat is 72 feet over all, has a beam of 18 ft. 4 in., and a depth of 7 ft. 6 in. She has a 50 h.p. Regal gasoline engine, and is equipped with the regular rigging of a vessel of her class. Accommodation is provided for a crew of 14 men.

Victoria, B.C.—The contract for the 450 or 500 tons of steel to be used in the construction of the three ships being built in the local shipyards of the Cameron- Genoa Mills Shipbuilders, has been secured by the Victoria firm of Messrs. F. G. Prior & Co. The steel which will be required under the contract will consist of bars, bolts, rings, rivets, etc., and the whole order for the three ships will be delivered on the ground within six weeks' time.

Kaministiquia Channel. — President Livingstone, of the Lake Carriers' Association, is advised by the Canadian Department of Marine and Fisheries that the dredging of the northerly half of the entrance channel to the Kaministiquia River to a depth of 25 feet has been completed and tested by sweeping. The whole entrance between the buoys is now 25 feet deep, with a width of 600 feet up to the Empire Wharf.

Government Sells C.G.S. Montmagny.—The Canadian Government steamer Montmagny, which has been beneath the waters of the St. Lawrence, near the Island of Orleans, for almost a year, has been sold by public tender to the St. Charles Navigation Co., of Quebec, for $25,000. The vessel originally cost over $100,000. A contract was some time ago given to the Levis Wrecking Co. to raise the Montmagny, but they were unsuccessful.

Great Lakes Record.—Great Lakes ore carriers established a new record in the month of July, loading 9,750,157 tons, which exceeds by 242,581 tons the movement in June, which at that time was thought to have set a mark that could stand for the year. Up to August 1, ore shipments for the season aggregated 29,365,724 tons, a gain of more than 5,000,000 tons over 1913, the banner year of the trade. Detroit vessel men predict that the year's movement will approximate 59,000,000 tons.

Soo Canals Traffic.—Records of traffic through St. Mary's Canals were broken in July, when 14,048,404 tons of freight were carried, an increase over the previous record made in June of 1,087,935 tons; 254 more vessel passages were made, compared with July of last year. Shipments of grain showed greatest increases. In 1915 there were 2,398,662 bushels of grain, and 3,938,366 bushels of wheat. During July this year 13,349,-113 bushels of grain and 31,907,803 bushels of wheat went through. Iron ore also shows increase of 2,547,023 tons over July, 1916. Of the total amount of freight, 2,629,439 tons passed through the Canadian canal, and the balance of 11,418,965 tons through the American.

Lake Carriers' Advance Wages.—At a meeting of the directors of the Lake Carriers' Association in Cleveland, Ohio, on August 2, wages were marked up $10 a month for all men on boats below the grade of licensed officers, making a second general advance by the Association this season. An advance of 10 per cent. was made the men at the opening of the season. This action affects fully 10,000 men on the Great Lakes. The scale which was adopted is independent of the fall schedule effective in October.

A. B. MacKay of Hamilton, Ont., a well-known figure in lake shipping, has just purchased from the National Steamship Co., of Toronto, the steamer Natironco at a price not disclosed. The Natironoco is a steel vessel of about 1,600 tons dead weight capacity. She was built at Detroit in 1892, and was transferred to Canadian registry about four years ago. At present she is engaged in carrying grain and coal on the upper lakes.

Vancouver Harbor Dues.—Vessels using Vancouver harbor are to pay a tax of three cents a registered ton on and after August 1, according to notice from Ottawa. The harbor commissioners had this clause in their original by-laws together with other tariffs and license fees. Owing to the strong opposition engendered the tax was suspended during the war, but now the commissioners have succeeded in getting an Order-in-Council through for the imposition of the three cents tonnage tax. However, all the other tariffs and licenses are cancelled and the three cents tax is the only one. Ships will not be required to pay on more than five entries in a year. Shipping men do not regard the tax as excessive.

S. S. Saronic Total Loss.—Manager Gildersleeve, of the Northern Navigation Co., intimates that the wooden steamer Saronic had burned to the water's edge on the shore of Cockburn Island, Georgian Bay, where she was beached by her skipper, Capt. J. D. Montgomery, when she broke into flames amidships on Lake Huron early Sunday morning, Aug. 20. The crew of 21 men landed on this bleak shore in lifeboats, and made their way to Thessalon, where they were provided for. The Saronic was built at Sarnia in 1882, and was 252 feet in length. She was formerly the United Empire, and was in the passenger service until the 1914 season. On the present trip she was taking a cargo of grain to Port Nichol. She had no wireless, which caused a late report of the accident.

Ottawa River Vessel Burned.—The pleasure steamer G. B. Greene, owned by the Upper Ottawa Improvement Co., which has plied the waters of the Upper Ottawa River for over a quarter of a century, was burned to the water's edge off her berth at Quyon on the morning of July 27. Four members of the crew, who were trapped below decks when the fire broke out, lost their lives. They are: John Stevenson, fireman, Luskville, Que.; Alcide Guertin, deckhand, Aylmer, Que.; Oscar Lapierre, deckhand, Quyon, and George C. Bryant, first mate, Mattawa. Owing to the age of the vessel, the fire spread so rapidly that no attempt could be made to stay its progress, and the members of the crew, ten in number, barely escaped with their lives by jumping overboard and swimming ashore. The fire was first noticed about 1.30 by one of the deckhands, A. Gibson, who awoke to find the cabin full of smoke. He at once gave the alarm and rushing on deck found the amidships part of the vessel a mass of flames, which had burned the hawsers holding her to the wharf. The boat was drifting out into the stream, with flames shooting from every part of her. So quickly did the fire spread through the ancient timbers that the crew, hurriedly awakened out of their slumbers, had to dash through a barrier of flames and smoke to the deck.

"Charles S. Price" Salvage.—Salvage work on the sunken steamer Charles S. Price, known as the "mystery ship," was abandoned on July 25, by the Great Lakes Towing & Wrecking Co. Captain Cunning, wrecking master in charge, left for Cleveland, where he will make a detailed report to the underwriters. It is now probable that unless some wrecker cares to take a chance on blowing up the Price for the junk that is in her the boat is on the bottom for all time to come. In a statement made just before leaving Capt. Cunning said:—"We have abandoned the work entirely on the Price. There is nothing but a scrap heap there, and during the two working days that divers have explored the hull we have become convinced that it would be impossible to float the hull without spending a fortune, and there would be nothing to show for the work but a pile of junk. The interior of the steamer, in the boiler and engine rooms, indicates that the boilers exploded. I do not say this is true, but it is probable, as the aft bulkhead is shoved forward and the machinery is wrecked and pushed towards the stern, indicating that an explosion or some other powerful agency tore everything to pieces. The aft section of the steamer is so badly damaged that repairs cannot be made under water. Our idea was to float the boat by compressed air, but with bulkheads broken and aft section damaged beyond repair, the air could not be controlled, and there was no chance. The aft and forward cabin sections are flat and part of the machinery is resting on the lake bottom. No bodies were found anywhere inside the hull, and if there are any in the vicinity they are so tangled up in the wreckage they never will be found."

AN INTERESTING SHIPBUILDING TEST

By A. J. Campbell.

THE Nova Scotia Steel & Coal Co. are making a test of the cost of building steel ships on the Atlantic seaboard. On a site by the East River, at New Glasgow, immediately to the rear of the Eastern Car Works—a subsidiary concern of "Scotia"—the keel is being laid of a ship of 2,000 tons deadweight capacity. The craft will be 220 feet long, with beam 35 feet and a moulded depth of 20 feet. The boat will be built to Lloyd's classification, and with all the scantlings 10 per cent. in excess of requirements.

A 1,000 shaft horse-power DeLaval steam turbine is being specially constructed for this vessel, it being geared to the propeller shaft through two sets of gearing. This will be the first boat built in Canada to be equipped with a geared turbine. The equipment will also be unique in regard to the auxiliaries. A rotary air pump and a centrifugal circulating pump will be driven by a single engine. The stem, stern post and rudder forgings, propeller shafting, propeller and all fittings will be made by the company's New Glasgow plant. Frames, floor plates, and the bulk of the other construction material will also be furnished by the latter.

Permanence of the Enterprise

When this ship is completed, it will be fairly well determined what Government assistance, if any, will be necessary in order to make the industry a permanent one. It is hoped, however, that the experiment will prove the amount of this assistance to be not beyond the ability of the Government to grant. It must be remembered that the Nova Scotia Steel & Coal Co. have not definitely settled on a policy of shipbuilding. They have decided to build one ship and they hope to build many; but they are not going to say positively what will be done until they find out what this first ship will cost. It would seem probable that the cost will be higher than the normal cost of construction in England, owing to the higher price of labor. It may be, however, that the discrepancy between the cost of construction in this country and the cost in the Old Country is perhaps more apparent than real. Some well-informed observers declare that this difference is not nearly so great as the Canadian public have been led to believe. It is pointed out that while labor costs are less in the Old Country, labor results are also less. Thus, it may be found that what was supposed to be a 25 per cent. difference in favor of the British yards will be reduced to possibly 10 per cent. Better service largely counter-balances cheaper work. The New Glasgow test will prove what this argument is worth.

Certainly the location selected for this test possesses many advantages. It has been said more than once that if shipbuilding cannot be carried on profitably at New Glasgow it cannot be done anywhere in Canada. The reason given is that there are few places where so many economies in carrying on the undertaking can be effected. The site owned by the company is practically free. A portion of "Scotia" staff will carry on the business organization. Much of the necessary machinery which a new company would have to buy is already installed either in the steel works or the car works; indeed numbers of machines, useful for ship-building purposes are installed there which the ordinary yard could not well afford to purchase. Moreover there is a marked disposition on the part of workmen at New Glasgow to co-operate. The obstinacy of the unions in England is one of the handicaps of the British shipbuilder. The Nova Scotia Steel & Coal Company are large owners and charterers of tonnage; they operate a considerable fleet at the present time, and when this ship is finished, if there be no customer in sight, they can use her as a collier themselves.

Factors Towards Success

Colonel Cantley was asked the other day what he considered was necessary to make this ship-building project a success. He replied:

(1)—Government assistance; perhaps not very much, but some.

(2)—The hearty co-operation of the workmen; it must be assured against onerous labor legislation.

(3)—Good shipping laws. Some of the laws enacted by the United States have handicapped the operation of American shipping very seriously. For example, on an American ship of a certain size, the navigation laws call for a crew of 32, whereas on an English ship of the same size only 27 men are required. Such legislation as this, in addition to the higher scale of wages, makes it difficult for the American ship to compete in the open market in normal times.

(4)—Lower insurance rates, and also the inspection and registration of Canadian ships made easier for their owners. With regard to insurance, it is a fact that the Norwegians are insuring their fleet at about half the price our vessels are paying at the present time.

It will be admitted that there is logic in a plea for assistance for steel ship building. At the very least an amount equal to the duty imposed on the material that would enter into Canadian built ships should be returned to the builder, and since we give direct aid to the developing of our land transportation, why not do likewise to encourage the development of our own ocean transportation? It is expected that the launching of this test craft will take place late this autumn.

LACHINE CANAL TRAFFIC IN JULY

ALTHOUGH the ten days that the Lachine Canal was practically closed to navigation and the water-borne stream of freight entering and issuing from Montreal, thereby interrupted, the totals for the month of July are nevertheless interesting in that they show certain changes in the tendencies of trade. For example, the 1,589,432 bushels of wheat brought down through the canal during last month only lack 283,235 bushels of reaching the total for July in 1915, and this is the more noticeable in that so far this year the monthly totals have been almost half of those for 1915. If there had been no hiatus in the daily receipts, it is believed that July's total this year would have exceeded the same month in 1915 very decidedly.

Grain, Produce, Coal

The total grain received last month was 3,381,363 bushels, an increase of 122,503 bushels. The delay caused by the trouble in the Lachine Canal will show its effect more in August than in July as the boats which were delayed did discharge their cargoes in July, but they will be later in their next return trip. In addition to wheat the only grain to show a decrease for July was barley, 306,196 bushels having come down the canal, as against 391,906 bushels for the same month a year ago. Other grains showed increases as follows: Corn, 340,853 bushels, against nothing for July, 1915; oats, 948,152 bushels, an increase of 66,730; rye, 81,000, an increase of 57,865 bushels; and flaxseed, 49,000 bushels, an increase of 26,000.

For the whole season to date, however, 1916 falls 8,992,839 bushels short of 1915 in the total amount of grain brought down, the figures being 11,920,617 bushels and 20,913,456 bushels.

In produce the only increase shown is in the total of 1,073 packages of butter, as against 1,049 for July, 1915. Other statistics in this department for last month are as follows: Flour, no sacks, as compared with 1,400 a year ago; eggs, 1,785 cases, 485 cases less than in July, 1915; cheese, 42,097 boxes, a decrease of 1,247 boxes.

Coal still maintains its lead, the 220,042 tons brought down last month being 34,427 tons in excess of the figures a year before last month.

Vessel Trips and Passengers Carried

Other statistics of interest follow for the months of July in 1915 and 1916 respectively: Trips, 1,143 and 1,094, decrease 49; tonnage operated, 593,509 and 582,015, decrease 11,494; passengers carried, 22,656 and 22,299, decrease 357; cargo tonnage, 452,033 and 471,061, increase 19,029; light trips, 379 and 357, decrease 22. When it is considered that the warm weather during the time the canal was closed was ideal for the Rapids trip, it is evident that last month showed up better for passengers than July in 1915 in spite of the slight decrease.

LAKE STEAMSHIP DEAL IS RATIFIED.

THE purchase of St. Lawrence & Chicago Steam Navigation Co., by Canada Steamship Lines, already approved by the directors, has been formally ratified at a meeting of shareholders of the latter company.

It was explained by J. R. Norcross, vice-president, who presided in the absence of the president, Mr. James Carruthers, that the opportunity of purchasing the controlling interest in the company presented itself some time ago, but, because Canada Steamships was unable to secure complete control, the governors of the guarantee fund refused to sanction the purchase.

Later on a syndicate, made up of directors of the Canada Steamships Company, purchased the stock, and now proposed to turn over to the company 9,664 shares of the St. Lawrence & Chicago Steam Navigation Company at a price of \$187.75 per share. In addition to this, which was the purchase price of the shares, the syndicate will receive an amount equal to the net earnings of the St. Lawrence Company during the period from April 20 to July 31, the period during which the property was in their hands.

The transaction, it was pointed out, would not involve new financing, nor yet constitute a charge on earnings. The funds required were already in hand in the fund made up of money received as insurance for vessels lost and further the company being acquired had some \$400,000 cash in its treasury.

In the first few years of the Canadian National Exhibition the bulk of the crowds were carried to the grounds by ferries running into Dufferin street slip.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Captain Hiram Rowe, a retired mariner of the Great Lakes, passed away at his residence in Collingwood, Ont., on August 5, aged 72 years.

John Conway, for over forty years lock-master at No. 2 Lock of the Lachine Canal and a well-known figure in the port of Montreal, died recently, in his 80th year. For the greater part of his long life he was to be found at his post at No. 2 Lock and as a result he was known to, and a friend of, all the crews of the boats passing through the canal.

Captain C. C. Bullock passed away on August 23, at his home, Granby, Que. Captain Bullock sailed the waters of Lake Memphremagog for many years, and came in contact with many visitors and people of the district. He commanded the steamer Mountain Maid for a few years and later took over the command of the Lady of the Lake, which position he held for 29 years, and until the vessel was sold this season. He was born in Georgeville in 1837.

Services Resumed.—The White Star-Dominion Line steamship Southland, formerly the Vaderland, which until a few weeks ago was in the service of the Imperial Government, arrived at Quebec on August 16, with passengers and a general cargo from Liverpool. With the arrival of the Southland, the Liverpool-Quebec and Montreal service of the White Star-Dominion Line, suspended shortly after the war, is resumed. Captain Berry, who is in command of the big liner, was in charge of the steamship Norseman, when that vessel was torpedoed near Saloniki last Janary. The Southland prior to the war was in the Red Star Line, New York and Antwerp service. She and the steamship Northland (previously the steamship Zeeland) are the two ships selected at present for the resumption of the White Star-Dominion service to the St. Lawrence.

S.S. "Nascopie" Returns.—The Hudson's Bay Co. icebreaker has arrived in Montreal. At the beginning of the war she was leased to the Russian Government to help in keeping the port of Archangel free of ice. The Russian Government at that time purchased as many ice-breakers as it could. The Hudson's Bay Co. refused to part with the Nascopie, but leased it until Russia could build ships to do the work. She left Simeonovo, the new port that the Russians are making on the Arctic, on May 29th last, called at Archangel, Alexandria, and Cardiff on the way, and made the trip without mishap. She leaves shortly for Hudson's Bay with supplies for the company's outposts.

LICENSED PILOTS

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio.
Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer,** J. R. Binning, Montreal.

SHIPMASTERS' ASSOCIATION OF CANADA

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

GRAND COUNCIL, N.A.M.E. OFFICERS.

A. R. Milne, Kingston, Ont., Grand President.
J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I., Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

Large Schooner Launched.—A launch of considerable interest took place early this month from the yard of Smith & Rhuland, the Lunenburg shipbuilders, the vessel in question being one of the largest yet built in Lunenburg, N.S., the industry being chiefly confined to the output of fishing schooners. At 8.30 in the morning, at full tide, the Hillcrest, as is the schooner's name, glided into the water, witnessed by a number of people, who came to see the event. The new vessel is 350 tons, and a three-master, with the most modern equipment for hoisting sails, and taking in cargo. The machinery used for this purpose, and also the steering gear, was manufactured by the Lunenburg Foundry Co. The owners, of whom Zwicker & Co., are the managers, are to be known as the Hillcrest Shipping Co., and this is to be the nucleus of a number of new ships which will be engaged in the foreign carrying trade. Captain Dawsan Geldert will be in command.

SS. "Otonabee" Burned.—The steamer Otonabee was totally destroyed by fire on the morning of August 15, together with part of the wharf at Big Bay, where the boat was lying. Terrific explosions from acetylene tanks at the lighthouse shook the cottages and Peninsula Park Hotel and gave the people a bad scare.

1916 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	G. T. G. Blewett,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	E. A. Prince,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jenne Mance Street	O. L. Marchand,	93 Fifth Ave., Lachine, Que.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th Street E.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	271 London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	176 King Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	J. A. Rowe	29 Parrsboro Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

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THE COMBINED RAILWAY AND STEAMER BILL OF LADING

OF all the objectionable shipping documents transmitted to Australian importers by Canadian exporters of goods and products, the "Combined Railway and Steamer Bill of Lading" easily takes first place. Prior to the war, the use of such documents was not general, but in recent months it has been the rule rather than the exception. So grievous is the discontent amongst importers of Made-in-Canada goods that representations have been made to the effect that the Canadian Government should be approached with the view to enacting legislation to make it an offence for the railways in the Dominion to issue a document so detrimental to the material interests of manufacturers and exporters, as the combined bill of lading.

The assumption is that manufacturers in Canada, especially those distant from the seaboard, are unaware of the serious reflection upon their lack of knowledge of oversea trade requirements by attaching a wholly incomplete bill of lading to their drafts upon Australian buyers, or covering purchases made under a letter of credit established in a Canadian bank. An occasional transaction of such character might be overlooked, but so common has the practice become that Australian merchants are refusing to accept drafts accompanied by the combined bill of lading, and Australian banks are instructing their respective agents in Canada not to negotiate drafts drawn against established credits unless they are supported by a clean steamer bill of lading.

Objection of Merchants

Some of the leading importers of Canadian goods and products have refused to accept or pay drafts supported by a combined railway and steamer bill of lading, as they claim that it is not a negotiable document because it absolutely gives no assurance when the goods will come to hand. Further, it is not a receipt from the steamship company, and the various lines invoiced may come forward in several steamers, thus entailing endless annoyance and trouble at the port of discharge.

In the case of iron and steel products shipped in bars or bundles, the combined bills of lading are endorsed by the railway company "shippers' load and count more or less," which gives the Australian consignee no grounds against the steamer for redress for any material short landed, as the shipping agents contend that such an endorsement frees them from any claim for the missing products. This combined bill of lading gives no guarantee whatever that the goods will ever be shipped intact from the seaboard.

On a copy of a combined bill of lading forwarded with this report, it was shown that 57,750 pounds of Canadian bar iron were shipped from an inland town, consigned to Melbourne, but if the purchasers receive only 50,000 pounds, or even less, they have no grounds for action in claiming upon the shipping company on account of the endorsement "shippers' load and count more or less."

Objection of Australian Banks

The opinion of a leading Melbourne banker upon the objection to the combined railway and steamer bill of lading was obtained, and is submitted for the information of Canadian banks, manufacturers and exporters:—"From a banker's point of view, the objection to the document is that it is not a legal security in Australia. The courts both in England and throughout the Commonwealth rule that a bill of lading is a valid instrument only when the goods are actually shipped. A bill of lading which does not show the name of the steamer is not a valid instrument, and is, therefore, not a legal security. In Australia, even though the name of the steamer be inserted, the document is not necessarily binding on a shipping company unless that particular steamer is in port at the time of date of issue of the bill of lading. My objections are as under:—

1.—A banker negotiating a draft supported by such a document has no tangible security.

2.—He runs the risk of the drawee in Australia declining to pay until arrival of the relative goods.

3.—No remedy is in the hands of the banker for goods short-shipped, and experience up to date shows that in connection with combined railway and steamer bills of lading irregularities in shipment have been almost chronic.

"It appears to me that an easy solution of the whole trouble could be achieved by the negotiating bank of Canada either declining to negotiate the draft until the goods were actually shipped, or offering to negotiate the draft on condition that interest during the period of delay between the date of negotiation and date of actual shipment should be paid by either the shipper in Canada or the consignee in Australia, or perhaps divide the interest equally between the two; but it should be a sine qua non that the draft must be retained by the negotiating bank in Canada until actual date of shipment is assured."—T. & C. Bulletin.

Owen Sound, Ont.—The Provincial Government has purchased the small steamer Wawana and is having her converted into a motor boat with oil engines. A complete reconstruction of her deck houses is being made to afford accommodation for the officers and crew. It is expected that the power installed will make the boat the speediest craft in the lake service.

Canadian Vessel Captains and Chief Engineers

Through the courtesy of the various Steamship Companies, we are enabled to give a list of 1916 season vessels, together with the names of their principal officers.

CHATHAM NAVIGATION CO., LTD., CHATHAM, ONT.

Vessel.	Captain.	Chief Engineer.
Ossifrage	T. J. Stockwell	G. Peel

DETROIT AND WALLACEBURG STEAMSHIP LINE, DETROIT, MICH.

Vessel.	Captain.	Chief Engineer.
Olcott	T. Moore	L. Miller

MERCHANTS TRANSPORTATION CO., LTD., SYDNEY, N.S.

Vessel.	Captain.	Chief Engineer.
Weymouth	W. E. Leblanc	P. Schrump

NORTH SHORE STEAMSHIP CO., LTD., SYDNEY, N.S.

Vessel.	Captain.	Chief Engineer.
Aspy	D. McDonald	S. O. White

PEACE RIVER NAVIGATION CO., LTD., EDMONTON, ALTA.

Vessel.	Captain.	Chief Engineer.
Northland Call	J. Williscroft	A. Grant

RICHMOND STEAMSHIP CO., LTD., SYDNEY, N.S.

Vessel.	Captain.	Chief Engineer.
Richmond	W. H. Micheau	R. G. Morrison

JOHN WALTER, EDMONTON, ALTA.

Vessel.	Captain.	Chief Engineer.
City of Edmonton	P. Christianson	....

WEST VANCOUVER FERRY CO., VANCOUVER, B.C.

Vessel.	Captain.	Chief Engineer.
Doncella	J. Watson	R. W. Pyne
Sonrisa	D. Smith	H. L. Thompson

ROSS NAVIGATION CO., LTD., PAS, MAN.

Vessel.	Captain.	Chief Engineer.
Brisbin	H. L. Weber	B. M. Olde
Minasin	H. H. Ross	T. Paquette

DOMINION TRANSPORTATION CO., CHICAGO, ILL.

Vessel.	Captain.	Chief Engineer.
Caribou	A. A. Batten	Jas. Nicoll
Manitou	N. J. McCoy	C. Kenny

MIRAMICHI STEAM NAVIGATION CO., LTD., CHATHAM, N.B.

Vessel.	Captain.	Chief Engineer.
Alexandra	Jas. Nowlan	W. S. Stewart
Miramichi	J. P. Bullick	N. Smith
Sybella H.	H. Copp	A. McIntyre

CANADIAN GOVERNMENT RAILWAYS, MONCTON, N.B.

Vessel.	Captain.	Chief Engineer.
Leonard	O. Dubois	O. T. Williams
Prince Edward Island	J. J. Murchison	R. L. Main
Scotia No. 1	R. L. Maguire	W. J. Johnson
Scotia No. 2	R. Keating	W. Anderson

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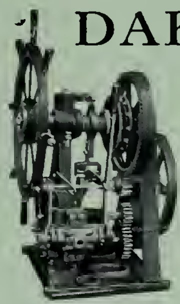

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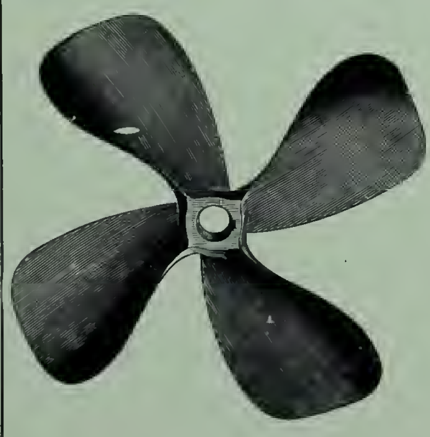

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Observations on the Quebec Bridge Centre Span Tragedy

By C. T. R.

Many opinions have been expressed, not a few theories have been developed, and from observation and otherwise there is a conflict of opinion as to what actually happened, to account for the centre span of the new Quebec Bridge failing to reach its intended location and finding instead a lodgment at the bottom of the St. Lawrence. The accompanying article, while not seeking to refute either superficially or ill-formed opinion, over-drawn theory, or excited observation, puts the matter of the "make-ready" of the centre span and its subsequent "hoisting to place" in definite, easily intelligible language, applicable more especially, of course, to the second effort to close the gap, but none the less pertinent to the first.

HOWEVER welcome an opportunity the lamentable disaster may have afforded the numerous critics of the "I told you so" class to express their "wise after the event" opinions, the fact remains that the span is not yet in position, and that, to insure the safe and successful completion of the notable undertaking, the reason for the mishap must be authentically established, the contributory factors duly analyzed, and the necessary precautions taken to not only overcome the cause of the present trouble, but to foresee and forestall any other possible difficulty which may arise on the next occasion.

That the real actual cause of the accident is known to the parties concerned, is not doubted, but whether it be deemed judicious or desirable that such facts should be publicly discussed is a matter which rests between the builders and the Dominion Government.

PONTOONS WITH CENTRE SPAN ABOARD BEING TOWED FROM SILLERY COVE TO THE BRIDGE SITE.

Structural Completeness

It is known, however, that the greater portion of the main flooring, together with a large number of cross and diagonal stiffening members were not yet in place, it being the intention to erect these after the span was elevated into position. Such a procedure does not, however, merit such criticism as might arise from hastily formed opinion. If it be possible to calculate the strength of the completed structure, it is likewise possible to arrive at the necessary degree of completion which would enable the span to support its own weight, so that one may therefore assume that the span was quite capable of being supported on four points as was done. That it was compatible with safety to leave off the most of the main flooring will be admitted by structural engineers, as, until the span was elevated and the ends of the main side girders permanently built onto the cantilevers, such flooring construction would have constituted a

PONTOONS WITH CENTRE SPAN ABOARD BEING MOVED INTO POSITION FOR LIFTING OPERATION.

CENTRE SPAN MOORED AND READY TO BE LIFTED FROM PONTOONS.

purely dead load amounting to 500 or 600 tons of material, with no resultant strengthening of the structure.

Consideration of the manner of slinging the span raises the question of the desirability of localizing the load on four points as was done. The span is designed to be built onto the cantilever ends so as to form a continuous fabric, and the additional support derived in

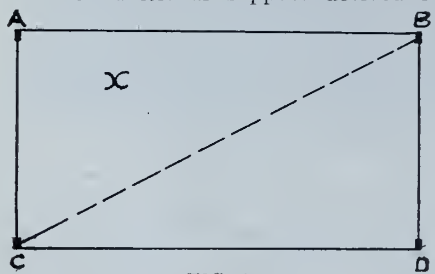

FIG. 1.

this manner may well impart the necessary strength to the span in position. While the span as a unit was doubtless correctly designed, so far as final conditions are concerned, it seems possible, according to all available accounts, that not only did one point of support give way, but that its giving way was to some extent due to local distortion.

While being constructed and transported to the site, the span was supported by ideal methods. The three pontoons at either end offered a well distributed area of support which, by virtue of being water borne was capable of absorbing or preventing any undue shock to the span. Once the span was suspended by inelastic slings from the cantilever ends, the compensating effect of the water-borne pontoons was replaced by uncushioned suspension from four practically rigid points. Taking the builders' own estimates of the rate of hoisting, viz., 70 lifts of 24 inches in 16 hours, which equals 1 lift every 14 minutes, and allowing 4 minutes for changing and adjusting tackle at each lift, there remains the fact that it was intended to lift the structure at an actual velocity of 2.4 inches per minute, roughly 1-25 inch per second. Without introducing intricate calculations, let the reader picture one end of the span having a vertical velocity of 1-25 inch per second, imparted to it from a rigid support, so that in 5 seconds the end was raised 1-5 inch. Allowing the various members of the span to adjust themselves to the stress of the lift, it might or it might not be 5 seconds before the stress reached the centre of

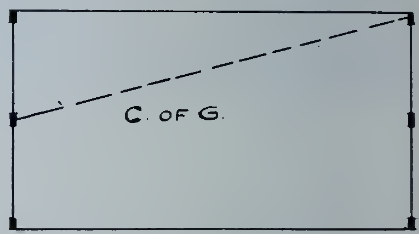

FIG. 2.

the span, being at the rate of 64 ft. per second. Any adjustment which the parts of the span would tend to make would now be deprived of the diminishing effect of the pontoon support, re-

CENTRE SPAN COLLAPSING AND DISAPPEARING INTO RIVER AFTER HAVING BEEN LIFTED A FEW FEET.

ulting in still further increased stresses when resisted by the unyielding support of the hydraulic lifting jacks. It is only necessary to consider this cycle of stresses recurring every few minutes in a structure which had just undergone a complete change in system of support, to appreciate the possible conditions of the case.

Actual Cause of Accident

The casting which is stated to have failed formed part of a ball and socket support, one of which was at each of the four corners as in diagram Fig. 1. A failure at A if it actually took place would result in the entire weight being supported on the two diagonally opposite points B and C as the point D would only be balancing the weight of the structure now pivoted on two points. The complete reversal of strains in many of the important members resulting from this lack of support, following on the repeated stressing due to rapid elevation may quite well have been the undoing of the job. Such an occurrence may very naturally have been left out of the list of possible contingencies taken into account by the designers.

In the absence of a detailed statement of future intentions beyond the determination to build and place another span the suggestion is advanced that with proper safeguards in lifting, along with increased stiffening, the job will be completed safely. Safeguards include methods as well as appliances, and the advantages of using three points of support at each end merit consideration. As shown in Fig. 2, should the support at one corner fail, the area still supported would be more than half, and if emergency stiffening were in place the evil effects of the overhung portion could be safely neutralized until corrected.

More Rigid Test for Tackle

The statement attributed to officials that the span had been resting on the ball and socket supports for six weeks previous to erection is doubtless perfectly true, but in view of the difference between conditions during that time and those under which the span was being elevated, it is not possible to accept this as a fair test of the ability of the supports to stand up at the crucial moment. It would appear that the rigid slinging aggravated the stresses in a green girder which had not been allowed sufficient time to settle and adjust itself to a severe change in its method of support. Such adjustment undoubtedly reacted on the supports so that they were stressed in a totally unexpected manner. That such stresses were intensified by the rate of elevation seems more than likely, and in a case of this kind there is truth in the adage "The more haste the less speed." True it would seem to be that it is safe to make haste slowly and the efforts of the builders to bring the undertaking to a successful conclusion will be none the less meritorious even if delayed by precautions against additional emergencies brought to light by the recent accident.

NEW TYPE OF CARGO SHIP

A NEW type of cargo vessel belonging to an Italian shipping firm recently made her maiden voyage to the United States. The name of the ship is the Milazzo, and she is said to be the largest purely cargo-carrying vessel in the world, having a displacement of 20,400 tons when loaded. The cargo hold has a flooring of steel plates which slope away from or toward the sides of the vessel like the letter W. and below this flooring are longitudinal tunnels each of which has a double line of rails. On these rails small trucks travel and are charged with grain or coal through small gate hoppers from the hold. When loaded the trucks are pushed along shafts in which are cable elevators. The latter are attached to the trucks which are raised to the deck where they dump their contents into chutes which discharge from the vessel. The shafts in which the elevators work are divided below the deck into two branches, which command the two tracks in each tunnel. These shafts are surmounted by tubular steel masts which are fitted with guides, and with triggers which automatically upset and discharge the cars as they are elevated to the proper level. The masts are provided with platforms to which the chutes are fixed.

TUBE FIXING IN WATER-TUBE BOILERS

SOME failures of Stirling water-tube boilers reported upon in two recent British Board of Trade reports, Nos. 2,405 and 2,406, show that the importance of securely fixing the ends of the tubes in the tube plates is perhaps not sufficiently appreciated by makers of this type of steam generator. It is common practice in boilers of the locomotive and Scotch multi-tubular type to fix the tubes by slightly expanding the ends into parallel holes in the tube plates, and when the design is such that the tube plates are held in position by stays or other attachments which make their rigidity independent of the holding power of the tubes, little exception can be taken to this method of fixing, for then, in the event of a tube working loose, nothing beyond leakage can occur. It is seldom of course, that even in these designs the stiffness of the tube plate is entirely independent of the holding power of the tubes, and if this becomes defective over a large area there is risk of the plate being bulged and forced over the tube ends.

In water-tube boilers of the Stirling and similar designs in which the lower drums are suspended from upper steam drums by groups of tubes, there are no stays to connect the drums and nothing to resist the tubes being forced out beyond the holding power of the tubes themselves. In commenting on the case, the chief engineer-surveyor to the Board of Trade calls attention to the excessive stress which tubes in this type of boiler have to bear, owing to the considerable weight suspended from them, and to the importance, therefore, of bell-mouthing the ends of the tubes to diminish the risk of the tubes being forced out of the tube-plate.

Local Overheating of Tubes

It should be remembered that in boilers of the type under notice the working conditions are rather trying to the tubes. They have not only to carry the load of the lower drums when filled with water, but are directly exposed to the intense heat of the fire and furnace gases which cannot be uniformly distributed, and, therefore, gives rise to racking stresses from differences of expansion. Obviously these are aggravated if the feed water is not good and incrustation accumulates near the tube ends, as local overheating is then set up. This, in fact, proved to be the precipitating cause of three failures in the course of three weeks in the case of one of the reports quoted, viz., No. 2,406, and emphasizes the importance of a water-softening plant in connection with water-tube boilers whenever the feed water produces scale in objectionable quantity. Grease is even more objectionable than scale, as the merest trace with some kind of feed water is sufficient to cause overheating, and, it may be added, is very liable to get introduced where surface condensation is practised unless great care is exercised in the lubrication of the engine and the separation of the oil from the exhaust steam.

FAILURES OF CRANKSHAFTS IN DIESEL ENGINES.

THAT the engineer in charge is primarily responsible for the lift of the crankshafts of Diesel engines is the opinion expressed in a paper read before the Diesel Engine Users' Association recently.

The paper states that certain reasonable and simple precautions will prolong the period of usefulness indefinitely. A number of failures cited in the paper were attributed to lack of alignment of the main bearings, which generally resulted from unequal wear of the several shaft bearings, although this same result was brought about in some cases by negligence in the erection of the engine, or to defective foundations in some of the older ones.

A four-cylinder engine is most likely to suffer shaft breaks, with the two-cylinder types having heavy fly-wheels, a close second. The shafts almost always fail through the throw arms, the crack starting at the center and working outwards. With the four-cylinder engine, the throw arm nearest the fly-wheel fails in most cases and this is also true of the two-cylinder units. Either throw of the single-cylinder type may fail and with a three-cylinder engine, which is the least likely to be affected, the failures are equally divided between the two end throws.

HIGH LIFT SAFETY VALVES.

AN opinion prevails that high-lift safety valves produce injurious shocks both to the boiler and valve and the Boiler Code Committee of the American Society of Mechanical Engineers propose to limit the permissible lift. In a paper on the subject submitted to the above society, G. H. Clark alludes to the inadequacy of present day valves to pass off the maximum quantity of steam generated. The discharge capacity of the ordinary valve is limited by both the apparent impossibility of regulation and the shock produced at closing. The pressure below the disc before and during the blowing period is investigated. The action of a valve depends, not on the magnitude of a lifting force, but on variation of lifting force with discharge capacity and pressure. The design of a valve adjustable for variable lifting force is described. Six charts show the characteristic actions of different valves. Discharge capacity of valves with diaphrams from 1 in. to 4 in. are tabulated. A valve with the discharge turned downwards, having an upward "jet" action on the disc, is shown and discussed. In determining the rules, valves must be considered on the basis of discharge capacity and action, rather than on the lift.

BRITISH AND FRENCH MUNITIONS OUTPUT.

IN the course of a long and exhaustive speech in the British House of Commons recently by the Hon. Mr. Montagu, Imperial Minister of Munitions, much interesting and highly informative date relative to the production of war supplies in Great Britain was made publicly available. The following statistical synopsis will be found to embody the more important features discussed:—

British Output.

Shells.—An output which in 1914-15 took twelve whole months to produce is now attained in Great Britain in the following periods:—18-pounder ammunition, 3 weeks; field howitzer ammunition, 2 weeks; medium-sized shell, 11 days; heavy shell, 4 days; or, lumping all natures of gun and howitzer ammunition together, we are now manufacturing and issuing to France every week about as much as the whole pre-war stock of land service ammunition in the country.

Artillery.—Our present monthly output of big guns is about twice as many as were in existence for land service when the Ministry of Munitions started. The monthly output of heavy guns increased more than six-fold between June, 1915, and June, 1916, and will soon be nearly doubled.

Machine Guns.—The weekly output has increased, since the Ministry of Munitions was founded, fourteen-fold, and is still increasing. Soon we will have overtaken all the requirements of the British Army, and will then be able to turn our manufacture exclusively to supply our Allies.

Rifles.—Nearly three times as many new rifles were accepted in the first year of the Ministry of Munitions' activities as in 1914-15. The equipment of our army now overseas, both in machine guns and in rifles, has been accomplished from home sources alone.

Small-Arms Ammunition.—The home production is now three times as much a week as a year ago. We meet all demands made by the War Office, and yet have built up a stock for the future.

High Explosives.—The production is now 66 times as much as it was at the beginning of 1915. The weekly consumption is between 11,000 and 12,000 times the amount manufactured in September, 1914.

Weapons for Trench Warfare.—The output of bombs increased 33-fold between May, 1915, and May, 1916. We have also supplied a large quantity of steel helmets and also some experimental body armour.

Transport and Finance.

The overseas transport of munitions has reached 1,300,000 tons.

There are now ninety-five national munition factories, and one of them fills twice as much as Woolwich.

Last year the United States supplied 70 per cent. of light shells; this year we shall make our own.

American heavy shell supply was invaluable, but we hope, with Canada's help, to be independent of it.

The finance department of the Ministry of Munitions controls an expenditure of $5,000,000 a day. Its supervision has saved $100,000,000 a year on shells; it has reduced American contract prices by 15 per cent.

Forty-five thousand soldiers have been recalled for munition work.

A year ago 1,635,000 persons were employed; to-day there are 2,250,000, and of these 400,000 are women.

French Output.

Since the beginning of August, 1914, the following increases in the manufacture of guns and shells have been secured in France:—

Machine Guns.—At the end of March, 1916, the production was 98½ times greater; at the beginning of June 131½ times; and a month later over 136½ times.

Guns.—The output of 75 mm. guns is 27 times, and 75 mm. gun carriages, 91½ times greater.

Heavy Guns.—Progress has been made in the manufacture of heavy guns, which is certainly not inferior to that of "75's," and new models are in process of production from which great results are expected.

Rifles.—At the end of March, 1916, the output was 237 times greater; at the beginning of June, 267½ times, and a month later 290 times.

Shells.—The manufacture of empty 75 mm. shells was 35 times greater in March and 38½ times at the beginning of July; of empty shells of greater calibres 54½ times and 79 times greater. At the present the output of these shells is 80 times larger than it was at the beginning of the war.

C.P.R. WHARVES AT VANCOUVER.

THE Canadian Pacific has plans for wharves at Vancouver which will cost $1,500,000. These plans will dove-tail into those which the city contemplates to carry out at the port. The latter is growing in value and bigness all the time. There is much complaint from shippers of congestion, for Vancouver is becoming a great port. The city is going to spend $5,000,000 on wharf extension in the immediate future, and the railway company, on its own account, has plans for a further extension of the wharves which it will use for its own business. Both east and west the Canadian Pacific Railway has now for its shipping interests, facilities which render it absolutely independent—this independence makng for better and more efficient service in the ocean carrying business, which the company has notably extended during the past few years. The fleet of the company now numbers, all told, over 100 vessels: but it has especially strengthened its Atlantic and Trans-Pacific service in latter years—recognizing, as it did, the possibilities of increased exchange between this continent and Europe and Asia.

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POWER FROM OCEAN TIDES

By A. J. Campbell.

FOR centuries it has been recognized that the millions of tons of water in motion through the ebb and flow of the tides would, if properly harnessed, give sufficient power to operate machinery installed the world over. The extraordinary tides of the Bay of Fundy have long beckoned to inventive genius. It has been generally recognized among engineers who have given thought to the subject that if at any point tide power is possible, the Bay of Fundy shore possesses distinct advantages as a site for experiment.

Bay of Fundy Adaptation

The Bay of Fundy is an arm of the Atlantic Ocean, separating Nova Scotia and New Brunswick. Its average width is about thirty-five miles. At the head it is divided into two branches by Cape Chignecto. The average speed of the tide in the bay is from one to two knots per hour, but in some places this speed is considerably exceeded. At some seasons the tide rises to a height of fifty-three feet. The swiftest tides, although not the highest, are at Cape Split, between Minas Channel and Minas Basin, where the usual maximum rate is from seven to ten knots and often more. Here a promontory rises abruptly from the water 335 feet above mean high tide level. The accompanying photographs give an idea of this location. It is at this point that preparations are under way to develop Hydro-Electric power from the tidal current. Briefly stated, the proposal is to place current motors in the tidal stream and operate pumps by means of their power, the pumps delivering water to storage reservoirs on a neighboring hill. From the reservoirs the water will flow as regularly as required to water turbines in a power house at the foot of the hill, these turbines driving electric generators.

Tidal Power Projects Elsewhere

In previous attempts made elsewhere to utilize tidal power large dams have been constructed. These dams enclosed reservoirs, which were filled by the incoming tide and emptied through the power gate between them, one reservoir being kept at high tide level and the other at low tide level. This method could not be satisfactory for continuous power unless the reservoirs were very large to prevent loss of head between tides, and the dams correspondingly large and expensive. In most cases such dams would interfere with navigation unless provision were made for lock canals. Moreover, the intermittent service makes some form of storage absolutely necessary. This, of course, requires large areas, expensive dams and similar structures.

Tide Motor Idleness

Any tide motor is necessarily idle at four periods in twenty-five, viz., at high and low water slacks. In consequence, some provision must be made to carry on the work during these periods. Electric storage batteries would be impracticable owing to the expense of installation and upkeep. An auxiliary steam plant for use at these periods would have to be sufficiently large to operate the machinery for the greatest need, because of the continually changing time of day when slack water occurs. That being so, the steam plant might as well be operated continually, as the additional cost of operating for the remainder of the time would not likely be as much as the interest on the entire installation.

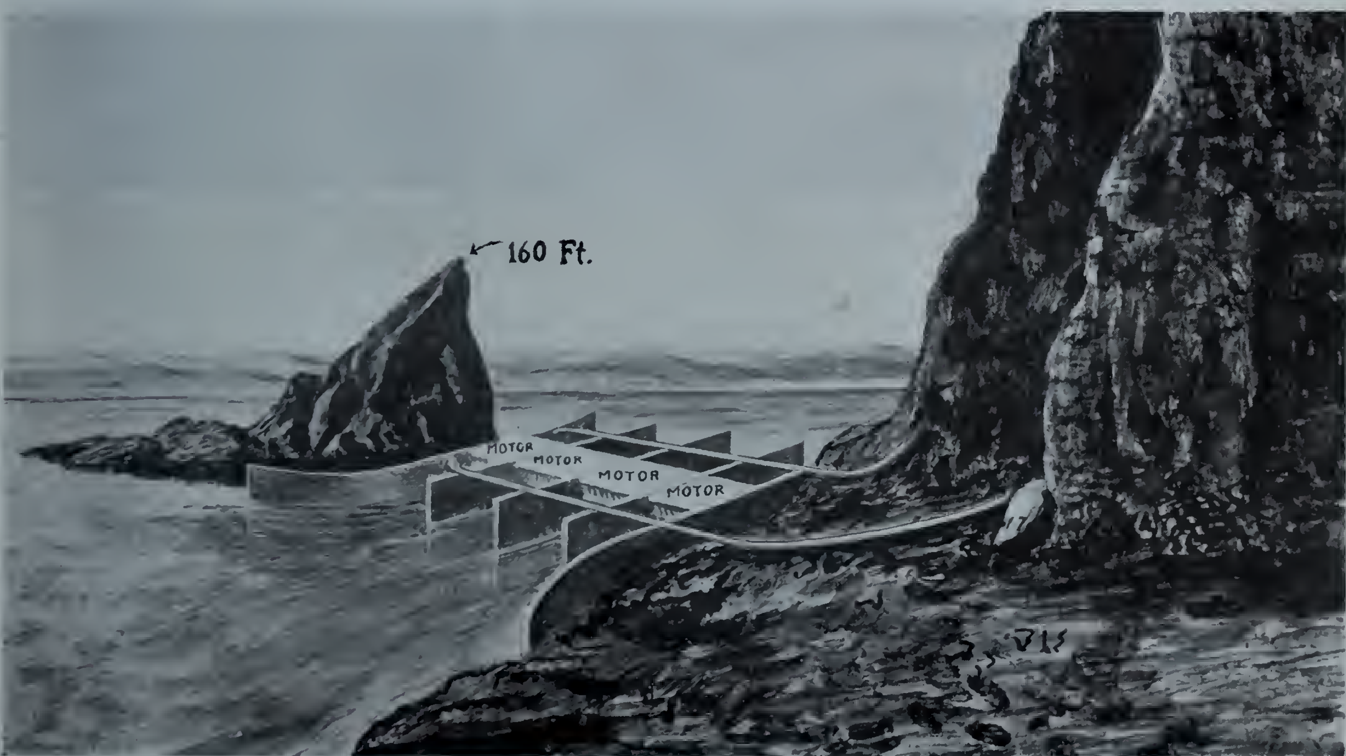

FIG. 1—SHOWING PROPOSED PUMPING PLANT INSTALLATION IN NATURAL TIDE RACE.

Not only is the flow entirely stopped at four periods in twenty-four hours, but the tidal height between these periods is constantly changing to a marked degree, and it would be difficult to adjust any machinery depending on tidal height or head unless it were adjusted to the lowest efficiency. Even then the power output would be a continually varying quantity. The fact that in most localities the tidal rise is very low makes any development dependent upon head costly, for the first cost of a low-head plant is always unusually great. In addition to other difficulties, a tide water like the Bay of Fundy must be free for navigation. An opening like Digby Gut might conceivably be dammed and a water power installed, were it not for the fact that navigation must not be interrupted.

Fundy Bay, and as great as any location in the world of which we have definite knowledge. The cliff rises from 335 to 400 feet above mean high tide, making necessary the handling of only relatively small amounts of water, thus reducing the size and cost of the reservoirs. The high head also makes all the power house machinery costs small in comparison with similar machinery for low heads.

Transmission Feature

The situation is very favorable for the transmission and distribution of power, while there is unlimited opportunity for the expansion of the plant as business warrants it. There is, besides, no interference with navigation. The plan for utilizing the energy of the tides at Cape Split involves no freak tidal motor nor water will run by gravity through concrete penstocks to the turbines in the power house. The latter will be located at sea level near the foot of the cliff, on the Minas Basin side of the Cape. These turbines will drive alternating current generators, which will deliver electrical energy to high tension transformers, from which the transmission lines will be supplied. It should be noted that the proposed method for use at Cape Split is not a general method of utilizing the power of the tides. It is made feasibly practicable, and at comparatively low cost there solely because of the unique combination of natural conditions.

Tidal vs. Interior Water Power

There has been little necessity for

FIG. 2—SHOWING THE NATURAL CHANNEL BARE AT LOW TIDE.

A power plant then for even a favorable tide like the Bay of Fundy must be so adjusted as to give continuous, regular and sufficient power with comparatively low cost of installation and operation, and at the same time must not interfere with shipping.

Proposed Location

The promoters of the scheme under discussion searched for a location possessing three requisite advantages—a swift current for a considerable portion of the day; high land nearby with an area sufficient for storage reservoirs; a suitable location for the power house. These requirements they found at Cape Split. This location has the longest continued swift currents of any place in the Bay—that is to say, the average speed of the current throughout the whole twenty-four hours is the greatest in any motor operated by the rise and fall of the tides. All the machinery to be used is based on well-known principles of operation, and most of it is of the usual type and of the usual sizes employed in connection with municipal waterworks and hydro-electric generating stations.

It is proposed to instal Clarkson current motors in channels located in the natural tide race at the Cape (Fig. 1), where the speed of the current exceeds that of our swiftest streams, and, so far as known, is not equalled by tidal currents anywhere on earth. These current motors of new and efficient design will operate pumps located in pump chambers in the channel walls, and elevate water to small regulating reservoirs placed on the adjacent high cliffs more than 300 feet above mean tide level. From the reservoirs or forebays the tidal development in America, as capital has been largely directed toward undeveloped interior water courses which are widely distributed. The methods of utilizing these have been carefully worked out. In considering this phase of the question, however, it is important to note that the Commission of Conservation (1910) estimated the possible development of water power for Nova Scotia to be only 54,000 horse-power, much of which would not be available for a portion of the summer unless extensive storage could be provided. This is not sufficient to carry the total installation of steam and water power of Nova Scotia alone (49,724 h.p.) throughout the whole year, and leaves no room for future development if water power were the only power used. If hydro-electric power comes into general use in Nova Scotia it must be through the utilization of tidal power.

Market for Tidal Power

Industries in the Maritime Provinces within reach of a Hydro-Electric plant at Cape Split require 85,000 horse-power, and are producing this at high cost from coal. Indeed, all the industrial centres of the Maritimes are available for electric transmission from this point, with the exception of those in Cape Breton Island, and even they are not beyond the electrical transmission distances in vogue in Ontario and elsewhere. The manufacturing plants of Halifax, Windsor, Springhill, Amherst, Sackville, New Glasgow, Moncton, Sussex, Truro and St. John are within easy transmission distance.

A population of one million lives within a radius of 125 miles of Cape Split. The two proposed transmission lines with their branches touch towns within less than 100 miles, having a combined population greater than that of any city in the Dominion except Montreal. The whole territory covered by the lines possesses a larger population than either Montreal or Boston, and exceeds the combined population of Toronto, Ottawa, Quebec, Winnipeg and Vancouver. While a large proportion of this population is rural, there is a very apparent tendency toward community gathering, and this tendency would, of course, be promoted by any general distribution of cheap power.

A suggested new outlet for power is a trolley line from Windsor to Annapolis. Such a line would pass within fifteen miles of Cape Split, and would follow the transmission line toward Halifax for twenty-five miles. The projected road would traverse a most prosperous farming district, not a little of which is poorly served by railroads, and would open up a passenger and freight traffic which should be profitable. There is also the ever-present possibility and desirability of electrifying any or all of the steam railroads at present established, particularly if the work of double-tracking the roads should begin.

Holding Company Formed

A holding company has been formed and the necessary funds have been subscribed to demonstrate exhaustively the practicability and the reliability of the project. This company is known as the Cape Split Development Co. The president is George B. Cutten, president of Acadia University, Wolfville, and the managing director is R. P. Clarkson, Professor of Engineering at Acadia. These gentlemen are firmly convinced that the problem of harnessing the Bay of Fundy tides has been solved, and that they have hit upon the means whereby cheap power in abundance is obtainable for the Maritime Provinces.

Preliminary work on the Hydro-Electric project has been already carried out, the necessary lands have been acquired, and the patent rights secured to the current motor to be used. A charter has been granted to Bay of Fundy Tide Power, Ltd., with wide scope as a public service corporation for the construction and operation of a hydro-electric plant at Cape Split. The control of this will be vested in the Cape Split Development Co.

MARINE INSURANCE

By E. V. Pannell.

FROM the earliest times cargo-owners and shipowners have recognized the necessity of safeguarding their property against the risks of the sea. In the early days of the Christian Era, when the Phoenicians and Tyrians traded with Spain, Gaul, and Britain, their frail ships were sometimes overtaken by tempests, which could only be ridden out safely by lightening the craft; it, therefore, became customary under extreme stress of weather to jettison a portion of the cargo. The loss thus occasioned was shared equitably by the various cargo-owners, and thus the principle of "General Average" was established. The word "Average" signifies "Damage," and of such, present-day marine insurance recognizes two kinds: "General," implying loss, as above described, by jettison, and "Particular," covering damage due to other causes.

Initiation of Marine Insurance

In the year 1670 a society of shipowners and master marines, meeting at Lloyd's coffee house in Cornhill, London, formed a marine intelligence department, issuing a shipping bulletin three times a week, which exists to-day under the well-known form of Lloyd's list of British and Foreign Shipping. About 100 years later the same society formulated the marine insurance policy which is now in use all over the world. Many other companies besides Lloyd's underwriters are handling marine insurance, but the form of policy and the warranties are practically universal.

Insurance Scope

The scope of insurance has been greatly extended, for, although it was the original intention of marine insurance to cover only the risks of the sea which no skill or care could prevent, policies may now be taken out to cover any conceivable risk. The underwriters have always reserved certain "warranties" or stipulations by which they exclude certain risks. For instance, a clause will be found at the foot of a marine policy stating "Corn, fish, salt, fruit, flour and seed are warranted free from average except general, unless the ship be stranded, sunk, burnt or on fire." Put in other words, this means that the above commodities are excluded from insurance except in the case of jettison or the ship be lost, in which case it is most probable that a total loss could be claimed. The object of the clause is apparent, as the above mentioned articles are peculiarly liable to damage, and hence not a good risk. This is the F.P.A. (free of particular average) clause which normally appears on every policy, but which may by arrangement with the underwriters be over-ridden.

A further warranty states: "Sugar, tobacco, hemp, flax, hides and skins as warranted free from average under five pounds per cent." This was designed to relieve the underwriters from having to settle petty claims for particular average amounting to less than 5 per cent. of the value of the goods insured. A similar clause related to the vessel itself, the limit in this case being 3 per cent. With a large and valuable cargo, 5 per cent. would amount to quite a large sum; it is, therefore, customary for shippers to protect themselves by dividing up the cargo into £100 blocks. By this means damage, which would amount to less than 5 per cent. on the whole cargo, will, if localized, probably reach very much more on the smaller lot, then particular average can be claimed and paid.

Two other warranties which are not mentioned, but are implied in the policy, are "Seaworthiness and Legality." The first covers absence of overloading, proper stowage, efficient manning, absence of cargoes of unusual risk, etc., whilst legality would be affected by the carriage of contraband or the insurance of a foreign vessel against war risks.

Insurance Comparisons

Comparing marine insurance with fire or theft insurance on land, it will be seen that there are certain distinctions. On land, a policy is a contract of indemnity by which the insurance company undertakes to restore the original condition of the property insured. It can hardly be said that marine insurance is of the same nature because there is no burden on the insured to prove the value of the loss, and in many cases it would be impossible to do so. Further, the issue of P.P.I. (policy proof of interest) policies to some extent lends itself to speculation. Nevertheless good faith is essential to the policy, and misrepresentation or concealment immediately render the insurance void. If the misrepresentation is accidental, it is customary to return the premiums otherwise they are forfeit. At the time of taking out the policy, all circumstances liable to influence the underwriters must be divulged, default in this regard being equivalent to concealment.

"Sailing" Clause

Besides the F. P. A. clause and the implied warranties already mentioned there are certain other warranties which are expressed in the policy. One is the warranty to sail on a certain date. To "sail" in this case is to cast off moorings or to weigh anchor and does not necessitate clearing the port. The insurance in this case would cover stranding of the vessel after casting off but before the port was cleared. If, however, the policy contains the words "sail from the port of ——————," the port must be cleared, otherwise the policy is void. This is an important point in war time as it is possible that the ship might be lost by a mine or infernal machine before clearing her port. The F.C.S. (free of capture, seizure, detention and the consequences thereof) clause is one which practically eliminates war risk and therefore in times like the present is usually over-ridden by being omitted or the words "including war risk," inserted in the body of the policy. Warranties sometimes given to the underwriters with the object of securing better rates are "part value uninsured," and "no iron or ore in excess of registered tonnage is carried."

Total Loss

In some cases the insurer will take out a T.L.O. (total loss only) policy thus eliminating particular average. Total loss is of two kinds, actual and constructive. The first applies when:—

(a)—The ship or subject matter is completely destroyed.

(b)—The matter is so damaged as to cease to be the subject of the insurance, "cease to exist in specie."

(c)—The assured is irretrievably deprived of the subject matter.

As an example of (b), a cargo of hides shipped from Valparaiso to Bordeaux were so badly damaged during passage as to putrify. It was, therefore put ashore at Rio as it was claimed that at the journey's end they would cease to exist in specie. Total loss was therefore paid.

Constructive total loss applies more often to the ship than to the cargo. It covers the circumstances where the goods are reasonably abandoned, or where the cost of recovery would exceed the value of the goods. In this case the insured hands to the underwriters a notice of abandonment formally surrendering all interest in the goods and claiming total loss. As a formality, the underwriters usually decline this notice so that same is accompanied with a writ and a formal action is entered for the recovery of T.L. based on the facts at the time of issuing the writ. Upon satisfying the claims the underwriter acquires all the rights of the insured by what is termed subrogation. Such rights may be the result of proceeding already instituted for compensation (in the case of collision), or salvage.

Payment of Insurance

When insurance has to be paid, the necessary investigations and apportionments are made, not by the underwriters themselves, but by an entirely independent body of highly specialized professional men, the average adjusters. Their work is frequently very difficult, particularly where general average is paid. It will easily be seen that if ten thousand dollars worth of a fifty thousand-dollar cargo were jettisoned the adjustment of the average payable by each of the separate shippers is no simple matter. In order to avoid detention of cargo it is usual, where a G.A. has been incurred, for the cargo owners to sign an average bond undertaking to pay their share of the G.A., when it has been computed, and they are called upon. Upon this understanding the cargo is delivered to the consignee. The average bond usually calls for a bank deposit as security. In order to avoid ambiguity as to the laws of general average which vary in different countries, the policy usually specifies that the York-Antwerp rules shall govern both G.A. and salvage. The foreign general average clause over-rides this and stipulates that the laws governing G.A. shall be those of the country of destination.

Period of Insurance

Insurance attaches from the time goods are safely loaded until they are safely landed. The policy is sometimes extended to cover between "shipper's and consignee's" warehouses, and this sometimes involves transfer by lighter or railroad. If insured for "voyage," however, the insurance ceases to attach 24 hours after mooring. Goods are generally insured between specified points or for voyage, but ships are usually covered by time policies for six months or one year.

Certain peculiarities attach to a marine insurance policy. For instance, as already noted, the F. P. A. clause states that average will not be paid except the ship is stranded or lost. However, a rider to the policy asserts that "grounding in the Suez Canal, Manchester Ship Canal, River Plate," and certain other locations "shall not be deemed a stranding." This clause is inserted because it is an everyday occurrence for a ship's keel to touch bottom in these channels.

Marine insurance was originally designed to protect shippers from losses due to the perils of the sea, piracy, restraints or rulers and princes, barratry of the master or crew, and jettison. It is, however, extended in modern times to cover any conceivable risk. Certain liabilities must, however, be undertaken by the shipowner and are accepted by the bill of lading. These are: (a) Improper stowage; (b) Negligence of servants; (c) Pilfering.

The shipowner's liability is limited, and the shipper's only really satisfactory indemnification is afforded by a policy of marine insurance.

GEARED TURBINES FOR U. S. DESTROYERS

IT was recently announced that the U. S. Navy Department intends to re-engine ships in the service that are now equipped with direct connected turbines. The first two to be so reconstructed will be the destroyers Henley and Mayrant. These are to be equipped with geared turbine units, for which contracts have been placed with the Westinghouse Machine Co., East Pittsburgh, Pa. Geared turbines have been decided upon due to the fact that they are lighter and take up less space than direct connected units, are much better mechanically because of their small size, and materially reduce steam consumption at all speeds and especially at cruising speeds.

The Henley was built by the Fore River Shipbuilding Co., Quincy, Mass., and completed in the fall of 1912. The main machinery consisted of two direct connected marine turbines with two compound cruising engines, which were connected to the main turbine shafting by means of jaw clutches. The turbines had fourteen ahead and two reverse stages. Steam was supplied to the turbines at a pressure of 250 pounds per sq. inch, by water tube boilers, for which oil was used as fuel. The machinery to be supplied by the Westinghouse Machine Co., will consist of two complete expansion geared turbine units of the impulse reaction type, with Kingsbury thrust bearings, and two geared cruising units. It is to be installed in the same engine room space and to connect with the existing propeller shafting, and drive the propellers at the same speed as formerly. The two main turbines will each have a capacity sufficient to move the ship at a speed of 15 knots per hour. They will be connected to the main turbines by clutches, and will be used only up to a speed of 15 knots. After this speed has been attained, they will be disconnected and the main turbine alone used. Reduction gears will reduce the turbine speed of 3,000 r.p.m. down to 640 r.p.m. for the propeller shaft.

The Mayrant was built by the Wm. Cramp & Sons Ship and Engine Building Co., Philadelphia, Pa., and was deliver ed to the Government in 1911. The machinery consisted of two turbines without cruising engines. The turbines were designed to develop 13,000 shaft horse-power, at a speed of 650 r.p.m. and with a steam pressure of 250 pounds gauge. They had 16 stages ahead and 7 stages astern. Steam was supplied by four water tube boilers. Oil was used for fuel, as in the Henley. The new machinery to be furnished will be essentially the same as that for the Henley. The main turbines, however, will each have a capacity of 7,000 shaft horsepower at a speed of 629 r.p.m.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

S.S. "HAULWEN" STRANDING

A FORMAL investigation was held in the Wreck Commissioner's Court, Montreal, on August 4th, 1916, into the causes which led to stranding of the S.S. "Haulwen" in Montreal Harbour, on June 14th, 1916, before Captain L. A. Demers, F.R.A.S., F.R. S.A., Dominion Wreck Commissioner, assisted by Captain Francis Nash and Captain Joseph Ostens Grey, acting as Nautical Assessors.

The master, Daniel Jenkins, deposed that the "Haulwen" is a steel built, schooner rigged, single screw vessel, with triple expansion engines, of a speed of 8½ knots loaded; that she is 2612 tons register, and 4031 tons gross; that she carries a crew of 28, including 2 deck officers and 3 engineers; that she was drawing about 22 ft. aft at the time of the accident; that he was on the bridge when she left Windmill Point at 5.20 a.m., with the aid of two tugs, which were cast off after she got out in the stream; that the weather was fine and clear, with no perceptible wind.

He stated that later on as they passed Vickers Dry Dock he noticed the fog was coming on, and it came on suddenly in a dense bank; that the pilot then suggested and ordered that the anchor be let go, and the helm was put starboard, and then steadied and the engines put full speed astern and the anchor let go with 45 fathoms of chain; that the ship swung rapidly and in attempting to give her more cable they saw she was not taking it, and came to the conclusion that she was hanging on a pivot, moving a few points aft and forward.

He stated that the vessel was floated with the aid of 4 tugs about 7 o'clock in the evening, and an inspection of the hull brought forth that the vessel had not suffered any serious injury.

The Pilot, Aubert Naud, also gave evidence, and the mate P. F. Lanigan, corroborated the master's evidence.

Finding

The evidence adduced in this case was obtained from three witnesses, the master, mate and pilot.

After reviewing the circumstances under which this accident occurred, the court finds that on this occasion the officers of the ship are held altogether blameless, and that the pilot was solely at fault, as there appeared to be no interference on the part of the master.

In view of the circumstances, the Court censures the pilat for not adopting what, on the face of it, would have been the proper thing to do, namely, the dropping of the starboard anchor instead of the port one when he saw she was going in the opposite direction to that which he wanted he to go.

S.S. "MIDDLEHAM CASTLE"

A FORMAL investigation was held in Montreal, on August 3rd, 1916, into the causes which led to the stranding of the S.S. "Middleham Castle," on Matane Reef, July 27th, 1916, before Captain L. A. Demers, F.R.S.A., F.R.A.S., Dominion Wreck Commissioner, assisted by Captain Francis Nash and Captain Joseph Oatens Grey, acting as nautical assessors.

The master, John Kelly, who was unrepresented by counsel, deposed that he holds a certificate of competency, No. 035020; that the S.S. "Middleham Castle" was a steel-built, single-screw vessel of 2,900 tons net and 4,534 tons gross, with a speed of 10½ miles, carrying a crew of 48, including three properly certificated officers; her draft at the time of the accident was 14 ft. 8 in.; that she was supplied with all necessary instruments for navigational purposes, and the standard compass had from 3 to 5 degrees deviation.

He stated that when at Sydney he secured a chart of American publication; but did not inquire nor ask any of the masters of the vessels in the harbor for sailing directions when he could not sesure them in Sydney; that he was a stranger in these waters; that from Sydney to Cape North he experienced clear weather, and that hazy weather was met later. Later he saw what he thought to be a buoy off Matane, and headed for it, thinking it was the gas and bell buoy. He did not recognize his error until he found the ship ashore, then he noticed the light and bell buoy on his starboard beam. He gave orders to the engine room full speed ahead and astern, but found his vessel turning differently to what he expected. However, he succeeded in floating his ship and proceeded on hugging the land, and passed inside of Cock Point Buoy.

The third officer and chief officer also gave evidence.

Finding

The evidence adduced, which was given by the three officers of the ship, has been sufficient for the Court to arrive at a conclusion; but here again the Court is non-plussed and handicapped owing to conditions existing in dealing with the master, John A. Kelly, certificate No. 035020, with the severity the case demands.

Here we have a master ordered to come to Canadian waters—waters which are absolutely unknown to him, since it is his first time on this coast. He stopped at Sydney, where, according to his evidence, he endeavored to secure some charts, but obtained for navigating his ship up the River St. Lawrence a chart of American publication. Without any sailing directions, not conversant with the tides and currents prevailing in this river, he ventured to sail his vessel within three-quarters of mile of headlands, which are really low points of land, the same as other points along his course, which the Court considers a foolhardy operation, and otherwise termed too close sailing.

This ship is ready to sail; in fact, the sailing date has been delayed in order for this investigation to be held. If the Court followed its impression it would suspend the certificate of the master for two months for this reckless navigation; but by doing so the Court exposes the vessel to some delay in obtaining another master.

The Court considers it will meet the situation as it is by severely censuring the master for venturesome navigation in unknown waters, without having first surrounded himself with the necessary information.

S.S. "FERNFIELD" STRANDING.

A FORMAL investigation was held in the Customs House, Halifax, N.S., before Captain L. A. Demers, F.R.A.S., F.R.S.A., Dominion Wreck Commissioner, assisted by Commander E. Wyatt, R.N.R., and Captain A. Cuthbert, acting as Nautical Assessors, on August 21, into the causes which led to the stranding of the S.S. Fernfield at Battery Point, Louisburg Harbour, N.S., on July 4, 1916, at about 4.30 a.m.

The master, James Brander, deposed that the Fernfield was a steel built, single screw vessel, with triple expansion engines and having a speed of 8 knots; she carried a crew of twenty-eight all told. When he left St. John, N. B., July 1, he experienced clear weather up to Seal Island, the weather then becoming intermittently foggy. The proper courses were steered to Louisburg; on reaching which he circled around the fair-way buoy till the weather cleared, and after about two hours wait the range leading lights of the entrance as well as the light house were seen. He steered for the said leading lights at a reduced speed. The turning buoy was seen on the port buoy, and when it was on the quarter the order astern was given and executed with at the same time slow porting. He saw the light on the pier but could not see the furthest ones. The wind was then fresh from a S.S. direction, a little swell being felt on his starboard side as he headed for the light on the wharf. When he gave the order slow ahead shortly after and the vessel did not answer her helm it was found that she had grounded on Battery Point Shoal; the engines were next put astern. The vessel swung around until she headed westerly, and an hour and a half later she floated off with some little assistance from a tug and the combined influence of wind and tide which was coming in.

Inspection of the logs showed them to be accurately kept, also the book of deviations; it was further noted that frequent observations were made. He did not have a man at the lead as it was doubtful whether one could be found on board who knew the lead, it being hard these days to find a capable crew. He did not make any allowance for the possible influence of wind on his ship, but admitted it might have contributed to bring his vessel on the shoal, combined with the effect of the long turn he took at the turning buoy. The first and second officers, wheelsman and engineer gave evidence corroborating in its entirety the version of the master, the whole being considered by the Court to be straightforward and honest.

Finding.

The evidence having been carefully considered by the court, it is of opinion that the master, from the time of leaving St. John, N.B., on July 1, until he reached Louisburg Light, exercised all the necessary and proper precautions in navigating his ship. Under the conditions existing, the Court finds however, that the master omitted to include in his calculations, the possible influence of the wind then blowing on his starboard side when he headed for the light on the wharf. In view of all the circumstances, the court did not deal with the Certificate of the master; nor reprimand him, but cautioned him to be more careful in the future in entering harbours with which he may not be well acquainted.

PORT AUTHORITIES CONVENTION AT MONTREAL

AFTER a cordial welcome to representatives from all parts of the United States and Canada to the 5th Annual Convention of the American Association of Port Authorities had been given on the morning of September 13 by Controller Ross, on behalf of Mayor Martin, and replied to by J. Spencer Smith, New York City, the delegates turned their attention immediately to papers and subjects dealing with matters connected with making harbors of most use at the least expense for maintenance or capital construction.

Outside of interesting official reports by the secretary, William Joshua Barney, of New York City, and the treasurer, Harry C. Gahn, of Cleveland, the interest of the day was concentrated in discussion of two papers, one by the chairman, W. G. Ross, president Montreal Harbor Commissioners, on "Port Organization and Administration," and one by Thos. S. Williams, of San Francisco, diagonally across the continent from Montreal, on "Concrete Wharf Supports in San Francisco Harbor." The varied conditions in all the harbors of the Atlantic and Pacific made the recitals of experience in various contrivances for modern harbor needs very interesting, and so far as Montreal was concerned the paper was more interesting because the delegates were afterwards taken all over the lower harbor, and shown the various works which had been constructed, accompanied by the engineers, harbor commissioners, harbor master and secretaries, to explain points about which they desired information. After a buffet luncheon on the steamer, the delegates returned to the offices of the Harbor Commissioners for the afternoon meeting.

Programme Features

In his address of welcome on behalf of the city, Controller Ross gave a brief history of Montreal, with some facts which would give the visitors a basis for gathering an idea of its character. W. G. Ross, chairman, welcomed the delegates on behalf of the Harbor Commissioners. At 4.30 the delegates went to Lachine to go down the Lachine Rapids and see the upper harbor works. The programme for the second day of the Convention consisted of:—

Morning session, 10 a.m.—Paper: Hon. F. W. Mulkey, Portland, Oregon, "Legal Jurisdiction Over Stream Beds and Shores and Navigable Waters, etc." Paper: Hon. E. N. Loeb, president Board of Commissioners, Port of New Orleans, "Glossary and Interpretation of Port Terms." Paper: Robert Bridges, president, Seattle Port Commission, "Rail and Water Terminal Facilities." Luncheon by City of Montreal on Mount Royal.

Afternoon session, 2.30 p.m.—Paper: F. W. Cowie, M.Inst., C.E., chief engineer, Harbor Commissioners of Montreal, "Canadian Ports." Paper: O. F. Lackey, Baltimore, Md., "The Establishment of a Maximum Channel Depth in Relation to Expenditure for Harbor Dues, etc."

7.30 p.m.—Banquet by Harbor Commissioners of Montreal at St. James's Club.

The programme for the third day of the Convention, in addition to general business, resolutions and election of officers, consisted of the following:—

Morning session, 9 a.m.—Paper: Hon. John Meigs, president, Department of Wharves and Ferries, Philadelphia, "The Granting of Free Wharfage by Private Corporations, etc." Paper: A. D. Swan, M.Inst., C.E., consulting engineer, Montreal, "Some Ports on the West Coast of South America, and their Future Development," and paper: Edward F. McSweeney, Boston, "Question of Switching Charges and the General Relation of Railroads at Each Port."

Luncheon by Shipping Federation of Canada.

Afternoon session, 2.30 p.m.—Inspection of railway terminals, elevators, transit sheds and port facilities in Montreal Harbor.

BIG SCHOONERS BUILDING IN NOVA SCOTIA

THE four-masted schooner Ada Tower, built by Councillor G. M. Cochrane, was launched at Port Greville recently. The Ada Tower is a vessel of 150 feet keel length. Her tonnage is 528. She will be commanded by Captain Leonard Tower, of Wood Point, N.B., and will be put in the lumber-carrying trade.

Four more schooners, one of them due to be launched soon, are now being built on the Parrsboro shore—two at Port Greville, one at Spencer's Island, and one at West Advocate. All of them are expected to be put into lumber carrying. One of the vessels now building at Port Greville is being constructed by Councillor G. M. Cochrane, and will be a three-masted schooner of 400 odd tonnage. The keel was recently laid. The other vessel under way at Port Greville is being built by H. Elderkin & Co. She is also a three-masted schooner, but will not be ready for launching for some little time yet.

At Spencer's Island, Captain James Pettis is building a three-masted schooner of about 425 tons. The vessel has a keel of 138 feet. The latter was laid some time ago, the frames being now in place. Spencer's Island people are specially interested in the building of this vessel because it is the first vessel to be built there in about fifteen years.

Steam Driven Auxiliaries of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that steam-driven auxiliaries aboard ship continue to increase in number, and that they are being designed and constructed to meet in the most effective manner, both ordinary and special service applications, this series of articles describing and illustrating at least the more important types of such apparatus seems to us more or less timely, both from the point of view of familiarizing engine and boiler room staffs with the products of different manufacturers, and that of their acquiring a closer intimacy with specific detail arrangement, relative to operation, maintenance and periodic overhaul.

BOILER FEED PUMPS—II.

THE chief conditions regarding installation, service, and operation of boiler feed pumps having been outlined and discussed in the immediately previous article of this series, particular attention will now be given the design and constructional features of boiler feed pump products more or less in evidence in Canadian steam power plant installations, large and small.

"Burnham" Pumps

Burnham pumps are built in Canada by Darling Brothers, Montreal, who supply them in a wide range of sizes and types. The pumps shown in Figs. 1 and 2 are of the simplex, piston type, the former being built in seven sizes from 10 x 6 x 12 inches to 14 x 8½ x 12 inches, and the latter from 12 x 7 x 16 inches to 14 x 9 x 16 inches. A cast-iron yoke is shown connecting the steam and water ends in Fig. 1, this being replaced in the case of the larger pump, with steel tie-rods.

These illustrations represent the makers' regular pattern Burnham pumps for general service such as boiler feeding and other high duty work. They are designed for a water pressure not exceeding 150 lbs. per square inch, are double-acting, and have water pistons designed for square fibrous packing suitable for handling either hot or cold water. They are regularly fitted with solid Tobin bronze piston rods, but the 14 x 8 x 16 and larger sizes are made with two-piece piston rods, of Tobin bronze in the water end and steel in the steam end. The two parts of the piston rod are fastened together by threaded steel clamp coupling on pumps with 14 or 16 inch steam cylinders, and with keyed coupling on larger sizes. This design enables the water piston to be removed with the least trouble.

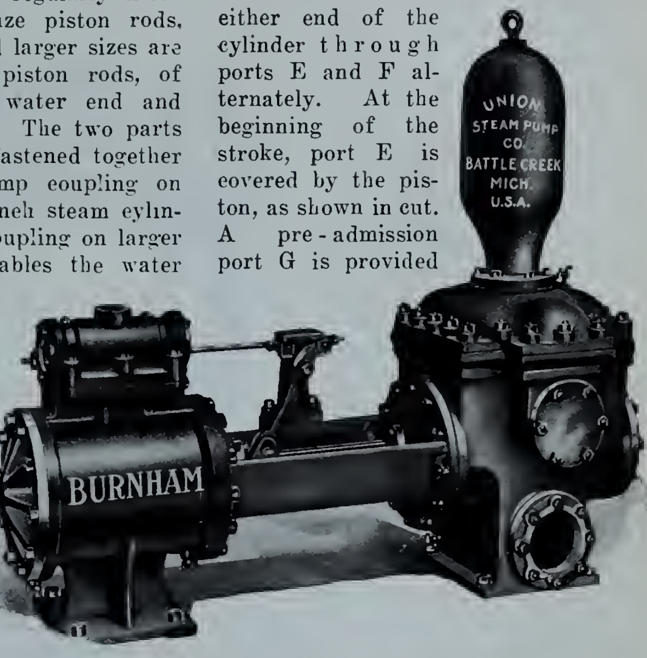

FIG. 1.—"BURNHAM" HORIZONTAL BOILER-FEED PUMP. PISTON PATTERN WITH CAST IRON YOKE.

The water end, which is shown in section in Fig. 4, is provided with heavy bronze linings in all sizes, those in the 7 x 4½ x 10 in. size and smaller being pressed into place, while the larger pumps have removable linings. All valve parts are of bronze, the seats being securely screwed into place with taper thread. Hard rubber valves are fitted except on the two smallest sizes, which are always built with brass valves.

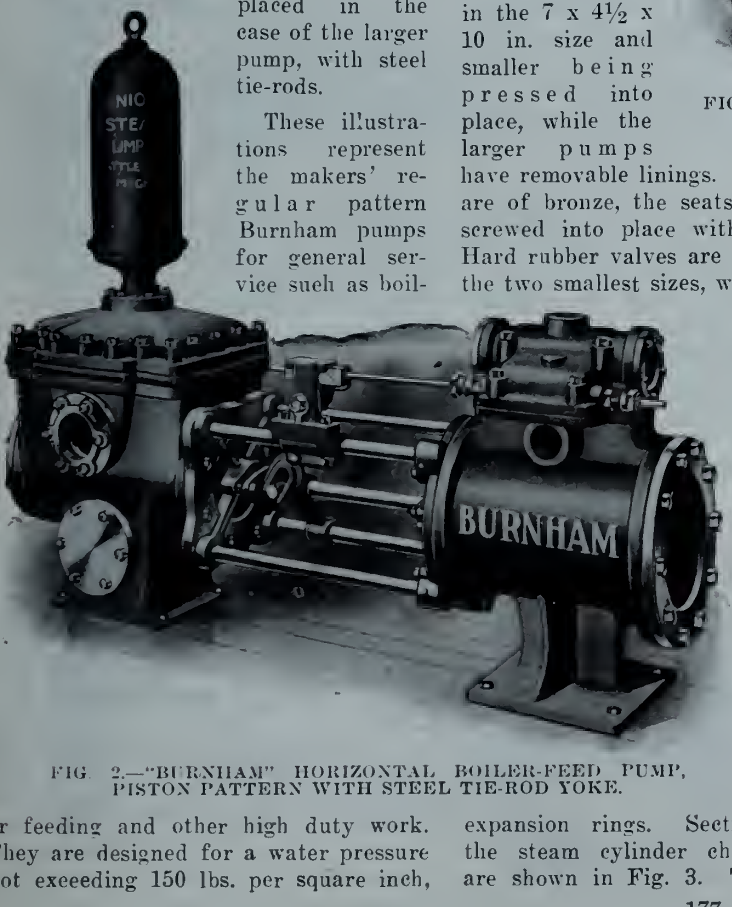

FIG. 2.—"BURNHAM" HORIZONTAL BOILER-FEED PUMP, PISTON PATTERN WITH STEEL TIE-ROD YOKE.

The steam cylinders have a removable steam chest, the valves being flat-faced D type, and capable of being readily rescraped to a tight fit when worn. The main steam piston and steam chest piston are equipped with expansion rings. Sectional views of the steam cylinder chest and valves are shown in Fig. 3. The upper view is a plan showing auxiliary valve and chest, and the lower is a vertical section through the cylinder. Live steam enters chest at B and is admitted to either end of the cylinder through ports E and F alternately. At the beginning of the stroke, port E is covered by the piston, as shown in cut. A pre-admission port G is provided which admits only enough steam to give the piston an easy start. When the main piston has moved far enough to uncover the port E, it receives the full steam pressure and moves at its normal speed until it covers the port F, when it traps the remaining exhaust steam in the end of the cylinder, thus forming a cushion which brings the rod to an easy stop.

The gear is positive in action and is operated by a slotted lever A, moved by a roller attached to the piston rod. The pin which carries the roller is fastened to the piston rod by a split coupling, the other half of which is forked and extends over to the yoke where it engages with an internal rib or tongue as shown. This prevents the piston rod from turning, and causes the roller to travel in a straight line irrespective of the angle at which the lever A may be. This lever A. alternately moves blocks K and L, both of which are fastened to valve stem T, which in turn moves auxiliary valve H (upper view) in the direction opposite to the motion of the piston.

At the end of the stroke, the auxiliary

valve H will be moved to the left far enough to open port P to exhaust through R, at the same time admitting live steam through port C. This causes steam chest piston M to move instantly, carrying main valve D with it, and reversing the motion of the pump. The steam chest piston has a pair of pre-admission ports similar to those described above for the main piston, and are for the purpose of giving a steam cushion to insure a quiet action. Blocks K and L are independently adjustable on rod T, enabling the engineer to make the piston run as close to the heads as he desires, and to make adjustment for wear. By moving block K 1-16 in. nearer to lever A, the main piston E will be stopped perceptibly earlier in its travel toward end of cylinder as shown, while similar adjustment of block L affects the piston travel in the opposite direction.

The advantages of this valve gear may be summed up as follows: A momentary pause of the piston at the end of each stroke, causing the water valves to seat quietly without shock or jar; a slow initial movement of the piston, whereby the water columns are started gradually, relieving the pump and piping of undue strains; a steam pressure on the main steam piston proportioned to the amount of work that it has to do; and immunity from damage in case of accident.

A compound steam pump of the Burnham type is illustrated in Section, Fig. 4. These pumps are made in a wide range of capacities with nine sizes of steam ends, from $6\frac{1}{8}$ in. and $8\frac{1}{2}$ in. diameter x 10 in. stroke to 24 in. and 36 in. diam. x 24 in. stroke. Equipment consists of counter, force-feed oil pump, and lagging on steam cylinders and steam chests, hand plates being fitted for access to water-valves. Being a sectional view there is shown method of coupling up the valve mechanism so that the steam supply for the two cylinders is controlled by the one auxiliary valve. The steam chest piston for the low pressure cylinder is provided with a spindle which is coupled as shown to a similar spindle on the high pressure steam chest piston. In this way the single auxiliary valve H, Fig. 3, is used to control the steam supply to both cylinders, which are connected by a substantial yoke of sufficient length to provide room for packing the two piston-rod stuffing boxes. Both the steam pistons are equipped with expansion rings—the low pressure piston being screwed tightly on to the piston rod and pinned in place, after which it is turned true. The high pressure piston has a tapered fit on the end of the piston rod, and is held in place with lock nuts.

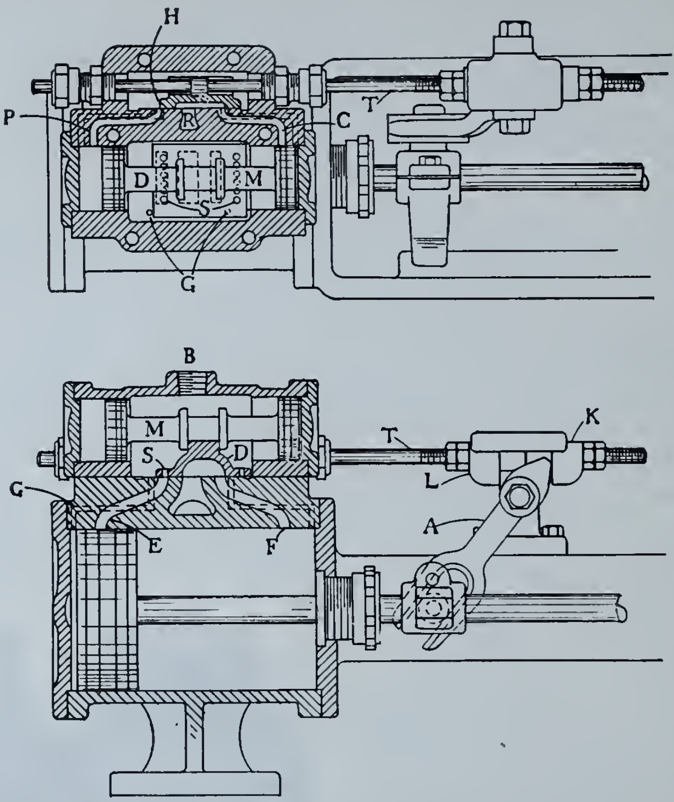

FIG. 3.—SECTIONAL VIEW OF STEAM END SHOWING CYLINDER CHEST AND VALVES.

With a compound pump of any type, the steam is used expansively. This cannot be done in a simple pump. A reduction of about 35 per cent. in steam consumption is obtainable as compared with a simple pump under similar conditions. This increased efficiency is accompanied by the ability to increase the water pressure from 50 to 70 per cent. in case of emergency by supplying live steam direct into the low-pressure cylinder through a valve provided for the purpose.

Double-acting plunger pumps are shown in Figs. 5 and 6, the former being known as the outside end-packed type, and the latter as the outside centre-packed type. Regarding Fig. 5, this pump is adapted for general use with water pressures not exceeding 150 lbs. per sq. in. The plungers are of cast iron with steel side rods. On the 7 in. size and larger, the plunger heads are made separate from the plungers, which allows them to be removed without disturbing either cylinders. As the plungers receive all of the wear on their exterior surface, to put a worn pump in good shape, it is only necessary to turn up the plungers in a lathe. As the piston rod does not enter the water cylinder it is made of steel.

The plunger pumps shown in Fig. 6 are designed for use at a pressure of 180 lbs. per sq. in. The plunger is submerged on both ends and packed on the outside at the centre. Tobin bronze is employed for the water piston rod which is secured to the steel rod in the steam end by a heavy threaded clamp coupling. Ample space is provided between stuffing boxes on the water cylinder for packing the pump plunger.

The stuffing boxes on all types of these plunger pumps, 12-in. and under, are made for $\frac{3}{4}$ in. packing; on the larger sizes 1 in. packing is used. Pumps larger than 4 in. have the plunger glands fitted with special wick-filled lubricating grooves and lubricators which oil the entire surface of the plunger at each stroke.

The general features of these plunger pumps are similar to the pis-

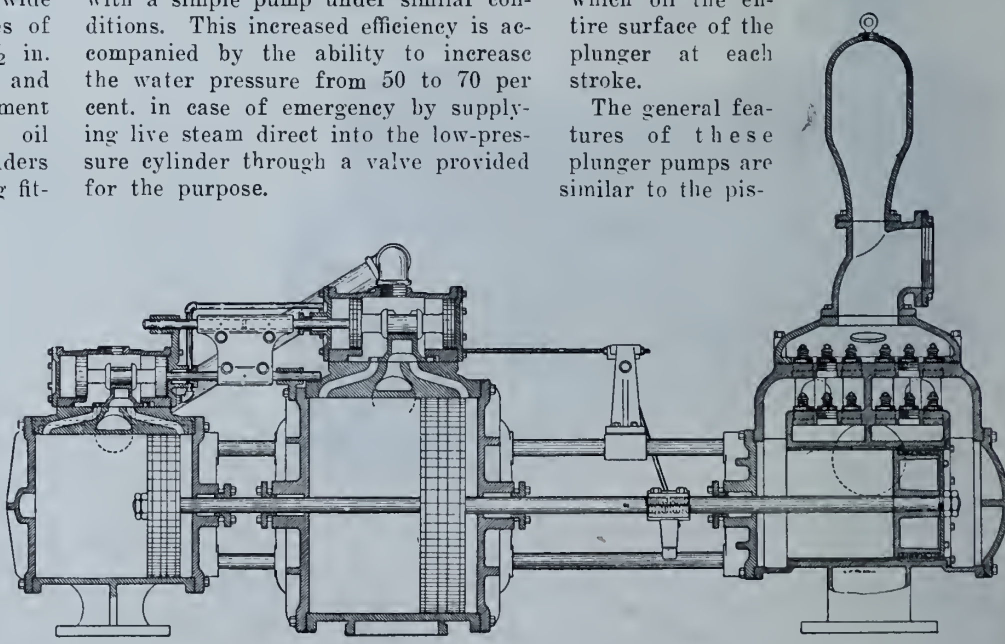
FIG. 4.—SECTIONAL VIEW OF "BURNHAM" COMPOUND PISTON PUMP.

ton type. Hard rubber valves, bronze springs, valve seats, plates, and valve stems being to standard specifications in all sizes.

'Weir Pumps''

The Weir standard feed pump for land installations, shown in Fig. 7, is built by G. & J. Weir, Ltd., Glasgow, Scotland, who are represented in this country by Peacock Brothers, Montreal and Vancouver. This pump is of the slow-speed, direct-acting type, which has been developed by the makers over a period of 25 years. The reputation for economy and long life enjoyed by this apparatus is due to the peculiar design of valve employed. The valve gear is positive, i.e., the steam valve can never be in such a position that the pump will not start immediately steam is turned on. The numbers on Fig. 7 refer to the following list of parts:—(1)—Steam slide valve chest; (2)—Double joint, etc.; (3)—Front stay; (4)—Bottom spindle; (5)—Valve gear levers; (6)—

Number and Names of Parts Shown on Fig. 5.

2	Outside Steam Cylinder Head.	108	Standard for Actuating Lever.
2A	Inside Steam Cylinder Head (for yoke).	109	Right and Left Cam Blocks on Valve Stem.
6	Steam Piston.	110	Bolt for Holding Actuating Lever.
37	Steam Cylinder Rings.	111	Guide for Actuating Lever Rod.
39	Steam Cylinder.	112	Stud Bolt to Hold Guide for Actuating Lever Rod.
19	Steam Valve Chest.	116	Clamp to Hold Standard for Actuating Lever.
20	Steam Valve Chest Heads.	68	Tie Rods.
21	Steam Chest Piston.	44	Water Cylinder.
37A	Steam Chest Cylinder Rings.	47	Water Valve Plate.
104	Main Slide Valve.	48A	Water Cylinder Hood.
105	Auxiliary Slide Valve.	18	Air Chamber.
36	Stuffing Box Gland for Piston Rod (Steam Cylinder), iron.	34	Air Chamber Plug.
105½	Valve Stem Rod.	15	Water Valves.
111A	Collars on Valve Stem Rod.	58	Water Valve Seats.
101	Auxiliary Valve Stem Stuffing Boxes.	48	Water Valve Bolts.
102	Auxiliary Valve Stem Stuffing Box Nuts.	86	Water Valve Springs.
103	Auxiliary Valve Stem Stuffing Box Glands.	4	Plungers.
106	Actuating Lever.	36A	Stuffing Box Glands for Water Plungers.
106½	Actuating Lever Rod.	12	Piston Rod.
		100	Side Rods.

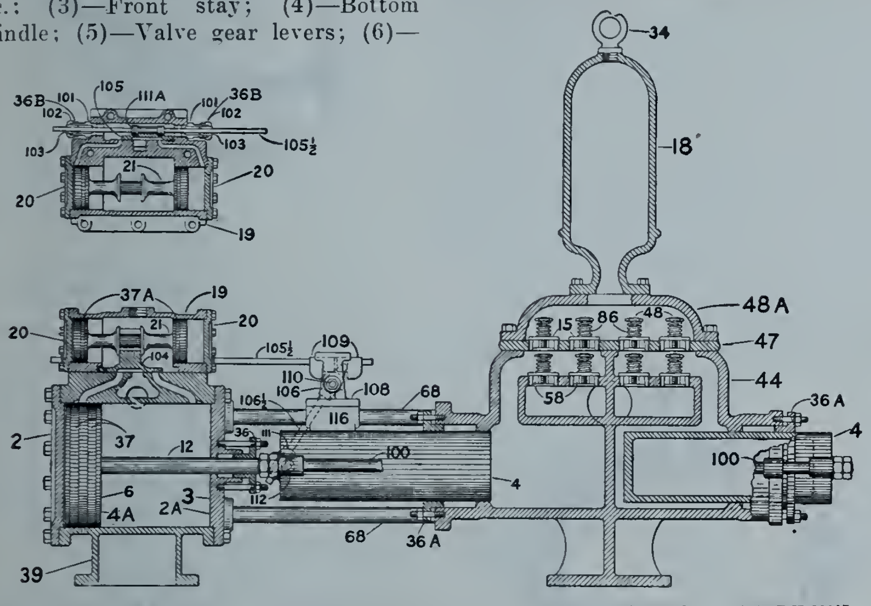

FIG. 5. SECTIONAL VIEW OF "BURNHAM" DOUBLE ACTING, OUTSIDE-END-PACKED PLUNGER PUMP.

Front stay bush; (7)—Ball crosshead; (8)—Main crosshead; (9)—Crosshead pin; (10)—Piston rod; (11)—Piston body; (12)—Piston rings; (13)—Cylinder cover; (14)—Discharge valve seat; (15)—Discharge valve seat ring; (16)—Suction valve seat; (17)—Suction valve guard; (18)—Discharge valve guard; (19)—Water valve; (20)—Bucket; (20a)—Bucket rings; (21)—Pump rod; (22)—Pump cover; (23)—Valve chest covers; (24)—Steam stop valve; (26)—Auxiliary valve spindle; (27)—Cylinder neck ring; (28)—Cylinder gland; (29)—Pump neck ring; (30)—Pump gland.

As regularly supplied, these pumps have cast iron steam cylinders covered with planished sheet steel, supported by steel columns on a cast iron pump cylinder fitted with gunmetal liner. In the smaller sizes a one-piece cold-rolled manganese bronze rod is used, the larger sizes having a steel rod for the steam end. Valves and valve seats are of bronze with gunmetal guards. The steam piston is of standard design, and the water piston is of gunmetal fitted with special ebonite packing rings, except when dealing with feed water over 190 deg. F., in which case it is made entirely of gunmetal.

Chief interest in this pump centres around the steam distributing valve. Detail views of the steam slide valve and chest are given in Figs. 8, 9, 10 and 11. The steam chest contains a main and an auxiliary valve. The main valve A distributes steam to the cylinder. The auxiliary valve B has two functions: it distributes steam to work the main valve; and its outer edge cuts off steam entering the main ports C and D leading to the top and bottom of the cylinder.

Both valves are of the simple slide type, but the main valve is half round, the round side working on the chest face, which is bored to fit. On the back of the main valve a flat face is formed upon which the auxiliary valve works. On this face, the ports C, D, E, F are cut, with the exhaust port H in the centre. The ends of the main valve are cylindrical, and project beyond the port

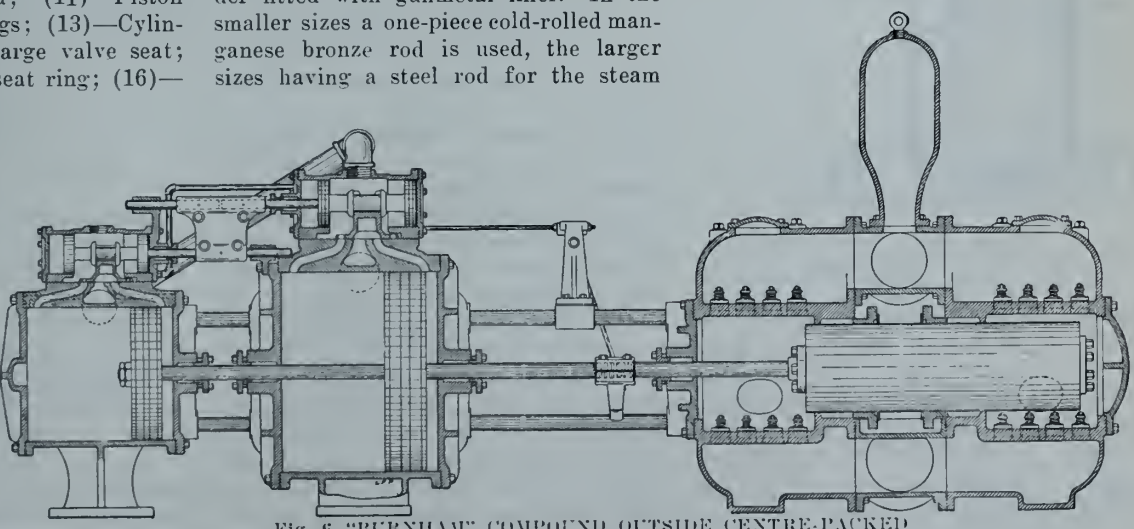

Fig. 6. "BURNHAM" COMPOUND OUTSIDE CENTRE-PACKED PLUNGER PUMP

face. They are fitted with loose bells or cylinders in which the valve works. These bells are held in position by the end covers and by faces cast on the chest for the purpose. The operation of the valves during a double stroke of the pump is as follows:—

When the piston is at the bottom of the stroke, the main valve is in the right-hand position, and the port C leading to the bottom of the cylinder is open to the steam pressure. This port remains open until the piston reaches half-stroke, when the auxiliary valve B begins to move in the same direction as the piston,

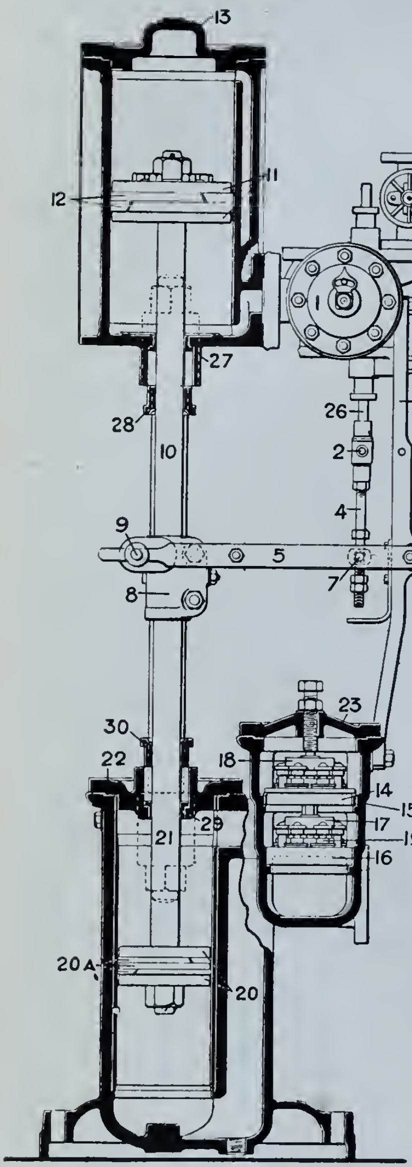

FIG. 7. SECTIONAL VIEW OF WEIR STANDARD VERTICAL FEED PUMP.

and at about three-quarters stroke the auxiliary valve closes the port C leading to bottom of cylinder. The remainder of the stroke is completed by the expansion of the steam already shut in the cylinder, or by more steam admitted through the by-pass, which will be described later .

When the piston reaches the end of stroke, the auxiliary valve opens the port E leading to the left-hand end of the main valve. The other end in this position is open to the steam through the port F, and the main valve is thrown

FIG. 8. WEIR STEAM VALVE, SECTIONAL PLAN.

over until the exhaust steam from the left-hand end of the main valve is cut off; this exhaust steam acts as a cushion and prevents the main valve from hitting the end cover. The main valve is now at the opposite end of its stroke, and the port C which admitted steam to move the piston on the up stroke, is open to exhaust. The port D leading to the top of the piston is now open to steam.

The action described above takes place also on the down stroke; the main piston travelling half its stroke before beginning to move the auxiliary slide, which again cuts off steam at about three-quarters of the stroke. The remainder of the stroke is travelled by the expansion of the steam in the cylinder, or by

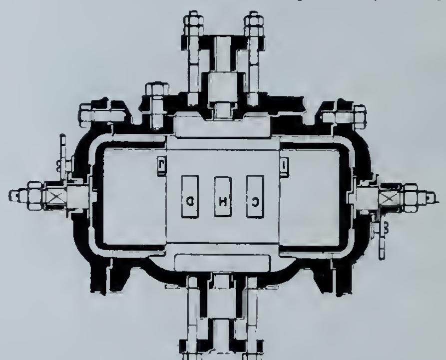

FIG. 9.—WEIR STEAM VALVE SECTIONAL FRONT ELEVATION SHOWING BY-PASS PORTS J.

fresh steam admitted through the bye-pass.

Under certain conditions the pump will not complete its stroke by the expansion of the steam in the cylinder; for instance, if the pump were started with the cylinder cold, the steam would rapidly condense and fall below the pressure necessary to move the piston. In such circumstances it is necessary to admit steam after the auxiliary valve is closed to main ports C and D on the face of the main valve, and this is done by means of the by-pass on each end of the chest. These by-passes, I and J, are made by cutting a port on each of the bells and a corresponding port on the back of the main valve. Provision is made on each end of the steam chest for opening and closing the ports by hand.

The main valve is not, as might appear from its shape, a piston valve: it is an ordinary slide valve and must, therefore, be kept tight by facing up in the usual way. It is important that the bars between the steam and exhaust ports should have a good bearing, as, if this bearing is properly maintained, wear and tear on the valve is reduced to a minimum. If, on the other hand, steam is allowed to leak past the bars, it soon cuts them away. In filing the valve face, care must be taken to file only the length of the valve travel. If the valve face is filed out to the ends the valve

FIG. 10. WEIR VALVE GEAR, SECTIONAL SIDE ELEVATION.

will no longer fit the bells accurately and its efficiency will be impaired. There is very little wear on the ends of the main valve, but if in the course of time the ends of the valve become slack in the bells, Ramsbottom rings may be fitted to ensure a steam-tight fit.

The auxiliary valve holds the main valve up to its face, and it may, therefore, be necessary, after bringing up the bearing, to put a liner between the valve spindle and back of auxiliary valve to hold it up. After lining up, move the main valve backwards and forwards by

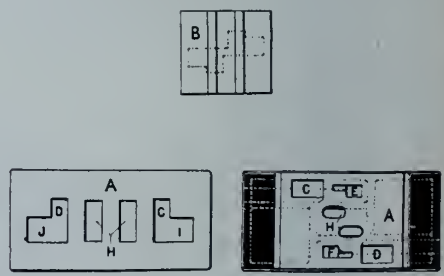

FIG. 11. UPPER—AUXILIARY VALVE. LOWER LEFT—MAIN VALVE FACE. LOWER RIGHT—FACE ON BACK OF MAIN VALVE FOR AUXILIARY VALVE.

hand to ensure that it is not too tight. The face on the auxiliary valve must also be kept in good order.

TO ENCOURAGE BUILDING OF SHIPS

THE Dominion Goernment has under consideration a plan for the encouragement of shipbuilding in Canada by an extension of the present system of State aid toward the construction of drydocks.

The desirability of reviving Canadian shipbuilding by some form of Federal aid was discussed at the last session of Parliament, and a sub-committee of the Cabinet was subsequently formed to study the situation. It is learned that the most likely course to be adopted and that on which the committee is at present bending its energies will not provide for direct State aid for shipbuilding, but will attain the same end by a relaxation of the conditions under which drydock subsidies are now granted. Two drydocks are already under way in Halifax and St. John but conditions have arisen which have made it impossible for the full benefit of the subsidy allowance to be secured for these enterprises. These will be made less stringent, and it is hoped in this way to take the first step towards encouraging shipbuilding in the Dominion.

BRITISH MERCANTILE SHIPBUILDING.

THERE are indications that the British shipbuilding situation is undergoing a change whch will be very welcome not only to shipowners, but also to the nation, to both of whom the shortage of merchant tonnage has become a serious problem.

For two years now, says the Liverpool Journal of Commerce, leading shipbuilders and marine engineers have devoted the best of their energies to naval work, the urgency and pressure of which would brook no delay, and as a consequence, the construction of merchant ships has been relegated very much to the background. The output of naval work by private yards has as a result been magnificent. We shall not know its full extent until the war is over, but we know already that it has called forth all the best forces of adaptability and organisation of which the industry is capable, and has involved an amount of strain on employers and employees alike that has been willingly, even cheerfully borne to the credit of all concerned.

Partial Release from Naval Work.

The net result of this great national effort is that the British Navy has been strengthened beyond all comparison, and is evidently regarded as now so supreme that the Admiralty is able to relax the pressure and free many of the yards to proceed with the construction of much needed merchant shipping. This is the change which has been inaugurated and, in the interests of our carrying trade, it has come none too soon. The output of mercantile tonnage has suffered severely during the concentration on naval work, and war losses at sea, as everybody knows, have been heavy. There is imperative need to hurry forward the production of cargo-carrying vessels. This is now to be done; is, indeed, already being done in many yards, and we may look for a steady increase in tonnage output during the remainder of the year.

With four months to go, our yards in that time will give a good account of themselves, for their resources have been increased and reorganized during the war period to an extent that will enable them to produce at a quicker rate than formerly, while in addition to the new shipyard on the Wye, there are several important extensions of premises in hand at Belfast, on the Clyde, and on the North-East Coast, all which will mean increased output in the near future. Moreover, a marked tendency is observed among shipowners to order duplicate ships, often several duplicates, which must necessarily save time and facilitate rapid construction.

Pre-War Orders Still Unfilled.

There are vessels which were ordered in the later months of 1914—i.e., just before and after the outbreak of the war—which have yet to be completed. These are making progress and will be launched very soon, making the berths left vacant free for the keels of ships since contracted for. There has been much trouble in completing these pre-war contracts, for they were placed originally at low prices, and the cost of turning out the ships with labour and materials at their present inflated values meant a serious loss to the builders and constituted a problem which required mutual good-will and agreement on the part alike of builders and owners to solve. Happily, in the main, it has been solved, chiefly by concessions on the part of the owners, most of whom were only too glad to see delivery of their ships in sight, even at augmented cost.

All new contracts placed during the last two years and particularly during the past twelve months, were naturally at very high prices—up to $100 a ton for large cargo carriers and considerably more for smaller vessels—but these figures extravagant as they are, have not prevented owners from ordering ships, and, as a matter of fact, more orders have been offered to builders than they could accept. Many recent contracts, however, could only be placed on an actual cost plus a percentage for profit basis and it is highly probable that these will work out to a price per ton still higher than indicated. In some cases where several ships have been ordered by one firm, the prices are regulated on a descending scale according to the date—one might almost say according to year of delivery, for most shipbuilders have already two years work on hand, and few yards can entertain further orders for delivery before the end of 1918.

Long Continued Activity Assured.

It emerges, therefore, that pronounced activity in the shipbuilding trade is already assured for two years to come, but with falling prices after the war is over, and so much leeway in construction to make good, it may be assumed that the period of activity will be much longer than two years, probably nearer five. If capital and labour can agree, the outlook is excellent.

There has been, and still is, considerable difficulty in getting engines for the ships turned out. All the marine engineers practically without exception, have been assisting the Government by turning out munitions of one sort or another, and the pressure of this work has forced private contracts far into arrears. Ships already launched are still waiting, and likely to wait, for their machinery before they can be completed, and until the "shops" are freed from munition work, which cannot be just yet, the delay in turning out engines must retard the completion of contracts in the shipbuilding trade. There are known to be large firms of engineers and shipbuilders who are willing to build hulls, but cannot undertake to deliver the machinery for them, and in authenticated instances the engines have had to be arranged for elsewhere. Time of course, will settle this difficulty, but not before the demand for munitions begins to slacken—a contingency which naturally depends upon the progress of the war.

The point to note meanwhile is, that the process of returning to normal conditions is under way. It may prove tedious, but it has begun, and, properly viewed, may be considered a great industrial achievement after the tremendous dislocation caused by the war.

Big Schooner Building in Nova Scotia. —The West Advocate vessel is being built by Captain T. P. Bentley. She will be a three-master of 138 feet keel length and 430 tonnage. Captain Bentley has had quite a gang of men at work for some time past and now has the satisfaction of seeing the vessel nearly ready for the water. The deck is in and the forecastle quarters and afterhouse are being finished.

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Vol. VI SEPTEMBER, 1916 No. 9

PRINCIPAL CONTENTS

THE QUEBEC BRIDGE TRAGEDY

If we might so express it, misfortune appears to dog the effort to bring to completion the work of spanning the St. Lawrence River by what is known as the Quebec Bridge. In spite of the elaborate arrangements made and the most carefully and skilfully devised precautionary measures taken, to "make North and South Shore ends meet," disaster supervened, with the result that the centre span or that piece which would have joined shore to shore now lies at the river bottom. This much may be said, however, regarding the method of procedure adopted—apparently ultimate successful accomplishment of the object in view had begun to demonstrate itself ere misfortune overtook the effort.

The calamity comes home to us with a much more direct keenness than did that which befel the predecessor of the present structure some nine years ago, being, if we might so say, just a trifle more national in its application. The loss of life fortunately is less than might have been expected, although to those to whom bereavement has come, the burden of the disaster is thereby not less lightened. To others again, escape with life has perhaps meant more or less serious injury. To the bridge engineers, the contractors and their operative staffs most closely allied with the work of planning a successful issue to the whole big undertaking, and on whose shoulders the great task bore still more heavily as September 11, 1916 approached, a measure of sympathy equally large with the bereaved and the injured seems unstintingly due. The disappointment, although a national one, will operate most severely within the individually circumscribed area referred to above, the intense anxiety of recent weeks and days accentuating its tragic side. On investigation, no interference with or menace to navigation has resulted. The raising or removal of the sunken and wrecked span will be subjects for consideration, and, incidental to either, a new method of "making ends meet" may be developed. The recent abrupt interference with the closing of the gap will postpone by a good many months both the latter eventuality and the subsequent official opening to traffic of the completed structure. Realizing the onerous nature of the task, the tremendousness of the risks involved, and the unexpected and unfortunate outcome of the present proceedings, may it not be possible to fill the breach otherwise?

BRITAIN'S WAR ENGINEERING ACHIEVEMENT

It is impossible, even from the most cursory perusal of the data embodied in the recent speech in the British Parliament by the Minister of Munitions—a synopsis of which appears in this issue, to feel otherwise than satisfied, not only with accomplishment to date as regards variety, type, quality and quantity of our munitions production and its contributory accessories, but to be disposed to look forward to continuous and still greater achievement as each succeeding day unfolds itself. The comparisons made—whether these be taken from a peacetime establishment point of view or from the period covering the early months of the conflict, bear an almost miraculous interpretation in the light of the knowledge now available.

Since the data referred to became public property, a clearer vision of the ultimate outcome of the struggle has been secured, and not only so, but an added inspiration has been given our people to persist in their meantime war-directed effort. It is also gratifying to note that our Ally, France, is in the same happy position as ourselves as regards munitions output, and that in her case too, the limit of achievement is still being extended. Side by side with our munitions production, may be placed that of our warship building and fleet maintenance, in which latter respects it may be said that we are even more comfortably circumstanced. Just what our naval strength is now is more or less of a profound secret, however, we know that peace time or early war month comparisons are equally disproportionate with those of munitions production. Although our fleet strength has been procured at what may be termed the expense of our merchant shipbuilding, evidences now point to a relaxation regarding the former, and a transfer of energy and effort to the latter.

MARINE NEWS FROM EVERY SOURCE

Vancouver, B.C.—The Harbor Commissioners will submit plans to the City Council with regard to the proposed harbor terminal railways.

Port Arthur, Ont.—The steamer Masaba, of Toronto, which grounded recently at Victoria Island, Lake Superior, has been released and brought here for repairs.

New Westminster, B.C.—The Western Marine Railway Co., has commenced work on the new shipyards on Poplar Island. The plant will cost about $80,000.

C.G.S. "Burleigh".—The schooner Burleigh will not be sold. She is a trim little vessel and in view of the shortage of tonnage on the Atlantic, it has been urged to retain her.

Port Moody, B.C.—Construction work will be started at once on the erection of a shipbuilding plant for Boyds, Ltd., of Port Moody, to include engineering and wood-working plants, foundry etc.

Sherbrooke, Que.—The Iron & Metal Supply Co., Montreal, propose to erect a factory, at an approximate cost of $15,000. A by-law will be submitted to the ratepayers to sanction certain concessions.

St. John N.B.—The Norton Griffith Co. are proceeding with harbor development work at East St. John. Three dredges are at work, in addition to crews employed in finishing a breakwater and in excavating for a dry dock.

Port Arthur, Ont.—The Western Drydock & Shipbuilding Co., have signed contracts for two more freighters the same size and type as the two at present under construction. The company has also in sight four other freighters of the same design.

Cobourg, Ont.—Mr. Brummel of East Trenton, it is stated, has just completed a new type of boat for carrying freight. The boat from outside appearances looks like a huge scow. It is to be run by two twenty-four horsepower gasoline engine, operating two propellers, and has a capacity of 600 barrels of apples. It was built for navigation on the Trent Valley Canal.

Windsor, Ont.—The Reid Wrecking Co. has succeeded in raising the steamer Henry Houghton, which sunk at Mullen's Coal Dock, Sandwich, Sept. 6. Captain Donoghue, master of the Houghton, took her to Oades drydock for repairs.

Government Dock Leased.—The Government dock at Windsor, Ont., has been leased for the winter to the Detroit & Cleveland Navigation Co., which will bring several of its big passenger vessels to that side of the river during the closed season.

St. John, N.B.—The Maritime Dredging Co. are proceeding with the reclamation work in connection with new piers on the western side of the harbor. The total fill will be about 475,000 cub. yds., of which 150,000 cub. yds. have already been dumped.

Toronto, Ont.—Tenders will be received until October 2, addressed to the Chairman of the Toronto Harbor Commissioners, and marked "Tenders for Cherry Street Bascule Bridge." All information may be obtained by applying to E. L. Cousins, chief engineer and manager.

Breakwater Completed.—A notice issued by the Marine Department, Ottawa, on Aug. 30, is to the effect that the breakwater at Goderich, Ont., has been completed to its full length of 1,400 feet, and the check water removed so that vessels can use the harbor on a direct course between the two entrance piers.

New Westminster, B.C.—The Saskatchewan Steel & Bridge Co., with plants at Moose Jaw and Medicine Hat, is planning to establish a plant on the coast with the ultimate intention of going into the steel shipbuilding business. A representative of the company recently visited this city with a view to selecting a suitable site.

Collingwood, Ont.—The oil tank steamer Iocolite left here on Sept. 16, on her maiden trip to Sarnia. A successful trial trip was made around the bay a few days previously. This is the second boat of the kind that has been built this year by the Collingwood Shipbuilding Co. for the Imperial Oil Co. A third one is expected to be launched shortly.

Barge Rob Roy Founders.—The old wooden barge Rob Roy, in tow of the tug Home Rule, foundered about five miles off Erie on Sept. 17, in the strong southwest wind. The Rob Roy was loaded with coal for Port Colborne and will be a total loss.

Montreal, Que.—The depth of water in the St. Lawrence Channel at Montreal continues to decrease materially from week to week, being on Sept. 20, some two feet below the ordinary summer level and not far from the low level of last year.

Icebreaker Burned.—The car ferry icebreaker St. Ignace, owned by the Canadian Towing & Wrecking Co., of Port Arthur, was destroyed by fire on August 30, in drydock at Port Arthur, Ont., where she had been recently taken for repairs. The St. Ignace was a 600-ton vessel, built in 1888. The loss represents about $50,000.

Montreal, Que.—The Victoria Pier will be formally opened by H. R. H. the Duke of Connaught at the end of this month, on the occasion of the Duke's farewell visit to Montreal. This event will not only mark the completion of another important undertaking, but will be the forerunner of similar and extensive developments along all the harbor front.

Canal Co. Raises Rates.—The Manchester Ship Canal Co., which controls the port of Manchester, England, has announced that rates for discharging and loading vessels and for quay porterage, warehousing and storing in the open of merchandise and minerals, have been raised 12½ per cent. Ship canal tolls and wharfage and ship dues have been raised 5 per cent.

Ottawa, Ont.—Tenders will be received until September 29, for the construction of an extension to the west breakwater at Port Stanley, Elgin County, Ont. Plans and forms of contract can be seen, and specification and forms of tender obtained at the Department of Public Works, Ottawa, at the offices of the District Engineers at Windsor, Ont., and Equity Building, Toronto, Ont., also on application to the Postmaster at Port Stanley, Ont.

Kingston, Ont.—The steamers Rideau King and Rideau Queen, which have for years plied between Kingston and Ottawa on the Rideau River, have been taken to Belleville, where an effort will be made to sell them. Since the death of Capt. Daniel Noonan more than a year ago they have not been operated.

Quebec, Que.—Messrs. J. S. Thom, M. J. Hackett and W. J. Hackett, hitherto joint owners of the Quebec Transportation & Forwarding Co., have sold their interests over the entire fleet of tugs and barges of the company to the Canada Shipping Co., of Montreal. The fleet consists of the sea-going tug Margaret, the A. H. Hackett, the J. H. Hackett, and Florence, as well as the barges Zapotic, Gladys, Hackett, Katie Hackett, Frank D. Ewen, and A. D. It is understood that the selling price was $150,000.

Windsor, Ont.—United States engineers will not remove the wreck of the steamer Topeka, sunk abreast of the Mullen's coal dock, Sandwich, a week ago. The wreck lies in 30 feet of water on the Canadian side, and must be removed by the Canadian Government. Vessels navigating the river may pass on either side of the hull, but the wreck is a menace to navigation. The owners have not decided what they will do with the steamer, but should they abandon her, her cargo of coal would well repay wreckers for removing the obstruction.

Record Ore Shipments. — Another record in iron ore shipments on the Great Lakes was made in August according to figures recently made public. There were loaded last month 9,850,140 tons, which was nearly two million tons greater than in August a year ago. For the season to Sept. 1, shipments aggregated 39,215,864 tons, an increase of more than 12,000,000 tons over the same period in 1915, and 7,000,000 tons more than the total movement in 1914. Vesselmen are confident the total shipments for 1916 will reach 60,000,000 tons.

Vancouver, B.C.—The C. P. R. announced recently that it had let a contract to W. D. Grant, of Vancouver, for the carrying out of a comprehensive dredging scheme on the waterfront between sheds 3 and 7. The contract will include the berth in front of the depot shed and the berths immediately east of that part now used by the Pacific Coast Steamship Co.'s steamers and others. The intention is to have a depth of water of not less than 33 feet, and it is very probable that when this work has been finished even bigger steamers than those at present running here will be employed in the service. Orders have been given to have the dredging work carried out with every expedition, and it is expected that a start will be made shortly. The contract will entail an outlay of some $200,000.

Ottawa. — Construction of a new lighthouse on Burnt Island, in the Thousand Islands, St. Lawrence River, is announced by the Canadian Department of Marine and Fisheries. The lighthouse replaces a former gas beacon on the east side of Burnt Island. It is in the form of a rectangular wooden dwelling. The light is of fifty dioptric type and is shown at an elevation of 64 feet and is visible five miles.

Ottawa, Ont.—Tenders will be received up to October 2, for the undermentioned metal supplies for delivery to H.M.C. Dockyards at Halifax, N.S., and Esquimalt, B.C.: Items 1, steel angles, bars, sheets and plates; 2, iron bars, fire bar; 3, brass bars and sheets; 4, copper sheets and bars; 5, solder, tin, and alloys; 6, tubes, brass and copper. Forms of tender and full information may be obtained by application to the Department at Ottawa, or to the Naval Store Officers, at H.M.C. Dockyard, Halifax, N.S., and Esquimalt, B.C. In making application for forms, the particular item or items for which forms are required should be clearly stated.

British Masters and Mates.—A new policy with regard to the admission of mates on British ships has been adopted by the British Board of Trade, according to a notification which has reached the Marine Department, Ottawa. Where formerly any candidate was admitted to the examination for masters and mates certificates and was qualified to take charge of ships of British register if successful, a new rule has been made. From now till the war is over every applicant for a certificate must be a British subject, and at the time of his birth each parent must have also been a British subject. It is understood, however, that the Canadian authorities will not adopt the same regulations, but will follow the same practice as formerly, admitting only British subjects to the examinations.

Halifax, N.S.—The St. Peter's Canal, which connects the Bras d'Or Lakes with the Atlantic at the Strait of Canso, and which has been closed for more than a year while being enlarged, was formally re-opened on September 2. This canal was first opened in 1865 and, with comparatively slight changes, has been operated since then. The lock has now been lengthened about 250 feet and a curve in the alignment is to some extent eliminated. The entrance to the canal at the southern end has been widened and enlarged, making a commodious and sheltered dock for vessels awaiting passage through to the Bras d'Or Lake. This canal makes it possible to carry on a considerable trade by sailing vessels and steamers drawing not more than 17 feet of water.

Waubic's Last Trip.—The Northern Navigation Company's steamer Waubic arrived at Collingwood on Sept. 18, to go into winter quarters, having made her last trip of the season from Penetanguishene to Parry Sound through the Thirty Thousand Islands of the Georgian Bay.

Sault Ste. Marie, Ont.—According to a new order issued at the American locks, all ships must stop at the pier and put men ashore to handle the lines before attempting to enter any lock. Heretofore, if the lock was ready to receive an approaching ship she was headed directly in without landing men until a stop was made inside the lock. The Lake Carriers' Association, on Sept. 5, notified its masters to rigidly observe the new requirement.

Survey Vessel Wrecked.—The Marine Department, Ottawa, received word on September 18, that the Hydrographic Survey steamer La Canadienne was wrecked the night before near Dorion, on the north shore of Lake Superior. The crew all got safely to land when the vessel was driven ashore. The steamer now lies on the beach with part of the bottom stove in, but it is thought she can be salvaged. Chief Dominion Hydrographic Officer W. J. Stewart, has left for the scene of the wreck to direct salvaging operations.

Port Mulgrave, N.S.—The Belgian steamer Indutiomare, of 962 tons, which was wrecked on the Magdalen Islands on August 21, and abandoned, has been brought to this port. The steamer appears to have sustained little damage. The Indutiomare drifted clear of the rocks after being abandoned, and was picked up in the Gulf of St. Lawrence by the tug Amelia. A five days' tow, in which the tug Goliath assisted for a part of the time, brought the steamer here. The Amelia's share of the salvage is estimated at $100,000. The steamer sailed from Newcastle about August 18 for Calais with a cargo of lumber of considerable value.

Shipbuilding in Old Quebec.—*The Quebec Telegraph*, of September 14, in its fifty years ago department, has the following: Several launches of newly built ships occurred on and about the 14th of September, 1866, in the various shipyards along the banks of the St. Charles. Mr. Rosa launched a bark of about 650 tons register and measuring 167 feet over all, which was christened the Niagara and was built for a firm in Marseilles, France. The same builder launched on the following day for a Sunderland firm a 600-ton barque, called the Hope, and about the same time a third barque of 850 tons. Messrs. Mackay and Warner, who owned the large house still standing between Charlesbourg road and the St. Charles river, and the shipyard adjoining it, launched at the same time a new barque 160 feet long.

Port Dalhousie, Ont.—Muir Bros.' dry dock at Port Dalhousie, after a spell of slack work, is getting busy again, and during the last few weeks has docked several steamers and barges. They have erected a large derrick for handling wheels and other heavy work in dry dock, and have installed a large pump also in dry dock to secure a dry floor quickly. Night work has increased owing largely to better facilities, passenger steamers especially, finding this a convenience, such vessels as the Macassa, Modjeska, and Dalhousie City having taken advantage of same to replace or repair broken wheels during the night. The C. S. Boone Dredging & Construction Co. have a fleet of dredges, scows, etc., laid up at the dry dock. The steamer Dalhousie City, on August 17, struck a half submerged piece of timber while coming to Toronto and broke two blades of her propeller. Muir Bros. arranged to dock her that night, which was done, the broken blades being repaired, enabling her usual trip to be made next morning.

Clyde Shipbuilding.—The output of mercantile tonnage from Clyde shipyards continues small in comparison with that of last year. During August only two vessels were launched, making a total of 16,000 tons, and bringing the eight months' total up to 29 vessels of 91,385 tons, as compared with 57 vessels of 170,268 tons in the corresponding period of 1915. In neither period is there any Government work included, so that this year the total is not much more than half that of last year. Work, of course, is plentiful in all the yards. A fair number of men are now engaged on mercantile contracts.

SHIPBUILDING FACILITIES OVERTAXED

ORDERS offering from Norway for ships, the construction of which, it is said, would insure all Canadian shipbuilding plants operating at full capacity for four years, have recently failed to interest Canadian shipbuilders whose plants are already working at capacity. The business was first offered to eastern builders, including the Nova Scotia Steel and Coal Company, but was refused by the president of the company, Colonel Cantley. The order was then placed before all the large firms of Montreal, as well as the Davie Shipbuilding Company, of Quebec, with the result already referred to.

The Canadian Vickers Company, of Montreal, in addition to the large Governmental contracts, is reported to be negotiating for the construction of two large freighters for an American line, and other important business. Other surrounding concerns are similarly situated, so that no hope whatever was held out that the business could be handled by Canadian industry. The representative of the Norwegian interests was instructed to find out how much, if any, shipbuilding space would be available for the purpose mentoned, and definite assurance was made that the orders would aggregate enough to keep production busy for the time indicated.

In addition to the fact that all plants are already working at capacity, the shortage of certain classes of material is largely blamed for the refusal of this order, which makes the second of its kind so disposed of within the last few weeks, the other having been a British Admiralty enquiry for a large number of steam trawlers. The shortage of plates is particularly mentioned in this connection, and is said to be primarily due to the fact that there are no plate mills in this country, which must largely depend upon the States for its supply in this respect.

Shortage Causes Delay

A delay of two months in the delivery of the 400 ft. long steel car ferry now under construction by the Davie Shipbuilding Co., of Quebec, for the British Columbia Government, is announced. The contract was to have been completed by this time. The delay is partially blamed on the shortage of plates. This is said to be the largest steel vessel ever built in Canada. It will also be equipped throughout with Canadian machinery and boilers, which are now being constructed in Toronto. The nearest previous approach to this achievement was in the case of the ice-breaker constructed by the Canadian Vickers Co. for which the boilers and machinery were imported from Great Britain.

Congestion at Montreal

Of a fleet of twelve ships recently purchased in Montreal for British owners, four are held up in that port awaiting dry dock accommodation, for the making of certain alterations that are necessary before Lloyds will insure them for the passage to England. The lack of dry dock facilities is largely blamed on the fact that the Government has cut off from use the principal dry dock for small craft in the Lachine Canal, in connection with the repairs that are being made on the canal following the recent break in it. A coffer dam has been built across the entrance to the dock while temporary repairs are being made with the result that the dry dock is out of commission.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Captain J. W. Charles, C.B., R.N.R., of the Cunard liner Ascania which arrived in Montreal on September 20, was at one time in command of the Lusitania, although not so when that vessel was torpedoed. He was in command of the Mauretania immediately previous to her being taken over for service by the Admiralty.

F. B. Leonard, of the Canadian Pacific Ocean Services, has resigned his position to enter the service of his country, and is leaving for England to take up military duties during the present month. Mr. Leonard has been in the service of the Canadian Pacific Ocean Services since September, 1912.

PACIFIC COAST PORT AUTHORITIES CONVENTION

MATTERS of considerable importance as regards harbor development, freight rates and other questions were discussed at the third annual convention of the Pacific Coast port authorities, which opened on September 4 in the Board of Trade rooms, Vancouver. F. L. Carter-Cotton presided, and W. D. Harvie, secretary of the Vancouver Harbor Commission, acted as secretary. The representatives of other port authorities present included: Portland, G. B. Hogardt, J. B. Ziegler and C. B. Moores; Seattle, Judge Remsberg, Capt. Dollar; San Francisco, T. S. Williams, H. B. Green; Vancouver, S. McClay, J. A. Fullerton and R. C. Hodgson, the latter chairman of the North Arm Harbor Commission. Nicol Thompson, president of the Board of Trade; F. L. Fellowes, city engineer; Jonathan Rogers, E. J. Leveson were also interested auditors.

At the commencement of the conference, a cordial welcome was extended to the delegates by Mayor McBeath, who gave them the freedom of the city, while Mr. Williams replied on behalf of the visitors. Perhaps the most interesting paper read during the session was one by Clarence H. Matson, of Los Angeles, on "The Effect of the European War on American Shipping." In the absence of Mr. Matson, the paper was read by the secretary. Further valuable papers were read during succeeding days of the convention. A tour of the harbor was made on September 6.

LICENSED PILOTS

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

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GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

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INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

SHIPMASTERS' ASSOCIATION OF CANADA

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

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J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I., Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

FOR NAVAL RECRUITING

THE Naval Service Department has completed arrangements for recruiting the five thousand Canadians who are to serve in the British Navy. Recruiting depots are to be established in Halifax, St. John, Quebec, Toronto, Winnipeg and Esquimalt, while recruiting in Montreal and district will be supervised from Ottawa. It is also intended to make use of the military organization to some extent in looking up recruits for the navy. The pay separation allowance, etc., will be the same as the land soldiers are entitled to, with, of course, the same share of assistance from the Canadian Patriotic Fund. The age limits and physical standards are slightly different in the case of naval recruits, the age limit for seamen being from 18 to 30 and for stokers from 18 to 38.

Sub-offices will be opened in various parts of the country in connection with the depots already mentioned, and the recruiting officers will travel from place to place. The recruiting at Halifax and Esquimalt will be under the direction of the naval establishments there, and at St. John and Quebec by the departmental transport offices. The men as they enlist will go to England and get their training at the naval depots there.

St. Ignace, Mich.—The burned and stranded hulk of the Northern Navigation Co. steamer Saronic, now lying in Georgian Bay, has been purchased by William Schlosser, of Milwaukee. She will be towed to Milwaukee and rebuilt.

1916 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	G. T. G. Blewett,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	E. A. Prince,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jenne Mance Street	O. L. Marchand,	93 Fifth Ave., Lachine, Que.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th Street E.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	[illegible]1 London St., W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	176 King Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	J. A. Rowe	29 Parrsboro Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

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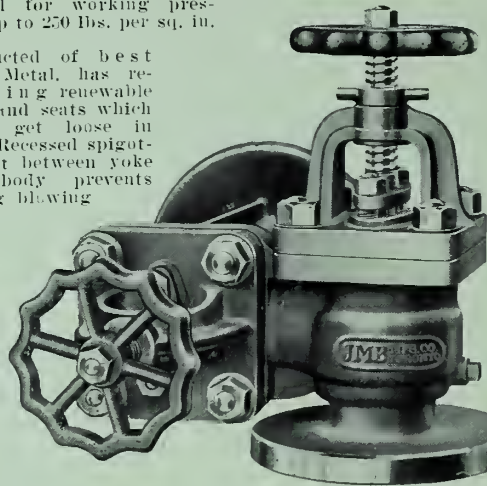

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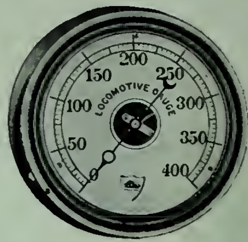

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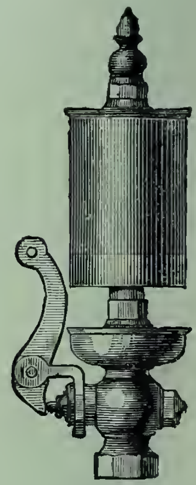

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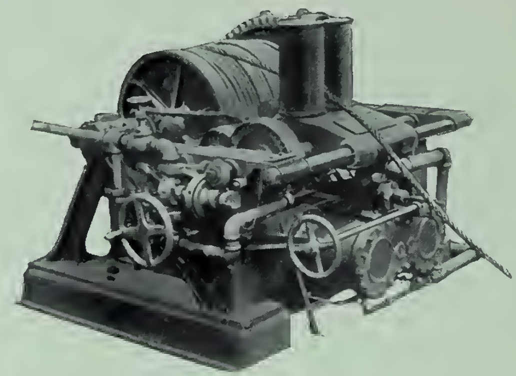

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Port of Vancouver Harbor Development: Present and Future

Contributed

To insure the future position of the Port of Vancouver as the premier port of the Pacific Ocean is the avowed intention of the Harbor Commissioners of that city. Increased activity in shipping and shipbuilding, along with unequalled, natural advantages, insure the ultimate success of the plans described herewith. The extent of the work, and completeness of the arrangements indicate a firm resolve on the part of the authorities to assist as far as lies in their power in maintaining the supremacy of British and Colonial world trade and commerce.

WHETHER or not the plans of the Vancouver Harbor Commissioners will make the proposed port facilities self-supporting, the intention is to provide a sufficiently comprehensive scheme to make the harbor the equal of any port in America in point of convenience for handling freight, and the low cost of such freight handling and of the wharfage charges for goods transhipped between vessels and railway cars. There is another feature, and that is the providing of industrial sites with terminal rail and water facilities, and with it goes, in the terminal railway scheme, the common privilege of freedom to all railways seeking entrance to Vancouver harbor.

Present Accomplishment

Plans so far gone on with by the harbor commissioners since taking office in 1913 have been the building of the Government wharf and elevator on Burrard Inlet, and the dredging of the channel in False Creek with the reclamation of a forty-acre area close to Granville Street bridge. The last item is almost completed now, and the deepening of the False Creek channel is fast nearing completion. When the announcement was made early in June by Mr. H. H. Stevens, M.P., that the harbor board was perfecting a somewhat ambitious scheme of harbor improvements, involving \$5,000,000, and projected to extend over a period of five to ten years in construction, widespread interest was taken by the business public generally. One objection only was taken, and that was the secrecy with which such a semi-public proposition had been carried out. The matter was there upon taken up with the members of the Board of Trade and a full and complete statement was given out.

What Further Plans Include

Included in the programme laid down by the commissioners, and for which they have secured approval by Dominion Order-in-Council, is the terminal railway referred to, the purchase of certain waterfront properties on Burrard Inlet, and of Kitsilano Indian reservation on False Creek. The full list of properties under negotiation at present is:

Kitsilano Indian Reserve, False Creek, 80 acres, estimated cost \$700,000.

Waterfront property at Port Moody, on Burrard Inlet, approximately 88 acres, with water frontage of half a mile, estimated cost \$550,000.

E. H. Heaps Co.'s mill property, Cedar Cove, Burrard Inlet, 16¾ acres, estimated cost \$650,000.

Wharf property of the Great Northern Railway Co. and the waterfront property immediately east of that property, estimated cost in all, \$1,800,000.

Right-of-way from the Kitsilano Reserve to the Heaps property, estimated to cost \$1,552,861.25.

Portion of right-of-way of Pacific Great Eastern, estimated cost \$516,267.

The total estimated cost of properties thus to be acquired is set at \$5,769,128.25. The harbor commissioners anticipate being able to exchange properties in the waterfront now in their possession for some of these parcels they wish to secure, thus reducing the outlay cost to the board by \$2,448,833.50. That would leave a balance of \$3,320,294.75. The commission proposes to float a Government-guaranteed bond issue of \$5,000,000 for the purpose of acquiring the properties and of putting in the improvements planned. The net cost estimated above, together with the \$200,000 bond issue already made, and which it is proposed to retire by way of consolidating the bonded debt in the one issue, will leave \$1,479,705.50 available for harbor improvements and terminal facilities.

Terminal Railway

The proposed terminal railway begins at Kitsilano Reserve, extends on the south side of False Creek to Glen Drive east of Main Street, thence to Harris Street, and thence to the Great Northern wharf. The proposed route takes in the existing B. C. E. R. transfer track on the south side of False Creek. The entire distance is 4.84 miles, the actual feet measurement, according to the plans, from point to point, as shown on the sketch plan prepared by the harbor engineer, being:

	Feet.
Kitsilano Reserve to Granville Street bridge	1,540
Granville to Connaught bridge	5,855
Connaught to Main Street bridge	3,580
Main Street to Glen Drive	4,860
Glen Drive to Harris Street	3,710
Harris Street to Great Northern dock	2,025
Great Northern dock to Dominion dock	3,990

It is the plan of the harbor commissioners to build large ocean docks at Kitsilano Reserve on English Bay. In this connection it is interesting to note that when the C. P. R. first built into Vancouver it secured a charter for what is still officially known as the English Bay branch, and which extends from English Bay Junction at the Burrard Inlet end of Columbia Street, through the False Creek yards and by way of Kitsilano railway bridge to the Kitsilano waterfront. The old railway bridge, rebuilt when the line to Steveston was constructed, long hung a disused wreck, falling to pieces over the entrance to False Creek. It had never been used for much more than to secure the standing of the charter for the English Bay branch. The intention of this branch was to connect with ocean docks projected to be built on the Kitsilano waterfront. Early maps of the city show the four piers which were planned to be built in connection with this dock scheme.

Industrial Sites

Another part of the proposed improvements on Kitsilano Reserve has to do with furnishing industrial sites. Speaking on this subject on June 20, H. H. Stevens, M.P., stated:

"Now, as regards the Kitsilano Reserve, make no mistake . The board is in possession of that reserve and we are going to arbitrate the matter, but you can get this very clear. We are going to build ocean docks there to handle ocean steamers and place industrial sites, and we are going to have our own railroad to connect those sites with our Government dock on Burrard Inlet."

The Port Moody portion of the commissioners' scheme was to provide that class of wharfage which was bound to be needed for the handling of bulk cargoes. All parts of the proposed improvements had been closely discussed and studied, declared Mr. H. H. Stevens, when in conference with the Board of Trade committee on June 23. "Each unit in this scheme," he said, "has been investigated, and we are satisfied that the units will be self-sustaining without any charge on shipping."

False Creek Improvements

With respect to the forty-acre reclaimed area on False Creek at Granville Street bridge, when complaints were made at the Board of Trade conference that the spoil filled in behind the bulkheads had silted out into the channel, it was pointed out that the bulk-heading is fifty feet back from the head line as planned, so that there is plenty of allowance made for any working out of the spoil from the fill. It was the intention to let the sand slope out to the property line, as people leasing sites on the reclaimed area would wish to build wharves to suit themselves.

The channel now nearing completion in False Creek is 350 feet wide, and it is the intention to have it 22 feet deep from English Bay right up to Main Street, where the proposed retaining wall is to be put in. This makes it available for many craft of considerable size which have not heretofore been able to make use of it. The spoil from the upper portion of False Creek dredging work has been deposited in the big fill made by the Canadian Northern at the head of False Creek, under the contract made with the City of Vancouver. That from the section of the creek nearer English Bay has been made use of to make the fill at Granville Street.

Time and Cost of Construction

To carry out the proposed improvements, the terms of the Order-in-Council approving it, fix five years as the minimum time in which the work shall be done, and that it might be ten years before it was entirely completed. Seattle is spending $6,000,000 on harbor improvements. That Vancouver will have developed and advanced sufficiently in five years to warrant all the expenditure proposed by the Harbor Board is the argument put forth. The terminal railway is held to be one of the necessities of the port. That the Dominion Cabinet approved of the plans of the commissioners is clearly shown. That they took every reasonable precaution and safeguard to protect the interests of those using the port is also easily established. The Order-in-Council reads in part, speaking of the conditions on which the $5,000,000 of bonds are to be secured, that they are to be used in "the gradual development extending for a period of five years of such items in the programme as in the judgment of the commissioners, with the approval of the Minister of Marine and Fisheries, promise to become immediately revenue producing, with the further condition that the plans, specifications and estimates of all work for the development of the above property or with the provision of other facilities shall receive the approval of the Minister of Marine and Fisheries before any work is started or expenditure on the same is incurred."

Federal Government Interested

The entire cost of those harbor and wharf improvements so far carried out in Vancouver has been borne by the Dominion Government. These are the False Creek dredging referred to, the dredging at the entrance to Burrard Inlet, which has been carried on for over two years, and the Government dock and grain elevator on the main harbor front.

The question of harbor improvements has long been a live issue in Vancouver, and the opinion has always been expressed generally among those informed on the subject that the Dominion Government had the chief responsibility in the matter, as ports on the eastern seaboard of Canada had been improved at large expense on behalf of the Dominion. In comparison with Vancouver, the work done at the port of Montreal is frequently referred to. The development of that port commenced on January 13, 1898, when the Dominion Government advanced $2,000,000 at 3 per cent. On May 23, 1901, another $1,000,000 was voted. On July 10, 1903, $3,000,000 was advanced, and on July 13, 1906, a further grant of $250,000 was issued to redeem debentures issued in 1876.

On April 27, 1907, another loan of $3,000,000 was made, and on May 4, 1910, no less than $6,000,000 were voted at 3½ per cent. to retire 100,000 debentures maturing in 1910.

On March 12, 1912, another $6,000,000 at 3½ per cent. was voted to retire debentures of the par value of $600,000 maturing at the rate of $200,000 per annum in each of the years 1913, 1914, 1915.

This money was lent by the Dominion Government to the port of Montreal and all the port is required to pay is the interest. In the case of Vancouver, the Government would have followed the same policy had it not been for the war, but the Commissioners state that after the war, they have the assurance of the Government to stand behind the terminal scheme.

The operation of the railway terminals has proved to be one of the most important and successful features of the development of Montreal harbor. On the north bank of the St. Lawrence River, adjoining the cities of Montreal and Maisonneuve in their most congested industrial districts, the harbor railway terminals extend. The total distance, measured along the river bank, is seven miles, but the total mileage of tracks is 44.9.

Existing Wharf Accommodation

Owing to present conditions in shipping, with very little freight arriving from the United Kingdom as in years preceding the war, there is no lack of shed accommodation on the docks now in existence, and no danger of congestion such as frequently occurred in the active years of expansion in 1912 and 1913. Storage space on the docks available for in and outbound cargo is covered by Evans, Coleman & Evans' dock with two piers, one 650 feet long and 100 feet wide, the other 810 feet long and 75 feet wide; Johnson dock with a shed 600 feet long; Balfour, Guthrie & Co. dock with shed 400 feet long and 100 feet wide; Great Northern dock with a shed the same size; C.P.R. docks with some ten sheds in all, of varying dimensions; Dominion Government dock with two sheds 800 feet by 80 feet.

Quite recently the Canadian Pacific Railway Company let the contract for the construction of another pier for ocean vessels at their docks. Additional shed space will be provided when this pier is built.

Harbor Dues

Harbor dues have yet to be agreed upon in respect of charges made by the Board of Harbor Commissioners. That body drafted by-laws including a tonnage tax of 3 cents per ton and the by-laws were approved by Dominion Order-in-Council in 1914. Opposition by the Vancouver Board of Trade, however, has prevented action being taken so far to enforce the collection of the proposed tax. Other port charges now in force and which are compulsory, consist of pilotage in and out, sick mariners' dues and bill of health. Pilotage charges are $1 a foot draft of vessel and 1 cent per ton. Sick mariners' dues are 1½ cents a net ton. British bill of health costs $1, and the American bill of health, if a vessel clears for such ports, is $5. On an average vessel of 3,000 tons the pilotage charges in and out would be $104 and with the sick mariners' dues and bills of health the total cost at present is $150. When the harbor commissioner's tax of 3 cents per ton is imposed an additional $90 would be charged. The charge, however, it is pointed out, would not be collected on more than five entries in any one calendar year, so that vessels plying in regular service would not have to add that amount to their dues every trip they made.

Comparison with Seattle port charges shows that in addition to pilotage and other items there is a federal tonnage tax of 6 cents, which is just double that proposed by the Vancouver harbor commissioners. The cost to a 3,000-ton vessel entering and clearing from Seattle would be $288, so that even if the 3-cent tonnage tax were imposed in the port of Vancouver the total dues on a vessel would still be less than in the Sound port.

SHIPBUILDING ON PACIFIC COAST

FROM Prince Rupert on the north to San Diego on the south come reports of shipbuilding activity, and the hum of industry is heard in all the shipbuilding yards of the Pacific Coast, where, it has been estimated, that steel and wooden ships are under contract or construction of a value of $75,000,000. There is every reason to believe that this encouraging condition will continue for a long time to come.

In the Pacific North-west, steel and

wooden ships are being constructed, there being contracts in hand for their construction reaching a total cost of $30,000,000. This estimate includes the work reported from yards in British Columbia, Puget Sound, Grays Harbor and the Columbia River, and is certainly a splendid showing for the shipbuilding of the Pacific North-west as well as foreshadowing a healthy and most encouraging revival in this most important industry. The preponderance of the tonnage being built is foreign, Norway leading with most of the steel steamships, although two of this class are being built for the Atlantic coastwise trade. The wooden ships are mostly for American owners, although the Government of British Columbia by offering a subsidy is greatly stimulating the industry so that it is forging ahead and may soon take the lead for this class of ships.

RATES TO BE PAID CANADIAN SEAMEN

AN Order-in-Council has been passed providing regulations for the enlistment of men "in the Royal Naval Canadian Volunteer Reserve" for overseas service in the Royal Navy. The men enlisting will be enrolled for the period of the war. Ordinary and able seamen will receive $1.10 per day; leading seamen, $1.20; petty officers, $1.40, and the chief petty officers, $1.90.

Men subsequently transferred to stoker ratings will be paid 10 cents per diem more than the pay of their equivalent seamen ratings. Wives and approved dependents of men enrolling will be paid from the date of enrollment separation allowance on the following scale: Wives and approved dependents of ordinary seamen, able seamen, leading seamen and equivalent ratings, $20 a month; petty officers and chief petty officers and equivalent ratings, $25 per month.

CONTINENTAL SHIPBUILDING AND SHIPPING DEVELOPMENT

SHIPBUILDING and shipping continue to experience real boom days in all the neutral countries of Europe, and shipyards are being constructed in many hitherto practically unknown locations. A review of the present state of affairs is published in *Engineering* which states that old shipyards are being extended and new ones formed, shipping companies are being started almost every day, old concerns increase their capital, vessels keep changing hands at fabulous prices, and harbor extensions to accommodate this new traffic are the order of the day.

In Holland, throughout Scandinavia, and in other countries, shipbuilding yards are provided with work for years to come, and new concerns are being started under the best possible auspices. At Kallundborg, in Denmark, a new shipbuilding company has just been formed. The corporation is filling up a portion of the fjord and letting the area for building purposes to the new company for a period of 50 years, and a floating dock will also be constructed. A large new local shipping concern, started for running sailing vessels, has decided to have six steamers, of 2,000 tons each, built at the new yard, and in their fleet six large sailing vessels are to have motors installed. Not the least interesting feature in the present feverish movement is the revival of the sailing ship. Many authorities however are extremely sceptical as to the future of the sailing vessel and discourage its renaissance.

Sweden

Swedish shipping concerns and Swedish yards are equally well employed. The largest steamer so far built in Sweden has just been launched at the Gota yard, Gothenburg. It is the Skagern, with a capacity of 8,000 tons, ordered by the Swedish Transatlantic Steamer Company, and intended for Australian trade. The keel was laid on January 5, 1916, and the boat is expected to be ready about November. A Swedish consular report urges the desirability of cultivating the Australian traffic, since the United States and Japan are doing their best to develop direct connections with Australia. Another Swedish shipping company which is greatly extending its fleet is that of the Nords German, which has six motor vessels in course of construction in Copenhagen, each of 6,450 tons, and three motor vessels in Gothenburg, each of 9,200 tons. The new vessels are intended to increase the company's traffic to Brazil, La Plata and on the Pacific Coast. Sweden has, on the whole, shown much enterprise and initiative of late years in extending her overseas shipping, and the value of her exports overseas, to Asia, Africa and America, rose from 13,570,670 kr. ($3,800,000) in 1905, to 44,692,275 kr. ($12,500,000) in 1913. The Swedish Government is also assisting shipping by loans and other ways, and is contemplating serious endeavors for keeping the North Swedish ports open beyond the usual time when ice stops the traffic. A number of ice breakers are being built for that purpose, and an expenditure of 25,000,000 kr. is considered necessary in order to keep shipping going for an extra month beyond the usual time.

Harbor Activity

Extensive harbor works and extensions are going on or approaching their realization in all three northern kingdoms. The plan for the Malmo free harbor has now been finally drawn up, and is calculated to entail an expenditure of 9,360,000 kr. ($2,610,000). The area for the free harbor is situated to the north-east of the present harbor, and the entrance is to be through the present inlet, 80 m. broad, by way of the eastern channel, both of which are to be deepened to 9.25 m. (30 ft. 4 in.). The basins of the new harbor are to have the same depth, and will comprise an outer harbor, 80-200 m. broad and about 400 m. long, and a basin east of the former, 100 m. broad and 500 m. long. The water area will be 33 acres and the land area 83 acres, the length of quay being 1,860 m. (6,200 ft.). All the quays are to be built of concrete, faced with granite. There will be one stationary 25-ton crane, and seventeen 5-ton movable cranes.

In Norway, the question of a free port is also to the fore, and of late Stavanger has come into prominence as the most favorable position, with convenient access from the sea, entailing very little loss of time. Further, Stavanger is at no great distance from the large English coal mining districts, and it is conveniently located for transit, both to other Norwegian ports and to Archangel and the Baltic. Norway's largest dry dock is at present being constructed at Stavanger, and additional railway facilities will establish connection between Stavanger and Christiania

Russia

Russia, in spite of the war, is exerting herself in no small degree to meet the after-war competition in shipping. Russian yards, both on the Baltic and the Black Sea, have been considerably extended during the war, in addition to which a large new shipyard is being constructed on the Murman coast. The Russian steamship companies, however, have not confined themselves to the home yards in the matter of new ships, having placed orders both with Swedish and Norwegian yards, in the same way as vessels are being built for Russian account in Japan, both at the Osaka yard and the Kavasaki yard.

Holland has no doubt materially improved her merchant navy during the war by selling old vessels and building new in their place, at the same time the Dutch yards have built a number of vessels for foreign account. As in other countries, an improvement of harbor and canal facilities has followed in the wake of the shipping boom. The course from the Hook of Holland to Rotterdam is to be or is being enlarged. There will be constructed a third Ymuiden lock, and the waterway from Ymuiden to Amsterdam will be widened and deepened so that the biggest steamers may get as far as Amsterdam.

The Development of Irregular Sheet Metal Pipe Connections

Staff Article

The problems dealt with in this article are typical examples encountered in actual practice, which, while not of very frequent occurrence, may be of considerable importance when met with. They possess considerable divergence from ordinary symmetrical forms and a study of the methods employed will enable their solution to be successfully undertaken.

A SHEET metal problem, involving some interesting projections and developments, is illustrated and described in the accompanying article. In Fig. 1 are shown four views of the piece required—(a) front elevation; (b) side elevation from the left; (c) side elevation from the right; and (d) top view. The diameter of the lower vertical section F is to be 2 feet, and also the branch A; the branch B is 18 in. in diameter, the centre line of both branches making an angle of 45 degrees with the centre line xy, and intersecting in a common point, as shown at O.

Drawing the Front Elevation

To draw the several views in Fig. 1. first erect the vertical line xy and the base line ab. From the point 4, mark off the distance 4, 0, equal to 2 feet, and from the point 0 draw the centre lines of the branch pipes at an angle of 45 degrees. At a distance of 4 feet from the base line draw the horizontal line 1^1 1^1, showing the top of the transition piece D; also a line 6 inches higher upon which the extreme points of the branch sections A and B lie. On either side and parallel to the centre line of each branch draw the lines 1, 1^1 and 7, 7^1 at a distance equal to the radii of the pipes. Draw the lines 1, 7 at right angle to the centre lines, and in such a position that the point 1 falls on the extreme top line. Then from the point 4 describe the semicircles into six equal parts, projecting the points parallel to their respective centre lines, and dividing the sections A, B and F as shown. Lay off the line 4^1 7^1 in A so that the two angles (i) and (i) are equal, also the line 1^1 7^1 in F, so that the angles (j) and (j) are equal. This makes the piece C a portion of a round pipe with a diameter equal to that of A and F.

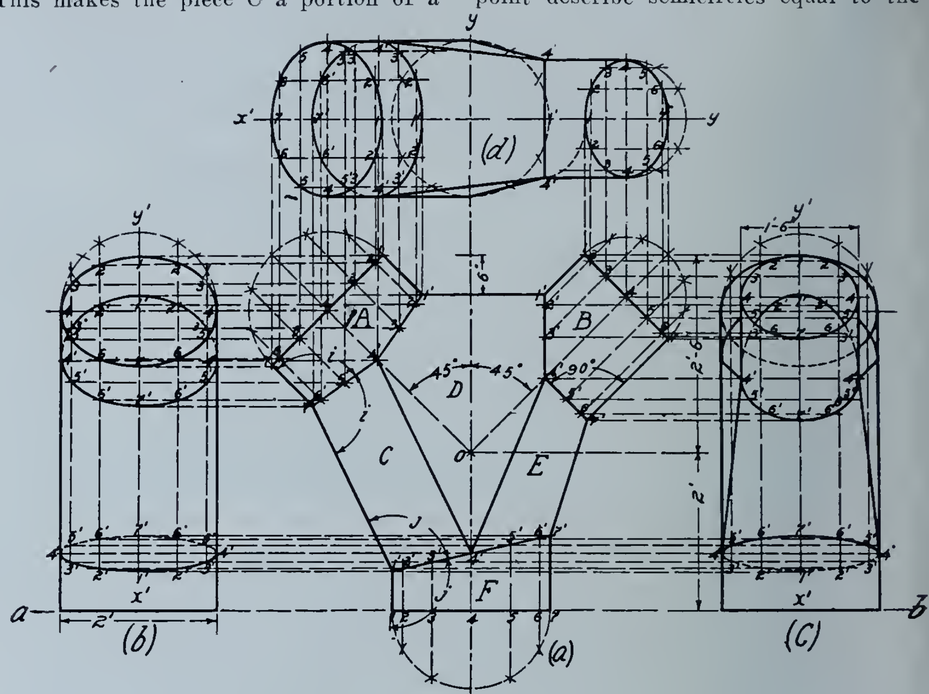

FIG. 1.

From the point 1^1 at B, drop a vertical line, cutting the centre line 0, 4 at 4, and from this point draw a line at right angle to the centre line. Connect the points 4^1 4^1 and 7^1 7^1, thus forming the piece E.

Top and Side Elevations

The two side elevations, and also the top view, can be obtained by the ordinary method of projection, care being taken to have similar points in the various views numbered alike. On the centre lines of both side views at a convenient point describe semicircles equal to the diameter of the corresponding pipes, and divide each into a certain number of equal parts, generally twelve divisions to a circle. The vertical projections for the side elevations are obtained from these circles, and the horizontal intersections are obtained from corresponding divisions on the front elevation. The top view is obtained in a similar manner, the horizontal projections being obtained from the construction circles, and the vertical intersections obtained from corresponding points on the front elevation; the ellipses representing the several openings and joints being drawn through the various intersections.

Developing Cylindrical Sections

The developments of the three cylindrical pieces, A, B and F, are shown in Fig. 2. The elevation of the three pieces are shown on the right. A semicircle is described on the base line and divided into six equal divisions; the projection of these points cutting the base and angular faces in the points shown. On the base line of the development twelve divisions are marked off, each equal to one-twelfth of the circumference of the pipe, and numbered with the correspond-

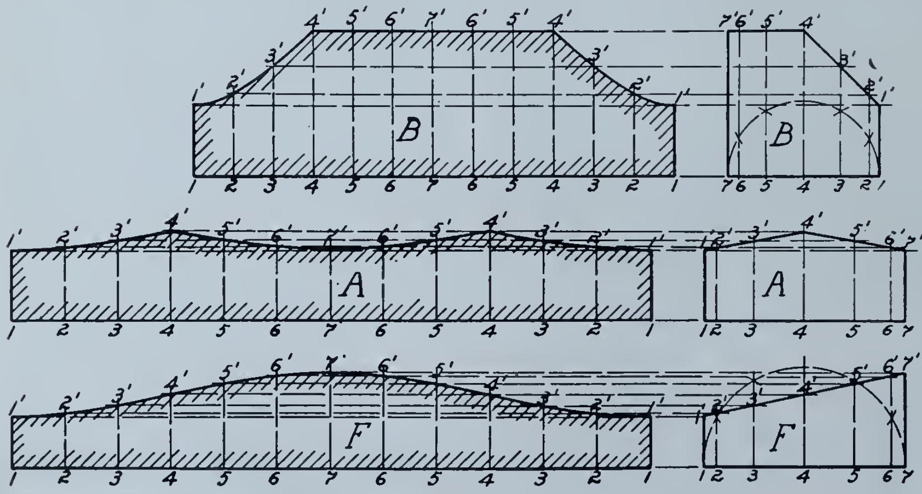

FIG. 2.

ing points in the elevation, the line 1, 1^1 representing the seam in each piece. Vertical lines are erected from each division on the base line, the intersection for the irregular curve being obtained from the horizontal projection of the corresponding points in the elevation. In developing these surfaces, no allowance has been made for seams—sufficient metal must,

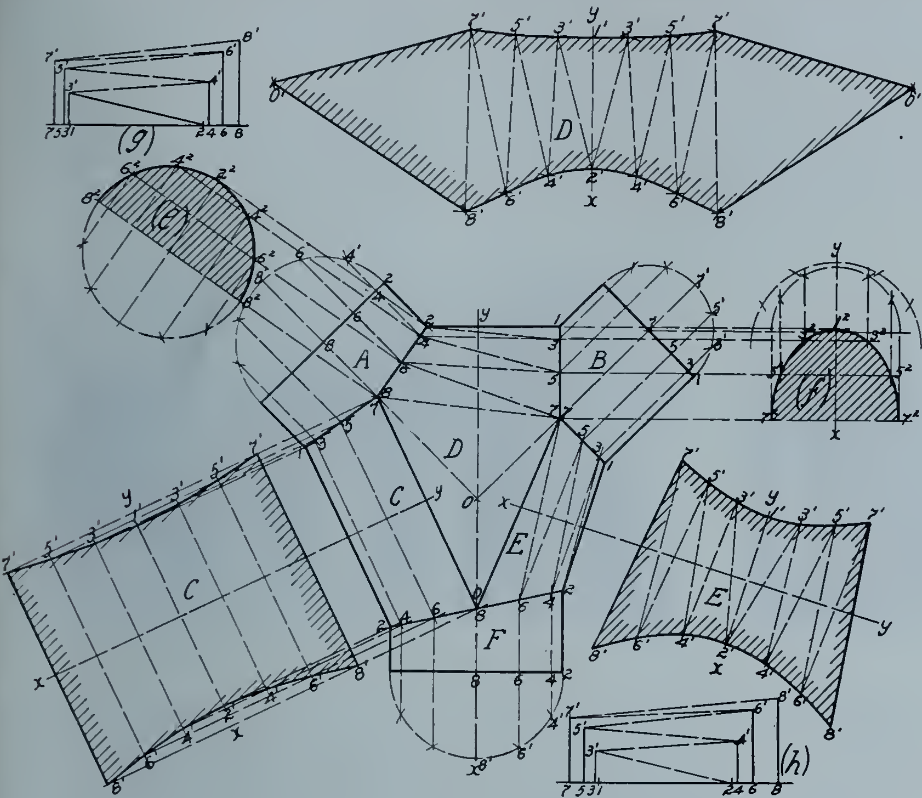

FIG. 3.

therefore be added where necessary, depending upon the style of joint used.

Transition Development

The development of the three transition pieces, C, D and E, is shown in Fig. 3. The piece C is developed similarly to those shown in Fig. 2. The centre line xy is drawn at right angle to the line 1, 2 in the elevation, and on this line six equal divisions are marked off, each equal to one-twelfth of the circumference of a 2-foot pipe. From these points on the centre line xy perpendicular lines are drawn, and the intersections of these lines with projections from the section C in the elevation are the points on the irregular curve.

The developed shape of the transition piece E is shown to the right of the elevation. To obtain the true length of the various radial and diagonal lines the triangulation method is used. The line 1, 2 being on the centre line of the side view, is, therefore, the true length in the front elevation, so with this as a basis we can proceed to obtain the true lengths of the other construction lines. On the base line at (h) lay off the various lengths, 1, 2—2, 3—3, 4, etc., as shown on E in the elevation, and erect perpendiculars at these points equal in length to the lines 3, 3^1—4, 4^1—5, 5^1, etc., in the semicircles at either end of the pipe connections. The length of the lines 2, 3^1—3^1 4^1, etc., in (h) will be the true length of corresponding lines in the elevation. As each half of the pattern is symmetrical, it can be developed on either side of a centre line.

At right angles to the centre line xy erect the line 1^1 2^1, equal in length to the line 1, 2 in the elevation. With 2^1 as centre and 2, 3^1 in (h) as radius, describe an arc that intersects at 3^1 with one drawn from the point 1^1, with a radius equal to one-twelfth of the circumference of an 18-inch circle. Then with 3^1 as centre and 3^1 4^1 in (h) as radius describe an arc that intersects at 4^1 with one drawn from the point 2^1, having a radius equal to the distance 6^1 7^1 on the curved line in F, Fig. 2. The development of E can be completed by following the method just described, noting carefully the corresponding figures and lines; the length of the line 8^1 8^1 in E will be of the same length as the curved line in F, as contained between the points 4^1 4^1.

The development of the transition piece D is shown at the top of Fig. 3, and is derived similar to that of E. The end portions that connect the two branch pieces, A and B, are divided by projecting lines from the semicircles as shown, the points 1, 2, 3, etc., forming the extremities of the radial and diagonal construction lines. The true shape of the ends are shown at (e) and (f), obtained in like manner to that described in Fig. 1. The true length of the construction lines in the elevation are shown by the cross lines in (g) Fig. 3, and are obtained the same way as in (h). On the centre line xy of the pattern D lay off the distance 1^1 2^1 equal to the line 1, 2 in elevation, and with 2^1 as centre and the length 2, 3^1 in (g) as radius, describe an arc that will intersect one drawn from the point 1^1, having the length 1^2 3^2 in (f) as radius. Then with 3^1 as centre and 3^1 4^1 in (g) as radius, describe an arc that will cut another arc drawn from the point 2^1, having the length 2^2 4^2 in (e) as radius. Proceed in this manner until the line 7^1 8^1 has been obtained, taking care that the curved line 7^1 7^1 in the pattern is the same length as that in (f), and the line 8^1 8^1 the same as the curved line in (e). Now with 8^1 as centre and the distance 7, 8^1 in (c) as radius, describe an arc at the apex 0^1, and from the point 7^1, with the line 7^1 8^1 in (h) as radius, describe an arc cutting the other at the point 0^1. Then lines drawn from the point 0^1 at either end to the points 7^1 and 8^1 will complete the development of the transition piece D.

B. C. SHIPYARDS BUSY

WORK in the British Columbia shipyards is going ahead at full speed. At the Victoria plant of the Cameron-Genoa Mills Shipbuilders, the operation of lining up the third keel for the schooner to be known as the Esquimalt has been completed. Each of the vessels will cost when completed about $130,000, so it is estimated, but from one cause and another the actual cost will likely be in the neighborhood of $150,000. They measure over all 225 feet, with a beam of 42 feet. Each will have a hold of 19 feet, will be schooner rigged with five masts, together with modern equipment for handling loads. The auxiliary power equipment will consist of oil-burning engines of the Bolinder type, which are being imported from Sweden. Three sets are already delivered, and it is expected that more will be on hand in time for the completion of other vessels on schedule time.

The Cameron-Genoa Mills Shipbuilders, Ltd., has to date invested about $50,000 in new plant and material. The Wallace Shipyards, Ltd., who are also building several ships of the above type, have invested about $35,000 in their enterprise.

To save time is not the same as being in a hurry. A scamped job is never a time saver, but always the reverse. Have plenty of lifting appliances of an adequate nature for the job of repairing or overhauling an engine, but never try to save time in the cleaning of small parts or adjusting to a nicety working details. Much time is lost in an engine room by lack of a beam and tackle, or even by the erection of such when really it should form a permanent feature of the installation.

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TRAINING IN TECHNICAL CHANNELS FOR SEAMEN

By Capt. Geo. S. Laing, I.M.S.G.

WHEN we realize that approximately three-fourths of our universe is covered by water, it emphasizes at once the vast importance of ocean, lake, river and canal transportation, or, in other words, shipping. Our world is a complex ball of interdependence. It is not too much to say that just as a ship (to wit, the ark) saved the situation in Noah's time, the vessels of the present day are the most important assets of any nation. After all, our Empire is really cemented together by its Royal and Merchant Navies, their combined power and commerce capacity contributing to such a consummation. To fully explain this last sentence, the following query has only to be voiced:—

What is the main factor in Canada's agricultural output? Answer—Ships to take it abroad.

The most of everything that you see around or handle in your daily tasks have been brought part of a journey by water. Try this out. It follows, then, that the shipping industry and the crews that man, officer, and command our steamers and sailing craft, are a community that deserve national recognition. If Canada is to expand in commercial and industrial lines, a merchant marine adapted for lakes and seaboard has to be worked up and manned by competent crews. This merchant marine is in the making at the present time, but it is still in short clothes and having its baby bumps.


BOY CREW, TRAINING SHIP "VIVID."


BOY CREW, TRAINING SHIP "VIVID."

Raising Our Vessel Standard

We have to entice boys and young men to take up this noble profession and see that the game is worth the candle. How can this be done? By making Canadian vessels worth sailing on as regards remuneration and accommodation, and then opening avenues of study where the men and youths of this manly calling can get their sailor schooling. Every maritime nation of any importance has nautical academies, navigation schools, or whatever you like to designate such places. The schooling of our childhood has to be supplemented with a technical education along the specific lines of our means of livelihood. As most of the world is praising our Royal and Merchant seamen just now, it may be of interest to hear something about the training ships and schools that made the men who are now "at the helm."

Toronto, with its coming harbor development, will have to do something more in the way of preparing boys and men for duties in the merchant marine. Surely Canada will never have to resort to "Shanghai" methods of manning vessels. One thing is plain, young Canadians must be prepared along the lines of seamanship and navigation so that they can, after acting as deck hands, watchmen and wheelsmen, pass the Government examinations for mate and master.


CADET TRAINING SHIP "VIVID."


WHITE STAR TRAINING SHIP "MERSEY."

Well Known Ship Schools

In the Mersey above Liverpool you can see one of the very famous floating schools, officially known as School-ship H.M.S. Conway, set apart for the training of officers in both the Mercantile

Marine and the Royal Navy. After a two or three years' course on this vessel, a boy can be drafted into the Merchant Service as an apprentice, or into the Royal Service as a "middy," or to undergo an extended course of naval science at the Royal Naval Colleges at Dartmouth or Greenwich. This grand old ship, the Conway, was one of the "wooden walls" of Nelson's time, and is well adapted for the rudimentary stage of a seaman and navigator's education.

The floating school H.M.S. Martin is a ten-gun brig, adapted for cruising. With the exception of a captain and instructors, the brig is worked by the boy cadets. Whilst steamers and machinery make up our present-day shipping to a great extent, the sailing ship knowledge is still the finest foundation for sailors and navigators to start on. Here the youngsters learn to sew and cut out sails, splice ropes, make knots, and work a ship up and down a channel in all weathers. This embodies such important things as reefing and furling canvas, taking soundings for depth, heaving the hand log for speed, steering, using sextant, chart, compass, and so on. There is not one man high up in the Royal Navy to-day who has not started life in a similar craft to those here illustrated.

In the Thames, off Greenhithe, you can see the old but still useful H.M.S. Worcester, another training craft, but for the Merchant Service only. At the present moment some of the old Worcester boys are captains on Atlantic liners, troopships, etc., while others are in the Naval Reserve or Intermediary Service holding rank as officers. The White Star training ship Mersey, another mercantile marine school, trades all round the world with her complement of embryo sailors and navigators.

The four-masted barque Port Jackson is another training ship for boys who wish to rise in the seafaring profession. She is one of the most handsome sailing ships afloat, having the distinction also of being a most expensive craft. She cost something like $150,000. Ships of this type will never be built again, as steamers have ousted them from the seas. The coming sailing ship is to be really an auxiliary vessel, with gasoline motor engines for use in calms and narrow waters.

How does the cadet training ship Vivid strike you? Isn't she a beauty? This craft was once at the disposal of the Royal Family for pleasure purposes, and was until her recent sinking the practical end for boys who attend the Royal Technical College, Glasgow. Here we have the auxiliary rig, both mechanical propulsion and sail propulsion. This nautical school aided hundreds of different grade merchant sailors to get certificates of competency.

High Positions Available

The highest men in both our Royal and Merchant Navies have most likely started life in one or other of the ways described here. There are, of course, many other schools, such as Trinity House, in Hull, etc., but it must be remembered that in both the services you start as a boy and climb up the grades, with so much sea service behind each examination; no soft job or rapid promotion because a rich uncle has "some stock in the company."

While these different vessels and colleges are open to boys who contemplate a sea life, boys can, if their parents consent, go right on board a sailing ship or steamer and be rated as apprentice, ordinary seamen, cabin boy, etc. Any or all of them may eventually rise to the top and be rated as captain or master in the Merchant Service.

The Royal Service is hardly so easy for the poor boy as the foregoing; still the merchant sailor youth can find his way into the Royal Navy through the R.N.R. (Royal Naval Reserve), and many of them do it and rise high up. Something like two thousand men holding captain's rank in the Merchant Service have been given Royal Commissions since the war broke out. These men, of course, had no actual connection with the senior service before hostilities broke out, but their merit whilst on board hospital ships, transports, mine-sweepers, etc., soon brought recognition. For all time, the Royal and Merchant Navies will be inseparable.

Night Schools for Seamen

The most feasible way of putting training opportunities in the way of our lake and coastal seamen is to open night classes in December, January, February and March. All of the men are ashore in the first three months of the year, and quite a few are available in December. Furthermore, these men as a rule cannot afford to be idle all winter, so temporary employment must be found for the daytime, which leaves a man free to attend school at night. Where lake seamen are idle all winter it means a considerable "dead horse" to be worked off during the sailing season. Again, the "pull and palm oil" examiner has disappeared, and, to get a mate's or master's license now, the applicant has to stand a reasonable test.

The man who does not apply technical study to his daily business must remain amongst the unskilled and uncertificated. We absorb certain knowledge by instinct, but I defy any man to become a sailor and navigator without a little systematic book study and diagrammatic demonstration. Some day we may have a craft in our local waters as well as a night school on the beach to further educate our coming ships' officers.

GRINDING BRASS VALVES

By D. A. Hampson.

WITH the automobile came valve grinding on such a scale that it has been brought home to most mechanics who, if told to grind in any kind of a valve, would straightway start the work with emery and oil or one of the various compounds of these. There is, however, a class of valve grinding met with in shops of supply manufactures and in certain branches of repair work that is quite different and little known outside of these lines. In this class are pet and stop cocks, valves used on bar and restaurant fixtures, shut off cocks for house water systems, and valves used in bottle filling work in various kinds of food production and packing.

All of these "valves" have a cylindrical core turned to a taper of approximately one inch to the foot and fitting in a body reamed to the same taper. The core is held to its seat by a D washer and nut at the small end. The material is cast brass of the best grade.

In the manufacture of these valves the taper of the two parts is made to correspond exactly, thereby reducing the amount of grinding; in repair work, circumstances may compel all the re-fitting to be done by hand grinding or grinding after awkward shaped pieces have been machined, perhaps none too well because of their shape.

Grinding is imperative—a perfect fit cannot be secured in any other way—for liquids such as gasoline, the familiar lead pencil mark and other visual tests, are not good enough, and the valves are tested by suction. In manufacturing this is done by applying the valve to a quick acting connection on the shop vacuum system—if the valve holds its weight, it is ready for any service—and a corresponding test for heavier valves. On a repair job the rather unsanitary method of testing is to put one of the connection ends in the mouth, close the lips tightly around it, and with a deep inward breath place the tongue over the opening. If the tongue is held fast, the valve is sure to be tight — tight enough for gasoline. Another less positive way is to oil valve and core and then blow in the connection looking for bubbles at the joint as an indication of a leak.

The Sand Medium

Sand is by far the best grinding medium for brass valves; emery or corundum should be used only when no sand is obtainable, for it is well nigh impossible for even a skilled grinder to keep from scoring the surfaces—something impossible with sand of the right kind, though the greenest boy in the shop does the work. White sands are used for valve grinding—sea sands or certain sands produced by glacial action—dry, sharp, and free from loam and vegetable matter. In general, any sand which is good for locomotive work will do for valve grinding.

The valve grinder oils the core, rolls it in sand and thrusts it, coated, into the valve. The actual work is as with any valve—turning the core through a small arc, shifting to another position and repeating with additions of oil as the work gets dry. Any of the common shop oils will do the work. The parts are cleaned in a pail of kerosene and the experienced grinder does not remove the core when the test shows a perfect seat, he simply washes the sand out through the ports. The sand is better used sifted, but if not, the larger particles or pebbles are shaken off after the oiled core is rolled in it.

GAS LEAK AND AN OPEN TORCH.

By J. H. R.

THE old adage of looking for a gas leak with a lighted match, has often been related—not always by the unfortunate explorer,—but by those who desire to warn others against embarking on a like enterprise. The original source of this article, not being of the ordinary gas leaking variety, may be of interest to the readers.

Some few years ago in a small jobbing shop, a number of special design internal combustion engines were being constructed, and when completed, were subjected to the usual test. During the operation of testing one of these engines, the charge refused to explode. After turning the engine over several times without success, the caps were removed from one of the valve seats, to try and locate the cause of the trouble. The operator, who was an experienced hand on gas engines, stooped down to investigate, but being rather dark, he called for a light. The light, which was an open flame torch, was handed to him, and unthinkingly he placed the light to the valve opening . The result, like the cellar explorer, was a gentle explosion, which centered itself in the face of the torch bearer, causing some serious burns, and the loss of his eyebrows and moustache; the latter being the most serious of all, as he stated himself he had been seven years in raising it.

THE ENGINEER OF TO-DAY

By N. G. Near.

IMAGINE, if you can, a lawyer who does not subscribe for a law paper, or who has no law books in his office. He would be a "poor excuse" for a lawyer, indeed. It would soon become evident to everybody who knew him that he was not up-to-date. He could not work long on the knowledge he had gained while at college, or that he had gained in some other office. I know of no such lawyer. I doubt if there is one, especially one that could truthfully be "called" a lawyer.

Again, imagine a doctor who refused to subscribe for a doctor's journal. He may be a graduate of the best known medical school in the world, yet, if he lays down flat after finishing his course and refuses to learn more, it would not be long and he would be properly termed a "back number." The function of the medical journals, like the engineering journals, is to keep its readers informed along the lines of latest practice. "Kinks" are to be found in medical papers just as in our papers. The journal is the proper channel for up-to-dateness. The book and the library are for reference to precedence and good practice in days gone by. Journals and books are indispensable.

The same may be said for the teacher. Teachers of any profession should be intensely up-to-date. It is impossible for them to do too much reading and studying.

Contractors, architects, concrete specialists, textile men, coal miners, machinists—every trade worker, in fact—should subscribe for some paper or other in his field in order to keep from dragging along behind the times. The paper subscribed for and read should be the best. The best paper is the one that is not too high above the reader's head and that is not so elementary as to teach nothing new—the paper must be alive to the present.

Engineering Process In the Lead

The engineering profession is just as important as are any of the above. There are more "new things" in engineering than in other lines, and therefore more to read about. The steam turbine, for example, has made enormous strides. Inventions of engineers make possible such highly developed sensations as the aeroplanes which loop the loop and fly circles around birds, the submarine, the battleship, enormous guns, the automobile, the steam railroad, and all electrical contrivances. All of these great things have been achieved since Watt made coal usable in the form of power. Power has therefore been the greatest civilizing agency and is now more important than ever.

Every engineer, no matter what his position, should read. Keep up with the times. Don't be a man of yesterday, last week, last year, or last generation.

WHY GAS ENGINE BELTS SHOULD BE OPERATED WITHOUT SLIP.

By "Artificer."

FEW operators of gas engines are aware of the seriousness of belt slip. Belt slip costs money, and the money loss can be easily computed if you know just how much the belt slips, and the amount of money you are paying per year for fuel. For instance, measure the diameters of your driving and driven pulleys (from center to center of belt) and compute the exact number of revolutions that the driven pulley should make. If it makes only 90 per cent. as many revolutions per minute as it should make, the slip may be computed as 10 per cent. 10 per cent. slip means 10 per cent. power loss, 10 per cent. fuel loss, and consequently 10 per cent. money loss. Each per cent. of slip means one per cent. money lost.

It is therefore clear that you should not permit slip at all. Just at the time of explosion there often is a little that cannot avoided, especially on engines [illegible] provided with small or light flywheels. With larger flywheels, where fluctuation is reduced to the minimum, there is less danger of slip and often none at all; but in any case it is a good plan to measure your pulleys and make the above computation, and if your pulleys are slipping 5 per cent.; if you are spending \$500 per year for fuel; you may as well save (\$500 $\times$ .05=\$25) \$25. per year through preventing slip by taking care of your belts and pulleys and preventing the wear that goes along with slip. Sometimes the cost of wear and tear is greater per year than the cost of slip. Both costs may be eliminated as well as not by giving the belts a little attention regularly.

Also, don't run your belts too tight. It has been demonstrated that a tight belt may require 50 per cent. more power to be operated than a "slack" one. Besides, tight belts will not pull so great a load, they make bearings wear out more quickly, they require lacing oftener, and are more liable to break. A slack belt will "live longer" than a tight one.

OIL RING BEARING TROUBLE

THE oil ring in a motor bearing failed to turn because it had been distorted into an elliptical shape by a crowding which it had received when the armature had been reinstalled after having been removed for repair. When an armature shaft is shoved into a bearing, the oil ring should be held up with a screw driver or other article of suitable shape. Assemblers accomplish the same result by turning an end shield upside down, for then the ring drops out of the way. Some operators lift the rings and rest them on the boss alongside the ring slot; this is not to be recommended as a general practice for the rings may be forgotten and remain raised out of the oil. Indeed, this has been found to be the cause of trouble in several instances of bearing heating. In these cases, however, the bearing was so inaccessible that only an experienced hand could locate the ring by feeling for it. Another very similar instance took place when a motor had to be disassembled on account of having been through a flood; in reassembling, the rings were left out entirely.

AUTOMATIC DISTRIBUTING VALVE FOR STEAM PUMPS

DESIGNED to meet all the requirements of a successful device for controlling the distribution of steam in pump cylinders, the Attwood Patent Operating Valve is applicable to both horizontal and vertical pumps without any change. An explanation of the working is given in the following illustrations:

Figs. 1 and 2 show a sectional plan of steam cylinder and steam chest, exposing the two piston valves A and B, the slide valve C and also the steam piston. The piston valve A engages slide valve C, which opens ports H and I to live steam and to exhaust port K alternately in order to operate the steam piston.

Live steam is admitted to centre compartment of steam chest containing the piston valve A and slide valve C. When the valves are in position shown in Fig 1, steam is entering cylinder by port I, and exhausting from cylinder by port H to main exhaust port K. Piston has completed its stroke from right to left by uncovering port F, and admitting steam by ports F and D on to end of piston valve B, which is now moved to the position shown in Fig. 2. Ports N and O admit live steam from the centre compartment of chest through the inside of piston valve A to the outer ends of same.

In Fig. 2 piston valve B has uncovered port M, and steam is exhausted from the right end of valve A through ports M and J to main exhaust port K, while port L is covered to the exhaust port J and steam accumulates at left end of valve A through port N and moves valve A from left to right, opening port H to live steam and port I to main exhaust K. Ports D and P are now open to exhaust the valve B to main exhaust port K and when steam piston has completed its stroke from left to right the reverse operations are repeated through the ports E, R and G respectively. Valve A overruns ports L and M at each end of its stroke, thus preventing waste of steam.

Figs. 3 and 4 are front elevation and end views of the Attwood patent horizontal, inside packed, pot valve pump, which is designed for medium pressure boiler feeding, tank, vacuum, and general purposes. Fig. 5 is a cross section through one end of the steam cylinder showing the main steam port entering the lower side of the cylinder bore.

Fig. 6 is a cross section through centre of steam cylinder and steam chest, showing screw tappings for steam, exhaust and lubricator connections. Fig. 7 is the same type of pump as Fig. 3, but fitted with extra long stretcher and piston rod which is the usual practice when used for pumping tar and chemicals, to prevent the fluid being carried by the pump rod into the steam cylinder.

Figs. 8 and 9 are front and side views of vertical outside packed ram steam pump, especially designed for high pressure boiler feeding and also for mine sinking purposes. Engineering readers will at once notice a distinct advance in the right direction by placing the steam chest and cylinder ports of the Attwood pump on the side of the cylinder instead of on the top as in previous designs, thus enabling the steam ports to drain the cylinder at every stroke of the piston, rendering the use of cylinder drain cocks quite unnecessary. Every operating engineer knows of the trouble caused by water accumulating in a pump cylinder when the steam ports are located on top of the cylinder necessitating the drain cocks to be left slightly open all the time

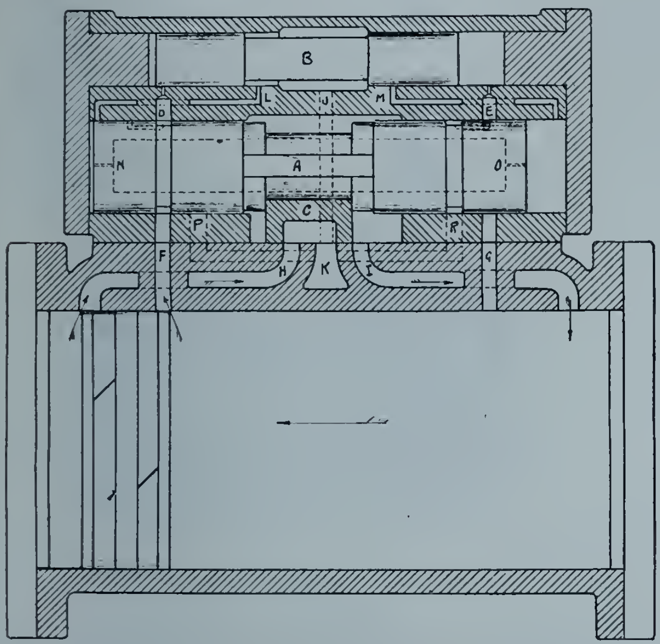

FIG. 1. SECTION OF CYLINDER ILLUSTRATING OPERATION OF DISTRIBUTING VALVE.

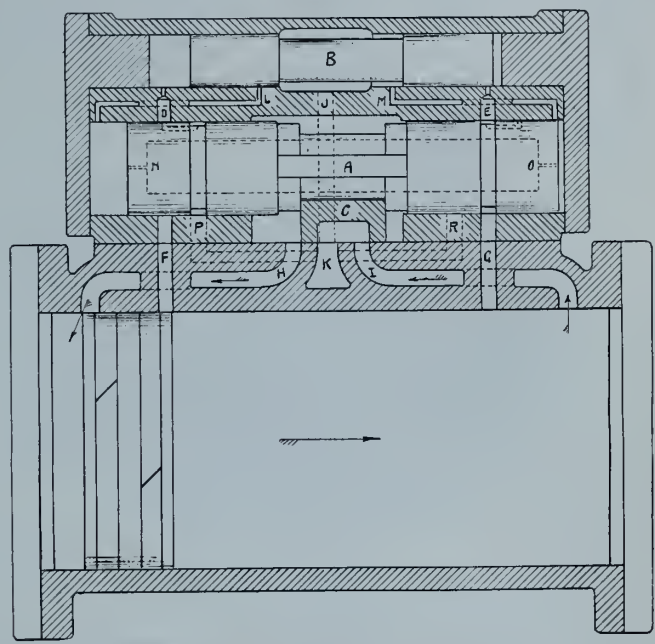

FIG. 2. SECTION OF CYLINDER ILLUSTRATING OPERATION OF DISTRIBUTING VALVE.

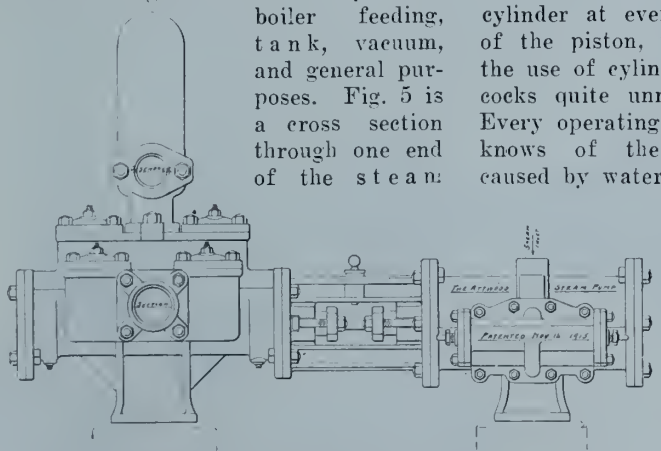

FIG. 3. ELEVATION OF INSIDE PACKED POT VALVE PUMP.

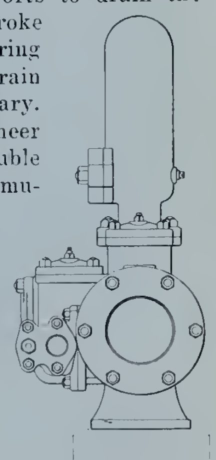

FIG. 4. END VIEW OF FIG. 3.

to prevent water hammer. This condition becomes still more aggravated in a vacuum pump operated by a governor when used on a steam heating system owing to the slow piston speed and occasional periods of rest. Condensation will accumulate in the steam line as well as in the steam cylinder.

Vacuum pumps on low pressures will frequently refuse to start off the governor under such conditions until the cylinder drain cocks are opened. Again pumps for mining purposes have long and tortuous steam lines which are not insulated and frequently have cold

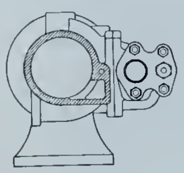

FIG. 5.

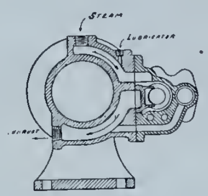

FIG. 6.

water dripping on them from the roof. Such conditions are the worst possible and produce the maximum amount of condensation and trouble for the engineer. The cylinder and valve becomes water-logged, lubrication is washed away, rod and joint packings are ruined and cylinder heads and pistons are frequently broken because the cushion is destroyed by the presence of water in the cylinder.

An examination of the drawings accompanying this article reveal two notable facts, viz.: 1st. The simplicity of the valve motion and its operation. 2nd. A complete automatic self-draining sysstem accomplished by the disposition of

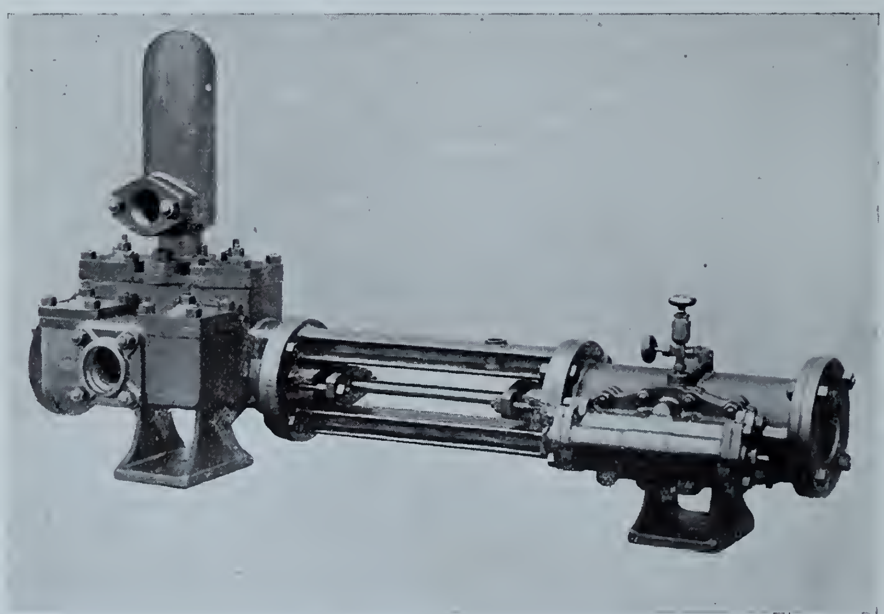

FIG. 7. HORIZONTAL, INSIDE PACKED, POT VALVE PUMP WITH EXTRA LONG STRETCHER AND PISTON ROD.

steam chest, steam cylinder ports and pipe connections, as illustrated in Figs. 5 and 6.

It is apparent that cylinder drain cocks are superfluous because condensation through all the operations drains to the atmosphere by gravitation and the arrangements of steam ports permit the use of saturated steam without any risk to the cylinder head as already demonstrated by a series of daring experiments carried out under the worst conditions.

Figs. 8 and 9 show improved designs of a vertical outside packed ram pump which has the special feature of dispensing with one of the ram packing glands used on this type of pump, thus enabling an outside packed pump to occupy practically no more space than an inside packed pump of same length of stroke.

The saving in weight, friction, packing and space appeals to marine and stationary engineers alike, and the moving parts which are accessible without disturbing any pipe connections are a feature of convenience that will be appreciated by everyone experienced in the upkeep and repair of machinery.

HOT BEARING EXPERIENCE.

THE test of years in practice has proved that the oil ring method of lubricating bearings is entirely satisfactory, says E. C. Parham in the General Electric Review. Although it is seemingly obvious that the following precautions should be taken, past experience has shown that it is necessary to call attention to the facts that (1) there must be oil in the oil-well, (2) the oil rings

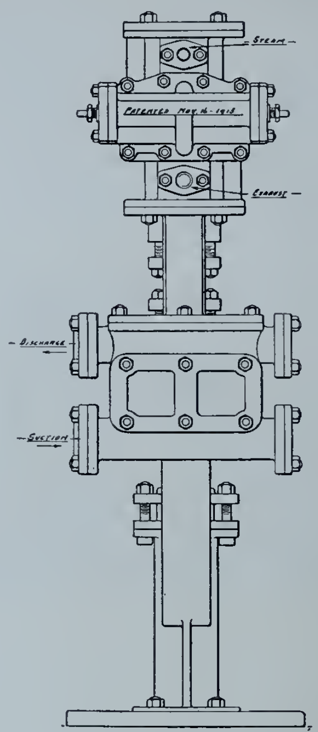

FIG. 8. FRONT ELEVATION OF OUTSIDE PACKED RAM PUMP.

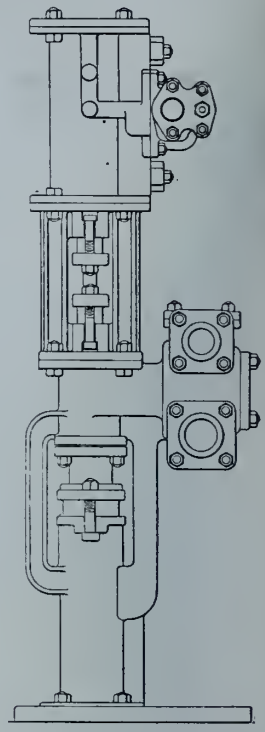

FIG. 9. SIDE VIEW OF FIG. 8.

must be installed, and (3) the oil rings must turn.

Complaint was made that the lining in one bearing of a motor armature had melted twice, notwithstanding the fact that the oil had been renewed just as often as had that of the other bearing which had given no trouble. The motor, being started and stopped by means of an automatic panel and being almost inaccessible, was not given daily attention. It would operate for about five days and then the bearing heating would produce a binding effect which would cause the motor circuit-breaker to open. The opening of the breaker was all that prevented the babbitt metal from running out and letting the armature down onto the pole pieces. An inspector, who was sent to locate the trouble, noticed that the floor was much more oily under the trouble-giving end of the motor than at the other end. This suggested that the oil flooding could not have been due altogether to careless oiling, for then the flooding at both ends would have been about the same. Inspection of the oil-well showed that there was but little oil in it although the other bearing was nearly normal; both bearings had recently been washed out and refilled. On refilling the oil well and carefully wiping the outside of the box, a crack was discovered through which the oil slowly oozed out. This was stopped by drilling, tapping and plugging a hole in the affected area.

Steam Driven Auxiliaries of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that steam-driven auxiliaries aboard ship continue to increase in number, and that they are being designed and constructed to meet in the most effective manner, both ordinary and special service applications, this series of articles describing and illustrating at least the more important types of such apparatus seems to us more or less timely, both from the point of view of familiarizing engine and boiler room staffs with the products of different manufacturers, and that of their acquiring a closer intimacy with specific detail arrangement, relative to operation, maintenance and periodic overhaul.

BOILER FEED PUMPS—III

A VERY complete line of boiler feed pumps is built by the American Steam Pump Company, Battle Creek, Mich. These are known as the Marsh pump and are designed for a maximum working pressure of 150 lbs. per square inch. They are built in twenty-three sizes, ranging in capacity from 20 boiler horse-power to 3,500 horse-power on a basis of four gallons per horse-power per hour at moderate speed.

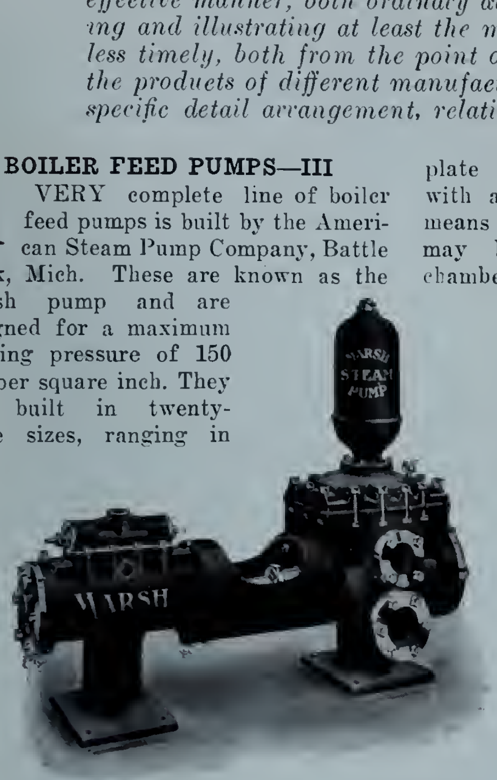

FIG. 12—EXTERIOR VIEW OF "MARSH" SIMPLEX PUMP

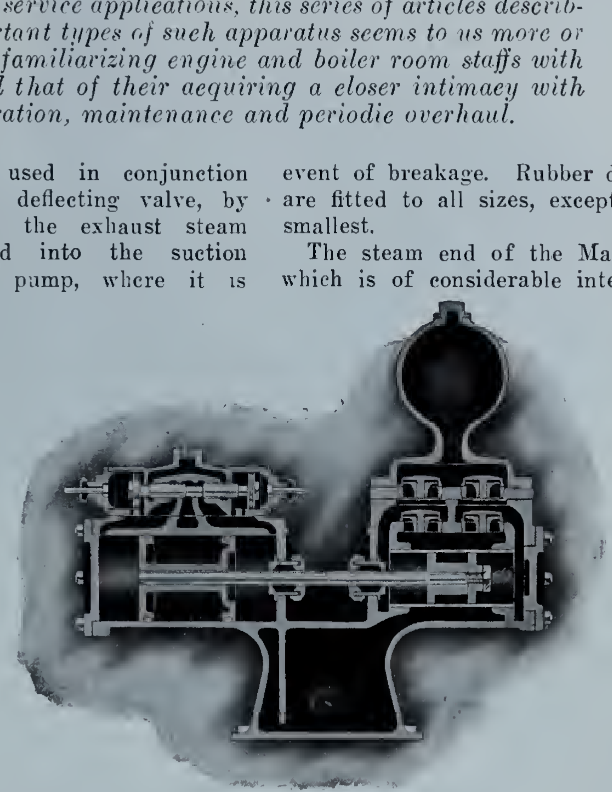

FIG. 13—TYPE B TO D "MARSH" PUMP IN SIZES 2½ X 1⅝ X 2 IN. TO 5 X 3 X 3½ IN.

"Marsh" Simplex Pumps

All of these pumps are of the simplex piston type and are illustrated in Figs. 12 to 16. The pump shown in Fig. 12 is typical of the larger sizes, sectional views of which are shown in Figs. 15 and 16, while Figs 13 and 14 are sectional views of the smaller sizes.

All Marsh boiler feed pumps are fully bronze-fitted, including solid bronze piston rods, and excepting in the four smaller sizes, cast bronze removable water cylinder bushings; pressed-in bronze bushings are fitted in the smaller sizes. The design adopted for sizes B to D, Fig. 13, is simple and compact, the two cylinders and base forming a single casting. In sizes C-2 to H, the steam and water cylinders are attached to the base, which in both of these designs forms a suction chamber, to which the suction pipe may be attached on either side. Being self-contained, these do not require large and expensive foundations.

To the left of the suction chamber will be noticed a baffle plate which is used in conjunction with an exhaust deflecting valve, by means of which the exhaust steam may be directed into the suction chamber of the pump, where it is condensed and combined with the water being pumped, thereby warming the water by adding the heat in the steam used to operate the pump.

In the pumps shown in Figs. 15 and 16, the cylinders are cast with separate bases. The steam and water cylinders are joined by heavy cast iron yokes with ring and plug fit to insure perfect alignment of wearing parts. In the largest sizes hand hole plates are fitted giving immediate access to all water valves, and the water end is built in three parts, thus obviating the necessity of purchasing an entire water end in the event of breakage. Rubber disc valves are fitted to all sizes, except the four smallest.

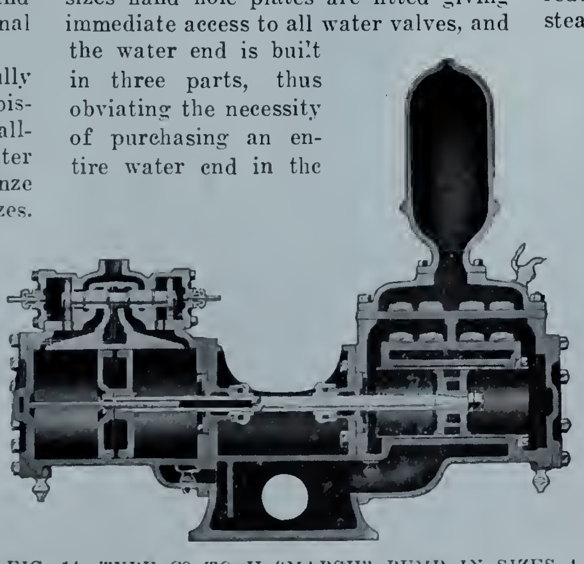

FIG. 14—TYPE C2 TO H "MARSH" PUMP IN SIZES 4 X 2½ X 6 IN. TO 7 X 4 X 8 IN

The steam end of the Marsh pump, which is of considerable interest, contains only two moving parts—the steam valve which moves backward and forward in the steam chest on top of the steam cylinder, and the steam piston itself. There are no moving parts on the outside and no tappets on the inside. Reference to any of the illustrations will show that steam which enters through the inlet on the top, passes to the left through the opening formed between the reduced neck of the steam valve and the steam chest, thence passing down through the port at the bottom of the steam chest and into the end of the steam cylinder. The steam piston is of a spool form, each head of which is provided with metal packing rings, the space between the heads forming a reservoir for live steam. This steam is supplied by a port in the steam chest above the valve, and passes, as shown by the white lines on the cuts to a point in the cylinder head or cover, from whence it passes through the central tube into the hollow piston rod and thence into the interior of the piston. As the piston moves to the right, the live steam which it contains passes through the port indicated by an arrow, and by pressing on the right hand end of steam valve forces it over to the left, closing the admission port at that end and admitting steam to the right of the piston, thus reversing the travel. In Fig. 13, the steam piston is made extra long and by means of suitable ports dispenses with the use of a hollow piston rod in the smallest sizes.

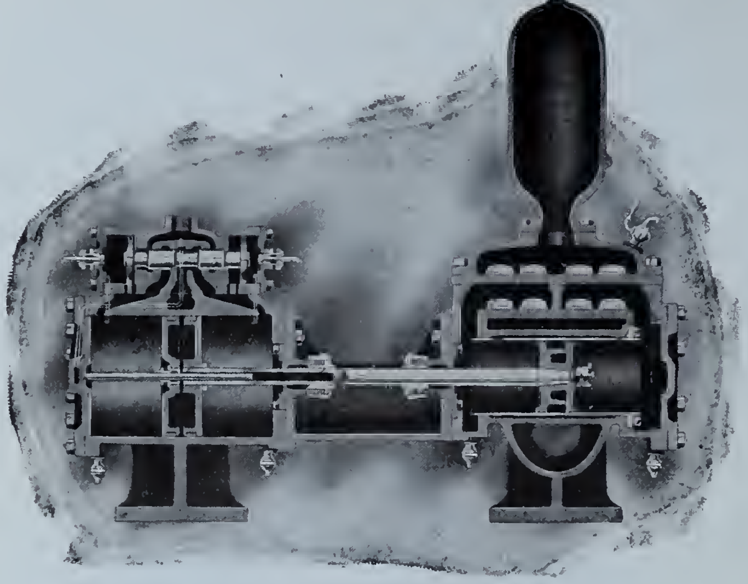

FIG. 15—TYPE HB TO N "MARSH" PUMP IN SIZES 7 X 4½ X 10 IN. TO 14 X 8½ X 12 IN.

''Deane'' Single and Duplex Pumps

Boiler feed pumps of both the single and duplex types are built by the Deane Steam Pump Co., Holyoke, Mass., the principle constructional features being illustrated in Figs. 17 and 18. The first of these shows the single pump which is made in eleven sizes of this type, from 50 to 500 boiler horse-power. Larger sizes, having capacity up to 8,000 boiler horse-power have a somewhat different style of water end with hand hole plates for access to the valves, which arranged in such a manner that the pump is always primed and ready to start.

The valve gear of the Deane single pump consists of few parts which are arranged to work in the same vertical plane thus avoiding various mechanical complications. The valve parts comprise a main valve and supplemental valve which are both flat slide valves, also a supplemental piston which is driven by the direct pressure of steam on alternate ends. The mechanical operation is as follows; the piston rod arm is securely fastened to the piston rod, and through the connection of lever and links, its motion causes the tappet block to slide back and forth on the valve rod between the two tappets. These tappets are keyed to the valve rod so that when the tappet block strikes either tappet it carries with it the valve rod and secondary valve, which uncovers a small port allowing steam access to one end of the valve piston, throwing it over and operating the main valve so as to admit steam to the pressure side of the main piston. The correct timing of the valve movements is dependent on the position of the tappets. If they are too near together, the valve will be thrown too soon and the pump short-stroked, and if too far apart, the pump will complete its stroke without moving the valves.

The Dean duplex pump is shown in Fig. 18, which a section of the whole pump with a plan view of the steam end and valve motion above, the steam chest cover being removed to show the valves. The duplex pump being practically two pumps side by side, enables the auxiliary valve and piston to be dispensed with; the slide valve which controls the admission and exhaust of steam for one piston receives its motion from the other piston. As explained before, it is desirable that the steam pressure should be maintained clear to the end of the stroke, and to accomplish this the steam port must remain open, or partially so, until the piston has reached the end of its travel. The difference between the thickness of the valve rod collars and the space between the lugs on the valves accomplishes the result by allowing the piston to travel a certain distance before starting to move the valve. The amount of this lost motion is carefully determined and accurately fixed by the makers, thus avoiding any subsequent adjustment.

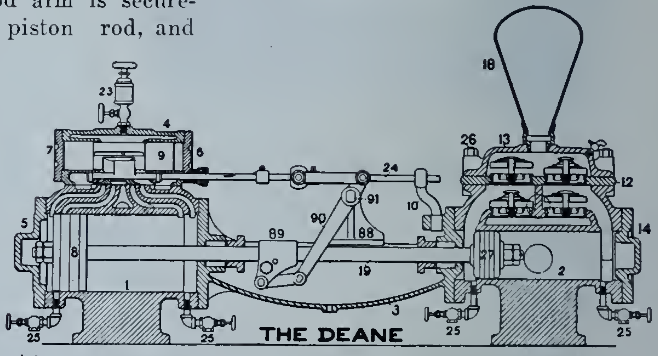

FIG. 17—THE "DEANE" SINGLE STEAM PUMP, SHOWING DETAILS OF CONSTRUCTION

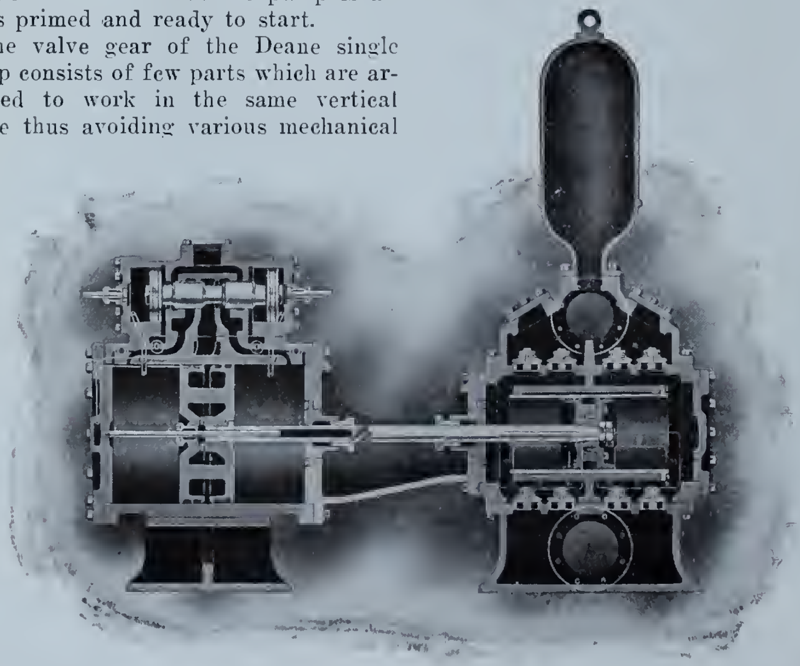

FIG. 16—TYPE O TO R "MARSH" PUMP IN SIZES 10 X 10 X 16 IN. TO 20 X 12 X 20 IN.

''Cameron'' Boiler Feed Pumps

Boiler feed pumps built by the A. S. Cameron Steam Pump Works, New York, are of both simplex and duplex types. The simplex pump is illustrated in Fig. 19, which shows the interior of the steam valve arrangement. The entire mechanism consists of four pieces only, all of them working in direct line with the piston.

The main slide valve G, controls the distribution of steam to the cylinder A, and is operated by the chest plunger F, the right hand end of which is shown in section; C is the piston; L, the steam chest; H, a lever by means of which the chest plunger F may be reversed by hand; I, I, are reversing valves which are alternately operated by the steam piston at either end of its stroke. When

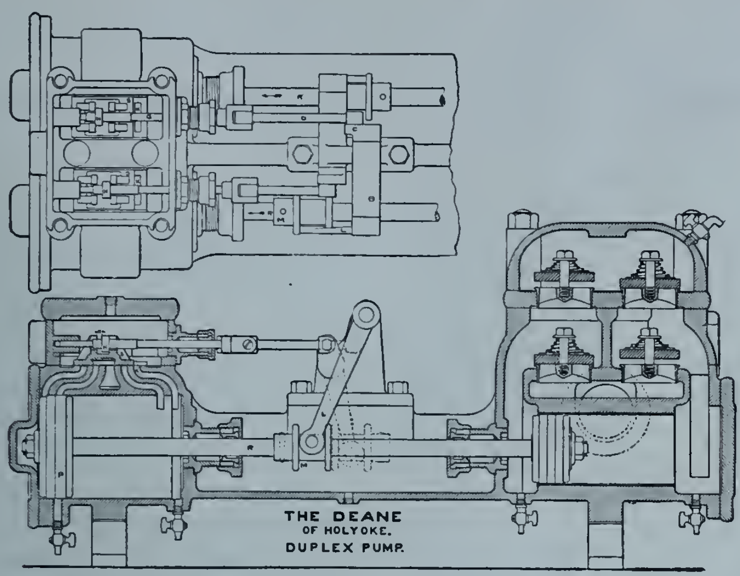

FIG. 18—THE "DEANE" DUPLEX PUMP WITH PLAN OF VALVE GEAR

not opened by the piston these reversing valves are kept in the position shown by live steam pressure from the steam chest. Both ends of chest plunger F, are hollow, and have holes allowing the steam pressure to balance all over, so that the passage leading to the left hand reversing valve is now filled with live steam. When the piston opens the reversing valve at the end of its stroke, this steam is allowed to escape so that the chest plunger F is relieved of pressure on this end and is instantly thrown over, carrying slide valve G and reversing the motion of the piston.

Fig. 19 also illustrates the Cameron valve chest and arrangement of water valves. By removing one bonnet or cover, the whole interior, with every

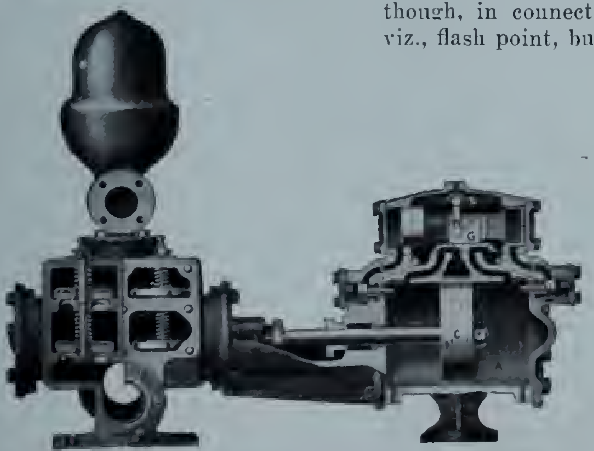

FIG. 19—SECTIONAL VIEW THROUGH "CAMERON" SIMPLEX BOILER FEED PUMP

valve, is plainly visible. The shelves or decks are bored out tapering, and the brass seats forced in, being thus readily renewable. Each stem holds two valves with their springs one above the other so that by unscrewing one plug, and pulling up the stem, both are released.

Cameron duplex pumps are made in a large range of sizes for working pressures of 150 lbs. per sq. in., and in numerous types. Fig. 20, shows the water end of the outside centre packed plunger pattern, so arranged that the plunger may be packed from the outside without requiring the removal of the cylinder head, and also permitting the packing to be tightened while the pump is in operation.

CONCERNING LUBRICATING OILS

ONE finds many plants these days buying lubricating oils based on gravity tests, says a writer in the Dodge Idea. The gravity of a lubricating oil is of small value in determining the lubricating value thereof, when considered by itself. It becomes very important, though, in connection with other tests, viz., flash point, burning point, viscosity and cold test, as it enables one to determine with considerable certainty the origin of crude petroleum from which it is produced, also aids in determining the presence of rosin and coal-tar oils, which are objectionable.

Materials selected as lubricants should, in addition to being satisfactory, be uniform in composition, so that they may be used with confidence, and should by all means be neutral chemically. That is to say, they must possess no properties liable to injure metals or other materials with which they come in contact. A good lubricant should adhere tenaciously to metallic surfaces, so that it may not be easily rubbed off.

One of the easiest tests I know of for acidity is to take a small sample of oil, place it in a test tube with a little cupric oxide and subject it to gentle heat for three or four hours. If fatty acid is present the solution will turn green, and if vegetable acid is present it will turn blue. In selecting the samples for trial, the operator or buyer should examine and compare them very carefully in every possible way. He should note their color and transparency, rub some of each between the fingers and thumb or on the palm of the hand, and note if the sample is smooth and oily and contains no grit; pour a few drops on a sheet of tin or piece of glass, holding it at different angles and noting how it flows, also whether it leaves any residue or gum in its tracks; examine it with a strong magnifying glass for foreign substances; smell it, and if it is rancid or has a very offensive odor, reject it.

Some manufacturers buy their oils based solely on color, which indicates the amount of carbon contained in the oil. Free carbon can only be removed, without deteriorating the lubricating properties of the oil, by actual filtration; but an oil should not be questioned

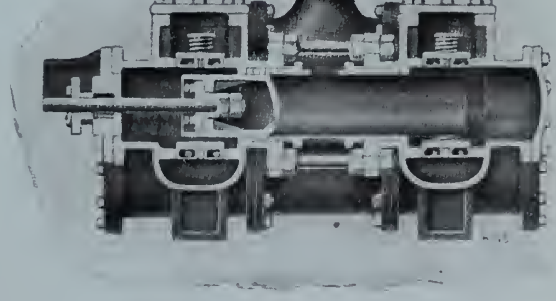

FIG. 20 — WATER END OF "CAMERON" OUTSIDE CENTER PACKED PLUNGER PUMP

simply because of its color. Continued filtration, while improving color, will greatly reduce the viscosity of the oil, hence its lubricating power.

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Vol. VI OCTOBER, 1916 No. 10

PRINCIPAL CONTENTS

GENERAL BUSINESS, SHIPPING AND SHIPBUILDING

NOT the least important feature of the prevailing prosperity in Canada is the marked improvement in the financial condition of many of our manufacturing establishments, large and small, particularly those engaged upon war orders. These concerns have been able to liquidate their liabilities and in many cases are accumulating substantial reserves. What is true in the sphere of general manufacturing is equally so as regards our shipbuilders and shipping corporations. Shipbuilding is booming as never before in our history, at least relative to steel construction, and as regards wood construction the present activity compares very favorably with past achievement. In the realm of shipping even more satisfactory returns are perhaps being realized, due to the dual circumstance that both lake and ocean transportation conspire to that end as compared with the former only in pre-war days. Vessel shortage for ocean service is all the time becoming more acute, and each day, so to speak, finds Canada's pre-war capacity for vessel production, turning down thousands of tons of building orders. Surely the time has arrived for our Government to interest itself to the point of action in fostering the establishment of greater and more widespread enterprise in shipbuilding, realizing as they cannot fail to do from the happenings of the past two years, that whatever other conditions may prevail when peace is declared, shipbuilding on a gigantic scale will claim precedence and be maintained at high pressure for probably a decade thereafter. Is the pressure being applied to Ottawa as powerful as is available and cannot the issue be forced to a successful conclusion? Additional, and the necessary pressure is, we believe, available to force a successful issue.

COAL SCARCITY IN CANADA

THE scarcity of certain varieties of coal continues to be a matter of first importance, not only in regard to the supplies available for shipping, but relative to the requirements of manufacturing establishments as well. That there will be no coal in the country by March 15, 1917, is the forecast of one official. The Dominion Coal Co. reported some time ago that it was bunkering large supplies of coal for use on Government transports in anticipation of an acute famine on the St. Lawrence route, and recent developments in widely separated quarters continue to emphasize the seriousness of the situation in its every aspect.

During the year 1915, from January 1, until September 30, the output of the Dominion Coal Co. collieries at Cape Breton showed a steady increase from 287,000 tons in the former month to 452,000 tons in the latter month, or a grand total for the nine months of that year of 3,666,000 tons. In January of the present year the output amounted to 407,000, this total being maintained very approximately up until the end of March. In April the output fell to 378,000 tons, rallying slightly in May to 383,000 tons since when there has been a steady decrease, the figures for September being around 345,000 tons. Should the rate of decrease continue, and there is little hope of its being arrested, the output for this year will show a falling off of probably three-quarters of a million tons.

In conversation with a gentleman in close touch with coal production elsewhere as well as here in Canada, we learn that instead of a decreased output being allowed to materialize abroad, special efforts have been put forth to intensify production, the various Governments concerned realizing as Canada's has not, that coal and especially bituminous coal is the basic munition in the war in which we are engaged. As if, however, ill-directed enlistment had not been sufficiently effective to restrict production, we understand that some 1,800 men left the Maritime Provinces in August to harvest in the West, the half of whom were taken from the mines and munition plants of Nova Scotia. A majority, if not all of those men were carried all or part of the way West on our Government Railroad, and of course at a low and attractive rate. Taken in conjunction with the lack of regulation of enlistments, it is plainly evident that the importance of coal for our shipping, manufacturing and power plant requirements is still unrealized by responsible Government.

MARINE NEWS FROM EVERY SOURCE

Unknown Craft Sunk.—After receiving the statements of eye-witnesses, the harbormaster at Port Hope, Ont., has reached the conclusion that it was a scow or some craft of that type that went down off Port Hope on October 17.

Wrecking Tug Sold.—The tug Diver of the Reid Wrecking Co., has been sold to Quebec interests for use on the Atlantic coast, and left on October 6. The blowing of many whistles saluted the Diver as she started out on her journey.

Vancouver, B.C.—If satisfactory arrangements can be made with the city, the Vancouver Shipyards, an old-established firm on Coal Harbor, proposes to extend its plant and construct steel steamers.

Montreal, Que.—It is understood that the Canadian Vickers Co. have contracted for the construction of two 7,000-ton steamers. It is further understood that the company will go right ahead with building freighters in a general way.

London, Ont.—The Dominion Government has awarded the contract for the construction of a new cement pier to protect the west side of Port Stanley harbor, and work is to be undertaken by the contractors at once. The cost will be around $100,000.

Developments on St. Lawrence Route.—Reports from London England, indicate that tentative arangements are being considered whereby the shipping companies will organize to develop transatlantic trade on the St. Lawrence River. By this means the volume of trade on the St. Lawrence route will be largely increased.

To Conserve Shipping.—An Order-in-Council has been passed extending the measures taken previously by the Government for the conservation of shipping. The transfer of British ships was restricted and made subject to Government control last year, following action by the Imperial Government. The embargo has now been extended to cover ship mortgages and mortgage transfers. This action, like the first, follows an Imperial regulation.

Vancouver Gets Vessel Contracts.—Captain F. R. Dedrick, on behalf of the Stol-Nielsen Co., has signed contracts for the construction in Vancouver of three steamers for his Norwegian principals. The vessels are to be standard type freight carriers of 8,800 tons, costing a million and a quarter dollars each. Two are to be built by the A. Wallace Co., of Vancouver, and one by J. Coughlin & Sons, in False Creek. Negotiations are now on for the building of five more boats of similar pattern.

Increase in Building Ships.—An announcement from London states that a substantial increase in merchant shipping under construction for the three months ending October 1 is reported by Lloyds. The report shows that on Oct. 1 there were 469 vessels building, representing a total of 1,789,054 tons. This represents about 249,000 tons more than the amount under construction at the end of the previous quarter, and 253,000 tons more than that building a year ago.

Ottawa, Ont.—The Canadian-built icebreaker, sold some time ago to the Russian Government, will be given a trial run at Murray Bay on the 23rd of this month. Representatives of the Russian Government are now supervising the completion of the vessel. The icebreaker was intended for the Canadian Government service and was accordingly christened the "J. D. Hazen," in honor of the Minister of Marine and Fisheries. Her new owners naturally prefer a Slavonic appellation, and she has been renamed his Imperial Russian Majesty's ship Mikula Selianinovitch.

New Boat for Ocean Service.—The steamer Thorjerd, the longest boat ever designed to pass through the Welland Canal, was launched on September 27 from the yards of the Western Drydock & Shipbuilding Co., Port Arthur, Ont., in the presence of a large crowd. The ceremony was performed by Mrs. D. J. Cowan, wife of Mayor Cowan. The Thorjerd is 261 feet long and 43 feet beam, of steel construction, built to Lloyd's highest class. She will be used in the Atlantic service. A sister ship will be launched shortly, and also sent to seaboard before navigation closes.

Combination Shipbuilding Plant on Pacific Coast.—Vickers, Ltd., Barrow-in-Furness, England, contemplate considerable expansion in Canada, and there is linked with the name of this firm that of Yarrow, of Scotstoun, near Glasgow, Scotland, who already are directly interested in extremely important ship repairing and shipbuilding enterprises on the west coast of Canada. The famous firm of Armstrong, Whitworth & Co., are also interested, it is said. Cammel, Laird & Co. and also John Brown & Co., of Clydebank, are considering plans for shipbuilding in Canada. Pacific coast points will, it is expected, be favored.

Shipping Destroyed.—More than three million gross tons of merchant shipping of all flags, types and classes have been destroyed as a result of submarine activities, floating mines and other war causes since the outbreak of hostilities, according to the New York *Journal of Commerce*. According to this authority, the number of merchant ships sunk or otherwise destroyed by the belligerents from the beginning of the war to October 1 was 1,662, with an approximate aggregate gross tonnage of 3,097,097.

Marine Motors in China.—While there are at present perhaps not more than a dozen marine motors in the vicinity of Amoy, this should become a good market for marine motors and sundry supplies, as the Chinese are becoming more and more acquainted with the use of motors and the great advantage derived through them. At present practically all of the local traffic is carried by sailing boats, which is both slow and expensive. If the benefits of marine motors were properly displayed, say by a demonstration agent, and a local agency opened, good results would undoubtedly follow.

Marine Engineers Required.—The Admiralty are still desirous that marine engineers who are free to transfer their services to the Royal Navy or auxiliary branches, where their training and experience will at once be of value to the State, should apply to the Inspector of Recruiting, Admiralty Recruiting Department, Great Scotland Yard, who will afford applicants full information and every assistance. Marine engineers who have enlisted in the military forces of the Crown must obtain, in the first instance, the consent of their commanding officers to a transfer.

Canada Steamship Line's New Vessel.—The new steamer Sir Trevor Dawson was christened at Superior, Wis., on October 18, by the breaking of a bottle of champagne on her bow. The Dawson will be put into commission for the Canada Steamship Lines. Mrs. J. W. Norcross, of Montreal, wife of the vice-president and managing director of the owners, dashed the bottle of wine against the bow of the ship. The Dawson is one of the largest boats ever built on the Great Lakes. The registered tonnage is 5,505 tons net. She is 598½ feet long, 58 feet broad, and 32 feet deep. The gross tonnage is 7,215 tons. She will carry ore.

5,000-ton Submarine Cruiser.—According to the Dutch technical journal *Prometheus*, there is building in Germany a submarine cruiser of 5,000 tons and 400 ft. in length, "as strongly protected and armed as medium-sized protected cruisers." The propelling machinery is said to develop 18,000 horse-power, to give a speed on the surface of 26 knots and when submerged of 16 knots. The radius of action is from 18,000 to 20,000 nautical miles. It is said that the vessel will have 30 torpedo tubes, and that in addition to a torpedo in each tube there will be carried two reserves for each tube, making 90 in all. Provision is also being made for carrying over 100 mines, and for dropping them through the bottom of the ship.

New Steamship Line to Canada.—The first steamer to load of the Marine Navigation Co., who are inaugurating a new steamship line between Canada and ports abroad, will be the Nigaristan, of 7,300 tons deadweight, early next month, to be followed by the North Cambria at the end of November. These steamers will make regular trips and offer a monthly sailing. They will be supplemented by others if occasion arrives. The Marine Navigation Company is also owner of a fleet of fine clipper sailing ships, purchased from well-known Aberdeen owners for the most part. Among them are the Inverneill, Invercauld, Invermay, Inversnaid, and Carnmoney, and also the Victoria, Clyde and First Prize, the last three now being converted to motor-ships. All of these vessels are intended for Canadian trade, particularly for lumber export from Chaleur Bay, Miramachi, etc.

THE MARINE ENGINEER IN EMERGENCY

THE generous and appreciative terms in which the chairman of the Union Steamship Co. referred to the marine engineer and his work and resourcefulness, in his presidential address to the Institute of Marine Engineers, emphasize by contrast, says the *Marine Engineer and Naval Architect*, communications we receive from time to time on the general attitude of those entrusted with the rendering of honor to whom honor is due, an attitude which carries a consequential effect to the public mind. Lack of the grace of appreciation may arise from want of knowledge, but such a condition is excusable to a certain extent only, as there are ample opportunities to gain the knowledge that is necessary to a faithful and true presentation of facts and a just appreciation of work accomplished under pressing conditions or of duties discharged with a high ideal in spite of adverse circumstances.

There have been many instances of devotion to the requirements of emergencies on the part of engineers where their special services have not received that recognition which was their due. The prominence of the bridge has at times o'ershadowed the engine-room, and very often "out of sight, out of mind," has acted to the disadvantage of those who keep their vigil down below, where the feet of the reporter seldom carry him, hence the meed of praise is not bestowed. However, on this score as a rule the marine engineer is diffident; he does his work and carries on his duties quietly without ostentation, as becometh the nature of his employment and the musical rhythm to which his ear is accustomed, a false note arousing him to alertness to discover the reason why it has sounded.

Spirit of Devotion to Duty

In the records of casualties at sea there are to the eye of the close observer cases where faithful devotion to the urgency of the moment in the engine room, has led to sacrifice on the altar of duty—all honor to such. There are others where the sacrifice has not been exacted, yet the spirit is the same, ready to do and ready to dare. Some again indicate close attention to relief duty in the engine-room to free others for work elsewhere in an emergency, a form of service which partakes of a magnanimity worthy of commendation when such is being meted out to the active participators in the course of action which is under review by the authorities. It would be invidious to cite examples and disturb memories which are treasured in the hearts and minds of those specially interested; our object is to call attention to a want of tactful care and attention to the adjudication of commendation and the award of merit.

When the commander receives an emblem for special services rendered by those under his jurisdiction, the chief engineer should not be overlooked when the services in question embrace strenuous emergency work on his part as well as on the part of his juniors—work without which the gratifying results, meriting the awards, would not be attained.

Sir William Benjamin Bowring, Bart., who died on October 21 in Liverpool, was one of the best known shipping men of England, and was identified with marine interests in Newfoundland and New York.

A BRAVE SKIPPER

ONE of the innumerable true stories which give the lie to German allegations of loss of British prestige concerns Skipper Frederick Firth, of the steam trawler Pelican. In January of the present year, his little vessel, following her peaceful occupation, drew in her trawl. As it came to the surface there appeared wedged between the trawl boards a great German mine.

"Why German?" it may be asked. Because, as the sequel shows, it was not fitted as the Hague convention enjoins with a device provided in all British mines, to render it innocuous when it got adrift. The skipper knew this well enough. German mines do explode—except when they are badly made—for, if the safety-device is fitted, it is always intentionally rendered incapable of doing its humane service. The deadly haul was already close to the trawler's side and might, and probably would, explode either by touching her or by the working of the boards in the seaway. There was nothing to do but take to the boat with the utmost possible expedition; but the skipper remained, making the simple remark, "I am going to try and clear this thing. If anything happens there will only be one chap lost."

When the boat was at a safe distance, he reversed the winch and lowered the mine in safety. Then he paid out till the mine was some eighty fathoms away. Then it went off with an explosion so terrible that even at that distance it almost lifted the little vessel out of the water. Wonderful to state, she was still able to float. The crew returned, and the men of the Pelican's home port, Grimsby, made Mr. Firth a presentation some weeks later. We may believe the skipper when he said, "I did not expect recognition." To such men such deeds come naturally. The White and Red Ensigns cover many of them afloat, whilst there are many more in khaki in Flanders and on the other fronts, and it is because we and our Allies have this spirit that the Kaiser knows his doom.

CONFERENCE OF CANADIAN SHIPBUILDERS

A CONFERENCE of the heads of the largest shipbuilding establishments in the Dominion, acting in conjunction with the past presidents of the Canadian Manufacturers' Association, was held in the Windsor Hotel, Montreal, during this month, to formulate a memorandum outlining a plan of Government ship subsidies which will be laid before the authorities at Ottawa at an early date. Amongst those in attendance were P. L. Miller, general manager of Canadian Vickers, of Montreal; Geo. F. Davie, president and general manager of the Davie Shipbuilding Co., Levis, Que.; Colonel Thomas Cantley, president and general manager of the Nova Scotia Steel & Coal

Co., of New Glasgow, N.S., a representative from Collingwood, Ont., and James Whalen, of the Western Dry Dock & Shipbuilding Co., of Port Arthur, Ont. In addition to the foregoing, a personal invitation to attend was extended to all the past presidents of the Canadian Manufacturers' Association and any others interested in shipbuilding, so that the conference represented what was probably the most influential interests ever assembled for such a purpose.

The initial proposal leading to this meeting was made on the occasion of the meeting of the Manufacturers' Association in Hamilton, Ont., last June, when it was decided to appoint a committee to formulate a plan of action with which to approach the Government at this time. It is understood that the individual members of the committee have in the interval studied the situation and the meeting was called to enable them to get together and so consolidate their views that some co-ordinated proposal, representative of the various interests might be agreed upon.

Shipbuilding Subsidy Aimed At

In a general way, the plan is said to favor some form of Government assistance by direct subsidy or otherwise, which will not only serve the purpose of assisting a struggling industry, but will also meet with the approval of the Western Provinces, which are usually opposed to such aid as being of benefit only to the East.

Individual and influential members of the Government have been approached in the past few months, and it is understood that the proposal will meet with favorable consideration at Ottawa. The Minister of Trade and Commerce indicated a plan of action in a speech during the last session. One of the arguments in favor of some form of ship subsidy is likely to take the form of pointing out that but for liberal government assistance in the way of bounties to steel makers in the past fifteen years there would have been no structure on which to build the present industrial prosperity.

Although representatives of the steamship companies operating in Canada did not participate in the conference, they share in the belief that some form of shipbuilding subsidy is necessary. One leading shipping man gave it as his opinion that a subsidy on both shipbuilding and ship cargoes would be essential.

NEW STORM WARNINGS ON GREAT LAKES

BEGINNING on October 15, a new system of storm-warning displays went into effect on the Great Lakes by the United States Weather Bureau, which sends out the following explanation of the new system:—

Small craft warning—A red pennant indicates that moderately strong winds are likely to interfere with safe operation of small craft are expected. No night display of small craft warnings is made.

Northeast storm warning—A red pennant above square red flag with black centre, displayed by day, or two red lanterns one above the other, displayed by night, indicates the approach of a storm of marked violence with winds beginning from the northeast.

Southeast storm warning—A red pennant below square red flag with black centre, displayed by day, or one red lantern displayed by night, indicates the approach of a storm of marked violence, with winds beginning from the southeast.

Southwest storm warning—A white pennant below square red flag with a black centre, displayed by day, or white lantern below red lantern displayed by night, indicates approach of a storm of marked violence, with winds from southwest.

Northwest storm warning—A white pennant above square red flag with black centre, indicates a storm of marked violence from the northwest.

Hurricane, or whole gale warning — Two square flags, red, with black centres, one above the other, displayed by day, or two red lanterns with white lantern between, displayed at night, indicate the approach of a tropical hurricane, or of one of the extremely severe and dangerous storms which occasionally move across the Great Lakes.

Masters are cautioned to look closely for these signals.

C. P. R. LINE TO VLADIVOSTOCK

AN order is reported to have been placed in England by the Canadian Pacific Ocean Services for the building of a fleet of steamers to run between Vancouver, Victoria and Vladivostok. No details have been given out. At the same time there is a report that a combination of Vickers, Yarrow and Armstrong Whitworth firms will go into shipbuilding on a large scale on the Pacific Coast. A plant will be located at Vancouver or Victoria.

Sir Thomas Shaughnessy was recently in Vancouver when he put his final approval on plans for the construction of the new steel pier, which is to cost a million anl a half dollars. Work has already commenced on this pier, which will range alongside the docks now used for Australian and Oriental trade. The new dock will be specially designed for the handling of heavy freight going to Vladivostok, it being estimated that tremendous expansion of trade between Canada and Russia will take place after the war.

LACHINE CANAL TRAFFIC

IN the Lachine Canal returns for the month of September, the features of a greatly diminished wheat supply and greatly increased coal arrivals, which have distinguished the season from the first, remain the same. It is encouraging to note, however, that while the number of trips through the canal, the total tonnage operated, and the passengers carried, are less than in the same month of 1915, yet the cargo tonnage has increased from 448,046 for September of 1915, to 470,965 for last month. That is to say, fewer boats have carried larger cargoes, and there have been fewer vessels which went up the canal without cargo. The figures for September, 1915 and 1916, respectively are as follows:—Trips, 1,178 and 1,076, a decrease of 102; tonnage operated, 589,755 and 568,268, a decrease of 21,487; passengers carried, 9,235 and 8,835, a decrease of 400; cargo tonnage, 448,046 and 470,965, an increase of 22,919; and trips light, 437 and 406, a decrease of 31. In the latter case the unusually large number of boats carrying pulpwood has helped to reduce the number of boats going up light.

Grain Carried

The total amount of grain which came down the Lachine Canal this season up to September 30 was 19,293,156 bushels, as compared with 29,253,043 bushels for the same period last year, a decrease of 9,959,887 bushels. Last month the disparity was even greater, 2,958,993 bushels of grain being received, as against 4,244,119 bushels for September, 1915. Wheat declined from 3,660,986 bushels in September, 1915, to only 1,269,788 bushels last month a decrease of 2,391,198 bushels. Oats and barley registered great increases, there being 1,086,888 bushels of oats last month, against 284,937 bushels a year ago, and 526,317 bushels of barley, against 153-103 in 1915. There was no corn last month, while in September, 1915, there were 41,585 bushels. Flaxseed fell off as well from 103,508 bushels a year ago to 76,000 bushels last month.

Coal and General

The total coal received amounted to 243,074 tons last month, as compared with 167,526 tons a year ago, an increase of 75,548 tons. In produce the only increase was in butter, 801 packages having been received, or two more than for September, 1915. The statistics for September, 1915 and 1916, in other items are as follows:—Flour, none; eggs, 1,860 and 1,261 cases cheese, 36,038 and 34,399 boxes; apples, 2,626 and 1,296 barrels.

THE BLUE PETER

WHO is there in the Royal Navy or the merchant service that has seen the "Blue Peter" flying on a homeward bound vessel of any kind without their thoughts tending in a similar direction? Yet how many know the origin of the term "Blue Peter," which from time immemorial has been the name given to the flag which is hoisted by vessels at the fore-topgallant masthead to signal approaching departure. *Notes and Queries* points out that the Oxford Dictionary gives the sixth significant of "peter" as portmanteau, trunk, bundle, or parcel. This use originated in the vocabularily of thieves during the seventeenth century; the earliest instance of the word's occurrence quoted being from Richard Head's "English Rogue" (1663); it is also used by Smollet. The Oxford Dictionary also cites an example of "Blue Peter" from the Naval Chronicle (1803):—

"She has had Blue Peter's flag flying at the fore as a signal * * * for sailing." And, under "Blue," one from Byron's "Don Juan" (1825): "It is time that I should hoist my Blue Peter and sail for a new theme."

Taking, then, this early significance of "peter" as a trunk or package, the meaning of the word seems likely to have arisen in the eighteenth century, or even earlier. The captain or the shipping agent of a vessel wishing, as the time of departure from port approached, to get all the cargo on board, formed a rough-and-ready device by running up a flag bearing a white, oblong figure, to indicate a trunk, case or cargo in general, drawn upon a blue ground, which represented the ocean. This was to show all parties interested in the vessel that the remaining cargo and personal effects must be shipped immediately, the vessel being ready for sea.

When the signification of the original "peter" as a trunk or case was lost sight of, through the flag receiving that name, the signal, naturally enough, would be called a "Blue Peter," in spite of the trunk being painted white, since the predominating color, which denoted the sea, was blue, and the color of a flag is always spoken of as that of its groundwork, and not that of the devices on it. It is also interesting to note that the pilot's flag, flown by a vessel which requires a pilot to take her into port, and was probably invented about the same date as the "Blue Peter," is an exact converse of that signal, viz., a blue, oblong block on a white ground.

OLD TIME SAILING SHIP AT QUEBEC

MEMORIES of the balmy days of Quebec's thriving timber trade, when the whole docking accommodation in and about the harbor often proved insufficient for the large number of sailing vessels coming to the port, were revived on October 15 by the arrival in port of the four-masted Norwegian sailing ship "Lancine".

The "Lancine" is 2,600 tons net, her length is 400 feet and breadth 44 feet She is one of the few full-rigged sailing ships which has visited Quebec in recent years. The most interesting feature about the vessel is that some twenty years ago she was a passenger mail steamer plying between New York and Havre under the name of the S.S. Pierre. For some reason which the present master (Captain Olufsen) does not know, the engines of the vessel were taken out and she went into the freight trade as a sailing ship. Speaking of past exploits of the "Lancine" shortly after his arrival in port recently, Captain Olufsen expressed the opinion that the ship was converted into a sailing vessel because she probably consumed too much coal.

The "Lancine" was built in Glasgow about fifty years ago. After being in the passenger mail service between New York and Havre for many years the vessel changed hands. She was dismantled and subsequently sold to a firm at Halifax from whom the present owners, J. L. Johanson and Co., bought her.

The present voyage of the "Lancine" from Scotland was slow. She left Greenock on September 10. Over five days were spent in the lower St. Lawrence, the tug having difficulty in towing the ship to port. The Union Jack flew at the stern of the vessel. She came to Quebec to take on a full cargo of spool wood and deals. She is chartered by the Robert Reford Co. and will be in port at the breakwater for about a fortnight.

THE "LUSITANIA" MEDAL

REUTER'S AGENCY learns that the latest product of German mendacity is contained in a Wolff telegram reproduced in German and Dutch newspapers recently, denying that any medal to commemorate the sinking of the Lusitania has been struck in Germany. This denial is somewhat futile, as many persons possess specimens of the medal, which is only another evidence of the extent to which Germany glories in acts of barbarism. As the general public are probably unaware of the facts, the following details of the medal and its designer will prove interesting:—

The medal was designed by a certain K. Goertz, a well-known German designer, who was born at Augsburg, in July, 1875. He studied at Berlin, Dusseldorf, Utrecht, and Paris, is a member of the Numismatic and Antiquarian Societies of Munich, and of the Austrian Society of Numismatics. He is now resident in Munich. The medal was included in Numismatic catalogues abroad when it was originally struck. It has been publicly exhibited throughout Germany and has been mentioned in that country both in speeches and in newspaper articles.

The Germans have now discovered that the medal is being interpreted abroad in a different sense from that contemplated by the designer. The medal is $2\frac{1}{2}$ inches in diameter, made of copper colored metal, and is in high relief. The inscriptions are in German. On one side, under the title, "No contraband," is a picture of the Lusitania sinking. On board the doomed vessel are shown guns, aeroplanes, and armored cars. Underneath is the inscription, "The great steamship Lusitania sunk by a German submarine on May 5, 1915." On the other side the medal bears the inscription, "Business before everything." Below is shown a book at the office of the Cunard Company, in which a skeleton is handing out tickets to a line of passengers. Near by is a prudent German wearing a top hat, apparently urging Americans not to go.

Catalogues

Tobin Bronze is the title of a 36-page booklet issued by the American Brass Co., Ansonia, Conn., dealing with Tobin bronze and its application. Its physical properties are described and the results of several tests given followed by tables giving approximate weights of rods and sheets. The booklet also contains a number of testimonials from firms who have used this material for various purposes.

Burd Piston Ring Directory for 1916 has been published by the Burd High Compression Ring Co., Rockford, Ill. This publication is a directory of piston ring sizes, which includes a tabulation of the piston ring requirements of practically every automobile of any import manufactured in the United States during the past ten years, besides information of like character covering the requirements of aeronautical, marine, stationary, and other types of internal combustion engines. The book is an invaluable source of information for garage men and those engaged in the repair of gasoline engines, and contains data on proper fitting and installation of piston rings, regardless of by whom manufactured. Stock sizes are indicated by an asterisk, which follows the telegraphic code word for every size listed. An additional telegraph code is provided, affording means of communication between the customer and the factory. This directory, while being more exhaustive than any other treatise of its kind ever attempted, is distributed among the garage trade free of charge.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Captain Frank Martin, the Canadian representative at Montreal of the new shipping concern, the Marine Navigation Co., will go to Halifax to open an office for the company there.

Capt. Dulmage, of Picton, of the steamer T. J. Waffle, was stricken with paralysis at Booth's wharf, Kingston, on Sept. 29, and was taken to the General Hospital for treatment.

Capt. Robert Fraser, marine superintendent of the Montreal Transportation Co., Kingston, Ont., has severed his connection with the company. Capt. Fraser will take up his residence in California.

J. W. Norcross, vice-president and managing director of the Canada Steamship Lines, leaves Montreal for London, England, about the latter part of the present month, and will be absent until about Christmas time.

John S. Leitch, manager of the Collingwood Shipbuilding Co., Collingwood, Ont., had the honor of being the "Headlight" in the August issue of *The Shipbuilder*, a prominent British monthly devoted to shipbuilding, marine engineering, and allied industries.

Ernest Carley, manager of the Cunard Steamship Co., Ltd., at Winnipeg, is reported dead there. Death came suddenly on October 5. He was a well-known steamship man in Western Canada, being a representative of the Cunard Line for both the Canadian and New York services.

J. W. Isherwood, inventor of the "Isherwood" system of ship construction, has opened an office in New York for the purpose of dealing with the American end of the business. This office will be in charge of J. W. Stewart, a member of his staff from London, who has had considerable experience in shipbuilding generally, and in the "Isherwood" system in particular.

William Garthwaite, of Paris, France, has been spending the past month or so in Montreal, perfecting the details of a new steamship line from Montreal and Halifax to St. Nazaire, France. He is well known in shipping circles in Paris, London, and Antwerp, and for several years prior to the outbreak of the war, was occupied in active competition with the German Hamburg-Sud-Amerikanische Line.

LICENSED PILOTS

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.: John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

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Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

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SHIPMASTERS' ASSOCIATION OF CANADA

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

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J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I., Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

Captain James Ewart, a Great Lake mariner, passed away during the present month. He was born at Cobourg sixty-eight years ago. From a cabin-boy on a lake steamer he won his way to the mastership of some of the largest steamers on the Great Lakes. The last two vessels which he piloted on the upper lakes' service were the steamers W. D. Matthews and the E. B. Osler. For many years he was Commodore of the St. Lawrence Navigation Co. fleet.

Sir Charles Cayzer died on September 28, at Aberfoyle, Scotland. Sir Charles, who was seventy-three years of age, was head of the prominent shipping firm of Cayzer, Irvine & Co., owners of the Clan Line of steamships. For many years he sat in the British Parliament for Barrow-in-Furness, being the first Conservative elected for Barrow. His daughter, Florence Gwendoline, married Admiral Sir John Jellicoe, Commander-in-Chief of the British home fleets, in 1902.

O. R. Sweeny, of Valparaiso, Chile, who is well known in ocean shipping circles, being the General Manager of the Compania Sud-Americans de Vapores, which operates a fleet of steamers along the west coast of South America, from the Panama Canal to Patagonian ports, is visiting Toronto. Mr. Sweeny is touring the United States and Canada, accompanied by his wife. From here he goes to Montreal, Ottawa and Quebec, and then to the Pacific coast.

1916 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jeanne Mance Street	O. L. Marchand.	2378 Clark Street
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th St. E., Vanc.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	29 Parrsboro Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	Alfred Roebuck	22 Kent Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross.	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

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Development of Ocean Service Shipbuilding in Canada--I.

By " Artificer "

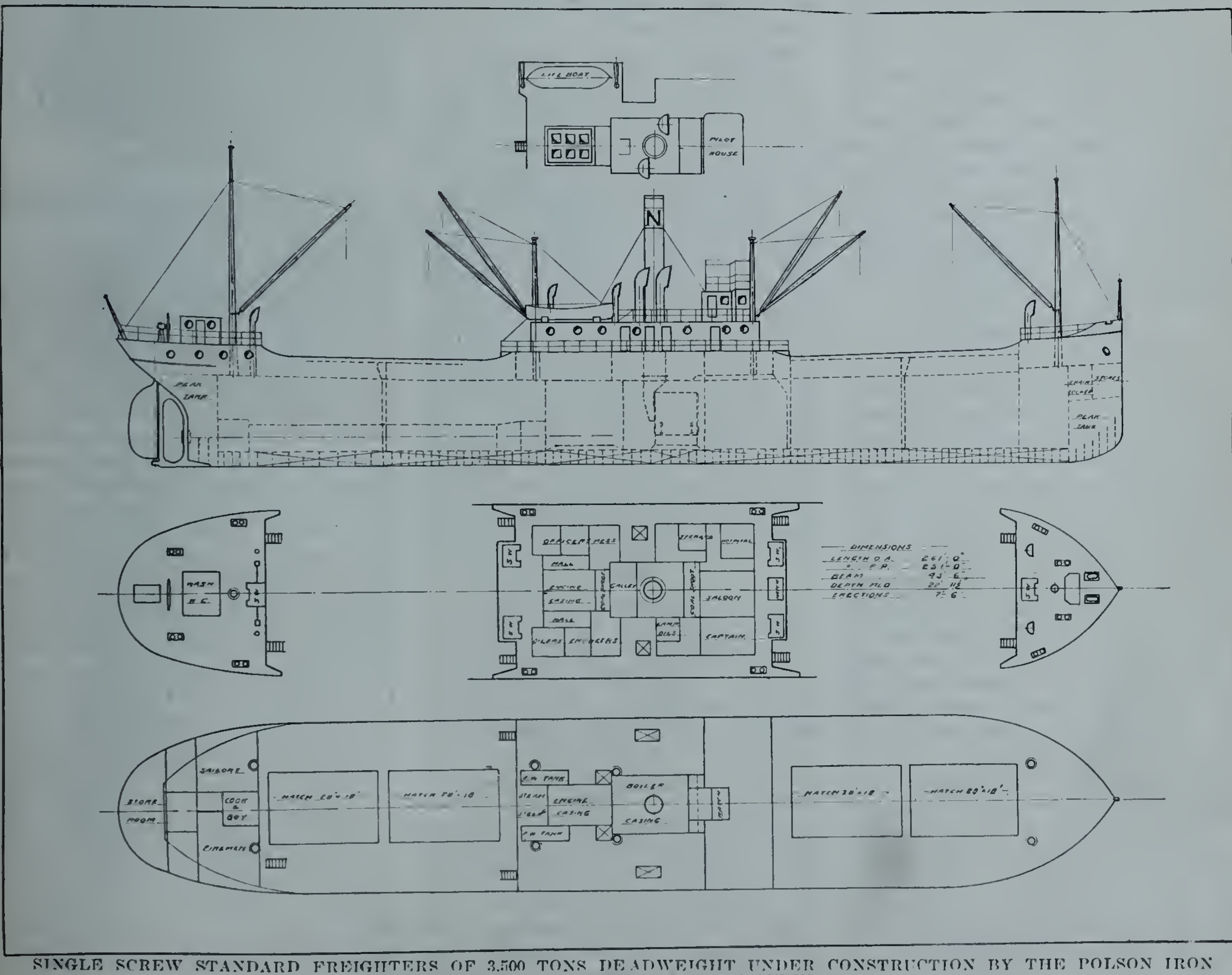
In addition to the widespread requisitioning of vessels for transportation purposes by the Allies, the war attendant and normal merchant ship losses and the many months' almost complete cessation of new construction on the part of the latter, the merchant marine of neutral countries has had the misfortune to become to a large extent the target for enemy submarine activity. Norway, perhaps more than any other nation, has suffered in this respect, hence the almost feverish anxiety being displayed by her shipping fraternity to have the losses made good at the earliest possible moment. In recent weeks many contracts have been placed on this continent to Norwegian account, and Canadian shipbuilders have not been lacking a securing at least a fair share of these. The vessel features of one such are here described.

NORWEGIAN FREIGHTERS BUILDING AT TORONTO

THE construction of two steel cargo steamers by the Polson Iron Works, Toronto for Christoffer Hannevig of Christiania, Norway marks a new development of the shipbuilding industry in the Queen City. Steel freighters are also being built on the Pacific Coast for Norwegian owners, from all of which it is evident that still more important developments may be expected in shipbuilding in Canada on not only her ocean shores but on those of her Great Lakes as well. The two freighters which have recently been laid down at Polson's shipyard, give indication of being but the first of a series of orders for vessels for foreign owners, as the shortage of tonnage has rendered imperative the building of new ships to replace those sunk during the past two years. There is every evidence that all our Canadian shipyards will participate to a generous extent both in quantity and variety of the new construction.

New Freighter Features

The new vessels will be of standard construction for ocean service, and will be able to navigate the St. Lawrence Canals to the sea only when in ballast, as the mean draught will be 19 ft. 6 in. when carrying a total deadweight of 35c tons. The principal dimensions are as follows:—Length over all, 261 feet; length between perpendiculars 251 feet; beam moulded, 43 ft. 6 ins.; and depth moulded 22 ft. $11\frac{1}{2}$ ins. The vessels are to be built of steel to class highest class Bureau Veritas for ocean service. They will have a flat plate keel and the framing is to be especially stiffened forward of the collision bulkhead. The



SINGLE SCREW STANDARD FREIGHTERS OF 3,500 TONS DEADWEIGHT UNDER CONSTRUCTION BY THE POLSON IRON WORKS, TORONTO, FOR NORWEGIAN OWNERS.

tank top plating is to be of steel ½ in. thick under the engines and boilers.

They will be of the single deck type, built on the deep frame principle, with cellular double bottom right fore and aft. They will have peak tanks and four watertight bulkheads. The poop bridge, and T. G. forecastle will be 7 ft. 6 ins. in height from top to top of beams. Each ship will have two wooden pole masts and four large cargo derricks with a winch to each. There will be two forward cargo hatches 18 ft. by 28 ft., and two aft. cargo hatches 18 ft. by 26 ft.

The stern post will be of cast steel 8¼ in. by 5¾in. with rudder frame of the single plate type, the coupled stocks being 7½ in. diameter. The deep frame system with auxiliary side frames will constitute the basic constructional features of the hull fabrication. Intermediate angle frame stiffeners will be installed in fore peak from about one foot below light draught line to about one foot above full load draught line. Water ballast will be carried in the double bottom and fore and aft peaks, all necessary connections leading to and from the engine room and being under control there. The shell plating is to be overlapped at the edges and to have overlapped scarfed butts. Bow plates between light and load draught lines are to be thickened about 25 per cent. as provision against ice, tapering to normal thickness at from 20 ft. to 30 ft. sternwards. The keel, double bottom floors, and frames are to be machine riveted. The main poop and bridge decks will be steel, and the forecastle deck of pine.

Deck Machinery

For handling cargo, there will be six 7 in. by 10 in. horizontal double cylinder steam winches of Clarke-Chapman type, one at each mast and derrick. The winches will have central barrels and drums and will be placed on girders above the deck. Each mast will carry one pitch pine, 3 ton derrick, the latter to be long enough to land cargo 10 ft. away from ship's side. The windlass will be of direct acting type for operation by hand, as well as by steam, and will be complete with reversing gear. A hand screw steering gear will be installed aft, and a steam steering gear amidships. The total bunker capacity will be about 350 tons.

Suitable accommodation for the officers and crew is provided, the sailors and firemen's quarters being aft, and those of the officers on the bridge deck. Two lifeboats and one dingby, will be carried by each ship, other equipment and fittings being in accordance with the classification requirements.

Main Engines

The propelling machinery will be constructed to Bureau Veritas requirements for a working pressure of 180 pounds The main engines will be of inverted direct acting, surface condensing, triple expansion type, the cylinders being 20½ ins. x 33 ins. x 54 ins. diameter by 36 ins. stroke. The condenser and pumps will be independent of the main engine structure. The H.P. and I.P. cylinders will be served by piston valves and the L.P. cylinder by a double ported slide valve. All these valves will be on the fore and aft centre line of the engine. The H.P. cylinder, steam chest and steam pipes are to be tested to 270 pounds cold water pressure, The bed plate will be cast iron of box section, as will also be the columns. All shafting will be of best open hearth forged steel. The crank shaft of forged steel will be of built-up type, with cast steel crank arms. The connecting rods, crossheads and piston rods will be of open-hearth, forged steel. The valve gear will be of "Stephenson" link motion type, with direct acting steam reversing gear. The propellers will be four bladed of cast iron.

Machinery Auxiliary Equipment

The pumping equipment will include deck pumps for each hold; vertical duplex, brass-fitted, main boiler feed pump; duplicate of the main boiler feed pump for use as a general service donkey pump; duplex horizontal piston type bilge pump; a 7 ins., duplex, brass-fitted, ballast pump; and a fresh water pump, 4½ ins. x 4 ins. x 5 ins. of duplex type; air pump and a centrifugal circulating pump for main condenser. The feed water heater will be of multi-coil type installed in the feed pump discharge line. One 7½ k.w. Enberg electric generating set will be installed in the engine room for the ship's lighting system. An evaporator of 15 tons capacity will also be installed in the engine room.

Boilers

The boiler installation will consist of two 14 ft. diameter by 12 ft. long, single-ended, Scotch marine type units, arranged for natural draft only, and built to pass Bureau Veritas requirements for 180 pounds working steam pressure. Each boiler will have three corrugated steel furnaces of 42 ins. inside diameter. The tubes will be 3½ ins. diameter, lap welded and standard gauge. There will be a separate combustion chamber for each furnace, and one double funnel to each ship.

The keels for both steamers have already been laid and launching in each case is expected in April 1917. The steam trials of six hours duration will take place on Lake Ontario.

WATER-TUBE BOILERS

IN the recent discussion concerned with the relative economy of the geared turbine or Diesel motor as compared with the standard type of steam engine, little has been said about the possibility of retaining all the practical advantages of the orthodox type of cargo-boat engine, while endeavoring to effect a saving in weight by changing the type of power generator. The water-tube boiler, says *Shipping Illustrated*, with its lesser weight and cost, appears to offer a field that might be worth investigating when it is desired to retain the ordinary style of engine for the propulsion of cargo boats. However, water-tube boilers have failed so far to win the approval of engineer superintendents whose word is often final with cargo boat owners; the outstanding objection being that it is difficult to keep the tubes clean and free from internal deposits and replacing damaged ones when necessary. Water-tube boilers also require greater care and attention, especially with regard to the supply of feed water. Their life is less than that of a Scotch cylindrical boiler. Probably conservatism has also something to do with the case, due to lack of first-hand knowledge of the type.

Operation Features

In water-tube boilers the circulation is more nearly natural than in fire-tube boilers and circulating devices are not, therefore, required. Steam may be raised in such boilers in from twenty minutes to one hour, depending on the type, character of the draught and other similar factors. With this type of boiler it is especially necessary, in order to obtain the best results, that the firing be light, frequent, and regular, and that the fires be kept as nearly as possible in a uniform condition. It is also necessary that the feed be regular and that the water must be carefully watched, since, from the small amount contained, any lack of feed in a given boiler will be followed by rapid lowering of the level and also by a rapidly-increasing risk of danger to the tubes. In water-tube boilers it is especially necessary that nothing but fresh water be used as feed and great care must be taken to keep the condenser tight and the fresh water make up ample in quantity. It is usually a very difficult matter to clean the tubes of water-tube boilers satisfactorily without the use of a steam jet after they become coated with soot and ashes on the outer or fire side. In continued steaming for long periods it is usually found necessary from time to time to let the fires die down somewhat and to use such methods as are available for blowing off and dislodging the soot from the tube.

The question of internal deposit and dirty tubes was one of the difficulties that occurred in the early stages of superheating. This has been so successfully overcome that superheating is now almost universal, and is now being fitted to such small craft as tugboats and trawlers. If a U-shaped superheater tube can be kept clean the comparatively straight boiler tube of greater diameter should present no great difficulties. Moreover, a superheater is in principle, to all intents and purposes, a water-tube boiler on a small scale. The same necessity applies to both, viz., pure feed water; the supply of this with modern facilities should be easily overcome. Regarding the extra care and attention required, this in the case of land boilers presents no difficulties, all modern land boiler installations being of the water-tube type. The regulation of feed can be controlled by automatic appliances.

On the score of conservatism it may be pointed out that the early Diesel engines were found to sell more readily if they were designed to look as much like the reciprocating steam engine as possible, not on the grounds of strength or suitability, but solely because engineers were more favorably impressed when they saw an engine which looked like the type to which they had been accustomed.

COMPRESSION TEST OF KEEL BLOCK

AN important test was conducted recently by the U. S. Bureau of Standards to determine the ultimate strength of a cast-iron keel block. As designed, the block was expected to withstand a load greater than could be exerted by any testing machine in existence. It did withstand the full capacity of the Bureau testing machine (10,000,000 pounds), when the load was applied over part of its bearing surface, it failed at 9,600,000 pounds.

The test of the block was preceded by several preliminary tests to determine the strength of oak timbers, which are usually placed between keel blocks and the keel of the ship. At loads from 300,000 to 800,000 pounds the timbers were completely shattered, the variation in the load depending entirely upon the variation in the area over which the load was applied. After these preliminary tests the keel block was subjected to a load equal to the capacity of the machine. At about 6,500,000 pounds several sharp reports were heard, but after the full load was applied there was no apparent damage to the exterior of the block. On dismantling, however, it was noticed that several of the webs of the various sections were cracked. It was then reassembled and the load applied over a smaller area, when it failed at 9,600,000 with a very loud report, and almost completed shattering of the various sections.

PROBLEMS OF TRANSPORTATION, MINING, MILLING AND IMMIGRATION

AT a recent sitting of the Dominion Royal Commission in Toronto, problems of transportation, mining, milling, and immigration were discussed. The Dominion Millers' Association was represented by Mr. C. B. Watts, who gave the Commission a long and detailed argument in favor of a Government-owned line of ocean going ships which should be used for carrying flour and other natural Canadian products from the Dominion to Great Britain. Special reference was made by Mr. Watts to the discriminating charges against flour cargoes in favor of wheat. Canada had spent many millions of dollars in building railways, but so long as the present ocean shipping business remained beyond the control of the railways or the Dominion Railway Board the transportation system of the country would never be complete, or wholly fitted to develop trade with other nations.

Mr. Thomas Marshall, Traffic Manager of the Toronto Board of Trade, also dealt with the transatlantic aspect of Canada's transportation problem. He stated that although no railway in the United States could own steamships for coastwise service, the dockage facilities on the Atlantic coast, as well as on the Pacific, were controlled by the railways. The rates between Canadian ports and the motherland were the same as those applying between New York, Boston and other American ports and Great Britain. Mr. Marshall considered that ocean rates even before the war were too high and advised a thorough investigation by a Government tribunal to test the justification of the seemingly high ocean freight tariff.

DAVIE SHIPBUILDING CO. CHANGES

GEO. D. DAVIE, president, and Thomas Robb and D. W. Ogilvie, directors of the Davie Shipbuilding & Repairing Co., Levis, Quebec, resigned from the board of that company at a meeting held in Montreal on October 20, as a result of financial changes that have placed new interests in control of the company. The only remaining member of the board is C. A. Barnard, of the Montreal law firm of Barnard, McKeown & Choquette, and he was until recently on the other side, having sailed for England in company with other Canada Steamship Lines officials.

Geo. D. Davie, the retiring president, has been associated with the company since its inception a number of years ago under the name of the Geo. Davie & Sons Co., and, following the reorganization of three years ago, when the company assumed its present form and name, he became president. It is understood that Mr. Davie continues to own most of the mortgages outstanding.

The company is one of the oldest shipbuilding concerns on the St. Lawrence, and is the largest in Canada, with the exception of Canadian Vickers, Ltd., Montreal. Its greatest achievement is the boat now under construction for the British Columbia Government, which is nearly 400 feet long.

DUTY ON SHIP MATERIALS

THE DOMINION GOVERNMENT has given Canadian shipbuilders permission to build ships for owners under neutral flags under certain safeguards. The Government has also passed an Order-in-Council relative to the duty on materials imported for building such ships.

This Order-in-Council, passed quite recently, provides "that a drawback not exceeding 99% of the Customs duty paid may be made by the Minister of Customs on materials used in the original construction of ships and vessels measuring over 500 tons gross tonnage built in Canada, when such ships or vessels are authorized by Order-in-Council to be exported for registry outside Canada, or are British registered in Canada, and are constructed so as to obtain a class in Lloyd's, Bureau Veritas, British Corporation, or other recognized classification satisfactory to the Minister of Customs, provided that the drawback payable under this section shall be in lieu of any drawback based on a specific rate per registered ton. "The claimant for the drawback must be the builder of the ship or vessel."

The payment of this duty, even where there was to be a drawback, meant that there would be a large amount of money tied up. The builders would still have been under the necessity of putting up this duty, which on a vessel of 8,000 tons would amount to about $80,000. The Government would have held this till the vessel was completed, and would then have returned it. The Government has been induced to remove this obstacle by providing that this ninety-nine per cent. need not be paid into its hands where the construction takes place under the eye of a Government Customs officer in charge of the works. All liable articles are to be placed under the control of this official until they are embodied in the vessels.

The Development of Irregular Sheet Metal Pipe Connections

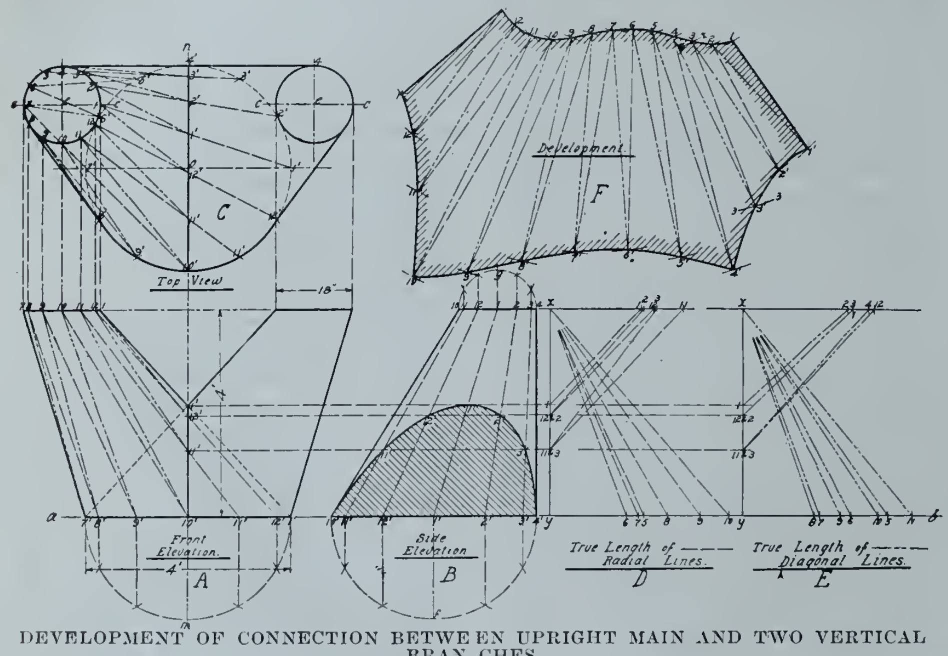
Staff Article

The problems dealt with in this article are typical examples encountered in actual practice, which, while not of very frequent occurrence, may be of considerable importance when met with. They possess considerable divergence from ordinary symmetrical forms and a study of the methods employed will enable them to be successfully negotiated.

CONNECTING UPRIGHT MAIN TO TWO VERTICAL BRANCHES

By R. Hamilton.

A PIPE connection is required to unite two branches to the main supply pipe; all three pipes of circular cross section and in a vertical position. The main pipe is 4 feet in diameter, the two branches 1 foot 6 inches in diameter, with one side of the connection perpendicular with the base or large opening, and the projection of the pipes—as shown in the top view—tangent to one another, the altitude of the connection being 4 feet.



DEVELOPMENT OF CONNECTION BETWEEN UPRIGHT MAIN AND TWO VERTICAL BRANCHES.

This problem with the accompanying solution illustrates an interesting example in triangular development. To obtain the three principal views necessary for the desired solution, proceed as follows:—First erect the perpendicular centre line mn, and from the point 0 describe a circle having a diameter of 4 feet; tangent to this circle at the point 4 draw the horizontal line 44^14. At a distance below this line, equal to the radius of the small branch pipe, draw the two horizontal lines cc and cc. With O as a centre and a radius equal to the radii of the large and small pipe, describe arcs cutting the lines cc at the point (e); with (e) as a centre, describe a circle representing the opening of the two branches, one on either side of the large circle. The top view can be completed by drawing the tangent lines connecting the three circles, and also the centre line representing the joint between the two halves of the connection, each of which are similar, but formed in the opposite directions. To obtain the front elevation, draw the base line ab and project the various points from the top view, cutting this base line and also the top line, which is drawn parallel to ab and at a height equal to the altitude of the piece; that is 4 feet. To the right of the front elevation, with a radius of 2 feet, and the point I as a centre, draw the semicircle 4^1f10^1 and divide it into six equal parts; from these points erect perpendicular lines cutting the base line as shown. From the point 4^1 draw the vertical 4^14, cutting the top line at the point 4; with 4 as a centre and with a radius equal to the radius of the small pipe, describe an arc cutting the top line at the point I; with the same radius and the point I as a centre describe the semicircle 4g10. Divide this semicircle into six equal parts, projecting the points down cutting the top line as shown. Now, from corresponding divisions in the large and small circles, in the top view, and also those in the front and side elevations, draw lines as shown. For instance, in the top view connect the points 1, 2, 3, etc., in the smaller circle with the points 1^1, 2^1, 3^1, etc., in the large circle; likewise in both elevations.

In the side elevation it is necessary to obtain the true shape of the opening between the two connections. From the points 1^1, 12^1, 11^1 on the centre line mn in the front elevation draw the horizontal projecting lines cutting corresponding radial lines in the side elevation as shown. Through these points draw the curved line 10^1, 11^1, 12^1, 1^1, 2^1, 3^1, 4^1.

True Length of Construction Lines

Before proceeding with the development of the pattern, it is necessary to obtain the true length of both the radial lines and the diagonal lines. The radial lines are those connecting similar points of division on the upper and lower surfaces, and the diagonal lines are those connecting opposite ends of adjacent radial lines; for instance, the line joining the point 9^1 on the base line with the point 10 on the top line is termed a diagonal line, etc. To obtain the true length of a line that is at an oblique angle to both the horizontal and vertical planes, proceed as follows:—By using the projection to a vertical line, of a line in the elevation, as one leg of a right triangle, and the length of the line as represented in the plan or top view, as the other leg, the hypotenuse of such a triangle will be the true length of the line. Therefore, to obtain the true lengths of the radial lines for the development of the pattern, erect the vertical line xy as shown at D, the point (y) being on the base line and the point (x) on the projection of the top surface. With the exception of the lines that intersect the centre line mn, it is evident that the vertical leg of the right triangle will equal the length of the line 4, 4^1, as shown by the horizontal projection. The various lengths of the horizontal legs are obtained from the top view; thus, the distance y6 in D equals the length of the line, 6, 6^1 in the top view; the line y7 in D equals the line 7, 7^1 in C; the line y5 in D equals the line 5, 5^1 in C, etc. For those lines falling on the centre line mn, the vertical leg of the right triangle is obtained by projecting the points 1^1, 2^1, 3^1, 11^1, 12^1 in B to the vertical line xy, the horizontal leg being derived as previously stated, with the exception that the length is taken from the top circle to the centre line mn.

The true length of the diagonal lines is obtained in the same manner, the vertical leg of the triangle being the same, and the horizontal leg being the length of the line in the top view, passing from a certain division on the base circle to the adjacent division on the top surface.

For instance, the distance y9 in E equals the length of the line 9^1, 10 in C, etc. The true lengths of the diagonal lines that intersect the radial lines cutting the centre line mn are found similar to that already described.

Pattern Development

To lay out the development on a flat surface, a start can be made from any point, but as a matter of convenience we will start with the line 4^1, 4, this being the only line whose true length is shown in the elevation. To distinguish the radial lines from the diagonal lines, the former are shown as a series of long dashes, while the diagonal lines are represented by long dashes, with two short dashes intervening. First draw the line 4^1, 4 in F equal to the corresponding line in the front elevation, then with 4 as a centre and the length 3, 4 in E as radius, describe the arc 3, 3 in F. With 4^1 as a centre and the distance 3^1, 4^1 on the irregular curve in B as a radius cut the arc 3, 3 in F at the point 3^1. Then with 3^1 as centre and 3, 3 in D as radius describe the arc x, x, and with 4 as a centre and one of the divisions on the small circle in the top view as a radius, cut the arc x, x in F at the point 3. The completion of the development can be easily understood from the above explanation, care being exercised in following the method described. Remember that when using the points 1, 2, 3, 4, etc., as centres, the radii will be the diagonal lines as found in E, and the distances represented by the divisions on the smaller or top circle. When using the points 1^1, 2^1, 3^1, 4^1, etc., as centres, the radii will be the radial lines as found in D, or the distances represented by the divisions on the larger base circle, or that shown on the irregular curve in B.

The foregoing constitutes the reply to a reader's query.

INCREASED VALUE OF CANADIAN FISHERIES

CANADA possesses the most extensive fisheries in the world, and the waters in and around Canada contain the principal commercial food fishes in greater abundance than the waters of any other part of the world. Apart from salmon, all the lobsters, herring, mackerel and sardines, nearly all the haddock, and many of the cod, hake and pollock landed in Canada are taken from within our territorial waters. There is a coast line of 5,000 miles on the Atlantic side, 7,000 miles on the Pacific, and 220,000 square miles of fresh water, stocked with many species of excellent food fishes.

During the fiscal year ended March 31, 1916, the total marketed value of all kinds of fish, fish products and marine animals taken by Canadian fishermen was $35,860,000, being an increase of $4,596,000 over the 1915 figures. British Columbia was responsible for $3,023,000 of the year's increase. Salmon was the chief product, representing a value of $11,262,000; lobster came next with $4,506,000; cod, $4,489,000; herring, $2,906,000; halibut, $2,261,000; haddock, $1,232,000: sardines, $1,229,000; whitefish, $1,048,000. Oysters had a value of $147,628.

The production by provinces, according to the Government records, is as follows:—

Province.	Value Produced.	Increase.
British Columbia	$14,538,320	$3,023,234
Nova Scotia	9,166,851	1,436,660
New Brunswick	4,737,145	*202,998
Ontario	3,341,182	585,891
Quebec	2,076,851	152,421
Prince Edward Island .	933,682	*327,984
Manitoba	742,925	*106,497
Saskatchewan	165,888	33,871
Alberta	94,134	7,414
Yukon	63,730	*5,952
Totals	$35,860,708	$4,596,077

*Decrease.

LOW WATER MAKES BIG LOSSES FOR SHIPS

THOMAS ROBB, secretary of the shipping Federation of Canada, gave evidence as to the state of the St. Lawrence River for navigation before the Dominions' Royal Commission at their session in Montreal on Oct. 31. He pointed out that the efficiency of the port had been seriously handicapped owing to the fact that the water level in the harbor of Montreal had fallen from 2½ to 3 feet in the last 25 years, and that the lowest water is 2.15 feet below the low water datum adopted by the Department of Marine for the 30-foot and 35-foot channels. When the lowest water prevailed in the harbor, ships were not able to load much over 25 feet, this representing an average loss of cargo from 1,300 to 2,000 tons. Montreal needed the largest ships that the port would accommodate, as a large cargo greatly reduced the cost of freight.

This condition of affairs is accounted for by the diversion of 8,000 cubic feet of water per second from Lake Michigan for the Chicago drainage canal, which considerably increased the discharge. To remedy this it was thought that a permanent dam should be constructed at some point for the purpose of increasing the depth of the water, and that large vessels should be locked through it.

The aids to navigation had been brought to a high state of efficiency with a view to securing increased trade and better terms on marine insurance rates. The pilotage arrangements were excellent, except below Quebec, where the pilotage was under the Corporation of Pilots, and things were not so satisfactory.

HUDSON BAY ROUTE BENEFITS DOUBTED

WHAT benefits are to be derived by the Dominion as the result of the construction of the Hudson Bay Railway was the chief point dwelt upon by the members of the Dominions' Royal Commission at their afternoon sitting on Oct. 25, when it heard W. A. Bowden, chief engineer of construction work of the Department of Railways and Canals.

"The problem is more complex than any other I have had to deal with," the engineer stated, when asked what the benefits to be derived from this big expenditure would be. He outlined the advantages in that the distance from the grain centres to Port Nelson was the same as the distance from Winnipeg to Fort William. The distance from Port Nelson to Liverpool was the same as from Montreal to Liverpool. Accordingly in distance there was a saving by the Hudson Bay route equal to that from the head of the Great Lakes to Montreal. The cost of haulage over this distance is from five cents to twelve cents a bushel.

Initial Information Unreliable

"The information we had when we started the work has proven very unreliable during the five seasons we have been working. For example, our information was to the effect that the route through Hudson Bay would be open to navigation about the last of June or the first of July. The facts are that it is not open until the last of July or the first of August. The date when it closed was not fixed in that early information. However, ordinary tramp steamers have left Port Nelson on October 23, and have gone through without damage by ice. A Government tug went through on Nov. 1, but the ice would have damaged a tramp. By having observation points at the Straits to direct the boats to open water, it would be possible that the season could be lengthened past Oct. 23."

"Would the grain be harvested in time to be shipped this way?" Mr. Bowden was asked.

"For August the grain shipped would be that which had been left over from the year before. There is always some at the head of the Great Lakes now at that time. The new grain would come on in September, and could be shipped through the months of September and October."

"Before this great expenditure was undertaken," asked one of the Commissioners, "were any steps taken to insure steamship service when the road is completed?"

"No, I do not think there should have been," replied the engineer, "because such a service would have been based on the worst conditions that might arise and, therefore, at the maximum expense."

B. C. SHIPS SOLD TO NORWAY

THE Dominion Government has given assurance that, subject to the final approval of the Imperial Government, ships built in Vancouver could be transferred to the Norwegian flag. Contracts for the building of three steel ships, valued at $1,250,000 each, include orders for two ships placed with the Wallace Shipyards, North Vancouver, and one ship with the firm of John Couglan & Sons. When all contracts are signed, it is expected that eight ships will be in the course of construction in a few months.

The principal dimensions of these ships are as follows: Length 423 feet 9 in., length between perpendicular, 410 feet, beam (moulded) 54 feet, depth (moulded) 29 feet 9 inches, draught (loaded) 24.2 feet, deadweight about 8800 tons, speed (loaded) 10½ knots, speed (light) 11½ knots, cubic capacity (grain) 490,000 cubic feet, cubic capacity (bales) 435,000 cubic feet, fuel oil 1,090 tons, coal bunker (permanent) 420 tons, coal bunker (reserve) 900 tons, gross tonnage (American) about 5730 tons, net tonnage 3880 tons.

The vessels which are all after the same pattern, are to be constructed from a combination of designs from approved models, and are said to be the best for all-round freight service in the world. The model is a result of years of experience of Norwegian shipping men. They are designed to carry any cargo and are of course constructed to survive any weather. They will have one funnel, eight large booms, eight winches, a 30-ton derrick on the after part of the foremast, raised winch, platforms, etc.

Altogether the Norwegian syndicate is building 16 ships between Seattle and Long Beach, Cal. These ships are valued at $50,000,000 and are being built in Seattle, Tacoma, Oakland, Portland, San Francisc and Long Beach. This will make 24 ships to be turned out by this syndicate, including the orders to be placed in Vancouver. Capt. F. C. Dedrick and Otto Dohl are representing the syndicate.

THE WAR AND MERCHANT SHIPPING

ONE thousand eight hundred and twenty ships, with an aggregate gross tonnage of approximately 3,328,584, have been sunk by belligerent nations during the twenty-seven months of war ending November 1, according to figures compiled from cable despatches and mail advices published in New York on November 1, by the Journal of Commerce. The losses during October were larger than for any one of the preceding five months, according to the statistics, amounting to 127 vessels of a total of 227,116 tons gross. The October rate of destruction was considerably in excess of the monthly average throughout the war period. Norway lost the largest number of ships —56, according to the statistics, but their gross tonnage was only 57,333, as compared with Great Britain's total loss of 115,546 gross tons of 38 vessels destroyed.

THE "LUSITANIA" MEDAL

REUTER'S AGENCY learns that the latest product of German mendacity is contained in a Wolff telegram reproduced in German and Dutch newspapers recently, denying that any medal to commemorate the sinking of the Lusitania has been struck in Germany. This denial is somewhat futile, as many persons possess specimens of the medal, which is only another evidence of the extent to which Germany glories in acts of barbarism. As the general public are probably unaware of the facts, the following details of the medal and its designer will prove interesting:—

The medal was designed by a certain K. Goertz, a well-known German designer, who was born at Augsburg, in July, 1875. He studied at Berlin, Dusseldorf, Utrecht, and Paris, is a member of the Numismatic and Antiquarian Societies of Munich, and of the Austrian Society of Numismatics. He is now resident in Munich. The medal was included in Numismatic catalogues abroad when it was originally struck. It has been publicly exhibited throughout Germany and has been mentioned in that country both in speeches and in newspaper articles.

The Germans have now discovered that the medal is being interpreted abroad in a different sense from that contemplated by the designer. The medal is 2½ inches in diameter, made of copper colored metal, and is in high relief. The inscriptions are in German. On one side, under the title, "No contraband," is a picture of the Lusitania sinking. On board the doomed vessel are shown guns, aeroplanes, and armored cars. Underneath is the inscription. "The great steamship Lusitania sunk by a German submarine on May 5, 1915." On the other side the medal bears the inscription, "Business before everything." Below is shown a book at the office of the Cunard Company, in which a skeleton is handing out tickets to a line of passengers. Near by is a prudent German wearing a top hat, apparently urging Americans not to go.

LACHINE CANAL DURING OCTOBER

LESS than one-fourth of the wheat came through the Lachine Canal during the month, which ended recently, than came through in October, 1915. The 1,399,038 bushels of wheat which came in lake boats and barges during October seems a small amount as compared with the 5,635,688 bushels taken through the canal in the same month last year. The only other decreases among the grains were in corn and flaxseed, neither of which came down at all, while last year in October the total was 68,081 bushels of corn and 41,602 bushels of flaxseed. Oats and barley, however, show the following splendid increases as between October in 1915 and 1916 respectively: Oats, 475,759 bushels and 1,238,902 bushels, increase 763,143 bushels, and barley, 211,115 and 474,018, increase 262,903 bushels. The total of all grains brought down the canal is half the amount carried last year for October, as follows: October, 1915, 6,432,245 bushels; October, 1916, 3,111,958 bushels; decrease, 3,320,287 bushels.

Less Produce Carried

The total grain brought down during the season up to October 31, amounted to 22,405,114 bushels, being 13,280,174 bushels less than the amount brought down during the same period last year. Just as during other months of this season, there is almost as great an advance in the amount of coal brought down as there is a decrease in the amount of grain. The number of tons carried last month was 224,646, as against 128,779 for October, 1915.

Eggs, cheese, butter and apples have been carried in much smaller quantity, decrease in apples and butter being nothing short of astonishing. As for flour, none was carried at all, as compared with 49,800 sacks a year ago. The comparative statistics for the Octobers of 1915 and 1916 respectively are as follows: Cases of eggs, 341 and 256; packages of butter, 317 and 123; boxes of cheese, 31,423 and 29,065, and barrels of apples, 14,067 and 2,650, a decrease of 11,417 barrels.

During the month there were fewer trips, less tonnage operated, fewer passengers carried, and less cargo tonnage than in October, 1915. The statistics for the two months follow: Number of trips, 1,123 and 977; tonnage operated, 573,729 and 500,204; passengers carried, 757 and 697; cargo tonnage, 487,905 and 431,902; and number of trips light, 455 and 391.

DELIVERY OF GOODS

ALL goods should be delivered to the steamer in the name or for account of the shipper who has contracted for the freight room, or in whose name the shipping permit has been arranged. The said permit should be presented either with the goods, or to the steamship company's clerk at the receiving pier before delivery is made. Goods that are to be shipped "in bond" should not be delivered until the steamer on which they are to be shipped is at her loading berth.

EDITORAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

POLYPHASE INDUCTION MOTOR TROUBLES CAUSED BY SINGLE PHASING

By Sydney Rose.

PERHAPS one of the most frequent causes of "burn-outs" in polyphase induction motors is that of single-phasing, this happening more frequently in smaller size motors than in the larger ones,

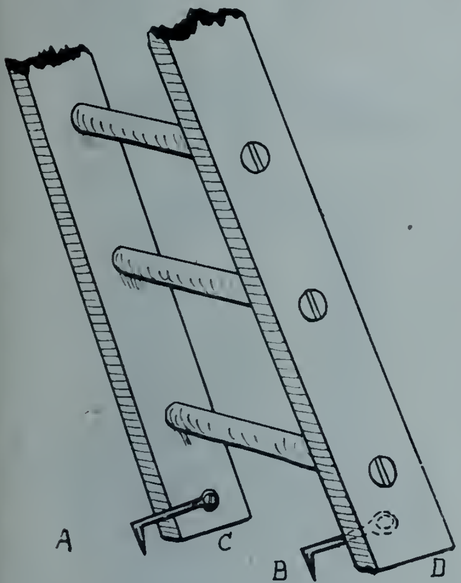


FIG. 1. ANTI-SLIP LADDER.

because the latter are generally better protected by relays and no voltage releases which cut off the current from the machine in case of trouble. Common sources of single phasing are the blowing of a fuse, and poor or broken switch contacts. Small polyphase induction motors are generally started by means of a switch which connects the motor directly to the line, or by means of a double-

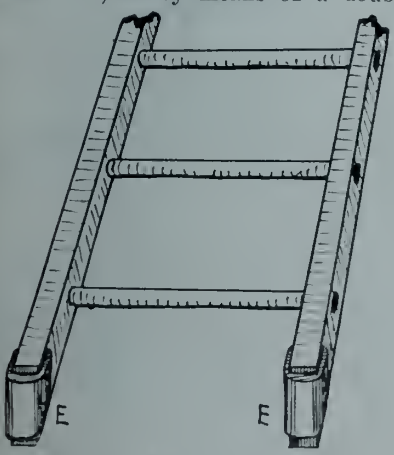


FIG. 2. ANTI-SLIP LADDER.

throw switch and a set of fuses for the starting and running positions, the set for the starting side being of greater capacity than those of the running side.

This method of starting with a double-throw switch and two sets of fuses gives the motor a better protection than the use of one set of fuses and a switch connecting the motor directly to the lines, because when this means of starting is employed the fuses must be capable of handling the starting current, which may amount to 2½ to 3 times full load current. Again, when such an arrangement is used, it is easily seen that, should one fuse blow, considerable damage or a "burn-out" will result before the other fuses blow and cut off the machine from the supply. Of course, such an eventuality may be easily guarded against if the motor be located where the engineer or other person in charge can cut it out of service.

Many small induction motors are installed in remote places where the operator in charge cannot see them, and, in such cases, care should be taken to see that all the switch contacts and fuses are in first-class order. Sometimes small polyphase induction motors are used on dumb-waiters and other classes of service where the machine is out of sight. Such motors are generally fused to allow for the starting current. Should one fuse blow and the machine fail to start, and if for the want of knowing better the controller be left in running position, the motor is likely to be burnt out before the other fuses blow. Of course, this trouble can be overcome by installing a relay arranged to cut all lines from the motor should necessity arise. The relay will be of the time-limit type so that it will not throw out on the momentary starting current. There are many such relays on the market, and their use for such purposes is recommended.

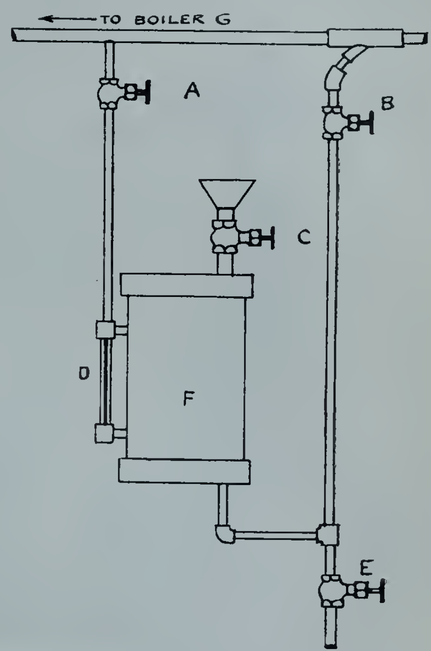
Another cause of trouble in induction motors which may be mentioned here is that of flooding the bearings with oil in such a way that the oil gets on the windings, and so causes a breakdown of the insulation between phases or from the windings to the frame of the motors. Care should be taken not to allow the oil to overflow, and, should any be spilled, it should be promptly cleaned off with a rag or waste; otherwise trouble is sure to result later. The greater part of the troubles with induction motors may be traced to some of the above defects.

ANTI-SLIP LADDER FOR TILE OR WOOD FLOOR

By J. E. Noble.

MAKE two hooks, as shown at A and B, Fig. 1, and fasten them to the ladder ends tightly with screw nails. When using the ladder on a rough wooden floor pull down the hooks and tap the point into the wood with the heel of your boot, and the ladder will be then absolutely safe.

For using a ladder on tile, polished wood, or any other smooth floor, nail a piece of sheet rubber (a piece of old auto tire or rubber fire hose will answer) on



BOILER COMPOUND FEEDER.

the bottom of the ladder legs at C and D, shown at E, Fig. 2. The two ideas can be used in combination on one ladder, if desired.

BOILER COMPOUND FEEDER

By J. Thorn.

ALTHOUGH numerous boiler compound feeders have been described and illustrated, the sketch and data of one herewith have several features of interest which have not come to my attention before. The pipe G is the feed from the pump to the boiler; F the compound holder made from a 4-in. or 5-in. nipple and two caps; D is a glass tube connected to the holder with two ordinary expansion tank fittings, and E is a draw-off cock. To make connection, use a half tee Y and a 45-degree elbow as shown. To fill compound holder, first draw off all the water at E, valves A and B being closed and C open. Next close E and fill the holder through the funnel at C, afterwards close C and open B. When the pump is running, the valve A can be opened slightly and the compound will feed slowly.

The compound does not pass through the pump to affect the packing, and it can be fed slow or fast as desired. The apparatus is practically fool-proof and is about as simple in detail and arrangement as can be devised; any engineer or fireman can put it together.

MAKING THE SHOP-LADDER SAFE

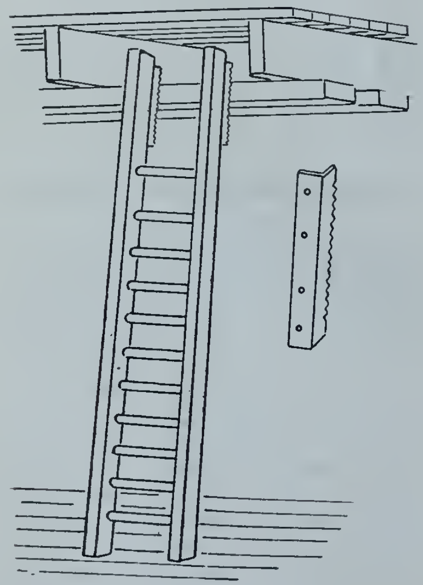
by A. D. I.

AMONG the many kinds of industrial accidents that occur in factories, none are perhaps so common and have such serious and fatal consequences, as those due to slipping shop-ladders. While a great deal of study has been given to render these safe, most of this attention has been given in providing means in having the feet of the ladder properly equipped with rubber or steel-pointed shoes.

Watch the Top

It never occurs to anyone that the top of the ladder, where so many exertions take place by workmen in doing overhead work, requires suitable equipment of some kind to prevent ladder from swaying from side to side. For as everyone knows who has had occasion to use one, a ladder, whenever placed against a stringer will seldom remain in position while one is standing on it, and workmen are obliged to take hold of a stringer with one hand in order to hold the ladder steady, by which they are greatly handicapped in handling tools, etc.

In the accompanying illustration, is shown an easily made simple attachment, that can be fastened to the top of any shop-ladder, which will prevent them



SAFETY DEVICE FOR TOP END OF SHOP LADDERS.

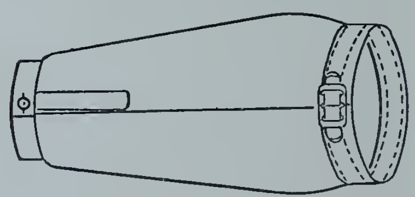
from swaying sideways, and also from slipping outward at the feet as usually happens. Referring to the sketch, two short strips of 1¼ in. angle-iron, having several teeth notched in on one side, are screwed in at the back of the ladder at the top as shown. When the ladder is placed against a stringer, the teeth become imbedded in the wood, causing the ladder to hold firm when so placed. There is little possibility of the ladder moving, and workmen can freely use both hands when working overhead.

Shop ladders are nearly always standing upright against walls and beams, owing to the less room they take up. As is well known these are often jarred against belts and pulleys and have to be constantly watched. In the adoption of this attachment this will hereafter be unnecessary, and also ladder accidents will be greatly checked, and less frequent than they are now.

A SLEEVE HOLDER KINK

by J. Wright

ENGINEERS and others who are in the habit of wearing sleeves at their work, have always experienced trouble in keeping these held up on the arms, for as soon as the elastic contained in-



USEFUL IDEA FOR HOLDING SLEEVES.

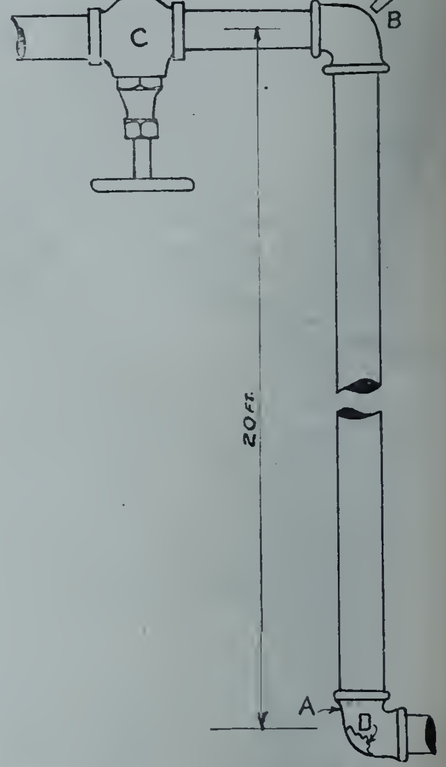
side the band around the top of the sleeve becomes stretched a little, the sleeve becomes loose and is constantly slipping down.

In the enclosed sketch, is shown a useful kink, wherein this trouble is overcome. A pair of adjustable sleeve-holders or armlet-elastics are placed inside the sleeve band, having the buckles protruding out as shown. When the sleeve becomes loose, it is only necessary to take up on the elastic by pulling the ends through the buckles.

REPLACING CRACKED ELBOW UNDER STEAM

By J. E. N.

THE following kink may help out some one under similar circumstances:—A 3-inch steam pipe had the stop valve C in the line as shown. The elbow at A had to be removed, as it was cracked at D. When the valve C was closed it leaked so much as to make it impossible to remove the elbow without turning the steam off at the main valve on the boiler. This could not be done at the moment. As a way out of the difficulty, the engineer ran the one-inch cold water hose to the point B, turned on the water, and allowed it to flow down the pipe, thus condensing the steam passing the valve C. Although the job was wet, it was not hot. The cracked elbow was removed satisfactorily, and a good one put in its



REPLACING CRACKED ELBOW UNDER STEAM.

place with equal success. This is no imaginary happening, it having actually occurred in the writer's experience.

There are 8,757 vessels registered in Canada, of which 4,312 are steamers. The tonnage amounts to 929,312. The number of vessels constructed in Canada last year was 246 of 18,832 tons, compared with 329 of 43,000 tons during the previous year. Over 45,000 sailors are serving on board these ships.

Not for Him.—"What's all this talk about a full dinner pail?" asked the woman with a positive manner.

"Why," replied the campaigners, "I am endeavoring to call your attention to the advantage of an abundant noonday lunch."

"Well, I'll have you to understand that my husband doesn't expect me to fix up any lunch for him to carry around. Dinner pail, indeed! When the whistle blows at noon he eats at a cafe, where he has all the luxuries, including the privilege of tipping the waiter.

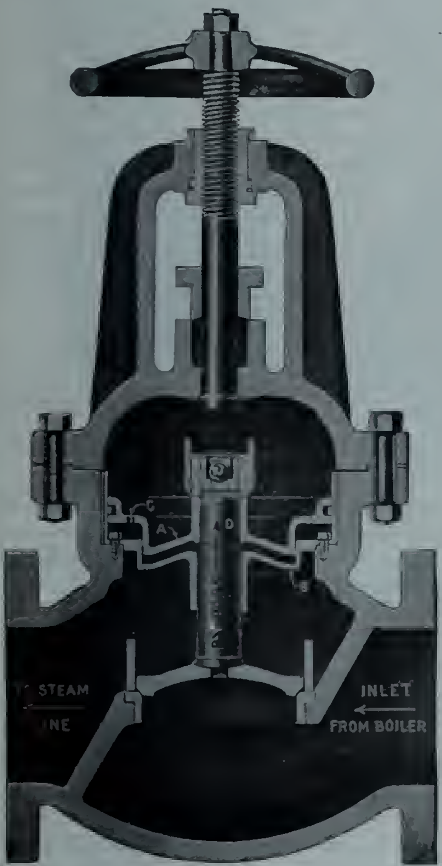
The new drydock, at Boston, Mass., which will be 1,200 feet long, will be the largest in North or South America.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Axuiliary Product Achievement

AUTOMATIC TRIPLE ACTING NON-RETURN VALVE FOR BOILERS.

NON-RETURN valves prevent the backward flow of steam into the boilers from the header in case of a rupture. The added emergency feature shown in the cuts also prevents an outward rush of steam should a break occur in the main steam line or branches. In a battery equipped with these valves the outflow from every boiler is stopped if anything happens to the header or main piping.



LONGITUDINAL SECTION AUTOMATIC TRIPLE-ACTING NON-RETURN VALVE.

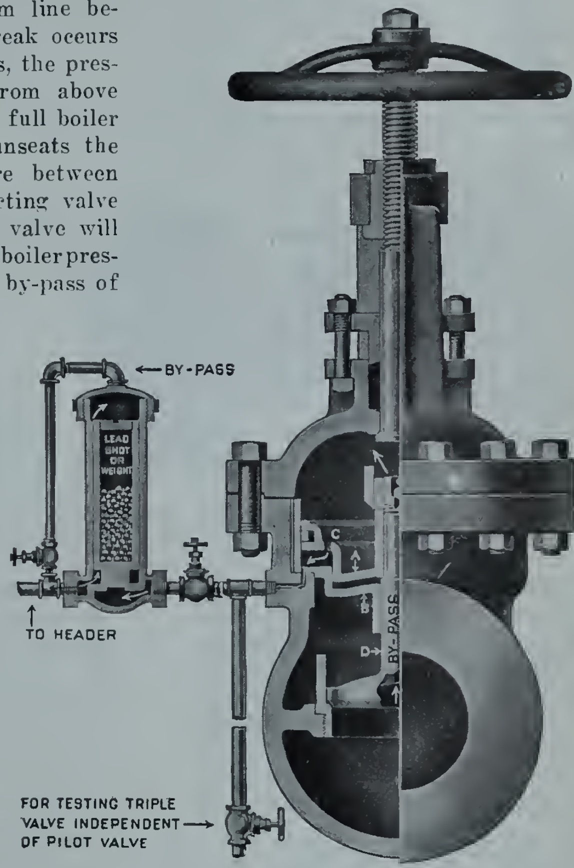
The sectional view shows the inside dash pot A attached to the valve disc, while the outside dashpot B acts as a cylinder, which is held firmly in place by cap bolts. The valve disc has a central port with a ball valve at the top and through this port full boiler pressure reaches the entire space above the liner and underneath the inside dashpot at C, therefore, it is balanced. A pipe connection is made to the exhaust port in the side of the triple acting valve, which communicates with the space between the two dashpots, being piped to the pilot valve which also connects with the outlet side of the valve or header.

The header pressure being on top of the piston of the pilot valve and the boiler pressure underneath, the weighted pilot valve piston, according to weight adjustment supplies the variation on which the triple acting valve will operate in case of a burst steam line beyond the valves. When a break occurs in the steam main or branches, the pressure is instantly removed from above the pilot valve piston and the full boiler pressure being underneath, unseats the piston, allowing the pressure between the dashpots of the triple acting valve to escape. The triple acting valve will immediately close, and the full boiler pressure still coming through the by-pass of the valve disc on top of dashpot A holds the valve to its seat, cutting off the flow of steam from the boilers.

Thorough cushioning of such valves is vitally necessary to eliminate disastrous hammering or pounding, and the Double Corliss Dash Pot arrangement, occupying the full area of the upper portion of the body, insures smooth, economic and reliable operation; holds the valve disc in perfect alignment with the seat, and makes the valve practically indestructible due to service. In the closure of the valves the double cushioned feature allows a quick drop to within 1/8 in. of the seat, then the valve closes easily under the control of the secondary dashpot. By turning the handwheel, the stem may be run down on top of the valve disc, thus making a permanent closure of the valve.

The triple acting valve may be closed or tested at any time independent of the pilot valve by having a small branch line run to any convenient point with a small hand valve attached, as illustrated. Upon opening the small valve and allowing the exhaust of pressure from between the dashpots of the triple acting valve, the latter will close —thus providing for all contingencies and insuring absolute safety in the operation of the plant. An automatic valve should be tested automatically to prove it operative to close in event of accident.

There is no adjustment to be made in the triple acting valve. The automatic pillot valve can be quickly set for any variation of pressure by simply adding or removing shot or other weight from the hollow piston for greater or less variation between the boiler and header pressure. The boiler and header pressure can drop together from say 175 to 50 pounds without operating the valves, but, the instant the variation of pressure reaches that for which the automatic pilot valve is set, the valves will operate quickly—which is the only time you want them to operate. The Golden-Anderson Valve Specialty Co., Pittsburgh, Pa., are the manufacturers of the foregoing.



PART CROSS SECTION THROUGH AUTOMATIC TRIPLE ACTING NON-RETURN VALVE.

OIL BURNERS WITH NATURAL DRAUGHT

SOME interesting experiments in connection with natural draught oil burners for naval boilers have recently been carried out by Lieut. L. R. Ford, of the United States Navy , on the U.S.S. Fulton. The burners are of the "inside

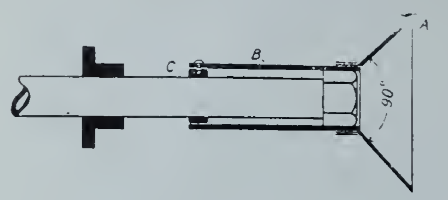


FIG. 1. BURNER WITH DIFFUSER.

mixture" type, the air and oil being discharged into a mixing chamber in the tip, where the mixture is given a whirling motion before issuing into the furnace. The air was supplied by a compressor. It was found that excellent combustion could be obtained with these burners, but very close attention on the part of the firemen was necessary to obviate the dangers due to fluctuations in the air and oil pressures, with the consequent extinguishing of the flame.

This defect, combined with the extravagant consumption of steam by the compressors, made it desirable to develop a method of using a mechanical atomisation system. A funnel-shaped diffuser A, Fig. 1, was made of sheet iron, and attached to the end of a piece of 1¼ in. pipe, B, 4 in. long, by means of a hand clip which permitted the adjustment of

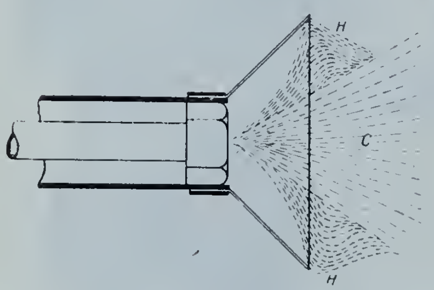


FIG. 2. EFFECT OF DIFFUSER.

the diffuser along the burner or nozzle. The diffuser was made with an included angle of 90 deg., and the diameter at the large end was 4⅝ in. The pipe was slipped on the burner over tip as shown in the sketch. A loose collar C sliding on the burner shank supported one end, the other end being supported by the burner tip. The pipe was secured to the loose collar by a small screw. This arrangement permitted adjustment of the distance the burner tip projected into the diffuser. To remove the burner from its holder it was only necessary to take out the small screw, draw the pipe and diffuser off the end of the burner, then draw the burner out of its holder in the usual manner.

When the burner was lighted a most interesting action was observed. With the diffuser drawn back, the flame would jump away from the burner, but when the diffuser was pushed forward, it would pick up the flame, and a short cone of clear flame would result. When adjusted to the best working position, a halo of white flame appeared around the edge—as shown in Fig. 2. The main body of the flame retained its conical shape, as shown at C, the cone extending back to the burner tip, but part of this flame seemed to draw out of the diffuser and curl down the edge, as shown at H. The combustion was very good, and further development was decided upon.

By fitting a cone—Fig. 3 in. of heavy sheet metal into the furnace opening, through which the burner was intro-

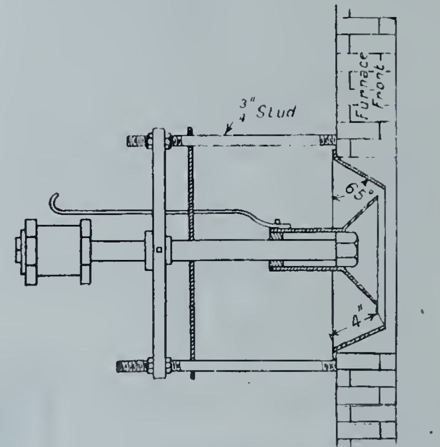


FIG. 3. BURNER, DIFFUSER AND CONE.

duced, a noticeable improvement in the furnace conditions was obtained. The flame was short, of dazzling whiteness, and smoke was completely absent. The air flowing into the furnace by natural draught seemed to mix thoroughly with the fuel, due to the influence of the diffuser and the Venturi-shaped furnace opening. In order further to promote the mixing of the air and fuel, it was decided to impart to the incoming air a rotary motion, and to do this the conical openings in the furnace front were modified by riveting helical fins D—Fig. 4, of thin sheet metal around the inner surface in the shape of a

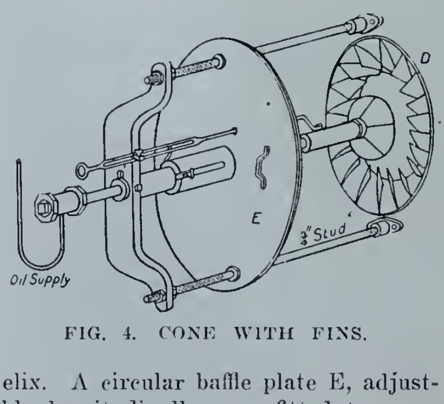


FIG. 4. CONE WITH FINS.

helix. A circular baffle plate E, adjustable longitudinally, was fitted to regulate the air supply, and the whole burner was constructed so that it could be moved in and out of the opening by the nuts and studs shown. Means were provided to maintain an even pressure of the oil to the burner.

The influence of the helical vanes on the air was very marked. The flame from the burner was very short and white, and the gas in the furnace quite clear. As soon as the brick walls in the furnace became heated-up, all sign of smoke disappeared. When the diffusers were adjusted to produce the halo round the edges the halo remained permanent. There was an entire absence of smoke and steam was made rapidly. The most surprising result was the low oil pressure required to maintain the steam pressure, and the wide range of pressure through which the burners could be operated smokelessly. Whereas, previously, an oil pressure of 200 lb. per square inch had been required, it was now found that the steam necessary to meet the normal demand could be generated with an oil pressure of 50 lb. to 100 lb. The steam pressure could be quickly and closely regulated by varying the oil pressure. The foregoing abstract is courtesy of "The Engineer," London, England.

TORONTO HARBOR DEVELOPMENT

THE Toronto Board of Harbor Commissioners has reclaimed since it commenced operations 300 acres of land. The greater part of this was done this year when the area reclaimed was upwards of 190 acres. Three and a half million cubic yards of material have been removed by the big dredges in doing this work. Taking the value of the new land at an average of $10,000 an acre, the Harbor Board has created an additional asset of $3,000,000.

This year there has been constructed 3,400 feet of substructure for the water front development from Bathurst street east. This is now ready for the cement top. Work on the ship canal is going on apace and Ashbridge's Bay is shrinking all the time as the big dredges continue to vomit forth sand and water from their faucets.

A great deal of work has been done on a drainage canal skirting the north shore of Ashbridge's Bay. This narrow channel runs down past Leslie street and is intended to take the drainage from Coatsworth's Cut into the lake. It is only temporary, however, and will be filled in with the rest of the bay. It is not the intention of the Harbor Board to give the property owners riparian priveleges along the channel. Many applications have already been received for industrial sites, and in not a few instances locations have been arranged.

Steam Driven Auxiliaries of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that steam-driven auxiliaries aboard ship continue to increase in number, and that they are being designed and constructed to meet in the most effective manner, both ordinary and special service applications, this series of articles describing and illustrating at least the more important types of such apparatus seems to us more or less timely, both from the point of view of familiarizing engine and boiler room staffs with the products of different manufacturers, and that of their acquiring a closer intimacy with specific detail arrangement, relative to operation, maintenance and periodic overhaul.

BOILER FEED PUMPS.—IV.

THE pump illustrated in Fig. 21 is of the simplex type with single automatic steam actuated, distributing valve, which dispenses with external valve gear levers, etc.

"Goldie & McCulloch" Simplex Pump

This design of pump is built by the Goldie and McCulloch Co., Ltd., Galt, Ont., who supply it in four sizes from 5 in. x 3 in. x $3\frac{1}{2}$ in. with a capacity of 470 to 950 gallons per hour to 8 in. x 5 in. x 10 in. with capacity of 3.000 to 6,000 gallons per hour. As can be observed in Fig. 21, the base is cast with enclosed compartment which forms suction chamber, to either side of which the suction pipe may be attached. The passage from this chamber into the water end is clearly shown in Fig. 22 along with the more important constructional features.

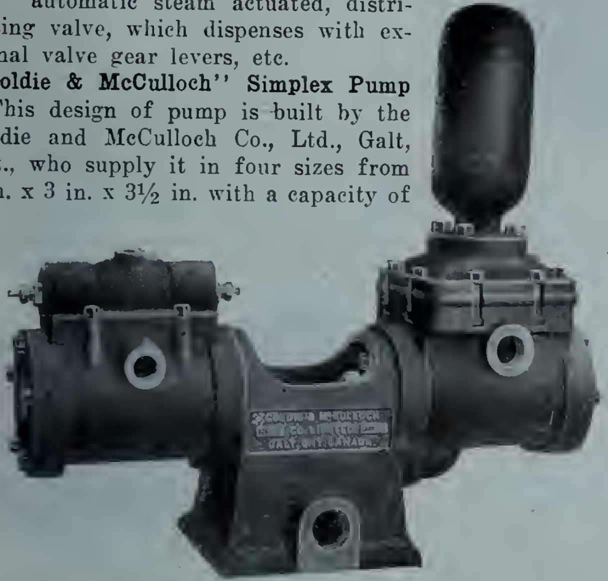


FIG 21. "GOLDIE & McCULLOCH" SIMPLEX PISTON TYPE BOILER FEED PUMP.

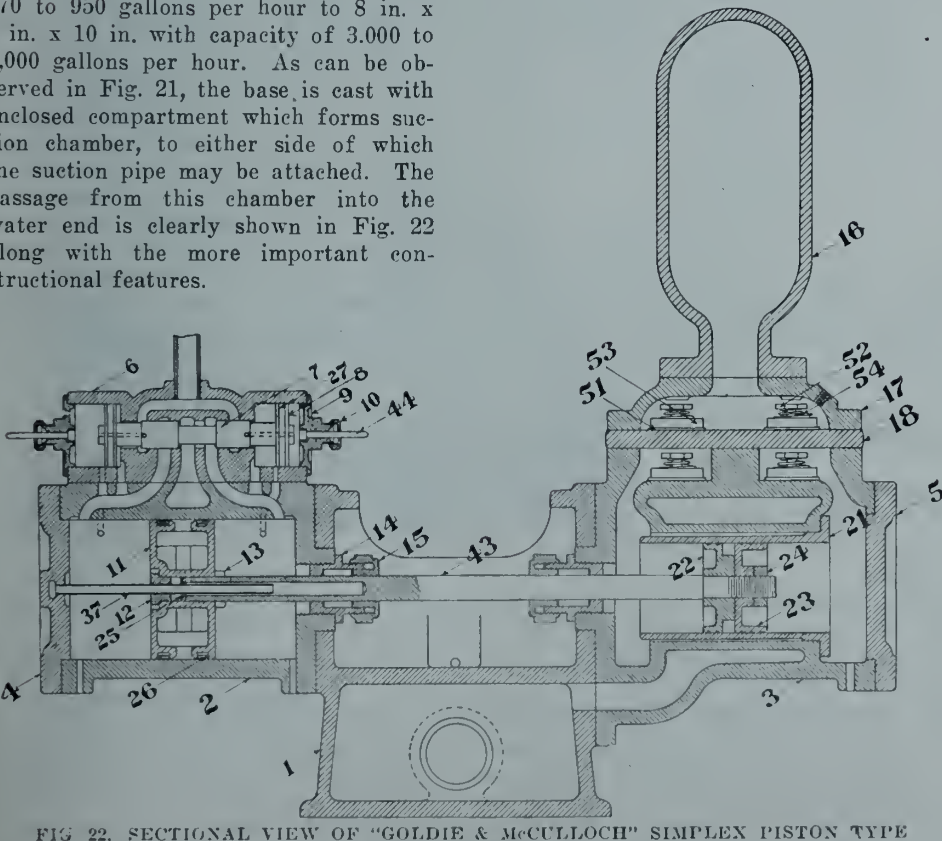


FIG 22. SECTIONAL VIEW OF "GOLDIE & McCULLOCH" SIMPLEX PISTON TYPE BOILER FEED PUMP.

The distributing valve for the steam end is of the straight piston type, the enlarged diameter in the centre controlling the admission and exhaust at the left and right hand respectively, the main piston as shown travelling from left to right. When the main piston reaches the end of its stroke, live steam, which is supplied to its interior by a tubular triprod 37, is by-passed to the outside of steam valve end 8, throwing the valve over to the opposite position and reversing the admission and exhaust of steam in the cylinder.

The water end as shown is fitted with a removable brass liner, the valve seats, rod, stuffing box glands, etc., being also brass, while the one-piece pistin rod is of Tobin bronze. The design of this pump does not involve the necessity of expensive foundations while the cylinder construction admits of easy removal for inspection on repairs.

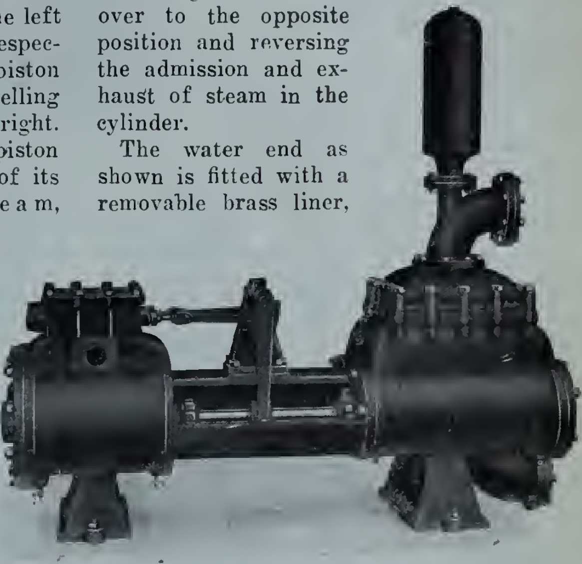


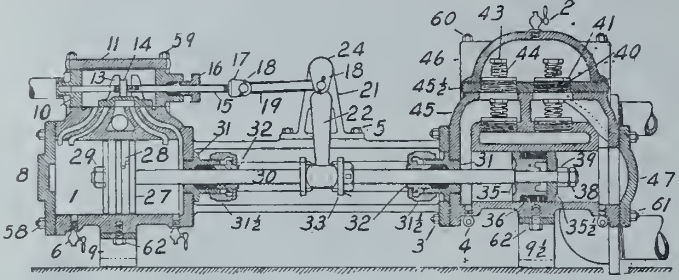
FIG. 23. "SMART-TURNER" DUPLEX PACKED PISTON BOILER FEED PUMP.

"Smart-Turner" Duplex Pumps

The pump illustrated in Fig. 23 is a 12 in. x $8\frac{1}{2}$ in. x 12 in. duplex, packed piston pump built by the Smart-Turner Machine, Co.. Hamilton, Ont., and is typical of the general design followed in all sizes of this type. Twenty-four sizes of this type are built capable of feeding boiler horse-power from 30 to 4,100. Packed water pistons and screwed-in brass valve seats are employed throughout the various sizes, rubber or brass valves being fitted according to the service.

Constructional features are clearly indicated in Fig. 24 (upper). Separate views of the principal parts are given in the lower portion of this illustration which also shows the discharge elbow and air chamber which is fitted to all sizes larger than $7\frac{1}{2}$ in. x 5 in. x 10 in.

Duplex, outside, end-packed plunger pumps as built by this firm are shown in Fig. 25, the particular size illustrated being 12 in. x 7 in. x 12 in. The complete range of sizes built in this type extend from $4\frac{1}{2}$ in. x 2 in. x 4 in. up to $18\frac{1}{2}$ in. x $11\frac{1}{2}$ in. x 15 in. Pot valves are used on all sizes, each valve, or in



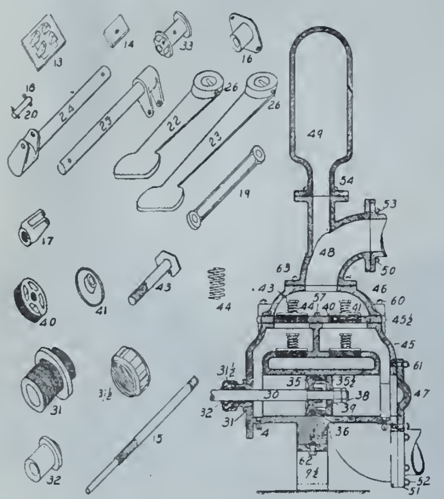


FIG. 24. SECTIONAL DETAILS AND PARTS OF TYPICAL "SMART-TURNER" PUMP.

the larger sizes each nest of valves is in its own pot, by removing the cover of which the valves are completely accessible for inspection or grinding.

This type of pump is well suited for high pressure boiler feeding up to 300 lbs. per sq. in., any leakage past the plunger being immediately observed, so that the packing is given more constant attention and the resulting effi-

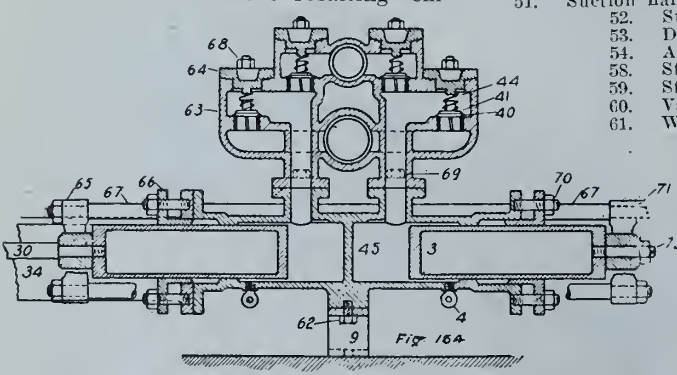


FIG. 25—WATER END OF "SMART-TURNER." OUTSIDE END PACKED PLUNGER PUMP

ciency of the pump maintained at a higher level. Brass valves of the wing pattern are employed, the wings being set at an angle so that in rising and falling the valves make a partial turn causing a self grinding effect which insures even wear and constant tightness of the valve faces. The arrangement of valves and plungers is shown in section in Fig. 25. The following list of part numbers corresponds to the numbers on Fig. 24.

1. Steam cylinder.
2. Water cylinder air cock.
3. Stud, stretcher to water cylinder.
4. Water cylinder drain plug.
5. Cap screw, pedestal to stretcher.
6. Drip cock, steam cylinder.
8. Steam cylinder head.
9. Steam cylinder foot.
9½. Water cylinder foot.
10. Steam-chest.
11. Steam chest cover.
13. Slide valve.
14. Valve rod nut.
15. Valve rod.
16. Valve rod stuffing-box gland.
17. Valve rod jaw.
18. Cotter pin.
19. Link.
20. Motion pins.
21. Pedestal.
22. Short lever.
23. Long lever.
24. Upper rock shaft.
25. Lower rock shaft.
26. Taper pins for rock shafts.
27. Steam piston.
28. Steam piston rings.
29. Steam piston rod nut, steel.
30. Piston rod.
31. Piston rod stuffing box.
31½. Piston rod stuffing box nut.
32. Piston rod gland.
33. Spool.
34. Stretcher.
35. Packed water piston body.
35½. Packed water piston follower.
36. Water piston packing.
38. Brass piston rod lock nut.
39. Brass piston rod nut.
40. Valve seat.
41. Rubber or brass valve.
42. Valve backing (for rubber valve only).
43. Valve bolt.
44. Valve spring.
45. Water cylinder.
45½. Valve deck.
46. Valve deck cover.
47. Water cylinder head.
48. Discharge elbow.
49. Air chamber.
50. Discharge flange.
51. Suction flange.
52. Suction flange nuts.
53. Discharge flange bolts.
54. Air chamber bolts.
58. Steam cylinder head stud.
59. Steam chest stud.
60. Valve deck cover.
61. Water cylinder head studs.
62. Cap screw, foot to cylinder.
63. Discharge elbow studs.

"Fairbanks-Morse" Boiler-Feed Pumps

The general design of these pumps is shown in section Fig. 26, while the external appearance of the medium sizes is in Fig. 27. They are built by the Canadian Fairbanks-Morse Co., Toronto, and are suited for boiler pressures up to 150 lbs. per sq. in. above which the outside packed plunger pump is adopted. They are of the duplex pattern, the steam mechanism of which is familiar to nearly all pump users. Flat steam

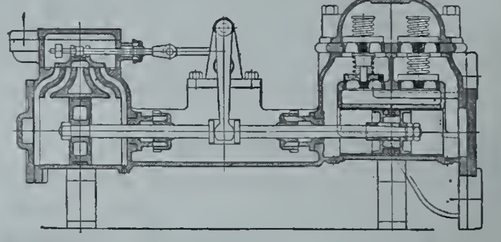


FIG. 26. GENERAL DESIGN OF "FAIRBANKS-MORSE" DUPLEX BOILER FEED PUMP.

slide valves are used for controlling the distribution of steam to the cylinder, while the water end is so designed that the water piston is submerged, by reason of all the water valves being located above the water piston, which works in a renewable liner. Spring controlled disc valves are used, the ma-

FIG. 27—EXTERIOR VIEW OF MEDIUM SIZE "FAIRBANKS-MORSE" PUMP

terial being either brass, hard rubber, or soft rubber according to the nature of the service.

Duplex ram pattern pumps are built for discharge pressures not exceeding 175 lbs. per sq. in. with capacities suited for boiler horse powers from 150 to 1,700. The design is such that all the desirable advantages of this type of pump are obtained, the element of slippage being reduced to a minimum and the volumetric efficiency correspondingly increased, see sectional view Fig. 28.

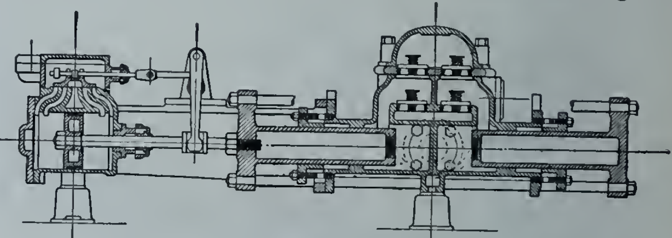


FIG. 28—SECTIONAL VIEW OF "FAIRBANKS-MORSE" OUTSIDE END PACKED PLUNGER PUMP

"Terry" Turbine-Driven Centrifugal Boiler-Feed Pumps

The subject of boiler-feed pumps would be incompletely covered were reference not made to centrifugal pumps for boiler-feed purposes. As is well known, centrifugal pumps are readily adaptable to widely different conditions of building up one stage on the other, the ability of the pump to operate against high pressurer being greatly increased so that as built by the Terry Steam Turbine Co., Hartford, Conn., pumps of this type direct connected to steam turbines, have capacities from 100 gal. per min. up with discharge pressures up to 300 lb. per sq. in.

A two-stage centrifugal turbine set by these makers is shown in Fig. 29, the capacity being 450 gal. per min., against a pressure of 170 lb. per sq. in. A sectional view of the centrifugal pump is shown in Fig. 30. After entering the suction branch A, the water passes through the annular suction passage B into the revolving impeller C. leaving it at the point D where it passes through stationary diffusion vanes and reversed by the outer casing at the point E and is directed toward the centre again where it enters the second stage impeller through the suction passage F being afterward discharged in the usual way through a tangential passage the flange on which is shown dotted behind the casing. The impeller shaft is supported on two bearings the one on the right being of the ring-oiling type, while the bearing on the left is arranged to take the thrust due to the pull of the two suction passages B and F, which draws the shaft toward the thrust bearing. This thrust bearing is water cooled by a by-pass pipe from the first stage casing into the suction pipe A, the packing glands being lubricated by a similar arrangement.

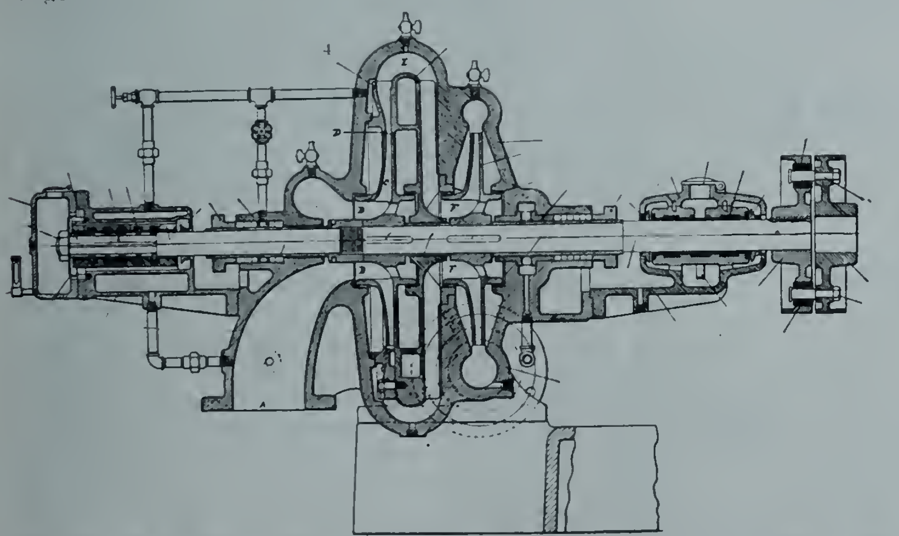


FIG. 30. SECTIONAL VIEW OF TWO-STAGE CENTRIFUGAL BOILER FEED PUMP.

Owing to the fact that the steam is used expansively, a turbine driven feed pump shows better steam economy than the ordinary direct driven reciprocating type. Apart from the pump itself, however, the absence of vibration is a desirable feature, not only in the machine, but in the feed water pipe line. The steady continuous flow of water induces a marked absence of vibration in the pipes while the almost entire absence of tear and wear makes itself evident in reduced packing consumption, etc.

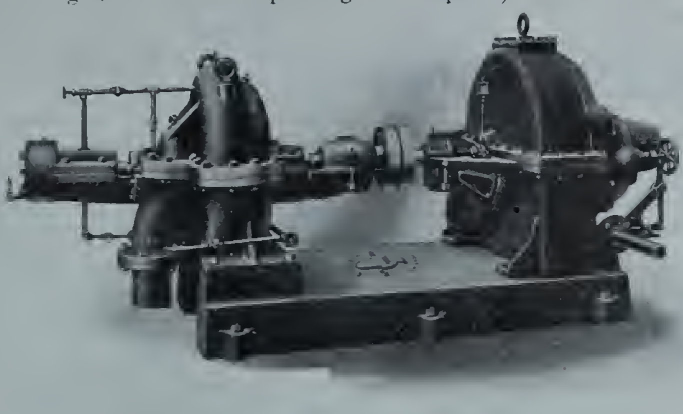


FIG. 29. TWO-STAGE CENTRIFUGAL BOILER-FEED PUMP DIRECT CONNECTED TO "TERRY" STEAM TURBINE.

INVENTOR OF FOG HORN DIED BLIND AND POOR

THE man who invented and installed the first steam fog horn died blind and in poverty despite his varied attainments and achievements in widely differing fields. He was John Foulis, a Scotchman, who came to St. John, N.B., in the early years of the last century. An interesting description of this versatile Scot is given in a paper recently read before the St. John Historical Society, by William Murdoch.

"He was a nephew of the brothers, Robert and Andrew Foulis, of Glasgow, printers and publishers whose publications were the admiration of all their contemporaries, and whose edition of Horace, published in 1744, was hung up sheet by sheet, in Glasgow, and a reward offered for the discovery of a single error.

"This scion of intelligent breed was a graduate of Glasgow University. After various experiences when a young man, even to serving as surgeon on a whaling ship, he finally settled in St. John and became a land surveyor, artist, analytical chemist and a civil and mechanical engineer. His survey of the River St. John is still in evidence in the Crown Lands Office of N.B. province. His chemical knowledge ranged from analyzed ores to making his own whiskey when overtaken by adversity.

"While operating as a mechanical engineer and owning a foundry, he engined the first steam ferryboat to cross St. John harbor, besides the first steam craft to ply the St. John River. Later on, when Mr. Foulis was the engineer of the Light and Signal Service of the Government of New Brunswick, his principal charge being Partridge Island (at the harbor's entrance), whereon was an automatic fog bell, he proposed a steam whistle, steam whistles being then new to the world.

"Later on his suggestion was acted upon. There was no patent law then and though in his old age, blind and poor, he was given no compensation."

SHIPPING AND WAR

IT is no longer a novelty to learn of ships earning their first cost from one year's freights. In the past two years freights have doubled, trebled and in certain instances increased ten-fold over the figures which obtained at the outbreak of the war. While high cost of labor and materials, reflected in operating costs, have had an influence in increasing freight rates, the three main causes are the requisitioning, especially by the British Government, of merchant vessels for war purposes, the internment of ships of the Central Powers, and the decrease in tonnage due to the submarine campaign. Over fifty per cent. of British registered tonnage has at some time or other been devoted to the military needs of the Allies. It is estimated that during the war period, the steam tonnage on Lloyd's Register as of July, 1914, has been reduced from 24,809,000 tons to 13,158,000 tons. In other words, making due allowance for new tonnage added, the depletion through Government requisitions, internment and war losses, has cut the available tonnage practically in two. The tremendous demand for cargo space has put into commission, on a very profitable basis, vessels which prior to the war could hardly pay their keep. This movement, while applying generally to neutral shipping is specially marked in the United States and the Scandinavian countries.

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Vol. VI NOVEMBER, 1916 No. 11

PRINCIPAL CONTENTS

IS A SHIPBUILDING COMBINE COMING?

FOLLOWING hard on the change of management of the Davie Shipbuilding & Repair Co., Levis, Que., comes advice that control of the Western Drydock & Shipbuilding Co., Port Arthur, Ont., has been secured by Canadian interests. In view of the foregoing we should not be surprised to find in the very near future other well-known plants of a like nature undergoing a change of personnel in their administration, and losing their identity except as to location in one gigantic merger. It is generally believed that the Canada Steamship Lines management are behind the movement towards a consolidation of the various interests. Such a programme will, we believe, contribute materially to both the development of our shipbuilding industry and the creation of a worth-while Canadian Merchant Marine.

CANADIAN SHIPBUILDING FOR EXPORT

ANENT the recently passed Order-in-Council at Ottawa, whereby a 99 per cent. drawback becomes effective on material imported for shipbuilding purposes in Canada, some difference of opinion appears to exist as to its all-round value to the industry here. The first clause of the Order-in-Council is that on which the question altogether hinges; we quote it as follows:

It is expressly stated in the foregoing that the drawback is only effective when vessels built here are authorized by Order-in-Council for export to registry outside Canada or for British registry in Canada. No concession is made with respect to Canadian built vessels to Canadian registry and as a consequence what has been promulgated savors of a hardship in the estimation of some. On the face of it, there does not, of course, appear any good reason why the Order-in-Council should not have been made all-inclusive in its application, yet "half a loaf is better than no bread," and as under present circumstances, the biggest half loaf is our shipbuilder's portion, it may not be in order to find fault to any great extent. The major portion of the vessel contracts under performance by our various shipbuilding plants are for registry other than Canadian, and for several years to come a like condition is certain to prevail.

Shipbuilding—wood and steel is booming in Canada as never before, ample evidence in itself that the recent Order-in-Council has accentuated rather than deterred the degree of activity. As bearing out this opinion we understand that the Shipping Federation of Canada—a body representative of our principal vessel owners, expresses the view that the drawback effect cannot fail to induce greater shipbuilding activity on our lake and ocean shores. In any case, the step taken by the authorities at Ottawa is in the right direction—aid to native shipbuilding, even although of outside registry, and bearing in mind the fact that the aid has been forthcoming at an opportune time to make it of helpful effect, there is little doubt but that the little remaining disability concerning Canadian built vessels for Canadian registry will disappear when conditions warrant.

It has been quite general practice to have our canal size lake-boats built in Great Britain in years past as also many of our coasting vessels, the difference in cost of construction materially favoring such procedure. Because of the world-wide shortage of "bottoms" for ocean services, due to the almost complete cessation of new construction in Great Britain for many months; the normal and war losses; the fact that the shipyards there will be taxed to the limit of capacity output for well-nigh the next decade; and that comparative costs as between Canada and the Old Country will have drawn more nearly level following the war, a lessened construction abroad of vessels to Canadian registry will result, with a corresponding increase in the home built product and like registry. As world output begins to overtake arrears and a slackening of the demand for Canadian built ships of outside registry becomes imminent, we look to see the drawback made applicable to all our vessel construction.

Marine News From Every Source

Montreal, Que.—Vickers, Ltd., have an order for two 7,000-ton steamers for Norwegian owners.

Vancouver, B.C.—The C.P.R. propose extending the passenger pier at this port approximately 400 feet.

Sarnia, Ont.—The Reid Wrecking Co. has purchased the steamer Kongo from its Cleveland owners. The Kongo is 250 feet long.

Halifax, N.S. — The North Atlantic Fisheries, Ltd., of this city has sold its Port Hawkesbury plant to Leonard Brothers, of Montreal and St. John.

Thorold, Ont.—The tug T. F. Battle, owned by Mayor Joseph Battle, was burned to the water's edge at the dock near Lock 21, Welland Canal, on Nov. 14.

On Canadian Register.—The steamer Nyanza, which was inspected at Sarnia on November 4 by Canadian steamboat officials, has been added to the Canadian registry.

St. Lawrence River Low.—Word was received at Kingston recently, that the water is very low below Iroquois. being some five inches under the usual vessel draught of 14 ft.

Shelburne, N.S. — Owing to the development in the shipbuilding industry here and demand for marine oil engines, it is proposed to establish a plant for making gasoline engines.

St. Catherines, Ont.—A serious accident occurred on the Welland Canal on Nov. 5 when the steamer J. H. Shrigley of Sarnia carried away both foot gates of lock 7. flooding the country in the vicinity.

The Bermuda Bunkering Co. has been incorporated at Ottawa with a capital of $30,000 to deal in coal and operate ships and docks, with head office at Toronto. Incorporators W. W. Perry, Kenneth McKenzie and Charles H. C. Leggatt, all of Toronto.

Vancouver, B.C.—Captain F. R. Dedrick, on behalf of the Stolt Nielsen Co., has signed contracts for the construction in Vancouver of three steamers for his Norwegian principals. The vessels are to be standard type freight carriers of 8,800 tons, costing $1,225,000 each.

New Glasgow, N. S.—The Nova Scotia Steel and Coal Co. have decided to enlarge their shipbuilding activities by building a second ocean going vessel, and one about 25 per cent. larger than that now under construction.

Kingston, Ont.—The steamer John F. Thom, belonging to the Thom Transportation Co. of Quebec, which recently went aground on the westerly end of Corrigan's Island, near Waddington, will be left in its present position until Spring.

Ottawa, Ont.—The Trade and Commerce Department announces that the Cunard Steamship Co. have chosen Halifax as their Canadian winter port for the new steamship service to be established between Bristol and Canada. Their steamers will call at both Halifax and New York on east and west-bound voyages.

La Canadienne Repaired.—The Dominion Government steamer La Canadienne, of the Hydrographic Service, arrived at Owen Sound on November 5 from Port Arthur to go into winter quarters. The vessel came off dock at Port Arthur after receiving repairs necessitated by grounding near Jackfish Bay last August.

The Polson Iron Works, Toronto, have signed a contract for two steel freighters for Christoffer Hannevig. Christiana, Norway. The ships will be 261 ft. over all, 43 ft. 6 in. beam, and 22 ft. 11½ in. deep. The total deadweight carried will be 3,500 tons. The two vessels will cost about $1,200,000, and will be completed July or August, 1917.

Hudson Bay Railway.—The Hudson Bay line will be finished in 1917, according to the contractors; but recent investigations, insisting that the Straits are only open about two months in the year, are calculated to dampen the ardor of those who claimed that the Straits were navigable for four or five months. Even the two months, always show, it is stated, floating bergs, which would render navigation difficult, and compel the building of a special kind of boat to resist the onslaught of floating bergs. The prospect is not too encouraging; but the line is to be finished, in any case. About 90 miles of track have been laid this past season. Labor has been scarce, which accounts for the rather slight record of work.

Buy Ships in Vancouver.—The China Mail Steamship Co,. which began trans-Pacific operations a year ago with the liner China, purchased from the Pacific Mail Co., has bought two steamers under construction at the Wallace Shipyard, Vancouver, B.C., paying $2,500,000 each for the liners, delivery to be made within ten months.

Heavy Ore Shipments.—An increase of more than 11,000,000 tons to shipments of iron ore from Duluth, Minn., is shown in reports for the season ended Nov. 1, as compared with the rcords of the corresponding period last year. Up to Nov. 1, 1915, shipments amounted to 29,345,174 tons, while during the 1916 season 40,608,767 tons have gone forward.

Great Lakes Water Impure.—Apparatus carried by Great Lakes steamers to purify lake water for drinking is described as 'woefully inefficient'' in a bulletin published by the Public Health Service, Washington, D.C. No purification method is in use by any steamer on the lakes, it is declared, which fulfils Federal requirements by ensuring safe water under all circumstances.

Port Arthur, Ont.—James Whalen, of Port Arthur, and John Burnham, of Chicago, by an investment of $1,500,000 have secured exclusive control of the Western Dry Dock & Shipbuilding Co. plant here. They have contracts for several boats, also assurances that the plant can be kept going at full capacity for a long time to come. They expect to turn out twelve boats in 1917.

Britain's Shipping Losses.—Of the total British tonnage of steam merchant shipping of 1,000 tons and over at the beginning of the war, the net loss to September 30, 1916, was slightly over 2½ per cent., according to a statement of Thomas J. MacNamara, Financial Secretary of the British Admiralty, in the House of Commons on November 15. This, he said, includes losses from all causes, whether war or marine risks.

Steamer R. Paul Burned.—The steamer R. Paul, of the St. Lawrence & Richelieu Navigation Co., was burned at Sorel on October 24, just as she was waiting for the railroad bridge to allow her to pass. All the fifteen passengers, the captain and the crew escaped without injury, with the exception of one of the former, who was badly burned about the arms, face and body.

Brantford, Ont.—With a view to the improvement of the Port Dover harbor Government officials paid a visit there recently, and gathered data to prepare plans for its deepening. Chief Engineer Stephen, of the Windsor office of the Department of Public Works; Martin N. Todd, general manager of the Lake Erie and Northern Railway, accompanied by Senator McCall, of Simcoe, comprised the party.

Machine Tool Equipment Aboard Ship.—The value of the machine tool and repair equipment on the United States repair ship Prometheus is said to be nearly $80,000. There are over fifty machine tools, including lathes up to 72-in. swing, vertical boring mill with table 6 ft. diameter, a radial drill of 48-in. capacity, and other tools, all of which are driven individually by electric motors.

Merchant Shipbuilding. — A substantial increase in merchant shipping under construction in Great Britain for the three months ending October 1 is reported by Lloyd's. The report shows that on October 1st there were 463 vessels building, representing a total of 1,789,054. tons. This represents about 249,000 tons more than the amount under construction at the end of the previous quarter, and 253,000 tons more than that building a year ago.

Australian Ships Load at Montreal.—The Australian Government, according to a report to the Trade and Commerce Department, Ottawa, has now in its service a fleet of 35 cargo steamers, some of which have already loaded at Montreal for Australian ports. In addition, five large sailing ships are being operated under Government control. The earnings of these ships are said to be satisfactory. The vessels will be overhauled in Australia and used in the transportation of wheat and other commodities.

Bunker Coal Prices.—The advance of 50 cents a ton to a rate of $3.95 in the price of fuel for steamers, announced by a leading shipper of Cleveland, O., has not been made general, and some of the coal men say they have not decided what action they will take along that line. Boat men claim that steamers carrying coal and ore at contract rates cannot stand the advance. At the rate operating expenses are being increased, vesselmen will be slow in making freight contracts for 1917, as boats carrying contract ore and coal are having pretty thin picking.

Will Build Wooden Vessels.—A. B. Mackay, of Hamilton, Ont., states that he has placed orders for six more scooners for the Mackay lake fleet, at a cost of $500,000. He declared that wooden sailing vessels of the type but on a larger scale than those used years ago are coming back on the Great Lakes. A four-masted schooner now under-construction at Meteghan, N.S., for Mr. Mackay was launched during the month.

Vancouver, B.C.—If plans which are at present in contemplation go through successfully, orders for vessels will be placed with the Wallace Shipbuilding Co. on the north shore and with Messrs. Coughlan & Son at their proposed yard on False Creek. So far as Wallace's yards are concerned, it means the expenditure of between four and five million dollars, but with regard to Coughlan & Son, no definite figure has yet been mentioned. Otto Dohl, of Philadelphia, representing a Norwegian shipping syndicate, and Jesse Stearns, representing American capitalists, were here in connection with these schemes.

St. John, N.B.—Arrangements are being perfected to care for a much larger business the coming winter than last. The Government Railway has promised to add to the trackage on the harbor front, and it has also contracted for the deepening of available berths. Among the steamship enterprises suggested has been that of a 25-knot all British steamer service to cross the Atlantic in three and a half days from a port on the west coast of Ireland to St. John or other maritime port. This suggestion has been made to the Dominion's Royal Commission by the representatives of an English shipbuilding firm.

Shipbuilding Amalgamation. — The Press Association is authorized to state that the old-established firm of Caird & Co., Greenock, Scotland, is in future to be closely associated with Harland & Wolff, of Belfast and Govan. There will be no real change in the management of the Greenock concern, the present directors, P. T. Caird and Arthur Caird still remaining directors of the joint concern. J. W. Kempster, one of the managing directors of the Belfast Company, will join the Board of Caird & Co. The fact that certain well known shipping companies have had practically all their most important vessels built by one or other of the two firms concerned makes the reason for their closer association apparent.

Vancouver, B.C.—The Dominion Government will promote the building of merchant ships in Canada for Norway. A telegram received from Ottawa reported that H. H. Stevens, M.P., had stated that an Order-in-Council granting necessary permission had been passed. Contracts for three vessels valued at $3,500,000, were already signed with Vancouver shipbuilding yards, and only required the assurance of the Government that the transfer would be granted on completion to become effective. Orders for seven or eight other vessels will be given almost immediately, and the total value will reach not less than $20,000,000.

Neutral Vessel Losses.—Lloyd's records, published on November 7, reveal the fact that 308 neutral ships of a gross tonnage of 421,333 have been sunk by the Germans since the war began. Of these by far the greatest number are Norwegian. The Norwegians have lost 168 ships of 212,314 tons, almost exactly half the total loss. The Swedes have lost only 47 ships of 41,779 tons. Denmark has lost 38 ships of 37,324 tons. Eighteen Dutch ships, totalling 54,914 tons, have been sunk. The Greeks have lost 22 ships of 41,540 tons. The Spanish have lost only ten, their tonnage totalling 24,-055, and the Portuguese two, of 841 tons. Both these were sunk before Portugal declared war on Germany.

Car Ferry Across Lake Erie.—A car ferry route has been established across Lake Erie between the ports of Port Maitland and Ashtabula, on the south shore of Lake Erie, by the T. H. and B. Navigation Co. The initial trip of the car ferry was made Oct. 21st with a full load for Hamilton and other points. The steel car ferry, Maitland No. 1, is the latest in car ferry building, carrying thirty-two loaded freight cars, and is equipped with every device for safe handling of the cars and freight. She will ply between Port Maitland, Ont., and Ashtabula, Ohio, connecting at the latter point with the New York Central and with the Pittsburg and Lake Erie at Youngstown, thus affording a new and fast route from the Pittsburg. Connellville and Cleveland districts.

Anchor-Donaldson Line. — A new steamship company, to be known as the Anchor-Donaldson Line, organized by a fusion of interests of the established Anchor and Donaldson Steamship Co., has been organized for Glasgow—Canadian passenger and freight trade. Directors of both companies will be represented on the Board of the new company, with Sir Alfred Booth of the Cunard Line as Chairman. The steamers Letitia, Cassandra, Athenia and Saturnia, will be transferred to the new organization. The Donaldson Line is now operating a service between Liverpool, the River Plate and leading South American ports. It has a fleet of twenty-five ships, totalling 89,992 tons. The Anchor Line operates a passenger and freight service between Glasgow and New York, calling at Liverpool in conjunction with the Cunard service. It has a fleet of fifteen ships, with a total tonnage of 114,222 tons .

Sarnia, Ont.—The steamers Royalite and Iocolite, of the Imperial Oil fleet, will leave in the near future for the Atlantic, where they will be engaged in the oil trade during the coming winter. It is expected that they will carry oil from Halifax to other points on the Atlantic, and will return to the lakes in the spring. They will take a cargo from here to Montreal when going East.

Merchant Shipbuilding at Barrow.—Vickers, Ltd., have determined to add to their industries at Barrow, England, a larger merchant vessel output. This has necessitated the extension of their already large shipbuilding yard, which for many years past has been exclusively employed in the construction of war vessels. They have, therefore, purchased from the Furness Railway Co. what is known as the Harbor Yard, with a frontage of upwards of 1,500 feet to Walney Channel, on which can be laid down twelve or fifteen vessels at one time. The firm can build at their new slipways vessels up to about 450 ft. in length, and at the old slipways warships or liners up to 1,000 ft.

Victoria, B.C.—The first and most important section of Victoria's greater harbor scheme is now practically complete. The huge breakwater, which is constructed of granite and reinforced concrete 2,500 feet to seaward, has reached such a stage that within four weeks the contracting firm, Sir John Jackson, Ltd., will have completed the undertaking. The contract has been under way for the past three and a half years, initial operations being started in April, 1913, and continuous progress has been maintained. When the entire scheme is completed, Victoria will have one of the finest harbors, equipped with the finest facilities for handling large ships on the entire coast. Rapid progress is being made by the firm of Grant Smith & McDonnell in the construction of the two concrete piers sheltered by the breakwater. The whole of the fifty-two reinforced concrete caissons required for the contract have been completed and, with the exception of one, all have been sunk in position on the site. At low water the outline of the piers can be clearly distinguished.

PORT OF MONTREAL SHIPPING

TAKING into consideration the lack of tonnage, high freight rates and high marine insurance risks which have prevailed during the year, Montreal shipping men generally express the opinion that the season of navigation has been well up to their expectations. With the continuance of the war, it was not supposed that any impetus would be given to the passenger traffic, although many vessels sailing from this port, despite submarine scares and other risks affecting their safety, have carried comparatively large numbers of passengers. Only one passenger vessel, the steamer Alaunia, met with disaster and that was after all those on board, with the exception of the crew, had been landed. Freight business, on the other hand, has continued abnormal during the past few months, and, although a few steamers have been released from Government service, the demand for cargo vessels shows no signs of diminishing. The steamer Cabotia is the only freighter definitely reported lost, while the A. D. Anderson is also believed to have met with disaster.

Grain Shipping

Large quantities of grain have left Montreal since the opening of navigation, and many steamers have relieved the situation to some extent. Italian vessels in particular have been prominent in the port, the largest steamer of this nationality, the Moltke, and probably the largest vessel to have come up the St. Lawrence since the war commenced, having paid two visits to take on cargoes of grain. Boats chartered by the French and other Foreign Governments, including a number of Belgian ships, have also arrived for cargoes.

While so much grain has been exported as to exceed last year's total, all the elevators in the harbor are still practically filled to capacity and only awaiting more steamers. Receipts in the Harbor Commissioners elevators alone total over 13,000,000 bushels in excess of 1915, total receipts including the Grand Trunk elevator being 73,435,630 bushels, and total exports 66,072,619 bushels.

Lake Boats Scarce

A scarcity of lake boats, many of which have been transferred to ocean or coast service, has been more pronounced than in 1915, but, according to present indications, there will be no falling off in cargo tonnage carried from the head of the lakes, although between 1915 and 1914 the drop totalled nearly 1,000,000 tons. At this writing, the figures are a little short of the total for 1915.

While there has been less grain coming, considerably more coal has reached the port by the canal route, and again owing to the scarcity of tonnage, very much less coal has been shipped from Nova Scotia, the number of coastal vessels to come up the St. Lawrence falling far short of last year. According to canal records, grain receipts show a drop of 13,000,000 bushels (35,685,288 bushels for 1915 as compared with 22,405,114 bushels) while the amount of American coal which has already come down by way of the canals approximates 1,500,000 tons, or half as much again as last year's receipts.

Wheat Figures

During October less than a fourth of the wheat arriving in Montreal came down by lake boats and barges as compared with the same month of 1915, (1,400,999 bushels as compared with 5,500,000.) Corn and flax seed totalled for this period last year over 68,000 and 41,000 bushels respectively, neither of which came down at all this year. Oats and barley, however, show proportionately big increases, the former 1,238,000 bushels against 475,000; and barley 474,000 against 211,000 bushels. No flour at all was carried during the month as compared with 49,000 sacks a year ago.

Customs collections are expected to show a substantial advance over last year's receipts, and figures so far compiled show that they are already in excess by approximately $4,000,000 of the twelve months' collections for 1915-16.

CANADIAN GOVERNMENT DREDGE LAUNCHED

DREDGE NO. 18, the largest of its kind yet built in Canada for the Department of Marine and Fisheries, was launched on Saturday, Nov. 18, from the shipbuilding yard of Canadian Vickers, Ltd., Maisonneuve, Montreal, by Mrs. Hazen, wife of Hon. J. D. Hazen, Minister of Marine and Fisheries. The dredge, which has been built for the use of the Department in making the North Channel, Beaujou, about 35 miles below Quebec, passable for big ships, is 292 feet in length, 48 feet in breadth, with a depth of 20 feet 6 inches, and is capable of dredging at a depth of 57 feet, the capacity being 1,500 tons per hour.

At a luncheon at the Ritz-Carlton Hotel after the launch, Hon. Mr. Hazen gave an address on shipbuilding in Canada, many prominent citizens being present. "During the present year," he said, "real and substantial progress has been made in the direction of establishing the shipbuilding industry on a permanent and profitable basis." He referred to plants at Montreal, Toronto, Collingwood, Port Arthur, and Vancouver, splendidly equipped for the construction of steel ships and in addition he mentioned the successful building of wooden vessels in Nova Scotia. The Minister said a large number of the highest class of auxiliary schooners for use in the timber trade between British Columbia and Australia and the Orient, are under construction in Vancouver.

Canadian yards have secured a number of contracts for ships for Norway. Following the outbreak of the war the Dominion Parliament decided to prohibit the export of ships from Canada without first obtaining approval from the Government. Permission is, however, being granted for the export of ships to be constructed as follows:—

Messrs. J. Coughlan & Son, Vancouver, B.C., three large steel freighters, with a carrying capacity of over eight thousand tons each, for a price of approximately $1,200,000 each; the Wallace Shipyards, Vancouver, four large steel freighters; the Western Drydock Company, Port Arthur, three full canal-size steel freighters; Thor Iron Works, Toronto, two full canal-size freighters; Polson Iron Works, Toronto, two steel freighters of approximately 3,000 tons capacity, and two of 4,250 tons capacity; Canadian Vickers, Ltd., Montreal, two steel freighters of about 7,000 tons capacity; the Nova Scotia Steel & Coal Co., New Glasgow, N.S., two steel freighters.

Conditions upon which permission for the export of these vessels has been given are that at no time during the continuation of the war shall the ships engage in any enemy trade, and that no demand shall be made on Great Britain for material, machinery or labor in connection with the construction of these ships.

Mr. E. M. McDonald, M.P., Pictou, N. S., also addressed the gathering.

BARGE "MAGGIE"—"HONOREVA" COLLISION

IN P. C. Bonham vs. the steamship Honoreva, the two appeals to the Supreme Court of Canada, one from the judgment of Judge Cassels in the Exchequer Court and the other from that of Justice Dunlop in the Admiralty Court, were allowed with costs. This interesting case was vigorously contested in the Canadian Courts for about two years, as it had a very important bearing upon the navigation of the Soulanges Canal, which is one of the main arteries connecting the St. Lawrence River with the Great Lakes.

Collision Data

At noon, June 27, 1914, the barge Maggie, owned by the plaintiff, was coming down the Soulanges Canal as a tow of the tug Frank Jackman. As the tug and tow were nearing Red River bridge, the steamship Honoreva was observed approaching the Red River bridge from below. She was nearer the bridge than the tug and tow and her pilot thought he had the right to pass through the bridge opening in midchannel, in spite of the fact that the tug had demanded, by one blast of her whistle and the Honoreva had agreed by her reply of one blast, to give the right to pass port a port, as provided by the Rules of the Road governing inland navigation. The whole controversy seemed to hinge on whether the first steamer to arrive at a drawbridge has the right to pass through the bridge opening in midchannel first.

Mr. Justice Dunlop, the Admiralty judge, took the view that the steamer arriving first had the right of way and dismissed the plaintiff's claim for the loss of the barge as a result of the collision which occurred immediately above the bridge. An appeal was taken to Mr. Justice Cassels, in the Exchequer Court, who affirmed Mr. Justice Dunlop's decision, dismissing the plaintiff's claim and sent the counter-claim of the Honoreva back to Mr. Justice Dunlop for reconsideration. The Admiralty judge reaffirmed his previous decision, maintaining the counter-claim of the Honoreva. An appeal was taken direct to the Supreme Court of Canada from this decision. This was the first time in the history of Canadian Admiralty law that an appeal of this kind was advised and taken, and the question of jurisdiction was very vigorously contested, both in the Exchequer Court and in the Supreme Court of Canada, which affirmed its jurisdiction to hear this appeal on the counter-claim and consolidated it with the main appeal from the decision of Mr. Justice Cassels.

Five Judges Unanimous

The five judges of the Supreme Court of Canada were unanimous in allowing the consolidated appeal, with costs in all the courts below, and in condemning the Honoreva and her bail for all damages occasioned by the loss of the barge Maggie. Mr. Justice Idington, with whom the Chief Justice concurred, said:

"The letter of the law, to say nothing of the reasonable conduct called for under the circumstances on the part of the pilot, had he realized, as he should have done, the actual situation, demanded that the respondent ought to have been, at her point of progress where the collision took place, on her own side of the channel. For those reasons I think the appeal should be allowed. The tug was smaller than respondent, and the insolence of the stronger, who will not be just, cannot be too often rebuked and made to bear the consequences of disregarding the rights of others."

In the course of his judgment, with which Sir Louis Davies concurred, Mr. Justice Anglin said:

"On the whole, in my opinion, the only proven fault which clearly contributed to the cause of the collision was the flagrant breach of the Honoreva of the provisions of Article 25 of the Rules of Navigation, which required her to keep the starboard side of the fairway. While the utmost skill may not have been displayed in the management of the tug and the barge when collision was imminent, while it may be that if there had been a bridle between them, as well as a tow rope, the collision would have been avoided—I think this extremely doubtful—there is not, in my opinion, any sufficient proof of fault such as would impose liability upon them. I would for these reasons, set aside the judgment of the learned judge of the Admiralty Court and the confirmatory judgment in the Exchequer Court, and would direct that judgment be entered for the plaintiff, declaring him entitled to the damages for which he sues and costs of this action, as well as of the appeals to the Exchequer Court and to this court. The counter-claim should also be dismissed, with costs throughout."

FALLING-OFF IN CANADIAN-BUILT SHIPPING

NOT since the phenomenally dull period of 1896 and 1897 has the volume of tonnage built in Canada been so low as that turned out during the last fiscal year, when only 13,497 tons were built. The lowest figure on record is that representing the output of 1896, which was 10,753, and in the following year it was 12,058. Next in order comes 1916, when 13,496 tons were built. It would appear superfluous to add that at no time has the country been in greater need of tonnage not only for lake but ocean purposes. The steady decline of the shipbuilding industry may be gathered from the following comparisons of tonnage built and registered in Canada:

Fiscal Year.	Tonnage Built.	Tonnage Registered.
1875	188,098	204,002
1880	68,756	64,982
1890	39,434	53,853
1900	28,544	40,443
1910	24,059	33,383
1915	45,721	55,384
1916	13,497	102,239

On the other hand, the tonnage calling at Canadian ports has steadily increased except for the two years since the outbreak of war.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Norman S. Thrasher, purchasing agent of the Wellman-Seaver-Morgan Co., Cleveland, O., has accepted the position of purchasing agent of the Western Dry Dock & Shipbuilding Co., Port Arthur, Ont. Mr. Thrasher was formerly purchasing agent of the American Ship Building Co., Cleveland, O.

Captain Thomas Berger, of the tug Scionda, owned by La Compagnie Generale d'Enterprise Publique, employed in bringing scows loaded with sand from Niagara-on-the-Lake to Port Weller, was drowned at the mouth of the Niagara River on November 7, slipping between his tug and a scow. His home was in Levis, Que.

Capt. Thomas Lynch, a well known mariner of the Rideau and St. Lawrence waterways, died at Westport, Ont., last month end. For many years he owned and commanded the steamer Freemason, which ran between the Bay of Quinte and Montreal, thence up the Ottawa and Rideau Rivers to Westport and Kingston. His last command was the steamer Rideau King. This he relinquished four years ago, when he retired.

Captain Andrew G. Braes, best known in Canada, and particularly in Montreal through his long connection with the Allan Line as commander of the Parisian and Tunisian, died at Fernhill, Pollokshields, Scotland, on October 28. He came into the service of the Allan Line when the latter purchased the State Line, then running between Glasgow and New York. He had been commodore captain of the State Line, being in command of the State of California up to 24 years ago. He had been with the State Line from its inception in 1880. He spent a year and a half in service connected with the Boer War as captain of the Allan liner Mongolian. Then he commanded in turn the Parisian and the Tunisian, until five years ago the health of his wife more than his own decided him to retire. About three years ago he became ill, and it was discovered that he had heart trouble. The final end was, therefore not unexpected. He was about 70 years of age when he died.

LICENSED PILOTS

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

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Secretary—Jas. Morrison, Montreal.

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Secretary—M. R. Nelson, 1184 Broadway, New York.

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SHIPMASTERS' ASSOCIATION OF CANADA

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

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J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I., Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

James Chase Wallace, former president of the American Ship Building Co., died on Oct. 31, at his home, in Lakewood, O., after an illness extending over several months. Mr. Wallace was born May 23, 1865, a son of the late Robert Wallace, who was one of Cleveland's pioneer ship builders. The younger Wallace followed in his father's footsteps and devoted his life to the building and operating of ships. With his father he organized the Cleveland Ship Building Co., and afterward effected the organization of the American Ship Building Co. Mr. Wallace began his business career in 1881 by starting his three years' service as a machinist. When the Cleveland Ship Building Co. was formed in 1887, he was placed in charge of the drafting room In 1890 he was named assistant superintendent of the company and in 1893 he was chosen vice-president and general manager. When the American Ship Building Co. was formed in 1899, it taking over the plant of the Cleveland Ship Building Co., Mr. Wallace was named vice-president and general manager of the new concern. This position he held until early in October, 1904, when he was chosen president of the American Ship Building Co., in succession to A. B. Wolvin. He retained the presidency until Sept. 23, 1914, when Edward Smith, since deceased, was elected.

B.O.T. CERTIFICATES FOR INTERNAL COMBUSTION ENGINE OPERATION

THE regulations for issuing these certificates contain the following provisions, says the *Marine Engineer and Naval Architect.* The holders will be entitled to serve in the grades specified as engineers of vessels propelled by internal combustion engines using oil, spirit, gas or othtr similar substance, but not by steam. Candidates

1916 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jeanne Mance Street	O. L. Marchand,	2378 Clark Street
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th St. E., Vanc.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	29 Parrsboro Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	Alfred Roebuck	22 Kent Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	36 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

for second-class certificates must not be under twenty-one years of age. They must have served at least four years in the works where internal combustion engines are made or repaired. Two years of this time must be spent at fitting, erecting or repairing these engines; the other two years may be spent at other branches or at an approved technical school, with, however, modified allowances as:—Fitting, erecting, repairing or turning, full time; drawing office or pattern making one-half time, with a maximum allowance of one year; planing, slotting, shaping and milling, one-third time; boiler-making or repairing, one-half time; smith work, one-half time, with a maximum of one year; coppersmith work, one-third time, with maximum of six months; school, two-thirds, with maximum of two years. Should the apprenticeship—which cannot be counted before the age of fifteen—be extended to five years or more, four years at turning, followed by one year at fitting or erecting may be accepted. Service as journeyman will qualify.

An alternative provision for special application is made to embrace those whose experience in motor-engineering may be considered as equivalent to what has been specified with additional three months' service at least on marine internal combustion engines, either in the works or on regular watch in the main engine-room, for each year which is specified. In lieu of the workshop service, six years' sea experience on regular watch in the engine-room of a suitable foreign-going or nine years in a home-trade vessel, will be accepted. In addition to the workshop service specified, candidates must have eighteen months' experience on regular watch at sea on the main engines of a foreign-going or twenty-seven months in a home-trade vessel, propelled by internal combustion engines of not less than 370 b.h.p.

For the first-class certificate, the candidate must not be less than twenty-two and a half years of age. He must have served for eighteen months with an internal combustion engine second-class certificate on regular watch and in full charge on the main engines of a foreign-going vessel propelled by internal combustion engines of not less than 560 b.h.p., or second in charge of a watch of three, or third in charge of a watch of six or more engineers. The sea service required on a home-trade vessel of similar power is twenty-seven months as chief engineer, or three years as second, or three years nine months as third or fourth engineer. An allowance of half the qualifying time specified may be made to engineers who have served in steam-propelled vessels, with a maximum of six months. Allowance may also be made for watch-keeping engineers in motor-driven vessels of the b.h.p. specified, engaged in lake, river or other service.

The examination questions are based upon the working principles, construction, running, overhauling and repairing of internal combustion engines, and auxiliary machinery, also properties of various oils and fuels used. A knowledge of steam boilers and auxiliary machinery found in vessels propelled by internal combustion engines is also necessary. Holders of steam certificates can have these endorsed on passing the examination for internal combustion engines, so also the holders of the new certificates may have theirs endorsed for steam.

Lagonda Boiler Tube Cleaners is the title of a very attractive catalogue L-9, just off the press, issued by the Lagonda Mfg. Co., Springfield, Ohio. The catalogue comprises 36 pages illustrating and describing the different sizes and types of "Lagonda" boiler tube cleaners for removing various kinds of boiler scale from all sizes and types of tubes. Several pages are devoted to cleaners for special uses such as economizers, evaporators, condenser tubes etc. The catalogue also deals with other boiler room specialties such as multiple strainers, grease extractors, automatic cut-off valves, automatic lubricaters, and reseating machines. A comprehensive description is given of each specialty accompanied by illustrations. A complete list of tube cleaner repair parts, is included with illustrations. A copy of this catalogue will be gladly sent to any engineer interested, upon request.

Morrison's Marine Lock-Up Twin Pop Safety Valve

is especially constructed to meet the demands of marine work. A notable feature is the complete encasement of the spring, protecting the valve from the action of the escaping steam. Either valve can be reached without disturbing the other, it being only necessary to drop steam long enough to bolt a blank flange on in place of the disabled valve.

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Can be furnished in **single** or **twin** types, both of which are endorsed by the Canadian Board of Marine Inspectors. The valve has Lock-up attachment, to prevent tampering and is fitted with suitable casing gear. Will open and close within three pounds of given boiler pressure.

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MARINE ENGINEERING of Canada

A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World. Published by The MacLean Publishing Co., Limited

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CAR FERRY ONTARIO No. 2

Development of Ocean Service Shipbuilding in Canada--II.

By " Artificer "

In addition to the widespread requisitioning of vessels for transportation purposes by the Allies, the war attendant and normal merchant ship losses and the many months' almost complete cessation of new construction on the part of the latter, the merchant marine of neutral countries has had the misfortune to become to a large extent the target for enemy submarine activity. All nations have suffered in this respect, hence the almost feverish anxiety being displayed by shipping interests to have the losses made good at the earliest possible moment.

CANADIAN-OWNED FREIGHTERS BUILDING

THE Thor Iron Works, Ltd., Toronto, have secured contracts for building two steel freighters for James Playfair, of the Great Lakes Transportation Co., of Midland, Ont. The vessels will be built to the highest class of Lloyd's Register for salt water service, with the fit-out in accordance with the requirements of the British Board of Trade. The vessels, one of which is now under construction, will be of single deck type, with poop, bridge and forecastle. They will have a steel deckhouse on the bridge deck, a chart room on top of deckhouse and navigating bridge. The transverse system of hull construction will be employed, and the propelling machinery will be located amidships, with coal bunkers in the wings. There will be two cargo holds, with two hatches to each, No. 1 hold extending from collision bulkhead to boiler room bulkhead, and No. 2 hold from engine room bulkhead to after peak bulkhead. The double bottom will be 3 feet deep, and will extend from collision bulkhead to after peak bulkhead. The principal dimensions of each vessel hull are:—Length over all, 261 feet; length between perpendiculars, 251 ft.; breadth moulded, 43 ft. 6 ins., and depth moulded, 28 ft. 2 ins.; dead-weight capacity, including bunkers, 4,300 tons.

Hull Construction

The vessels will have flat keel plate, also bilge keels, the latter extending for about 100 feet in length amidships and of 9 ins. depth. They will have straight stems and elliptic sterns. All hull and tank plating will be of steel, construction generally being in conformity with Lloyd's requirements. The propeller frames will be of wrought iron or cast steel. The rudders will be of steel plate. The hull will be divided by four watertight bulkheads, equipped with watertight doors. A screen bulkhead is placed between boiler and engine room from tank top to main deck. The shafting tunnel will be of steel plate riveted and caulked watertight, one section being arranged for the easy removal of the shafting. The engine foundations will be of built-up plate and angles of substantial construction, while those for the boiler will consist of longitudinal plate girders. Suitable accommodation is provided for the navigating officers, engineers and crew, same including bath rooms, lavatories, hospital, etc.

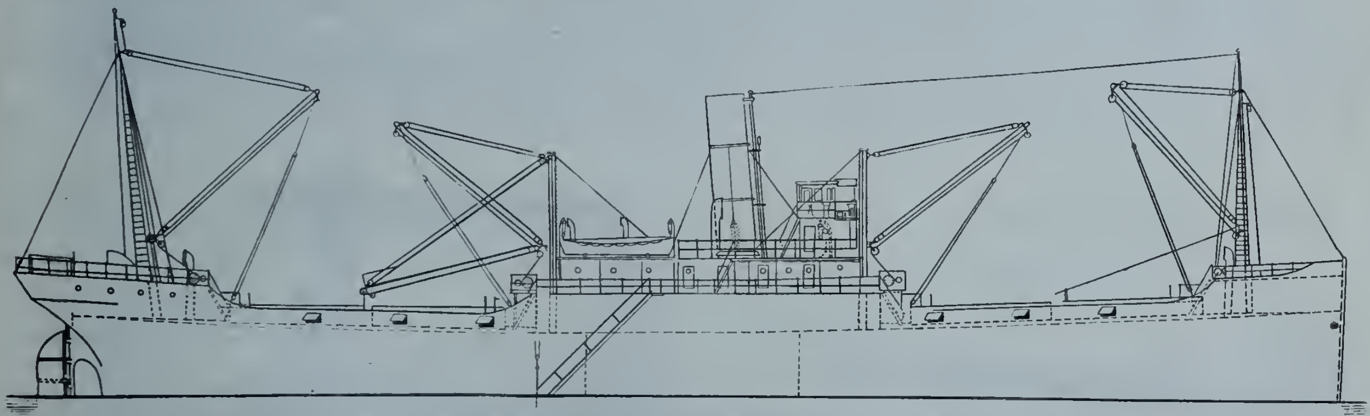
Ship Deck Machinery

Each vessel will be equipped with National stockless anchors and chains; an 8-in. x 8-in. steam windlass, fitted with hand attachment and friction brakes; and a steam steering engine in after end of engine casing. The steering engine will be capable of putting the rudder over to 35 degrees with vessel loaded and engines running full speed. Four steel cargo masts with pine booms, each capable of lifting four tons, and five 7-in. x 12-in. reversible single drum, two-speed steam winches will constitute the cargo handling equipment.

Main Engines.

The main engines will be of the triple expansion, surface condensing type, each of the three cylinders working on a separate crank placed at an angle of 120 degrees. The H.P. cylinder is 20 ins., the I.P. 33 ins., and L.P. 54 ins. in diameter, with a stroke of 40 inches. The maximum indicated horse-power to be developed will be 1,300. The high pressure cylinder will have a piston valve, while the other two will have double ported slide valves, equipped with relief frames, the low pressure having a Lovekins assistant cylinder in addition. The piston rods, connecting rods and crossheads will be of open-hearth steel. Stephenson's link motion with double eccentrics, a steam reversing as well as hand reversing gear, constitute the valve operating mechanism features.

An Edwards single-acting air pump, also a double-acting circulating pump, are arranged in connection with the surface condenser. Two boiler feed pumps, each of which can supply the boilers when operating at full power, also two single bilge pumps, form part of the make engine structure. The crank shafts are built up in three interchangeable sections, with solid forged couplings and cast steel crank webs. The propeller shafting is to be of steel or wrought iron, with solid couplings. The propeller will be cast iron, four bladed, in one piece.



STEEL FREIGHTERS FOR OCEAN SERVICE, BUILDING BY THOR IRONWORKS, LTD., TORONTO.

Boiler Room Installation

The boiler room of each ship will contain two regular marine type, single-ended, three furnace boilers of 190 pounds per sq. inch working pressure. The furnaces are of Morrison suspension type, the grate area and heating surface being 126 sq. ft. and 5,250 sq. ft. respectively per ship, with no provision made for other than natural draught. The boilers are each 14 ft. 6 ins. mean diameter by 11 ft. long. Other boiler room equipment includes a vertical feed water heater capable of raising the hot well temperature of the boiler feed water to 210 degrees with a back pressure of 6 pounds, also a steam operated ash hoisting apparatus.

Additional auxiliary equipment in the engine room includes:—One horizontal, duplex type, 7½-8-7 ins. ballast donkey pump; one horizontal, duplex type, 6-4-6 ins. boiler feed pump; auxiliary condenser and pumps to take care of exhaust steam from windless, winches, dynamo engine, ballast and independent boiler feed pumps; steam-driven dynamo, switchboard, etc. The ships will be electrically lighted throughout, the different sections being under control from the engine room switchboard. The main and auxiliary machinery is being supplied by the John Inglis Co., Strachan Avenue, Toronto.

UNITED STATES SHIPBUILDING

AMERICAN shipyards, says the *Iron Age*, in November completed 100 vessels of 90,636 gross tons, thereby breaking all records for a single month in the history of the industry. All of these ships were officially numbered for the American flag except two steamers of 7,847 gross tons for Norwegian owners. There were also built and officially numbered during the month 9 yachts, aggregating 237 gross tons. The November output brings the production of American shipyards for the 11 months of the calendar year 1916 up to 1,115 vessels, aggregating 522,083 tons, a figure materially in excess of the record for this period in any year. The following table shows the distribution of the month's construction by material and rig.

	No.	Gross Tons.
Wood:		
Sailing	4	2,168
Steam	8	1,959
Gas	29	1,749
Unrigged	31	8,962
	72	14,838
Metal:		
Sailing	..	......
Steam	19	59,238
Gas	5	7,257
Unrigged	2	1,219
	26	67,714
Totals:		
Sailing	4	2,168
Steam	27	61,197
Gas	34	9,006
Unrigged	33	10,181
Grand total	98	82,552

Atlantic and Gulf shipyards constructed more than one-half the November output, completing 57 vessels of 48,476 gross tons, of which 9 aggregating 35,605 tons were of steel and 48 aggregating 12,871 tons were of wood. The output of the Pacific yards included 10 vessels, aggregating 4,427 gross tons, of which one vessel of 3,820 tons was of steel and nine aggregating 607 tons were of wood. The yards on the Great Lakes turned out 18 vessels of 28,757 tons, of which 15 of 28,280 tons were of steel and three aggregating 477 tons were of wood. Thirteen vessels, aggregating 892 tons, were built on the Western rivers, one of 9 tons being of steel and twelve, aggregating 883 tons, of wood. Of the two vessels built for Norwegian owners, one was of 5,729 tons and the other of 2,118 tons.

During November, 39 American vessels, aggregating 29,809 tons, were transferred to foreign flags, these vessels ranging from small gas yachts of 9 tons to steel steamers of 2,667 tons each. Since July 1, 1916, returns show the sale of 87 American vessels of 106,689 gross tons to foreigners, of which 40,601 were sold to Norwegians, 19,689 to French, 11,276 to Japanese, 11,140 to Uruguayans, 7,955 to Dutch, 7,370 to British, 2,357 to Nicaraguans, 1,393 to Spanish, 1,083 to Cubans, 974 to Russians, 962 to Portuguese, 838 to Danish, 366 to Venezuelans, 232 to Dominicans, 222 to Mexicans, 202 to Costa Ricans, and 28 to other foreigners.

ELECTRICALLY-OPERATED GANTRY AT THOR IRON WORKS

AT the shipbuilding plant of the Thor Iron Works, located at the foot of Bathurst Street, Toronto, an electrically-operated gantry has recently been constructed over the shipway, which greatly facilitates the shipbuilding operations being carried on there. The gantry, the general features of which are shown in the illustration, has a capacity of 20 tons, a span of 60 feet, and one outboard arm of 15 ft. in length. It has a clear lift of 56 ft. from hook to rail; is of double girder type construction, with operating cage suspended from trolley. The speeds and scope of service are as fol-

ELECTRICALLY OPERATED CANTRY AND SHIPBUILDING BERTH AT THOR IRON WORKS, TORONTO.

lows:—Hoist, 30 ft. per minute; travel, 250 ft. per min.; and traverse, 200 ft. per min. The hoist motor is of 35-h.p.; travel motor, 35-h.p.; and traverse motor, 7½-h.p., all operating on 500 volts, direct current. The gantry is fitted with electric brakes in addition to mechanically operated brakes, and all the gears are of cast steel. The gantry is especially well equipped with electric light clusters for night work.

In addition to a view of the gantry, the photograph shows one of the two steel freighters now on hand under construction.

H. M. C. TORPEDO BOAT "GRILSE"

AFTER being to all intents and purposes officially posted as lost, while on a voyage from Halifax, N.S. to Bermuda, B.W.I., H. M. C. torpedo boat Grilse has arrived at Shelburne, N.S., badly battered by wind and sea, and with unfortunately the loss of six of her crew. The vessel left Halifax at 3 p.m. on Monday, Dec. 11, and, as bad weather was encountered the same night, it was decided to put into Shelburne, for shelter.

On Tuesday the storm continued, and, as night advanced, it became more severe. As a result, the Grilse began leaking and commenced to settle dangerously by the head. Wireless calls were sent out for assistance. Tremendous seas piled over the little craft, smashing her hatches and flooding her engine room.

The Grilse carried three boats, two of these were smashed and carried away, her life rafts also being washed adrift. Hope was given up, but while power remained, the wireless flashed out S.O.S. signals, and the news that the vessel was sinking. By this time she had reached what was thought to be the latitude and longitude sent out in the final call. It is now evident that there was some inaccuracy, the Grilse not having reached quite so far to the northward as the waters searched by the vessels which rushed to her assistance.

Helplessly the little craft drifted before the sixty-mile an hour gale but, to the surprise of those on board, kept above water. One tremendous sea smashed on board, destroying a deck house and carrying away her mast. The six sailors who lost their lives went over under that terrific weight of water, while at the same time the wireless outfit became a hopeless wreck. Shortly after midnight the storm somewhat abated and although there were occasional gusts and a succession of heavy seas it became evident that the weather was moderating; the men in consequence took heart and worked hard to save their ship.

Although she settled heavily by the head it was evident when daylight came that her tanks were saving her and that the leak could be controlled. Finally the engine room was cleared of water, and the engineers were able to get steam, and make port as already stated.

HIS MAJESTY'S CANADIAN TORPEDO BOAT "GRILSE" AS SPEED PLEASURE YACHT.

The Grilse as will be noted from the illustration is a low lying, high speed craft of some 175 feet long. She was built by Thorneycroft for an American owner along torpedo boat destroyer lines, being later purchased by J. K. L. Ross of Montreal, by whom she was handed over to the Government following the outbreak of war. On being refitted she went into service as a speed patrol boat.

SHIPPING SEASON AT PORT McNICOLL

DURING the season of 1916 there arrived at Port McNicoll, 226 grain-laden vessels, while 106 trips have been made by the C.P.R. steamers with passengers and package freight. The elevator has handled nearly 44,000,000 bushels of grain, about twice as much as any other port, and there have been handled through the sheds 282,433 tons of flour and feed, eastbound; and 69,100 tons of package freight westbound.

The following vessels are lying in the harbor with cargoes aboard:—J. F. Taylor, 185,500 bushels wheat; G. A. Graham, 147,000 bushels wheat; W. G. Morden, 735,250 bushels wheat; Valcartier, 297,760 bushels corn; Haggerty, 519,500 bushels wheat; Masaba, 87,000 bushels wheat; Sarnian, 188,000 bushels wheat; Paipoonge, 126,950 bushels wheat; Mariska, 142.980 bushels wheat; E. B. Osler, 332,950 bushels wheat; Emperor, 545,026 bushels wheat; Philbin, 350,000 bushels wheat; Davidson, 342,000 bushels wheat; Sultana, 135,000 bushels wheat; Adams, 305,700 bushels oats; Congdon, 372,000 bushels oats; Garretson, 368,000 bushels oats. Total, 5,230,616 bushels afloat.

Next season, if the C.P.R. builds the proposed addition to the elevator, and another tower, handling in the neighborhood of 75,000,000 bushels will be possible.

SHIPPING SEASON AT HEAD OF LAKES

A COMPARATIVE statement issued by the Board of Grain Commissioners of Canada giving the total quantities of grain shipped from Port Arthur and Fort William during the seasons of navigation 1913, 1914, 1915 and 1916, shows that during the past year a record has been created both in number of cargoes shipped from the head of the lakes and in the quantity of grain carried. In 195 Canadian vessels, and 565 American vessels, 253,969,500 bushels of all kinds of grain were carried east. This is an increase of 341 cargoes and 52,200,000 bushels over 1915, and is more than double the amount shipped in 1914. In 1914. American vessels carried only one-third of the amount of grain shipped from the head of the lakes, but in 1916 Canadian vessels carried only 13,000,000 bushels more than American vessels.

In the season just ended, 565 United

States vessels carried 84,397,000 bushels, as against 138 vessels carrying 23,000,000 bushels in 1914. For the period September 1 to December 13, 1916, 65,680,000 bushels were shipped to Canadian and United States ports, in 474 vessels, of which amount 39,500,000 bushels went to United States ports and 26,180,000 busbels to Canadian ports.

LIGHTSHIP TENDER "VERCHERES" SINKS AND IS RAISED

THE sinking of the steamer Vercheres, one of the vessels under the control of the Montreal Agency of the Department of Marine and Fisheries, has had a remarkable sequel, of which the denouement is that the boat is now in Sorel undergoing repairs and little the worse for her temporary immersion under the waters of the St. Lawrence. The Department of Marine officials give the chief praise for this quick work to the skilful management of Alphonse Desrochers, general superintendent of the Sincennes-Macnaughton Co., and four of his men.

The steamer Vercheres left Three Rivers about 4 o'clock on Wednesday morning, December 6, on her way to Sorel. When one mile and a half up the river she encountered a quantity of ice, which in the darkness could not be avoided. The force of the collision with the ice knocked boles in the hull of the Vercberes, and the boat immediately began to fill. In a short space of time she sank in about 18 feet of water. Captain Marchand and the crew of 14 managed to get off in safety, taking most of their private effects with them. Captain J. D. Weir, superintendent of lighbts, who was being taken to Sorel by the boat, also escaped. He hastened immediately to the signal service station at Three Rivers, and called up C. A. Le Bel, acting agent for the Montreal agency of the Department of Marine. The latter communicated the news of the accident in turn to the Deputy Minister at Ottawa, who immediately authorized the Montreal Agency to get all tbe assistance available for raising the boat, if possible.

Arsene Larocque, president of the Sincennes-Macnaughton Co., who happened to be in Sorel at the time, offered the use of his wrecking plant and two large lake barges to the Department. This generous offer was accepted, and on tbe evening of the day on wbich the accident occurred this plant was towed down to where the Vercheres was lying. Operations started early on the morning of Thursday. What had all the appearance of a difficult job was soon well in hand, Alphonse Desrochers and four of his best men, assisted by the crew of the Vercheres, succeeded in a few hours of hard and trying work in raising the boat completely out of the water and in patching the holes in the hull. The boat was then towed to Sorel, where she is receiving the necessary repairs, which, according to report, are not of a very serious nature. The Vercheres has been used for the lights, and not for the buoys, by the Montreal agency, but her chief use in the past has been as an inspection steamer. She has been mostly at the disposal of the Chief Engineer at Ottawa.

STEAM BOILER BRIEFS

LEAKAGE through brickwork settings can be lessened by giving the walls two coats of Portland cement wash, followed by one coat of cold water paint to brighten them up.

In water tube boilers, the heating and grate surface should not be less than a 50-to-1 proportion respectively, the type and also the height of the same class boiler often necessitate, however, a considerable variation of the above. With cylindrical boilers, one-third of this can be used, because the ratio of evaporation per sq. ft. of heating surface is approximately for water-tube type 3.5, and for cylindrical type 10; therefore $\frac{10}{3.5} = 2.86$, say, 3.

The area and air spaces of fire grates vary with the class of fuel to be burned. Hard coal can be burnt on ordinary grates; slack requires larger grate area but smaller air spaces, while wood requires both larger grate area and larger air spaces comparatively.

Small diameter tubes provide greater heating surface and give increased evaporative efficiency in a given space, but are disposed to foul quicker than those of larger diameter.

Water softening provision for all types of boilers cannot be too strongly urged, an efficient type of water softening apparatus installed making for certain economy. Less tban three degrees of bardness by Clarke's scale should not, however, be pressed.

The value of large steam room is greatly over-rated, yet if too small, the steam—particularly at high pressures—will sweep up the water in the form of spray and cause priming. Other causes of priming are foul water and operating with too high a water level. Too much water space makes for slow steaming and consequent waste of fuel at starting, but provides a great reserve of steam for sudden calls.

SHIP'S OPTION—WEIGHT OR MEASUREMENT

WHEN a steamship company makes a freight quotation "per ton, weight or measurement, ship's option," it is understood that the charge will be made on a weight basis if the weight of the shipment exceeds the cubic measurement of same, or on a measurement basis should the cubic measurement exceed the weight, while practically all the foreign steamship lines quote freight rates on the basis of 2,240 pounds or 40 cubic feet measurement to the ton.

Disputes are frequent between shippers and steamship companies in regard to the cubic measurements of packages. Sometimes tbese are the result of careless measurement on the part of the shipper, but usually the dispute arises because of the fact that steamship companies, as a rule, measure all packages in a rectangular way, so that all tbose irregularly shaped are estimated as though rectangular and are figured by tbeir greatest dimensions. The reason for this is that irregular packages are not easily stowed, as it may be difficult to find smaller packages to fill in the vacant spaces, in wbich case "dunnage" or ship's lumber has to be used to keep the cargo from shifting.

Although a steamship company may have been charging on a certain kind of goods according to a weight basis, they may at any time change to a measurement basis, and this occurs for many reasons. For instance, a steamship company may find that competing lines, either from this country or from Europe, are charging on this class of goods on a measurement basis, and in order to equalize rates the change is made to a measurement basis.

There is no doubt of the steamship company's right to charge on either basis, whichever will give them the most revenue, and the steamship companies do not hold themselves to maintain their rates for any length of time, unless by freight contract arranged between them and the shipper for a stated time. This latter is the only way that a shipper can protect himself against change of rates. During 1915, steamship companies in almost every trade increased their rates, owing to the demand for space and the higher rates they had to pay for the use of steamers which they charter. This made it almost impossible to arrange freight contracts for any length of time.

There is no dividing line as to weight or measurement, above or below which a steamship line will charge on one basis or the other. It is simply a matter of figuring out on which basis they will make the most money, and unless a contract has been arranged, quotations are supposed to apply only on the steamer loading at that time, or the next steamer to be placed on the berth.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

"HOCHELAGA"-"ETOILE" COLLISION

ARISING out of a collision in the St. Lawrence near buoy 49 between the steel, screw propelled vessel Hochelaga, owned by Furness Withy & Co. and under charter by the Dominion Coal Co., and the wooden paddle wheel propelled vessel Etoile, owned by its master, a Dominion Wreck Commissioners' Court of Inquiry found that the master and pilot of the latter vessel invited a collision by their deliberate violation of Articles 19, 21, 23, 25, 29, Rules of the Road, and cancelled the master's certificate held by both. While censuring the master and pilot of the Hochelaga for an apparent share in the collision, sympathy was expressed for them because of the anxious and nerve-racking experience through which they had been made to pass wholly on account of the ignorance displayed in the navigation of the Etoile.

"Borghild"-"Oriole" Collision

In reference to a collision south of Seal Island near entrance to the Bay of Fundy, on Aug. 12, between the Norwegian S.S. Borghild and the American fishing schooner Oriole, owned by Wm. H. Jordan & Co. of Gloucester., Mass., an investigation by the Dominion Wreck Commissioner's Court of Inquiry resulted in the master and mate of the Borghild being found in default for violating Article 16 of the Rule of the Road, the master of the Oriole being equally in fault for carrying a press of canvas, violating first paragraph of Article 16, and thereby inviting the collision. Both vessels being of foreign register the Court had no further jurisdiction than to make above observations.

"Fremona" Stranding

In view of the circumstances attending the stranding of the S.S. Fremona at South Point, Anticosti Island, a Dominion Wreck Commissioner's Court of Inquiry on Aug. 29, arrived at the opinion that the master was derelict in carrying out the responsibilities of his position, and failed to follow sailing directions governing navigation in the St. Lawrence. While reprimanding him severely for lack of caution, prudence and seamanlike carefulness, the Court, on account of conditions brought about by the war, did not deal with his certificate. The court considered that aids to navigation around Anticosti cannot be bettered and any additional aids would be misleading.

"Primrose"-"Turbinia" Collision

A collision between the Ferry Steamer Primrose, and the steel, triple screw, turbine driven steamer Turbinia in Toronto Harbor on Aug. 13, was investigated by a Dominion Wreck Commissioner's Court of Inquiry. The Court suspended the certificate of the master of the Turbinia for one year, finding him in default regarding the Rules of the Road revised and passed by Order in Council Feb., 1916, Article 22 and stating that any loss of life would have justified them in calling upon the Civil Courts to deal with the matter. The master of the Primrose was found to have wilfully failed to observe provisions of Article 30 and flagrantly violated Rules 35, 37 and 38, and his certificate cancelled. Granting of mates' certificates to both masters was recommended, while violation of Section 97 of the Canada Shipping Act was charged against the Primrose for not having a properly certificated mate when licensed to carry 900 passengers.

"Matatua" Stranding

The stranding of the twin screw, steel vessel Matatua owned by Shaw, Saville Co., of London, bound from Sydney, C.B. to England, was the subject of investigation by a Dominion Wreck Commissioner's Court of Inquiry at Halifax, N.S., Sept. 14. Possible compass errors due to injuries sustained by the boat at St. John following a series of explosions, and also the fact that the master had suffered a paralytic stroke a few days after taking over the vessel in her injured condition at that port were given every consideration by the Court, which in view of the fact that he failed to even consult the Sailing Directions, take soundings, or diminish speed after being in a fog for a number of hours found that the ship was carelessly navigated in view of the possible conditions, and that the master was not in a fit condition to accept his responsibilities. While expressing sympathy with him, his certificate was suspended for three months, and no fault was found with the other officers of the ship.

"Kalibia" Stranding

An investigation by a Dominion Wreck Commissioner's Court at Montreal on Oct 5, was held, into the causes of the stranding of the single screw, steel vessel Kalibia, owned by the Clyde Shipping Co., Glasgow, which happened at a point near Fox River, on the South Shore of Gulf of St. Lawrence, Sept. 24. The Court expressed satisfaction with the methodical manner in which the navigational functions and duties had been carried out, and gave every credit to the master for his unbroken record of many years, but severely reprimanded him for failing to take a cast of the lead when he found his observations were not coinciding. No fault was found with navigating from a chart of 1890 as it was the only one obtainable, and the master's certificate was not dealt with.

"Indutiomare" Stranding

The circumstances attending the stranding of the steel built, single screw vessel Indutiomare of Antwerp, on White Horse Rock, Magdalen Islands, Gulf of St. Lawrence on Aug. 19, were investigated by a Dominion Wreck Commissioner's Court of Inquiry at Halifax, Oct. 13, which found that the master was over-confident in his compass, and failed to follow his originally intended course after making cross bearings which did not coincide, failing, in their opinion, to exercise the judgment which is expected from a ship master. A copy of the report was submitted for transmission to the Belgian Government as the Court had no jurisdiction over the certificate of a foreign ship master.

"Samuel Marshall" Stranding

As a result of the evidence submitted before a Dominion Wreck Commissioner's Court of Inquiry at Quebec, Oct. 23, into the causes whereby the Samuel Marshall stranded at the entrance of the Saguenay River, Sept. 18, the possible misinterpretation of a pilot's duties and responsibility was considered to have caused the master and the mate to forget their duties to a regrettable extent. The end of the navigation season nullifying the effect of a suspension of certificate, the Court imposed a fine of two-thirds of expenses on the master, and one-third on the mate, the pilot being fined $100 for default in discharging certain obvious duties.

"Twickenham" Coal Chute Collision

In arriving at a finding regarding damages sustained by a coal chute at No. 2 Dominion Coal Co., Sydney, N.S., Oct. 11, a Dominion Wreck Commissioner's Court of Inquiry found that the master of the Twickenham should have issued orders to unmoor his ship, and, when once clear from wharf, then handed over the responsibility to the pilot, that certain action of the master was but an error of judgment, and cautioned him as to future care.

"Chambly" Foundering

A Dominion Wreck Commissioner's Court of Inquiry at Sorel, P. Q. investigated the causes of the sinking of the tug Chambly of the Department of Marine, near Cap a la Roche, River St. Lawrence. Oct. 4, attributed the accident to bad judgment on the part of the First and Second Captains, the existing system of employing officers in these capacities being too ambiguous as regards individual responsibilities, and condemned them to each pay half of the cost of the investigation. The attention of the Department of Marine was also called to evidence regarding the unseaworthiness of the vessel and the questionable manner in which certain repairs were carried out.

"Haulwen" Stranding

The stranding of the single screw steamer Haulwen owned by W. & C. T. Jones, Cardiff, on Aug. 12, near Point Citrouille in the St. Lawrence River, was the subject of investigation by a Dominion Wreck Commissioner's Court of Inquiry at Montreal, Nov. 23, the Court finding the pilot committed an error of judgment due to lack of forethought, the question being purely one of seamanship which every pilot is expected to be acquainted with, and imposing a fine of fifty dollars and costs of the investigation.

"Hungerford" Stranding

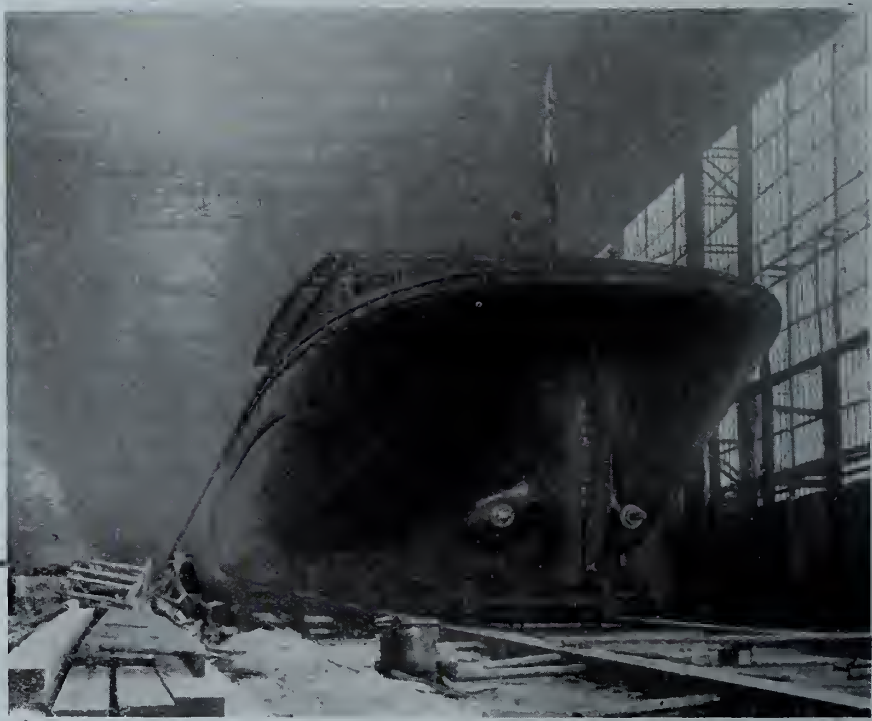
As a result of the evidence submitted before a Dominion Wreck Commissioner's Court at Montreal, Nov. 24 regarding the causes of the stranding of the Hungerford on Nov. 19, the Court treated the occurrence as a minor offence, the pilot to pay the cost of investigation. The Hungerford was a steel built, single screw vessel of 12 knots, bound for Montreal in water ballast, and touched ground off Champlain. River St. Lawrence. The smoke from pulp mills in the vicinity of Three Rivers was regarded as a menace to safe navigation, and was shown to have contributed to the accident under investigation, while the practice of extinguishing binnacle lights to facilitate the work of the pilot was deprecated when there was an absence of leading objects or temporary obscuration by fog, mist or smoke as in this case.

"LEGAL," "NET" AND "GROSS" WEIGHTS

IN arranging consular documents for some countries, it is necessary to state the "net" as well as the "gross" weight. The "net" weight represents the weight of the merchandise in its original package. The "gross" weight is the entire weight of the package as shipped. The New York Journal of Commerce gives the following definitions of net, gross, and legal weight:—

Strictly speaking the net weight of goods is simply the weight of the goods themselves, without any package or container of any kind. The gross weight is the weight of the goods and the package containing them. "Legal" weight is determined in such manner as the particular law in question may direct, and there is no other way to find it except by consulting the law. While net weight is, strictly, such as we have defined it to be, some tariff laws give it a special definition for the purpose of assessing and collecting duties. This is true also of "legal weight," and it is sometimes true even of gross weight, thus actual weight of the goods freed from all packing, receptacles, or wrappers." In other cases dutiable net weight does not include the weight of any common exterior cover, receptacle, package, wrappers or packing, but includes all interior or immediate receptacles. The Mexican definition of "legal weight" is more or less common and is as follows:—

By legal weight is meant the weight of the goods, together with that of their interior packing, such as wrappers, receptacles, card board and wooden boxes, tins, etc., inclosed in the outer packing case in which imported. When goods duitable on legal weight are not inclosed in interior packages, but in one outside inclosure only, the intrinsic weight of such goods will be considered as legal weight. The important point is to note that the law of the particular country in question must be consulted as to the definition of these terms in the tariff act of that country.



STERN VIEW OF C. G. DREDGE IN CANADIAN VICKERS SHIPBUILDING SHED PREVIOUS TO LAUNCHING.

REBABBITTING BEARINGS.

IN pouring a bearing on a horizontal shaft, says a writer in the Dodge Idea, cut out only one of the old bearings at a time, using the old one in order to hold and clamp the mandrel. If it is worn out of true or too thin to hold the mandrel in the right position, put in shims of paper as may be required in order to line it up as wanted, then clamp the mandrel in the position it is desired to assume when finished. This being done, wrap the shaft of the bearing to be poured with oiled paper, and around this wrap a twine string spirally from one end of bearing to the other. This holds the paper snug, and, when the bearing is poured and the string removed, there remains a nice oil channel.

Arrange to pour both the top and bottom of bearing at the same time. This is done by cutting the liners so that they fill out to the shaft nicely, afterwards cutting some notches at intervals for the metal to pass through to fill the bottom. This will leave small strips of metal between the top and bottom, but a thin cold-chisel, driven carefully between the ends of the cap and bottom portions of the bearing, will easily break them apart. Make a funnel of clay or putty around the hole, to hold a surplus of metal, so as to get the benefit of the pressure to insure complete filling of the bearing. The bearing is now ready for the metal.

In heating be sure to not get it too hot. This, in my opinion, is where some of the springing trouble starts. Heat until the metal will just brown a dry pine stick. If both the top and bottom are poured at the same time, there is little, if any, danger of springing the shaft. The metal, of course, falls on the top of shaft, but it immediately starts down the sides, following around the shaft on both sides and passing through the openings in the liners into the bottom. By pouring as fast as it will run, it is only a few seconds until the metal in the bottom has reached the shaft. tending to heat it and offsetting the heat on top. The metal falling down both sides of shaft has tended to spread the heat over a considerable part of its circumference, and the time which has elapsed is so short that there is very little heat absorbed by the shaft. anyway. With the offsetting heat coming from the bottom, it will only be once in many operations, if at all, that trouble will be encountered from this cause. When one bearing has been poured as directed, cut out the next, using the new one by which to clamp and line the shaft, and proceed as above.

J. W. Norcross, managing director of the Canada Steamship Lines, has been elected a director of the Sterling Bank of Canada.

H. H. Drake has been appointed shipping master of the port of Halifax, the office having become vacant by the death of Howard Bligh. Mr. Drake has been in the office for twenty-five years.

Canadian Vessel Registry.—On March 31, 1916, the total number of vessels on the Canadian register was 8,631 of 1,215,021 gross tons measurement, while the total tonnage transferred during the twelve months ending on above date was 25,834. represented by 24 vessels.

C. G. S. Dollard Going East.—The Canadian Government steamer Dollard, which has been the principal buoy boat for the last three years in the employ of the Department of Marine and Fisheries under the Montreal Agency, has left Three Rivers to take up work in the lower provinces for Department of Marine and Fisheries.

COLLINGWOOD SHIPBUILDING PLANT CHANGES HANDS

THE sale of the Collingwood Shipbuilding Co.'s assets and plants at Collingwood and Kingston, has been finally ratified by the shareholders, the actual transfer of the property taking place on January 2, 1917.

The new company is yet to be organized by the purchasers, Messrs. H. B. Smith, J. W. Norcross and R. M. Wolven, and will have a capitalization of $2,000,000. The bond holders will be represented on the board by two directors elected from amongst themselves. Under the agreement no dividend will be paid on the ordinary stock until after the bonds have been provided for both as to interest and sinking fund.

The original company have now on hand a large amount of work, and it is understood that contracts for several steel vessels for Norwegian interests have practically been closed. The prospects for the town look exceedingly bright, especially as the shipyard will undoubtedly be in a position to keep the plant working to capacity all the time. Another dry dock of larger dimensions than either of the present ones will be one of their early requirements, and construction of this may be expected during the coming year.

The retiring directors of the Collingwood Shipbuilding Co. are Messrs. Thos. Long, Capt. Alex. McDougall, S. H. Lindsay, H. B. Smith, Simon Dyment, M. P. Byrnes, and T. P. Long. Mr. H. B. Smith will probably be the president of the new company, and S. H. Lindsay, secretary-treasurer.

Shipyard Establishment

The Collingwood Shipbuilding Co. was organized in 1901, largely through the instrumentality of the late J. J. Long, by absorbing the old Collingwood Dry Dock Co., which had been building wooden boats for some years. The members of the old concern, Messrs. Thomas and John J. Long, Chas. Cameron, Capt. P. M. Campbell and H. B. Smith, continued in the new organization, with Capt. McDougald, of Duluth, as a new and active spirit. Hugh Calderwood, the well-known authority on shipbuilding, was the first manager. He was succeeded by J. M. Smith, the present superintendent of the Duluth Shipbuilding Co., he being in turn succeeded by J. S. Leitch, the present manager.

The company has built a number of the finest passenger and freight steamers on the Great Lakes. During sixteen years the plant has been in operation, there have been built and delivered 49 steel vessels and numerous notable and extensive rebuilding and repair jobs. There are at present on the stocks undergoing construction a 550-foot bulk freighter, and two large oil vessels for ocean service.

The company also operates two large shell departments, which have been working to capacity for the past two years.

About six years ago the company acquired the Kingston Government Dock, which they fully equipped, and it has done a profitable business both in construction and repair work.

LOWER ST. LAWRENCE IMMUNITY FROM ACCIDENT

FOR the first time during the last sixty-two years, not a single accident to a seagoing vessel occurred during the past year in the River St. Lawrence between Quebec and Father Point. A letter has been received by the Minister of Marine, Hon. J. D. Hazen, from Lloyd's Canadian agent, Henry Fry & Co., of Quebec, which calls attention to this fact and compliments the department. The letter is as follows:

"Our firm has represented Lloyd's of London, Eng., during the past 62 years and twenty-six other bodies of underwriters in the United Kingdom, Continent of Europe, as well as America for an average of over forty years, and we beg to inform you that it has afforded us much pleasure to report to them that during the past year not an accident to a seagoing vessel has occurred in the River St. Lawrence between Quebec and Father Point.

"This is highly satisfactory, and we believe due to the many improvements made by your department through dredging and additional lighting of the river. Allow us to suggest that the above fact should be brought under the notice of underwriters generally. We might add that we cannot find another instance of a like character in our official records kept during the past 62 years."

MONTREAL SHIP WORKMEN'S MUTUAL BENEFIT ASSOCIATION

THE twelfth annual report of the joint committee of management of employees and workmen forming the Ship Workmen's Mutual Benefit Association of the Port of Montreal, which was organized twelve years ago, shows that the society has made substantial progress during the season just closed. Starting with 112 working members, it has reached the maximum of 315, the largest number enrolled since the year 1909. During the twenty-seven weeks of navigation that it has been open, members who paid ten cents per week were entitled to receive five dollars per week for thirteen weeks in case of accident while employed on the wharves or on shipboard, and three dollars per week in case of sickness, and their representatives in case of fatal accident, would have been entitled to $100 benefit.

The twelfth annual report presented at the general meeting held in the Sailors' Institute recently shows that $536.85 was received in contributions from the workmen, that $191.63 was paid in cash benefits to sick and injured members during the season, and that $257.52, equal to 20½ weeks' dues of ten cents, were available for dividends to members who continued their payments to the close of the season.

There are many French-Canadians among the members, and the committee of management includes: Messrs. Jos. Pare, Edward Moyen, and Arch. Thompson, as representatives of the workmen, and Messrs. David Isles and C. H. Lemessurier, as representatives for the honorary members and employers. W. J. McGiffin, marine superintendent of the Allan Line, is the chairman.

The annual meeting for the election of officers will take place prior to the opening of navigation in May next. The honorary members of the society who supplement the weekly subscriptions of the workmen in a regular proportion include the principal representatives of the Allan, Dominion, Cunard, Donaldson, Thomson, Furness, Manchester, South African, New Zealand Shipping Co., Nova Scotia Steel & Coal Co., and Dominion Coal Co. lines of steamships.

QUIT LAKE SERVICE FOR OCEAN

IN addition to 55 lake vessels which passed through the Lachine Canal during the 1916 season on their way to a new life on the ocean, there were eighteen other vessels bound on the same errand, also thirteen tugs and steam yachts. Of the tugs and yachts an uncertain number returned to the Great Lakes, but, even of these, at least some have undertaken duty on the Atlantic Coast. The total tonnage of these vessels, excluding the tugs and yachts, approximates 70,000 net tons. Their absence from the lakes and the absence of those vessels which passed out in 1915 as well, have made quite a difference to inland navigation, and stimulated the grain-carrying trade of the railways as well. After the war a number may return to the trade in the Great Lakes, for which they were built, and for which they are well adapted, but some will certainly never return. German submarines and mines being likely to operate to that effect.

The following list of vessels and their tonnage which have passed through the Lachine Canal will indicate the volume of the seaward movement, the 13 tugs and steam yachts referring to being omitted:

Huron, 1,309; Minneapolis, 1,221; St. Paul, 1,221; Pere Marqurtte, No. 5, 1,296; W. H. Brown, 1,874; Lackawanna, in two parts, 1,995; Guataunger, 1,503; Mooremack, 856; G. R. Crowe, 2,347; Selwyn Eddy, in two parts, 1,613; Joahn Mjelde, 1,275; Gisla, 1,259; Maryland, in two parts, 1,900; Munisla, 1,144; Gaute, 1,259; Nordeal-Morge, 1,281; Albert Soper, 268; Resolute, 219; Gijones, 1,275; Wm. Edwards, 973; Gettysburg, 744; Moonlite, 1,411; Corsica, in two parts, 2,300; Westland, 1,259; L. E. Hines, 790; E. L. Fisher, 805; Newwalk, 881; P. L. M., No. 4, 1,325; Sunge, 97; Sekstant, 1,492; Twilite, 1,580; H E. Gilley (tug), 49; G. C. Cleveland (tug), 91; United States, 811; P. L. M. No. 5, 1,325; Levisa, 1,259; Dawnlite, 1,601; Russell Sage, 456; Comber, 97; G. Y. Gowan, 176; Norfolk, 1,780; Lar Fostmans, 1,257; tug White Cap, 97; Manta, 2,081; Sunlite, 1,980; Begna, 1,803; Philadelphia, 1,780; Sioux, 1,260; Ozama, 1,259; Thorgerd, 1,486; Sarnolite, 1,588; tug Tide, 97; Blaamyra, 1,484; Carib, 1,259; R. P. Ranney, 1,441.

The following sailing vessels have also gone through:

Keewatin, 199, schr.; Arundell, 257, barge; Quickstep, 268, schr.; W. D. Hassack, 272, schr.; W. K. Moore, 618, barge; Charles Marshall, 195, schr.; drege No. 9, G. L., 100, dredge; Connelly Bros, 698, barge; Baltic, 369, barge; Minerva, 212, schr.; Stanlite, S.O. Co., 1,411, schr.; Arundel 198, schr.; A. Anderson, 680, barge; Ananac, 496, barge; C. H. Hackley, 197, schr.; J. A. Holmes, 167, barge; S. O. Co., No. 82, 2,070, barge; Daylite, 1,601, schr.

GREAT LAKES MENACED BY CHICAGO DRAINAGE CANAL

THE danger to the commercial interests along the Great Lakes, due to the withdrawal of water by the Chicago Drainage Canal, has been urgently called to the attention of the United States Congress by Secretary of War Newton D. Baker. He informed Congress that action is imperative "unless there is to be an enormous loss to the navigation of the Great Lakes." In explaining the serious aspect of a situation vitally affecting a region which originates more freight than any like expanse of territory in the world, Seceretary Baker said:—

"Application was made to the War Department for permission to connect the canal with the south branch of the Chicago River, thus reversing the flow of that stream and diverting its waters from Lake Michigan into the drainage canal, and thence into the Mississippi river.

"A conditional permit was granted in 1901, authorizing the diversion of 4,167 cubic feet seconds, and this amount has continued to be the legal limit. The drawing of water from the Chicago river into the canal affects the general navigation of the country on account of the tendency of such diversion to lower the level of the waters of the Great Lakes.

"More water is now being diverted than is authorized, and it seems quite clear that with the growth of population in Chicago, the authorities of the sanitary district contemplate still larger diversions than those already made, perhaps to the extent of 10,000 cubic feet seconds. This, it is estimated by the United States Lake Survey, would lower the waters of Lake Michigan and Lake Huron nearly 7 inches, Lake Erie about 5½ inches, and Lake Ontario about 4½ inches, mean lake levels, the reduction being much greater at low-water periods.

"The effect of such a lowering of lake levels would obviously be enormous losses to navigation interests and would necessitate large expenditures by the general government for the restoring and re-organization of river and harbor improvements on the Great Lakes and their connecting waters, for which already appropriations aggregating more than $90,000,000 have been made.

"A related project to the Chicago Drainage Canal is the canal proposed to be constructed for commerce from Chicago through the Desplaines River, and applications for permits have been made to the War Department to authorize this construction. The matter has also been considered in Congress but no action taken.

Vessel Interests Threatened

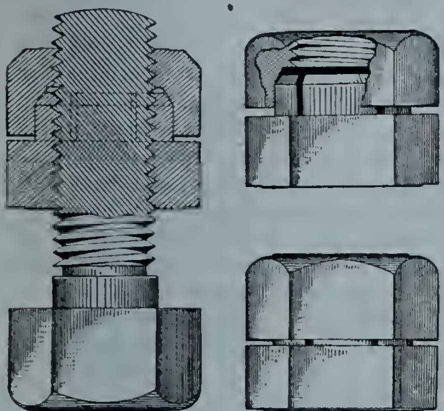
"This subject ought to have the immediate attention of Congress, for, while it is asserted on behalf of the project that there is no intention of making further withdrawals of water from the Great Lakes for the purpose of the canal than are largely being withdrawn for the drainage canal, yet it seems quite clear that should this commercial waterway be established and constructed, and then a greater volume of water needed for its operation than was originally estimated, the pressure to allow additional lake diversions would be very great, and if it be true in fact that such diversions are prejudicial to the navigation interests of the Great Lakes and the eastward flowing waters, the relative advantages of the two uses of these waters ought to be seriously weighed and finally determined by the legislative body."

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Axuiliary Product Achievement

NEW TYPE LOCK NUT

A LOCK nut in which the dead and not the moving member is locked has been developed by the Western Screw and Lock Nut Co..



NEW TYPE LOCK NUT

San Francisco, Cal. With this nut no washers are required and the nut can be locked at any point on the bolt, an arrangement which makes it possible to take care of oscillating or pulsating movements. The bolt and nut can be used over and over several times, it is claimed, without damaging the threads. It is possible also to fit a United States standard nut tightly on a bolt having a V-thread, and it is also possible to make a nut tight on a loose fit bolt.

The lock nut consists of two members. The lower, which is the nut proper, is similar in form to a regular hexagon nut and has four flexible finger members projecting from its upper surface. When the upper or locking member is screwed down, these fingers are compressed and the nut is frozen, as it were, to the bolt. The locking action is secured by turning the locking member firmly. When locked in place this member is counted on to help carry the load. One of the features of the lower member is a number of threads which provide capacity to carry the load. The nut is released with an ordinary wrench, and when the locking member is released it will of course move as one of the ordinary type.

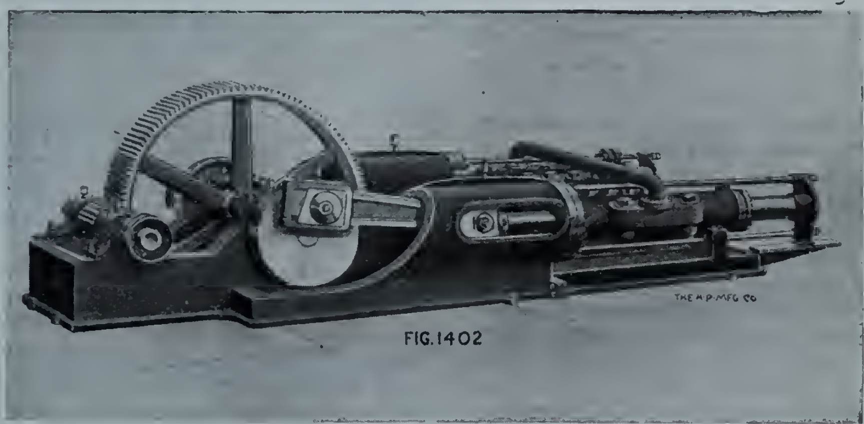
A recent test of the holding power of one of these nuts was made by bolting two pieces of ¾ x 1½-in, bar steel together with a ¾-in. lock nut and one of the ordinary type placed 6 in. apart. The steel bars were suspended on heavy springs and an air hammer delivered 500 blows per minute with a force of 25 lbs. midway between the two bolts. It is stated that the ordinary nut was jarred off in a short time, thus leaving the strain on the other bolt. After 9 hours of continuous jarring at this rate the lock nut was still gripping firmly.

STEAM TURBINE DRIVEN INDUCED DRAFT FANS

THE high degree of perfection now obtainable in high-speed reduction gears is resulting in the adoption of steam turbines as the motive power for such items of boiler house equipment as induced draft fans. The simplicity and reliability of steam turbines renders them very suitable for boiler-room service, but until high-speed gears were commercially available, their relatively high speed had prevented the extensive use of steam turbines for the fans referred to, as such fans on account of the large volumes handled are usually of relatively slow speed.

Two recent installations of turbine-driven fans are shown in Figs. 1 and 2, the turbines being built by the Terry Steam Turbine Co., Hartford, Conn., and the fans by the Green Fuel Economiser Co., Beacon, N.Y. These fans are driven through herring-bone reduction gears, the unit in Fig. 2 having a ratio of 6.78 to 1, with a maximum pinion speed of 3,630 revs. per min. Fans for this class of work require from 25 to 50 horse-power, and give a draft of from 2 in. to 5 in.

On account of the warm location the bearings of both fan and turbine are water cooled. The turbines are of the Terry helical flow type in which the steam is passed repeatedly through a single row of moving buckets, this design permitting the use of a wheel made from a single steel forging with buckets milled from the solid.



MOTOR-DRIVEN HORIZONTAL HIGH PRESSURE HYDRAULIC PUMP.

MOTOR DRIVEN FOUR PLUNGER HORIZONTAL HYDRAULIC PUMP

THE hydraulic pump illustrated by the accompanying photograph is a recent addition to the extensive line of high pressure hydraulic pumps built by The Hydraulic Press Mfg. Co., Mount Gilead,

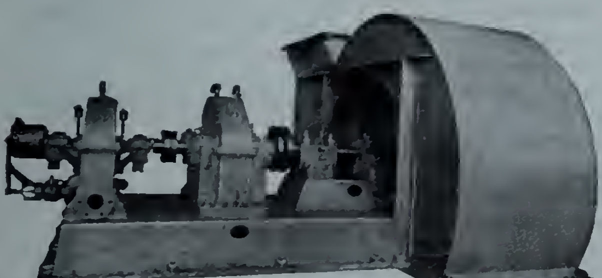


FIG. 1. STEAM TURBINE-DRIVEN INDUCED DRAFT FAN WITH GEAR REDUCTION.

FIG. 2. FAN WITH CASING REMOVED, SHOWING CONSTRUCTION OF IMPELLER.

Ohio. It is of the horizontal, four-plunger type and designed to fill the requirements for a simple, heavy duty hydraulic pump for supplying a large volume of water or other fluid against a high pressure.

It is designed so that it may be equipped with sixteen different sizes of plungers ranging from 1⅜ inches to 5 inches in diameter, advancing by quarter inches. The water cylinders are made of forged steel for the highest pressures. For the medium pressures, 1500 to 2900 lbs. per sq. in. inclusive, cast steel is used, and for the lowest pressures the cylinders are semi-steel. The pressures range from 9500 to 700 lbs. per sq. in., and the water capacity from 24 to 326 gals. per min. All sizes have bronze valve seats and bronze or nickel steel valves.

The pump illustrated is built for motor drive, requires 150 horse power to operate, and is equipped with a flexible shaft coupling for motor connection. Any motor having a speed of from 450 revs. per min. to 750 revs. per min. may be used. The speed of the shaft is 60 revs. per min. The stroke of the plungers is 16 inches, the two cracks being set at 90 degs., so that a more uniform flow of fluid may be obtained than with a triplex pump.

At all points where the strain and wear is most severe, the parts such as main bearings, connecting rod ends, cross-head guides, valves and valve seats, are of easy access for adjustment and replacement. The frame or pump bed consists of two heavy castings securely bolted together. the cross-head guides and main bearing containers being machined in the frame. This insures perfect alignment and gives the most rigid construction. The pump occupies a floor space 18 feet, 8 inches in length by 6 feet, 10 inches in width. While the illustration shows the pump equipped with a spur gear and pinion, it may also be equipped with a herringbone gear and pinion.

Amalgamated Engineering & Drydock Co.—The insistent demand from neutral countries for ships to replace the vessels being destroyed by the war has revived interest in the Amalgamated Engineering & Drydock Company, which a few months previous to the outbreak of war had plans completed for the construction of the largest drydock, shipbuilding and engineering plant on the British Columbia coast at Burrard Inlet. J. C. V. Spratt, of the Victoria Machinery Depot, Victoria, B.C., was at the head of the undertaking. It is stated that the company is now going ahead, and has placed contracts in the United States for the erection of the plant, which will cost approximately $5,500,000.

CANADA'S MERCHANT MARINE

THE report for the year ending with March 31 last of the marine branch of the Department of Marine and Fisheries indicates that, with other interests, those connected with ship owning suffered somewhat during the early war period. On December 31 of the years 1914 and 1915 the tonnage of vessels on the registry books of Canada, by provinces, was as folllows:

	1914	1915
New Brunswick	55,522	56,219
Nova Scotia	135,053	125,567
Quebec	259,143	267,897
Ontario	314,660	312,971
P. E. Island	10,029	11,518
British Columbia	147,192	144,835
Manitoba	7,999	7,480
Yukon	2,295	2,295
Saskatchewan	529	530
	932,422	929,312

Vessel Registry

The number of registered vessels at the end of 1914 was 8,772 and at the end of 1915 it was 8,757. In the latter year, the average tonnage per vessel was 106. The figure is small from a variety of causes. The official list of shipping in Canada includes practically every craft of greater size than a skiff. Some are credited with one ton only; some run into the thousands. Again in New Brunswick and Nova Scotia the fishing industry calls for the services of a goodly number of small sailing vessels, running from 30 to 100 tons register. In Nova Scotia especially these keep a number of yards busy. Lunenburg has 300 names on its list, the average tonnage being about 90. Digby has 104, Yarmouth 216, and Halifax 324. Chatham, N.B., has 389, and St. John 225. Fishing vessels also add considerable to the records of British Columbia. Ontario is the large vessel owning province, chiefly because of the construction and purchase of steamships for the service of the Great Lakes. Its record fell off last year, however, the 38 craft added to the register of its ports measuring only 4.709 tons, while Quebec, with 49 new names on its list, added 7.790 tons to the total of 246 vessels of 18,832 tons of new registrations in all Canada.

Canadian Owned Craft Vicissitudes

The greatest tonnage of vessels owned in Canada is credited to the year 1878, when 7,169 names had a registered tonnage of 1.333.015. The lowest figures are noted in 1906, when 7.512 vessels of 654.179 tons were recorded. Between the two years mentioned one of the great revolutions in the shipbuilder's craft took place. Due in part to the sense and enterprise of a prominent Montreal shipping man, Sir Hugh Allan, steel began to replace both wood and ordinary iron as a material for marine construction. British builders led in the substitution, and as improved methods of producing steel led to its being cheaper, it took and still easily holds the lead.

There was no steel producing industry in Canada on a scale large enough to make this country a factor in the industry in its new phase, therefore, as the Tyne-built tramp steamer replaced the wooden wind-jammer, the amount of shipping owned or registered here went down. The development of commerce on the Great Lakes helped to bring about a revival. Steamships for the service were built in Great Britain, came with cargoes to Montreal, where they were cut in two, floated up the canals to Lake Ontario or Lake Erie and there rejoined and started in the carrying business. Shipbuilding plants at Toronto and on the Georgian Bay also turned out steam vessels from 2.000 to 7.000 tons gross measurement. Most of the steel has had to be imported, not much more than the assembling being done in Canada.

There is now, however, a possibility, even a probability, that steel ships for ocean as well as inland service will be regularly built in this country. The steel works, especially in Nova Scotia, are being steadily developed, and judging by what they accomplished during the past two years, they will have no difficulty in the near future in providing the material for modern ship construction. At New Glasgow, where the Nova Scotia Steel & Coal Co. has its rolling mills, an experimental vessel is well on the way to completion, giving promise of success and the creation of a new local industry.

At Montreal Canadian Vickers have established a plant which has already shown in a remarkable way its capacity for doing work of the most delicate character, as well as that which ordinarily falls to a general shipbuilding yard. In British Columbia also plans are under way for new building. Within the next few years it is reasonable to expect that there will be a considerable addition to the merchant shipping, built and owned, as well as registered, in Canada, to the advantage of all concerned, commercially and industrially.

St. Lawrence Ship Channel.—The ship channel of the St. Lawrence River for 220 miles below Montreal has been continuously undergoing improvement; lighthouses, lighted buoys, semaphores, wireless telegraph, signal stations, pilotage arrangements having not only been established but their service efficiency developed to the fullest extent.

Steam Saving Auxiliaries of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that steam-driven auxiliaries aboard ship continue to increase in number, and that they are being designed and constructed to meet in the most effective manner, both ordinary and special service applications, this series of articles describing and illustrating at least the more important types of such apparatus seems to us more or less timely, both from the point of view of familiarizing engine and boiler room staffs with the products of different manufacturers, and that of their acquiring a closer intimacy with specific detail arrangement. relative to operation, maintenance and periodic overhaul.

FEED WATER HEATERS—I.

THE economy in operating expense which can be effected through the use of feed-water heaters is so great that few plants of any size are now erected in which heaters are not installed. Apart from fuel economy, the evil effects on a boiler structure resulting from the feeding of cold water are so serious that a feed-water heater may be justified on that account alone. The most important benefit, of course, and one which makes the most direct appeal is the saving of fuel, which is brought about by the use of exhaust steam.

With an initial temperature of 65 degs. Fahr. and a final temperature of 200 degs., which is easily obtainable with any modern apparatus using exhaust steam at atmospheric pressure, there is a saving of about 12 per cent. in fuel, and it may be assumed generally that every 11 degs. that feed-water is heated by exhaust steam means a saving of 1 per cent of fuel.

An exhaust steam feed-water heater possesses an advantage in fuel-saving over injectors or live-steam apparatus, because these latter draw live steam from the boiler, and an exhaust heater makes use of a product which has already done useful work.

Types of Heaters

Two general types of heaters are in use—the open and the closed, the selection of either type being occasionally influenced by local conditions, such as condensing or non-condensing engines, existing filtering and purifying equipment, quality of feed-water, and proportion of steam available for heating purposes.

Where exhaust steam is available in sufficient quantity the open type heater can be used to advantage, as the temperature attainable in closed heaters is not so high for the same amount of steam, due to the fact that in the closed type the heat has to pass through the metal separating the steam from the water.

Open type heaters consist of a square box-like chamber divided into suitable compartments, containing various parts of the apparatus. The upper portion contains a series of trays, over which the cold feed water passes while falling from the top to the bottom of the heater. Some types have an additional connection through which the hot discharge from steam traps, reheaters, engine drains, heating systems, etc., can be added to the contents of the heater. The water level in the heater is maintained at the required height by a suitable float valve, and a similar valve controls the overflow, preventing the level from rising too high should the pump be at rest for an extended period and the heater continue to receive drip water, etc.

Removing Soluble Impurities

When the feed water contains scale forming salts which are precipitated at temperatures lower than 200 degs. Fah., the traps receive this deposit, being removed through access doors for periodical cleaning. Matter in suspension which is not separated by heating is removed from the water by means of a filter containing coke or some similar mechanical medium, while in some cases chemical purifiers are combined with the heater, completely removing such scale-forming impurities as are not disengaged and separated by the previous action of the heater.

Closed Type Heaters

Closed type feed-water heaters are generally constructed with a cylindrical shell, the closed ends of which are connected with tubes or pipe coils of various shapes and sizes. End covers enclose the tubes and carry connections to admit either steam or water to the inside of the tubes as may be called for in the design. When the feed-water passes through the tubes and the steam is admitted to the shell, the heater is known as being of the water tube type. When conditions are reversed and the steam flows through the tubes, the heater is said to be of the steam tube type.

Necessity for Oil Separation

Owing to the fact that the exhaust steam and water are mixed together in open heaters, it is absolutely necessary that oil and grease carried over from the engine be completely removed before the steam enters the heater; otherwise these substances are liable to be returned to the boiler along with the feed water, giving rise ultimately to trouble. Closed heaters avoid this trouble altogether, because the steam and suspended oil particles never come in contact with the feed-water, although in some cases the drain from closed heaters may be connected to the hot well in the case of condensing engines, in which event a feed water filter would be necessary to remove the oil before the water was returned to the boiler.

For this reason, oil separators are an important part of all open heaters, while the lack of a separator on a closed heater would detract still further from the efficiency of the latter type, as the presence of a thin film of oil on the tubes would add to the loss of heat during transmission from one side of the tube to the other. Oil separators therefore are nearly always used with exhaust heaters, and generally form a component part of the apparatus.

Manner of Connection

Both open and closed heaters may be connected to the exhaust pipe in a variety of ways, which apply equally to both types. The "thoroughfare" method in which all of the steam passes through the heater makes it necessary for the oil separator to remove all of the oil carried over in the exhaust. On the other hand a single connection may be made to the main exhaust pipe and the vacuum formed in the heater may be relied on to induce a flow of steam into it.

These methods only apply of course to non-condensing plants. Where a condensing plant is working under a vacuum of say 26 in. the exhaust steam temperature would be betwen 120 and 130 degs. with a condenser discharge temperature of about 100 degs. In this case modern practice frequently calls for steam-driven auxiliaries and their exhaust steam, after performing useful work in air pumps, feed-pumps, etc., can be used in an exhaust heater of suitable type, raising the feed-water temperature from about 70 degs. to over 200 degs. Should sufficient exhaust steam be not available from the auxiliaries, a closed type heater may be inserted in the main exhaust pipe and a temperature of over 100 degs. obtained in the feed-water before it is passed into the final heater. Modern plants, however, have the proportion of their various units balanced so that this latter arrangement is not of frequent occurrence.

"Webster" Feed-Water Heater and Purifier

This apparatus is built by Darling Brothers of Montreal in a number of types adaptable to a large variety of conditions, different types being illustrated in Figs. 1 to 3.

Fig. 1 is a cut away view showing part of the exterior and interior of a Class "EC" heater which is built in a range of sizes from 500 to 10,000 horsepower. The steam supply enters through the large flange connection on the upper part of the heater at the left, the plates immediately behind the opening being the baffles of a "Webster" oil separator which form part of the heater construction. The operating principle is a combination of centrifugal force, impact and adhesion of the entrained oil against the vertical steel baffles, one edge of which is curled back against the flow of steam so that the particles of oil in the steam are arrested in their flight, falling by gravity into the receiving well and thence to waste through a drain pipe. The two latter items can be observed in the illustration, the drain pipe being fitted with a check valve and globe valve.

The steam supply is drawn into the "Webster" heater through a branch from the main exhaust pipe with a gate valve in it, which obviates the difficulty attendant upon taking all of the exhaust steam with its entrained oil through the heater.

The feed water enters through a float controlled valve on top, the connecting rod to adjustable counterweight and float being shown at the right of the heater. A waterseal distributing-trough receives the feed-water from the inlet pipe, the purpose of the water seal device being to prevent any back pressure steam which might accumulate from entering the cold water supply and causing water hammer.

Overflowing from the trough in an even sheet, the water is distributed over a series of oppositely inclined, finely perforated copper trays, arranged one above the other as shown in the illustration, so that the water in its downward course falls from one tray to the other, and any water which does not pass through the perforations will fall upon the projecting upper edge of the next tray. This arrangement maintains the water in a finely divided state while in the heating chamber allowing it to mingle with and be thoroughly heated by the surrounding steam, with a consequent liberation of gases and precipitation of solids.

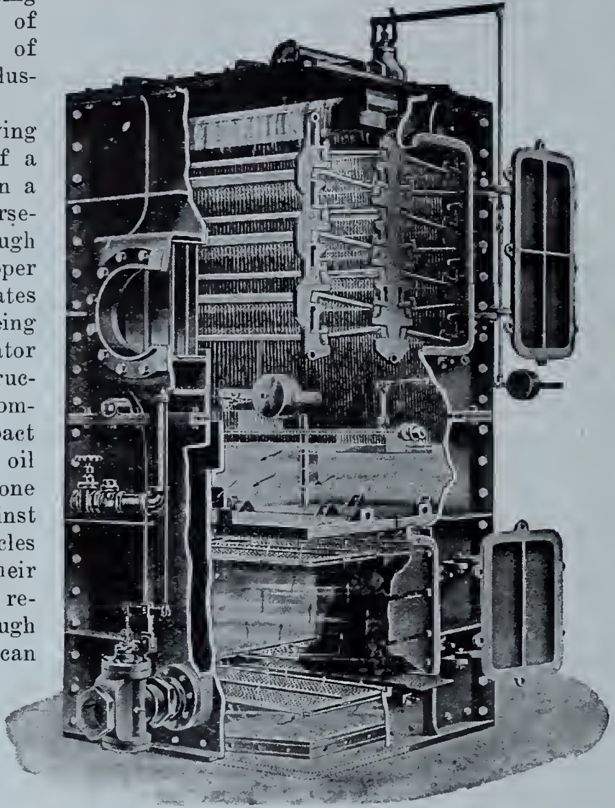


FIG. 1. "WEBSTER" FEED WATER HEATER AND PURIFIER, 500 TO 10,000 H.P.

The lower part of the heater provides storage capacity and also space for the filter. Between the level at which the float closes the cold water supply valve and the level of the overflow, there is ample space for the accumulation of condensation from heating systems, dry kilns, etc. Any dangerous excess of water automatically passes out of the heater when the water reaches a high level, the float valve which controls this being normally closed to prevent loss of steam.

The filter, as shown in Fig. 1, extends across the full width of the heater and close up to the front wall. The water falling from the trays passes down around the back, and underneath the filter, rising upwards through the filtering medium till it reaches the outlet to feed-pump.

Access to trays and filter is had through the hinged doors which are shown open, a section of the filter door being partly withdrawn. A quick-opening drain valve is provided at the lowest part of the bottom, through which the heavier sediment and impurities may be withdrawn from the settling chamber. The light, floating surface impurities are removed by a suitable skimmer, passing into the waste pipe with the overflow through the automatic valve.

For waters that contain incrustating materials not disengaged or separated at exhaust steam temperatures, or by filtration of feed water thus heated a special type of apparatus is built by this firm, in which the feed-water with-

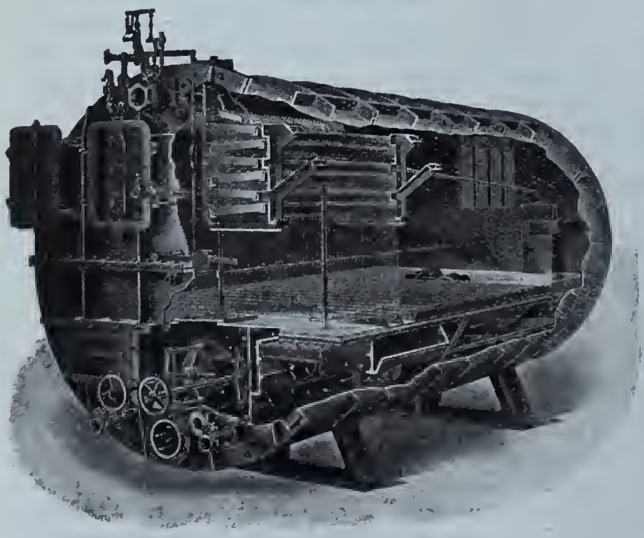


FIG. 2. "WEBSTER" FEED WATER HEATER AND CHEMICAL PURIFIER, 500 TO 5,000 H.P.

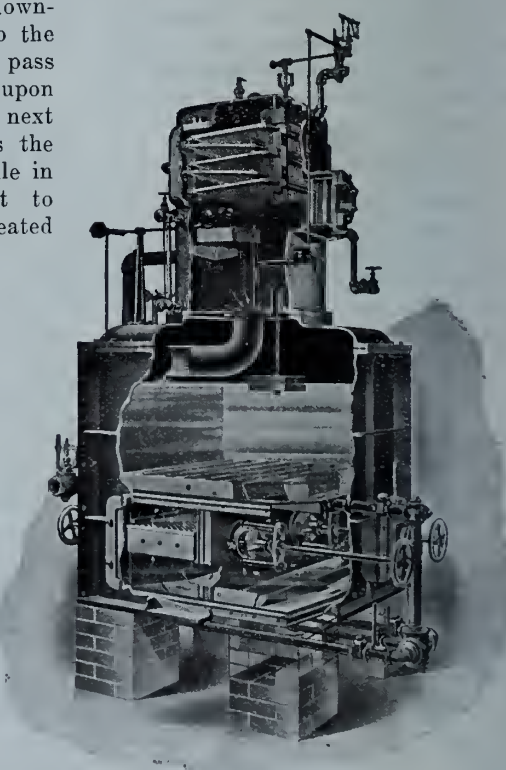


FIG. 3. "WEBSTER" FEED WATER HEATER AND CHEMICAL PURIFIER, 50 TO 300 H.P.

in the heater can be treated while hot, by the proper chemicals to separate and remove such scale-forming impurities before the feed-water is pumped into the boilers. This apparatus is known as the "Webster" Feed-Water Heater and Chemical Purifier and is illustrated in Figs. 2 and 3, the latter showing class EC built in sizes from 50 to 300 horse-power, and the former, class E D from 500 to 5,000 horse-power.

These are somewhat similar in appearance to the apparatus shown in Fig. 1, except in the case of the largest size which is built in the form of a horizontal cylinder. The internal arrangements are identical in principle, the cold water entering at the top, descending over the trays and subsequently passing through chambers containing purifying chemicals.

Reilly Multicoil Heater

A modern example of a closed heater of the water-tube type is found in the "Reilly" heater, which is the product of the Canadian Griscom-Russell Co., Montreal. As indicated, the water is in-

FIG. 4. REILLY MULTI-COIL HEATER.

side the coils and the steam in the shell. Close-grained cast iron is the material of which the shell, manifold and heads are made, the heating surface being formed of pure copper tubing of relatively small diameter arranged in numerous vertical coils, which are connected to the top and bottom distributing headers by screwed union joints. These coils are all made to standard dimensions and are detachable and interchangeable, access to the interior of the shell being had through a door shown in illustration Fig. 4.

The elasticity of construction obtained through the use of coiled copper tubes avoids undue strains due to variation in temperature of the different parts, while in the case of accident or wrong usage, the entire coil units can be renewed without disconnecting either steam or water piping, in addition to which, type C heaters are provided with separate manifolds which permit wide variation in position of water connections in stock units.

The rapid swirling flow of water through the coils maintains it in constant agitation, resulting in remarkably high efficiency. Unusually large space is provided for the passage of steam, which eliminates the possibility of additional back pressure being put upon the engine.

This heater may be placed in a horizontal as well as a vertical position, and can be connected up either as a through heater or an induction heater. In the through system, the steam passes completely through the heater and then through the back pressure valve, the steam entering at top or bottom as desired. In the induction system the heater is closed on either top or bottom, and the other end is connected to the exhaust steam main, which has an atmospheric branch pipe with back pressure valve. This arrangement causes the heater to float on the end of the exhaust pipe, drawing more or less steam into the shell according to the temperature imparted to the coils by the incoming feed-water.

TESTING STEAM ENGINES AND BOILERS

THE value of plant tests as a means of obtaining data for the guidance of designers cannot be too highly rated. Not only to the designer, but to the operator, are the results of value, and the general lines on which tests should be conducted formed the subject of a paper presented to the Institute of Marine Engineers recently by G. James Wells, on the "Determination of Steam Engine and Boiler Efficiency and Engine Testing."

The author pointed out that the object of such tests is to find the efficiency of the plant as a whole, also that of each organ, so that the possible places for improvement may be at once detected. The efficiency may be defined as the ratio of the heat utilized to the heat supplied. Fundamentally, therefore, a test becomes in the main the measurement of quantities of heat. The engineer in charge is supplied with fuel, either solid or liquid, and it is the latent heat of this fuel that has to be accounted for, and each item of waste valued, and separated into groups: avoidable and the inevitable.

Heat Estimation

The store of heat locked up in the fuel may be estimated very closely if the chemical composition be known, or it may be determined experimentally by means of a suitable calorimeter. This quantity is usually expressed as so many units per pound of fuel. In order to liberate this heat, an apparatus must be provided for the engineer, known as the furnace, and so the processes of combustion must be examined and the exact quantity of heat liberated must if possible be measured and the initial waste due to the imperfect action of the furnace and the loss incurred determined. The wastes being determined, the knowledge obtained must be used for the purposes of improving the conditions of combustion, and so reducing the total losses to a minimum. The leakage will, of course, be due to incomplete combustion, and the loss of heat carried away by the products of combustion into the uptake. With regard to test methods in the engine-room, it was suggested that the following work is advisable: Indicator diagrams from the cylinders taken simultaneously from both ends; all gauges, revolution counters, barometer, inlet and outlet temperatures of the circulating water, read at intervals, samples of the steam tested at the boiler and engine stop valves for the amount of moisture present; the weight of water from the jacket drains as well as the separator in the steam main noted. As the engine power being developed would be practically uniform, these observations noted every 30 minutes would probably suffice both in the engine and boiler-rooms.

Record Observations

All the observations should be entered in the log of the trial with the time at which they were made and afterwards plotted upon a time base chart, so that any errors may be at once detected, and if possible corrected and allowed for when deducing the actual performance of the engines. From the data so collected the several quantities of heat required for the determination of the efficiency of the plant may be found after the manner already indicated in the previous suggestions. The chief requisite for making such a test is organization; each man should have certain duties allotted to him which he is capable of doing without too great a rush. The engineer in charge should give the signal first to stand-by and the second signal a minute later to make and record his observations. Thus each man can get close to his instruments and, looking at them, may have actually read two or three of them and only needs to watch them so that at the second signal he starts writing them down and then moves off to the other points where observations are made.

Port of Montreal.—The St. Lawrence, owing to its situation, is the natural route from the Atlantic to the northern and north-western half of the North American continent. The possibility of converting Montreal into a deep-water seaport was first suggested in the year 1825, when the Lachine Canal was completed, connecting Montreal with the Great Lakes, and establishing the route commercially.

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Vol. VI DECEMBER, 1916 No. 12

PRINCIPAL CONTENTS

BRITAIN'S NEW WAR ADMINISTRATION

THE passing-up of Mr. Asquith, and his replacement as British Premier by Mr. Lloyd-George, have, it may be asserted, created world-wide interest, so much so that, during past weeks, the daily air, land and sea routine of the actual combatants has been relegated to second place. Two and a half years of war has demonstrated beyond question that, in the administration and direction of each and all of its departmental features, there lies a man's job; in addition, the bringing of the gigantic conflict to its logical conclusion, gives clear indication that a succession of men, rather than otherwise, must needs lay hold of the reins. This latter, we take it, is responsible for a recreated British Administration, and while the means employed to establish the newly fledged regime have, according to report, a more or less sordid side, the time was actually ripe for a more vigorous and determined effort to win the war than in recent months has been in evidence.

This war before it can be brought to a successful termination for the Allies will involve a more or less lengthy series of relays—administrative in London and on the various battle fronts, just as much so as the necessity exists for such a plan being operative in the fighting line. While, therefore, great expectations have been aroused—largely due to Mr. Lloyd-George's personality and his already war record, there is just the possibility that many of them will remain unrealized when his stepping-out time comes, and the next man in line takes hold. Without being pessimistic, it may truthfully be said that it is still "A Long, Long Way to Tipperary," and if Britain's new Premier and his colleagues develop lines of supplementary activities as effective as those formulated by their predecessors in office, the fact that several reconstituted Ministries may yet be needed to realize final victory will in no way detract from any sectional achievement toward that end that our most recently created adminstration may establish.

THE "GRILSE" NEAR-TRAGEDY

THE fact that H.M.C. torpedo boat Grilse managed to make port after being battered and bruised to the point of foundering with all hands, is due in the first place to her soundness of construction at the hands of her builders, and secondly to the herculean efforts of the crew to keep her afloat by hand pumping and baling, even when all hope of rescue seems to have faded. To those familiar with the appearance of the vessel—a very good idea is to be had from our illustration, and bearing in mind the fact that she is but a converted yacht, it seemed almost like courting disaster to have her put to sea—especially on the Atlantic, in midwinter. If we will have a Department of Naval Service, then let us have the proper vessel constituent to undertake its work. At the moment we can ill-afford to lose the six members of the crew of the Grilse, although it was nip-and-tuck that the loss wasn't fifty-six.

We might have afforded to lose the ship, but not so the men, and it seems to us that, after the recent experience, definite steps should be taken to ensure that the Grilse be put on a service which will harmonize with her original design idea, and that if circumstances demand the presence of a speedy torpedo boat destroyer or destroyers on our coasts, these be procured immediately from Britain, where the matter of half a dozen transferred to Canada would neither minimize the effectiveness of nor impoverish the main auxiliary or supplementary fleets. As has been aptly said, when not a few million dollars are being spent meantime on war-time non-essentials, our Dominion Government would be well advised to divert say a couple of millions to the purchase of a trio of destroyers, the most modernly and effectively armed and the speediest that science and the wit of British marine engineering skill can produce. A low-lying rakish craft with a short, stocky stack or two, and a wireless mast, no matter her speed, if originally designed as a novelty in pleasure yachts, is impossible of conversion to a place in the torpedo boat class, and the man-in-the-street should not be the only possessor of such knowledge.

MARINE NEWS FROM EVERY SOURCE

Toronto, Ont.—The Canada Steamship Lines have established a machine, woodworking and repair shop on the Yonge street wharf.

Victoria, B.C.—An order for a steel stern-wheel vessel, similar to one now under construction, has been placed with the firm of Yarrows, Limited, of this city.

Sarnia, Ont.—The Reid Wrecking Co. is preparing to raise the steamer Frontier, which lies at the bottom of the River Thames, at Chatham, where it sank a few months ago. The boat is owned by A. R. Bartlett, Windsor.

Halifax, N.S.—The Plant Line, which for many years has maintained a regular service between Halifax, Hawkesbury and Charlottetown, will discontinue its winter service at the end of the year and may not resume sailings in the spring.

Sault Ste. Marie, Ont.—The steamer Thorgerd, built in the Port Arthur Shipyards, has left here on her maiden trip. She will be used in the Atlantic Coast trade between New York and the West Indies. The Thorgerd is owned by a Norwegian firm.

The Sault Shipping Co. has been incorporated at Ottawa, with a capital of $300,000, to build and operate steamships, with head offices at Sault Ste. Marie, Ont. Incorporators are Alex. Taylor, Rex E. Nicholson, and Joseph E. Gibson, all of Toronto.

The American Star Steamship Corporation has, it is understood, purchased the Fordonian and Algonquin from Canadian owners. The Fordonian was built in Glasgow in 1912 and has a gross tonnage of 2,368 tons. The Algonquin, with a gross tonnage of 1,806 tons, was built in 1888.

Ottawa, Ont.—Tenders will be received up to January 15, 1917, for the construction of a reinforced concrete lighthouse tower and fog alarm building combined, and a wooden dwelling at Point Abino, Township of Bertie, Welland County, in the Province of Ontario. Plans, specifications, form of contract and schedule of wages, can be seen, and forms of tender procured, at the Department of Marine, Ottawa; at the Harbor Master's Office, Toronto, and at the post offices, Welland, Port Colborne, St. Catharines, Bridgeburg, Hamilton and Brantford.

Toronto, Ont.—The Canada Steamship Lines propose keeping the "Macassa" in service between Toronto and Hamilton, as long as possible, owing to the large amount of freight offering and shortage of cars. The steamer Dalhousie City will also continue in commission as long as possible.

Sarnia, Ont.—A new iron range light showing the way into the St. Clair River from Lake Huron is now being erected. The light will be constructed of steel, and will replace the wooden structure destroyed when the Port Huron and Duluth Steamship Line freight sheds were burned.

London, Ont.—The Dominion Government has awarded a contract to M. J. Hogan of Port Burwell for the construction of a new concrete pier protecting the west side of Port Stanley harbor. The contract price was $135,000 and the work will be undertaken early in the spring.

Halifax, N.S.—The steamer Algonquin, which was bought last spring from the St. Lawrence & Chicago Steam Navigation Co., by the Nova Scotia Steel & Coal Co., has been sold to William Job, of New York, it is reported, for oil interests. She made two trips to Newfoundland, taking general cargo and returning with iron ore.

Toronto, Ont.—The following steamers of the Canada Steamship Lines will winter in Toronto: Passenger—Cayuga. Chippewa, Corona, Chicora, Toronto. Kingston, Modjeska, Macassa, and Belleville. Freight—City of Hamilton, City of Ottawa, Joyland, Oatland, Haddington, Fairfax, Cadillac, besides ten barges and two tugs.

Winnipeg, Man.—It is understood here that a dock, capable of accommodating ocean-going vessels, has now been completed at Port Nelson, on Hudson Bay. It is 3,000 feet out from shore, and connected with the mainland by a steel trestle, over which trains will be running next summer to reach the ships. Grain elevators and warehouses will be located on the new dock.

Destroying Sunken Vessel.—Captain Troter is destroying the hull of the sunken steamer Topeka with dynamite. The wreck has been lying in 45 feet of water in the Detroit River, opposite Sandwich, since August 15, when the Topeka was sunk in collision with the steamer Christopher.

Owen Sound, Ont. — The C.P.R. steamer Keewatin cleared on her last up trip from this port on Dec. 3, taking on large consignments of cement, nails and apples, and closing a record in the number of trips during the season. The Keewatin and her sister ship, Assiniboia, each made a record of 38 trips for season 1916.

The Sault Shipping Co., a newly-incorporated concern, has purchased from the Lake Commerce, Ltd., of Toronto, the steel steamer Valcartier, formerly the W. H. Mack. The price was not announced. The boat will be delivered to the new owners at the close of navigation, and will be operated next season under the management of the Algoma Steel Corporation at Sault Ste. Marie, Ont.

Shipbuilding to Foreign Account.—In the British House of Commons on Nov. 30, Chiozza Money inquired if Vancouver and Montreal shipyards were building cargo steamers for Norwegian account; if it was in the national interest for British colonial yards to build ships for neutrals when it was so difficult for British shipowners to get deliveries. Bonar Law replied that the Government was communicating with Ottawa on the subject.

Montreal, Que.—The Montreal Dry Docks and Ship Repairing Co., Ltd., which had to close their dock on account of the repairs to the Lachine Canal, took advantage of the circumstance to extend their plant. The length of the dock has been increased from 240 to 425 feet and the depth from 10 to 13 feet. The company expects to have eight or nine boats in for repairs during the next few months.

Port Arthur, Ont.—John Burnham & Co., associated with other banking interests, of New York, have purchased the Western Drydock & Shipbuilding Co., of Port Arthur. H. G. Chace recently returned to New York from an inspection of the property, which will shortly be refinanced to permit of an enlargement in capacity. The company is now constructing vessels for foreign countries. James Whelan, of Port Arthur, is president.

Montreal, Que.—Announcement is made that the control of the shares of the Montreal Transportation Co., has been purchased by L. L. Henderson and associates. At a meeting of the Board of Directors, Mr. Henderson was elected president and managing director, with A. A. Wright, of Toronto, vice-president and treasurer. The other directors are Messrs. Farquhar Robertson, Abner Kingman, A. G. Thomson, A. E. Ogilvie and H. A. Calvin.

Suspended for Running Short-handed.—The Cleveland, Ohio, inspectors of steam vessels have suspended the license of Capt. Walter P. Rouvel, master of the steamer Perseus, for two months, for running short-handed. Rouvel was reported to the Collector of Customs for violating the rules, and he may be fined. The license of Charles J. Francombe, chief engineer of the same steamer, was suspended for four months for running short-handed and working the oilers on two watches instead of three, as required by law.

Haileybury, Ont.—The entire fleet of the Timiskaming Navigation Co. has been purchased by Mr. P. Gibbons. In the deal also are included all the wharves and other equipment. The new owner proposes to convert the "Silverland" into a tug, while the "Jubilee" will be refitted somewhat and kept for towing purposes. The "Meteor" and the "Timiskaming" will be taken into the Government shipyards of the Lake Shore road to undergo repairs during the winter preparatory to their being used for passenger traffic on Lake Timiskaming next spring.

Floating Drydock Projected.—Arrangements have been completed for the construction of a large floating drydock at Vancouver. The structure will be a 16,000-ton, double-section dock, capable of handling a boat of 18,000 tons, which is the measure of maximum requirements on the Pacific to-day. The company is the Vancouver Drydocks, Ltd., with Charles Meek, of Vancouver, as the moving spirit. Bonds to the amount of two million dollars have been sold to Breed, Elliott & Harrison, of Cincinnati. A ship repair and shipbuilding plant is a part of the plan decided upon. Contracts for construction and machinery are being let, and the company announces that it will have the dock in operation within a year. There will be subsidy aid from the Governments of both the Dominion of Canada and the Province of British Columbia, on the ground that the dock will be a commercial and naval asset.

Halifax Fire.—Starting from an unknown cause in the office of the Marine Navigation Co., a fire swept right through the Pickford & Black Building, on the north side their wharf, on the night of Dec. 3, and left it nothing but a shell. The following firms did business in the building: R. B. Seeton & Co., H. F. Burton, I. H. Mathers & Co., Geo. MacKeen & Co. on the lower floor; Capt. Neil Hall, F. A. Giles & Co., Smith, Tyrer & Co., and the Marine Navigation Co. on the second floor. The third floor was used by Pickford & Black as a workshop and storehouse, in which the stevedore end of their business was done. The loss is a heavy one.

Collingwood, Ont.—The SS. "Sarnolite," which the Collingwood Shipbuilding Co. has built for the Imperial Oil Co., of Sarnia, ran her special trials on the measured mile course outside the harbor on Nov. 17, the results being in every way satisfactory to Captain R. W. Henderson, Marine Superintendent for the owners. This is the third steamer which the builders have delivered to the Imperial Oil Co. this year. The three vessels, namely, "Royalite," "Iocolite," and "Sarnolite," are going into service on the ocean this winter. The three ships are all of the same dimensions, 250 ft. x 43 ft. x 18 ft., moulded, 2,600 tons deadweight, speed on trial 10 knots loaded.

Marine Insurance Higher.—Advices from New York state that marine war risk insurance has made another substantial increase. Five per cent. is charged on all United Kingdom business whether passenger or tramp steamers. Last rates were 3 per cent., with fractional higher and lower quotations. Mediterranean risks cannot be placed under 7 per cent., while 10 per cent. is expected to be the general rate. London rates are up to 5 per cent. on Transatlantic risks, an increase from 3 per cent. Mediterranean rates are firm at 7 per cent. for belligerent vessels, and 10 per cent. for neutrals. An explanation of the higher rates on neutrals is given in the low percentage of armed belligerent ships sunk.

The Canada West Coast Navigation Co.—A new transportation concern, which has entered what is practically a new field in shipping in British Columbia, has some strong men on its board. Prominent among those who have invested their capital in the new undertaking are: James Carruthers, head of the Canada Steamship Lines; J. W. Norcross, of Montreal, vice-president and managing-director of the Canada Steamship Lines; James Whalen, of the B. C. Sulphite & Fibre Co., and president of the Western Drydock & Shipbuilding Co., of Port Arthur, Ont.; M. J. Haney, railway contractor, of Toronto; Sir Trevor Dawson, managing director of Vickers, Ltd., London, England; Roy M. Wolvin, a Great Lakes transportation man, and who is president of the new shipping company; H. W. Brown, president of the H. W. Brown Co., and formerly local manager of the Pittsburg Steamship Co., Duluth, who is general manager of the Canada West Coast Navigation Co.

C. S. L. Vessel Charters.—J. W. Norcross, managing director of the Canada Steamship Lines, makes the announcement that negotiations have been completed for the chartering of fifteen steamships for ocean service for the year 1917. At the present time Canada Steamship Lines have eighteen ships in ocean service, and although present arrangements only provide for the service of fifteen of these for 1917, it is likely that the whole fleet will be re-engaged again. It is announced that rates are considerably higher than a year ago. Mr. Norcross has just returned from a trip to London, where he had several conferences with the London Advisory Board of the company.

North Vancouver, B.C.—Good progress is being made on the motorship Mabel Brown, at the Wallace Shipyards, and it is expected that she will leave the ways within the next fifteen or twenty days. The boat is being built for the Canadian West Coast Navigation Co., and when completed will be one of the finest craft of the kind on the coast. The Wallace Shipyards are hurrying the work on another vessel, the Geraldine Wolvin, a sister ship of the Mabel Brown, and it is expected that this boat will be ready for launching towards the latter part of January. About this time another vessel, which is being built at Victoria by the Cameron, Genoa Mills Shipbuilders, Ltd., will also be ready to take to the water.

Rescue After 22 Days.—Captain A. Diamond and crew of the wrecked Newfoundland schooner, William A. Wight, arrived at Halifax on Dec. 6 on their way to their homes. For twenty-two days and nights they were battered about in a succession of hurricanes, with no fresh water, and with constant pumping necessary to keep their dismantled bulk afloat. Twice they saw steamer lights and burned flares of distress. Following these flares the steamer lights were extinguished. Finally they were picked up by the American oil tank steamer Gold Shell, whose captain told the shipwrecked men that wireless warnings had been sent out to avoid suspicious lights as German submarines were using flares as traps and were operating far out in the Atlantic.

Toronto, Ont.—The Canada Steamship Lines have arranged to place another steamer on the New York-Bermuda line, controlled by the company. The new steamer is the Trasosmontes, which will run in connection with the steamer Bermudian. The new vessel is a Portuguese craft, most modern in every detail. The company will also add to its fleet plying on the New York-West Indies-South American route. The freighters Canadian and McKinstry, which have just made their final trips on the Great Lakes with grain cargoes, are now on their way to New York to receive their initial cargoes.

American Shipbuilding—The Bureau of Navigation of the U.S. Department of Commerce reports that American shipbuilding had its greatest month in November, when one hundred vessels were completed, the gross tonnage of which was 82,552. All but two will sail under the Stars and Stripes. With respect to shipbuilding, the United States is busying itself, as is the case with the Maritime countries of the Old World. The war is taking a heavy toll of shipping, but this loss is stimulating the builders to greater efforts. There will be many ships on the seas to carry the world's commerce after peace comes.

State-owned Steamship Line.—A state-owned line of steamships is to be operated between Atlantic and Pacific ports of Canada by way of the Panama Canal. The official announcement was made on November 25 by Hon. Dr. Reid, Minister of Customs. Contracts have been authorized for the construction in British Columbia of two vessels for this trade. For some time British Columbia people have been agitating for an arrangement whereby all water communication between Atlantic and British Columbia ports might be had via the Panama Canal. It was found impossible to charter vessels for such a service.

Collingwood, Ont.—The agreement entered into by the directors for the sale of the Collingwood Shipbuilding Co.'s assets to Messrs. H. B. Smith, R. M. Wolvin and Capt. J. W. Norcross, was confirmed at a special meeting of the shareholders held here on Dec. 6. The capital of the company is $1,300,000, for which the syndicate will give $650,000 in fully paid-up shares, and $1,950,000 of ten year bonds, bearing 6 per cent The formal transfer will take effect on January 2 next. The deal includes the transfer of the yards and plant here, also the company's interest in the shipyard at Kingston, where the Government graving dock is under lease.

WAR DESTRUCTION OF SHIPPING

IT has been estimated by marine authorities that the destruction to shipping as a result of hostilities during the twenty-eight months of war ended December 1 amounted to 1,948 vessels, having a total gross tonnage of 3,627,082. The record includes all losses due to submarine warfare, mine explosions, gunfire and similar causes affecting the merchant shipping of the world, and is based upon all available sources of information concerning sinkings, including cable despatches and mail advices received from time to time.

Estimated at the current value of old tonnage, the total destruction represents a loss of more than $400,000,000, but, as it would be impossible to replace the vessels under present conditions of shipbuilding at $100 per ton deadweight on an average, the actual loss is much larger. This is without taking into consideration the value of cargoes destroyed with the ships.

November losses were the heaviest that have occurred in any one month during the current year, amounting to 120 vessels, with an aggregate gross tonnage of 285,357, or more than was destroyed in August and September together. Losses during the last eleven months have amounted to 1,749,079 tons, compared with 1,878,003 tons in the preceding seventeen months. During the last eight months the losses have been 1,372,598 tons, a figure which will probably be increased by later reports of November sinkings. The total is complete except for November, reports of losses being delayed sometimes until well into the succeeding month. The following table shows the number of vessels and the tonnage destroyed during each of the last eight months:

	Number.	Gross tons.
November	120	285,357
October	134	239,526
September	101	154,688
August	100	130,262
July	145	102,522
June	64	126,369
May	63	118,094
April	90	214,880
Totals	817	1,372,598

The average monthly rate of destruction since the beginning of the war has been something less than 130,000 tons, so that the November destruction is more than twice the average.

DRY DOCK PUMPING PLANT AT PANAMA

THERE has recently been carried out a series of tests with the pumping plant at Dry Dock No. 1, Balboa, says The Canal Record. The plant comprises four 54in. main pumps and two 20 in. drainage pumps, each with a vertical induction motor, all housed together with the necessary accessories and the motor-driven air compressors in the building on the south wall of the dry dock at its entrance. The conditions entered into with the H. R. Worthington Co., contractors for the entire plant, required that each main 54 in. pump should discharge an average of 11,100 cubic feet per minute of sea water when pumping against a rising tide. which tide is specified to reach an elevation + 8.5 when the dry dock floor, at elevation —39.5, is bare of water.

The average overall efficiency of the units was guaranteed to be 64.5 per cent. including all losses in motors and pumps. The 20 in. drainage pumps were required to have an average capacity of 1,375 cubic feet each, with an overall efficiency of 64 per cent., when pumping from the culvert below the floor of the dry dock, from elevation—42 to elevation—52 with the tide rising from elevation 0.0 to elevation + 8.5. It was found that with 35 feet of water in the dock, one main pump can lay bare the floor in 5 hours 10 minutes.

On July 18, at 4.20 a.m., all four main pumps were run at once, starting with about 47 feet of water in the dock. On this run the dock was emptied in 1 hour 45 minutes. The drainage pumps emptied the culvert under test conditions in about 2 hours 40 minutes, showing them to be above the special capacity. While the complete computations have not yet been finished, sufficient calculations have been made to show that each unit exceeded the guaranteed capacity and efficiency. The pumping plant, with the air compressors controlled from the same switchboard, constitutes the largest single electric load on the Isthmus. If all pumps and compressors are running, a total of about 7,500 h.p. is required, or almost the entire present output of the hydro-electric installation.

SHIPBUILDING IN BRITISH COLUMBIA

IT is of interest to note that there are fully twenty-five wooden ships now under construction on the North Pacific Coast, between British Columbia, Puget Sound and Oregon ports. The vessels, though rigged as five-masted schooners, are properly classed as motor ships of the general type which the Swedes and Danes have perfected to such a degree in recent years. The design for these new vessels is a new departure in naval architecture. The vessels are built on low lines, with minimum amount of space which cannot be used for cargo. It is estimated by the designer, J. H. Price, that the cargo space of these vessels is 95 per cent. of the whole.

The general dimensions of the new vessels are given as 44 feet beam, 21 feet depth, 225 feet keel, with length over all 265 feet. Their lumber capacity is figured at 1,500,000 feet, considerably over the average of the old-time wind-jammer. Power is furnished by two Bolinder engines of 160 horse-power each. These engines are of Swedish design, Diesel type, using crude oil fuel. Without the aid of the sails it is figured that the engines will drive the ships at a seven-knot rate, loaded.

British Columhia's new fleet of lumber carriers will have the distinction of being the first ships to he huilt under and classified according to the new rules of Lloyd's Register of Shipping. Because of radical changes made in wooden shipbuilding on this coast in recent years, changes which are considered to mark great progress, most recently huilt vessels had been classified under other shipping registers, as Lloyd's rules had not been altered and were rather strict with respect to the changes which had grown up.

R.N.R. OFFICER'S SALVAGE EXPLOITS

TO he in the right place at the right moment has heen the remarkable and fortunate experience of Lieut. E. Wilkinson, R.N.R., upon several occasions, as here duly chronicled. Lieut. Wilkinson is in command of one of H. M. patrol vessels, and according to a correspondent, has again carried out a very successful case of salvage. It would appear that the Norwegian harque Asvald, helonging to Holmstrand, about 700 tons register, and loaded with a cargo of timher, was on October 6 overtaken hy a violent gale when north of the South Bishops Rocks, during which the vessel had her fore and mainmasts carried away, and hecame a derelict. Later she was fallen in with by the tug Pentower, which took the crew off.

As the harque was not far from land, the tug master decided to try and get the Asvald into port, and after some difficulty, succeeded in getting a towrope passed, and towing commenced. The tow was not of an easy character, as the barque was full of water and only floating on her cargo. A westerly gale was hlowing, with a high sea running. Towage operations went on well until nearing Dinas Head, when the tow rope parted, and the Asvald, which was at the time less than half a mile from the shore, began to drift rapidly towards the rocks.

Just as all hope of salvage had heen given up, Lieut. Wilkinson, in his patrol vessel, fortunately appeared on the scene, and with his usual promptitude of action, displayed in similar cases on former occasions, at once took in the situation. The barque was driving bow on to the rocks, and Lieut. Wilkinson promptly hrought his vessel across her stern, thus making a breakwater for his boat, which he had lowered, and a wire hawser was quickly secured to the barque's mizenmast. The vessel was then towed off stern first until she was out of danger. The fact that the Asvald's how was already on the edge of the hroken water from the rocks shows that a few minutes' delay would have meant the total destruction of the barque, and consequently enhances the difficulties that Lieut. Wilkinson had to contend with in carrying out this remarkahle and praiseworthy salvage opoperation. The Asvald was eventually towed into Fishguard Harbor and securely moored to a huoy, thus ship and cargo were saved from what at one time appeared inevitable destruction, by a memher of the merchant service.

This is about the fifth case of salvage successfully carried out hy Lieut. Wilkinson since being in command of a patrol vessel. On a former occasion a Scandinavian barque, also loaded with timber, has been hlown on shore on the rocks around the Smalls during a gale, and with great risk to himself and vessel Lieut. Wilkinson succeeded in towing this vessel off in a water-logged state and taking her safely into Milford Haven.

It is to be regretted that owing to his position as a naval officer Lieut. Wilkinson is not entitled to receive anything in the shape of salvage remuneration, his services are, therefore, all the more meritorious when it is considered that although without any hope of reward he has never failed to extend a helping hand, when occasion arose, in true British sailor spirit. Lieut. Wilkinson is a native of Liverpool, and prior to the war was an officer on Liverpool-owned ships.

THE CLYDE'S ACHIEVEMENT

THE man whom Sergeant Rafferty, of the 190th L.B.D.'s, was recruiting was (says a writer in the *Scottish American*) clearly a Scot, and a Clyde-huilt one at that. It was when, to make a little conversation, the Sergeant said something laudatory about the extent and organization of the Krupp's works at Essen that the storm broke.

The Clyde man listened with a somewhat pitying and forhearing smile, and when the limit was reached, "Man, but ye're a bletherin' huddie, after a'." he said. "D'ye know anything ahoot the Clyde? Let me tell ye. Before the war the Clyde produced in one year three-fourth as much as the whole o' Germany in ship-huilding an' so forth, and as much as the whole United States. An' noo, since the war startit, the valley o' the Clyde from Glesca to Port Glesca is one shipyard, engineerin' works, and munitions factory comhined. They get oot the iron, and the coal to smelt it, pit the steel through the mills, set up the ribs and plate the ships, feenish them, engine them, pit the guns and munitions aboard them, man them wi' bluejackets, maistly frae Lewis an' thereahouts, rin up the White Ensign, and awa' tae the hottlin' tred, hottlin' up the Germans, and collectin' suhmarines, like the goldfish for the museum in the Kelvingrove Park at Glesca. Man, ye could drop Krupp's intil the Clyde Valley and lose it thae days! Aheid o' us in organization! Dinna be a dam eejit, man! An' if onyhody tells ye we hae onything tae learn frae the Germans in the wye o' engineerin', shipbuildin' and a' the trades that follow on them, tell them frae me, Erchie Paiterson, formerly Clyde riveter, an' noo a 'Wee Black Deevil,' tae bile their heids!"

LACHINE CANAL TRAFFIC

UP to the end of Novemher, 24,581,371 bushels of grain passed through the Lachine Canal, just 16,082,728 hushels less than passed through in the same period last year. For Novemher alone the amount of grain which passed through was 2,176,257 hushels, less than half of the amount for November, 1915, which was 4,978,811 bushels. Produce also showed a decrease, and the net tonnage operated was less than in the previous November. The surprising thing, however is that the cargo tonnage was greater last month by 29,368 tons than a year ago. The explanation of this lies mainly in the fact that the amount of coal carried last month was 120,548 tons, and only 98,826 tons in Novemher, 1915.

Comparing November, 1915 and 1916, every grain showed a marked decrease, even oats and barley, which had shown increases in previous months, taking the down grade at last. The amounts, in bushels, are as follows:—Wheat, 1,439,364, decrease, 1,234,008; corn, nothing, decrease, 80,000; oats, 688,393, decrease, 1,431,836; barley, 48,500, decrease, 39,402; and flaxseed, nothing, decrease, 17,308.

In produce there are decreases in every item, as witness the following totals for last month:—Flour, nothing, decrease, 47,000 bags; eggs, 22, decrease, 29 cases; butter, 50, decrease, 95 packages; cheese, 15,458, decrease, 1,719 boxes; and apples, 3,852, decrease, 4,135 harrels.

The numher of trips made through the canal last month was 750, a decrease of 84 from the same month in 1915. The tonnage operated was 386,174, a decrease of 39,027 net tons. There were 402 passengers in boats, which passed through the canal, or down the rapids, 77 more than a year hefore. The cargo tonnage was 350,908, against 321,540 tons in Novemher, 1915. The number of trips light was 272, and the fact that this was 1,022 less than for the same month in 1915 is one reason why a smaller net tonnage carried more cargo even though fewer total trips were made.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Charles Booth, chairman of the Booth Steamship Co., died in London, England. on November 23, aged 76.

Captain John Mathias, a well-known skipper of the White Star-Dominion service, died as the result of an accident at sea, on December 8.

W. G. Ross, chairman of the Montreal Harbor Commission, attended the U. S. National Rivers and Harbors Congress held at Washington, D.C., December 6. 7, and 8.

R. D. Keag, general manager of Yarrows, Ltd., Esquimalt branch, who recently died, was widely known and esteemed both in Canada and Scotland, having had a very extensive experience.

Charles P. Sumner, for many years general agent for Canada and the United States of the Cunard Steamship Line, with headquarters in New York, has resigned. Mr. Sumner has had a long and distinguished career in the maritime world. A native of Boston, he first entered the shipping business in New York in 1870, when he opened a branch for George Warren & Co., shipowners and merchants.

G. D. Davie, president of the Davie Shipbuilding & Repairing Co., Levis, Que., had a pleasant surprise, recently, when President Carse and Henry R. Sutphen, vice-president of the Electric Boat Co., presented him at the Chateau Frontenac with a gold chronometer watch. The inscription inside the case of the watch, at the back, explains the reason of the presentation. It runs:—"Presented to George Duncan Davie by the directors of the Submarine Boat Corporation, U. S.A., as a token of appreciation of the great energy and ability shown by him in the construction for the British Admiralty of three hundred and twenty-five 80-ft. motor launches at Levis, Que., during 1915 and 1916."

T. Ashley Sparks, who succeeds Charles P. Sumner as general agent at New York for Canada and the United States, of the Cunard Steamship Line, is a partner in the firm of Funch Edye & Co., the present agents of the Commonwealth and Dominion line in New York. Mr. Sparks will, in due course, join the board of directors of the Cunard Co. At the same time arrangements are being made for the incorporation of the firm of Funch Edye & Co., and for the acquisition by the Cunard Co. of an interest in the business, which will, however, continue to be managed entirely by the partners, who now constitute the firm. Mr. Sparks was born in London in 1877, and was educated at St. Chad's College, Denstone, and Hurstpierpoint England. He came to the United States in 1897 to join Shewan, Tomes & Co., of Hong Kong, and was agent in New York for them from 1900 to 1907. He formed and managed from 1903 to 1907 the American-Asiatic Steamship Co., running a freight service between New York and the Far East. In 1907, he joined the firm of Funch Edye as a partner. He is a member of the Board of Governors of the Produce Exchange, of the Board of Managers of the Seaman's Church Institute, and of the Executive Committee of St. George's Society of New York, and of the N. Y. Chamber of Commerce and India House. He will have the task of reorganizing the company's business in the United States, which now includes the Commonwealth and Dominion Lines to Australia and New Zealand, in addition to the Cunard and Anchor Lines to Europe, in preparation for the new conditions which will exist after the war.

LICENSED PILOTS

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Aveuue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio. Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

SHIPMASTERS' ASSOCIATION OF CANADA

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

GRAND COUNCIL, N.A.M.E. OFFICERS.

A. R. Milne, Kingston, Ont., Grand President.
J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B; Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I. Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

OIL ENGINES VERSUS STEAM MACHINERY

THE advantages of marine oil engines over turbines and reciprocating steam engines are not so well known as they should be. In order to show the importance of our building motor ships in fu-

1916 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince.	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy.	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jeanne Mance Street	O. L. Marchand.	2378 Clark Street
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th St. E., Vanc.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger.	Bienville, Levis, Que.
Sorel.	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonueau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	[illegible] London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	29 Parrsboro Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	Alfred Roebuck	22 Kent Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

ture in preference to steam-driven vessels, the advantages of the former are fully set forth below:—

1—The space occupied by the propelling machinery is very much less than with steam engines and boilers, there being a reduction of at least 50 per cent. in the fore-and-aft space. This reduction, however, does not fully indicate the saving in space, as in a steamship the funnel casing and ventilating trunk over the boilers take up a good deal of room which could be utilized for other purposes in an oil-engined vessel, only a small trunk with skylights being necessary over the engines.

2—Oil fuel for Diesel engines only occupies from one-quarter to one-fifth of the space needed by coal for steam plant having an equal radius of action. Moreover, the oil can be stored in a double-bottom or in tanks, where it takes up no space which could be used for cargo. As regards weight, oil is about one-third the weight of coal for an equivalent mileage.

3—Another advantage of oil for propulsion is that the bunkers need not be filled up nearly so often as with coal. This feature enables vessels trading to the East or to the West Coast of America to fill up their bunkers for the round voyage in foreign ports where oil can be purchased at very low prices. Moreover, the process of taking in oil through a pipe is much quicker and less costly than the operation of coaling. The saving of time owing to these features in an oil-driven ship is very considerable, and time for a large vessel is a very important item, as expenses, such as insurance, capital charges, wages, and other items, are continually going on, whether the ship is carrying cargo or lying idle in port.

4—In addition to the reduction in the amount of fuel consumed for a given horse-power, which is now well known, a considerable saving in fuel occurs in an oil-engined ship compared with a vessel driven by steam machinery, owing to the fact that when oil engines are stopped no fuel is being used, whereas unless steam engines are to be shut down for several days, steam is kept up in the boilers by means of banked fires, whereby a considerable amount of coal is consumed. Moreover, banked fires have a particularly bad effect upon the smoke tubes, which soon become choked with soot, so that when the engine is started again more coal is needed to keep up steam. This question of stoppages is especially important in the case of tugs and passenger boats making short trips with frequent calls at landing stages. Then we have in a steamship the coal taken to raise steam, which, with Scotch type boilers of any considerable size, varies between 24 and 48 hours. In a motor ship the engines can be started at any moment with only a few minutes' preparation.

5—The engine-room staff is very much reduced for oil engines compared with the number required for steam machinery, as no firemen or coal trimmers are needed, and, in large vessels, no extra engineers to look after the boilers.

6—The repairs to oil engines do not cost nearly so much as those involved by steam plants, as there are no boilers to be cleaned inside and out and otherwise kept in order, while the entire absence of glands upon the engine and on the numerous stop valves to be found in a steam installation saves a large amount of attention for repacking.

7—There is practically no danger of explosions, as only the compressed air reservoirs are under pressure, while the piping therefrom is very small. Moreover, these parts are not subject to corrosion, as is the case in steam boilers.

8—The oil engine maintains its high economy throughout the longest voyages, whereas with steam plant the boilers become foul with soot outside and with scale inside, while a good many leaks develop, which features lead to a considerably increased consumption of coal.

9—In cases of breakdown, one cylinder, with its moving parts, can be much more easily put out of commission than is the case with a steam engine.

10—Less cleaning and painting, which involve much expense in boiler rooms, while the absence of cinders in the bilges eliminates the labor of removing them in port and trouble owing to choked pump strainers.

11—An oil engine on board ship can be much more easily governed than a steam engine when a vessel is pitching and the propeller periodically coming out of the water. Under such conditions the steam in the valve chests will cause a steam engine to race, although the throttle may be closed, whereas the cutting-off of the oil supply immediately slows down an oil engine.—*Motor Ship.*

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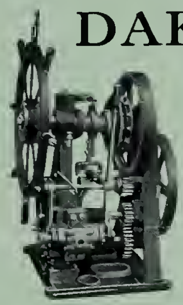

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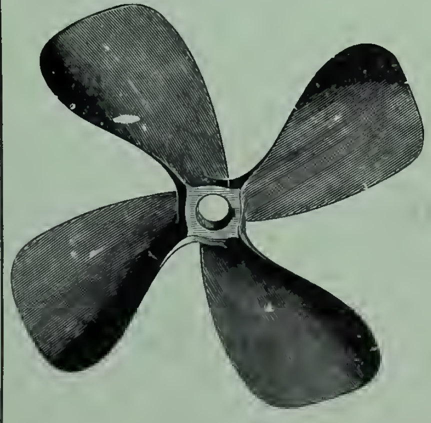

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