Ocean Freight Rates.
In 1898 and 1899 the commercial world emerged from several years of depression, during which commerce and shipbuilding had languished. Returning prosperity increased the amount of available freight to the point where the existing shipping was unable to carry it. The charter rates, which had been low, now rose to a point of high profit and shipbuilding began with feverish haste. In the midst of this rising tide of the shipowners' prosperity the South African war broke out (October, 1899), and hundreds of merchant-men were recalled from their usual employment and used by the British Government for carrying war supplies. This so intensified the scarcity of shipping that rates rose to a point where the meanest kind of a vessel, either sail or steam, would pay for herself in clear profits within a few years, sometimes even within a few months. Every shipyard in the world strained its energies to meet this great demand. Every place suitable for the laying of a keel was engaged for many months, sometimes as much as two years in advance. But the day of reckoning was to come. By 1902 a large number of new ships had been launched; the British Government was releasing the ships in the transport service; there was industrial depression in Europe, particularly Germany; the great drought of July, 1901, had almost cut off the corn export of the United States and for a similar reason there was no export of wheat from Australia. The combined effect of this sudden lessening of freight and increase of shipping was a surplus of ships. There was not enough work to keep them all busy, but no owner wanted his ships to be the idle ones. If large profits could not be obtained, small ones were better than none; so the rates were cut. Down, down they went to the bare cost of operation and below, because it was better to work a ship for a loss of $20, $50 or $100 a day than to have her lie in port at a loss of $150, $200 or $300 per day. For many months during 1902 and 1903 thousands of tramp vessels, both steam and sail, were a source of constant loss to their owners. In some cases, as that of a large steamer with nothing to do,
this loss amounted to hundreds of dollars per day, then for a short period a voyage at less than cost would temporarily reduce the loss. Well might the shipowner who was in August, 1902, carrying wheat from India to England for ten shillings per ton, out of which he must pay Suez Canal tolls, call it a "ruinous figure."

This depression lasted longer than any other within a half century. The accompanying chart shows this clearly. For once fluctuations have been absent because of the dead level of continuous depression. A completed chart from 1866 to 1899 shows fluctuations quite uniform in frequency and degree.3

The effect of this depression of rates was a reduction in the value of shipping amounting in some cases to about 50 per cent. In 1900 a nearly new modern freight steamer of 5,200 tons' (dead weight) capacity sold for £65,000. In February, 1904, a 5,800-ton vessel of the same type, condition and speed sold for £33,500, and the depression of the shipowners had extended to the shipbuilders. Three years after the booming prosperity and long waiting lists of January, 1901, there was scarcely a shipyard in any country but had vacant "ways" and found it impossible to secure enough orders to keep all its employees busy, and in many cases this depression reached a stage of acuteness that resulted in financial embarrassments and failures.

2nd. The making of rates for shipments comprising less than a full cargo involves a consideration of (a) line traffic and of (b) the so-called "berth" traffic, which is a sort of compromise between the line and charter traffic.

(a) Rates in line traffic differ at many points from the full cargo traffic, yet they show the working out of the same principles. Competition is nearly always present, and the process of dickering in the bargain for each shipment is common. There is no more uniformity of rate for all the

3 It should be noted that the lower rate on this chart is for small shipments in line vessels, and the higher rate is for full cargoes to British ports.
goods on a line steamer at one time than there is for all the many shipments that may fill a train. Valuable goods are charged a high rate and cheap ones a low rate, and different shipments of the same article often have different rates. A line steamer outward bound from an American port usually derives its freight profit from such commodities as machinery and manufactured articles, provisions, oil cake, flour and other prepared food-stuffs. Grain is also usually taken, but at rates that are rarely profitable and always below the full cargo rate for grain. Grain is heavy, but easily handled, because usually handled in bulk, and it makes very desirable ballast to steady the ship. Accordingly the policy is to fill the ship as full as possible with good paying freight and finish her off with grain, some hundreds or thousands of tons, as the case may be. The grain shipper does not especially desire these small and irregular shipments. If the European grain market is favorable at all, it is favorable for a shipload of grain, and if the shipper must ship less he will have a concession in rates. This is the more easily obtained because he knows that the shipowner wants it to serve as ballast. Hence it comes about that the line steamers carry a certain and variable amount of grain at lower rates than the tramps.

The fact that the steamship line represents an organized business gives it a tendency to greater steadiness of rates than prevails among the chartered vessels, but if fluctuations do not come as quickly they come as surely on routes where there is competition for the work.

The variety in rates is further increased by the practice of the managers of some lines to make as many long contracts as possible, sometimes for a year or a season, and secure other freight in advance to be taken during a certain month or within a certain week. The year contracts and the month contracts will probably differ in rate, and they are both likely to differ from the rate current at the time of sailing. The last shipments are contracted for in the light of the then existing market conditions, and may be high or low, accord-
Ocean Freight Rates.

ing to the abundance or scarcity of freight at the time the vessel is finishing out her cargo. If freight is scarce the final rate may be lower than the long contract rates, or if abundant the rate may rise. Freight may be shifted from one line to another so easily that it is actively sought. All the companies engaged in the trans-Atlantic trade have agents in the commercial centers like Buffalo, Chicago, St. Louis, and these agents in turn have their local connections. If freight promises to be scarce for a certain scheduled sailing, telegrams will be sent to the inland agents, or sometimes a personal representative will be sent from New York, Boston or Philadelphia to Chicago or Minneapolis with power to make such contracts as he finds necessary to secure the freight for the otherwise empty space. So it is that competition dominates also in line traffic.

Governments have in no wise attempted by their authority to control ocean rates. Individuals and corporations have made numerous attempts to eliminate competition by agreements among the parties engaged in the particular trade in question. Such a case is the successful shipping ring which has recently been able to control for several years the freight situation for direct trade between Great Britain and India. Individual shippers sometimes avoid its grasp by sending freight by way of Antwerp or other continental ports. One of the two great German lines attempts to hold its patrons and at the same time charge a fair rate by giving, at the end of the year, a rebate of 10 per cent. on all freights paid during the year, provided the shipper has patronized no other line in a German port. This also leads to evasion because the shipper is free to ship via the Dutch or Belgian ports, which handle so much of German trade.

Usually all attempts at rate agreements have failed before they have been of much practical benefit. It is easy enough to maintain them during prosperity and rising rates, but they have gone to pieces in dull times owing to the pressing necessity for income, the lack of satisfactory means of dividing the traffic and the ease of undercutting.
As steadiness of rates is not to be had from unrestrained commerce, nor from the agreements of independent owners, we have recently seen the attempt to control the North Atlantic trade by consolidation. The International Mercantile Marine Company, a combination of great lines, is usually considered to be a result of the fierce and destructive competition and rate cutting that marked the declining traffic and rates of 1901-02. Rival English, American and Belgian lines were placed under one management, and strong financially guaranteed contracts were made with the German lines with the object of controlling competition from that source. The ultimate success of the venture has yet to be demonstrated by experience. As the promoters could not get the Cunard Line into the combination, that company as well as several others may inflict great injury and possible destruction through competition which is now in progress.

Much interest attends the effort of the great corporations to prevent the low extremes that have come from the full and free working of opposing companies. It is claimed by the promoters of this consolidation that the object is not to force rates to a high figure, but to prevent periods of excessively low rates and, above all, to maintain steady and even rates.

(b) The second method of shipping partial cargoes is by the "berth" traffic. This is a sort of compromise between the work of the chartered vessel and the liner, and the rates, like the business, are also somewhat of a compromise. The "berthed" vessel has usually just completed a charter contract, and is sent on a single disconnected and rarely repeated voyage in which she carries freight on the basis of a liner, and makes the rates after the manner of a chartered vessel. A vessel is said to be put upon the berth when a steamship agent in some port announces that if sufficient freight is offered he will dispatch a certain vessel to a certain port at about a certain date. This is more apt to occur at the end of a route, where more freight is received than dispatched. Thus vessels are put upon the berth in Australasia, China,
Ocean Freight Rates.

Japan and the Straits Settlements to load for the Atlantic, or in Europe to load for America and occasionally also in the heavy exporting ports to load outward freight. To secure berth cargo in the port of discharge is better than going elsewhere in ballast. If the agents can in a short time make enough provisional contracts to promise success, the announcement is made final and the loading proceeds. The "putting of a vessel upon the berth" is the signal for active bargaining. The cargo is usually made up of many small shipments, and the rates of carriage for the different lots are often made with the same freedom of competition that prevails in the larger operations of chartering vessels. If freight is more abundant than space, the rates are high. If the reverse is true, the rates may decline sharply. The following cases typify the rate making for the berth traffic as it is now carried on. A steamer was loading in Japan for New York. Her agents finding cargo scarce, and rivals plentiful, agreed to take a partial cargo for 20 shillings per ton and depended upon finishing cargo at other ports. At Hong Kong freight happened to be abundant, and the agents were able to secure 30 shillings per ton for the remainder of the cargo—50 per cent. more per ton for a 1,600-mile shorter haul. Sometimes the rate varies for similar goods shipped on the same ship from the same port to a common destination. The ship may be on the berth and loading at a good freight rate, but rivals appear and freight becomes scarce as the time for sailing approaches. Waiting is expensive, and rather than dispatch her with empty space the agents will sometimes contract at the last for a few tons or a few hundred tons at very low rates. Examples are not uncommon where this reduction amounts to one-half of the usual rate, but as it costs no more to carry it than to go without it, it pays the owner of the ship. If two or three ships are loading in the same port for the same destination, the freight rate may rise the minute that one of the ships lessens the competition by weighing anchor to sail. Thus the berth traffic practically repeats upon a small scale for small shipments the free bargaining of charter arrangements.
PART II.— Routes and Shipping.

CHAPTER V.

TRADE ROUTES OF THE OCEAN—STEAMER ROUTES.

The ocean presents a multitude of trade routes. There are hundreds of seaports to which vessels go with greater or less regularly and often from various other ports, and, as between every two ports there is some route that is better than all others, there are hundreds of trade routes passing in all directions across all oceans between the frigid zones and some routes invade even a portion of the Arctic Ocean. All of these routes would scarcely receive attention in an exhaustive treatise, and certainly not in a monograph. They are too numerous for charting on ordinary maps, and only those of importance in world commerce will receive attention here.

The number of ocean routes has been more than doubled during the latter half of the nineteenth century by the use of the steamer. This newer type of vessel rarely followed the older route that had sufficed when wind and sail were the sole dependence of the navigator. The sailing vessel must depend upon winds, weather, currents and tides, and in order to take advantage of these factors it is often necessary to make detours to catch favorable conditions or to avoid the danger of being blown upon the shore. The steamer, with greater power of guidance and always desiring to save time and fuel, goes as nearly as possible in straight lines. Hence the two types of vessels rarely follow the same track, and there are, for a large part of the world’s trade, two distinct sets of routes: those followed by steamers and those followed by sailors. This chapter deals only with steamer routes.

(50)
Leading Steamer Routes.

In this one class there will be no attempt to describe or enumerate all the routes. For an economic discussion many routes which, from the standpoint of the navigator, are separate, may be grouped under one heading and treated as a unit, as in commercial service they really are. The routes of the ocean, like those of the land, consist of trunk lines and branches or feeders, which, leaving the main ocean thoroughfares, reach out to the islands or to the ports of the more isolated arms, gulfs and bays that indent the continents. These trunk routes give the real circulatory system through which passes the greater part of the commerce of all nations. The advantage of location possessed by the great routes causes them to draw to themselves through their feeders the great majority of vessels traversing the ocean, but with the sailing routes added to the steamer system the whole sea surface is by no means included as a part of some route. There are wide stretches of the ocean over which a ship never passes from one year's end to another, unless it be some marine explorer, a wandering dialer; a ship in distress driven from her course by storm or accident.

A country as large as England could without interfering with any trade route be located many times over in untravelled seas, such as parts of the Indian, South Atlantic and Central and South Pacific Oceans. The great basis of international trade is the exchange between the regions producing manufactures and those producing raw materials and food. Western Europe and eastern North America are the greatest manufacturing centers for the rest of the world, and are consequently the starting point or the ending point for the leading ocean routes. Since the leading commercial countries of Europe are on, or adjacent to, the English Channel, that body of water may, in a partly figurative, but almost literal sense, be considered as the origin of European routes and similarly New York Bay of the American routes. As North America is also the greatest exporter of food
and raw materials to Europe, the most important of the ocean trunk routes connects eastern North America with northwestern Europe. Over this great thoroughfare passes regularly more than a sixth of the world’s ocean shipping, including the largest and fastest ships afloat.

For convenience we will call this the North Atlantic trunk route. It is not strictly accurate to call it a route, for it is a complex group of routes crossing and paralleling each other and converging to several foci, but they are surprisingly close together in midocean. The Liverpool steamship owners’ association declared in an address to the British Board of Trade “that all vessels crossing the Atlantic to this country (Great Britain) from ports in North America take practically the same route from 60° W. longitude.” This comes about because of the advantage of following the great circle route, which, curving to the northward, makes all vessels, whether from Halifax, New Orleans or Vera Cruz, follow close to the northeastward-trending coast of America to the Grand Banks off Newfoundland before starting to cross the ocean. During the spring and summer months a somewhat more southerly track is followed, owing to the floating ice, and for this reason the St. Lawrence steamers are compelled to pass to the south of Newfoundland. During the ice-free part of the year, from September to April, the compact sheaf of routes is somewhat scattered, and for a short time steamers pass down the St. Lawrence and to the north of Newfoundland with a considerable saving in distance.

These northern routes are so much shorter than the direct following of the parallels of latitude, that the route from Liverpool direct to Greytown, Nicaragua, is only 323 miles, one day’s moderate steaming, shorter than the route by way of New York. Norfolk is a common coaling port for vessels passing from the Gulf of Mexico to Europe.

Next to the North Atlantic in importance is the Mediterranean-Asiatic trunk route, passing from the Straits of Gibraltar around the continent of Asia to Japan. This route, the great thoroughfare between the east and the west, has
Leading Steamer Routes.

many feeders east of Gibraltar, and double termini in the Atlantic, one in the region of the English Channel, one in America, chiefly New York, but partly also in the Gulf of Mexico. As it skirts the coast of Eurasia it is fed by a branch from every bay that indents that great land mass, and by other branches from Africa, the East Indies and Australasia. Important contributions come from Barcelona in Spain, Marseilles in France, Genoa and Naples in western Italy, Venice and Trieste on the Adriatic, Smyrna and Piraeus on the Ægean, Constantinople, Odessa and Batum on the Black Sea. At Alexandria the commerce of Egypt is received and at Aden a part of the trade of the Persian Gulf, East Africa and Bombay, the main line going on to Ceylon and Singapore. At Colombo vessels for Calcutta, Madras and Burmah turn northward into the Bay of Bengal and the Australian mail steamers turn southward across the Indian Ocean; at Singapore the route, rounding the corner of Asia, sends a branch to Java and on to Torres Strait and east Australia, receives the traffic from Siam, Tonquin, the adjacent East Indian Islands and some from Manila. The main route passes on to Hong Kong, Shanghai and Yokohama; Shanghai being the branching-off point for the trade of Vladivostok, Port Arthur, Tien Tsin and other ports in North China and Korea.

This great route from the west to the east is the creation of the Suez Canal. Before the opening of that gateway of the seas it was entirely unprofitable for steamers to engage in the trade between the Orient and the Atlantic. The trade was then comparatively small, and the greater part of the present traffic is the creation of the new route.

The South African trunk route is not such a coasting route, nor is it so well supplied with feeders. The peculiar shape of the west African coast, and the scattering character of its commerce, have brought about a duplication of ocean routes in the Atlantic west of Africa. The coasting and local route follows the coast, settlement by settlement, from Morocco to German Angola. The more important route,
The Organisation of Ocean Commerce.

the South African trunk route, sweeps boldly around the continent to Cape Town, with occasional stopping of ships at the Cape Verde Islands for coal. At Cape Verde, or to the south of it, two branches unite to form the route, one connecting with the English Channel, one with New York Bay. East of the Cape of Good Hope, the vessels in the African trade stop at the British South African ports of Port Elizabeth and East London, most of them continuing to Delagoa Bay, but rarely farther. A few pass up the east coast of Africa. African ports are, however, the destination of but a part, less than half, of the vessels traversing the South African trunk route. The others go directly to Australia and New Zealand, often without touching Cape Town. From the United States to Australia the Suez Canal route is practically as long as the Good Hope route, and all the vessels naturally follow the cheaper and more open route around the continent. From England the saving by canal is about a thousand miles, not enough to make its use profitable for any but fast passenger and mail ships. The purely freight lines from Europe use the South African trunk route. The more important lines steer directly from South Africa to Adelaide, Melbourne and Sydney, and sometimes go on to Brisbane. Less important ones run directly to Freemantle, West Australia, to New Zealand or to New Zealand via Melbourne or Hobart (Tasmania).

The South American trunk route sweeps around the two longer sides of that continent from Cape St. Roque to Panama and on up the coast of America to British Columbia. Like the other trunk routes it is fed from two sources, Atlantic North America and Europe, the two parent streams uniting at Cape St. Roque. The greatest sources of traffic for this route in eastern South America are the Brazilian coffee from Rio Janeiro and Santos, and the grain and animal products of the La Plata ports. Many vessels, devoted only to the trade of the west coast, call at east coast ports only for coal, but discharge and receive cargo at many ports upon the west coast between Valdivia in southern Chile.
Leading Steamer Routes.

and Guayaquil, Ecuador. A few steamers continue this semi-coasting trade along the coasts of western Colombia, Central America, Mexico and the United States to San Francisco. Other steamers round the continent of South America, but have no South American trade. One New York line engaged in the American coasting trade, calling for coal only at Coronel, Chile, steers directly across the Pacific to San Francisco or Hawaii, according to the demands of freight. Sometimes the service of this line is extended to Portland and Puget Sound ports. Since 1901 a number of steamers have sailed from the Pacific ports of North America for European ports without doing a coasting trade en route, but all steamers in this trade are an innovation in a trade that has belonged exclusively to the sailor.

At Magellan Strait the traffic of this route is swelled by vessels in the New Zealand trade, particularly those returning loaded toward Europe. With this exception, the South American trunk does not receive long branches or feeders as does the Mediterranean-Asiatic in rounding the continent of Asia. The difference is more apparent than real. The Asiatic route skirts the heads of peninsulas, and is often hundreds of miles from the ports lying at the heads of the seas indenting the coast. The branch routes to these ports are evident. The coast of South America is so even that any steamer passing around the continent passes comparatively near to all the ports. The real effect of branches is preserved by the division of the territory among the steamer lines. Some call at the ports of one section of the coast and have no freight connection whatever with other districts. Some lines of west coast South American steamers are as separate from the other traffic of the South American trunk as the Calcutta or Zanzibar steamers are separate from the remaining traffic of the Mediterranean-Asiatic trunk.

The region, called by the Germans the American Mediterranean, has three main inlets: one in the Florida Straits, between Florida and Cuba; one in the Windward Passage, between Cuba and Hayti; and the third at St. Thomas, east
of Porto Rico, at the head of the curve by which the Lesser Antilles bend southward and connect the Greater Antilles and South America. The passages near Guadalupe and Barbadoes are also used. All of these inlets are frequented by vessels from New York and Europe, and the Windward Passage is on the route from New York to Panama and the proposed canal.

The location of the islands and the surrounding mainlands divides the ports of this part of the world into two natural circuits, one in the Caribbean, one in the Gulf. These circuits are followed by vessels in the general trade, and direct routes are followed by the vessels engaged in the special trades. The Caribbean circuit is followed by several lines of vessels. The ports of call are not the same for all lines, but the following ports are well served by vessels usually entering from the east: Guadalupe, Barbadoes, Trinidad, La Guayra, Cartagena, Colon, Port Limon, Greytown, Kingston and St. Thomas. The Gulf circuit usually includes Havana, Progreso, Vera Cruz, Tampico and Galveston or New Orleans. The special trades are fruit, iron ore and sugar, all of which usually go in full cargoes; the first because of economy of time, the last two because of economy of cost. The iron ore is from Santiago, Cuba, the sugar chiefly from Cuba, and both reach their principal market in the eastern United States, being shipped to Baltimore, Philadelphia, New York and Boston. The fruit trade (chiefly bananas) is more widely distributed. From eastern Honduras fruit steamers ply to New Orleans; from Costa Rica, Colombia and the Greater Antilles to the leading Atlantic ports of the United States; and from Jamaica direct to Bristol, England, and occasionally to Liverpool, Manchester and Glasgow.

The trade routes of the Pacific are of less importance than those of the Atlantic, although their rapid rise in traffic suggests their future importance. But despite the riches upon its shores, the Pacific may well be called a waste of water. Only upon or near its margin will great and promising trade routes arise, leaving its vast center to silence and to
Leading Steamer Routes.

routes of secondary importance. It is difficult to realize that this one ocean embraces nearly one-half of the entire surface of the globe, that between the mainland of the American continent at the equator, in Ecuador, and the opposite mainland of Asia, near Singapore, lies the distance of twelve thousand miles or 175 degrees, almost half the distance around the world. Between these two equatorial points upon the spherical surface of the globe there are three connecting lines of practically equal length, one following the equator directly across midocean and two following the meridians (great circles) and passing respectively through the north pole and the south pole. As steamer routes follow great circles, the great size of the Pacific causes most of its routes to avoid its middle and skirt its margin, rather than to steer boldly across as in the Atlantic. Between the north and the south the great circles cross the middle of the ocean, but there are few lands upon the north and south for routes to reach, and routes from east to west following great circles keep in high latitudes near the margin of the ocean to secure their shortest courses.

The heaviest commerce in the Pacific waters passes up and down the coasts of East Asia and of South America, bound for the exits at Singapore and the Straits of Magellan. By far the most important route entirely upon the Pacific is that connecting North America and Asia, the American-Oriental trunk route. Like the North Atlantic route this is a composite one, and not so compact because of the irregularities produced by the calls of some lines at Hawaii, two thousand miles below the line of shortest passage between Puget Sound and Yokohama. It is, nevertheless, proper to consider the North Pacific lines as one trunk route, since all the different courses are close together at the American end, and converge at Yokohama and follow the Asiatic coast to the ports of China or the Philippines. One line now sends steamers to Manila directly from Yokohama, having them call at Hong Kong and Shanghai on the return. It is probable that other lines now sailing no farther than Hong
Kong will, upon the increase of Philippine industry, extend their service by making Manila the final destination. On the American side the routes originate at six places: Manzanillo, Mexico; San Diego, San Francisco, Portland and Puget Sound, and before many years there will probably be other American ports added to the list. There are now lines of vessels starting from San Francisco and San Diego, and calling at Honolulu, although it lengthens the voyage from the first city more than eight hundred miles. From all of these six starting points vessels also go directly to Yokohama, and usually by the northern or great circle route. From Puget Sound it is impossible to follow a perfect great circle because of the Aleutian Islands, within sight of which the vessels pass in good summer weather. In the winter it is the practice of some captains to steer straight across the ocean or even to go south of the direct route to secure more favorable winds and weather. The great circle route is the one most commonly followed, unless calling at Hawaii, and from all points on the American coast including Panama this, the mathematically shortest route to any point in Asia, follows the coast line to California, passes close to San Francisco, closer to Puget Sound than to Hawaii and thence northward to the latitude of Alaska before turning south and skirting the shore of Japan.

A route of less importance and far less promise than the Oriental is the Pacific Coast-Australasian, the last of the steam trunk routes. This route, like the preceding, is composite and more definitely spread out than any of the other trunk routes. On the east is the course followed by the line plying between San Francisco and Auckland, New Zealand, via Tahiti, Society Islands; on the west that from Vancouver to Sydney via Honolulu and Fiji Islands. By a branching of the route at Honolulu, San Francisco is connected with Sydney, and by other branchings at Fiji and Samoa, British Columbia is connected with New Zealand.

This route across the Pacific has been found by experience to be the quickest mail route from Australia to Europe.
The weather in the Pacific is usually reliable and favorable, and when the mail has reached San Francisco by direct steamer, it has the advantage of the fastest long-distance train service in the world to New York, and thence to Liverpool the fastest steamship service in the world. In competition with this is the route followed by the slower steamers crossing the Indian Ocean, the Red and Mediterranean Seas and delivering the mail to the railway only at Brindisi, Italy, whence it crosses the Alps to Paris and London, with several days saving of time.

There are two reasons why the Pacific Coast-Australasian route lacks great promise for the future. The first is that the climate and resources and stage of present and prospective industrial development of Australasia and the Pacific Coast of America are too nearly alike to give the natural basis for any extensive exchange of products. They are more nearly rivals than economic complements. The other reason for the secondary rôle of this route is that it now serves partly as the outlet for the region to the east of the Rocky Mountains, and the Panama Canal will in a few years compete heavily for that trade.

This brief presentation of the world's steamer routes makes no pretence of being full or complete, but only to point out the main arteries of world commerce, leaving the minor tributaries and distributaries to be worked out by those who may have a special interest in the subject.

The avenues of commerce have been divided off into routes having separate names, but it should not be thought that each is separate from the others. The divisions have been made in part for convenience of description, for the routes are not entirely separate, but connect and overlap at various points into a unified system encircling the world.

No trunk route with its branches can be considered as an independent unit of circulation with vessels limited to it, and going and coming in even procession with equal numbers inbound and outbound. As no country imports and exports equal quantities of freight, so no route has similar
amounts of freight or the requirement for equal numbers of vessels going and returning. It is usually but not always true that the line steamers go and return by the same route. The irregular element is chiefly furnished by the chartered vessels or tramps which depart from the trunk routes at ports where more freight is imported than exported. They go seeking freight, and join other routes at ports that ship more freight than they receive. By this process the South African trunk route is a heavy loser, and the South American and the Mediterranean-Asiatic are gainers. South Africa imports coal, flour, lumber and general manufactures and supplies—all of them being heavy and bulky articles. The leading exports are gold and diamonds, requiring no space worth mentioning. South Africa is, therefore, a dispersing place for vessels charged with ballast and seeking freight. Some go to India for grain or jute, others to Burmah for rice, others to Java for sugar, some to Buenos Ayres for wheat, some are even compelled to go to the United States.

In Australia the same conditions are repeated. This commonwealth imports iron, lumber and general manufactures and exports wool, hides and meat, all of them several times as valuable per ton as the staple imports. Sometimes there is a small export of wheat, but there is usually a large surplus of shipping that must fall back upon coal, which fortunately Australia possesses at Newcastle, sixty miles north of Sydney. With this cargo many vessels go to East Indian and Oriental ports—Batavia, Sourabaya, Singapore, Manila, Hong Kong. After discharging the coal they can sometimes reload directly, but often another though shorter ballast voyage must be made to secure a cargo of Java sugar, Manila hemp, Siam or Burmah rice or even Indian jute, grain and seeds. From Newcastle other vessels, usually sailers, depart to Hawaii for sugar, or to San Francisco, Portland or Puget Sound for wheat. Others, both sail and steam, carry coal cargoes to northern Chile for nitrate of soda. By these various routes a large proportion, possibly a half, of the vessels that go out on the South African trunk route return to the North Atlantic by another way.
Leading Steamer Routes.

China and Japan are likewise countries with a surplus of outgoing shipping, and Japan is an exporter of coal that is in common use as far south as Singapore, and it is sometimes sent to Hawaii and the Pacific Coast of the United States. The surplus shipping of East Asia usually seeks cargo in the Philippines, Java or United States; some vessels crossing the North Pacific and transferring themselves from the Mediterranean-Asiatic trunk to the South American by way of the American-Oriental.

Triangular voyages are often made in these transfers from route to route. There is such a one in the North Atlantic.

Brazil exports coffee very largely to the United States, and as the return cargo is light, many of the coffee ships load in American ports for Europe and return thence with European goods to Brazil, completing a triangular voyage. Voyages of a triangular character are often made by tramp vessels, and many of them can be figured out from the examples given above, but none of the many triangular voyages are so plain, so unobstructed and so nearly equilateral as the Atlantic triangle.
CHAPTER VI.
COAL SUPPLY AND COALING STATIONS.

The coal supply and coaling stations are topics of prime importance to maritime commerce. Steam has encroached upon sail until, at present, over nine-tenths of the ocean work is done by steam-driven vessels, fed almost exclusively with coal. This dependence upon coal makes the coal supply one of the most important questions connected with the management of shipping and the selection of routes. It is entirely possible that some revolutionary invention may displace coal as a source of power, and cause the importance of coaling stations to decline as suddenly as it arose. For the present, however, the coal problem occupies a position of unchallenged importance.

As was pointed out in the chapter on the charter traffic, the distribution of coal among the world’s coaling stations is largely a by-product of the charter traffic. Owing to this dependence the coal secured by ocean steamers away from their home ports is originally derived from a surprisingly small number of places. The great bulk of it comes from Wales, some from eastern United States, Australia, Japan and small quantities from India, southern Chile and the Puget Sound district of United States and Canada. Another result of the distribution by charter vessels is the relative cheapness of coal near centers of production of general commercial products, which give return freights to coal-carrying vessels.

*Prevailing Freight Rates for Coal, March 16, 1904, from Wales to*

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<td>Port Said</td>
<td>1.32</td>
<td>Buenos Ayres</td>
<td>1.92</td>
</tr>
<tr>
<td>Aden</td>
<td>2.28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(62)
Prices of Welsh Coal from Hull, Blyth & Co.'s Coaling Contracts for 1904. Prices in Shillings.

<table>
<thead>
<tr>
<th>Port</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gibraltar</td>
<td>22</td>
</tr>
<tr>
<td>Constantinople</td>
<td>22</td>
</tr>
<tr>
<td>Naples</td>
<td>19½</td>
</tr>
<tr>
<td>Bahia</td>
<td>38½</td>
</tr>
<tr>
<td>Rio Janerio</td>
<td>33½</td>
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<tr>
<td>Santos</td>
<td>40</td>
</tr>
<tr>
<td>Montevideo</td>
<td>30</td>
</tr>
<tr>
<td>Buenos Ayres</td>
<td>28</td>
</tr>
<tr>
<td>Cape Town</td>
<td>44</td>
</tr>
<tr>
<td>Mauritius</td>
<td>41</td>
</tr>
</tbody>
</table>

Examination of the above table of coal freights shows that the rate bears little relation to the distance; that to Buenos Ayres being lower than to Santos, which is nearer; and that to Constantinople, near the Black Sea grain and oil ports, being a little less than to Algiers, which is about half as far, and on the same route. In the table for coal prices we see the same factors making striking differences among the five South American ports mentioned, Brazilian coffee and Argentine wheat being the causes of variations. Cape Town, with no return cargo, has coal more than 50 per cent. higher than Buenos Ayres, although about equally distant from Wales. Mauritius, located in the Indian Ocean, far beyond Cape Town, has sugar to export and coal cheaper than Cape Town. These peculiarities of distribution are factors of great importance and universal application in the development of coaling stations.

In deciding what shall be his coaling stations for a particular voyage or a particular route, the manager of steamers must consider several factors which may give different results under different commercial conditions, for there is a rather surprising degree of option and variety of choice open to the man who considers this question. The resultant decision is a neat balancing of profit and loss factors. 1. Comparison must be made of the advantages of carrying much coal or much freight. 2. Port charges due to entering ports. 3. The distribution of possible stations and the longest link in voyage without coal.

1. If the route offers the possibility of coaling several times along its course, as almost all long routes do, shall the steamer stop frequently for coal and carry the greatest pos-
The Organisation of Ocean Commerce.

sible freight cargo or shall she carry less tons of freight and more tons of coal from the most favorable places for coal purchase? That question is answered by comparing the profit derived from carrying the extra tons of freight, with the loss from buying en route the extra tons of coal that are made necessary. The changing price of coal and the changing profits from freights, and the difference in coal price at different stations, make this a fluctuating balance. If the profit in carrying a ton of freight from New York to Australia is $5 per ton, and the loss in purchasing coal at Cape Verde rather than New York is $4 per ton and at Cape Town $8 per ton, the steamer will probably coal at Cape Verde and pass Cape Town. If the freight profit drops to $3, and the Cape Verde coal margin remains at $4, the coal will most likely be secured at New York for the entire voyage. Decisions of this character make constant fluctuations in coaling practice. The steamer bound from New York to China may secure an extra lot of paying cargo at the last moment, making it necessary to coal at the Azores and frequently beyond. If the freight is not so abundant the first stop may be at Algiers, and the number of coal stops for the voyage will be less. There are times when regular Oriental liners steam from Liverpool to Japan without coaling en route.

2. The costs of stopping are always a deterrent from making frequent coaling stops. A stop means the loss of valuable time, and it may mean the payment of harbor dues, wharf dues, quarantine and pilotage, one or all. These charges materially increase the real cost of the coal.

The above-mentioned factors contain a large element of choice, but this is usually lacking in the third.

3. The longest break without the possibility of coal may decide the amount of bunker space that must be left, and unless way freight can be taken for intermediate ports, that longest break will decide the coal space and make it profitable to carry coal past good coaling stations that may be closer together. The steamer route from New York to San Fran-
Cisco is an illustration. From southern Chile the steamers, after coaling at Coronel, steer directly across to San Francisco. The coal space necessary for this part of the voyage will hold enough coal to bring the steamer out from New York to Coronel without stop at any port of eastern South America.

As a result of the conditions affecting the coal supply and its distribution, there is a decided tendency to supply steamers as near as possible to the source of the coal. This is much less true of express steamers making a specialty of speed, than it is of the purely freight service. By coaling at the home port the purchaser avoids the payment of coal freight and is, in a measure, his own freight carrier. The coal merchant in the Mediterranean or West Indies must buy the coal in Cardiff, Philadelphia or Pittsburg or Norfolk, pay the out-freight and then receive a profit on both transactions when he sells to passing steamers. If the shipowner buys in the original coaling port he can secure it as cheaply as the merchant, and save the profit made by the latter. This reasoning explains the common practice of the owners of vessels plying between the cities of the United States and the West Indies, and England and the Mediterranean. The steamers usually set out with enough coal to last for the round trip, and purchases are made en route only under unusual circumstances. More pronounced examples of this avoidance of intermediate stations will appear in the discussion of the coal supply along the principal routes.

The great ocean trunk routes differ widely in their dependence upon and their supply of coaling stations.

The Atlantic North trunk has no coaling stations except those at the eastern and western ends. Fortunately for the commerce on this route there is an abundant coal supply at each end, and in times of disturbance in coal production and supply, the line steamers are able to secure enough coal at either end to run them on the return trip. Under ordinary conditions American coal is used going east and European going west. Most of the coal for the European supply of
Steamers comes from England, even though the vessels are running to continental ports.

It is quite common for European steamers plying to ports in the Gulf of Mexico to coal at Norfolk, Va., on the return voyage. This is the port of shipment for the Pocahontas coal, than which there is no better for steaming purposes.

The Mediterranean-Asiatic trunk has an exceptionally favorable chain of coaling stations scattered at convenient intervals along its route. Steamers dispatched from America pass within sight of the Azores, where the port of St. Michaels offers a good coaling station. Then come Gibraltar, Algiers, Malta, Port Said, Aden, Colombo, Singapore, Hong Kong, Shanghai and the chief terminus, Yokohama, lying near the Japanese coal fields. This route has, in addition to the frequency of its stations, several causes making coal cheap. It is produced at both ends of the route, and cheap freights distribute it along the route. Freights are low to the Mediterranean because of the export freight furnished by Black Sea grain, Sicilian sulphur, and the exports of Egypt. India has a heavy grain export, which has made cheap import coal, but in recent years the mining of Indian coal has almost stopped the import of this commodity. Coal is drawn to Singapore by the possibility of out cargoes of Java sugar or Asiatic rice, so that in this market the shipper can buy Australian, Indian, Japanese and sometimes Welsh coal, and passing steamers are almost invariably supplied here. Of equal importance as a coaling station is Port Said. Algiers and Colombo are next in importance and but slightly less frequented. Algiers is popular with the American lines, while some of the British call at Gibraltar. St. Michaels, Azores, is also frequently used as a point of supply for American vessels, particularly in times of prosperity among shippers, but the American vessels oftener go on to Algiers for the first stop. Many vessels coal at Aden, but this port is less used than the rest, because lying, as it does, between two desert regions, coal is high and passing steamers are often supplied at Port Said,
Coal Supply and Coaling Stations.

so that they can pass on to Colombo and even Singapore. As mentioned above, vessels sometimes use the route without coaling at all.

The South African trunk route offers a strong contrast to the Mediterranean-Asiatic. The available ports are fewer, no coal is produced for export along the route and there is no surplus of exports to make coal importation easy. The nearest sources of supply are Australia and England, each more than five thousand miles distant from South Africa, the natural location for a great coaling station. St. Vincent, Cape Verde, is, however, used much more than Cape Town. The latter city is used only by vessels in the African trade, those to Australia pass the Cape of Good Hope without stopping and many do not stop at Cape Verde. In cases of emergency, Albany, West Australia, is a convenient port, but steamers usually go directly to Adelaide, Melbourne or Sydney. This last city, the metropolis of Australia, is near the coal mines, is the greatest coaling station of the southern hemisphere and is visited by nearly all steamers that go to Australia. The island of St. Paul lies in the southern Indian Ocean, almost on the track of the Australian steamers, and it has a good harbor, but no use is made of it and the island is uninhabited.

In the trade along the west coast of Africa, which is nearly monopolized by lines from Liverpool, Hamburg and Antwerp, the usual practice is to carry coal from Europe to last both ways.

The South American trunk route is well supplied with coaling stations throughout the greater part of its length, and has the great advantage of a local coal supply beside the sea in southern Chile, latitude 38° S. The heavy exports of Chilean nitrate and Argentine wheat do much to facilitate the importation of coal for the central part of the west coast. The stations are well distributed. Steamers from Europe pass Madeira, the Canaries and the Cape Verde Islands, those from the United States pass near the outer West Indies. After reaching Cape St. Roque, the route
The Organization of Ocean Commerce. passes close to Pernambuco, Rio Janeiro and Montevideo on the east; Punta Arenas on the Straits of Magellan, and a succession of ports on the western coast, of which the most important are Coronel, Valparaiso, Iquique, Callao, Guayaquil and Panama, Acapulco and San Francisco. As is the case on the Mediterranean-Asiatic trunk, the ports are not equally used as coaling stations. Line steamers from New York to Buenos Ayres often aim to carry enough to last them back to New York, and if they run short, supply themselves at St. Lucia in the Lesser Antilles. Line steamers to the west coast often go directly to Coronel, as do the San Francisco steamers. Nitrate steamers are supplied in the nitrate ports, Autofagasta and Iquique, chiefly with Australian, but also some Welsh coal. The bunkers are usually replenished at Coronel, Montevideo and St. Lucia, or at St. Vincent, Cape Verde, if the destination is in Europe. The trade routes of the West Indies and the Caribbean are abundantly supplied with coaling stations in the multitudinous ports of that region, but a comparatively small amount of coaling is done. The direct lines from the United States usually carry enough coal to last both ways. For the British lines the distance is too great, and they usually take on coal at some West Indian port. St. Thomas, lying on the northeastern passage to the Caribbean is probably the most important of these coaling stations, with Kingston, Jamaica and Havana next in importance. The Pacific, the largest and widest of the oceans, has a multitude of islands dotting its surface, but none of them are coal producers, and surprisingly few coaling stations have developed among them. This is to be explained by the high price of coal upon small islands, and by the additional fact that each of the four continents bordering upon the Pacific has a coal-producing area near its shores: New South Wales in East Australia, Chile, Japan and the Washington and British Columbia field. Each of these districts is on or at the end of a trunk route, and between them they are
able to supply most of the coal used in the Pacific. Yokohama, Osaka, Moji and Nagasaki are the chief Japanese coaling ports, and the terminal ports perform that service in America. The only coaling station of importance away from the mainland is at Honolulu, Sandwich Islands. Some of the lines passing over the American-Oriental route stop here for freight, but it is not a regular practice for them to secure coal at this port. Steamers in the North Pacific trade usually run from Japan to the mainland of North America without coaling, and most of them without stopping. Those following the great circle route pass close to or in sight of the Aleutians, but coal is never taken in this region, although the Aleutian port of Dutch Harbor is used as a coaling station by the Behring Sea traders.

The coaling practice on the Pacific Coast-Australasian route is quite similar to the above. Calls are made at Honolulu, Samoa, Fiji and Tahiti, but the steamers usually start with enough coal to carry them for the whole breadth of the Pacific.

In this chapter no attempt has been made to give a complete list of the world's coaling stations. As with the ocean routes, only the most important have been referred to. There are hundreds of lesser trade routes and coaling stations that are not of sufficient importance in international trade to merit discussion in a work of this character. Every port having lines of local steamers is likely to have coal for their accommodation. The minor or so-called outports on the routes of coasting steamers, such as those along the western coasts of Africa or South America, often have limited coal supply, although it is not regularly called upon. Ports from which tramp steamers occasionally depart are also stations where coal may usually be obtained. These lesser ports, however, do but an insignificant share of the total coaling traffic. The most of it takes place at the comparatively few important stations upon the trunk routes. In some seas coaling stations of minor grade are very numerous. On the Pacific Coast of South America, coal supplies
were kept in 1901 at thirteen of the twenty-five ports of call for European and American steamers. On the shores of the West Indies, the Caribbean and the Gulf of Mexico there were forty-three coaling stations. The Mediterranean possessed seventy-nine, the Black and Azof Seas fifteen, the Atlantic Coast of the United States seventeen, of Canada and Newfoundland twenty-six.

The statements made in this chapter are not made with reference to war vessels. With this type of craft questions of economy and cost are minor considerations, and coal is commonly taken wherever its location is most convenient.

The facts here given concerning the numbers of stations are taken from the United States Navy Department's coaling station map, a publication which has, unfortunately, been discontinued, owing to the difficulty of keeping the information properly revised.
CHAPTER VII.

TRADE ROUTES OF THE OCEAN—SAILING ROUTES.

The location of sailing routes differs from that of steamer routes because of the different methods of navigation. With the steamer every mile covered costs a certain coal consumption, so that the steamer routes, reckoned in miles, are almost always the most direct routes possible, deviations only being made to avoid rocks, ice, thick fog or very stormy locations. The steam navigator thinks of his voyage in miles because distance is the chief factor, but the sailing captain reckons his voyage by days because the varying winds may take his ship one mile or two hundred miles in a day; or, again, headwinds may make it necessary to "tack," or sail from side to side, so that two hundred miles of sailing means but one hundred miles of progress. So it is that sailing routes are decided not by the shortest lines, but by wind and other conditions over the seas traversed.

The force and regularity of the wind differ greatly in different parts of the ocean, and to avoid regions of calm or of low winds or headwinds, the sailing routes often make wide detours in midocean, and owing to the peculiarities of a sailing ship these vessels rarely go to and fro between two given points by the same route, because the wind that speeds the departing, retards the returning vessel. Further than this, the winds in many parts of the world change with the seasons, and the sailing routes of winter are different from those of summer. Owing to the lessened certainty of location and lack of freedom along coasts, sailing routes do not lend themselves so easily as steamer routes to a classification into trunk routes and branches.

Where such classification is possible it is decided more by wind influence than by common destination, and it is better to consider the routes with regard to the location of all
routes in each particular ocean rather than with regard to destination and origin of each particular route. The location of a sailing route depends upon so many different natural phenomena that all those in a particular ocean should be described at one time, because their location reflects the general climatic conditions of the ocean.

If such use of terms is permissible, it may be said that the sailing routes are more oceanic than the steamer routes because the sailing captain studiously avoids the vicinity of coasts and closed or narrow seas. The dangers of sailing are increased as the land is approached, and the coasting trade, with its frequent entering and leaving of ports and following of coasts, is not attractive to the owners of sailing ships. The Suez Canal is not used at all by sailors passing between North Atlantic and Oriental ports, because of the light winds of the Mediterranean, and the still lighter and more uncertain winds of the narrow and rocky Red Sea. All sailing vessels passing between the North Atlantic and the Pacific or Indian Oceans, almost all of those engaged in the sailing traffic, are compelled to traverse the length of the Atlantic, and the routes are decided by the prevailing winds which are a part of the general atmospheric circulation of the earth. An explanation of this circulation is essential to an understanding of sailing routes of all oceans.

The combined influence of the motion of the earth and the different temperatures in different latitudes produce a general wind system upon the surface of the earth and with increased regularity upon the oceans. This is studied by the sailing captain as carefully as the coal question is by the owner of a line of steamers. The winds are most regular and reliable in the hot latitudes. That part of the torrid zone receiving the most direct rays of the sun gets hottest and is a region of calms because the highly-heated air is rising. This rising air of the zone of calms is replaced by the air that blows in from north and south, the trade winds, which sweep regularly over the torrid zone and are deflected from north and south winds to northeast and southeast winds
Sailing Routes.

by the earth's rotation toward the east. In some regions, particularly off the coast of Spain, the trade winds extend to a considerable distance north of the tropic, but this is unusual. Owing to the apparent northward and southward motion of the sun, the zone of the trade winds also moves several degrees north each summer and south each winter. For the southern hemisphere the direction of these seasonal movements of the southern trades should be reversed. In the temperate zones the prevailing winds are westerly, though not so constant as the trade winds, being more liable to disturbance by cyclonic storms, during which the wind blows from all points of the compass in turn.

The sailing routes of the Atlantic illustrate in a striking manner the effects of the prevailing winds. Between the northern states and the English Channel the sailing vessel goes before the westerly wind and follows closely upon the steamer route. Returning there are two routes, a southern and a northern. The northern faces the west wind and involves much tacking back and forth. The southern route going southwest to avoid the westerly winds and get into the trades, passes along the coast of Spain, south of the Azores and Bermudas, and, crossing in the latitude of Havana comes up northwestwardly to the middle Atlantic states. If the destination is the Gulf of Mexico, the vessels go still farther south, passing into the Caribbean near Barbadoes and out through the Yucatan Channel into the Gulf. In the winter this southern route is made even longer because the vessel must go farther south to reach the trade winds. Even the vessel bound for New York may then go one hundred and fifty to two hundred miles south of the tropic of Cancer. At this season the seas east and north east of Newfoundland are more favorable to ships because free from ice. The icebergs and ice floes are released from their frozen moorings by the summer thawing and float about the ocean during summer and autumn. The solid freezing of winter holds the next ice crop in place until the succeeding June.
route. From the North Sea they go around Scotland, those from the Channel steer northwest from the Scilly Isles or southwestern Ireland, till latitude 54 degrees is reached, then from midocean a southwesterly route is followed along the coasts of Newfoundland and Nova Scotia. This northern detour is taken to avoid the strong headwinds and storms which often rage during this season with great fury between 45 and 50 degrees north.

The most important sailing routes of the Atlantic are those leading to the other oceans by way of Cape of Good Hope and Cape Horn. The inbound and outbound tracks differ, and there are also the seasonal variations, but these sailing routes are more deserving of the name of trunk routes than any others in the world. The equatorial section of the outbound route is followed by all vessels from both Europe and America destined to the coasts of the five continents bordering upon the Pacific and Indian Oceans. The inbound routes to Europe and America are not at any time united so completely, although they have some of their divisions in common.

The outgoing routes converge in the equatorial section because they cannot safely pass Cape St. Roque without going with the trade wind that blows from the Canaries directly toward the point of South America. European vessels have a direct route from the English Channel till they reach the trade winds off the coast of Spain or Morocco.

The vessels from the Atlantic Coast of the United States would be delayed by the trade wind if they sailed directly toward Brazil. The quicker way for them to reach Cape St. Roque is to go with the west wind eastwardly across the Atlantic toward the Azores, then turn south and go with the trade wind. This route joins the European near the equator. From this point southward to the tropic of Capricorn vessels bound for the Indian Ocean proceed directly south to avoid the southeast trade and catch the prevailing west winds which carry them across the South Atlantic to Cape Town and into the Indian Ocean. A part of the
Sailing Routes.

southeast trade is deflected toward the southwest along the slanting coast of Brazil. To take advantage of this wind and a similarly deflected equatorial current the route to the Pacific separates from that to the Indian Ocean opposite Pernambuco and follows the coast, passing inside the Falkland Islands and around Cape Horn.

The inbound routes of the Atlantic are everywhere in different locations from the outbound. In returning from the Indian Ocean the southern west winds are a hindrance and the navigator keeps as close to the Cape of Good Hope as possible, and sails northwest into the trade winds and on toward the equator. The American and European routes from the Indian ocean diverge from the Cape; the first-named going almost directly to New York, thus crossing the northeast trade at a right angle, and having nearly the same angle to the Gulf Stream and the prevailing westerly winds north of Bermudas. The European routes in crossing the northeast trades are driven so far to the west that they enter the zone of westerly winds in the longitude of Eastern Brazil and Greenland, and, passing to the west of the Azores, approach their destination from a westerly direction.

The captain sailing around Cape Horn into the Atlantic desires to avoid the coastal wind and current that carried his ship downward and inside the Falkland Islands. Inbound, he steers far to the east of the Falklands, keeping in the prevailing west winds as long as possible, and then borne onward by the southeast trades makes a gradual curve toward the equator at midocean. If the destination is America, a northwesterly route is taken at 10° S., and north of the equator, the routes to American and European ports are similar to those from the Indian Ocean, described above.

The trade routes of the Pacific are shaped by the same forces that operate in the Atlantic. The effect of the prevailing winds is distinctly marked in the north and south routes. Northward from Cape Horn vessels run comparatively close to the coast and directly across the course of the west winds. When the ships bound for the Pacific Coast of
the United States reach the southeast trade they follow it to the equator, work as best they can directly north across the zone of calms and then at right angles across the northeast trade until they reach the westerly winds, before which they run directly to the land. This last characteristic is much more pronounced in the route from Australia. The remarkable curves in the northern and southern parts of this route giving it the shape of a letter S, are striking evidences of the value to the sailor of the westerly winds of the temperate zones. The sailing route from San Francisco to Cape Horn goes southward with the northeast trade, turns to the west to get a sailing angle across the southeast trade and then below the tropic, gradually swings southeastward to the Cape with the westerly winds. From San Francisco to Australia the route is comparatively direct, going with the northeast trade toward the equator, at a right angle to the southeast trade until close to the tropic of Capricorn, where a turn to the west is made to avoid the westerly winds until as near the Australian Coast as possible.

The most curious of all Pacific routes are those followed between San Francisco and other North Pacific ports and Panama and Callao. Between the equator and Central America, and running west as far as 115° W., is the largest region of calms in the world. At certain seasons there are daily thunder storms and slight breezes that blow a vessel a few miles this way one day and possibly the opposite way the next. There are cases on record of vessels that have beaten about the Bay of Panama and the adjacent ocean for more than one hundred days without making any material progress. South of this zone of calms is the southeast trade. In avoiding these difficulties it is the custom for sailing vessels bound for Central and South American ports to pass far to the west where the zone of calms is narrow, and go around below the trade wind which is a headwind, and then across or with this wind to the port desired. Coming out from these coasts is easier because the trade wind is favorable, but the calms are none the less formidable, and from Panama
they must be avoided according to Maury by a southern detour made by beating down the Colombian Coast to the neighborhood of the equator, passing westward by the Galapagos Islands to one hundredth meridian, then northwest toward Cipperton Rock, 10° N. and 109° W., whence the course follows previously mentioned routes to the northward.

In the North Pacific the route from the Orient to North America is like the corresponding route of the North Atlantic, a simple following of the westerly winds. Westward, the vessels drop down into the latitude of the trade winds near the latitude of Hawaii, and sail directly west near the twentieth parallel until necessary to turn off to reach the ports of Japan or China.

Equally simple is the much-frequented route across the South Pacific from Australia to Cape Horn. The west wind enables the ship to sail directly toward the Cape. A great circle route cannot be followed because of the danger from floating Antarctic ice.

The wind system of the northern half of the Indian Ocean is unlike that of the other oceans, because of the disturbing influence of the continent of Asia. This enormous and largely arid land mass lies just to the north of the trade wind zone, and in summer it becomes so much hotter than the ocean to the south of it that the air rising from over the land draws toward the land an enormous southwest sea breeze blowing from the equator toward Asia—directly reversing the trade wind during the summer months. These winds, bearing the name of monsoons, occupy the latitude of the northern trades, and by their force sweep across the greater part of the usual zone of calms, and in the season of the northern summer they exert some influence several degrees south of the equator. The southern part of the Indian Ocean has a normal trade wind at all seasons and the northern part has in the winter months.

The sailing routes of the Indian Ocean, unlike those of the Atlantic and Pacific, have somewhat the form of trunk lines and branches with separate systems inbound and outbound.
The inbound trunk follows the southern margin of the ocean from west to east. On this thoroughfare the navigator takes advantage of the steady west wind as long as possible before turning northward to the ports of Africa, Asia or the East Indies. Australian vessels complete the voyage before the west wind. Vessels turning toward Asia or the Sunda Islands can sail by the trade winds directly north to the vicinity of the equator. Here the course, for points beyond the equator, must change to take advantage of the changing monsoons. The summer route to Bombay passes north close to the east coast of Madagascar, and goes with the southwest monsoon across the Arabian Sea. The winter route, avoiding the full force of the winter (northeast) monsoon, goes northward toward Ceylon and then turning northwest follows the west coast of India at right angles to the wind. The return routes for both seasons follow closely upon the latter route as far as the equator, and then, like all the returning routes of the Indian Ocean, go west southwest across the southeast trade wind to the point of Africa, avoiding the westerly winds as much as possible. The routes to and from Calcutta show the results of exactly the same principles that entered into the location of the Bombay routes. They do not cover so wide an area because the Bay of Bengal is so much narrower than the Arabian Sea. Sunda Strait, the sailors' gateway to the East Indies, the Philippines and the coasts of East Africa, is below the monsoon zone, and has but one approach directly from the south and one outbound route, a direct line to the point of Africa.
CHAPTER VIII.

THE PROBABLE EFFECTS OF THE PANAMA CANAL UPON OCEAN TRADE ROUTES AND COALING STATIONS.

There is no better way to realize the world character of present commerce than to speculate upon the probable changes to result from the opening of a canal across the American isthmus. The effects of this new inlet to the Great Pacific will run through the world's commerce like new gold in the currents of financial circulation. There is no limit to the field of its influence. The trade of all the great nations, and of most of the secondary ones, will be directly affected; every one of the great trunk routes for both steam and sail will become of more or of less importance as a result of the opening of this new highway between the two greatest commercial oceans. It is impossible to foretell with exactness the extent of these changes; indeed, it will be impossible to state them statistically when they have occurred, unless in the interval statistical work of a hitherto unprecedented character is taken up and completed.

Two elements confuse any estimate of the probable use of an isthmian canal: (a) the rate of toll, (b) the improvements in the methods or cost of navigating ships.

(a) The Panama Canal is not, like the Suez Canal, to be the money-making scheme of a private company. Nevertheless, tolls will almost certainly be charged, and, as with all other canals, the rate of toll will affect the extent to which commerce will use the waterway. The question of toll rate is of especial importance in the management and traffic of the Panama Canal, because such a large proportion of its trade might be driven to other routes by high rates of toll. In this respect it is signally different from the Suez Canal. The American canal has four main fields from which and to which its commerce may come and go: Pacific North
America, Pacific South America, eastern Asia and Australasia. Two of these four trade areas are upon the margin of the zone of canal influence. A high rate of toll might drive away completely the commerce of Australasia, most of the South American and, if accompanied by low tolls at Suez, a considerable share of the Asiatic trade might also be lost to the American canal. But a reduction of the Suez rate is highly improbable, because the reasons that prompt to low tolls for the Panama Canal, prompt to high tolls for the Suez. Of the traffic for this canal, a surprisingly small portion is upon the margin of its traffic zone, only the Australasian, and the greater part of that follows the Good Hope or Magellan routes. The great bulk of Suez traffic is bound to or from southern and eastern Asia, and the saving is so great that the shippers can afford to pay high tolls. If the tolls were raised one-third or one-half, nearly all of the traffic would at present continue to use the canal, and if the rate were reduced one-third or one-half there would be but slight gains in tonnage, certainly not enough to make up the loss in revenue.

With the Panama Canal, traffic will fluctuate with the rate of toll. It is possible that as much revenue will be derived from a low rate as from a higher one, because of the greater amount of business done. For example, a rate of $1.50 per ton (net register) would yield, for four million tons, six million dollars. The same income would be derived from $1.00 per ton on six million tons, and there would be a great additional saving to commerce because of the greater number of ships following the shorter route.

In operating the Panama Canal, the United States Government may follow one of three toll policies. The toll may be fixed with the object of (1) paying a profit to the government, in the form of interest on the investment; (2) paying expenses and providing for a sinking fund to cover the cost of construction; or (3) to merely pay operating expenses. The fourth possibility, absolute freedom from tolls, scarcely merits consideration.
The first plan, that of deriving profit, is highly unlikely, owing to the great interests of the American commerce in the canal, and the general policy of the government in making improvements to foster trade. Of the two remaining policies, the third is quite as likely to prevail as the second. In that case 50 cents per ton promises to be adequate to cover all expenses from the very beginning, while the rate of $1.00 per ton would within a short period probably provide for interest payments. Considering the commercial policy and commercial interests of the United States, and the probable deflection of commerce by a high rate of toll, it is not likely that the rate will exceed $1.00 per ton, and it may be much less. The discussion in this chapter is based upon anticipations of a toll of $1.00 per ton, although the possibility of the cheaper toll is not thereby dismissed to the realm of pure speculation.

(b) The use of the canal will be materially affected by any improvements in shipping or conditions in the shipping market which permanently or temporarily affect the cost of running ships. The shipowner will pay tolls to send his ship through the canal because it costs less than to pay operating expenses for a longer voyage around. Improvements may reduce these expenses so that for some shippers there will cease to be profit in using the canal.

Ship expenses may be roughly divided into the following classes: 1. Cost of construction. 2. Interest on the cost, along with insurance, and, at times, a positive profit over and above interest. 3. Wages, including provisions. 4. Motive power, including repairs to machinery and fuel. Each of these four elements is subject to change with the passing years, and some of them to very great change. The steady progress of science and mechanical invention is reducing the cost of construction. The rapidly increasing accumulations of capital are bringing down the rate of interest and the necessary interest charges on a ship. Improvement in ships' machinery is reducing the demand for human labor, lessening the number of the crew and the size of the
wage roll. This process has not ended. Well-nigh revolutionary changes in ship mechanism seem to be among the early possibilities, and, as in the past, this will be accompanied by further reductions in the fourth element of cost—repairs and fuel. Ten or twelve years of progress and change along these lines may bring about such different conditions that certain traders now willing to pay a certain toll at the canal, will then find it more profitable to go around than pay that toll.

Similar relapses in canal traffic are likely to be produced temporarily by periods of great depression in the shipping business. As has been pointed out in the chapter on charter traffic, these crises go to surprising extremes, entirely wiping out profits and interest on the investment, and sometimes incurring heavy cash loss from operating expenses. One result of such conditions is a reduction of cost to the charterer who might find that it paid him for a short time to abandon the use of the canal, although under normal conditions he used it regularly. The Suez Canal traffic does not fluctuate on this account, because it has practically no free marginal traffic. The term "free marginal" traffic refers to the tramp vessel bound by no obligations but those of economy, and having the possibility of choice of routes other than the canal. The only Suez traffic that is at all marginal is the Australian, and the really marginal Australian traffic goes by the Cape of Good Hope, leaving only the mail lines to pass by Suez. The reason for using the Suez Canal is economy of time, not cheapening of freights, and the mail contracts and the special character and traffic of the vessels render them free from the influence of temporary conditions of the ship market. They must continue their established practice. Much of the Panama Canal traffic, being freight only, could shift to any route that was most profitable, and other routes would rival a high toll Panama Canal.

The American isthmus occupies such a commanding and strategic point in the world system of ocean highways, that the great trunk routes will be examined in succession to
## TABLE OF DISTANCES

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>New York via Present Route</td>
<td>13,714</td>
<td>13,564</td>
<td>13,514</td>
<td>11,601</td>
<td>13,658</td>
<td>13,083</td>
<td>14,333</td>
<td>12,575</td>
<td>10,425</td>
<td>9,221</td>
<td>8,461</td>
<td>8,150</td>
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<tr>
<td>Panama Canal</td>
<td>5,299</td>
<td>9,835</td>
<td>10,885</td>
<td>11,585</td>
<td>9,814</td>
<td>10,022</td>
<td>8,454</td>
<td>10,530</td>
<td>2,864</td>
<td>4,021</td>
<td>4,630</td>
<td>4,836</td>
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<tr>
<td>Saving by Canal</td>
<td>8,415</td>
<td>3,720</td>
<td>1,629</td>
<td>16</td>
<td>3,844</td>
<td>3,061</td>
<td>5,799</td>
<td>2,045</td>
<td>7,501</td>
<td>5,200</td>
<td>3,831</td>
<td>3,024</td>
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<tr>
<td>New Orleans via Present Route</td>
<td>14,114</td>
<td>14,020</td>
<td>13,879</td>
<td>12,966</td>
<td>14,025</td>
<td>14,051</td>
<td>15,301</td>
<td>13,543</td>
<td>10,823</td>
<td>9,621</td>
<td>8,861</td>
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<tr>
<td>Panama Canal</td>
<td>4,608</td>
<td>9,234</td>
<td>10,284</td>
<td>10,984</td>
<td>9,213</td>
<td>9,421</td>
<td>7,933</td>
<td>9,920</td>
<td>2,263</td>
<td>3,420</td>
<td>4,029</td>
<td>4,237</td>
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<tr>
<td>Saving by Canal</td>
<td>9,416</td>
<td>5,695</td>
<td>3,505</td>
<td>1,982</td>
<td>5,417</td>
<td>4,030</td>
<td>7,368</td>
<td>3,614</td>
<td>8,560</td>
<td>6,201</td>
<td>4,832</td>
<td>4,023</td>
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<tr>
<td>Liverpool via Present Route</td>
<td>14,084</td>
<td>11,640</td>
<td>10,580</td>
<td>9,677</td>
<td>12,324</td>
<td>11,650</td>
<td>12,949</td>
<td>11,151</td>
<td>10,722</td>
<td>9,501</td>
<td>8,531</td>
<td>8,230</td>
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<tr>
<td>Panama Canal</td>
<td>8,038</td>
<td>12,574</td>
<td>13,624</td>
<td>14,324</td>
<td>12,553</td>
<td>12,761</td>
<td>11,273</td>
<td>13,260</td>
<td>5,603</td>
<td>6,760</td>
<td>7,369</td>
<td>7,577</td>
</tr>
<tr>
<td>Saving by Canal</td>
<td>6,046</td>
<td>2,034</td>
<td>2,041</td>
<td>2,047</td>
<td>319</td>
<td>1,102</td>
<td>1,676</td>
<td>2,118</td>
<td>5,110</td>
<td>2,831</td>
<td>1,462</td>
<td>653</td>
</tr>
</tbody>
</table>

1. Via Straits of Magellan.  
2. Via Pernambuco and Callao.  
3. Via Suez Canal.  
4. Via San Francisco.  
5. Via San Francisco and Yokohama.  
7. Via Wellington.  
8. Via St. Vincent, Cape of Good Hope and Melbourne.  
10. Via St. Vincent and Cape of Good Hope.  
11. Via Wellington and Melbourne.
determine the probable changes that will come with the connection of the Atlantic and Pacific Oceans at that point.

The South American trunk route will be the one most affected by the new waterway across the isthmus. It is true that the countries of Atlantic South America will continue to trade as before, but all, or nearly all, of the heavy Pacific trade using this route will be diverted to the canal route. This is especially true of the three regions nearest the canal—the Pacific Coast of United States and Canada, along with Hawaii; western Mexico and Central America; and northern South America. As shown by the accompanying table, the steamer’s voyage will then be a little over five thousand miles from New York to San Francisco, as compared with the present journey of over thirteen thousand miles by the Magellan route, a saving of more than eight thousand miles. From Liverpool the saving is two thousand miles less; from New Orleans a thousand miles more. The greater saving from New Orleans is due to the proximity of that city to the canal, and to the westward trend of the Gulf of Mexico, which gives a greater distance from the eastern point of South America. To Guayaquil, the most typical port of the Pacific side of northern South America, the saving in distance from New York, New Orleans and Liverpool is respectively seven thousand five hundred, eight thousand five hundred and five thousand miles. In all cases the routes between Europe or the United States and any of the Pacific-American countries north of Peru will be shortened by a distance one and two-thirds to three times as great as the trans-Atlantic voyage from New York to Liverpool. Every steamer engaged solely in this trade will necessarily use the canal or incur heavy loss by using the longer route.

Toward the southern part of the continent there is some debatable trade, which may follow the Magellan in preference to the Isthmian route. Such trade will, however, be of comparatively small amount and will belong to Europe, not the United States. It will be of small proportions, because the bulk of Chilean commerce originates in the northern
Effects of Panama Canal Upon Trade Routes.

part of the country, the part south of 42° S. being practically devoid of population or of trade. More than three-fourths of the entire export trade of Chile is the nitrate of soda and ores of the north; Iquique, the leading port of the district, is near the center of the South American Coast. The agricultural exports come chiefly from Valparaiso, and smaller quantities from other ports as far south as Valdivia. It is the trade of agricultural or southern Chile with Europe that is debatable. For the United States trade with this region the distances saved by the canal practically settle the question of Chilean trade in favor of the canal route. From New York the saving is 5,200 miles to Iquique, 3,800 to Valparaiso and and 3,000 to Coronel; from New Orleans 6,200, 4,800 and 4,000 respectively; from Liverpool 2,800, 1,450 and 650.

The best way to determine the influence of the canal in this trade is to examine the cost of operating ships, and see what tolls could profitably be paid. Fortunately, the practice of chartering steamers permits us to see very accurately what it costs to operate vessels. The owner of the vessel hires and pays the crew and pays for insurance, provisions and engine stores, and in fixing the rate for letting his steamer he is supposed to provide for wear and tear, and for his profits. The charterer provides for agency fees, pilotage, port charges, stevedoring and coal. As the charter money is sometimes agreed to a twelvemonth in advance, and the average coal consumption is known, the cost of a voyage from port to port can be estimated to a nicety.

The actual cost of running steamers is shown by the accompanying record of typical cases. Two British steamers were operated under time charters by an American firm engaged in the Chilean trade. The first column shows the cost to the firm of operating these steamers in the autumn of 1900, a time of great prosperity in the shipping business. The first steamer was much less expensive than the second, because she was nearing the end of a long contract made in a cheaper ship market than then existed. The second
column shows the approximate cost of the same steamers if they should have happened to be rechartered at the rates prevailing in March, 1903.\(^5\)

**Cost of Running Ships.**

1. *Gross Register, 3,048; Net Register, 1,954; Dead Weight Capacity 5,000, including Coal and Stores. Freight per dead weight ton per month (30 days).*

<table>
<thead>
<tr>
<th>Counting 1(\ell), $4.86, 5,000 tons</th>
<th>Autumn, 1900.</th>
<th>Spring, 1903.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal, 20 tons per day, 30 days, 600 tons</td>
<td>@ 4s. 6d. $5,467.50</td>
<td>@ 3s. 3d. $3,947.82</td>
</tr>
<tr>
<td></td>
<td>@ $3.00 1,800.00</td>
<td>1,800.00</td>
</tr>
<tr>
<td>Per month ...</td>
<td>$7,267.50</td>
<td>$5,747.28</td>
</tr>
<tr>
<td>Per day ......</td>
<td>242.25</td>
<td>191.59</td>
</tr>
</tbody>
</table>

2. *Gross Register, 3,244; Net Register, 2,190; Dead Weight Capacity, 5,100, including Coal and Stores. Freight per dead weight ton per month, (30 days).*

<table>
<thead>
<tr>
<th>Counting 1(\ell), $486, 5,100 tons</th>
<th>Autumn, 1900.</th>
<th>Spring, 1903.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal, 20 tons per day, 30 days, 600 tons</td>
<td>@ 5s. 6d. $6,816.15</td>
<td>@ 3s. 3d. $4,027.72</td>
</tr>
<tr>
<td></td>
<td>@ $3.00 1,800.00</td>
<td>1,800.00</td>
</tr>
<tr>
<td>Per month ...</td>
<td>$8,616.15</td>
<td>$5,827.72</td>
</tr>
<tr>
<td>Per day ......</td>
<td>287.20</td>
<td>194.25</td>
</tr>
</tbody>
</table>

Each of these vessels had a speed of about nine knots per hour, that being the usual speed for the tramp steamers that carry so large a share of the world's commerce. After making allowance for the delay in passing through the Panama Canal, the nine-knot steamer would save twelve and one-half days, avoiding 2,800 miles of sailing. Would it pay the European shipowners in sending their ships to and from the northern ports of Chile to pay canal tolls to save twelve days? For the 1,954-ton steamer, the toll, at $1.00 per ton, would be $1,954, and the saving, at $242.25 per day in 1900,

\(^5\)At the beginning of January, 1905, the rates would have been from three to six pence less per ton per month.