IX

THE NAVIGABLE RHINE

BIRDS-EYE VIEW OF THE DÜSSELDORF RHINE HARBOR

THE NAVIGABLE RHINE

THE DEVELOPMENT OF ITS SHIPPING THE BASIS OF THE PROSPERITY OF ITS COMMERCE AND ITS TRAFFIC IN 1907

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WITH ILLUSTRATIONS

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TO

MY FATHER

This series of books owes its existence to the generosity of Messrs. Hart, Schaffner, and Marx of Chicago, who have shown a special interest in trying to draw the attention of American youth to the study of economic and commercial subjects. For this purpose they have delegated to the undersigned committee the task of selecting or approving topics, making announcements and awarding prizes annually for those who wish to compete.

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PREFACE

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BIBLIOGRAPHY

AMSTERDAM, THE HARBOUR OF. Published by the Amsterdam Chamber of Commerce, 1907.

ARNECKE: Der Niederrhein als Ein- und Ausfuhrstrasse Rheinland-Westfalens (in dem Jahresbericht der Ruhrorter Handelskammer 1898. Teil I).

BARCK: Der Karlsruher Rheinhafen. Stuttgart, 1909.

BLAUSTEIN: Führer durch die Häfen zu Mannheim, Rheinau und Ludwigshafen. "Rhein"-Verlagsgesellschaft. Duisburg-Ruhrort, 1909.

CORDS: Die Bedeutung der Binnenschiffahrt für die deutsche Seeschiffahrt. Stuttgart, 1906.

DENKSCHRIFT DES ZENTRALAUSSCHUSSES DER RHEINSCHIFFAHRTS-INTERESSENTEN. Mainz, 1907.

DENKSCHRIFT ÜBER DIE ERBAUUNG EINES NEUEN HANDELS- UND INDUSTRIEHAFENS ZU FRANKFURT A.M. Frankfurt, 1907.

DENKSCHRIFT ZUR ERÖFFNUNG DER NEUEN HAFENANLAGEN. Köln, 1898.

DIXON: A Traffic History of the Mississippi River System. Doc. No. 11 of the National Waterways Commission. Washington, 1909.

ECKERT: Das Mainzer Schiffergewerbe in den letzten drei Jahrhunderten des Kurstaates. Leipzig, 1898. — Die Rheinschiffahrt im 19. Jahrhundert. Leipzig, 1900.

GELPKE: Die Schiffbarmachung des badisch-schweizerischen Rheines. Goldach, 1909.

GOTHEIN: Die geschichtliche Entwicklung der Rheinschiffahrt im 19. Jahrhundert (Bd. 101 der Schriften des Vereins für Sozialpolitik). Leipzig, 1903.

HANDELSKAMMERBERICHTE UND STATISTISCHE MITTEILUNGEN DER RHEINSTÄDTE UND MÜNDUNGSHÄFEN.

HEUBACH: Skizzen über Verkehrsentwicklung, Frachtpreise und Verkehrspolitik am Oberrhein und in Südwest-Deutschland (Schriften des Vereins für Sozialpolitik, Bd. 89).

JAHRESBERICHTE DER ROTTERDAMER UND AMSTERDAMER HANDELSKAMMERN FÜR 1907. Deutsche Ausgabe.

JAHRESBERICHTE DER ZENTRALKOMMISSION FÜR DIE RHEINSCHIFFAHRT. Mannheim. Jährlich.

KURS: Schiffahrtsstrassen im Deutschen Reiche usw. (Jahrbücher für Nationalökonomie, III. Folge, Bd. 10).

LENSCHAU: Deutsche Wasserstrassen und Eisenbahnen in ihrer Bedeutung für den Verkehr. Halle, 1907.

LOTZ: Verkehrsentwicklung in Deutschland 1800–1900. Aus der Sammlung: "Natur und Geisteswelt."

MAINZER HAFEN, DER (Sondernummer der Zeitschrift "Rhein" im Herbst, 1907.)

NASSE: Der Rhein als Schiffahrtsstrasse (Bd. 102 der Schriften des Vereins für Sozialpolitik). Leipzig, 1905.

NOTICE SUR LE PORT D'ANVERS. Bruxelles, 1905.

OTTMANN: Denkschrift: Die Duisburg-Ruhrorter Häfen. Zur Vollendung der Hafenerweiterungen 1903 bis 1908. Im Auftrage des Herrn Ministers der öffentlichen Arbeiten. 1908.

PETERS: Schiffahrtsabgaben (Bd. 115 der Schriften des Vereins für Sozialpolitik). Leipzig, 1906–1908.

PETERSILIE: Schiffahrt und Güterverkehr auf dem Rheine während der Jahre 1891–1905. Auf Veranlassung der Zentralkommission für die Rheinschiffahrt. Selbstverlag der Kommission, Mannheim, 1908.

PRELIMINARY REPORT OF THE INLAND WATERWAYS COMMISSION. Senate Doc. No. 325, 60th Cong., 1st Session. Washington, 1908.

PRELIMINARY REPORT OF THE U. S. NATIONAL WATERWAYS COMMISSION. Senate Doc. No. 301, 61st Cong., 2d Session. Washington, 1910.

SCHMIDT UND SCHNELL: Taschenkalender für die Rheinschiffahrt. Mainz, 1909.

SCHULTE: Die Rheinschiffahrt und die Eisenbahnen (Schriften des Vereins für Sozialpolitik, Bd. 102). Leipzig, 1905.

SEIBT: Die verkehrswirtschaftliche Bedeutung der Binnenwasserstrassen (Schmollers Jahrbuch, Bd. 26, 3).

SERVICE DU PORT. STATISTIQUE. Anvers, 1907.

SIEBENECK: Vademecum für den Rheinschiffer. Mannheim, 1905.

STATISTIK DER GÜTERBEWEGUNG AUF DEUTSCHEN EISENBAHNEN, 1907. Berlin, 1908.

STATISTIK DES DEUTSCHEN REICHES, Bd. 192: Die Binnenschiffahrt, 1907. Berlin, 1909.

STATISTIK DES DEUTSCHEN REICHES, Bd. 139 a.: Die Stromgebiete des Deutschen Reiches.

SYMPHER: Dreissig Jahre Deutscher Binnenschiffahrt 1875–1905. Sonderabdruck aus der Zeitschrift für Binnenschiffahrt, Jahrgang 1907, Heft 22.

TRANSPORTATION BY WATER, 1906 (illustrated). Special Report of the Bureau of the Census, Department of Commerce and Labor. Washington, 1908.

TRANSPORTATION BY WATER IN THE UNITED STATES. 3 vols. Special Report by the Commissioner of Corporations, Department of Commerce and Labor. Washington, 1909–1910.

ULRICH: Staffeltarife und Wasserstrassen. Berlin, 1894. — Staatseisenbahnen, Staatswasserstrassen und die deutsche Wirtschaftspolitik. Berlin, 1898. — Preussische Verkehrspolitik und die Staatsfinanzen. Berlin, 1909.

VERHANDLUNGEN DES VEREINS FÜR SOZIALPOLITIK ZU MANNHEIM, 1905 (Bd. 116 der Schriften des Vereins für Sozialpolitik). Leipzig, 1906.

WIEDENFELD: Die nordwesteuropäischen Welthäfen. Berlin, 1903.

WIRTSCHAFTLICHE ENTWICKLUNG DES NIEDERRHEINISCHEN STEINKOHLENBERGBAUS. Berlin, 1904.

WIRMINGHAUS: Die Rheinschiffahrt und die Schiffahrtsabgaben (Sonderabdruck aus Conrads Jahrbuch. Jena, 1907).

WOLTMANN: Führer durch die Ruhrhäfen. "Rhein"-Verlagsgesellschaft. Duisburg-Ruhrort, 1909.

WOLTMANN UND BARTSCH: "Ist es notwendig, die Abmessungen des Rhein-Herne-Kanals zu vergrössern?" Duisburg-Ruhrort, 1908.

YSSELSTEYN: The port of Rotterdam. Rotterdam, 1908.

ZEITSCHRIFT "DER RHEIN." 1900–1909.

ZEITSCHRIFT FÜR BINNENSCHIFFAHRT, 1900–1909.

ZIMMERMANN: Führer durch den Düsseldorfer Hafen. Düsseldorf, 1909.

The bibliography is alphabetically arranged. The various books are later referred to in abbreviated form, as: "Schulte, p. 123."

THE DEVELOPMENT OF THE RHINE'S COMMERCE

THE NAVIGABLE RHINE

CHAPTER I

THE RHINE BEFORE 1800

THE historical development of navigation on the Rhine is the best introduction to a study of internal waterways in Germany. Before 1800 the Rhine was, as it still is, the chief waterway of Germany and Europe. The typical stages of development, — such as the mediæval staple and transfer right of powerful cities along the watercourse, the competition of river and railway in the nineteenth century, the long struggle to free the river of the tolls that hampered it in this competition, — these experiences of all German rivers stand out with particular distinctness when we consider the Rhine.

Historical interest alone might not justify us in following this development. But an understanding of at least the changes of the nineteenth century on the Rhine is imperative to a comprehension of many survival-forms and many opinions and prejudices vitally at work on the river to-day. For instance, a large and influential party in Germany cannot be convinced that the moderate tolls which the Prussian Government is attempting to coerce the other German governments to reintroduce on German rivers, are in any way different from the exorbitant burdens that their grandfathers and fathers worked half a century to remove. They are certain that these latter-day tolls, presented at first in a comparatively harmless form, are suspiciously capable of development and are designed to have the effect of the former tolls: to drive the traffic from the water to the rails and to swell the receipts of the state railways.

When in the thirteenth century the Roman roads were fallen into decay, internal waterways took upon themselves an importance which they held for hundreds of years. Particularly is this true of the Rhine, for the great commercial routes from Orient to Occident led from Venice over the Alps and down the Rhine; or via Constantinople and up the Danube, down the Main and Rhine. On its banks great emporiums arose for all western Europe: Strassburg, Mayence, Frankfort on the Main, Cologne. Cologne, where goods could be transferred from river boat to the sea-going ships of those days, became a trade centre of world significance.

In 1453 Constantinople fell; then followed the occupation also of Egypt by the Turks, the discovery of America, the circumnavigation of Africa. The new way to the treasures of the Orient swung around the Cape of Good Hope and gave to Antwerp, Amsterdam, and London in turn the glorious distinction of being the metropolis of east and west, as Venice and Genoa had been before. Just as the Rhine cities had shone in the reflection of the Italian splendor, so the river now bore upstream to the same cities on its banks the same wares from the new sea harbors and the new wares that America began to furnish. Downstream went grain and lumber for the Dutch trade in grain and the Dutch shipbuilding industry; besides woolen manufactures and the steel workmanship of Solingen.

As long as the Emperor held the reins in the Holy Roman Empire, he protected the traffic on the Rhine, which bound his lands together from north to south; but the Peace of Westphalia in 1648, at the end of the Thirty Years' War, brought ruin to the river as it did to so much else in Germany. The devastations of the war had left the inhabitants no money to buy with, no industries to produce goods. The newly freed Netherlands closed navigation on the Scheldt and thereby shut off Antwerp (then in the Spanish Netherlands) from connection with the sea and the Rhine

for two hundred years. With that the Dutch, to make the German hinterland completely dependent on merchants in the Dutch harbors, laid heavy tolls on all traffic that passed direct from Rhine to sea or from sea to Rhine, in the attempt to escape the Dutch monopoly. This through traffic in many of the most important staples, such as salt and tea, was forbidden. It was that age of mercantilistic foreign policy, when Holland and England, by war and bloodshed on sea and land, by tariffs on export, import, and through traffic, were fighting for the final commercial and naval supremacy. In 1651, three years after the Peace of Westphalia, Cromwell produced the English Navigation Act, designed to make — as it did help to make — England carrier and middleman for the world.

However, the most fateful result of the Peace was to weaken the authority of the Emperor, and give the princelings of the numerous principalities and powers along the Rhine free hand to fill their coffers by tapping the shipping as they pleased. The modern view that internal transportation is to be free from taxation, that the wealth created by an unhindered exchange of goods is better taxed at some other point, — this view was almost unknown in the eighteenth century and slowly fought its way to recognition in the hundred years just past. Tolls on German rivers endured, as we shall see, until 1868–70, tolls on the state roads were collected until 1875. Even the state railways in Prussia, whose profits, from the time they were taken over by the state, were to serve as the signal for reducing rates, have reduced rates at a snail's pace and at present show a yearly net profit of 400 million marks,[1] after paying interest on the capital investment. Now that the railways are in state hands, this is a tax on traffic. It is an easy, unostentatious way to raise money, which the state has become dependent on, and no Prussian Minister of Public Works would dare to keep the promise once made and

[1] A mark is approximately 23.8 cents; a dollar is 4 marks, 20 pfennigs.

lower his rates to let the shippers have their traffic moved at cost prices. The parliament, on whose shoulders the burden was to be placed of inventing other ways for raising these 400 millions, would soon make the minister feel its displeasure.

So with the princeling: for him taxes on traffic were the chief source of income, for his country was wretchedly poor, and his towns of any wealth were very often strong enough to invite their lord and master to keep his hands off. But traffic on a great commercial route could not well escape him. The carriers could not well conceal the quantity or value of their cargoes; if they had no money to pay, the toll-man took payment in kind. Nor was this toll taken by the princeling alone. The picturesque castles on the Rhine were often enough the nests of robber knights, which they had bought or forced from the princeling, and from which they levied tolls on the passing boat. From Strassburg to Emmerich on the Dutch border there were still, in 1790, 29 toll-stations, to say nothing of those from Emmerich to the sea. In the eighteenth century, one third of the value of a cargo was levied by the toll stations on the forty miles between Bingen and Coblenz.

"The bishop and the king divide
Stronghold and abbey, church and town,
The Rhine can count more tolls than miles
And knight and priestling grind us down.
The toll-man's heavy hand falls first,
Behind him stands the greedy line:
Master of tolls, assayer, scribe, —
Four man deep they tap the wine." [1]

[1] "Der König und der Bischof teilen
Sich Burg und Stadt und Stift und Dom;
Mehr Zölle sind am Rhein als Meilen
Und Pfaff und Ritter sperrt den Strom.
Zollschreiber ist zuerst Empfänger,
Dann stellt sich der Beseher ein,
Ihm folgt Nachschreiber, dann Nachgänger:
Vier Mann hoch zapfen sie am Wein."

These tolls stood in no relation to services rendered in the interest of navigation by those who collected them, for these levied as much as the traffic could stand and still live, and hardly kept the miserable towpaths in condition to be used. The towpath ran now on one side of the stream, now on the other, so that the horses had to be continually ferried over the river and back again. The tolls were of different sorts, seldom according to the weight of the cargo. They were levied according to the nature of the cargo, the capacity of the boat, the judgment and corruptibility of the officials, or according to all four standards together. A cargo upstream from Rotterdam could never tell what new toll stations had been erected or what would be charged this trip at the old ones. States on opposite sides of the river had separate toll stations. Until the French occupation, when the boats were officially gauged and marked, even a full cargo of a single article could be unloaded, inspected, weighed, etc., — for each of these processes a fresh tax, — at each of the twenty-nine stations.

Before the second quarter of the last century, river improvements as we know them to-day, improvements that aim at a deep wide channel, were few. Downstream the boats drifted or sailed when the wind was with them, upstream they sailed with the wind where the current was slow, otherwise they were towed by horses or men on the towpath. This means of propulsion, as well as the comparatively small quantity to be moved of those goods that could bear the tolls, and were therefore offered for transportation, forbade the use of large vessels with any considerable draught; and only in the rapids at the Binger Loch did the boats find the channel shallow and dangerous. So there was much less need to deepen the channel than to keep the towpath in order. Low water, which to-day does the damage, was less to be feared than the floods that overflowed the towpaths and tied up the boats for weeks at a time.

Until well into the nineteenth century the staple and transfer rights of Mayence and Cologne continued to exist. The staple right meant that goods could not be transported past the city concerned without being unloaded there and exposed for sale. This custom created great trade centres which drew buyers from all the territory round, and it filled the pockets of the fortunate cities with market fees; but it meant a severe delay, expense, and uncertainty for the through traffic. This staple right was often limited to a number of the most important articles, the staple goods; but the transfer right knew no such exception. No merchandise could be carried past Mayence or Cologne without being there unloaded and transferred into the vessels of the Mayence or Cologne boatmen, to whom further shipment belonged. The boatmen explained the origin of this transfer right as arising from a philanthropic anxiety on their part for the welfare of Rhine navigation. The boats for the lower, middle, upper Rhine and for the Main (at whose mouth Mayence lies), were different types, they said; each of these sections had its own particular fluvial dangers. Only the tried boatmen of Mayence and Cologne had that experience with boat and stream which could assure safe transport for merchandise. The merchants and boatmen of Rotterdam, Frankfort, and Strassburg would gladly have taken the risk; they saw in the transfer right a measure to monopolize shipping for the boatmen's guilds in Mayence and Cologne, to increase their trade, their storage and forwarding business, to burden the traffic with tolls for unloading, weighing, and warehousing. The staple right and the transfer right constituted an internal Navigation Act. In 1789 Cologne's traffic on the river was 75,000 tons, and only one quarter of the goods that arrived, remained in Cologne; the other three quarters were reloaded into Cologne boats and shipped farther.[1]

[1] Gothein, p. 25.

The exclusive right of carrying on river traffic in Cologne and Mayence belonged to the boatmen's guilds of these cities, with a limited number of members. The Cologne guild had 120 members in 1789. These boatmen monopolized the traffic in merchandise between Cologne, Mayence, and the great trade centres of the upper and lower Rhine. To the "lesser boatmen" (usually unorganized) of the other Rhine towns fell passenger trade and traffic between points intermediate to the centres just named. The guild members made their trips one after another in regular order, the boatman keeping no schedule but starting when he had a full cargo and not before. The market-boat of the large towns, a leased monopoly plying regularly to the nearby river villages, was the most important instrument of local traffic. Frankfort on the Main was, excepting during its annual fair, dependent on the Mayence market-boat. Before and after the fair, the boats from the Rhine above and below the Main could sail past Mayence on their way to Frankfort and past it on their way back. This was the only exception to the application of the transfer right. Market-boats still flourish in Holland, that land of waterways where towns of importance are still without railway connection. It is astonishing to see the number of market-boats which supplant a local train service and establish a regular connection between Amsterdam and the tributary land around. The boats lie about the shores of great basins in Amsterdam, like farmers' carts in a market-place, selling their country produce and loading city wares for the communities they serve.

The freight boats of the Rhine up to 1800 loaded from 25 to 100 tons.[1] The rates charged were fixed for the guild boats by the city authorities, who had to take care that the boatman made his living. Because of the number of boatmen and the slowness of the boats — a trip from Rotterdam to Cologne lasted 6 weeks[2] — each man had a turn three

[1] Eckert, *Das Mainzer*, p. 20. [2] Gothein, p. 11.

times a year at the most. That the boatmen were taken care of in the matter of rates, we learn from the complaints of the merchants. According to the Cologne records a cask of wine from Frankfort to Cologne (130 miles) cost 40 imperial thalers,[1] from Mayence to Cologne (115 miles), 32 thalers; a ton of herring from Cologne to Mayence cost 8 thalers, tolls included. This difference in the freight rates arose from the difference in the tolls, which could be extremely high for wine but had to be low for herring if they were to be transported at all.

The result of all these influences was that transportation on the Rhine was made very costly and that all goods which could avoid the Rhine, did so. Frankfort merchants could often have their purchases sent via Bremen, up the river Weser and overland from Cassel cheaper than via Rotterdam and up the Rhine. Havre, with the help of the splendid toll-free French canal system that reaches westward to Strassburg and Basle, extended its influence through a good portion of the nineteenth century deep into southwestern Germany.[2] Only when the Rhine was liberated from the Dutch transit tolls, the river tolls, the staple and transfer rights, guilds and prohibitive official rates, could the real development of the river traffic begin. We shall now trace briefly the course of this liberation.

[1] A thaler was three marks or 71.4 cents.

[2] Wiedenfeld, *Die nordwesteuropäischen*, p. 8.

ENTRANCE INTO THE HARBOR OF DÜSSELDORF

CHAPTER II

THE LIBERATION OF THE RHINE AND THE PRESENT STATUS

THE first step towards relief from these burdens was taken by France when it annexed the territory on the left bank of the Rhine as far as Holland and compelled the German states to regulate the Rhine tolls in the Octroi Treaty of 1804. France refrained from exacting a total freedom from tolls out of consideration for the border states who were to a high degree dependent on them. However, the whole toll system was greatly simplified.

The control over the Rhine passed out of the hands of the states on its banks into the administration of a governing board located in Mayence. This governing board consisted of a director and four inspectors. All the various former tolls were abolished and two new ones introduced: a graded attestation-fee for all boats with a capacity of over 50 tons, and the octroi — the first toll levied on the weight of the cargo. It was attempted to ascertain the proceeds of the old tolls and convert them into ton-kilometre[1] rates. The maximum toll for the highest class of goods was fixed at 40 francs per ton from Emmerich to Strassburg, at 26.60 francs from Strassburg to Emmerich; downstream the towpath was not used. Many goods had only one fourth or one twentieth of this maximum toll to pay. The proceeds of the octroi could be used only for improvement of the river, the building and maintenance of towpaths. Here for the first time arises the idea of a relationship between tolls and improvements of the waterway. The number of toll stations between Strassburg and Emmerich

[1] A kilometre is five eighths (.621) of a mile.

was reduced from 29 to 12. The boats were officially gauged and marked, and the officials could from now on read the weight of the boat-load from the gauge, when the cargo was simple; for mixed cargoes bills of lading were introduced. Even if the tolls were not greatly reduced, order and simplicity were brought into the toll system. In 1810, when Holland was annexed to France, this administration was put in force for the whole length of the Rhine.

The staple right was taken away from Cologne and Mayence but not the transfer right, for France did not wish to make too radical changes. But the boatmen's guilds in these towns were opened to all Rhine boatmen instead of only to the burghers of Cologne and Mayence,—a beginning of industrial freedom. Traffic rates were still officially fixed, but the governing board made the improvement of compelling the guild brothers to run a regular service: each boatman sailed in turn at a prescribed time whether he had a full cargo or not. In spite of these improvements the traffic on the Rhine declined during this French period; for instance, the number of the boatmen's guild brothers in Cologne sank from 120 before the French wars to 70 in 1815.[1]

That, however, was due to the universal unrest and uncertainty of the time, the constant wars, the continental blockade that Napoleon enforced against England and the advancement of the French border to the Rhine with a rigorous application of customs duties. The French occupation left behind for the states on the Rhine the example of a centralized, simple, and just administration of the waterway and an ideal of a toll-free river, just as the French left in German soil the seeds of so many other modern and liberal ideas that were to grow and bear fruit. In 1813 the French power ceased, and with it the independent governing board, having charge of the whole river, passed, never to return.

[1] Gothein, p. 25.

To the Treaty of the Congress of Vienna in 1815 was appended an agreement concerning the Rhine, which, for the purpose of "freeing the Rhine," appointed a central commission of representatives from each of the riparian states: Baden, France, Bavaria (for the Palatinate), Hesse, Hesse-Nassau, Prussia, and Holland. This preliminary agreement enunciated only general principles that were to guide the commission. The control over the Rhine returned into the hands of the seven states, and with it the duty of caring for the towpaths. The octroi was recommended as toll; the rates for the tolls could not be higher than formerly. No more cities were to be invested with the transfer right, the commission was to decide about the fate of the transfer right of Cologne and Mayence. The most important portion of the agreement were the words: "Navigation on the Rhine, from the point where it becomes navigable to the sea [jusqu'à la mer] and vice versa, shall be free, in that it cannot be prohibited to any one."

The commission met on the 15th of August, 1815, and sixteen long years were spent before its work was completed and a Rhine Treaty was framed. The delay was caused by the strife between the Dutch and the Prussian representatives. The Dutch wanted to interpret freedom of navigation "jusqu'à la mer" as meaning *to* the sea but not *into* the sea. So after 1815, just as before, they upheld the prohibition of through traffic from the German Rhine to the sea for a number of important articles such as tea, salt, spices, which the German towns must therefore buy from Dutch merchants. But against this position Prussia had a trump card: the transfer right of Cologne. As long as this was upheld, the Dutch boatmen could not sail past Cologne and navigate on the middle and upper Rhine. Prussia refused to treat regarding the abolition of Cologne's ancient right before Holland was ready to remove the blockade at the mouth of the river. Not until 1831

was the difficulty settled by a compromise in the Rhine Navigation Treaty.

Transit traffic from river to sea was declared free, but Holland was allowed to discriminate in its tolls between goods that were unloaded in Dutch harbors and those that were not — of course in favor of the former. All transfer rights, the official regulation of rates, the boatmen's guilds, were abolished. With one mighty stride the Rhine, in the year 1831, stepped forth from the Middle Ages. The seven states agreed each to keep its towpaths in repair and furnish free ports for transit goods. The attestation-fee (according to the boat's capacity) and the octroi (according to the cargo's weight) of 1804 were retained, as well as the division of goods into classes. Under the commission an overseeing board of a director and four inspectors was appointed. There was instituted a Rhine toll court at each of the toll stations; the commission was to act as a court of appeals.

The rapid growth of traffic on the Rhine attending the introduction of steam navigation in the years after 1831, we shall follow later. Here we must complete our survey of the movement to liberate the Rhine from tolls, now that the other hindrances to a development of its shipping had fallen: the guilds, staple and transfer rights and official rates. It was particularly difficult to bring about the abolition of these tolls because they constituted a considerable portion of the receipts of the smaller states which began to spend great sums in improving the river. For example, Hesse-Nassau had spent ten million marks[1] for this purpose up to 1866 and was naturally reluctant to relinquish the possibility of getting back the interest on at least a portion of this capital. How severe these tolls[2] were for the river traffic in the days of rising railway competition is evident when one reads that from Emmerich to Mannheim the toll per ton-kilometre for the goods that paid the

[1] Peters.

[2] See Peters: part ii, p. 138.

maximum rate — the majority of goods — amounted in 1851 to 5.5 pfennigs (2.2 cents a ton-mile).[1] Of course these were simply the toll rates and do not include the charges for transportation.

Prussia, which was eager to widen the market for its rapidly developing coal and iron industry in the provinces Rhineland and Westphalia, took the lead in reducing the tolls; the expanding German Customs Union furthered a free exchange of goods within its boundaries. When Napoleon annexed Antwerp, he revived navigation on the Scheldt — closed since 1648 — and when the present territory of Belgium was given to Holland in 1815 the river remained open. But the older Dutch harbors, whose influence preponderated in Holland, caused a severe discrimination to be exercised against the newcomer, and not until after Belgium became independent in 1831 did Antwerp's new life begin. It led to the Dutch tolls on the lower Scheldt being bought off. In 1843 the new railway from Antwerp to Cologne was opened and the pressure of this competition drove the Dutch rapidly to reduce the tolls they had fought so hard for; to remove them entirely in 1851, if Amsterdam and Rotterdam did not choose to see their entire trade transferred to Belgian hands. This freedom of the Dutch Rhine put Antwerp, which is also a Rhine sea harbor, on equal footing with the Dutch harbors and became the basis for that keen competition between the three seaports which still serves the Rhine so well.

In the meanwhile the same movement towards reduction of the tolls proceeded in Germany on the part often of Prussia, often of the entire Customs Union, and the number of articles that paid one fourth or one twentieth of the maximum rate, or that were wholly free, increased. Under the rising competition of the railways, at first in private

[1] A pfennig is one hundredth of a mark, or approximately one fourth of a cent. The ton-mile rate may be obtained by multiplying the ton-kilometre rate by two fifths.

ownership, even the reduced tolls were felt to be intolerable. The private railways, here as everywhere, were not particularly delicate in the methods they employed to lame their competitors on the water. After the War of 1866 Hesse-Nassau, the worst enemy of reductions, was annexed by Prussia, and in the Peace of that year the other states agreed to a total freedom from tolls on the Rhine. This was brought about by the Revised Rhine Navigation Treaty of 1868, signed by Holland, Prussia, Hesse, Bavaria, Baden, and France (which still held Alsace).

The Revised Rhine Navigation Treaty is in force to-day. After 1870, when the newly created German Empire annexed Alsace, it took France's place as the sixth of the treaty powers.[1] Navigation on the Rhine and its tributaries, so far as they lie within the boundaries of the treaty-making powers, is open to boats of all nations. Among the branches of the Rhine delta, Leck and Waal are considered as part of the Rhine. On the Rhine or its tributaries no tolls can be levied which are "founded on the mere fact of navigation"—an unfortunate expression that gave trouble later. No bridge fees, such as for the opening of pontoon bridges, can be levied on the Rhine, though tolls for the use of adjacent artificial waterways are allowed. Bridge fees are allowed on the tributaries, as are tolls for the use of canalized portions of these rivers. Wandering channels are to be kept buoyed off. Each state shall treat the citizens of the other treaty powers as its own. Import or export duties for goods moved on the Rhine may not be higher than for those on land. The right to steer a barge or steamboat on the river is dependent on the possession of a navigator's license, granted after four years on the Rhine, two years thereof in active service on a boat.

Special pilots and steersmen may be licensed by the

[1] Throughout this book the separate German states, which possess a high degree of independence and in whose hands control of the Rhine lies, are to be carefully distinguished from the German Empire.

treaty states, but boats cannot be compelled to employ them. The states agreed to keep the stream and the tow-paths (now little used) in good condition. Plans for improvements of the river, in so far as they concern adjacent states or those across the river from each other, must be mutually made known and agreed upon. The water of the river is reserved exclusively for navigation; no dams, mill-races, etc., may be built.

The states are to name four inspectors, of whom each is to visit his entire section of the river twice a year, hear complaints, investigate the condition of the waterway, and report to the governments within his section. Minor complaints he can rectify, and if the states do not follow his further suggestions, he reports the fact to the central commission, composed of representatives of each of the six riparian powers. The central commission, in company with chosen technical experts, visits the entire course of the Rhine yearly, to ascertain what river improvements, what changes in regulations for navigation, etc., are needed.[1]

All barges with a capacity of over fifteen tons and all boats with motors must carry a ship's certificate, given after an official examination which determines the fitness of the boat and its equipment. The line of deepest immersion is clearly marked. This first examination must be repeated whenever a shipper requires it, and the result of the examination is again recorded in the certificate. Owing to the fact that the lower Rhine is in Dutch hands, the treaty contains a number of regulations about transit goods in bond. The Rhine toll courts are retained under the new name of Rhine navigation courts. Appeal is to a superior court of one of the states or to the central commission.

The central commission, though formally an advisory

[1] In addition to this, a yearly tour of inspection is made by the Prussian Commission for Rhine Navigation which has charge of the improvements in Prussian territory. To this tour not only technical experts are invited but also representatives of Chambers of Commerce along the watercourse and of other interested official or semi-official bodies.

board whose decisions gain force only after each of the six powers agrees to them, exercises nevertheless a great influence because its recommendations are seldom disregarded. The states have issued identical regulations for Rhine navigation, framed by the central commission.[1] Each offense against these regulations is punished by a fine up to 300 marks. Lastly, the commission enforces these regulations for Rhine navigation, decides cases appealed to it from the navigation courts, and publishes yearly a Report on Shipping on the Rhine with which we shall have to do later. The treaty changed the seat of the central commission from Mayence to Mannheim, which indicated the shifting of the head of navigation on the Rhine.

The central commission is far from being an ideal body; it represents six interests which are not always in harmony. Though the states profit from one another's experience, there is no unification of the improvements on the river. The smaller states have not been able to spend money as promptly nor in such quantities as Prussia, to whom fortunately the most difficult and costly work fell: the deepening and widening of the rocky channel between Bingen and St. Goar. Hesse delayed a long time with dredging a proper channel in the Rheingau, a lake-like broadening of the river above Bingen. Baden refused for years to regulate, or allow Alsace to regulate the Rhine from Mannheim to Strassburg. Baden was fighting to keep Mannheim the head of navigation, to make through traffic to the south go on the rails at Mannheim and feed the long southward-reaching lines of the Baden state railways, which run

[1] Whoever desires to follow this subject further will find reprinted in Siebeneck's *Vademecum für den Rheinschiffer* (Mannheim, 1905): the Revised Rhine Navigation Treaty of 1868, the above-mentioned Regulations, the Imperial Statute regulating Civil Rights in Internal Navigation, special Regulations for Rafting, concerning the Transportation of Explosives, Poisons, etc., numerous Regulations for navigation on particular sections of the stream and on tributaries, Regulations for individual river harbors, etc., etc.

parallel to the river. Each of the states has a separate division for the Rhine in its Ministry of Public Works; which duplication of costs would be spared if the river were in Federal hands.[1]

Division of power between Empire and state came at a time when several of the states entered with the greatest reluctance into the Empire and reserved for themselves all the independence they could. Neither in Germany nor in America is the balance of power between federation and state satisfactorily or finally adjusted.

[1] The same cause lowers the profits of the railways of the smaller states which, out of a not unfounded jealousy and fear of Prussia's preponderating influence, resisted Bismarck's attempt to unite them into an imperial system. The Prussian-Hessian state railways give an average return on the capital invested in them of 6½ to 7 per cent; the state railways of Saxony, for example, not 3 per cent.

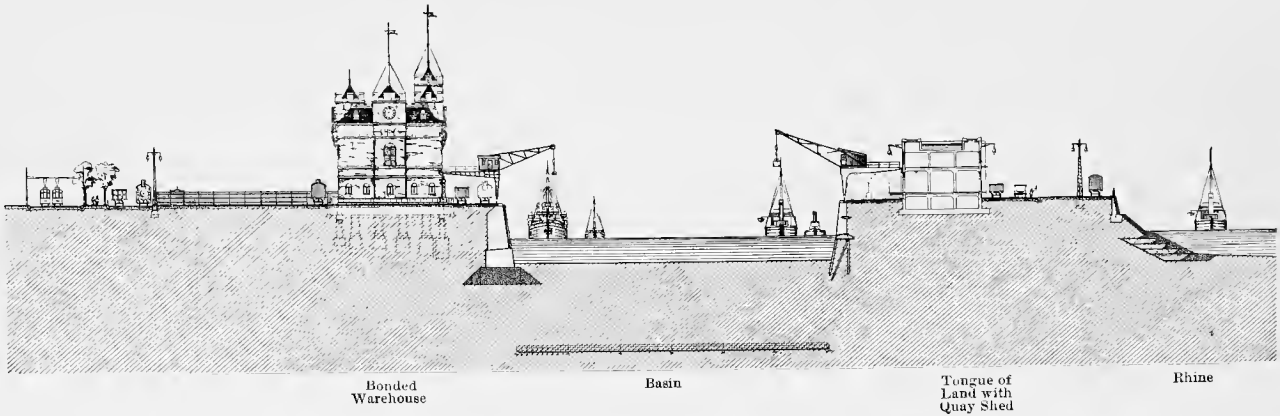
CHAPTER III

THE DEVELOPMENT OF TRAFFIC ON THE RHINE IN THE NINETEENTH CENTURY

We have seen that at the beginning of the century and until 1831 the bulk of shipping on the Rhine was in the hands of the boatmen's guilds in Cologne and Mayence, that in these towns the transfer right was exercised upon all through traffic, that the development of traffic was hindered by heavy river tolls. In spite of the relief that the Octroi Treaty of 1804 afforded, the traffic, far from increasing, decreased up to 1815, owing to the continued wars and the continental blockade. The boatmen had in the meanwhile reduced the duration of the trip from Rotterdam to Cologne from 6 weeks to 10 days, from Mayence to Strassburg from 6 weeks to 16 days.[1] From 1815 to 1831 industrial life took an upward swing. The peace that Europe had longed for allowed the development of manufacturing and trade, further favored by the formation of the German Customs Union and the beginnings of the free-trade idea with its lowering of customs duties. The increasing use of coal for house-firing and industrial purposes caused the Rheinish-Westphalian coal-fields, adjacent to the Rhine, to expand their production, and furnished the chief item of Rhine traffic from that day to this.

The influence of the first Rhine Navigation Treaty of 1831, abolishing boatmen's guilds and transfer rights, was more severe on the transfer towns than on the guilds. The latter met the new conditions by forming associations, whose members sailed one after another according to a published schedule, exactly as before. Though they could no longer hold up through traffic nor have the authorities fix

[1] Eckert: *Rheinschiffahrt*, p. 51.



CROSS-SECTION OF A BASIN IN THE DÜSSELDORF RHINE HARBOR

rates for them, they were still recognized as the most reliable carriers. To accelerate transportation they kept relays of horses at intervals along the towpath and they moved the bulk of the shipments until the tugs and barges of the great companies took it from them.

Cologne met the new order of things with more courage than Mayence. The Cologne Steamboat Navigation Company (founded 1827) closed with the Holland Steamboat Navigation Company (founded 1822) a division of middle and lower Rhine, the Rhine below Cologne being assigned to the Dutchmen. This agreement could not last long, for other companies arose, but it helped to tide over the worst years. The excellent association boatmen helped to keep a part of the through goods transferred at Cologne; above everything else the city pushed the construction of the railroad from Cologne to Aix-la-Chapelle where it met the road to Antwerp. The citizens of Mayence were more concerned to get damages from the Hessian Government for the abolition of the transfer right than to bow as gracefully as they could to the inevitable. As the significance of Mayence had rested upon its privilege and not upon its geographical situation, the goods formerly transferred there went through to Mannheim.[1] There remained for Mayence only the transfer of the Rhine-Main traffic from Rhine to Main vessels. Even this was lost when in 1887 the canalization of the Main as far as Frankfort, admitting the largest Rhine barges, was opened. Mayence is dead; long live Mannheim!

The use of steam as motive power — that power which first gave the river new life, then created its great competitor, the railways — began at the end of the period 1815–31. In 1816 a Dutch steamboat came from Rotterdam to Cologne in five days. An extra of the "Cologne Ga-

[1] In 1832 Mayence's river traffic in a number of the most important articles had sunk to one fourth and less of what it was in 1829 (Gothein, p. 206).

zette" reported: "To give an idea of the safety of steam navigation, we will remark that the wife of Herr von Vallenhofen [the captain] accompanied him the entire journey with her nursing child." In 1822 the Dutch Steamboat Navigation Company was formed, in 1827 the Cologne, in 1838 the Düsseldorf Company, devoting themselves principally to the passenger trade. From the beginning these three companies predominated in the passenger traffic on the Rhine, and only locally have other companies been able to do business. Since 1853 the Cologne and Düsseldorf companies have formed a pool; they transport together about two million persons a year, the Dutch Company considerably less than one million.[1] In the early thirties the individual boatmen with their towed "diligences" for the transportation of passengers, were driven to the wall by the steamboats.

In the first years of steam navigation it occurred to no one that the freight traffic on the river could also be won over by the steamboats. The costs of the new machines, the costs of operation, the initial freight charges on the steamers were high. The weight of the engines was so great that the vessel could take on little else and keep afloat in the shallow channel. The difference in time compared with the association boatmen (5 days Rotterdam-Cologne instead of 10 days) made little difference for the majority of the freight, especially as the boatmen were so much cheaper. From Holland the use of tug and barge was introduced on the Rhine. It was this particular use of the steamboat, not its invention, that made the future of freighting on the Rhine. A steam tugboat weighted down to the limit with powerful engines can pull far more goods in several barges, each similarly full, than the steamboat itself can carry if half burdened with engines, half with freight.[2] On the

[1] *Bericht der Zentralkommission.* These passenger companies also carry express goods, but their charges are high, for reasons explained in the next paragraph.

[2] Even to-day in spite of deep channel, expansion engines, steel boats,

same principle a strong horse can pull, in a wagon behind him, more weight than a weak horse can carry on his back. Tug and barge furnished a means of transportation cheaper than even the boatmen with their horse-relays.

From 1829 to 1837 the Dutch company towed boats of the association boatmen, but these latter, who saw their trade threatened, refused to employ the tugs excepting when the towpaths were overflowed and the horse-relays were impossible. In order to employ its tugs the Company saw itself compelled to build barges. These underbid the boatmen, and steam towing companies sprang up in Mayence, Cologne, Düsseldorf. The association boatmen of Mannheim were wiser than their fellows and bought themselves tugs, founding the Mannheim Steam Towing Company, which still exists, though now as one of the largest stock companies on the Rhine. The continual cheapening of transportation rates indicates the difficulties the association boatmen had to contend with; for instance, the average rate per ton was:[1] —

Year	*Amsterdam-Cologne*	*Rotterdam-Cologne*
1830	29.40 marks	29.40 marks
1834	17.20	14.80
1847	13.80 "	12.40

In 1848, the great Revolution year in Europe, the boatmen and the sympathetic populace of Cologne actually attacked the tugs. A petition was sent to the National Assembly that met in Frankfort, invoking the Assembly "in the struggle of the working middle class against the moneyed aristocracy of the nineteenth century, to take sides with labor against capital, against the Mammon-serving merchants in the boatman's trade." In their simultaneous petition, the companies remarked with bitter truth: "It is the old struggle of the robber's nest against

the Rhine freight steamers can load only 1000 to 1200 tons, while the usual cargo of a barge train is 6000 tons.

[1] Schulte, p. 326.

the cannon's powder, of clerks against the printing-press, of the artisans against machines, of stage-drivers against the railroad; but the order of things will allow neither retreat nor stagnation."

Before the abolition of the guilds in 1831 there were seldom middlemen between the shipper and the boatman. Under the guild régime there was only one possible boat at a given time and only one rate — the official one. The merchant could cart his own goods down to the wharf and see them shipped. But when the guilds were abolished there were many boats sailing at the same time and many rates bidding for the traffic. The shippers intrusted the engagement of the boat to the new race of professional forwarders who set the competing boatmen against each other and by their superior business ability were able to take most of the profits in the trade out of the hands of the simple river people. At the same time the improved roads, and still more, later, the railroads, increased the number of absent shippers who sent or received goods via the river town and were necessarily dependent on the forwarders there. The new steam towing companies united the business of forwarding and shipping, which was a further advantage for them. Some of the independent boatmen went into the service of the companies, some of them sold their boats to the latter, some of them bought tugs and failed or succeeded and expanded into companies[1] themselves, some of them remained free lances seeking business as they could find it: they constitute the race of independent boatmen on the Rhine to-day. But the future belonged to the corporations. The above-mentioned Mannheim Steam Towing Company transported to Mannheim upstream past Coblenz:[2] —

[1] Many of the best-known names on the Rhine — Fendel, Louis Gutjahr, Knipscheer — have come up from the ranks.

[2] W. Borgius: *Die Entwicklung des nordwestdeutschen Getreidehandels.* Freiburg, 1899, p. 110.

Year	*Tons*
1843	1,177
1846	14,616

As a further indication of the rapid growth of Rhine traffic in these days: the Cologne Company (which specialized in the passenger trade) transported: —

Year	*Persons*	*Goods (in tons)*
1830	52,580	8,592
1852	601,982	23,637

This was the Golden Age of the tributary streams: Neckar, Main, Lahn, Moselle, Ruhr, Lippe, and the Rhine-Rhone-canal. Commerce and trade expanded and the railroads were not yet built or were so short and so sparsely distributed that they served as hand-maidens for the waterways. On the Lippe, which was not for some time caught in the railway net, the traffic reached its high-water mark with 14,935 tons in 1854.[1] The career of the Ruhr is typical for the other streams. Frederick the Great had canalized the Ruhr, which flowed through the Rheinish-Westphalian coal-fields and transported most of the product of the mines. The Ruhr boats were loaded on the Ruhr, sailed down into the Rhine and on to their destination or filled the coal magazines of Ruhrort and Duisburg, at the junction of the river with the Rhine, where a great supply was kept. The coal traffic of the Ruhr grew from:[2]

1814	70,000 tons
1847	over 800,000 tons

On the Rhine-Rhone canal, finished in 1834, the traffic rose before 1848 to 750,000 tons, while in 1847 only 560,000 tons passed Emmerich, the German border town on the Rhine.[3] The world of transportation seemed to belong to the waterways.

Then the railroads appeared on the scene. At first they

[1] *Die wirtschaftliche Entwicklung des niederrheinischen*, etc.
[2] *Denkschrift über die Ruhrhäfen*, p. 14.
[3] Gothein, p. 272.

were looked upon, as the steamboats had been, as principally destined for passenger traffic.[1] The watchword was coined: "for merchants the railway, for merchandise the waterway." The first railroads were built perpendicular to the course of the Rhine and acted as feeders to the river:—

1840. Mayence (Kastel) — Frankfort.
1840. Mannheim — Heidelberg.
1841. Düsseldorf — Elberfeld.
1843. Antwerp — Cologne.[2]
1845. Deutz — Minden.
1847. Duisburg — Dortmund.
1853. Ludwigshafen — Kaiserslautern.

The Baden line (opened 1846) from Mannheim to Basle, parallel to the Rhine, was the first great competitor to the river, whose traffic above Strassburg it killed with a single blow. It could do this the more easily because the river above Mannheim was more shallow, swift, and dangerous than below, which of course found expression in the water rates. There passed under the Strassburg bridge going upstream in 1843: 1790 tons; in 1846: 92 tons.[3] Shipping from Mannheim to Strassburg was almost as seriously affected. Until in the nineties Mannheim remained the Farthest South of "big-navigation."[4]

Below Mannheim the railroads struck first at the tributary streams. The small capacity of the boats that can float on them made them easy prey. If barges of even moderate size are to be used on them, they must be canalized, and locks, even if there are no tolls for their use, make

[1] Railroads in Germany were very skeptically received. The driver of the Berlin-Potsdam stage-coach asked how a railroad could pay when there were not enough passengers to fill the stage-coach. A learned man in a learned pamphlet warned passengers of the danger of brain concussion from traveling through space at this unheard-of speed.

[2] Of course this railroad was also a competitor against the Rhine from the Dutch harbors to Cologne. But Cologne had no rail connection with Bingen, Mayence, and the upper Rhine until the middle of the fifties.

[3] Eckert: *Rheinschiffahrt*, p. 331.

[4] "*Die Grosschiffahrt.*"

traffic slow and dear. If the tributaries can be canalized to take the barges of at least 600 tons, or better still, the big barges of the main stream (as the Main, canalized to Frankfort, now can), they have a future. But such a canalization is sometimes technically, sometimes financially, impossible. Transport on boats of less than 600 tons capacity is not profitable on the main stream. It is cheaper to bring goods by rail to the Rhine harbor and transfer them for further transportation to the great Rhine barges of 1500 tons and more, than it would be to bring them down the tributary and down the Rhine to their destination on small barges, without transfer.[1]

Coal from the Saar district, which had formerly floated down the Saar and Moselle to the Rhine, was carried after 1853 by the new railroad to Ludwigshafen, opposite Mannheim. On April 3, 1845, the proprietor of the daily market-boat plying between Mayence and Frankfort notified the mayor of Mayence that he would no longer ply, as the new railroad had taken his trade away.[2] Similar but not so rapid was the downward career of navigation on the Ruhr. In 1847 the section Duisburg-Dortmund of the Cologne-Minden Railway was opened, parallel to the Ruhr; in 1848 the parallel line Ruhrort-Oberhausen of the Rheinish Railway. Coal traffic on the Ruhr sank from more than 800,000 tons in 1847 to 500,000 tons in 1850.[3] It was cheaper to bring the coal on the rails direct from the mine to Duisburg-Ruhrort and there transfer it to the Rhine barges, than to cart the coal to the banks of the Ruhr and ship it in the little Ruhr boats. The cost of carting averaged 40 pfennigs per ton-kilometre,[4] the first railway rate 13 to 14

[1] The tributaries float barges of the following capacities: Neckar 360, Main 400 tons (up to Aschaffenburg; above this point 160 tons), Lahn 160 to 190, Mosel 160, Ruhr 165, and Lippe 150 tons.

[2] Eckert, *Rheinschiffahrt*, p. 293.

[3] *Denkschrift über die Ruhrhäfen*, p. 14.

[4] 16 cents per ton-mile.

pfennigs, soon reduced to 2½ pfennigs.[1] All the mines were not immediately served by the railways and the production of coal increased more rapidly than these were built. So the traffic on the Ruhr did not drop; instead it reached its highest figure in 1860:[2] —

Coal	*Other goods*	*Total*
867,735 tons	72,440 tons	940,175 tons

As the railway system was completed, these 867,735 tons sank to 100,000 tons in 1875, to nothing at all in 1890.[3]

The Rhine was never so hard hit. It lost its passenger traffic in persons engaged in business, but hardly noticed the loss because of the increasing swarms of "trippers."[4] The three passenger companies do most of their business during three or four months of the year and pray for a long hot summer. Coal, instead of being brought up the Rhine from Duisburg-Ruhrort, after the railways had brought it to the latter point, began to come direct by rail from the Ruhr district to Düsseldorf, Cologne, etc. So it is to-day: the Ruhr coal for towns on the German Rhine from Bingen down is brought by the railway. The transfer from rail to barge at Duisburg-Ruhrort is not profitable for coal destined to points below Mayence. Though water transportation is for most goods cheaper than the railroads, the goods must cover a considerable distance on the water if they are to save enough on freight charges to pay for the transfer from rail to barge or from barge to rail. If there is to be such a transfer both at the beginning and at the end of the water trip, this latter must be still longer.[5]

[1] Arnecke, p. 45.

[2] *Die wirtschaftliche Entwicklung*, etc., p. 72.

[3] *Denkschrift über die Ruhrhäfen*, p. 14.

[4] A large proportion of these are foreigners. Byron's *Childe Harold* started the stream of English tourists toward the Rhine.

[5] Peters reckons that when two towns lie on a first-class waterway, water transportation pays when the distance between them is 25 miles; if only one of the towns is on the waterway, the water portion of the combined rail and water route must be 45 miles; if both towns are off the waterway, 100 miles.

The competition of the railroad from Antwerp was felt in the cities below Cologne. In 1844 the Chamber of Commerce in Düsseldorf wrote that the relation of the rail rates Antwerp-Düsseldorf was to the water rates Rotterdam-Düsseldorf: [1] —

	Per 100 *Kilogrammes* (1/10 *ton*)		
For pig-iron	137:230 centimes	For oil, wine	268:293 centimes
cotton	208:275	coffee, rice	238:285

Yet even when the railway system was completed, it had more the effect of slowing up the growth of Rhine shipping than of destroying it.[2] The railroads multiplied their figures year by year while the river traffic climbed slowly up. The Rheinish, the Cologne-Minden and the Bergisch-Märkisch railways increased their freight traffic in the period from 1850 to 1870 from 102,000 to 20,965,000 tons, or as 1 to 20; the traffic on the Rhine at Emmerich (on the Dutch border) increased during the same period from 573,000 to 1,913,000 tons, or as 1 to 3½.[3]

When in the sixties and early seventies the river shipping, in spite of freedom from tolls, developed slowly, people began to doubt the ability of the Rhine to compete on equal terms with the railway. The railways, in private hands, could fight the river with weapons that are international: discriminatory rates and the refusal of transfer facilities. Only in the transportation of bulk goods was the river so superior as to be safe. But bulk goods such as predominate on the Rhine to-day — goods that go by the barge load — were just beginning to be of importance. Transportation was only beginning to be cheap enough to allow these bulk goods, usually of small specific value, to

[1] Gothein, p. 274.

[2] Cologne was an exception to this; there the river trade decreased (Gothein, p. 274). Cologne's

	River Traffic	*Railway Traffic*
1856	366,724 tons	436,228 tons
1863	233,687 tons	790,778 tons

[3] Arnecke, p. 44.

be moved long distances without becoming so dear as to find no purchaser at their destination. Goods of low specific value were for the first time in history entering into commerce. The presence and predominance of these bulk goods has revolutionized the art of transportation. How they prevented a further decline of traffic on the Rhine relative to the traffic on the railroads is narrated in the next chapter.

CARGOES OF IMPORTED LUMBER IN A BASIN OF THE DÜSSELDORF HARBOR

VIEW OF THE HARBOR AT DÜSSELDORF

CAUSES FOR THE PROSPERITY OF COMMERCE ON THE RHINE

CHAPTER IV

THE GROWING PREDOMINANCE OF BULK GOODS IN COMMERCE

THE first reason for the Rhine's prosperity to-day is to be found in the change in the nature of the goods that form the staples of commerce. In 1840 the two leading articles in the upstream traffic by Emmerich were cane sugar and coffee; in 1907 the two leaders were iron ore and wheat. The following table illustrates how the bulk goods, in which the Rhine's future lay, remained true to the river when much of the other freight was deserting it for the railway.

TRAFFIC ON THE RHINE AT EMMERICH, IN TONS[1]

HIGH CLASS GOODS

	Upstream *Coffee*	*Upstream* *Cotton*	*Upstream* *Cotton wares*	*Downstream* *Silk*
1856	31,637 tons	12,915 tons	1,263 tons	879 tons
1866	18,945	9,048[2]	567	10.1

BULK GOODS

	Past Emmerich Downstream *Coal*	*Past Coblenz Upstream* *Coal*	*Past Mannheim Downstream* *Salt*	*Past Coblenz Downstream* *Iron Ore*
1856	317,890 tons	23,550 tons	17,366 tons	145,300 tons
1866	803,740	62,765	34,449	287,370

The tremendous change in the articles of the Rhine's shipping is clear when we compare the traffic on the river at the Dutch border in 1840 with that in 1907.

[1] *Jahresberichte der Zentralkommission*, printed in Eckert: *Rheinschiffahrt*, pp. 350, 351, and Schulte, pp. 313, 370, 371.

[2] Partly due to the Civil War in America. During the actual war years, imports from the southern states sank rapidly. From 1860 to 1862 these imports via Emmerich decreased as follows: cotton from 22,502 to 14,299 tons, pitch and resin from 12,552 to 1929 tons, tobacco from 6012 to 3602

TONNAGE OF GOODS ON THE RHINE PASSING LOBITH[1] ON THE DUTCH BORDER[2]

Upstream

Total	1840 127,815 tons	% of total	Total	1907 15,783,123 tons	% of total
Cane sugar	17,850	13.5	Iron ore	6,039,115	38.3
Coffee	15,735	12.3	English coal	1,806,886	11.4
Pig iron	9,731	7.6	Wheat	1,663,217	10.5
Rape and clover seed	7,603	5.9	Wood	1,118,733	7.5
Cotton thread	6,934	5.3	Other ores	715,049	4.6
Oil	5,887	4.6			
Whale-oil	5,639	4.2			

Downstream

Total	1840 373,917 tons	% of total	Total	1907 7,276,029 tons	% of total
Coal	138,356	37.0	German coal	3,548,230	48.8
Oak	101,068	7.3	Sand, gravel, etc.	1,113,784	15.3
Pine	33,980	9.0	Manufact. iron	798,760	10.9
Stone	19,377	5.2	Stone and stoneware	497,274	6.9
Wheat	17,979	5.0	Cement	247,058	3.4
Tuff (stone)	13,405	3.5			

Of all the articles in the 1840 tables, only one holds its place in 1907: German coal downstream. In 1840 one misses entirely the most important articles in the predominating upstream traffic to-day: ores, wheat, wood, petroleum, etc. Wheat and wood appeared among the leading articles downstream. The relation of Germany's imports to its exports on the Rhine was 1 to 3 in 1840, in 1907 2½ to 1. The river has become the route that furnishes a great industrial nation cheaply with its raw products and food-stuffs.

tons, turpentine oil from 1034 to 105 tons. The decrease was still greater as the northern blockade became more effective. (Eckert: *Rheinschiffahrt*, p. 329.)

[1] The upstream and downstream goods are recorded at Emmerich, the German customs station, and at Lobith, the Dutch customs station across the line.

[2] *Jahresberichte der Zentralkommission.*

In these figures we can read not only a total change in the Rhine traffic: the growing predominance of bulk goods, of imports over exports. The figures reflect the new German commercial life. After the Franco-Prussian War of 1870–71 German industries, particularly the iron industry, began their splendid development. Great quantities of iron ore were imported, and the finished iron was sent downstream to the world's markets. Native wood can no longer satisfy the demand for use in building and in manufactures: the tonnage of foreign wood imported grows from year to year. The creation of new railways, roads, and buildings calls forth great shipments on the Rhine of sand, gravel, cement, and stone. The population of Germany, which increases naturally at the rate of 900,000 persons a year, can no longer be supported by native bread-stuffs: America, Argentine, Russia, and Roumania send their shiploads of wheat and rye. Towering above everything else is the enormous tonnage of coal, which again reflects the manufacturing activity. Germany is ceasing to be a self-sufficient "agricultural state" like its neighbors, Russia, Austro-Hungary, and France; and it is becoming, like England, a workshop for the outside world, dependent thereon for raw materials and food.

Along with this increasing preponderance of the shipload bulk goods which favored the Rhine in its competition with the railroads, went an improvement of the waterway, the boats, the Rhine harbors, and the sea harbors. The railroads in private hands were bought up by the state, which could not carry on a war of extermination against private operators on the river.[1] These developments expressed themselves in a tremendous sinking of water rates

[1] Moreover, the Central Association for Navigation on German Rivers and Canals, founded in 1869, has been the centre of a successful agitation for river and harbor improvements and for the building of canals; for instance, the great Midland Canal. The Association publishes in Berlin the weekly *Magazine for Internal Navigation* (see Bibliography).

and furnish to-day the foundation of the Rhine's prosperity. As such they will be treated in later chapters.

If we continue the comparison between the Rhine and the Rheinish, Cologne-Minden and Bergisch-Märkisch railways we reach a different result from the former one. We saw that the railway traffic increased in 1850–70 as 1 to 20, while the tonnage on the Rhine at Emmerich increased only 1 to 3½. In the years 1885–1907 the traffic on these railways (or their equivalents in the Prussian railway system) advanced from 44 to 158 million tons, an increase of not quite 1 to 4, while the traffic on the Rhine at Emmerich grew from 4.4 to 23 million tons or as 1 to 5.[1] But these comparisons give only the hint that a change has taken place; they do not show its extent. The railroads in question have been continually extended and are part of the greatest single railway system in the world; moreover they run not only parallel to the Rhine but in all other directions. The Rhine, from its very situation, has mostly to do with the transportation of exports and imports, the greatest exception being coal upstream from Duisburg-Ruhrort. However Germany's commerce with foreign countries has grown in the last quarter century, this growth is small compared with the enormous increase in the internal exchange of goods. We shall later see how the Rhine has increased its share of the traffic in goods where it can compete directly with the railways; for instance, transportation of imports.

The effect of these changes on the relation between waterway and railway traffic in all Germany is shown by Sympher in his article, "Thirty Years of Internal Navigation in Germany, 1875–1905." He assumes that the length of the navigable waterway system has not increased in this period, as the length of the waterways that have become obsolete more than balances all additions to the system.

[1] Arnecke, p. 46, and *Statistik der Güterbewegung auf deutschen Eisenbahnen*, 1907.

In the meanwhile the length of German railways has increased from 26,500 to 54,400 kilometres. In spite of this, the waterways had in 1905 a larger percentage of the total German traffic than they had in 1875.

I. GERMAN NAVIGABLE WATERWAYS EXCLUSIVE OF RIVER-MOUTHS ADMITTING SEASHIPS

	1875	1905
Length	10,000 km.	10,000 km.
Goods arrived	11,000,000 tons	58,800,000 tons
Goods departed	9,800,000	46,400,000
Net ton-kilometres	2,900,000,000	14,810,000,000
Tonnage per kilometre	290,000	1,567,000
Average length of transport	280 km.	290 km.

II. GERMAN RAILWAYS

	1875	1905
Length	26,500 km.	54,400 km.
Ton-kilometres	10,900,000,000	44,600,000,000
Tonnage per kilometre	411,000 tons	820,000 tons
Average length of transport	125 km.	151 km.

III. PERCENTAGE OF TOTAL INLAND TRAFFIC

	1875	1905
Internal waterways	21	25
Railways	79	75

CHAPTER V

IMPROVEMENTS OF THE CHANNEL AND THE BOATS

As one reason for the Rhine's prosperity to-day we have already considered the change in the nature of the goods offered for transportation: the growing preponderance of bulk ship-load goods. Not less important was the deepening of the river to admit the barges of to-day: of 1500 to 3000 tons capacity.[1]

The entire basin of the Rhine may be divided into the Swiss or headwater basin from the headwaters to Basle, the plain of the upper Rhine from Basle to Bingen, the middle Rhine which flows through the mountains from Bingen to Bonn and furnishes the most picturesque scenery on the river, the plain of the lower Rhine from Bonn to the sea. In spite of the great plans of the Swiss, who are canalizing the Rhine from Basle to the Lake of Constance with the dream of making this latter the great internal harbor of Europe, — in spite of these plans, shipping above Basle is now confined to local traffic on the Lake of Constance. So we may leave the Swiss basin out of consideration and divide the river from Basle to the sea geographically into upper, middle,[2] and lower Rhine. The length of these sections is as follows:[3] —

Section	*From*	*Length*	*Navigable Tributaries*
Upper Rhine	Basle to Bingen	224⅓ miles	Neckar, Main
Middle	Bingen to Bonn	79	Moselle, Lahn
Lower	Bonn to Hook of Holland	231⅔	Ruhr, Lippe
	Total	535	

[1] There is one barge of 3600 tons on the Rhine.

[2] In this book, by the middle Rhine the section Cologne-Mayence has hitherto been meant. In the face of the natural division above given, common usage still considers Cologne-Mayence as the middle Rhine, which usage, excepting in this chapter, is retained in the following pages.

[3] *Statistik des deutschen Reiches: Stromgebiete*, p. 104.

Below the Dutch border the river splits into two arms, Waal and Leck, which, dividing and reuniting, wander through the Rhine Delta to the sea. The name "Rhine" disappears. Rotterdam, 20½ miles from the Hook of Holland, is the river's natural sea harbor, but the Waal is connected with Amsterdam by the Merwede Canal, with Antwerp by protected coastal waterways joined together by a short canal. The largest Rhine barges reach Antwerp, all but the largest reach Amsterdam, toll-free, and thus it is that the Rhine has three competing seaports.

We noticed that, up to the time when steam navigation was introduced, attention was fixed principally on keeping the towpath in condition. It is now seldom used excepting for the few miles between Assmannshausen and Bingen, where teams of horses help the tug get the barges upstream through the heavy current. The use of tug and barge, particularly of the increasingly large barges that the traffic demanded, required a constant deepening of the channel. The extent of these improvements is indicated by the increasing difference between the water gauges of the river towns and the navigable depth of the river. With a water stage of 4 feet, 5 inches on the Cologne water gauge the boatman can reckon on a navigable depth of 9 feet, 10 inches from the Dutch border to Cologne.

The nature of the works that attained this deep channel was determined by the nature of the river. On the Rhine above Mannheim most of the work up to this time has been "river correction,"[1] principally in the interest of adjacent land. The river bed wandered formerly hither and thither, changing with every summer flood that overflowed the banks and laid great stretches of country under water. The overflow territory between Basle and Mannheim was

[1] In Germany a distinction is made between "river correction," designed to protect adjacent land from the ravages of high water, and "river regulation" which insures navigation against damage from low water.

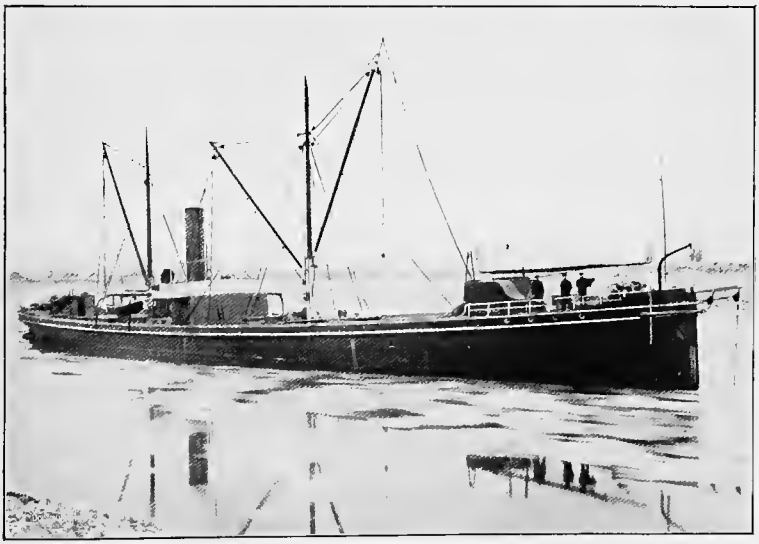
513 square miles. The winding course of the river was straightened by through-cuts; floods made harmless by the erection of dikes at a greater or less distance back from the river bank, according to the profile needed to carry off the flood waters without overflow. This work was begun in 1812 by Baden and France, which then owned Alsace, and has reduced the above-mentioned overflow territory to 128 square miles.[1] The principal value that this river correction had for navigation was a shortening of the course of the river by 45 miles. At present the river is being regulated in the interest of navigation from Mannheim to Strassburg. The chief work consists in the construction of moles out of fascine-work, built out into the stream. The back of the moles is a little below high water, the distance between their opposite heads represents the desired width of the river, which gradually sands up between the consecutive moles. It is calculated that the current, confined to this bed, will have volume and force to keep the channel constant and clear and thus save dredging.

The next works of importance are in the Rheingau; a lake-like widening below the mouth of the Main, between Mayence and Bingen, caused by the river being driven through the narrow pass below Bingen. In the Rheingau, where the current is naturally sluggish, sand brought down by the Main is deposited. This must be continually dredged out to keep the channel clear, and the wandering sand islands must be given a settled habitation. The Rheingau was put in order by Hesse and Prussia, the riverain states, in the years 1884–93.

The middle Rhine from Bingen to Bonn breaks through the mountains and rushes through a narrow rocky bed,—in the Binger Loch with a fall of two feet in 1000 and a high-water speed of eleven feet a second. Rocky reefs lay across the stream. Here the reefs had to be removed and the channel blasted out. Prussia has been at work on this section

[1] Adjacent land in Baden increased 39 million marks in value.

SHALLOW-GOING, SIDE-WHEEL TUG OF THE SORT IN USE ON THE RHINE



A RHINE FREIGHT STEAMER

since 1831 and two thirds of all moneys spent on regulating the Rhine have gone for blasting operations on the section Bingen-Coblenz. The work was particularly difficult because neither by this blasting nor by the dredgings in the Rheingau could the area of the water surface in the Rheingau be reduced. The wine growers on the river banks protested against such a reduction, claiming that an undiminished water surface was necessary to reflect the sun and send up the mist, on which the quality of the grapes is dependent. In the Binger Loch itself it was impracticable to create a width of channel such as obtains on other portions of the Rhine. Only here are barge trains forbidden to pass each other. A signalman on the Mouse Tower[1] directs the traffic.

Below Bonn the river quiets down and has from here to the sea the character of a lowland stream. Here again through-cuts had to be made, the river banks — especially at curves — protected against erosion, dikes erected where the adjacent land was low. Dredgings were carried out where the current was sluggish and had deposited sand; Holland particularly has had to spend great sums for dredging. Fascine-work moles were built out into the stream where the river was too wide and needed to be compelled to concentrate its energy.

In 1881 the technical experts of the riverain states, after a voyage of inspection on the Rhine, set up the following ideal standard: —

On the Section	*A Channel-depth of*
Below Cologne	9 feet, 10 inches (3 metres)
Cologne to Coblenz	8 feet, 2½ inches (2½ metres)
Coblenz to Mannheim	6 feet, 6¾ inches (2 metres)

These depths were to obtain at low water as recorded by a stand of 4 feet, 11 inches (1.5 metres) on the water gauge at Cologne. On the German Rhine these depths have more than been attained, for the 2.5 metres depth reaches up-

[1] It was here that the wicked bishop of Bingen is reported to have met his fate.

stream twenty-two miles past Coblenz to St. Goar. According to the Imperial Statistics the navigable depth is:—

Section	
Below Cologne	9 feet, 10 inches
Cologne to St. Goar	8 feet, 2½ inches
St. Goar to Mannheim [1]	6 feet, 6¾ inches

This of course does not mean that vessels below Cologne can be loaded to draw 9 feet, 10 inches; 7½ feet is a full load. In the same way, 4⅓ feet is a good loaded draught for boats going through to Mannheim at the above stage of water. Unfortunately the depth of 9 feet, 10 inches that obtains from Cologne to the Dutch border has not been attained below that point. The Waal has a depth (under above conditions) of 8 feet, 10 inches (2.7 metres), the Leck of only 6½ feet (2 metres). Holland is trying to dredge the Waal to 3 metres.[2] The width of the channel above Cologne is 200 to 300 feet, excepting in the Binger Loch, where it is only 75 feet; below Cologne the width is 300 to 500 feet.

Sympher reckons that the Rhine is on the average navigable for 304 days in the year.[3] He finds that during this period the boats can load

a full cargo ⅓ of the time
¾ cargo ⅔ of the time
½ cargo all the time.

As we shall see, the standard barges on the river load 1500 tons. One must remember that the Rhine is particularly fortunate in that it has its source among the Swiss glaciers. In midsummer, when less favored streams suffer from low

[1] At present at low water the boatman reckons on a depth of channel Mannheim to Strassburg: 4 feet; Strassburg to Basle: 3 feet. The new regulation-works will give the river from Mannheim to Strassburg the same channel-depth as below Mannheim.

[2] Ysselsteyn, p. 90.

[3] Navigation is suspended by heavy fogs, high floods, floating ice, and rarely by low water. At low water the boats may have to carry a very light cargo to get through the Binger Loch, but they are seldom absolutely unable to get past. (Sympher: *Wasserwirtschaftliche Vorarbeiten, Anlage*, vi, p. 8.)

water, the glaciers melt, and there is less danger of low water in July and August than of floods. This comparatively regular supply of water could be made still better by converting the huge lake of Constance, through which the Rhine flows, into a reservoir to hold the waters at flood time and let them gradually out in the dry season. An insignificant raising of the lake's surface would accomplish this purpose.

Along with this deepening of the channel went a steady increase in the size of the Rhine tugs and barges. The largest barge on the Rhine in 1840 had a capacity of 400 tons, in 1880 of 800 tons, in 1900 of 2000 tons; in 1909 there was one barge of 3600 tons, destined to carry iron ore from Rotterdam to Ruhrort. This barge contains the contents of five large German freight trains, each of 75 10-ton cars. On the railroad the capacity of the largest standard freight cars is still only 20 tons.[1] In these great barges the spill and scoop principle in loading and unloading, with its cheapening of transfer charges and its shortening of transfer time, shows to the best advantage. The costs of operation are little higher for a large barge than for a small one. A comparison of water rates for coal, Ruhrort-Rotterdam, 1904–07, on large and on medium-sized vessels shows the advantage the former possess: during the four years the rates per ton on the big boats averaged 10 cents less.[2] The average capacity of the coal-barges built by the great coal transportation companies — of which we shall hear later — was:—

Before 1860	477 tons
1861–1870	529
1871–1880	679
1881–1890	929
1891–1900	1277
1900–1906	1585
since 1906	1815

[1] There are some exceptions. For instance, the Bavarian state railways have some cars of 45 tons to bring tender coal from the Rhine barges unloaded at Gustavsburg, opposite Mayence.

[2] *Denkschrift:* "*Ist es notwendig,*" pp. 10–13.

The size of the barge that gives the best returns gets continually larger. Not only at high water but also at low water the big boat pays: when the loaded draught of the boat can be 4 feet, the barge of 1700 tons can take a cargo of 650 tons, the barge of 650 tons a cargo of only 300 tons.[1] And at low water the water rates and the profits of the barge are often highest. The larger the vessel, the greater the usefulness of the coal tip, the automatic grab crane, the loading bridge, elevators for unloading grain, etc. In 1907 there were 11 barges of more than 2000 tons capacity on the Rhine.[2] These huge boats are profitable only for simple cargoes; when the cargo is mixed it often costs too much and takes too long to make it up, — for instance, if the barge has to be towed from one seaship to another in Rotterdam to complete its cargo. Moreover, boats of 1800 to 2000 tons seem to have reached the limit of safety for getting through the Binger Loch and for manœuvring and passing other barge trains on the Rhine above that point. A barge of 1800 tons has a length of 295 feet, a width of 40 feet, a loaded draught of 9 feet, and costs (built of steel) $22,000.[3] A barge train of tug and 4 barges is a quarter of a mile long.

In the same way the horse-power of the tugboat has increased. When we compare a tug in the forties with a modern tug we find that the horse-power has increased from 50–100 to 1300–1500, the cargo in the barge train from 600 to 6000 tons. Compound engines and tubular boilers decrease the coal consumption. The duration of the trip Ruhrort-Cologne (58 miles) has been reduced from 40 to 18 hours, the consumption of coal per hour from 1¼ to ⅘ tons. Below Cologne screw tugs are preferably employed: they draw more water but cost less and pull more per horse-power. On the Rhine from the

[1] Schulte, p. 523.
[2] *Bericht der Zentralkommission.*
[3] Woltmann: *Führer*, pp. 37–40.

Binger Loch upwards the shallower-going side-wheelers are more used. A side-wheel tug of 1200 horse-power has a length of 240 feet, a width without the paddle-boxes of 28 feet, with them of 63 feet, a draught with 10 tons of coal on board of 3 feet, 10 inches. Such a boat costs about $90,000.[1]

In the meanwhile iron (later steel) replaced wood as material for body of barge and tug. This innovation was introduced by the Dutch shipbuilders when the cheap importation of German wood on the Rhine ceased and wood from over sea was found little cheaper than the more durable iron. Wooden barges cannot stand the rough loading from coal tips, etc.; moreover, steel barges draw less than wooden ones of the same capacity. In 1907 there were only three wooden boats on the Rhine of over 800 tons.[2] Wooden boats play an important part to-day on the Rhine only in carrying coal from Ruhrort to stations on the little Dutch and Belgian canals; these smaller boats help raise the Dutch proportion of the Rhine fleet. The relation of the number of German is to the number of Dutch barges on the Rhine: for barges of less than 1000 tons capacity 1 to 3; for barges of 1000 to 1500 tons 2½ to 1; for barges of over 1500 tons, 3 to 1. But, even for the Dutch and Belgian canals, steel barges are being more and more built. For the pure canal traffic — for instance, market-boats to Amsterdam — the picturesque combination of sailing and towage by horse and man is being replaced by steel boats with small gasoline engines, powerful enough for the still waters of the canal.

There were in the Rhine fleet[3] in August, 1906, 10,534 boats with 30,675 men in their crews.[4] Of these boats 1272

[1] Woltmann: *Führer*, pp. 37–40.

[2] *Statistik des deutschen Reiches, Stromgebiete*, p. 41.

[3] Boats in the list of the Insurance Companies' Association. No boat outside this list will be employed by a shipper.

[4] The total number of persons engaged in Rhine shipping, afloat and ashore, is approximately 45,000.

were steamboats with 288,793 horse-power, 9262 barges with 3,557,666 tons total capacity. Of horse-power in the steamboats 69 per cent were in tugs, 16 per cent in freight steamers, together 85 per cent. Of these 288,793 horse-power in the steamboats, 64 per cent were in German, 28 per cent in Dutch, 8 per cent in Belgian ownership. Of the 9262 barges 5856 were steel, 3406 wooden. Of the 9262 50 per cent were Dutch, 29 per cent German, but of the total capacity of the barges (3,557,666 tons) 50 per cent were in German, 34 per cent in Dutch, 15 per cent in Belgian hands. The wooden boats of small capacity in Dutch hands account for this difference. Steel as well as wooden barges for the Rhine are built mostly in Holland. Wages are cheaper there, there are no state insurance burdens for the shipbuilder to carry as in Germany, and Holland buys ship plates from the German Steel Trust cheaper than they are sold in Germany. But in the construction of the steamers it is a problem of combining the least possible draught with the greatest possible horse-power. Here the German technical superiority comes into play: most of the tugs and other steamboats are built in Germany.

Of the particular types that have been developed in the Rhine fleet perhaps the most interesting are the "Rhine-sea" steamers. These ply from Rhine harbors between Cologne and Ruhrort and the seaports of the North European coast (also London). The 47 Rhine-sea steamers have a total capacity of 41,310 tons, the separate ships vary from 342 to 1770 tons and draw 11 to 14 feet loaded. Rhine freight steamers, like these Rhine-sea steamers,[1] came into use as soon as the depth of channel allowed ships to be operated with enough draught to carry both engines and cargo. Express goods on the Rhine are moved by freight steamers which with engines of 600 horse-power and a draught of 8 feet carry 1000 to 1200 tons. The few express steamers of the passenger companies carry 200 to

[1] *Bericht der Zentralkommission.*

300 tons, are swifter but considerably dearer than those just mentioned.[1]

The Rhine tank boats are a link in the splendid transportation system of the Standard Oil Company. The Company's tank steamers are filled in the American harbor from pipes, and the oil is drawn out of them into the waiting river tank boat in Rotterdam. This tank boat is towed up the river to its destination, where the oil is pumped out into the tanks that stand on the river edge in nearly every large city on the Rhine. Ten years ago petroleum came to Germany in barrels. Now one sees thousands of barrels piled high by the side of the tanks, memorials of an obsolete form of transportation.

[1] Germany has six times as many vessels on her internal waterways as on the sea. (Sympher: *Dreissig Jahre*, p. 2.) Even the carrying capacity of the former is 1½ times as great as that of the latter. (1 net register-ton = 1½ tons capacity.)

CHAPTER VI

DEVELOPMENT OF THE RHINE'S SEA AND RIVER HARBORS

No less important for the future of the Rhine than these improvements in channel, tug, and barge, was the development of the seaports the river serve, of their over-sea connections, and of the river harbors.

Up to the seventies the seaports of the Rhine were dependent for their over-sea commerce on lines that began and ended in England. If goods were destined for foreign parts they were taken to London or Liverpool and there re-shipped. But when the German and Belgian imports of breadstuffs and raw materials, their exports of finished products, grew enormously, it was worth while for the great English — later the German — lines to have their ships call at Antwerp. They chose Antwerp because the big steamers could get up the Scheldt to Antwerp, while the New Maas to Rotterdam, the Zuyder Zee to Amsterdam, were badly sanded up. The Dutch harbors have had first-class connection with the sea only a few years. Rotterdam's difficult and costly "New Waterway" was finished in 1896. In the same year was opened Amsterdam's North Sea Ship Canal, a cut through the peninsula of North Holland that meant the definite abandonment of the Zuyder Zee for Amsterdam's over-sea routes.[1]

As the great lines first called at Antwerp it became and has remained the seaport of a large, rich hinterland: for even western Germany the most important port for all but bulk ship-load goods. Rotterdam has only little Holland and Germany to draw on. Antwerp has not only the Rhine

[1] The advisability of winning a great area for cultivation by diking off the Zuyder Zee and drying it up, is being considered.

but also a network of 300-ton canals reaching over Belgium and deep into France. Boats of 7,385,539 tons burden came to Antwerp in 1907 from the interior; of these only one fourth from the Rhine.[1] Germany has certainly no higher percentage of Antwerp's railway traffic of 9,305,246 tons. Antwerp has charge of the exports and most of the imports of Belgium, northwestern France and, to a lesser degree, also of Germany west of the Rhine. By being able to thus unite the water and rail lines of communication with a great industrial region having heavy imports and exports, Antwerp has the basis for a frequency of the regular steamship lines calling there to complete cargoes such as Rotterdam can never possess. Rotterdam is dependent on bulk goods. As the exports of industrial northern Europe consist mostly of the specifically more valuable goods of a general cargo, we might expect to find Antwerp's exports greater. Such is the case. The Belgian port exported 5,632,500 tons,[2] against Rotterdam's 2,260,100 tons, in 1907.[3]

Rotterdam is well aware of this advantage of Antwerp's and is at work creating new steamship lines, the principal fruit of her endeavors being the Holland-American Line. So far as these connections go, the German exports on the Rhine go largely via Rotterdam. But it is in imports that Rotterdam's importance lies, and the bulk goods that come by the ship-load and constitute the greater part of the imports are carried more by independent ships than by regular lines.

Antwerp's imports in 1907 of 8,814,000 tons were considerably behind Rotterdam's with 17,288,000 tons. The ocean rates for ship-loads from distant countries are the same for all harbors on the North European coast: the cargo is brought to Rotterdam as cheaply as to Antwerp.

[1] *Service du port: Statistique*, 1907.
[2] *Ibid.*
[3] *Bericht der Handelskammer*, Rotterdam, 1907.

The Rhine and coastal waterways route to Antwerp is nearly a day's journey (50 miles) longer from Rhine points than the distance to Rotterdam is. This makes the river rate for grain shipped up the Rhine from Antwerp 12 cents a ton dearer than from Rotterdam. Therefore as soon as the channel let seaships come up to Rotterdam, this harbor got the imports of ship-load goods that sought the seaport nearest the importing German hinterland. Of Rotterdam's 17,228,000 tons imports 5,857,000 tons were ores; 11,996,000 tons were ores, English coal and grain — 70 per cent of all the imports. Of these 11,996,000 tons all the ores and about two thirds of the grain and coal are reported in the statistics as crossing the German border on the Rhine.

Amsterdam has been making efforts to renew its former greatness and to take a place by Antwerp and Rotterdam as a seaport of the first class. In 1896 the new North Sea Ship Canal in its present form was ready. In 1892 the Merwede Canal from the Waal to Amsterdam gave the city adequate communication with the Rhine, but the canal, as is usually the case with canals after a time, is proving too small for the largest and newest river barges.[1] Rates on a canal are always higher than on a river. Amsterdam has neither Rotterdam's cheap water communication with the German hinterland nor Antwerp's wealth of steamship lines. Amsterdam's steamship connections are principally with the Dutch East Indian colonies. With imports of 1,844,720 tons and exports of 871,482 tons Amsterdam is far behind its rivals.[2] Yet it is still jobber for the Netherlands. Grain and Brazilian coffee imported in Rotterdam are sometimes taken on barges to Amsterdam, where they are stored and distributed to all Holland.

[1] The canal is 44 miles long. Amsterdam is only 15 miles farther from the upper Rhine by water than Rotterdam, but the difference in time is from half a day to a day. Boats must run slower through the canal and lose time in the locks.

[2] *Bericht der Amsterdamer Handelskammer*, 1907.

HOISTS DISCHARGING SPANISH IRON ORE THAT HAS COME UP FROM ROTTERDAM BY BARGE
IN THE BACKGROUND ARE BLAST FURNACES. RUHRORT

LOADING IRON TIES INTO A BARGE FOR EXPORT
AT RUHRORT

Long established trade relations — such as those just mentioned — with the hinterland or with foreign countries often determine by which harbor goods are imported or exported. Antwerp and Amsterdam are much better off in this respect than Rotterdam. The great Belgian investments in Argentine explain Antwerp's lead in the importation of Argentine's grain and oilseed; the practical monopoly of imports from the Congo Free State has a similar reason. Amsterdam is still the great market for eastern tobacco and eastern coffee. These are ship-load goods that would otherwise probably go via Rotterdam. The latter is more or less a transshipment harbor. Mannheim buys direct from America or Argentine the grain unloaded in Rotterdam, dealers in the Rhine harbors buy their English coal from Cardiff, Krupp brings iron ore via Rotterdam from his own mines in Bilbao.

To sum up: Rotterdam is the natural Rhine seaport and has the shortest, cheapest water communication with the German interior. Rotterdam predominates in the bulk goods importation and exportation for west Germany — the Rhine territory. Imports and exports of the more valuable goods that go to make up a general cargo, belong primarily to Antwerp because of its steamship lines. Antwerp and Amsterdam increase their quota of exports and imports by long established trade relations at home and abroad.

All three ports are well fitted out. At low tide ships of 26 feet draught can reach Antwerp and Rotterdam, ships drawing 31 feet get to Amsterdam at all times through the Ship Canal. Each of the harbors has a number of basins of large area allowing free movement of incoming or departing vessels without disturbing those discharging cargoes. In Antwerp, the focus of foreign steamship lines, we find great stretches of perpendicular quay wall along the river front, where liners can tie up and be in the shortest possible time discharged or loaded. Harbor portal cranes rush the trans-

fer of cargo between ship and shed or standing freight car.[1] Sheds protect the goods destined for re-shipment by rail or barge, warehouses serve the interests of local traders and forwarders, a wealth of railway tracks provides for the swift forwarding of goods inland from ship, shed, or warehouse.

In Rotterdam, the harbor for ship-load goods, we find quay wall also, but the method of discharging is usually different there. The seaships are made fast to mooring-posts in the basins, two barges lie alongside on either side of the ship, and grain brought up by the ship's winches is slid through chutes into the barges. The floating suction grain elevator[2] sucks grain out of the ship, cleans it and drops it into the river boat. If this elevator is used, it lies between ship and barge. Export coal is loaded by the coal tip; import coal is discharged by winch, pulley, and basket, or by means of an elevator that works on the principle of the bucket-chain grain elevator. Ore is discharged similarly. Below Rotterdam is an ore unloading-plant which consists of a loading bridge spanning a neck of land, on one side of which the ocean steamers, on the other the barges lie. A self-loading bucket fills from the steamer, runs over the bridge and discharges into the ore heaps on land or into the barges if they are at hand. Human labor is as far as possible replaced by machines, which innovation often caused serious disturbances at its introduction. As far as equipment goes, Amsterdam is in no way behind its rivals.

At the same time modern harbors were being built in the cities along the Rhine. Each of them wanted to get breadstuffs and raw materials cheaply for its population and its industries, and to provide the latter with a cheap export

[1] Barges on hand when the ship is discharging are loaded over the ship's side.

[2] Grain elevator is used in this chapter in the European sense of a mechanical device to discharge — elevate — grain.

route. Each of the cities wanted to gain for its forwarders the transfer between rail and water for the largest possible territory, to win for its warehouses and silos the widest possible dominion.

The largest harbor on the Rhine is the group called Duisburg-Ruhrort, whose most important member is the harbor at Ruhrort, belonging to the Prussian state. Until Ruhrort had railway communication with the coal fields it remained nothing more than a magazine for the little coal that came down the Ruhr and was stored here instead of sailing on direct to its destination. In 1858 the present Ruhrort harbor obtained railway connection with Oberhausen, and since that date the harbor has been continually enlarged. The course of the Ruhr had to be twice changed to make room for new basins. In accordance with its station as a coal harbor Ruhrort is equipped with coal tips. These grasp a 20-ton car and tip it until its contents flow down a chute into the barge. A coal tip loads 2000 tons in 10 hours, and there are at present 11 such tips.[1] A great deal of coal is still loaded by crane and wheelbarrow. Loading bridges, with traveling crabs carrying self-loading buckets of 3 to 5 tons capacity, bring iron ore out of the barges and distribute it to the ore heaps of the blast furnaces back from the harbor. Ore is discharged into freight cars by cranes. Ruhrort was until 1868 built from the Ruhr Navigation Fund, the proceeds of Ruhr tolls. When these were abolished in 1868 the traffic was already so great that the harbor dues financed further enlargements.

In the meanwhile the city harbor at Duisburg and the railway harbors at Hochfeld and Ruhrort were built. The two latter were taken over by Prussia as the railroads

[1] Coal pockets are not practicable for Ruhrort. The varieties of coal shipped are many and the barges generally take several kinds each. It is cheaper to switch the 10-ton freight cars before entrance into the coal tip than to tow the barge about from pocket to pocket.

passed into state ownership. In 1905 Duisburg formed an agreement with its old rival Ruhrort, as a result of which all harbors of the group [1] are now managed by an Administration of the Duisburg-Ruhrort Harbors. Besides these there are many loading places and private harbors of the great industrial works that are settling more and more on the river, to enjoy the water rates. This harbor group [2] had in 1907 a water traffic of 21 million tons, as great as Hamburg's seaward traffic.[3]

Mannheim's story is similar to Ruhrort's. The real development of the harbor began only after it had direct railway connection with the hinterland. That is the case with all the Rhine harbors. No internal harbor to-day can wax great on the commerce between itself and other river harbors or between itself and the sea harbor at the river's mouth. A great internal harbor is the focus of that transfer between rail and water which serves a large tributary territory. As Mannheim remained half a century the head of navigation, there was from the beginning a community of interest between the river and the Baden railways, which terminated in Mannheim. The state of Baden built the harbor and has, besides never charging harbor dues, always put its lowest rates on freight transferred in Mannheim. At the same time the harbor at Ludwigshafen in the Bavarian Palatinate, opposite Mannheim, was built and the railways there adopted the same policy as in Mannheim. In the nineties the harbor at Rheinau, on the southern outskirts of Mannheim, was built by private persons,

[1] Excepting Hochfeld.

[2] From now on, when Duisburg-Ruhrort is spoken of, the entire group is meant.

[3] France and America each have an internal harbor with a traffic greater than that of the greatest national seaport. Duluth has already passed New York. In 1906 Marseilles's seaward traffic was 6,745,840 tons. Paris's traffic on the Seine, amounting to 10,526,646 tons in 1906, reached 12,743,854 tons in 1907. (Édouard Payne in *Nouvelle Revue*, 1908.)

though its administration is now in the hands of the Baden railways. This harbor group with a total water area of 500 acres, had in 1907 a river commerce of 10,000,000 tons, about 4,500,000 tons greater than the seaward traffic of Bremen.[1]

Between these two great groups other large Rhine harbors have been new-built or modernized: Düsseldorf,[2] Crefeld, Uerdingen, Neuss, Mühlheim, Cologne, Mayence, Gustavsburg, Frankfort and Offenbach (both on the Main), Worms, Carlsruhe, Strassburg, and Kehl. The nearness of consecutive harbors to each other and their competition for the common hinterland provide an uninterrupted modernizing of the harbor equipment and administration. That is why the finest river harbors in the world lie on the Rhine. Neuss sees to it that Düsseldorf does not lag behind, Muhlheim does the same for Cologne, Ludwigshafen for Mannheim.

A first-class river harbor must have first of all a water area so great that many boats can come in and out, can be loaded and unloaded at the same time without disturbing each other. In winter the dues of the swarm of boats hibernating in a large harbor are a good source of revenue. This water area is usually provided in the form of basins; the tongues of land that divide them carry railroad tracks. Perpendicular quay walls allow the boats by low water as well as by high to lie close in, within reach of the cranes. For discharging package freight cranes are needed; elevators discharge grain. Coal is unloaded into the freight car by a crane or distributed by the self-loading bucket of the traveling loading bridge over the coal magazines that line the harbors on the upper Rhine. Floating cranes transfer goods from one barge to another.

On the quays run double railroad tracks so that cars

[1] From now on, excepting where the contrary is stated, by "Mannheim" this harbor group will be meant.

[2] Düsseldorf, for instance, has spent $4,500,000 on its municipal harbor.

can be loaded and switched out at the same time. The portal cranes that span the tracks load into cars or swing the goods across to the first or second floor platform of the sheds beyond. Customs officials must be on hand to expedite dutiable foreign wares. The local merchants demand warehouses at the waterside with a department for bonded goods for which the duty need only be paid when they are taken out to be sold. Dealers in grain erect silos on the water's edge, which by means of grain elevators fill themselves direct from the barges.

To shelter the shipments of the Standard Oil Company, the harbor has a tank plant, isolated from the rest of the harbor, with a capacity of thousands of tons of petroleum. Oil is pumped from the barges into the tanks, where it awaits distribution through the city in an oil wagon or re-shipment inland in a tank car.

Lastly, no ambitious Rhine city can be without an industrial harbor — a block of land attached to the commercial harbor which is offered for sale to industrial concerns. At first it was the iron industry, then the chemical, that settled in these harbors, as they received barge-load consignments of raw materials up the Rhine. But such is the attractive force of cheap water rates that to-day in the Mannheim industrial harbor, for instance, all sorts of industries are represented, from steam flour mills to a mirror factory.

By far the larger part of traffic on the Rhine is upstream; four fifths of the barges discharging in Mannheim go back downstream empty. This means extremely low water rates for exporting industries: Mannheim's manufactures come more cheaply to the world's markets than Hannover's, though the latter city has an incomparably shorter railway connection with Bremen and the sea. The prospect to get a downstream cargo from a river town cheapens the water rate upstream to that town. Industries on the river get cheaply rid of their liquid waste, and as the harbor is some

distance removed from the residence quarter this latter is rid of annoyance from the presence of factory chimneys. The cities increase their population and their tax lists by the newcomers. In the five years 1899–1904, in spite of the bad times, Mannheim had through its industrial harbor increased its yearly taxes by six million marks and its laboring population by 1000 persons.[1]

[1] Blaustein: *Führer*.

CHAPTER VII

DEVELOPMENT OF STEAMBOAT COMPANIES AND THE RAILROADS

As we saw, the steam towing companies in the forties, their combination of tug, barge, and forwarding business, gradually crowded out the association boatmen with their horse-relays. Those who did not sell their boats to the companies or grow into companies themselves, remained independent, seeking cargoes from trip to trip. They exist to-day as the so-called independents, who make up the large class of persons possessing each one or two barges or a tug. The number of these independents shows no tendency to diminish in spite of the advantages which the corporations have over them. The independent, who with his wife and children can often man the barge, needs earn so little that he can frequently underbid the companies. The family lives in a cabin aft in the barge, and the man's earnings need only feed, clothe, and warm them and pay the interest on his barge's mortgage, which the Dutch boatbuilder probably still holds. But the independent's net profits are small. If he does not make over his boat for the year to a company on none too favorable conditions, he is dependent for cargo on the state of the freight market. Almost every report from the Shipping Exchange in Rotterdam or Antwerp reads: "excess of barges."

In spite of this chronic excess of barge room new boats are continually being built. The young boatmen want to be independent even though they see the hard fight the independents have. Independents and companies are constantly modernizing their boats by selling their old ones and buying new; and the Dutch shipyards, to keep busy, build boats on very small cash payments. The Rhine fleet,

which consisted in August, 1906, of 1272 steamboats, 3406 wooden and 5856 steel barges, was increased before January, 1907, by 59 steamboats, 530 steel and 72 wooden barges. Those were additions to the fleet of 4.6, 9, and 2 per cent respectively, within four months.

Under these conditions there is naturally a severe competition for the traffic, a competition in which the independents are the weaker party. Nasse published the journal of an independent in the year 1902 and represents the case as typical.

The barge was, in the year 1902,

En route with cargo	52 days
En route without cargo	14
Engaged in loading and discharging	176
Unoccupied	123

That is no satisfactory report for a barge of 1800 tons with a value of $20,000 to $22,000. Even if the case is not typical, it shows how badly matters can go with the independent.

The waste of 176 days for loading and unloading could not occur to a company boat, for the company usually has its own cranes and elevators before its own warehouses and silos in the different harbors, and these attend to the barges as soon as they arrive. The company has not only barges but also tugs, and can put both to the best use, like a railroad company with its rolling stock. Branches and agencies in the Rhine harbors, the sea harbors, and inland collect business. The Mannheim Warehousing Company, for instance, has branches in Antwerp, Rotterdam, Basle, Chiasso, Esslingen, Heilbronn, Carlsruhe, Kehl, Kempten, Cologne, Lindenberg, Mülhausen, New Ulm, and Strassburg; it is, moreover, represented in Brussels, Amsterdam, Bremen, Hamburg, Stettin, Düsseldorf, Bonn, Coblenz, Bingen, Mayence, and Zürich. As forwarders the companies maintain a regular service between their Rhine harbors and the hinterland; finally, they have agreements with the ocean

steamship lines. The traffic in package freight, which as on the ocean belongs to the regular lines, is wholly in their hands. The same is true of the greater part of the bulk goods traffic. The companies make time contracts with the largest shippers. With the formation of the Coal Contor,[1] the independents lost the traffic in German coal, as they now get only what the members of the Contor cannot move.[2] The independents lost the transportation of barrels of petroleum when the Standard Oil Company introduced tank barges. Because of its bad effect on the barge's plates, iron pyrites is usually left to the independents to carry; because of the time lost in loading and unloading bricks, stone, lumber, the companies do not often compete for this business.

As we have seen, the traffic in piece-goods is wholly in the hands of the companies. In 1907 there passed Lobith in freight steamers 876,483 tons, 3.9 per cent of commerce on the border. But this tonnage is no measure of the traffic in package goods, which is largely handled by the express barge trains, — barge trains of 4000 to 6000 tons in 4 or 5 barges that cover the distance between Rotterdam and Mannheim (354 miles) in 5 days, only two days longer than the express steamers of the passenger companies.[3] From Mannheim upward the current gets stronger, the channel shallower. A tug brings 6000 tons in 4 barges from Rotterdam to Mannheim in 5 days, 2000 tons in 2 barges from Mannheim to Strassburg (81 miles) in 2 days, 700 tons in 2 barges from Strassburg to Basle (79 miles) in 2 days. Downstream it goes more swiftly: Basle to Strassburg 1 day, Strassburg to Mannheim 1 day, Mannheim to Rotterdam 3 or 4 days. Though the barges on the Rhine must generally go empty downstream for lack of cargo, they are

[1] See page 61.

[2] The traffic in coal is 40 per cent of the Rhine's total traffic.

[3] These take three days because they call at a large number of Rhine stations.

THREE RHINE-SEA STEAMERS DISCHARGING AT DÜSSELDORF

THE COAL TIP LOADING GERMAN COAL FOR EXPORT
RUHRORT

usually towed; partly to save time, partly because of the danger to a drifting barge on a crowded river. Excepting passenger and freight steamers on the lower Rhine, boats as a rule are anchored at night; on all but clear nights they are compelled to anchor.

There are two groups of companies that play the leading parts in Rhine shipping: the coal transportation companies of the Coal Contor and the great Mannheim companies, of which some specialize on package, some on bulk freight. The more important members of these two groups are:[1]—

Firm	*Domicile*	*Tugboats*		*Barges*	
		No.	*H. P.*	*No.*	*Capacity (tons)*
1. Matthias Stinnes	Mühlheim an der Ruhr	21	15,270	85	83,109
2. Harpener Berghau A. G. (Abt. Schiffahrt)	" " "	17	13,047	74	65,000
3. Hugo Stinnes	" " "	3	4,500	28	37,300
4. Raah, Karcher & Co.	Duisburg	7	6,025	82	45,870
5. Franz Haniel	Ruhrort	12	8,430	30	48,780
6. Mannheim. Dampfschlepp-schiffahrtsgesell.	Mannheim	133		62	67,000
7. Mannheimer Lagerhausgesell-schaft	"	7		35	50,000
8. Badische A. G. für Rheinschif-fahrt und Seetransport	"	12		65	76,300
9. Rheinschiffahrts A. G. vorm. Fendel	"	17		73	82,000
10. Vereinigte Spediteure u. Schiffer, Rheinschiffahrtsgesellschaft "Rheinstrom"	"	4		250	300,000

Of these 10 the first 5 belong to the Coal group, the second 5 to the Mannheim group.

All attempts but one to form combinations with the purpose of regulating competition, have failed. This exception is the Coal Contor,[2] formed in 1904, a creation of the Rheinish-Westphalian Coal Syndicate which controls the output of the great Ruhr basin and so the coal supply of most of western Germany. This Contor was composed

[1] Compiled from: Woltmann: *Führer durch Ruhrhäfen;* Blaustein: *Führer durch Mannheimer Häfen,* and *Mühlheimer Handelskammerbericht,* 1907.

[2] For Coal Contor see: *Kartellrundschau,* 1903–08; *Jahresberichte des Oberbergamtsbezirks Dortmund,* 1904 and 1908; *Reports of Chambers of Commerce on the Rhine.*

of companies which were at the same time coal dealers and coal transporters and which could prove that they had, in the years 1901–03, bought from the Syndicate and transported at least 50,000 tons coal, coke, and briquettes per annum. As the requirement of 50,000 tons was bitterly complained of, it was allowed that two parties which had together so bought and transported 50,000 tons should unite into a single company. The original capital was entirely in the hands of the Coal Syndicate and of four of its members: the great mining and transportation companies, Matthias Stinnes, Hugo Stinnes, Franz Haniel, and the Harpener Mining Company. To-day, of the 9 members of the Board of Directors of the Contor, 2 are representatives of the Syndicate, 1 of each of the four above-mentioned companies.

The Contor has the transportation and sale of coal to that territory which gets its Ruhr coal over Duisburg-Ruhrort; i.e., all the German coal that uses the Rhine. This territory corresponds roughly to south Germany, Switzerland, Alsace, and the neighboring part of France, and Holland.[1] The Contor took over and keeps in repair the cranes, loading-bridges, coal yards, etc., of its members and pays a yearly rental therefor. The members are given coal to transport in quantities corresponding to their average transports in the years 1901–03 (see above). In the same proportion the dividends of the Contor are distributed. The dividends are in addition to the rates paid the members for the act of transportation. These are very liberal and are fixed by the Contor for four years at a time. The rates were, for instance, in 1907: —

Route	*Per ton*
Ruhrort to Frankfort (exclusive of Main canal dues)	2.60 marks
Ruhrort to Mannheim[2]	2.60
Ruhrort to Carlsruhe	3.00

[1] Belgium is given by the Syndicate to another contor.

[2] How liberal these rates are is shown from the following case. In Nov., 1909, a forwarding firm in Rotterdam had contracted to transport 200,000

The total transports of the Contor and the proportions of its most important members in 1907 were:—

	Tons
Total Transports	9,231,600
Coal Syndicate, Essen[1]	1,431,800
Matthias Stinnes, Mühlheim an der Ruhr	1,156,200
Raab, Karcher & Co., Mühlheim an der Ruhr	1,064,000
Hugo Stinnes, Mühlheim an der Ruhr	687,000
Harpener Bergbau A. G. (Abt. Schiffahrt) Mühlheim an der Ruhr	656,800
Franz Haniel & Co., Ruhrort	653,800
Total	5,649,600
Percentage of total transports belonging to these six	61%

	Dividends and salaries of Board of Directors	*That meant, dividends per ton transported*
1904	2,481,335 marks	30 pfennigs
1907	7,187,031	70

If after the first year, 1904, the result of the year's activity was reported " satisfactory," at least the same may be said of 1907.

Probably the world's most powerful corporation, the Standard Oil Company, is strongly represented on the Rhine, through its German branch the German-American Petroleum Company. The oil wells in America, the pipe lines to the refineries on the coast, the tank steamers on the ocean, tank barges on the river, standing tanks in the Rhine harbors, tank cars, tank wagons, and the litre measure with which the driver doles out petroleum to the German Hausfrau, are all the property of the Standard Oil Company. The latter also allows its Belgian branch to sell on the west bank of the Rhine and has a competitor in the Pure Oil Company. Moreover, Galician oil is beginning to come

tons English coal from Rotterdam to Mannheim at 1.60 marks per ton. So there was paid per ton to
Coal Contor for shipment Ruhrort to Mannheim (220 miles) 2.60 marks
Private forwarder " Rotterdam to Mannheim (354 miles) 1.60 "
(*Düsseldorfer Neueste Nachrichten*, Nov. 6, 1909.)

[1] The five following members are both great mining companies and also members of the Syndicate. (Raab, Karcher & Co. is the Rhine transportation branch of the Gelsenkirchener Bergwerks-Verein.)

into the Rhine territory by railroad. Wm. Müller, Rotterdam's greatest importer of iron ore, has a similar organization to that of Standard Oil. Under the firm are nine ore mines in Sweden with 2200 workmen and a yearly production of 600,000 tons. Müller has two large ore steamers for the sea and a fleet of barges that handle most of his shipments up the Rhine. He has time contracts with great ore consumers of the provinces Rhineland and Westphalia.

Rhine-sea navigation began with the formation of the Rhine and Sea Navigation Company in Cologne in the year 1888. This represents an attempt to avoid the transfer between river boat and sea ship in Rotterdam. The service is between Rhine harbors such as Ruhrort and Cologne on the one hand and seaports of the North European coast and London on the other hand. The 47 steamers [1] in this service in 1907 were divided between six companies; 30 of the 47 belonged to the Steam Navigation Company "Argo" in Bremen, which company transported 54 per cent of the goods in Rhine-to-the-sea traffic. The Hamburg-American Line and one other Hamburg company tow sea-going barges between Hamburg and the above-mentioned Rhine harbors. A large number of small sea-going sailing ships come up as far as Remagen (to fetch Apollinaris water) and to Oberlahnstein.

One of the most interesting and significant of recent developments on the Rhine is the new service, Strassburg-Basle, begun in 1904. Mannheim was long the head of navigation, until it was found that smaller barge trains could, for five to six months, get through to Strassburg. In the nineties Kehl and Strassburg built themselves harbors. The swift current between Strassburg and Basle and the "constantly wandering sand bars" were looked upon as permanent hindrances to navigation above Strassburg. But Rudolf Gelpke, a young engineer in Basle, did not

[1] *Bericht der Zentralkommission.*

believe the hindrances were impassable.[1] He called a movement into life which culminated in the arrival in Basle in June, 1904, of a tug and a barge carrying 300 tons of coal. The barge was lost going downstream and nothing more was attempted that year. Since then the city of Basle has erected on the river bank a small terminal with two cranes, and Basle and the Swiss Parliament subsidized the steamboat companies who would build over their barges to allow them to pass under the low bridges between Kehl and Strassburg. Basle's traffic increased to 4200 tons in 1907 and to 40,000 tons in 1909. As we have already seen, a barge train of 2000 tons in two barges can be brought to Strassburg. If the two barges are so lightered in Strassburg that they come through to Basle with only 700 tons between them, it is less because of the necessity of the case than because of the cautiousness of the boatmen on a new section of the river. The greatest hindrance to navigation above Strassburg are the two low iron bridges between Kehl and Strassburg. When the Kehl water gauge registers 6½ feet, there is not enough water to navigate upstream; when the gauge registers 11½ feet, the barges can no longer pass under the bridges. Yet the average number of days of open navigation to Basle was 100 in the years 1905–08. Basle is now about to build a Rhine harbor. The success of the movement is due to Gelpke alone, who is putting through the far greater plan of canalizing the Rhine from Basle up to the Lake of Constance.

Finally, as the chief cause of the Rhine's prosperity today, we must consider the extension of the railroads and the comparatively harmonious relations between them and the river. For although in certain routes[2] the railway, by means of hostile rates, competes directly with the waterway, there is a very moderate limit to the rate differentia-

[1] For the first few years Gelpke, who had mapped out the channel, piloted the tugs of the timid companies above Strassburg.

[2] This subject is treated later on.

tion. Transfer facilities are never denied. In general it may be said that the two work hand in hand. We noticed that each Rhine harbor developed its water traffic only after railways were built inland from the harbor and after the harbor had concentrated on itself the transfer of freight between water and rail for a large territory. The Rhine's shipping is simply the sum of the traffic in these different harbors.

An act of transportation occurs only when the price of an article where it is produced plus the cost of transportation does not make the article so dear that it finds no buyer at its destination. Even if we assume that without the existence of the railroads the water rates could have been reduced to their present low level, the territory that could receive and send goods over the Rhine would be confined to a narrow strip on either side of the river. The high cost of wagon transportation would prohibit the goods being sent far inland from the harbor. We saw that the cost of carting coal from the coal mines to the Ruhr was 40 pfennigs per ton-kilometre (16 cents per ton-mile). We may assume that the ton-mile rate for goods carted inland from Mannheim was at least as high. When, soon after the opening of the Baden Railway from Mannheim to the south, the coal rate per ton-kilometre was reduced to 1.7 pfennigs [1] (about .58 cent per ton-mile), it meant that coal could for the same price be taken twenty-five times farther inland on the railroad than on the highway. The circle that represented the territory which could afford to have its coal sent via Mannheim was replaced by a new circle with a radius twenty-five times greater than the old. So with each of the great Rhine harbors, which together give the measure of the Rhine's prosperity.

[1] This was the pure ton-kilometre rate. The entire freight rate in Germany is composed of this and of a lump dispatching-fee, also graded according to the quality of the freight; for instance, 60 pfennigs per ton for coal.

Yet the assumption that the Rhine, without aid of the railroads, could have reduced its rates to their present level, is false. This was made possible by that very growth of traffic and its centralization in focal Rhine harbors, which depended on the assistance of the railroads. Where the latter, as in Baden, worked hand in hand with the Rhine, they increased its tributary territory; where, as in Prussia, they sometimes competed with the waterway, they often drove it to invent higher forms of transportation and commercial organization, — all of which appeared in the water rates.

The Rhine can rejoice that, where it has competition, this is of the mild sort beyond which state railways dare not go, because of their fear of Parliament and public opinion. A good example of the different policies of railways in private and in public hands is furnished by the Holland and Prussian railways in their treatment of imported iron ore destined for the Rheinish-Westphalian industrial district. The shipments from Rotterdam to the German blast furnace by rail direct are in competition against ore sent by water from Rotterdam to Ruhrort and at the latter point transferred to the rails. For the direct shipment the Holland railways[1] give not only their lowest tariff but also rebates at the end of the year if the shipments have reached a certain amount. Prussia, by uniting with Holland in this and by putting high tariffs on ore transferred at Ruhrort, could diminish the quantity sent up the Rhine. Instead, Prussia out of consideration for the iron industry, sees herself compelled to put a low tariff[2] in force for imported ore transferred at Ruhrort.

How different matters could be if the railroads were in private hands, is seen in the experience of other countries so situated. In explanation of a law proposed in the French

[1] These are state railways under private management.

[2] Exceptional Tariff for Raw Materials (2.2 pfennigs per ton-kilometre and 70 pfennigs dispatching-fee).

Parliament in 1903, the proposer says:[1] "There is almost an absolute separation between railways and waterways and it is extremely rare that a shipment is made over both. In France more than 32 million tons circulate on the navigable waterways and more than 114 million tons on the railways; but the tonnage transferred from one to the other is insignificant. This situation, unfortunate for industry and commerce, arises from the rivalry between waterway and railway. The great railway companies show themselves little disposed to increase transfer facilities and accept a reform which they consider harmful to their interests." In England the railways long ago bought up the principal canals — mostly private — and put them out of service.

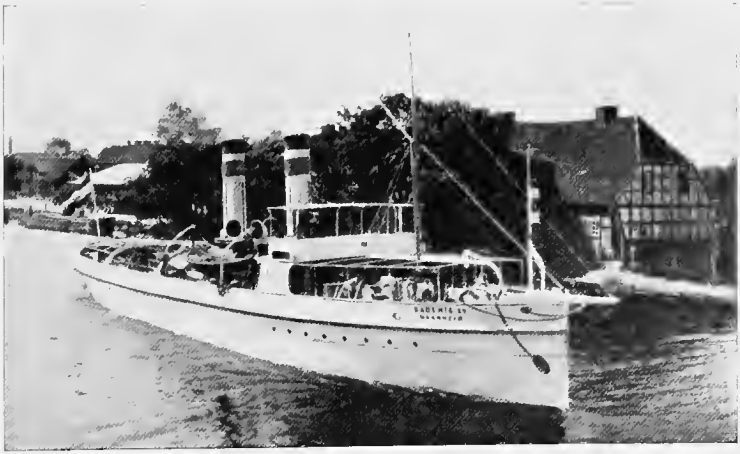
But neither France nor England furnishes the best example of what railroads in private ownership can do to a river like the Rhine. France is so overspread with her splendid network of canals that a considerable traffic takes place on them in spite of railroad competition. Little England, with her multitude of harbors and the short distance from every inland point to one of them, was destined by nature for railroads and coastwise navigation. But the Mississippi, similar to the Rhine, comes from the heart of the American continent. It flows through a valley so productive of wheat, corn, and cotton as to be the admiration and envy of the world. Before the days of the railroad the river was the export and import route for the whole country west of the Alleghenies. The railroads not only discriminated against the river in rates; they refused transfer facilities and often bought up the land along the river bank so that no rival railroad could work with the river. Not only have the railroads drawn the export of the upper Mississippi valley to the eastern seaboard; they have created in Galveston on the Gulf of Mexico a railroad sea harbor whose commerce has already passed that of New Orleans.[2]

[1] Quoted in *Peters*, part ii.

[2] This subject is treated later.

THE RHINE'S TRAFFIC IN 1907

SIDE-WHEEL FREIGHT STEAMER BEING UNLOADED AT MANNHEIM



SMALL SCREW TUGBOAT FOR USE ON THE UPPER RHINE

CHAPTER VIII

RIVER TRAFFIC OF RHINE SEAPORTS AND TRAFFIC ON THE GERMAN-DUTCH BORDER

As statistics concerning shipping on the Rhine we have the Yearly Reports of the Central Commission for Rhine Navigation. Besides information concerning technical and economic innovations on the river, the reports give the number of tons "arrived" and "departed" in 38 German Rhine harbors according to a list of 62 items.[1] At Emmerich on the German side and at Lobith on the Dutch side of the border, the customs officials note through traffic on the river according to the same list.[2] The Lobith tables distinguish the goods further as coming from or destined for Nymweg, Dordrecht, and other Dutch Rhine harbors, Rotterdam, Amsterdam, "other Dutch seaports," Belgium. Moreover, Lobith distinguishes the direct traffic between Rhine and the seaports of the North European coast: with Bremen, Hamburg, Stettin, "English harbors," etc.

How the Emmerich and Lobith tables differ from each other is seen from the following comparison : —

BORDER TRAFFIC ON THE RHINE 1907 [3]

	Downstream	*Upstream*	*Total*
According to Emmerich	7,200,884 tons	16,009,041 tons	23,209,925 tons
According to Lobith	7,287,688	15,792,433	23,080,121
More in Emmerich		216,608	129,804
Less in Emmerich	86,804		

[1] The Reports of the Commission for the years 1891–1906 have been worked over by Dr. Erich Petersilie and appear, with many textual explanations, in Petersilie's book (see Bibliography at beginning of this volume).

[2] These Emmerich and Lobith statistics are contained in the Report of the Commission.

[3] When not otherwise stated, statistics in this and the following chapter are quoted from: 1907 *Bericht der Zentralkommission.*

It is better to follow the Lobith returns, partly because they seem more reliable, partly because they must be used in any case to distinguish traffic between the German Rhine and the different seaports it serves.

The Chambers of Commerce of Rhine cities in their yearly reports often have useful tables complementary to the official statistics. The shipping on the tributaries and of other German rivers and canals is reported in the publications of the Imperial Statistical Bureau (Internal Navigation in 1907). These returns, which are made identically with those of the Commission's Report, are, like the latter, defective in that they do not state the ultimate source or destination of the shipment whose tonnage they report.[1] Thus we are informed regarding only one point in the course of a particular act of transportation. The grouping of articles in the official list is an unsatisfactory one. Iron pyrites, jute, and maize have no place in the list. Iron pyrites is contained in the item "other than iron ores," maize under "other grain and légumes"; jute helps swell the tonnage under "all other articles." Traffic in the many German harbors outside the 38 in the Commission's Report is only caught when it is received in one of the official harbors or passes the border; for instance, basalt-stone downstream from Linz, Apollinaris water downstream from Remagen, the tremendous local traffic in brick from brickyards on the river banks.

The year 1907 was in one respect an unfavorable one for navigation on the river. From September on, the time when the largest quantities of goods are moved, the boatmen had low water to contend against. But on the other hand 1907 was, up to its last quarter, on the crest of the wave of prosperity, and low water in the fall did not prevent traffic on the river from reaching the highest point in its history, a point not reached by either of the two following years.

[1] Lobith's above-mentioned returns are a partial exception to this defect.

Rhine traffic in a few specific articles serves as an index of Germany's prosperity. In bad times, the factories reduce their production and their coal consumption; the coal receipts in the German Rhine harbors sink. At the same time the Coal Syndicate, in order to get rid of its production, sells abroad at any price, and the exports on the Rhine past Emmerich rise. In good times the Syndicate reduces its exports; it cannot even satisfy the home demands, and English coal is imported: the German Rhine harbors show an increase in coal "arrivals," the tonnage of downstream coal exported past Emmerich is smaller, the upstream English coal shows an increase. In the same way the river imports of iron ore past Emmerich into Germany indicate the state of the iron industry, the imports of soft lumber the prosperity of the building trades. The year 1900 was the last year of a period of prosperity, in 1902 times were exceedingly bad, 1904 was on the upward path again, 1907 on the crest of the wave that receded as 1908 came in. The following table shows the effect that these changes had on the above-mentioned articles of Rhine traffic.[1]

	1900	1902	1904	1907
	Tons	*Tons*	*Tons*	*Tons*
Coal arrived in German Rhine harbors	5,160,000	4,300,000	5,400,000	6,980,000
Coal imported past Emmerich	629,000	73,000	172,000	1,800,000
Coal exported past Emmerich	1,900,000	2,800,000	3,700,000	3,500,000
Iron ore imported past Emmerich	2,600,000	2,500,000	4,000,000	5,400,000
Soft lumber imported past Emmerich	477,000	312,000	463,000	615,000

The entire traffic on the Rhine amounted to 64.5 million tons in the year 1907, in the German Rhine harbors alone 41.4 million tons, of which 28.9 million tons were moved upstream, 12.5 million tons downstream. The upstream movement predominates in most of the articles, particularly in coal, iron ore, grain, tropical products, and other foreign goods. Downstream go more manufactured iron, soda, salt, stone, sand, gravel, and brick.

After these general considerations we may turn our

[1] Read the table horizontally.

attention to the traffic in 1907 between the German Rhine and the three sea harbors, Rotterdam, Amsterdam, and Antwerp. The material for the comparison is the distinction (already explained) which the Lobith returns make between goods destined for or from Belgian[1] harbors (river and sea harbors), Rotterdam, Amsterdam, other Dutch harbors (inland and sea harbors). Of these "other Dutch harbors" one can make short work. There passed Lobith downstream 2,049,428 tons directed to them. Of this tonnage 1,094,240 tons were German coal, 889,932 tons sand, gravel, stone, cement, and other building materials. The upstream traffic of these harbors amounted (at the border) to 386,765 tons, of which 297,576 tons were imported iron ore.

According to the Lobith statistics, Rotterdam's river traffic with the German Rhine was in the year 1907: —

(*Leading articles*)

Upstream		*Downstream*	
Total traffic	12,674,637 tons	Total traffic	2,085,989 tons
Iron ore	5,384,461	German coal	766,227
Grain	2,225,811	Sand, gravel, etc.	800,422
English coal	1,742,372	Manufactured iron	260,329
Wood	1,100,697	Stone and stoneware	140,783
Other than iron ores	533,965	Cement, limestone	95,390
Petroleum	243,127	Fertilizers	76,911
Pig and scrap iron	196,124	Wine	25,714
Fertilizers	126,658	Clay wares, porcelain, etc.	22,577
Oil-seed	112,047	"All other articles"	254,746
Fatty oils and fats	110,530		
Sugar, molasses, syrup	101,023		
"All other articles"	836,987		

The traffic between the German Rhine and Belgian harbors has principally to do with Antwerp, but this is certain only when goods have their origin or destination over sea, such as oil-seed, cotton, etc. Certainly half the downstream coal is not destined for Antwerp. Lobith reported traffic passing the border, destined for or from Belgian harbors in 1907, the leading articles shown in the table on the next page.

[1] Under this head are also included goods going through Belgium to France; for instance, Ruhr coal.

(*Leading articles*)

Upstream		*Downstream*	
Total traffic	2,246,495 tons	Total traffic	2,691,241 tons
Grain	782,415	German coal	1,660,492
Iron ore	348,495	Manufactured iron	369,311
Oil-seed	205,714	Sand, gravel, etc.	238,668
Other than iron ore	166,331	Limestone, cement	94,383
Cement	97,134	Fertilizers	43,370
Fertilizers	92,140	Salt	38,066
Clay, earth, etc.	63,343	Coke	27,757
Pig and scrap iron	62,353	Stone and stoneware	26,908
"All other articles"	197,972	"All other articles"	120,468

Amsterdam's corresponding traffic passing the German Dutch border in 1907 was: —

(*Leading articles*)

Upstream		*Downstream*	
Total traffic	306,905 tons	Total traffic	275,281 tons
English coal	39,764	Manufactured iron	69,820
Earth, clay, etc.	37,211	Sand, gravel, etc.	50,896
Petroleum	33,447	Cement, limestone	31,233
Flour, bran, etc.	20,910	German coal	26,035
Oil-seed	15,292	Stone and stoneware	12,470
Other metals than iron	14,012	"All other articles"	41,620
Syrup, sugar, molasses	13,322		
"All other articles"	28,176		

From these tables we see that Amsterdam plays a comparatively unimportant rôle, noticeable principally for the 69,820 tons manufactured iron destined to Amsterdam for export. Belgian harbors exceed Rotterdam's shipments to the Rhine only (among the leading articles) in oil-seed, cotton, cement, earth and clay. Of these only two are from over sea, and therefore from Antwerp: oil-seed and (East Indian) cotton. The predominance in these two explains itself from Antwerp's steamship and trade connections with Argentine and India. Of the other two articles, cement certainly does not come from Antwerp; it is Belgian cement imported into Germany to fight the German Cement Syndicate. Among articles of importance Belgium receives more only of coal, coke, salt, and manufactured iron. Coal, coke, and salt are principally for Belgian industries. Of the 369,000 tons manufactured iron which are bound for Belgium — mostly Antwerp — probably more is exported than of the 266,000 tons destined for Rotterdam.

We saw that Lobith also distinguishes goods in Rhine-

sea traffic: direct in Rhine-sea ships between points on the lower Rhine on the one hand, and English harbors (London), German harbors on the North Sea, German harbors on the Baltic, Russian harbors, "other harbors," on the other hand. Rhine-sea traffic began being recorded in Lobith in 1902 and seemed then to have reached the point of saturation. This traffic has not increased since 1903; instead it has gone back. Its proportion of the total shipping on the border was in 1902 one twenty-eighth, in 1907 one sixty-sixth. An attempt made in 1901 to extend the scope of these direct connections by adding a service to Spain, Italy, Sicily, Algiers, — chiefly to take general cargo south and bring fruit back, — failed. The "Argo" boats that carry on this service now discharge into river boats at Rotterdam.

This fact probably explains the skepticism with which the future of Rhine-sea traffic is regarded. Until a channel of quite another depth is created from Cologne to Rotterdam, even the smallest sea-going steamer must count on having frequently to be considerably lightered in order to get up the river. If this lightering is to be done at all, it is cheaper to lighter the whole cargo into a boat built to operate more cheaply on the Rhine. If the Rhine to Cologne were made accessible at all seasons to the small sea-going steamers, these latter still operate with higher costs than big steamers on the sea, and than river steamboats on the river. The difference more than covers the cost of transfer. One must admire Cologne's enterprise in calling the Rhine-sea traffic into life and sympathize with her dream of renewing her former greatness. She wants a low-water channel to the sea of six metres — one metre more than the Weser to Bremen — which would make Cologne accessible to standard sea-going steamships. Supposing this were attained, the costs and delay of operating the big unwieldy boats on the narrow winding river 197 miles from Rotterdam to Cologne, — these costs would be so much

greater than the costs of towing barges of equal capacity that the transfer in Rotterdam would more than pay. Cities far inland the world over, unless, like Montreal, they are connected with salt water by something equivalent to an arm of the sea, will do well to renounce dreams of seeing ocean liners at their doors. It was observed that Mannheim has a river traffic about twice the seaward traffic of Bremen. The ambition of being such an inland harbor is great enough for any city. In the case of the Rhine, the 6-metre channel will never be dug. Holland has no idea of spending millions to further a project that aims to make Rotterdam superfluous.

According to the Lobith returns the Rhine-sea traffic amounted in 1907 to 347,000 tons. Among the river harbors Cologne had the largest proportion of this: 74,000 tons. Of the over-sea harbors at the other end of the line the German harbors of the North Sea and the Baltic Sea had 250,000 tons or 73 per cent. Hamburg alone has 33 per cent. The leading articles in Rhine-sea traffic were, in 1907: —

	Upstream		*Downstream*
Total	168,321 tons	Total	174,090 tons
Sugar, molasses, syrup	17,353	Manufactured iron	55,482
Fatty oils aod fats	17,554	lostruments, machines	7,644
Flour, bran, etc.	13,997	Brick, etc.	6,468
Flax, hemp	9,597	Wine	6,435
Soft lumher	8,693	Clay, earth, etc.	5,769
Barley	7,121	Soda	5,402
Coffee	5,353	Metals other than iron	5,314
Cement	5,104	"All other articles"	52,245
"All other articles"	39,300		

Of all this the significant thing is the 55,482 tons manufactured iron downstream, coming from the Rheinish-Westphalian industrial district. Of this iron 18,041 tons went to Hamburg.

According to the Lobith statistics the Rhine's total traffic on the Dutch-German border in 1907 will be seen from the table printed on page 78: —

(*Leading articles*)

	Upstream		*Downstream*
Total imports into Germany	15,792,483 tons	Total exports from Germany	7,287,688 tons
Iron ore	6,089,115	German coal	3,548,230
Grain	3,035,393	Sand, gravel, etc.	1,113,784
(Wheat)	(1,663,217)	Manufactured iron	798,760
English coal	1,808,886	Stone and stoneware	479,274
Lumber[1]	1,195,643	Cement	247,058
Other than iron ore	715,049	Fertilizers	156,826
Petroleum	313,299	Salt	55,992
Pig and scrap iron	268,065	Bricks, etc.	39,408
Fertilizers	224,848	Coke	37,950
Fatty oils and fat	166,922	Clay wares, porcelain, etc.	35,780
Sugar, molasses, syrup	133,872	Wine	35,288
Clay, earth, etc.	119,815	"All other articles"	474,533
Cement	110,629		
Other metals than iron	108,803		
Flour, bran, etc.	94,782		
Stone and stoneware	77,857		
Coffee, cocoa, etc.	41,973		
"All other articles"	607,609		

One sees what tremendous dimensions the traffic in bulk goods has assumed, particularly in the imports, of which iron ore and grain constitute two thirds. The first four articles above make four fifths of the upstream shipping. The Rhine's significance as an import route becomes clear when we consider that the Rhine's proportion of Germany's total imports in 1907 was: for iron ore 59 per cent, wheat and spelt 64 per cent, rye 45 per cent, barley 25 per cent, coffee 19 per cent, tobacco 25 per cent. On the Rhine were shipped 25 per cent of Germany's coal exports. Coal amounts to about one half the downstream traffic; after it come sand, gravel, etc., for building purposes. Sand and gravel, which play so great a part in the Rhine's traffic, usually come downstream: they are not valuable enough to stand upstream towage any distance. They are generally a by-product of dredging operations. Often private firms are allowed to dredge for sand and gravel, under direction of the state engineers. Manufactured iron went downstream in enormous quantities — from the Rheinish-Westphalian industrial district; next in order came cement and fertilizers. To be sure, the above statistics are weight, not value statistics. The latter would change the order of the articles, for instance: —

[1] In this item is contained a great quantity of American pitch-pine.

Article	*Tons imported*	*Specific value per ton*	*Total value*
Iron ore	6,039,115	18.00 marks	108,700,000 marks
Wheat	1,663,217	168.00	279,400,000

Value statistics would probably go a long way towards equalizing exports and imports, though the latter are three times greater according to weight. The 15,000 tons exported instruments and machines represent a very high value. Many of Germany's manufactured goods with which she pays for bulk imports, are included under "all other articles." The Mannheim Chamber of Commerce gives us a glimpse into the composition of this rubric when it tells us that Mannheim sent downstream in 1907, under "all other articles," 14,697 tons condensed milk (from Switzerland).

CHAPTER IX

TRAFFIC IN GERMAN RHINE HARBORS

To have a comparatively complete insight into the traffic in German Rhine harbors, it is only necessary to study in detail the traffic in Duisburg-Ruhrort and in Mannheim. The former is the great harbor for bulk goods, the latter for piece goods. Together they have a traffic of 31.4 million tons or 75 per cent of the total 41.4 million tons received or sent in all German Rhine harbors. Of the ten articles with the largest total tonnage "received" in these harbors: coal, iron ore, "earth, sand, clay, gravel," grain, wood, ores besides iron ore, pig and scrap iron, stone and stoneware, oil-seed, petroleum, — each of these has its largest "receipts" in Duisburg-Ruhrort or Mannheim. Of the ten articles with the largest total tonnage shipped from German Rhine harbors: coal, manufactured iron, "sand, gravel, etc.," iron ore, stone and stoneware, cement, coke, salt, pig and scrap iron, wood, — of all these only four (iron ore, stone, cement, and wood) have their largest shipments elsewhere than in Mannheim or Duisburg-Ruhrort. The latter have a corresponding predominance in most of the articles received, — such as cotton, rice, sugar, fatty oils and fats, machines, — and in most of the articles shipped, such as soda, machines, wine, flour. So we shall consider the traffic of the two great harbors in more or less detail. For the other harbors we can content ourselves with giving the total traffic and going into detail only when a harbor presents us with something particularly worth our notice.

The total tonnage arriving from upstream in the German Rhine harbors was in 1907, 4.6 million tons, of which 3.8 million tons consisted of building materials. The total shipment upstream from German Rhine harbors was 7.8

A ROW OF GRAIN ELEVATORS IN THE HARBOR OF DUISBURG

million tons, of which 6.9 million tons were coal. The sum of these two — shipments upstream and arrivals downstream in German Rhine harbors — is the measure of the Rhine's significance for internal German traffic. This sum is 12.4 million tons. As we saw, the tonnage passing Lobith on the German border was 23.08 million tons. Hence, Germany uses the Rhine to exchange with foreign countries twice as many goods as are moved on the river within her own borders. The total traffic of German Rhine harbors was in 1907: —

	Arrived		*Shipped*
Total	25,763,657 tons	Total	14,787,033 tons
From downstream	21,099,117	Sent upstream	7,818,520
From upstream	4,664,540	Sent downstream	6,986,513

The swiftness with which Duisburg-Ruhrort (the harbor group) is developing, is shown by a look at the traffic tonnage in the years 1900–07. It amounted to: 14.1, 14.5, 14.0, 19.9, 20.9, 21.5 million tons respectively. This total of 21.5 million tons in 1907 was divided as follows: —

	Arrived		*Shipped*
Total	9,585,388 tons	Total	11,995,962 tons
From downstream	7,856,951	Upstream	7,170,656
From upstream	1,728,457	Downstream	4,825,306

ninety per cent of the total water traffic in Duisburg-Ruhrort is composed of five articles: iron ore, grain and wood arrived; coal and coke, pig and manufactured iron sent. The following tables give the direction and quantity in which each of these staples of Rhine commerce was moved:[1] —

Arrived		*Sent*	
I. Iron ore from		IV. Coal and coke	
Downstream	5,839,226 tons	Upstream	6,786,261 tons
Upstream	327,439	Downstream	3,825,556
Total	6,166,665	Total	10,614,817
II. Grain from		V. Pig and manufactured iron	
Downstream	820,928	Upstream	143,664
Upstream	5,174	Downstream	679,707
Total	826,102	Total	823,371
III. Wood, lumber from			
Downstream	382,676		
Upstream	228,304		
Total	610,980		

[1] *Zweiter Duisburger Handelskammerbericht*, 1907.

No other German river harbor has such a water traffic. Hamburg's entire seaward traffic, which includes the coasting trade, was, in 1907, 21,812,426 tons. Duisburg-Ruhrort is the portal through which the Rheinish-Westphalian industrial district satisfies its demand for the raw products of its iron industry and its coal mines (mine lumber). Through this portal the industrial district draws grain to support its population. Via Duisburg-Ruhrort it ships its products: coal, coke, iron. The following statistics give the destination of the 9,065,602 tons coal sent from the Duisburg, Ruhrort, and Hochfeld harbors (the principal members of the group). Coal was shipped from these harbors in 1907:[1]—

Upstream

To stations	Ruhrort to Cologne exclusive	95,052 tons
	Cologne inclusive to Coblenz inclusive	53,490
	Coblenz exclusive to Mayence exclusive	136,729
	Main harbors	786,642
	Mayence exclusive to Mannheim exclusive	1,046,444
	Mannheim and above	3,958,332
	Total	6,076,789

Downstream

To stations	On Rhine to Emmerich inclusive	118,264 tons
	In Holland	1,791,477
	In Belgium	964,095
	In France	114,661
	Total	2,988,497

But there was also considerable traffic in Duisburg-Ruhrort in the goods that make up the other 10 per cent of its commerce on the water. Those of these other articles contributing each more than 5000 tons to the total traffic in 1907 were:—

	Arrived		*Shipped*
Sand, gravel, etc.	665,472 tons	Sand, gravel, etc.	301,714 tons
Ores besides iron ore	158,327	Fertilizer (Thomas slack)	78,280
Stone and stoneware	102,519	Tar, etc.	32,946
Cement, limestone	67,353	Flour, meal, etc.	13,082
Other metals than Iron	41,290	Fatty oils and fats	7,615
Petroleum	38,510	Stone and stoneware	6,889
Salt	38,007	"All other articles"	46,644

[1] *Zweiter Duisburger Handelskammerbericht*, 1907.

Arrived	
Oil-seed	34,990 tons
Coal	23,239
Fatty oils and fats	23,343
Flour, meal, etc.	21,492
"All other articles"	884,114
Pitch, etc.	5,318

Among the shipments we notice (after sand, gravel, etc.) fertilizers and coal tar, by-products of the iron[1] and coke industries. Stone, sand, gravel, etc., as arrivals testify of the building activity of the boom year 1907, while the other arrivals are raw products for the many-sided industry of the district, or bulk good necessities for its population, such as petroleum and flour. But here the list stops suddenly. We find no arrivals of valuable piece goods like coffee, rice,[2] wool, cotton; no shipments of machines, etc. We have to do with a bulk good harbor.

Duisburg-Ruhrort has set apart a portion of the latest accretions to her harbor as an industrial harbor. In the meanwhile industries having to do with bulk raw or finished products that could be received or sent on the Rhine settled on the river bank or back from the harbor basins; in some cases, like the "Gewerkschaft Deutscher Kaiser," they built themselves small harbors and now form members of the Duisburg-Ruhrort group. Omitting all others, we give the statistics for the concerns engaged in the "heavy" iron industry:[3]—

	No. of Workmen	*Production*		
		Pig iron	*Steel (in blooms, etc.)*	*Rolling mill products*
Gewerkschaft "Deutscher Kaiser"	7957	636,369 tons	706,954 tons	609,385 tons
Rheinische Stahlwerke	6075	410,518	419,643	400,260
Aktiengesellschaft "Phönix"	4819	310,751	414,481	305,855
Fried. Alfred Hütte der A. G. Krupp	4674	627,186	507,364	375,490
Niederrheinische Hütte	1373	99,224	72,600	34,500

[1] The slack of the phosphate pig iron refined hy the Thomas and Gilchrist process — "Thomas slack" — is ground and furnishes a phosphate fertilizer.

[2] We have already mentioned coffee as a bulk goods in sea commerce. The great importers are still the merchants of the seaports; so piece-goods shipments on the river are the rule.

[3] *Zweiter Duisburger Handelskammerbericht*, 1907.

Duisburg-Ruhrort is the harbor of a great industrial district, small in size, thickly populated, working intensively. It is the portal of Germany's greatest iron industry. The district uses the harbor to carry on its traffic in bulk goods with Holland, Belgium, and the territory tributary to the upper Rhine. Duisburg-Ruhrort's tributary territory is limited by the competition of the sea harbors, Hamburg, Bremen, Emden, Amsterdam, Rotterdam, and Antwerp, each armed with cheap railway rates. The waterway is only 134 miles long from Rotterdam to Duisburg-Ruhrort. If the latter sends import goods many miles inland to the east, it meets with the competition of direct railway transport from Bremen; a short distance to the west, Antwerp's territory begins. Twenty-two miles to the north Düsseldorf lies, with its own hinterland.

Mannheim has a very different situation. It lies 354 miles up the river from Rotterdam and has been up to the present, for most of the year, the head of navigation. As a result this river harbor has a tremendous territory to the east that gets import goods and sends exports via Mannheim cheaper than via any German seaport. To the west, Mannheim's influence extends to the French border, but little beyond, because of France's *surtaxe d'entrepôt:* an addition to the customs duty made for all foreign goods imported via other than French harbors. To the south, Mannheim reaches past Switzerland and into northern Italy. It supplies the Palatinate, Alsace, Baden, Württemberg, Bavaria, western Tyrol, and Switzerland with bulk goods such as coal, coke, grain, and petroleum — Mannheim is called the petroleum-reservoir of south Germany and Switzerland. Moreover, Mannheim forwards for this territory exports and imports of many piece goods of high specific value, as we shall see. Mannheim owes its traffic not only to its situation but also to state aid and to the harmony that has existed between the river and the railways. Harbor dues have never been charged. As the

Baden railways terminate in Mannheim, which has hitherto been the head of navigation, the railways have given their lowest rates for goods transshipped in Mannheim: for instance, 1.7 pfennig per ton-kilometre [1] for coal and transit grain. These rates hold not only for goods that are immediately transshipped, but also for such as are stored in the warehouses, silos, or coal magazines of Mannheim. It is clear what this means for the latter's wholesale trade.

The harbor group which we call Mannheim is made up, in Baden, of the — part state, part municipal — harbor at Mannheim, and the harbor in private hands at Rheinau, 5½ miles above Mannheim. In the Palatinate, across the river, is the state harbor Ludwigshafen, directly opposite Mannheim. The harbor at Mannheim is the oldest and most important of these harbors and was built, with the exception of the municipal industrial harbor, by the Baden state railways.

In the same way Ludwigshafen was built by the Palatinate Railways (now in state hands), to give Ludwigshafen a share in the great transshipment traffic at the head of navigation. Mannheim forwarders own the warehouses at Ludwigshafen also and do most of the latter's business, excepting in German coal, which here, as everywhere, is in the hands of the Coal Contor. Rheinau is almost entirely a coal harbor. It lies off the Rhine above Mannheim on the main line of the railroad Mannheim-Basle. For coal transshipped south, Rheinau offers an advantage. Water rates to Rheinau are the same as to Mannheim. From Rheinau a 10-ton car of coal south-bound saves 37½ cents (.68×5½×10). The land adjacent to the Rheinau harbor is in the hands of a syndicate composed of the Coal Contor and three banks. In Mannheim the direct transshipment from barge to car is of more importance than in Rheinau, where the land is cheaper and where the coal is brought at high-water season and stored in heaps fifty feet high, covering enormous areas.

[1] .68 cent per ton-mile.

As the Rhine above Mannheim has been navigable for four or five months of the year less than the river below that point, Mannheim has considerable shipments upstream, coming principally from its stores of grain and coal. If during low water three or four days of navigable water on the upper Rhine set in, Mannheim can dispatch barge trains to Carlsruhe, Kehl, and Strassburg. These upstream shipments of Mannheim in 1907 amounted to: —

(Leading articles)
Shipped upstream

Total	355,875 tons
Coal	168,780
Grain	111,416
Petroleum	9,809
Flour, meal, etc.	9,034
Oil-seed	6,824
"All other articles"	16,757

Mannheim received from upstream 149,236 tons, mostly bricks from the brickyards between Mannheim and Speyer (121,158 tons).

But Mannheim's traffic with upstream points was trifling compared with the total traffic of 9,891,858 tons. The traffic with downstream in 1907 was: —

(Leading articles)

	Received from downstream		*Shipped downstream*
Total	8,125,165 tons	Total	1,201,582 tons
Coal	4,495,279	Salt	174,203
Grain	1,360,243	Sand, gravel, etc.	88,729
Earth, sand, gravel, etc.	274,677	Cement	83,380
Wood	245,711	Manufactured iron	82,614
Ores besides iron ore	158,327	Wood	78,993
Petroleum	157,956	Other than iron ores	74,261
Coke	149,810	Pig and scrap iron	61,439
Pig iron	148,491	Flour, meal, etc.	61,130
Lignite coal	103,053	Stone and stoneware	56,571
Sugar, molasses, syrup	86,618	Fertilizers	29,912
Oil-seed	86,099	Grain	22,927
Cement	76,076	Soda	16,713
Manufactured iron	70,202	Clay-ware, porcelain, etc.	13,989
Fertilizers	63,275	Sulphuric and other acids	12,057
Fatty oils and fats	50,738	Fatty oils and fats	11,508
Flour, meal, etc.	42,881	Rags	10,554
Tar, pitch	39,209	Wine	10,062
Stone, stoneware	26,118	Asphalt, etc.	7,162
Metals besides iron	25,801	Machines	7,136
Coffee	16,262	Petroleum	6,271
Rice	15,427	Potatoes	5,914
Bricks	13,697	Glass and glassware	4,590
Raw tobacco	12,032	Furniture and woodwork	4,221
Wool	11,633	"All other articles"	248,884

(*Leading articles*)

	Received from downstream
Raw cotton	10,382 tons
Peat	9,667
Machines	8,074
Fruit	7,837
Wine	6,124
Hides, skins, leather	5,937
Barrels, boxes, sacks	5,030
"All other articles"	311,415

Here we have to do with a totally different traffic from that of Duisburg-Ruhrort. The great diversity of Mannheim's traffic is what strikes us. There are 62 articles in the list in which statistics are kept. Mannheim received from downstream more than 5000 tons of each of more than half these 62 articles. Among the goods received are not only grain and raw materials for manufacturing industries, including high-priced raw materials such as wool and cotton. In addition to these we see valuable articles of consumption such as coffee, fruit, wine, and tobacco; equipment for factories, such as manufactured iron and machines.

Mannheim is an inland Antwerp. Over the south German railways the threads of inland communication unite in Mannheim, which handles the transfer between cheap and dear means of transportation for south Germany and Switzerland. Naturally, a great wholesale trade has grown up in Mannheim, particularly in grain, coal, and petroleum. In the Statistics of Freight Traffic on German Railways we can find hints of the direction and extent of Mannheim's transshipment and wholesale trade. Mannheim sent by rail in 1907 more than 20,000 tons wheat to each of the following states: Baden, Palatinate, Württemberg, Alsace, and Switzerland; more than 5000 tons petroleum to each of the following: Switzerland, Württemberg, Baden, south Bavaria, north Bavaria, Palatinate, Alsace, and Hesse-Nassau; more than 50,000 tons coal each to Baden, Württemberg, Switzerland, Alsace, Palatinate, and north Bavaria. How strongly Mannheim is interested in the exports of the iron industry on the river Saar is seen in the shipment downstream of 82,614 tons manufactured iron

and 29,912 tons fertilizer (Thomas slack). Some meshes of Mannheim's net lie far out: Mannheim sent by rail 14,992 tons coal to France and received from France 2259 tons rags, from Austria 3796 tons glassware.

Until the nineties Mannheim was practically the head of navigation. When it was discovered that even without regulating the river, big barges could get up to Strassburg half the year, the head of navigation moved up to the latter point. Basle promises eventually to replace even Strassburg. But Mannheim's traffic has not gone back, in spite of the development of these new harbors; they seem to live from the water traffic they have called into life. So it will remain in the future. Even after the river from Mannheim to Strassburg is made navigable for ten instead of five or six months, this regulation cannot reduce the swiftness of the current which makes a tug bound for Strassburg drop in Mannheim half the barges in its train. This means lower water rates, proportionately, for Mannheim. Moreover, a glance at the map shows that the river makes a turn towards the west at Mannheim. The result is that the latter point is as near to most of its present tributary territory as the new harbors are. These will probably take over only the transshipments between Rhine and upper Baden, upper Alsace, France, and Switzerland to the west of Zürich. Finally, Mannheim, like Antwerp, has developed a wholesale trade, particularly in grain, which has a great exchange here. This promises to hold for Mannheim transshipments that might be handled farther up.

But Mannheim began early to attach to itself a traffic that no other harbors can touch, the traffic which serves the industries settled in Mannheim, Ludwigshafen, and Rheinau. Of these industries those settled on the municipal industrial harbor of Mannheim proper are but a fraction. In the district Mannheim there were in 1907, 47,775 laborers, 20.3 per cent of the entire laboring population of Baden. Of these there were employed in the city of Mannheim:[1]

[1] *Mannheimer Handelskammerbericht*, 1907.

In metal manufacturing processes	2,622
Manufacture of machines, instruments, etc.	11,271
" " furniture, wood-work	3,516
" " chemical products	1,641

In Ludwigshafen one need only mention the Baden Aniline and Soda Works, with 7700 workmen.

From the statistics of downstream traffic, already given, we can see the effects of these industries on the receipts and shipments of certain goods. First, they demand great quantities of coal and swell the coal receipts. The 158,000 tons "ores besides iron ore" are principally iron pyrites for the Baden Aniline and Soda Works and other chemical plants. From these come also the shipments of 16,713 tons soda and 12,057 tons sulphuric acid. Naturally, the upstream rates to a point giving such downstream shipments, are lowered. The great flour mills take a good portion of the arriving grain and give the barges 61,130 tons flour to send downstream, 9034 tons to send upstream.[1] Those are only a few examples of the effect which a high stage of industrialization in the river harbor produces on nearly every article in traffic.

The other Rhine harbors, which had each a traffic figure of more than 100,000 tons, are given below. The Main harbors Frankfort and Offenbach may be treated as Rhine harbors. In 1887 the canalization of the Main from Mayence to Frankfort (20 miles) for 1500-ton Rhine barges was opened. Later this canalization was extended seven miles up the Main to Offenbach. Since then the river traffic of these two harbors has been, in quantity and quality, on a level with that of their fellows on the Rhine.

	Arrived		*Shipped*		
Harbor	*Upstream*	*Downstream*	*Upstream*	*Downstream*	*Total traffic*
Strassburg	602,534			24,486	627,020 tons
Kehl	109,825	1,128	497	11,143	168,492
Lauterburg	241,558			222	241,180
Carlsruhe	376,462	91,608	890	90,129	559,089

[1] See the statistics.

	Arrived		Shipped		
Harbor	*Upstream*	*Downstream*	*Upstream*	*Downstream*	*Total traffic*
Speyer	75,524	39,808	1,727	15,687	141,912 tons
Worms	309,260	9,895	2,999	32,360	354,514
Gernsheim	90,273	12,875	397	3,307	106,852

Strassburg received 341,013 tons coal and 164,400 tons grain. Besides this Rhine traffic, Strassburg has a considerable traffic on the Rhine-Marne and Rhine-Rhone canals, running west and south respectively into France. Far the most important of the goods appearing in the other harbors is coal arriving upstream. Lauterburg has received this coal to the extent of 226,599 tons. Among the shipments downstream Carlsruhe's 74,212 tons soft lumber is noticeable. It comes mostly from the Black Forest, and Mannheim lost it to Carlsruhe when the barges began to go up to the latter place. In shipments of lumber Carlsruhe holds the first place among Rhine harbors.

	Arrived		Shipped		
Harbor	*Upstream*	*Downstream*	*Upstream*	*Downstream*	*Total traffic*
Offenbach	250,942	31,124	11,608	5,660	299,334 tons
Frankfort	1,079,425	99,109	21,463	255,379	1,465,376

Offenbach is noticeable only for upstream coal. Frankfort received upstream (from the Rhine) 482,141 tons coal and 24,653 tons petroleum. Frankfort sent downstream 39,050 tons iron ore, from the mines by Gelnhausen, and 12,056 tons glassware mostly from Thuringia.[1]

	Arrived		Shipped		
Harbor	*Upstream*	*Downstream*	*Upstream*	*Downstream*	*Total traffic*
Gustavsburg	1,005,771	260	57	9,797	1,065,885 tons
Mayence	227,370	806,468	6,881	229,670	1,271,389
Kastel	308,581	160,232	69,520	105,179	643,512
Biebrich	44,901	60,560	840	9,304	115,606
Schierstein	5,344	99,532	3,595	63,588	172,059
Budenheim	32,209	40	1,128	152,942	186,419

Gustavsburg is again a pure coal harbor: 917,807 tons coal arrived upstream. The Coal Contor sends via Gus-

[1] Frankfort received by rail from Thuringia in 1907: 19,666 tons glassware.

GRAIN ELEVATOR AND WAREHOUSE IN A BASIN OF THE MANNHEIM HARBOR

WAREHOUSE ON WATERFRONT AT MANNHEIM

tavsburg most of the coal for Bavaria, where the state railways constitute the largest consumer. Mayence's good days are past. The first step in its fall was the abolition of Mayence's transfer right in 1831, which let the Rhine traffic go through to Mannheim. The second step, the canalization of the Main to Frankfort, let the Main traffic — hitherto transshipped to Main boats at Mayence — go through to Frankfort. The traffic figure of Mayence for 1907 is swelled by 551,598 tons sand and gravel arriving from upstream, caused by great local building operations. In Mayence and Schierstein the Main log rafts are bound together to greater Rhine rafts and sent downstream: to the amount of 268,915 tons in 1907. Mayence holds the first place in the shipment of beer — 6399 tons downstream, mostly Bavarian beer for export; the second place in tonnage of wine shipped: 8261 tons (Mannheim 10,062 tons). Kastel received upstream 33,320 tons "fertilizer": raw material for the chemical works in Amöneberg. Kastel sent 23,360 tons fertilizer (finished product) up and down stream. Budenheim with 147,792 tons stone (basalt) shipped, has the highest figure among Rhine harbors.

	Arrived		*Shipped*		
Harbor	*Upstream*	*Downstream*	*Upstream*	*Downstream*	*Total traffic*
Bingen	92,868	79,032	1,761	77,330	250,991 tons
Oberlahnstein	78,751	48,564	4,054	272,439	403,808
Coblenz	48,937	25,423	2,352	35,141	111,853

With 234,652 tons Oberlahnstein has the first place, Bingen with 54,493 tons the second place among Rhine harbors in the shipment of iron ore — all downstream.

	Arrived		*Shipped*		
Harbor	*Upstream*	*Downstream*	*Upstream*	*Downstream*	*Total traffic*
Cologne	537,185	272,812	100,650	126,092	1,036,739 tons
Mühlheim	244,083	62,567	24,020	78,904	409,574
Neuss	320,047	69,726	36,424	7,909	434,106
Düsseldorf	505,552	473,235	65,000	89,557	1,133,344
Uerdingen	166,474	233,569	29,392	12,180	441,615
Wesel	59,118	681,887	6,050	4,183	751,238

In Rhine harbors from Bingen down, coal plays a minor rôle in the river traffic: it is cheaper to get Ruhr coal direct by rail from the Ruhr mines, as already explained; only English coal comes on the water. Grain takes the lead in the harbors grouped above. Cologne received 50,734 tons "fertilizer" upstream: raw phosphates for the chemical works in Kalk, across the river. Cologne's traffic is remarkable for its diversity. Cologne and Neuss[1] are noticeable for their receipts upstream of flour: 21,186 and 28,699 tons respectively in the year 1907. Mühlheim received upstream 35,794 tons "ore besides iron ore"; here, as in Mannheim, this represents iron pyrites for chemical works. Neuss and Uerdingen have large receipts of imported oilseed for use in the local oil mills: 47,819 and 59,510 tons respectively. Neuss has, after Mannheim, the largest receipts of raw cotton: 8568 tons, destined for the spinning-mills in München-Gladbach. Düsseldorf, with receipts upstream of 211,785 tons grain, is ahead of all but the two greatest Rhine harbors. Correspondingly large is the quantity of flour that Düsseldorf ships from the mill on its industrial harbor: 23,858 tons. Düsseldorf also receives 164,563 tons wood (half of it imported), which gives occupation to the planing mills, wood-working establishments, etc., in its industrial harbor. The manufactures of Düsseldorf and its hinterland are reflected in its downstream shipments of 42,926 tons manufactured iron and 19,786 tons glassware, in which shipments it holds the second and the first place respectively, on the Rhine. The principal items in Wesel's traffic are sand and gravel (606,077 tons) and stone (49,414 tons), coming downstream. As these items appear year after year in Wesel's statistics, they are not to be explained by temporary building activity.

[1] On the industrial harbor of this enterprising city the International Harvester Company and the American Radiator Company, among others, are erecting German works.

THE RHINE'S COMPETITORS

CHAPTER X

THE RHINE'S COMPETITORS

As we have repeatedly seen, the importance of a river as a navigable waterway depends only in part on its state of improvement, on its fleet of tugs, barges, and steamers, on its sea and river ports with their freight-handling and warehousing facilities. These conditions can only have an effect proportionate to the extent and economic development of the territory which the waterway serves. The extent of country which has advantage from cheap rates on the river is to-day dependent on the railway lines that radiate from the river or run parallel to it, their willingness to act as feeders to the waterway and to be fed by it, or their fixed determination not to coöperate. The effect of an unbridled competition of railroads against waterways, which cannot be independent, is shown by the experience of England and America and, to a lesser degree, France. The fate of the inland waterway depends on the rates and the transfer facilities which its complementary railways give.[1]

To understand the elements of the competition which the Rhine has to meet, we may consider how matters would be if those elements of competition were removed. Let us suppose there were only one sea harbor (Rotterdam) on the north European coast from the Atlantic Ocean to Russia, and let us suppose that the railroads running parallel and at angles to the Rhine gave the same ton-kilometric rate for all goods, and for parallel and comple-

[1] What has here been said or will be said regarding inland waterways must not be applied to the Great Lakes of America, which are an inland waterway in somewhat the same sense as is the Mediterranean. They are inland seas.

mentary acts of transportation. In this case, it would be comparatively easy to discover the territory served by the Rhine-rail route instead of by rail direct from Rotterdam. Peters states[1] that, when the destination or source of a transport lies on a first-class waterway, the saving of water over rail transportation is, after forty-five miles on the water, sufficient to pay for the transfer to the rails. In the case we are assuming, Rotterdam, the source of the shipment, lies on the Rhine. Forty-five miles up, or about at Bommel, goods could be transshipped a short distance inland east and west. A point any considerable distance inland from the river could get goods cheaper direct by rail from Rotterdam. Perhaps Bommel could transship west as far as Hertzogenbusch. Farther up the river shipments from Rotterdam would have been so much cheaper than by rail that the harbors on the German Rhine could transship further inland: Ruhrort or Düsseldorf to Cassel eastward, Cologne to Aix-la-Chapelle westward, Coblenz to Luxembourg westward, Frankfort eastward to Plauen in Saxony. In any case, the territory served by the Rhine, which with the aid of the railroad rate-sheets we could approximately map out, would have the shape of a wedge, with the point in Bommel, broadening until it was stopped by the competition of Mediterranean harbors.

But the situation is, of course, not so simple. In the first place there are many great harbors besides Rotterdam on the north European coast: Hamburg, Bremen, Amsterdam, Antwerp, Dunkirk, and Havre; and each cuts a slice off the Rhine's hypothetical wedge. They do this not only when, because of short, direct, railway connection, they are the natural seaports for the districts which they affect. Old established steamship lines and trade relations at home and abroad, as well as special railroad rates, allow them to push still farther forward. Moreover, there are two competing waterways: the Dortmund-Ems canal

[1] See footnote, page 28.

from the seaport Emden to Dortmund, and the Rhine-Marne Canal from Strassburg, which, with connecting canals, forms a through route to Antwerp. Finally, the railroads do not give a single ton-kilometre rate for all goods nor are, in many cases, the same rates given for goods using the waterway for part of the route as for those that go exclusively over the rails. The statistical means at hand are far from complete, and yet it is possible to see the principal effects of the competition to which the Rhine is subjected.

The Dortmund-Ems Canal is 125 miles long from Emden to Dortmund and was completed in 1899 at the cost of 80 million marks. It was designed to give the Rheinish-Westphalian iron industry a cheap route over which to import its iron ore and export coal and manufactured iron. A further design was to create a new German North Sea harbor, Emden, over which to divert a great traffic that had fallen to Rotterdam and Antwerp. Dortmund and Herne, the two northern termini of the canal, lie in the heart of the industrial district and compete with transshipment over Duisburg-Ruhrort for the exports and imports mentioned above.

The canal takes barges of only 750 tons, compared with the 1500 to 3000-ton barges on the lower Rhine. Tugs on the canal may not steam faster than five kilometres (three miles) an hour because the wash engendered by a higher speed endangers the water-tight canal bed, which often lies above the surface of adjacent land. Tolls amounting to 10 to 50 pfennigs (2.4 to 12 cents) per ton further handicap the canal. Steamship connections for Emden did not spring up in the night; Hamburg and Bremen have put sea-going lighters into service which bring a large part of Emden's traffic to these seaports for foreign shipment.[1] All these

[1] In Germany the conviction is coming to predominate that the German hinterland cannot support three world harbors and that a diversion of the Rheinish-Westphalian foreign trade to Emden, while it would affect Rotterdam, would also certainly affect Bremen and Hamburg.

considerations limit the effect of the competition that the canal can exercise against the river.

On the canal were imported in 1907 232,199 tons grain.[1] Of this only the quantity discharged in Dortmund, 41,143 tons, can be considered as competing against grain on the Rhine: against that discharged in Duisburg (820,928 tons). The territory to which Dortmund transships grain on the rails is said to be bounded by Hamm and Iserlohn. The downstream shipments[2] of manufactured iron on the canal were small, 39,585 tons,[3] because of the lack of steamship lines in Emden. Of coal 228,711 tons went downstream on the canal, but practically exclusively from mines on its banks. So with the 462,748 tons iron ore upstream: it was destined mostly for works that lay directly on the canal.[4] Dortmund, in order to supply with imported iron ore the two works "Hösch" and "Hörde" on its own outskirts, was obliged to build a municipal railway with 40-ton cars and low rates, in order to get the business away from Duisburg-Ruhrort. No better illustration could be found for the superiority of free stream over lock canal. The two routes competing are as follows:—

	Water	*Rail*	*Total*
I.	Rotterdam-Duisburg 134 miles	Duisburg-Hösch 35 miles	169 miles
II.	Emden-Dortmund 125 miles	Dortmund-Hösch 2 miles	127 miles

The extraordinary thing is, of course, the distance that ore via the Rhine can travel on the rails and yet be cheaper than via Emden with scarcely any rail transportation.

Summing up, we can say that the canal takes a small slice of Duisburg's grain trade; moreover, that it takes away from the Rhine considerable downstream shipments

[1] *Die Binnenschiffahrt*: upstream through the locks at Meppen.

[2] Downstream through the locks at Meppen.

[3] Duisburg-Ruhrort shipped downstream 679,707 tons.

[4] Duisburg-Ruhrort received from downstream 5,839,226 tons iron ore, shipped downstream 3,825,556 tons coal.

of coal, upstream shipments of iron ore — but only for works directly on the canal. When the Midland Canal[1] is finished, which will connect Rhine and Dortmund-Ems canal, it is expected that the Rhine will extend its territory far to the east. Dortmund's grain silos will be filled by boats from the Rhine. Bremen will also draw off (per Midland Canal and Weser) a portion of the traffic now going through to Emden so that the latter harbor and the lower Dortmund-Ems Canal will be more or less isolated.

The Rhine-Marne Canal running west from Strassburg connects with the French East Canal. The latter joins the river Maas and this is united with the Scheldt at Antwerp by the Scheldt-Maas Junction Canal. Thus there is a waterway taking 300-ton barges, extending from Antwerp to Strassburg. The Rhine-Marne Canal competes with the Rhine in supplying Alsace with over-sea grain and with coal. The canal route for grain, Antwerp to Strassburg, has the advantage over the Rhine route, Rotterdam to Strassburg, that it is navigable all the year, excepting when repairs are being carried on, while the Rhine Mannheim to Strassburg has not been navigable for big barges during six months of the year. The grain gets to Strassburg in eight days on the river, in eight weeks on the canal, which is toll-free. The water rate in summer on the river is four marks per ton, in winter on the canal five marks.[2] But not only during months of low water on the river is grain shipped to Strassburg on the canal. Even in summer, if grain des-

[1] The Midland Canal, for 600-ton barges, was planned to run from Ruhrort to Herne on the Dortmund-Ems Canal, from Bevergern on the Dortmund-Ems Canal to Minden on the Weser, from Minden to Magdeburg on the Elbe. It was designed to be an east-west waterway completing, with the south-north rivers, a national waterway system. The Agrarians (Conservatives) in the Prussian Parliament feared the cheap influx of foreign grain and, in the law which was finally passed in 1905, broke the canal off at Hannover. As the canal is being built, the section Hannover-Magdeburg is lacking.

[2] Personal information from the director of a Strassburg Navigation Company.

tined for Strassburg arrives in Antwerp but is not needed for some time in Strassburg, it is cheaper to send the grain on the eight weeks' trip over the canal than it is to get it to Strassburg in eight days, on the Rhine, and have seven weeks' storage to pay there. However, the use of slow-going canal boats as storehouses is no basis on which a waterway can ground its prosperity. The chief reason for the canal grain traffic to Strassburg is the impassability of the Rhine above Mannheim during half the year. There arrived in Strassburg in 1907 per canal 72,466 tons[1] grain, per river 164,400 tons.

Alsace is interesting as being the scene of a struggle between three districts, all competing to supply it with coal. The Saar district, the nearest and the natural source of supply, is connected with Alsace by the Saar coal canal which runs into the Rhine-Marne Canal. Moreover, this latter leads, through France, to the Belgian coal fields. The Rhine, at Duisburg-Ruhrort, receives shipments of Ruhr coal for the upper Rhine. We can see the course of this contest by the following statistics:[2]—

Saar Coal brought into Alsace

	By water Tons	*By rail* Tons
1883	223,000	507,000
1900	264,000	646,000
1907	190,000	701,700

Coal brought from Belgium into Alsace*

	By water Tons	*By rail* Tons
1883	1,000	6,300
1900	157,000	71,000
1907	175,000	71,000

* Some of this is English coal.

Ruhr coal brought into Alsace

	By water Tons	*By rail* Tons
1883	33,000	37,000
1900	376,000	188,000
1907	601,000	119,000

[1] Part of this tonnage is probably from France.

[2] *Strassburger Handelskammerbericht*, 1907.

Saar coal is slowly progressing: it increased its consumption in Alsace during the above period by 160,000 tons, due principally to the railroads. Belgian coal has learned to use the canal and increased its exports into Alsace by 140,000 tons. Ruhr coal, largely by use of the Rhine, supplies Alsace with 560,000 tons more at the end than at the beginning of the period. When, after the present river improvement from Mannheim to Strassburg, the Rhine up to the latter point is made navigable for five months more of the year, it is reasonable to expect that Ruhr coal will make further conquests at the expense of the Saar and the Belgian supply. For the same reason the canal grain traffic, in so far as its existence is due to low water on the Rhine, will disappear.

Finally, the competition of the railways. These may be divided into two groups: the south German and the north German (or Prussian). The south German railways are a continuation of the Rhine. Even when the Rhine above Mannheim has been regulated, it will be a competitor only to the lines of the Baden and Palatinate railways which parallel the river. At present the Rhine does not compete with the railways of the Palatinate, Alsace, Baden, Württemberg and Bavaria; they are all fed by the mass of traffic transshipped in Rhine harbors and, moreover, they get as long a haul from the Rhine harbors as if the goods came south over the lines of the Prussian-Hessian state railways.

With these latter it is a different story. They would handle a far greater ton-mileage of Rheinland-Westphalia's exports and imports if these could be diverted to the German sea harbors Bremen and Hamburg, instead of using the Rhine and contributing to the commerce of Antwerp and Rotterdam. If the Rhine did not exist, the Prussian railways would have the long haul between Gelsenkirchen [1] and Bremen-Hamburg instead of the short haul between

[1] Centre of the industrial district.

Gelsenkirchen and Ruhrort, for iron and steel exports. The Prussian-Hessian railway system would have, in transporting Ruhr coal south, the long haul from Gelsenkirchen, instead of the short haul from Gustavsburg,[1] to the Bavarian border.

From these different relations between rail and waterway in north and south Germany arises a different treatment of transshipped goods. The South German railways, following Baden's example, give their lowest rates for transshipments. For instance, we saw that coal and transit grain transshipped at Mannheim enjoy the ton-kilometre rate of 1.7 pfennigs[2] even if they are stored in Mannheim 6 months before being reshipped. Prussia follows this policy only in certain cases. In general, Prussia gives her lowest rates only for goods when they are shipped their entire way through Prussia on the rails and, if they are exports or imports, when they go via a German sea harbor. As an exception to this we noticed (page 67) that Prussia puts her low tariff for raw materials (2.2 pfennigs per ton-kilometre) on imported iron ore transshipped at Ruhrort. Here the welfare of the blast furnaces was of more importance than the financial interests of the Prussian state railways. A few other such exceptions come from the days when the railroads were in private hands. These exceptions had to be carried over in order not to destroy industrial interests dependent on them. But the rule stated above is the rule according to which Prussian rates are formed, in the majority of cases.

Some examples of the quantities transshipped in Mannheim to different parts of south Germany were given on page 87. Mannheim's receipts by rail of 2259 tons rags

[1] Opposite Mayence. Gustavsburg is the point where the Coal Contor transships its coal destined for Bavaria.

[2] The ton-mile rate is two fifths of this. The dispatching-fee is 60 pfennigs per ton. The dispatching-fee varies from 60 pfennigs to 1.20 marks according to the class of goods, and of course plays an important part in the total ton-mile rate, particularly for short transports.

from France and 3796 tons glassware from Austria were extreme cases of the extent of Mannheim's hinterland.

We may now consider the working of different Prussian tariffs. Besides the Report of the Central Commission for Rhine Navigation, already mentioned, the material for a comparison of rail and water traffic is furnished by the yearly Statistics of the Freight Movement on German railways. In this latter, Germany is divided into thirty-seven districts; adjacent foreign countries add to the number so that the total is sixty-four. The internal traffic in each German district and its traffic with each of all the other districts in the list is recorded according to a table of seventy-five different articles. Similarly, the entire traffic of all Germany with each of the foreign districts or countries is given. The Elbe sea harbors (Hamburg), the Weser harbors (Bremen), the Rheinish and Westphalian sections of the small Rheinish-Westphalian industrial district, the Saar coal and iron country, Duisburg-Ruhrort, and Mannheim each constitutes a traffic district. The other districts, so far as they come into consideration here, correspond to the Prussian provinces[1] or the south German states.[2]

Hamburg and Bremen received by rail from the west German industrial region, in the wider sense,[3] 502,800 tons manufactured iron in the year 1907. These are exports which would be expected to go down the Rhine and via Antwerp and Rotterdam but which are diverted by Prussia's special export rates for German sea harbors. These 502,800 tons manufactured iron amounted to only 156,100 tons in 1890. To be sure, the exports of manufactured iron on the Rhine (downstream past Emmerich) increased

[1] West Rhineland, east Rhineland, Westphalia, Hesse-Nassau, and Hesse.

[2] Hesse-Darmstadt, Palatinate, Alsace, Lorraine, Baden, Württemberg, north Bavaria, south Bavaria, Thuringia, Switzerland, etc.

[3] Traffic districts 21–28.

1890–1907 even more rapidly from 45,279 to 798,760 tons;[1] but this does not lessen the fact that the Prussian special rates materially reduce the traffic naturally belonging to the Rhine. Iron and steel manufactures are carried to the Rhine harbors for transshipment at the rate of 1.8 cent per ton-mile; to Bremen and Hamburg in certain cases [2] at ton-mile rates of .48 and .56 cent per ton-mile. Moreover, it must be kept in mind that the dispatching-fee for goods taxed with the high ton-mile rate, is correspondingly high.

Iron ore is shipped from the ore-fields in Nassau direct to the blast furnaces of Rheinland-Westphalia at a ton-mile rate of .88 cent (tariff for raw materials). It is taken by rail to Oberlahnstein for transshipment down the Rhine at the ton-mile rate of 1.4 cent. (Special Tariff III.) The result is that the ore going on the river cannot stand a second transshipment, inland from Duisburg-Ruhrort. The 234,652 tons iron ore transshipped from rail to water at Oberlahnstein are practically all destined for Krupp's blast furnaces in Rheinhausen, opposite Duisburg. Nassau sent by rail to furnaces on the east bank of the Rhine (districts 22–25) 560,925 tons ore. Of the 1,568,051 tons phosphoric iron ore (minette) which Lorraine sends to the narrower Ruhr district,[3] not a ton is transshipped in Coblenz. The reason is the same differentiation as above in disfavor of transshipment.

In spite of the cheap transshipment rates of the south German railways, the transshipment territory for coal soon comes to its limit. The best coal will not stand the rough handling it receives at the hands of coal tips and ponderous self-loading buckets. Coal re-sifted on coming out of the

[1] Principally because of the great works that have settled on the river banks. See page 83.

[2] Iron and steel for the German shipbuilding industry, for export to the Orient and Africa.

[3] Traffic districts 22, 23, 28.

CONCRETE FREIGHT SHEDS IN THE HARBOR AT DÜSSELDORF

RHINE-SEA STEAMER DISCHARGING

barges at Mannheim after its second transshipment — the first being from rail to water in Duisburg-Ruhrort — shows a loss in value of 1.40 marks per ton.[1] All express shipments go by rail. When we consider the sources of the coal supply of north Bavaria, which from its position seems destined to get its coal via the Rhine harbors (Gustavsburg, etc.), we find that this is by no means exclusively the case. North Bavaria in 1907 was supplied with coal as follows:—

Transshipped at Gustavsburg and Offenbach	(traf. dis. 32)	340,247 tons
Frankfort	(21)	58,810
Mannheim	(34)	20,113
Total		419,170 tons
Direct from Ruhr coal-fields		351,394

So the direct supply is not on any account to be left out of the reckoning.

Mannheim sent to Switzerland 260,759 tons coal by rail in 1907, the Ruhr district sent 137,033 tons direct; but the Ruhr sent Italy 94,667 tons against Mannheim's 773 tons.[2] In the two last cases the Prussian tariff for export coal helped. This tariff, together with the rebates of the Dutch railways, delivers German coal in Rotterdam 10 cents a ton cheaper than the tariff for raw materials would deliver it. Not only is Rotterdam largely supplied with German coal by rail; but also in all Holland the waterway can only compete successfully where the destination is on a waterway navigable for big barges, or where the destination is on a waterway but has no railroad connection. Germany (the Ruhr district) sent Holland, in 1907, 3,150,497 tons coal by rail, by the Rhine — via Lobith — only 1,886,502 tons. Via Lobith there went in 1907, 1,660,492 tons coal des-

[1] The coal is pulverized during loading and unloading. This coal dust is pressed into briquettes in the briquette factories on the upper Rhine harbors. Germany has practically no anthracite. All black coal is "hard" coal (*Steinkohlen*).

[2] The Saar coal-fields sent Switzerland 637,906, Italy 18,669 tons.

tined for Belgium, with its splendid modern canal system; while Belgium received by rail only 1,373,581 tons from the Ruhr.

To be sure, all the competitive tariffs of the Prussian railways have not been successful. In 1887 a low tariff was introduced for petroleum imported in Bremen; the tariff was later extended to Hamburg. It put the Rhine under severe competition until the tank barge was invented: a form of transportation that could defy the lowest railroad tariffs. In 1907 Hamburg and Bremen sent by rail to the Rhine's territory — west and south Germany and Switzerland[1] — 49,243 tons petroleum and other mineral oils. Belgium sent into the same territory by rail 16,505, Holland 4,912 tons. Upstream there came via Lobith 313,299 tons. Of this quantity one half (157,956 tons) was received in Mannheim. Imported grain goes as far as it can on the water, as it is in all cases, whether coming from a sea harbor or river harbor, transported on the Prussian railways at the high rates of Special Tariff I (1.8 cent per ton-mile).

If the competition between the railroads (and the German sea harbors) and the Rhine in the transportation of a valuable foodstuff, coffee, is considered, another element of competition is observed to operate. Bavaria received its coffee as follows:—

From Mannheim	575 tons
Hamburg	5768

i.e., from Hamburg 10 times more than from Mannheim. Here the deciding point is the strong position of Hamburg's coffee importers.

How strongly these two elements — discriminatory railroad rates and established trade relations abroad — can work, is seen when the competition of rail and waterway in the transportation of raw cotton and of wool is analyzed. For imported wool there are no special rates, and there is

[1] Traffic districts 21–36, 57.

no great importation of wool in German sea harbors. Bavaria received in 1907 1,102 tons wool from Hamburg and Bremen, 1,442 tons from Antwerp by rail direct, 3,795 tons via Mannheim. The river predominated.

One might expect Mannheim to exhibit the same predominance in raw cotton. But here rates and import trade are seen in fullest operation. Prussia gives a low tariff for cotton imported via Bremen. The latter harbor imported in 1907 2 million bales of cotton, or about as much as Liverpool. Bavaria's raw cotton came from the following sources: —

From Mannheim	628 tons
Austria (Trieste)	4,718
Hamburg	8,797
Bremen	55,688

Bremen sent to Duisburg-Ruhrort, destined for the local textile industry, 2,370 tons cotton. Duisburg-Ruhrort received by water only 683 tons. To west and south Germany Bremen shipped by rail in 1907 274,423 tons cotton; up the Rhine via Lobith came only 30,011 tons. Alsace gets its raw cotton from sources that denote the competition of many seaports. In 1907 Alsace received raw cotton:

Via Mannheim	222 tons
From Belgium (Antwerp)	2,440
France (Havre and Marseilles)	20,556
Italy (Genoa)	5,097
Hamburg	1,064
Bremen	21,737 [1]

[1] For examples of the competition of foreign harbors in supplying Switzerland with grain and coal, see the following chapter.

CHAPTER XI

WATER RATES

THE Rhine possesses certain natural advantages in its competition with the railways, advantages which express themselves in lower rates. The roadbed of the Prussian-Hessian state railways cost about $100,000, the improved Rhine $60,000 per mile. On the railroads no such traffic per mile of line is possible as on a river like the Rhine. On the Rhine from Kehl to Rotterdam there were moved, on the average, 18,240,000 tons over each mile of river, in the year 1905. In the same year the average mile-traffic of German railways was 1,312,000 tons. The splendid municipal harbor at Düsseldorf cost $4,500,000; the Düsseldorf railway stations, if their cost could be ascertained, would be found to be far dearer. The Rhine is handed over to the public to use free of charge, and the Düsseldorf harbor dues are so low that the city contributes $100,000 a year to the harbor's support. The Prussian state railways must return 6 to 7 per cent on the capital invested in them.

The same is true of floating stock on the water and rolling stock on the rails. The following table illustrates this:[1] —

Transporting body	*Cost*	*Cost per ton capacity*	*Cost per 1500 tons capacity*
1500-ton barge	$22,000	$14.30	$22,000
15-ton freight car	946	63	94,600

The cost of a modern tug (see page 45) is $90,000. It brings 4000 to 6000 tons in four or five barges upstream. A first-class freight locomotive with tender can be had for $45,000. But the locomotive does well if it can pull fifty 15-ton cars, or a train-load of 750 tons. To pull 6000 tons eight loco-

[1] Peters, part ii.

motives are required: cost $360,000. It is doubtful whether this advantage is materially reduced by the greater speed at which the cars are moved, enabling them to handle greater traffic in a year. The following schedule, usual with the 1500-ton barges of the Coal Contor, is as good as the railroads in Germany can maintain: —

Loading in Ruhrort	1½ days
Ruhrort to Mannheim	3
Unloading in Mannheim	2
Mannheim to Ruhrort	2

The operating expenses on the river are correspondingly lower. A freight locomotive of standard size, pulling a full train, burns about .449 English pounds of coal per ton-mile.[1] The tug [2] described at the bottom of page 44 is guaranteed to bring 4500 tons in four barges from Ruhrort to Cologne (fifty-eight miles) in eighteen hours with an expenditure of 900 kilogrammes coal per hour. That is equivalent to .136 pound of coal per ton-mile. The greater effectiveness of a horse-power in the marine engine than in the locomotive is indicated in Conrad's comparison. According to Conrad,[3] a horse draws: —

On level rails	10 tons
On still water	60

There are eleven men on the crew of the tug, but of them only the captain and the chief engineer are skilled labor. There are eight locomotive engineers and eight firemen in the locomotives. The sixteen men on the crews of the barges (4 × 4) would hardly man eight freight trains. Excepting one steersman for each vessel, the men on the barges are unskilled labor and wretchedly paid. So one can say that the roadbed, terminal facilities, rolling (floating) stock, and costs of operation are cheaper for waterway than for railway transportation.

[1] See "1909 Report of the Mersey Railway," cited in *Zeitung des Vereins deutscher Eisenbahnverwaltungen* of March 26, 1910.

[2] *Führer durch die Ruhrhäfen.*

[3] Conrad: *Volkswirtschaftspolitik*, Jena, 1902, p. 401.

Now, regarding the advantages which the railroad has: greater speed, greater punctuality of delivery, greater regularity and security of the service offered. These disadvantages of waterways are less marked on the Rhine than on most streams with long periods when low water or ice cause navigation to be absolutely suspended. This latter case is rare on the Rhine and yet fogs, high water, floating ice, etc., cause considerable disturbance. These influences impair the punctuality and regularity of service, and, at some times, its speed. The speed is under normal conditions not much slower on the waterway. The through barge trains from Rotterdam to Mannheim in five to six days are about as swift as deliveries made by the railroads.[1] The superior security of railway transportation is an important factor, and finds expression in insurance rates. Nothing but an act of God excuses the railway from responsibility for goods which it transports; the transportation company on the Rhine is responsible only for accidents caused by gross carelessness of its employees; losses from other causes are borne separately by owners of ship and cargo. The result is that none but valuable articles are insured in railway transportation and that the insurance premiums here are much lower than corresponding premiums on the water. As insurance premiums are expressed in per cent of the value of goods transported, the most valuable goods do not go on the river: the premium would more than eat up any saving in costs that the waterway could offer. Moreover, in the case of highly valuable goods, of perishable fruits, cattle, corpses, etc., speed of delivery is of more importance than difference in rates. On the other hand, we must remember that the articles which form the backbone of traffic to-day — coal, ores, grain, sugar beets, sugar, iron, etc., — are, by the aid of modern de-

[1] Of course the direct railroad route is superior to the water route in speed of delivery when there is a transshipment between water and rail to be made, as in the majority of cases of water transportation.

vices for handling freight, more cheaply and more speedily loaded into a barge and out of it than into freight cars of corresponding total capacity. Other articles, such as glassware, wine and condensed milk, are by nature better suited for water than for railway transportation, because on the water they are less shaken up.

Railway tariffs are published and hold for a long period in advance. Water rates are in most cases the result of bargaining in private or on the Shipping Exchange and are made anew each day, like prices on the Stock Exchange. They vary with the variations of demand and supply for ship-room and according to the stage of water in the river. They are low in the spring when water is high and business is slack, high in the autumn when water is low and goods are clamoring to be moved. If we take a rate obtaining on a certain day or if we take the average for a season, we have the water rate for that day or that season only. If we take the average rate for the year, we get a price which probably was the market price of transportation on no occasion whatever in the year. One long-time water rate is known: the tariff of the Coal Contor from Ruhrort to harbors on the upper Rhine, fixed for four years in advance. The rates in time contracts of transportation companies on the Rhine are carefully guarded business secrets.[1]

Moreover, while being astonished over the difference between ton-mile rates on the water and the railroad, one must not forget that the water rate does not include insurance nor the transfer costs at one, often both ends, of the water route. For instance, if we investigate the relative costs of rail and water transportation for coal between Duisburg-Ruhrort and Mannheim we find the following rates per ton:[2] —

[1] These contracts usually contain a low-water clause, providing for a raise in rate when the stage of water sinks below a certain level.

[2] Peters, part ii, p. 142.

	Total rate	*Per ton-mile*
On Rhine	$ .62	.28 cent [1]
On railroad	1.90	.95 cent [1]

But all coal is brought to Duisburg-Ruhrort on the rails and there transferred into the barge; so these transfer costs and the cost of bringing the coal for transfer (from Gelsenkirchen) must be added. As almost all arriving coal is again transshipped to south Germany to the rails at Mannheim, the water route must also be charged with the cost of this transshipment. The water route must lastly be charged with the insurance premium. Making these additions we get the following result.[2]

Water and rail versus direct rail shipment of coal Gelsenkirchen to Mannheim

Water and Rail	*Per ton*
Rail: Gelsenkirchen to Duisburg	$ .37 cent
Transfer in Duisburg, insurance, etc.	.06
Water: Duisburg to Mannheim	.62
Transshipment, Mannheim	.10
Total	1.15
Per ton-mile Gelsenkirchen to Mannheim	.52 cent
Rail direct	
Rail: Gelsenkirchen to Mannheim	$2.02
Total	2.02
Per ton-mile Gelsenkirchen to Mannheim	.93 cent

As has been repeatedly said, the significance of a waterway consists in this transshipment. The railroads cannot get long-distance bulk traffic between river towns, nor do they try to do so. Therefore the only useful comparisons between water and rail rates are comparisons between pure rail rates and water and rail rates with transshipment, like the above.

Continuing this investigation of the cheapness of distributing Ruhr coal to south Germany by railroad and by

[1] Here and throughout the rest of this chapter, the ton-mile rate given is the total rate and includes the dispatching-fee.

[2] *Denkschrift des Zentralausschusses*, p. 103.

water and rail, we can see the financial advantage of the latter route diminish as the transshipment goes farther inland from Mannheim.[1]

		Water and rail to Mannheim, rail to below station, per ton, total	*Rail direct from Gelsenkirchen to same station*	*Rail route dearer by*
I.	Bruchsal	$1.51	$2.12	$.61
II.	Carlsruhe	1.57	2.14	.57
III.	Heilbronn	1.73	2.26	.53
IV.	Pforzheim	1.75	2.26	.51
V.	Stuttgart	1.94	2.38	.42
VI.	Göppingen	2.15	2.50	.35
VII.	Freiburg	2.15	2.60	.45
VIII.	Basle loco	2.42	2.80	.38
IX.	Ulm	2.44	2.69	.25
X.	Constance	2.61	2.95	.34

As the better grade of coal has to be re-sifted at Mannheim after the double transfer and loses thereby 33½ cents per ton in value, number IX in this list would get these better grades direct from the mine. Numbers VI, VIII, and X would often enough have their good coal sent direct, as the saving in the water rate is minimal when deterioration in quality is considered.

Rates for grain imported at Rotterdam and shipped to Mannheim per water and per rail can be similarly compared:[2]—

WATER VERSUS RAIL TRANSPORTATION FOR GRAIN ROTTERDAM–MANNHEIM

Water Route		*Rail Route*[3]	
Water freight Rotterdam–Mannheim	$ .79	Freight Rotterdam–Mannheim	$4.38
Transfer from ship to barge in Rotterdam, to rails in Mannheim, insurance, tare	.52		
Total	1.31		4.38
Per ton-mile	.37 cent		1.36 cent

[1] *Denkschrift des Zentralausschusses*, p. 104.

[2] Peters, part ii, and *Denkschrift des Zentralausschusses*, p. 111.

[3] The comparison is not perfect because the cost of transfer from ship to rail in Rotterdam is not given.

The difference is so great that practically no foreign grain comes to south or west Germany except via the Rhine harbors. To protect German grain from foreign competition high rates are charged for all but foreign grain in transit; for instance, en route to Switzerland. But grain transshipped in Mannheim for Switzerland soon meets the competition of Genoa and the Italian railways. The line between the German and Italian territory is sharply drawn, as is seen from the following table: [1] —

GRAIN FREIGHTS TO SWITZERLAND

	Via Mannheim: Water to Mannheim, rail to stations below	*Via Genoa: Rail direct to same stations*	*Via Mannheim: dearer + cheaper —*
Goldach	$4.28	$5.08	$.80 —
Zürich	4.42	4.66	.24 —
Gossau	4.62	4.99	.37 —
Zug	4.88	4.37	.51 +
Lucerne	5.06	4.55	.51 +
Glarus	5.36	4.87	.49 +

In the same way, foreign sea harbors compete to supply Switzerland and Italy with coal. English coal via Genoa has already conquered northern Italy. We saw that Ruhr coal via Mannheim costs Basle loco $2.42 or 12.5 francs per ton. French railways bring English coal from harbors on the English channel to Delle on the northwestern Swiss border for 8.4 francs per ton. [2]

The following tables were compiled by Rudolph Gelpke in collaboration with the Mannheim Chamber of Commerce, and may be considered [3] more exact than the "authoritative" compilations of German government officials. This is a comparison of the cost of transporting over-sea goods from Rotterdam to Constance, on the lake of Constance. In both cases the Rhine is used. In the first case the goods are put on the rails at Mannheim to complete its

[1] *Denkschrift des Zentralausschusses.*

[2] Major Placke at the Erster Deutscher Binnenschiffahrtstag, Weimar, 1909.

[3] Gelpke: *Die Schiffbarmachung.*

journey, in the second case at Kehl, opposite Strassburg. The distances are: —

I.	Rotterdam-Mannheim	(water)	354 miles
	Mannheim-Constance	(rail)	190
	Rotterdam-Constance		544
II.	Rotterdam-Kehl	(water)	435
	Kehl-Constance	(rail)	125
	Rotterdam-Constance		560

I. WATER-RAIL ROUTE ROTTERDAM–CONSTANCE VIA MANNHEIM

FREIGHT RATES IN DOLLARS PER METRIC TON

					Goods of special tariffs		
	Grain	*Coal*	*Pig iron*	*Class B*[1]	*I*[2]	*II*[3]	*III*[4]
Water freight	$ .83	$ .71	$ .83	$1.31	$1.19	$1.19	$1.07
Transshipment costs	.26	.15	.17	.31	.31	.31	.31
Insurance	.07	.007	.024	.33	.36	.28	.24
Rail freight	2.61	1.53	1.90	4.67	3.57	2.72	1.90
Total	3.76	2.40	2.92	6.62	5.43	4.50	3.52

Reckoning the first three items (water freight, transshipment costs, and insurance) as composing the total water rate, we get the following ton-mile rates in the above route: —

					Goods of special tariffs		
	Grain	*Coal*	*Pig iron*	*Class B*	*I*	*II*	*III*
Ton-mile water rate (cents)	.33	.25	.30	.55	.53	.50	.46
Ton-mile rail rate (cents)	1.37	.80	1.00	2.47	1.87	1.46	1.00

[1] General freight in carload lots.

[2] For instance, machines, paper, herring, soda, etc.

[3] For instance, railroad ties (metal) and rails, hemp and jute, etc.

[4] For instance, wood, logs, stones, lime, second-hand agricultural machines, etc.

II. WATER-RAIL ROUTE ROTTERDAM–CONSTANCE, VIA KEHL

FREIGHT RATES IN DOLLARS PER METRIC TON

					Goods of special tariffs		
	Grain	*Coal*	*Pig iron*	*Class B*	*I*	*II*	*III*
Water freight	$1.31	$1.07	$1.31	$1.91	$1.79	$1.67	$1.43
Transshipment costs	.26	.15	.17	.31	.31	.31	.31
Insurance	.10	.01	.03	.48	.48	.38	.31
Rail freight	1.83	.99	1.38	3.12	2.45	1.99	1.38
Total	3.50	2.22	2.89	5.82	5.03	4.35	3.43

That is equivalent to the following ton-mile rates, calculated as above in example I:—

					Goods of special tariffs		
	Grain	*Coal*	*Pig iron*	*Class B*	*I*	*II*	*III*
Ton-mile water rate (cents)	.38	.26	.35	.62	.59	.55	.47
Ton-mile rail rate (cents)	1.46	.79	1.10	2.42	1.96	1.60	1.10

These examples indicate what ton-mile rates the river affords, and from this and the preceding chapter can be seen about how the traffic is divided between rail and water. Hostile railway tariffs, as in Prussia, reduce the Rhine's sphere of influence; coöperative tariffs, as in south Germany, widen that sphere. If all the railroads should introduce hostile tariffs and at the same time refuse transshipment facilities, the river traffic could be killed here, as elsewhere; for river traffic cannot exist without the help of the railroads. But state railroads have their policy directed by a ministry and a parliament which, however they would like high returns from the railroads, realize that this must not be attained at the expense of depriving a great territory of a cheap waterway. The ministers know very well that the railroads could never replace the rates of the waterway, if this were crippled. So, even in Prussia, the hostile rates are a compromise between the needs of Prussia's finances and the needs of her industries, a compromise in favor of the latter.

The river's rates get comparatively cheaper as the length of transport increases. For distances above three hundred miles the river is from two to three times as cheap as the railroad; the Rhine's rates are for most goods, including costs of one transshipment, well under one half cent per ton-mile. With the improvement of river, boats, and facilities for handling freight, these rates are constantly sinking.

CHAPTER XII

RHINE AND MISSISSIPPI

THE Mississippi is the American Rhine, Weser, Elbe, and Oder all combined. It furnishes the best American comparison with the Rhine and perhaps an occasion for applying the lessons in waterway transportation which the Rhine has to teach. Both Rhine and Mississippi flow through the heart of a rich continent; each represents nature's route of communication between its own fertile valley and the outside world. In their history the streams present a striking parallel up to the period 1860–70; then transportation on the Rhine is modernized and the river takes its place as the greatest waterway in the world, while the Mississippi retains its ancient form of transportation and goes down under the competition of the American railroads.

We saw that the early railroads in Germany were built perpendicular to the Rhine and were considered as feeders to it. When the short railroad lines had begun to be connected up, and the through routes began to compete with, the Rhine, the change in the nature of the traffic between the Rhine Valley and foreign parts was already one that signified a preponderance of bulk goods: coal, iron ore, lumber, wheat, petroleum. Not only did these goods clamor for lower rates than the railroads could give, the cost of loading these goods into the huge river barges at Rotterdam and of unloading them at the river port was also far smaller than the corresponding operation in the case of the little standard 10-ton Dutch and German cars. The spill and scoop principle at the basis of this handling of bulk goods is one whose advantage obviously increases with the size of the transporting unit.

In spite of these advantages which a river like the Rhine has over railroads, the latter might possibly have driven the waterway from the field, had the railroads remained in private ownership. As has been repeatedly said, the traffic on a waterway depends on the extent to which the railroads are willing or compelled to coöperate and extend its influence. Neither New York nor Hamburg could become even a second-class seaport if dependent on the exchange of goods between Hamburg and New York alone. They are great ports because they collect and distribute shipments and receipts each for a distant hinterland. Nothing but a similar activity on the river can make a great river port or a dense river traffic. The railroads must do this collecting and distributing at a fair and non-discriminatory rate; otherwise waterways are improved in vain.

In Germany private railroads did not long continue to employ the methods we know so well, in their efforts to paralyze the competition of the Rhine: refusal of prorating agreements, refusal of transfer facilities, unfair rates for working with the river as compared with their rates for working against it. In the seventies the majority of the railroads in private hands in Prussia were bought up by the state and a milder era of competition dawned for the Rhine.

When the Prussian railroads were nationalized, the intention was to use them to supply railroad transportation at cost; any surplus was to serve as a signal for reducing the rates. But rates could hardly be reduced fast enough to efface the surplus that piled up under the new, efficient, centralized management. The surplus soon became the principal item in the state revenues; no minister dared to reduce it and propose the raise in the rate of the income tax which would have to meet the deficit. As a result, the Prussian-Hessian state railways are earning six to seven per cent on the money invested in them, the state is de-

pendent on the railway surplus, and rates cannot be violently reduced.

If reductions of the Prussian rates in general is prevented by financial considerations, reductions in these rates for the sake of exterminating waterway competition is still more efficaciously prevented. The waterway interests are represented in Parliament as are the exporting interests, dependent on the cheaper waterway transportation. The publicity of government rates makes it impossible for the railway officials to exercise any judgment in the matter. Rates tending directly to incapacitate the waterways would be regarded as a measure against the good of the country. The waterways and the harmonious relations which the railways are compelled to have with them are a counterbalance against the generally fiscal policy of the state railways. Until the latter can supply the cheap rates of the waterways, these have their unassailable place in the Prussian state.

This coöperation between rail and water routes has encouraged the building of water terminals by cities on the Rhine's banks. Sheltered basins have been constructed where the boats and barges are loaded and unloaded without disturbing the traffic of the main stream. Freight-handling machinery, such as cranes for package freight and cantilever hoists for coal, facilitate and cheapen the transfer of freight. Substantial sheds, warehouses, and elevators on the river bank shelter the goods and ship them inland by rail. Railway tracks connect directly with these sheds and warehouses as with the quay wall alongside which the vessels lie. The harbor is administered as a unit by the city that built it, not with the purpose of making money or even expenses out of it but with the purpose of so cheapening transfer between boat and rail that a great hinterland can send and receive goods over the river port. We saw that Düsseldorf has spent 18 million marks on her harbor and operates it at a yearly loss of 400,000 marks.

WATER AND RAIL CONNECTION AT DÜSSELDORF

Yet Düsseldorf thrives and is the envy of the older commercial and industrial cities on the Rhine; Düsseldorf is able to look beyond the immediate receipts of a tax on traffic.

The floating stock on the Rhine has been continually improved. Barges have increased in capacity until they now carry from 1500 to 3000 tons. The material of their construction changed from wood to iron, then to steel. The tugboats have steel hulls, compound engines, tubular boilers, twin screws; they pull upstream 6000 tons of cargo in a barge train. Barges and tugs have only a low-water depth of 6½ feet to work on; hence it is apparent that they represent a remarkable technical adaptation to the river on which they ply.

On the Rhine the shipper finds great navigation companies of long standing and proven merit; they operate through lines from upper Rhine ports to all three of the Rhine sea harbors. These companies have agents in important inland cities who collect and distribute freight transshipped between river and rail at Mannheim, and other upper Rhine ports. The companies have contracts with over-sea lines from Antwerp, Rotterdam, and elsewhere. The Hamburg-American line sends sea-going lighters up the Rhine to collect cargo for over-sea destination. There is a circular issued by the Hamburg-American line and the "Rheinschiffahrts A. G. vorm. Fendel," a river navigation company of Mannheim. It reads as follows:—

"The Hamburg-American Line, in conjunction with the 'Rheinschiffahrts A. G. vorm. Fendel' of Mannheim, maintains a direct and regular barge service from Strassburg, Karlsruhe, and Mannheim-Ludwigshafen to Hamburg. Departures every sixth day with direct through bills of lading, via Hamburg, to transatlantic places and vice versa."

Up to 1860 the history of traffic on the Mississippi is similar to the history of the Rhine, excepting that the

American river was not burdened by river tolls which it took half a century to remove. During the first half of the nineteenth century the exports of most of the country west of the Allegheny Mountains were drained off to New Orleans by means of the magnificent system of waterways at the disposal of that port. Staples of commerce were corn, lard, bacon, whiskey, apples, potatoes, hay, etc. — lumped under the name of "western produce," which supplied the southern plantations and were exported from New Orleans. The southern states added cotton, tobacco, and molasses to the downstream trade. Planters in northern Alabama sent their cotton down the Tennessee River to the Ohio, down the Ohio and Mississippi to New Orleans. In 1860 New Orleans saw 3500 river steamers arrive, bringing cargo to the value of 185 million dollars.[1] New Orleans was accounted the fourth seaport in the world — after London, Liverpool, and New York — and handled in 1860 27 per cent of our exports. In 1907 her percentage was 9 per cent.

In the Mississippi region, as along the Rhine, railroads at first served primarily as short lines connecting inland communities with waterways; for example, the Madison and Indianapolis, the Evansville and Crawfordsville, the Louisville and Frankfort. The Pennsylvania Railroad for some time after reaching Pittsburg was dependent on the Ohio packets for westward connection.[2] But the railway lines did not long regard themselves as feeders to the waterways. In 1858 there were two through rail connections between Chicago and the eastern seaboard. These, in conjunction with the water route formed by the Great Lakes and the Erie Canal, were already drawing off to the Atlantic coast our exports of western produce.

The Civil War suspended navigation on the lower Mississippi. In the meantime the transcontinental railroads, north of the line of operations, extended their connections

[1] Dixon, p. 33.
[2] Dixon, p. 31.

and services and got the exports of the West once for all in their grasp. When the war was over the channel of the Mississippi had gone wild, after five years of neglect. At the end of the war New Orleans found her channel to the sea too narrow for large steamers to enter. This evil has been remedied and the Mississippi has been given a low-water depth of 9 feet for 840 miles (up to Cairo), a depth of 8 feet for 1000 miles (to St. Louis). We need not look to find the inferiority of the American river in the insufficiency of its channel. The Rhine has a channel of only 6½ feet at low water and that for only 350 miles upstream from Rotterdam. The Mississippi and its tributaries have 2500 miles of 6-foot navigation.[1]

We have seen that the traffic on the Rhine in 1907 amounted to 64.5 million tons. In the year 1906 the traffic on the entire Mississippi river system (16,000 miles) was 19.5 million tons.[2] It has been observed that the traffic on the Rhine passing the German border station Emmerich increased 400 per cent from 1885 to 1907. From 1889 to 1906 traffic on the Mississippi river system decreased 31 per cent. While the German border traffic was increasing from 4 to 23 million tons, the traffic on the Mississippi system was decreasing from 28.4 to 19.5 million tons.

First and foremost, the American railways have waged war without quarter on the river. Not only is rail connection denied the river; in many cases the water front is owned by a railroad which uses it as a freight and switching yard and sees to it that no rival has opportunity to connect with the boat lines. The railroads refuse to prorate with the river. Furthermore — and what is most important — the railroads give exceedingly low rates on their lines paralleling the river and recoup themselves by high charges on lines perpendicular to the watercourse. Abun-

[1] *Preliminary Report of National Waterways Commission*, p. 28.

[2] *Transportation by Water* (Census Bureau), p. 179.

dant material on this subject is presented in the "Preliminary Report of the Inland Waterways Commission" (pages 318 ff.). This rate policy of high perpendicular rates means a refusal to distribute and collect freight for the river. It is a practice sanctioned by legal decision, for within a year after the passage of the Interstate Commerce Act of 1887 a decision was rendered declaring that the "long and short haul" clause of the act did not apply when water competition was present. So long as this policy in railway tariffs is allowed, it is vain to improve our rivers. The water route cannot be employed without the coöperation of the railroads.

When we contrast Rhine with Mississippi ports, the difference is striking. We see no harbor basins, no freight cars waiting for transshipments, no electric cranes or coal hoists, no modern freight sheds, warehouses, and grain elevators, — nothing of the sort is to be seen on the miserable and desolate levees of Memphis, St. Louis, and St. Paul. Though manual labor is dearer in America than in Germany, and hoisting machinery cheaper, no crane or other mechanical freight handler is used in our Mississippi ports. A horde of roustabouts, who form part of the boat's crew, leisurely roll or tug the freight ashore. If the shipment is to go inland, it must be drayed up the hilly levee and through the city streets to the freight-receiving station of the railroad. The latter unwillingly takes the shipment and charges a high rate on it for having come part way by water instead of by another railroad. Whoever takes a steamboat ride on the Mississippi experiences a similar difficulty in getting to and from the landing. Passengers will often stand the discomfort for the sake of the boat trip. Freight has no such æsthetic preferences. Only in the rarest cases is there a coal hoist at any of the destinations of the coal barges that go downstream from Pittsburg. As a rule, the barge is dropped from the tow at the town for which it is destined; there the consignee has it unloaded by manual labor.

The great difference between high and low water stages on the Mississippi is given as the main reason why terminals with modern freight-handling machinery, sheds, and warehouses, are not constructed at Mississippi ports. The fluctuation between high and low water amounts to 60 feet in Cincinnati, 44 feet in St. Louis, 55 feet in Memphis. Such huge differences are rare on the Rhine. It is probable that masonry walls, topped by railroad tracks and flanked by freight sheds, would be impracticable for the Mississippi ports, from a financial point of view. A long, heavy quay wall, constructed with deep foundations and carried 60 feet up into the air so that its tracks, sheds, etc., would be above the high-water mark, is an enterprise that would compare favorably with the erection of the Pyramids.

Basle has a fluctuation of its water stage that parallels our fluctuations on the Mississippi. Instead of a perpendicular masonry wall with deep foundations Basle has a forty-five degree levee with no foundations at all. Above the high-water mark on this levee are railroad tracks. A horizontal crane-trackway — movable longitudinally — runs out from this point and is supported at its outside end by a perpendicular leg running on a rail halfway down the levee. An electric crane runs out this trackway and from the end can unload a barge alongside, even at low water. Returning over the trackway the crane swings its burden into a railroad car or deposits it on the front platform of the shed beyond the railroad tracks.

Either a freight-handling device of this sort or an adaptation, in a lighter form, of the coal-hoisting machines in Duluth seems practicable for the Mississippi ports. The cantilever arms of the modified coal hoists could be projected far enough to reach barges at the lowest stage of water. These devices suggest themselves for package freight. For loading and unloading bulk goods such as coal, ores, and grain we have unequaled models in the machin-

ery employed in the Superior and Erie ports of our Great Lakes. There are possibilities of radically reducing the present cost of transferring goods between boat and rail in Mississippi ports.

Until our river cities construct at least simple terminals of this sort, how shall we be impressed with their contentions for further deepening of the waterways? If they believe in waterway transportation, why do they not provide terminals for the roadbed which the government hands over to them? The Rhine has 350 miles of 6½-foot waterway; on its German portion alone are at least 12 first-class harbors of the sort already described. The great majority of them were constructed at heavy expense by the Rhine cities. On all the 2500 miles of 6-foot waterway in the Mississippi system is not a single reputable harbor. One is tempted to suspect that our Mississippi cities agitate for deeper channels not in order to use them, for they make no move in that direction, but in the hope that the railroads, out of fear of potential competition, will lower their rates to river points. Proper rate reductions can be made by the Interstate Commerce Commission, not by the spending of millions on waterway improvement. The latter policy results in lower rates to water points, for which the railroads recoup themselves by higher charges for inland service. The physical difficulties in the way of harbor construction are not insurmountable. They will be diminished if the plan succeeds of constructing reservoirs at the headwaters of the Ohio and Mississippi, designed to catch the flood waters, let them out at low-water season, and thus do away with violent fluctuations in the water stage.

In the matter of steamboat type we on the Mississippi have advanced little beyond the boat of Civil War days. Not only is there an amazing number of ancient, decrepit steamers on the river, tottering about until a snag, a collision, or a boiler explosion sends them to a watery grave; even the new boats show no advance in type. They are

still wooden, flat-bottomed stern-wheelers, their monumental smokestacks emitting dense clouds of black smoke to obscure the landscape and testify of the coal they waste. They are double-deckers; the continuous upper deck prevents the use of freight-handling machinery to load and unload the cargo on the lower deck. Barges are of steel construction only in the rarest cases. The pride of the Mississippi river system are the fleets of coal barges floated downthe Ohio River from Pittsburg. A huge tug lashes to herself several acres of barges with 40,000 to 50,000 tons of coal aboard, waits for high water on the Ohio, and sets off downstream like a great floating island. Barges are dropped off at various points on the way to New Orleans. This is picturesque, but is possible only on a river practically deserted excepting for downstream coal tows. If ever a heavy traffic in both directions is developed on the Mississippi system, coal tows will have to be strung out and limited in length as they are on the Rhine.

The Rhine-sea steamers would seem to be, technically, a possibility on the Mississippi. They are discussed in chapter VI. They have a capacity of from 350 to 1750 tons and a draught, fully loaded, of 11 to 14 feet. They ply between Rhine ports from Cologne downward and seaports on the North European coast as far east as St. Petersburg, also to London. For some time the "Argo" company ran a fruit line from Cologne and Düsseldorf to Spanish and Italian ports. The Rhine, on the stretch of 210 miles from the Hook of Holland to Cologne, has a low-water depth of 8 feet, 10 inches — the depth of the Waal. The Mississippi has 9 feet for 840 miles to Cairo, 8 feet for 1000 miles to St. Louis. The analogy of the Rhine-sea service would be a line of these steamers from St. Louis and points below to ports on the Gulf of Mexico, Florida, and in the nearer West Indies.

The result of our type of boat and barge and our lack of terminal facilities is a high insurance rate, which, as it is

expressed as a percentage of the value of goods, acts particularly on more valuable freight and keeps it off the water. On the Mississippi from Vicksburg to New Orleans the insurance rate is 45 cents per $100, or about 20 cents per bale of cotton.[1] The water freight is 75 cents per bale, so insurance amounts to one third the freight rate. The rail rate is $1 per bale, and no insurance is carried for rail shipments. The total cost of the river shipment is 95 cents against $1 by rail, a very slight advantage.

The organization of transportation on the Mississippi system presents another great contrast to the Rhine. There are no great companies on the Mississippi, with the exception of a few Pittsburg coal transportation companies. Nearly one half the steamboats on the Mississippi are run independently with no attempt at concerted action. There is no through line from the Ohio River to New Orleans, from the Upper Mississippi to New Orleans, or even from St. Louis to New Orleans. It is impossible for shippers to arrange for through handling of their goods. Repeated rehandling by irresponsible steamboat captains causes damage to freight and makes fixing of responsibility, to say nothing of collecting damages, difficult.[2]

Yet were all these disadvantages of the Mississippi, as compared with the Rhine, removed, one cannot prophesy with certainty that a traffic would arise on the Mississippi comparable with that on the Rhine. Traffic is not simply a matter of fair complementary rail rates, modern terminals and floating stock, proper organization of river transportation. Density of traffic in a country bears a relation to density of population. This principle is not abrogated by the necessary modification that we produce and consume more per unit of population in the United States than in Germany and that we have here a more

[1] *Report of Commissioner of Corporations on Transportation by Water in United States*, vol. i, pp. 17, 359.

[2] Dixon, p. 68.

complete geographical specialization of production, all of which calls for transportation. The population in the United States is 91,972,267, according to the preliminary figures of the census for 1910. That means a density of population of 31 per square mile in the United States as a whole. The density of population in the North and South Central States, those of the Mississippi valley, is 34 per square mile. The density per square mile is for Germany 290, for Belgium 620,[1] and for the Rhine valley nearer that of Belgium than that of Germany.

Yet a larger portion of the total traffic of this part of Germany moves in the direction of the Rhine than the proportion of Mississippi valley traffic that moves or ever will move in the direction the river flows. The Germans of the Rhine valley are an importing and exporting people, importing bulk foodstuffs such as grain and flour, raw materials like ores and wood; exporting coal and manufactured goods of the greatest variety. West Germany, particularly the provinces of Rhineland and Westphalia, is the workshop of the empire. The Rhine runs through this manufacturing district and gives the latter its logical connection with the outside world.

In America our foreign is dwarfed by our inland trade. The grain produced for export in the Mississippi valley is heavily drawn off by the routes consisting of the Great Lakes and the New York railroads, the Great Lakes and the St. Lawrence, the Great Lakes and the Erie Canal. This will be still more the case when the new Erie and the new Canadian canals are finished. The grain destined for inland shipment will take a direction such that the Mississippi can be of no use to it. Livestock is nowhere in the world moved on inland waterways; it requires swifter transportation than the river can give. Cotton produced near the Mississippi may, if coöperative railway rates can be secured, be moved in greater quantities on the river;

[1] *Preliminary Report of National Waterways Commission*, p. 30.

yet one can scarcely conceive that New Orleans will thus seriously affect the cotton exports of Mobile or Galveston. The cotton belt runs east and west, not north and south, and under the most favorable conditions New Orleans by means of the Mississippi can control only a small portion of it. As Northern lumber is more and more cut out, there should be a heavy upstream movement of lumber, though this may be adversely affected by reciprocity with Canada and free Canadian lumber.

The prospects are that before long the principal products of the Mississippi valley, excepting cotton, will no longer be exported; they will scarcely be able to supply the growing demands of our own country. This trade will be from the agricultural West to the more populous, manufacturing East, and in it the Mississippi can have no part.

It is of course possible that the completion of the Panama Canal will create traffic for the river. The Canal will no doubt cause radical readjustments in the direction of our inland trade, in comparison with which its effect on our foreign trade will be trifling. If any sort of coöperation is secured from the railroads on the Pacific Coast, freight from points west of the Rocky to points east of the Allegheny Mountains should go via the Canal. Under similar conditions, a good portion of the traffic from points west of the Sierra Nevada and Cascade mountains to points in the Mississippi valley should go via the Canal and be transshipped at New Orleans from ocean to river steamer or barge.

Yet those interests — the Mississippi cities — which most confidently predict such results from the opening of the Canal, and claim for the Mississippi such an important part in our future foreign and inland trade, make no move to utilize the present waterway or to demonstrate its possibilities by diverting to it a larger share of the existing north-south traffic. Are they building modern water terminals or constructing steel fleets of steamers, tugs, and

barges under the management of large and responsible companies? If not, this apathy speaks louder than all clamors for deeper channels and higher levees. If those who know the river best will show their confidence in its future, not only will they easily obtain any reasonable expenditures to improve and extend navigation on the Mississippi system, but also the railway legislation which the river needs will not long be withheld.

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Projected Canals
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SWITZERLAND
GERMANY
HANOVER
SAXONY
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