SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

874 BROADWAY, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.....$3.50 a year.
Great Britain and Europe..... 4.50 a year.

Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and one hundred copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

For Advertising Rates apply to HENRY F. TAYLOR, 47 Lafayette Place, New York.

THE EVOLUTION OF COMMERCE.[1]

FOR over three thousand years the great highway for commerce has been from India by the Persian Gulf and the Euphrates or by the Red Sea to the Mediterranean, and thence through the Mediterranean by Gibraltar to western and northern Europe, and, in our day, thence to America.

Along this route cities and nations have sprung up, increased in wealth and power, and passed away, giving place to other cities and nations further westward. These nations have been great carriers and distributors of minerals and goods, as well as capitalists and bankers, or carriers, bankers and manufacturers; in either case controlling the commerce of the world. This control has never for any long period been held by the same race, but has passed from one nation to another, always from the east toward the west.

The earliest highway of commerce was from India through the Persian Gulf, up the Euphrates to the Mediterranean; and carpets and precious stones were then as now carried over this route. Explorations and surveys for a railroad have been recently made along this "our future highway to India." Caravans brought spices from Arabia and rich stuffs from Babylon and Nineveh to the shore of the Red Sea. Solomon made a navy of ships and Hiram sent in the navy his "Servants, shipmen that had knowledge of the sea, and they brought gold from Ophir, great plenty of almug trees, and precious stones."

Tyre and Sidon founded colonies on the shores of the Mediterranean, enslaving the Spaniards and compelling them to work the mines of gold and silver already opened in Spain. Their ships sailed through the Mediterranean, by the Pillars of Hercules, into the Atlantic Ocean, turning northward to England for tin and copper and on into the Baltic Sea for furs and amber; turning southward along the western coast of Africa, passing certainly two thousand miles to the equator and probably rounding the Cape of Good Hope into the Indian Ocean. Products from the west were brought in ships to Tyre and Sidon and exchanged for the goods of the east, their merchants making profits on each transaction both as merchants and as carriers. Tyre and Sidon became wealthy, luxurious, and effeminate. Some of their citizens saw in Africa a richer soil and a better situation for a large city, and founded Carthage. The Carthaginians inherited the trade of Tyre and Sidon, and in addition opened highways to Egypt and into the interior of Africa, bartering their wares in Egypt for corn and grain and in Africa for ivory, gems, and slaves. They planted colonies in Africa and Sicily, and for a time were successful rivals of Greece and Rome.

The rule of the ocean transferred from Asia to Africa remained there but a short time, for the day of Europe came with the rise of Greece and Rome.

The Greeks founded colonies in Asia Minor, Sicily, and Italy. The ruins of great cities with Grecian temples and amphitheatres are found at Girgenti and Syracuse in Sicily, at Pæstum and other places in Italy. Under Pyrrhus, their armies were defeated by the Romans and their colonies captured. Deprived of these, their power rapidly declined and Greece became a Roman province.

Rome.

Rome founded few colonies, but she conquered the nations of Asia, Africa, and Europe, and brought under her sway cities, kingdoms, and empires. She boasted of five hundred cities in her Asiatic province that had been founded or enlarged and beautified by the Cæsars. One hundred and twenty vessels each year brought the goods of India from the delta of the Ganges, and large fleets from Egypt came laden with corn and grain. She imported from every country, but exported little, paying for her imports by taxes levied on her colonists.

Rome was the first power to incorporate conquered states into her dominion and extend citizenship to all the people in her empire; so that Paul could say in truth, "I am a Roman citizen and to Cæsar I appeal." So salutary and beneficial was her rule that under it these countries prospered more than under their own rulers. What Rome seized with strong hands she defended, and in return for taxation gave protection. She has no more enduring monuments than her roads, the remains of which are now found in every country of Europe. Though built as military and post-roads, they were used largely for commerce. All started from the golden mile-stone in the forum; one ran over the Brenner pass north-eastward to the Baltic Sea, another followed the north-western coast of the Mediterranean to Spain and southern France, another crossed the Alps and extended through France to the British Channel and through England to Scotland, where the Romans built a wall, ruins of which now bear witness to its strength. Another way went southward to Naples and Brindisi, and another led eastward to Macedonia and Greece. As these were the only roads in all these countries, it was truly said, "All ways lead to Rome;" and over them the messengers of Cæsar travelled more rapidly than the mail-carrier of our fathers on our mail-routes.

Venice and Genoa.

After five hundred years of empire Rome fell, and the Dark Ages followed. From A.D. 400 to A.D. 800 commerce and trade died out. The only vessels on the Mediterranean and Baltic were piratical crafts; Jerusalem and the Holy Land were captured by the Turks; the Crusades began, forerunners of a higher civilization and more extended commerce. Thousands and tens of thousands of people from all parts of Europe and all ranks of life, bearing the pilgrim's badge — the blood-red cross — journeyed toward the Holy Land, first in vast crowds led by Peter the Hermit, then in great armies led by kings and generals. For two hundred years this movement continued. Venice and Genoa furnished ships to carry the armies of France from Italy to the Holy Land. The Venetians were shrewd merchants and drove hard bargians, stipulating for cessions of land at the best commercial points and adequate compensation for their services. After the failure of each Crusade they brought back remnants of the troops and pilgrims, and with them the products of Asia Minor, and books and art treasures from Greece. These were distributed all over Italy, and led to the renaissance of the thirteenth and fourteenth centuries.

The trade with the East brought power and wealth to Venice

[1] Annual address by the president, Hon. Gardiner G. Hubbard. Presented to the National Geographic Society Jan. 15, 1892. Nat. Geog. Mag., Vol. IV., 1892.

and Genoa. They founded colonies on the Black Sea, in Asia Minor, and on the Asiatic coast. Venice alone had three thousand merchant vessels. Their commerce was not confined to the borders of the Mediterranean, for the goods of the Orient were distributed by the way of Augsburg and Nuremberg to the interior of Germany and to the towns of the Hanseatic Confederation. Thus commerce was opened with the interior of Europe.

By the failure of the Crusades, the power of the Turks, which had been for the time checked, grew and increased. They conquered the holy places of the earth, Asia Minor and Syria, and finally, crossing into Europe, gained Constantinople. The colonies of Venice and Genoa were captured; their fleets disappeared from the Mediterranean. In western Europe the Spaniards under Ferdinand and Isabella conquered the Moors, who for many ages had occupied the larger portion of Spain; and as the Crescent appeared in eastern Europe, the Cross triumphed in the west.

Spain and Portugal.

Then a new power appeared upon the stage. Spain and Portugal entered upon an era of exploration and discovery in regions unknown to Venice and Genoa. Commerce, which in the Middle Ages had been confined to the Mediterranean Sea, was now extended to the countries on the Atlantic Ocean, and the Cape Verde Islands, Madeira, and the Canaries were discovered. In one generation (between 1470 and 1500 A.D.) more and greater discoveries were made than in any other period of the world's history. The Portuguese sailed along the eastern coast of Africa and rounded the Cape of Good Hope; Vasco de Gama crossed the Indian Ocean to India; Columbus sailed westward to find the Orient, and discovered a New World; Magellan circumnavigated the globe; Balboa crossed the Isthmus of Panama and was the first to see, on the same day, the sun rise out of the Atlantic and set in the Pacific; and soon the eastern and western coasts of America were explored from Newfoundland to Cape Horn and from Cape Horn to Panama.

Both Portugal and Spain claimed all the New World, and as they could not agree upon a division of territory they referred the matter to the pope, who divided the New World between them. The Atlantic became the great highway for commerce, while the Mediterranean was deserted, and Venice and Genoa existed only in the past.

The commerce of Portugal was coextensive with her dominion, which extended from Japan and the Spice Islands and India to the Red Sea, thence to the Cape of Good Hope; and with their possessions on the eastern and western shores of the Atlantic and in Africa and Brazil completed their maritime empire, the most extensive the world has ever seen. Then a single fleet of one hundred and fifty to two hundred and fifty caracks sailed from the port of Goa to Lisbon; now there sails but one vessel a year from all India.

From Spain ships sailed both to the Caribbean Sea and to Cape Horn and thence to Chile and Peru, or directly north-westward from Cape Horn to the Phillippine Islands. Spain conquered Mexico, Central America, and all South America except Brazil. The gold and silver of Peru and Chile and the goods of the Orient were brought to Spain and Portugal. As their wealth and power increased the spirit of exploration decreased, and for nearly two hundred years the Spanish ships sailed in a fixed course by the same lanes, exploring the ocean neither toward the north nor the south, leaving undiscovered the great continent of Australia and numerous groups of islands.

The Spanish and Portuguese leaders were cavaliers who despised all commerce excepting in gold and silver, all kinds of manufactures, all manual labor, and the cultivation of the ground; they came not to colonize, but to satisfy by the labor of the enslaved aborigines their thirst for gold and silver. The whole political power was retained by the king of Spain and administered by Spaniards. While the silver and gold of America and the wealth of the Indies poured into the treasuries of Spain they wanted nothing more. Like ancient Rome, they took all the wealth of the conquered countries, making no return; but they did not, like Rome, give wise and equitable laws and a stable government to the countries they conquered.

The Netherlands.

The inhabitants of the Netherlands were manufacturers, and supplied the markets of Spain and Portugal and their colonies, thus reaping as large profits from their trade with these countries as the Spanish and Portuguese from the mines of gold and silver.

No part of Europe, says Motley, seemed so unlikely to become the home of a great nation as the low country on the north-western coast of the continent, where the great rivers, the Rhine and Scheldt, emptied into the North Sea, and where it was hard to tell whether it was land or water. In this region, outcast of ocean and earth, a little nation wrested from both domains their richest treasures.

The commerce of the Hanseatic towns, which had depended for their trade on Venice and Genoa, became less and less as the glory of those cities waned. Antwerp, with its deep and convenient rivers, stretched its arms to the ocean and caught the golden harvest as it fell from its sister's grasp. No city, except Paris, surpassed it in population, none approached it in splendor. It became the commercial centre and banker of Europe; five thousand merchants daily assembled on its exchange; twenty-five hundred vessels were often seen at once in its harbor, and five hundred daily made their entrance into it. The manufactures of Flanders and the Netherlands had been noted for many generations, and now vastly increased and were distributed all over the world. The Netherlands, though the smallest, became the wealthiest nation of Europe. Then came the long-continued war with Spain, ending in the siege and fall of Antwerp and in the imposition of such taxation as no other country had ever endured. As Antwerp had grown on the ruins of the Hanseatic towns, so her fall became England's gain.

France and England.

In America, north of Mexico, neither silver nor gold had been found to tempt the Spanish and Portuguese. The larger portion of the northern Atlantic coast was one long sand beach, broken by great estuaries and the mouths of great rivers; the rest was rocky and rugged, the temperature generally cold, the land unfertile and barren. For these reasons North America was left to the French and English. The French claimed Canada and the whole of the territory of the United States save a narrow strip of land on the Atlantic coast. The French population was small and was made up principally of fur traders and half-breeds; Great Britain held New England, Virginia, and the Carolinas.

After the first fever of religious colonization had passed, about the commencement of the eighteenth century, there was scarcely any emigration from England to America and but little trade between the two countries. The population of North America was small, its commerce less, with little profit to the European merchants. The country possessed no peculiar advantages for the production of articles of value in foreign markets; there was nothing, therefore, to invite immigration or commerce.

The chief inducement to the English to navigate the Atlantic was the hope of capturing the treasure-laden Spanish galleons and the rich Spanish cities.

Sir Francis Drake, Sir Walter Raleigh, and other navigators, aided by Queen Elizabeth, with bands of buccaneers, refugees from all countries, though mostly Englishmen, explored the recesses of the Caribbean Sea, crossed the Isthmus of Panama, and launched their little vessels on the Pacific. In fifteen years they captured five hundred and forty-five treasure ships, sacked many towns, trained the English seamen, and laid the foundation for the navy of Great Britain.

The growth of English commerce was slower than that of Spain, Portugal or Holland, and it was not until the middle of the eighteenth century, or two hundred and fifty years after the discovery of America, that she entered upon that career which gave her the control of the ocean. Her commerce was built up by protective laws, founded on the Navigation Act of 1651, which prohibited foreign vessels from carrying to or from England the commerce of any country but its own. These laws were universally regarded as among the chief causes and most important bulwarks of the prosperity of Great Britain, and they were con-

tinued until English ships controlled the carrying trade of the world, and were not finally repealed until 1854.

The mechanical devices of Watt, Arkwright, and other great inventors gave to England that supremacy in manufactures which she has ever since retained. The French revolution a little later aroused the fear of the statesmen, merchants, and capitalists of England that the energy of the new republic would be as omnipotent in mercantile affairs as on the field of battle. They believed that France might regain the colonies and with them the commerce she had lost, and therefore England declared war against Napoleon, which was carried on almost continuously from 1793 to 1815. The shipping of the continent disappeared or was captured by the fleets of England; the colonies, and with them the commerce, of Spain and Portugal, Holland and France, passed to England; and though she is still burdened with the debt then created, she has never lost the commerce and carrying trade she then obtained.

The population of the colonies of Great Britain is about one-sixth of the entire population of the globe; and their territory comprises eighty per cent of the available temperate regions of the earth belonging to the Anglo-Saxon race.

The commerce of England has given wealth to her bankers and merchants, and employment to her artisans, ship-builders, iron-workers, miners and manufacturers. Her exports of produce and manufactures have increased five hundred per cent in fifty years, or from $356,000,000 in 1840 to $1,577,000,000 in 1890, and are carried by her ships to every quarter of the globe. Though dependent on America for her food supplies, these are moved in British ships. The commerce of the world pays tribute to the bankers of London and makes that city the money centre of the world. Her best market is India, and from India comes her largest imports; next to these from the United States.

India.

Egypt, Nineveh and Babylon in prehistoric times, Tyre and Sidon and Greece under Alexander, Carthage and Rome under the Cæsars, Venice and Genoa in the middle ages, Portugal and Holland, and lastly England, have drawn great stores of wealth from India.

From India science and literature were handed on to Europe, and from India has come the religion of more than half of the human race. For India the Spanish sailed westward; for India the Portuguese sailed eastward; Portugal was the first to reach the goal and obtain the prize. Greater riches have been drawn from India than from the gold and silver mines of America, since for all ages it has been the storehouse from which treasures were derived. Portugal held India from about 1500 to 1600. Ships brought the silks and precious stones of India to Lisbon, where they were sold to the Dutch and distributed by them through Europe. Spain conquered Portugal, and to avenge herself on Holland excluded her merchants from Lisbon. Then they sailed directly for India, dispossessed the Portuguese, and the commerce of India was for the next hundred years controlled by Holland.

Then for a short time India was divided between France and England, but under Lord Clive and Warren Hastings the possessions of France passed to the East India company, and when their charter expired it was made a province of the crown and the Queen of England became Empress of India.

Unlike Rome and Spain in their dealings with conquered nations, England gives a fair exchange for all she takes, and rules in India for India, giving a more stable and equitable government than India ever before enjoyed.

To-day Tyre, Sidon, and Carthage are known only by their ruins; the glory of Greece and Rome, of Venice and Genoa, has passed; the power of Spain and Portugal has waned, while India is developing a social, moral, and political prosperity, with wealth and commerce unknown in any former period of her history.

Suez Canal.

Much of the trade of India in ancient times passed through a canal connecting the Red Sea with the Mediterranean, the remains of which still exist, and efforts to reopen it have been made at different times by Egypt without success. In 1856 de Lesseps obtained concessions from the khedive for the Suez Canal, and commenced the work under the direction of the best engineers of Europe. De Lesseps applied to English capitalists for help, but they were deterred by Lord Palmerston, who said he "Would oppose the work to the very end." Mr. Stevenson, the engineer, supported Lord Palmerston, declaring that "The scheme was impracticable, except at an expense too great to warrant any expectation of returns." The emperor of France lent his name to the company, and large sums of money were raised in France; but the canal was constructed mainly by the money and laborers of Egypt. It was opened in 1869, and immediately English steamers began to sail through the canal, and the route around the Cape of Good Hope was almost abandoned. Other flags soon followed, and the commerce with India and the east, so long lost to Venice and the ports of the Mediterranean, was revived.

In 1875 Lord Beaconsfield purchased for England a controlling interest in the Suez Canal, and England now rules both Egypt and the canal. The vessels of all the maritime nations of the world are constantly passing through the canal, with the single exception of those of the United States.

Colonies.

The commerce of the great nations of the world has been principally with their colonies or dependencies, and from this commerce they have derived their wealth. The mother country in return for its real or nominal protection, and for its own aggrandizement, has restricted the commerce of her colonies.

The European nations adopted four classes of restrictions: —

1. Restricting the exportation of goods from the colony except to the mother country.

2. Restricting the importation of goods from foreign countries into the colonies.

3. Restricting the exportation or importation of goods excepting in ships of the mother country.

4. Restricting the manufacture even of their own raw products by the colonies. So strong was this feeling in England that even Lord Chatham declared in Parliament, "The British colonies of North America have no right to manufacture even a nail or a horseshoe."

Most of these restrictions have been removed, though the result still remains.

The Phœnicians, Carthaginians, and Greeks had colonies on the Mediterranean. The Romans conquered, and held as subjects, nations and empires. Venice and Genoa had colonies on the Black and Mediterranean seas. Spain and Portugal held as dependencies all Central America, South America, Africa, India, and the islands of the Pacific. The Dutch Republic and France planted colonies in India and America. England has colonies in every part of the world, and on her dominion the sun never sets.

Germany, France, Portugal, and Russia, appreciating the necessity of colonies for the extension of their commerce and for opening new markets for their manufactures, are planting colonies, France in Cochin China, Germany on the eastern and western coasts of Africa and the islands of the Pacific. Portugal, aroused to a new life, is determined to hold her remaining possessions in Africa; Russia is steadily adding to her dominion in Asia, and her railway from the Caspian Sea to Samarcand has opened in western and a part of central Asia a market for her manufactures and commerce hitherto supplied by Great Britain.

United States.

The United States is the only nation that has become great without colonies and without foreign commerce and shipping. Its vast extent of territory, where the east and west, the north and south, are separated more widely than the colonies of Tyre and Sidon or of Carthage and Rome from the mother countries; the great variety of climate, the fertile soil, its varied occupations and manufactures, and a widely distributed population, have created an enormous inland commerce and given that trade and wealth which other countries find in commerce and exchange with their colonies. Our population, wealth, internal commerce, exports and imports have increased at a more rapid rate than

those of any other nation in a similar period. This is not due in any great degree to immigration, for our population has increased in no greater ratio since this immigration commenced than before, and experts believe that it would have been as large and more homogeneous without immigration. We had at one time a large foreign commerce, and our merchants were the first to establish direct trade with China and the East Indies; the Stars and Stripes were seen floating on every sea and flying in every harbor, and for years we were the second maritime nation of the world.

The commerce of the world passed from wooden sailing ships to side-wheel steamers, to iron and then to steel propellers; England was a worker in iron and machinery of every kind, we were not. The civil war came and hastened the day which was sure to come. Our shipping faded away faster than it had arisen, while that of Great Britain increased as rapidly as ours decreased. This was not owing to a decrease of our foreign trade, for during the last twenty years our exports and imports have increased more than twice as rapidly as those of Great Britain.[1] Eighty-seven per cent of these exports and imports are carried in British ships, consigned to English houses which have been established in every large port in the world, and the proceeds are usually remitted to the London banker.

Fortunately, our flag never disappeared from our inland waters and from our coasting trade; for foreigners are excluded from the coasting trade, even where the ports are fifteen thousand miles apart by water.

The substitution of steamers for sailing ships and of steel for wooden propellers, which took place from ten to twenty years ago on the ocean, is now going rapidly on upon our lakes. Where in 1886 there were but six steel propellers, now there are sixty-eight; and of 2,225 vessels on the northern lakes, 1,153 are steamers, 902 are sailing vessels. The action of Congress in providing for the construction and equipment of war vessels by competition has led our ship-builders within the last eight years to establish ship-yards and machine shops where the largest ships can be built, and we are now building as large and fast vessels of war as England. Our ship-builders claim that they can construct ships equal in carrying capacity, speed and strength to those of Great Britain, and at no greater cost; though they cannot be run so cheaply because our sailors are better housed, fed and paid than those of other nations. The day will surely come when commerce will make her last movement westward, when America, lying between Europe and Asia, with her boundless mineral and agricultural resources, her manufacturing facilities, her extended sea-coasts, will be the foremost nation and New York the commercial capital of the world.

Nicaragua Canal.

From New York to San Francisco by land is about 3,000 miles, by water it is about 15,000 miles; yet, notwithstanding the greater distance, freight is constantly sent by water. From San Francisco it is about the same distance by water to either New York or London. If a waterway could be opened across the isthmus of Panama from one ocean to the other, the distance from New York to San Francisco would be diminished more than one-half, and San Francisco would be over 2,000 miles nearer New York than London. The first proposition for canals connecting the two oceans was made in 1550, suggesting two routes, by Panama and Nicaragua; and explorations and surveys of both have been frequently made, and various attempts made for their construction.

The success of the Suez Canal induced M. de Lesseps to undertake the connection of the two oceans by the construction of the Panama Canal, believing that the tonnage passing through it would equal that of the Suez Canal. This work has not been successful; the canal remains unfinished, with no prospects of completion.

Several hundred miles north of Panama is the lowest continental divide; 148 feet above tide-water on the Pacific slope of this divide is Lake Nicaragua, connected by the river San Juan with the Atlantic; up this river and through this lake, some thirty years ago, was one of the regular ways of intercommunication, both for freight and passengers, between New York and California.

The Maritime Canal Company and the Canal Construction Company, organized by Americans, have obtained concessions from Nicaragua, and have made surveys for canal, slack-water, and lake navigation from Greytown on the Atlantic through Lake Nicaragua to Brito on the Pacific, a distance of 170 miles. A harbor has been opened at Greytown and considerable work performed on the canal. The Panama route had the great advantage of an open channel from ocean to ocean, whereas the Nicaragua route requires several locks to cross the divide; but Brito is some six or seven hundred miles nearer California than Panama, a saving in distance that will compensate for the delay in locking. The opening of this canal will be the greatest benefit that could be conferred upon our commerce and shipping.

Freights by water between New York and California are now so high that a large portion goes by railroad. The effect that this canal should produce will be evident if we consider the great difference in expense between land and water carriage. Rail rates between New York and Chicago are a trifle over six mills per ton per mile, while the ocean rates on grain to Liverpool in 1888 were about half a mill per ton per mile; and one mill per ton per mile, or three dollars per ton from New York to Liverpool, is said to be a fair rate, while the all-rail rate between New York and San Francisco averages from forty to eighty dollars per ton, according to the class to which the freight belongs. It takes from seven to ten days to go from New York to Liverpool, twice as long from New York to San Francisco by rail, thirty days by Panama, and one hundred and twenty days by the all-water route around Cape Horn.

The opening of this canal will therefore reduce the freight on goods between the east and west at least three fourths and possibly more. It will give us a free, easy, and cheap communication by water between the Eastern and Western States; our commerce will be built up, and the wealth and commerce of the Atlantic coast and the population of the States on the Pacific coast will be increased in a wonderful manner.

The opening of this route will give a demand for large steamships, and when we have such ships large ship-yards and machine-shops will spring up, and these alone are wanted to enable us to build and run ships on the Atlantic Ocean in competition with Great Britain. Then the prediction of Mr. Cramp will be fulfilled, that Englishmen will be asking one another, "Can we build ships as economically as they do in the United States?"

Modes of Conveyance.

The earliest transportation of merchandise was by caravans. The first caravan of which we have any certain account was that of the Ishmaelites and Moabites, who, while they were travelling from Gilead with their camels, bearing spices, balm, and myrrh to Egypt, bought Joseph of his brethren and sold him as a slave to Potiphar. These caravans were formed of merchants banded together for protection, under a guide and leader, sometimes numbering several hundred, with one thousand camels in a caravan. They travelled from seventeen to twenty miles a day, but only in the spring and autumn months. At night they stopped at caravansaries, where free lodging was furnished to men and beasts. In Turkistan and Arabia all trade and travel was by similar caravans until the railroad was opened across the desert by Merv and the Oxus to Samarcand.

Navigation was first by boat, and ages afterward by vessels. The earliest vessels of which we have any account were employed in carrying cattle down the Nile, and were propelled by sails and rowers. The vessels, at first small and with few rowers, were slowly increased in size and number of rowers until three, four, and even five banks of oars, one over the other, were used. They were often from 150 to 175 feet long, and from 18 to 26 feet in breadth, drawing from 10 to 12 feet of water, and sometimes carrying two hundred rowers and several hundred men. All these ships were without decks, whether sailing on the Mediterranean

[1] The exports of the United States have increased 112 per cent, the exports and imports 92 per cent; the exports of Great Britain 35 per cent, her exports and imports 37 per cent.

or Atlantic. They sailed by day, putting into harbor at night, and never losing sight of land unless driven by stress of weather. At first they sailed only with the wind, but by slow degrees they learned to tack; then decks were built over the stern and prow, leaving the mid-ships exposed to the high seas. This class of vessels, sometimes with banks of oars, continued until the middle of the last century. In the early part of the fifteenth century smaller but stronger vessels of better material were built for the voyages of discovery undertaken by the Portuguese. At this time also the mariner's compass was brought into general use, having been introduced from Arabia; eighty years later it found its way to England. Two of the vessels of Columbus were decked only at the prow and stern, and the three were manned by one hundred and twenty men.

The Armada of Queen Elizabeth was formed of merchant vessels fitted up as men of war, and not until the time of Charles the First were there any regular ships of war in England or, probably, in other countries.

Commerce was usually carried on by companies, with rules regulating the quantity of goods to be exported, so that the market should not be overstocked and unremunerative prices obtained. Sometimes the merchant was owner of the vessel, who adventured with his cargo and sailed in his own ship. The ships were constructed with little reference to speed, sailing forty or fifty miles a day.[1]

The steam engine came into use near the middle of the eighteenth century in England, and two generations passed before it was used on vessels. The first steamboat ran on the Hudson in 1807, in England in 1812. Then another generation passed before the ocean was crossed by the "Sirius" and "Great Western" in 1833. These ships sailed from seven to eight knots an hour. Ten years later iron ships were built; then came the propeller, the invention of Ericsson, followed by vessels built of steel, and lastly the "City of Paris" and "Majestic," carrying fifteen thousand tons of freight and sailing five hundred knots a day, or twenty knots an hour.

Until the present century all commerce between remote points was by water, excepting in the Roman Empire. After the downfall of Rome there was neither commerce nor travel and no use for roads, the cost of transportation even for a short distance exceeding the value of the goods.

The railroad was introduced about the same time into England and America, and was rapidly extended into every country. The steam-engine on land and water has revolutionized the methods of transportation and created a new commerce. "The movement of goods in a year on all the through routes of the world did not then equal the movement on a single one of our trunk lines of railroad for the same period." Formerly it cost ten dollars to move a ton of freight one hundred miles; now it can be moved thirteen hundred miles for the same sum. The grain and corn from our western lands, then not worth the transportation to the sea coast, are now sold in London, and our prairies yield to the western farmer greater profit than the grain lands of England yield to the farmer there. The land commerce created by steam probably exceeds to-day the commerce carried on the water.

The cost of moving freight by railroads varies greatly in different parts of the United States and in different countries. The highest cost west of the Rocky Mountains is two and a quarter times more than in some of our middle States. The average freight receipts per ton per mile in this country is $0.922, which is less than those of any other country, although the Belgian and Russian rates are not much higher. In England the rates are from fifty to seventy per cent higher than in America, and in the other countries of Europe higher than in England.

In England and America the railroads are operated by private companies in competition.

In France railroads are operated by private companies regulated by law, the country being divided among different lines of road. Lines are constructed by private companies and run at rates fixed by the government.

[1] The breadth was about one-fourth the length, and not until within forty years were the proportions of one-tenth or one-twelfth of the breadth obtained.

In Belgium and Germany the principal roads are owned and operated by the government.

Our system has yielded the best results to the people.

The commerce which was in olden times transported only twenty or twenty-five miles a day is now moved five hundred miles a day by water and eight hundred miles by land. Correspondence, then carried no faster than freight, is now borne by telegraph to the farthest ends of the world.

All these changes have taken place within a single generation; for our fathers could not travel any faster than Alexander or Cæsar. Steamships, railroads, and telegraphs within that time have transformed all commercial transactions and the methods of commercial business. Formerly eight months were required to execute an order in India or China and obtain the return; now one day is sufficient. These commercial changes caused a revolution in the modes of business, and were the main factors which produced the monetary disturbances of 1873, the effects of which we yet feel, so long has it taken the world to adjust itself to its new relations.

The Future of Commerce.

The commerce of the world originated in Asia; it was carried to Africa and thence to Europe, and from Europe to America. This movement can go no further westward, for on the other side of the Pacific is China, which has successfully resisted every attempt of the European to encroach upon her domains, and India with its teeming population of two hundred and fifty millions; so that America, the last of the continents to be inhabited, now receives the wealth of India and Asia pouring into it from the west, and the manufactures and population of Europe from the east. Here the East and West, different from each other in mental power and civilization, will meet, each alone incomplete, each essential to the fullest and most symmetrical development of the other. Here will be the great banking and commercial houses of the world, the centre of business, wealth, and population.

The end is not yet. Inventions are increasing in a geometric rather than an arithmetric progression. The limit of steam-power has not been reached, for with a high temperature in the steam-boiler the addition of a few pounds of coal increases the steam-power so greatly that we are unable either to control or to use it.

Electricity has just begun to offer new opportunities to commerce. We are no longer compelled to carry our factories to the water-power, for by the electric wire the power may be brought to the house of the operative, and we may again see the private workman supercede the factory operative. A few cars and small vessels are moved by electricity — the forerunner of greater things. We know little of this new agency, but its future growth must be more rapid and more wonderful than that of steam.

The secretary of the Smithsonian Institution (Mr. Langley) tells us that "before the incoming of the twentieth century, aerial navigation will be an established fact."

"The deeper the insight we obtain into the mysterious workings of nature's forces," says Siemens, "the more we are convinced that we are still standing in the vestibule of science; that an unexplored world still lies before us; and, however much we may discover, we know not whether mankind will ever arrive at a full knowledge of nature."

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

The Loup Rivers of Nebraska.

PERCEIVING by Professor Hicks's reply (March 4) to my comment (Feb. 19) on his essay on the Evolution of the Loup Rivers (Jan. 29) that I had in part misapprehended his meaning, I have corresponded with him in order to understand more clearly the share that he ascribes to headwater erosion and capture in the development of the present stream courses. As is not infrequently